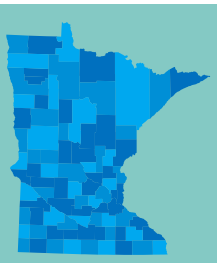
Grant

June 2024

Steamboat River Watershed Nine Key Element Plan

MINNESOTA POLLUTION CONTROL AGENCY



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Executive summary

The Steamboat River watershed is a priority area for the Hubbard Soil and Water Conservation District (SWCD) and their partners (including but not limited to Minnesota Pollution Control Agency (MPCA), Minnesota Department of Natural Resources, and Leech Lake Band of Ojibwe) for the protection and restoration of its waterbodies. The waterbodies addressed in this Nine Key Element (NKE) plan include the Necktie River, Hart Lake, Bungashing Creek, Pokety Creek, Steamboat Lake, and Steamboat River. The Steamboat River Watershed (Figure 1) is an amazing resource for recreation for residents and visitors from across Minnesota and the Midwest. The watershed is nestled between the cities of Bemidji, Laporte, and Walker which are major recreation hubs and population centers. Recreation activities extend beyond fishing, swimming, and resorts to ATV trails, hunting, and hiking. The watershed with its lakes and streams is extremely important economically.

Figure 1. Steamboat River Watershed (WHAF, 2023)

The waterbodies provide biologically significant fisheries including Brook Trout in the streams and Tullibee and Lake White Fish in Steamboat Lake. Popular gamefish species present include walleye and northern pike. Wild rice is an important resource in the watershed with three lakes and one river designated as wild rice waters.

The Steamboat River watershed is a hydrologic unit code (HUC) 10 watershed (0701010201). The watershed is comprised of the five HUC 12 watersheds listed in Table 1.

Table 1. HUC 12 watersheds in Steamboat River Watershed

Watershed	HUC#	Drainage area (ac)*
Steamboat River	070101020105	22,906
Necktie River	070101020104	16,111
Pokety River	070101020103	11,470
Bungashing Creek	070101020102	18,159
Headwaters Necktie River	070101020101	13,976

* Sum of the subwatershed areas do not equal total area due to rounding.

The lakes and streams of the watershed have been assessed by the MPCA. The only impairment(s) identified are for mercury and nutrients for lakes (Table 2). No stream reaches in the watershed were identified as impaired; however, only three reaches were assessed for aquatic life use. The remaining reaches were not assessed.

Table 2. Impairments in the Steamboat River Watershed

Water body name	Water body type	Year added to List	AUID	Use Class	Affected designated use	Pollutant or stressor
Hart	Lake	2016	29-0063-00	2B, 3C	Aquatic Recreation	Nutrients
Steamboat*	Lake	2006	11-0504-00	2B, 3C	Aquatic Consumption	Mercury in fish tissue

* Steamboat lake has a partial Tribal designation Leech Lake Band of Ojibwe

The completion of a total maximum daily load (TMDL) for Hart Lake has been deferred until after the next MPCA assessment cycle for the Leech Lake River (LLR) watershed. The decision to defer the TMDL was made based on MPCA's work on developing a shallow lake eutrophication standard for lakes in the Northern Lakes and Forests Ecoregion of Minnesota and expected contribution of nutrients to the lake from natural background sources (MPCA, 2017). Implementation of this plan is expected to reduce phosphorus (P) loading to meet the eutrophication standard for Hart Lake.

A primary concern for the watershed is poor aquatic habitat and bank erosion present in the channelized portion of the Necktie River. Approximately 19,650 feet of the Necktie River was dredged in the early 1900s between the old CSAH-9 bridge and Hart Lake. The erosion rates in the channelized section of the river were estimated to be 30 times higher than in natural channel areas through a Bank Erosion Hazard Index (BEHI) survey. Re-meandering the river through its historic natural channel is needed to restore the ecological function of the river and reduce downstream loading of sediment and nutrients.

Wild rice is a culturally and economically valuable resource to the region and is an important component of fish and wildlife management. Throughout the Steamboat River watershed there are many beds of wild rice, including in Steamboat Lake and River, Hart Lake, Swamp Lake, and the Necktie River, among

many others. The harvest of wild rice is particularly important to members of the Leech Lake Band of Ojibwe, who harvest on waters both within and off Reservation. Because wild rice regulations on state waters often allow harvest before Reservation waters, many Band members harvest wild rice on Hart Lake. Hart Lake is impaired for nutrients and experiences sedimentation and nutrient input from historic channelization of the Necktie River that may threaten the production of wild rice.

Much of the watershed is covered by forests and wetlands that provide water quality protection for the river, streams, and lakes even though wetlands can be a natural source of phosphorus and low dissolved oxygen. Protection of the natural land cover is important to protecting water quality especially with development pressures with the proximity of the city of Bemidji (Figure 14).

The Hubbard Soil and Water Conservation District's (SWCD) mission statement follows as such "The purpose of the Hubbard County Soil and Water Conservation District is to conserve, protect, and enhance the soil and water resources of Hubbard County by providing leadership, education, and assistance."

The Hubbard Soil and Water Conservation District (SWCD) has been conducting a variety of conservation programs and projects since 1969. The Hubbard SWCD has a long history of working directly with private landowners, townships, county, state, federal, and local community partners. The Hubbard SWCD's work area contains a variety of landscapes and land uses from forests, lakes, wetlands, and farmlands that all play a key role in the district's conservation efforts. The Hubbard SWCD's work area contains over 200 named lakes (water covers around 7.7% of the work area) and over 98,000 (around 15% of the work area) acres of wetlands.

The Hubbard County SWCD is a partner in a variety of county-wide and watershed-based conservation plans including the Local Water Plan adopted in 2016, Mississippi River Headwaters One Watershed One Plan adopted in 2022, Leech Lake River One Watershed One Plan adopted in 2019, and currently in the planning phase of the Crow Wing River One Watershed One Plan.

The NKE plan (in collaboration with 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 U.S. Environmental Protection Agency (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

The Steamboat River Watershed is a high-value watershed that is currently meeting most water quality standards; however, it has a variety of important waterbodies and unique resources that have been or are degrading due to land use change and historic modification. Water quality assessments for many of the lakes and streams were completed by the MPCA in 2016. The assessments are made to evaluate the water quality conditions present with state water quality standards.

Water quality monitoring of the streams and lakes is being conducted in 2023 and 2024 as part of the second 10-year cycle for MPCA assessment of the Leech Lake River HUC8 watershed. The new water quality data will be added to the plan when available.

Lakes

Water quality data is present in the MPCA Environmental Quality Information System (EQuIS) database and assessments have been completed for three lakes in the Steamboat River watershed (Table 3). Swamp Lake is a fourth lake in the watershed that has not been assessed given that no data is present in EQuIS. The only 303(d) list impairments for lakes are Steamboat Lake for aquatic consumption by mercury in fish tissue and Hart Lake for eutrophication. Portage and Steamboat Lakes are assessed as fully supporting aquatic recreation.

Table 3. Lake assessment results for lakes in the Steamboat River watershed (MPCA 2016)

Lake name	DNR Lake ID	Area (acres)	Trophic status	Max. depth (m)	Aquatic Recreation Use Support Status
Portage	11-0490-00	360	Mesotrophic	19.8	Full support
Steamboat	11-0504-00	1,761	Mesotrophic	28.3	Full support
Hart	29-0063-00	208	Eutrophic	3.2	Non-support
Swamp	11-0483-00	600		36	Not assessed

The water quality data for the lakes is summarized in Table 4 and Table 5.

Table 4. Summary of summer (June-September) lake water quality monitoring in Steamboat River watershed lakes

Lake name	DNR Lake ID	Period of record	# years with data	# samples	Average TP (µg/L)	Average chl-a (µg/L)	Average Secchi (m)
Portage	11-0490-00	2008, 2011-2013	4	5-8	16	4.6	3.3
Steamboat	11-0504-00	2009, 2011	2	9	19	4.4	3.6
Hart	29-0063-00	2012-2013, 2015, 2018-2020	6	12-20	52	25.4	1.3
Swamp	11-0483-00	No data in EQuIS					

Table 5. Summary of Secchi disk depth volunteer monitoring in Steamboat River watershed lakes

Lake	Site ID	First year - last year	# years with data	# measurements	Average Secchi disk depth (m)
	11-0504-00-201	2004 - 2017	14	121	3.6
	11-0504-00-202	2006 - 2022	17	217	4.1
Steamboat Lake	11-0504-00-203	2010 - 2022	13	123	3.6
	11-0490-00-201	1998 - 2008	9	87	3.3
Portage Lake	11-0490-00-202	1997 - 2021	25	216	3.2

The phosphorus data for the lakes is shown in Figure 2, Figure 3, and Figure 4.

Figure 2. Steamboat Lake phosphorus concentrations

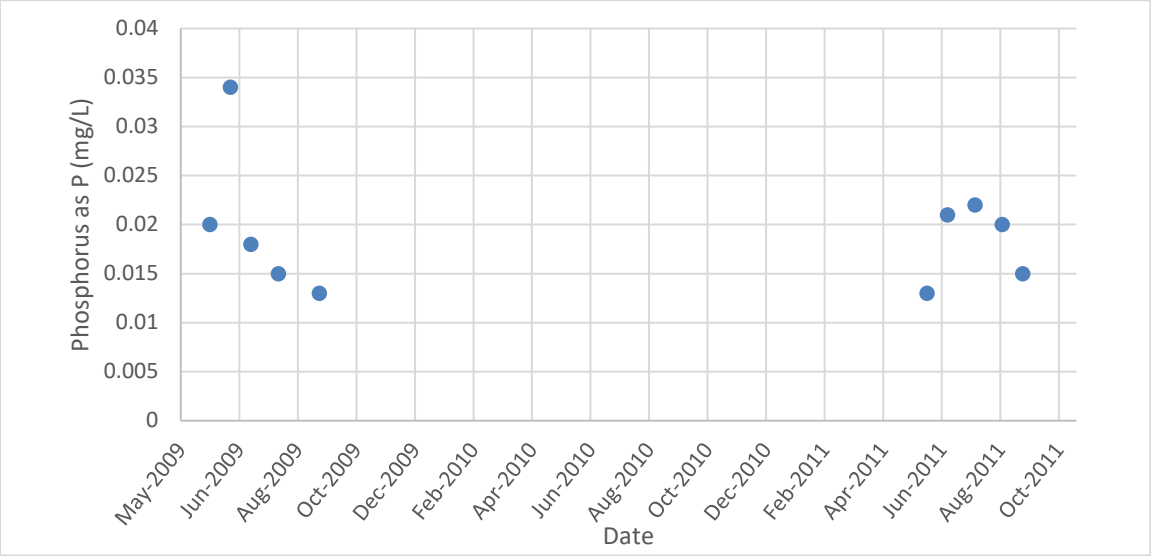


Figure 3. Portage Lake phosphorus concentrations

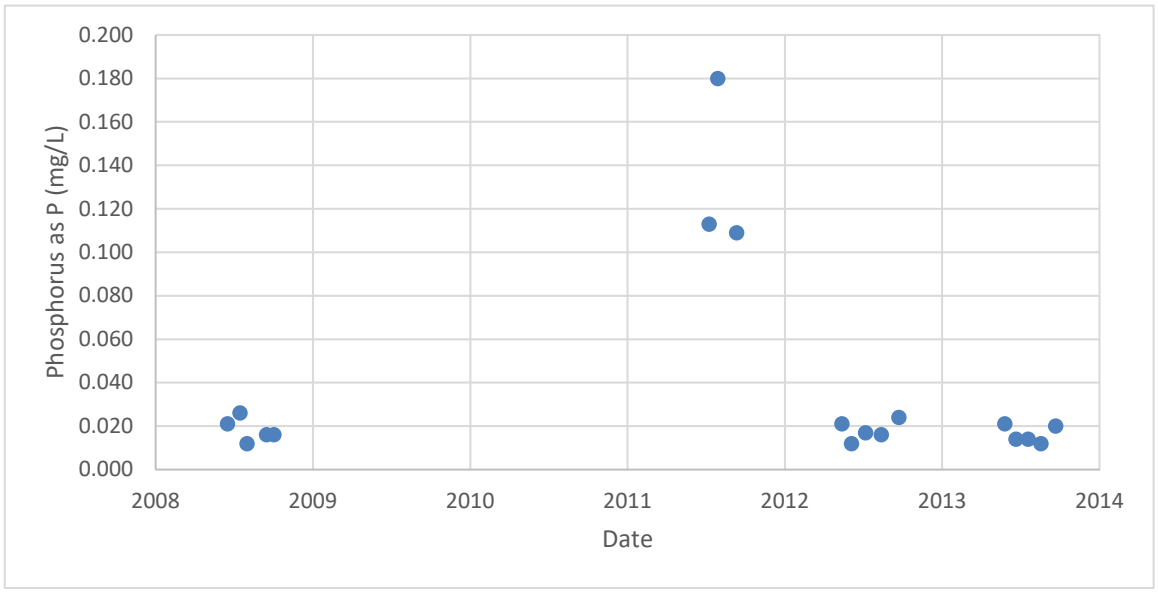
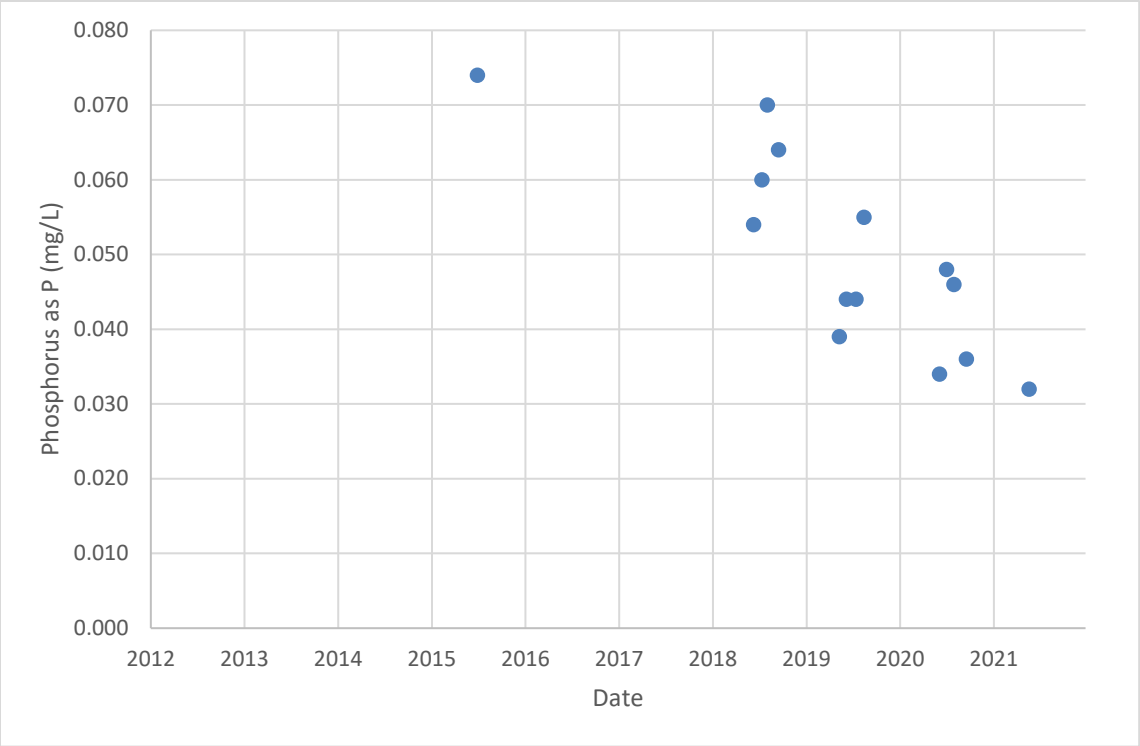


Figure 4. Hart Lake phosphorus concentrations



The chlorophyll-a data for the lakes is shown in Figure 5, Figure 6, and Figure 7.

Figure 5. Steamboat Lake chlorophyll-a concentrations

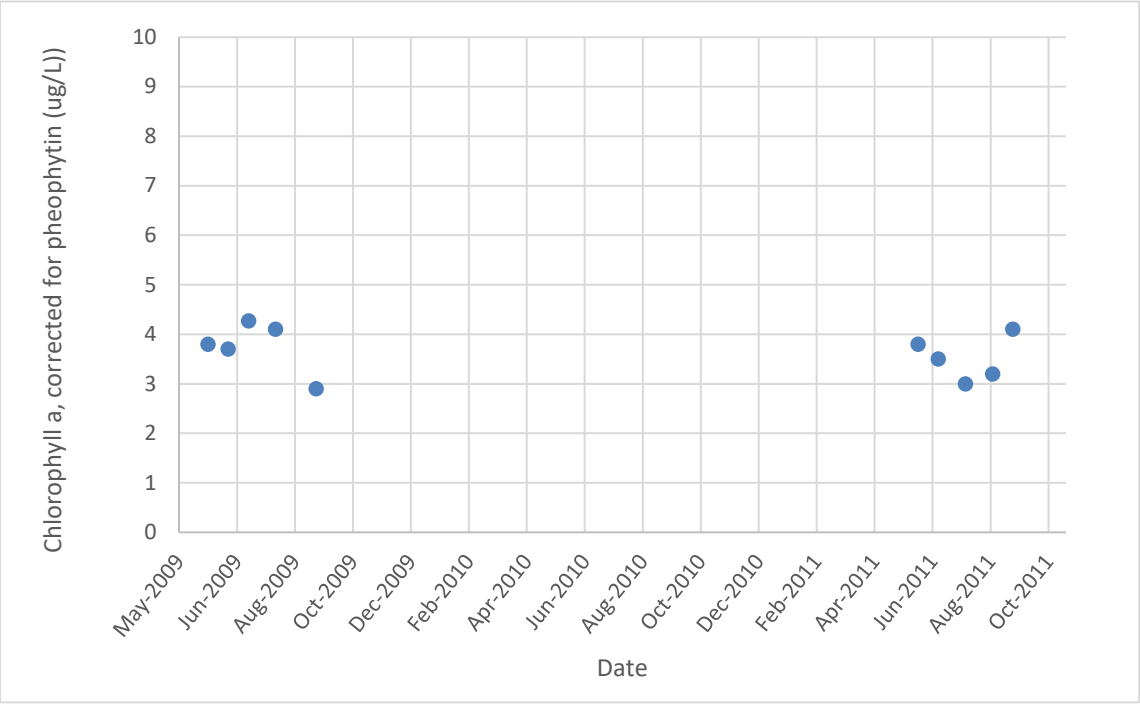


Figure 6. Portage Lake chlorophyll-a concentrations

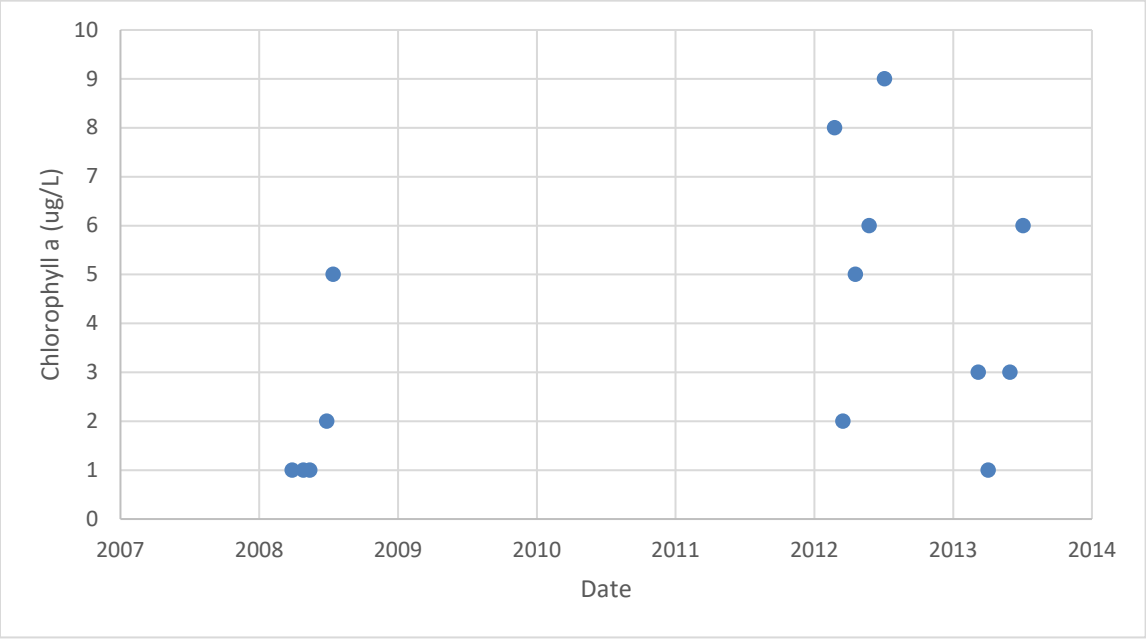
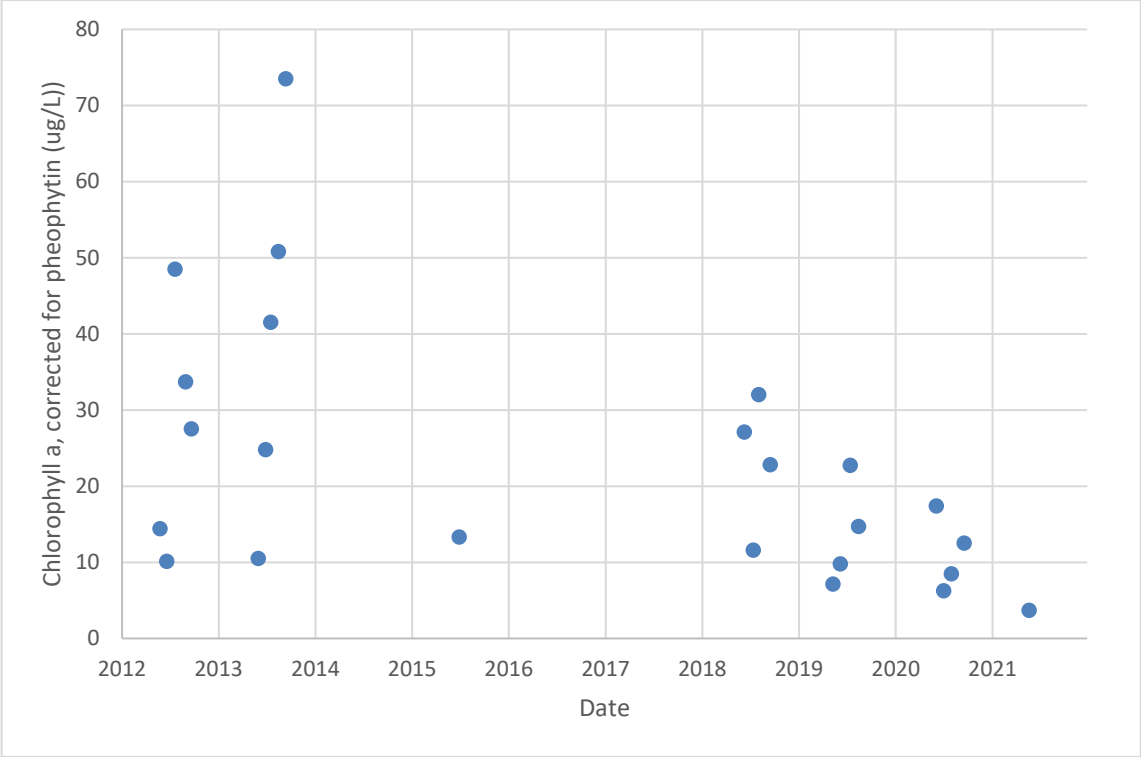


Figure 7. Hart Lake chlorophyll-a concentrations



Water clarity data and trend analyses for Portage, Steamboat, and Hart Lakes are shown in Figure 8, Figure 9, and Figure 10. No trend in water clarity was identified for Portage and Steamboat Lakes. The clarity of both lakes is considered good (MPCA water quality dashboard, 2023). A test for trend was not made for Hart Lake due to insufficient data. The clarity of Hart Lake is much lower than the other lakes.

Figure 8. Water clarity and trend analysis for Portage Lake (MPCA 2023)

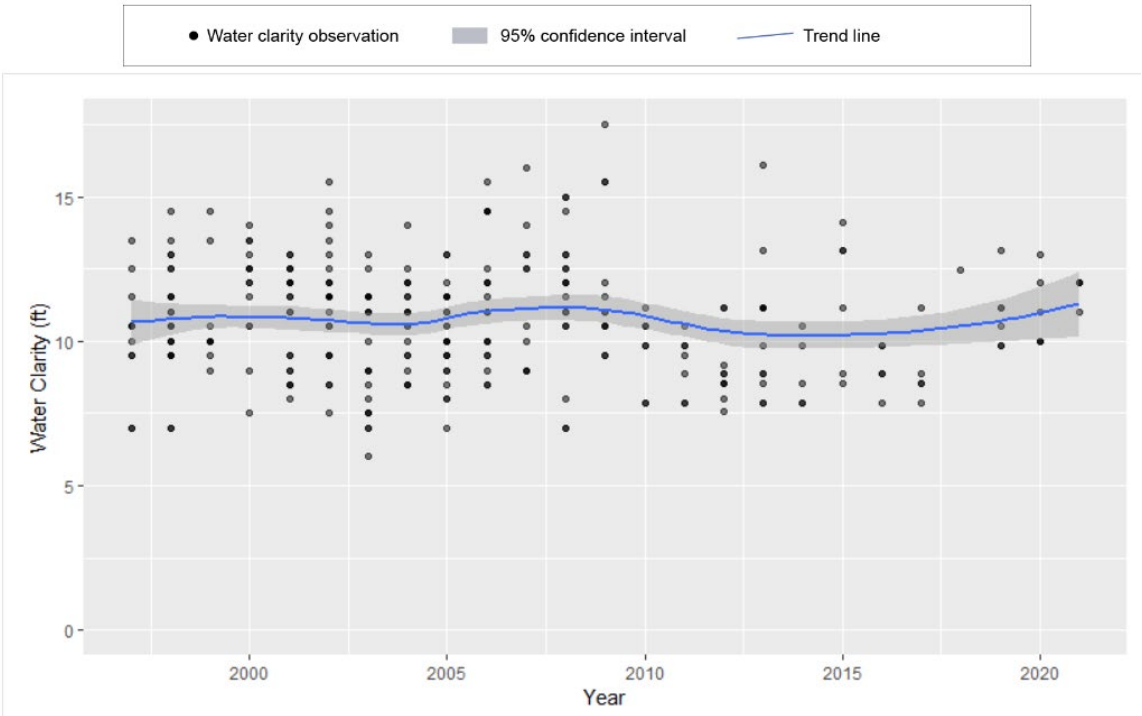


Figure 9. Water clarity and trend analysis for Steamboat Lake (MPCA 2023)

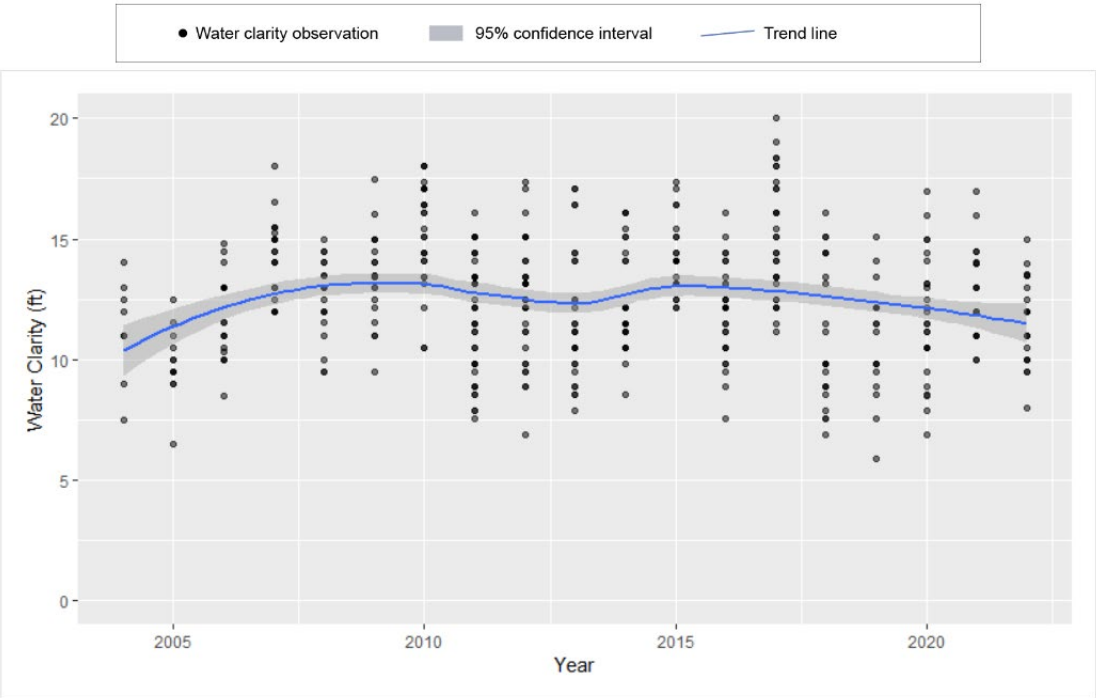
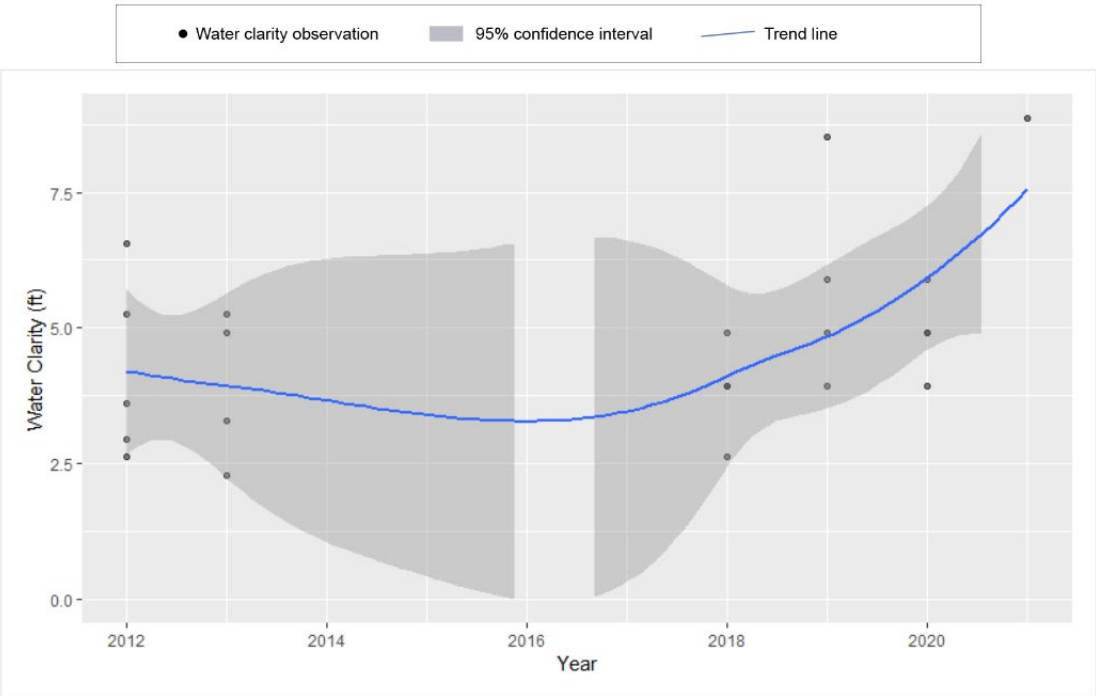


Figure 10. Water clarity and trend analysis for Hart Lake (MPCA 2023)



The level of focus relative to fisheries, phosphorus sensitivity, and biological significance for the lakes is shown in Table 6. The vigilance level is assigned when a watershed is less than 25% disturbed and greater than 75% of it is protected through ownership or easements. The protection level represents watersheds that have less than 25% disturbance and have less than 75% land protection. Phosphorus sensitivity categories of highest and high represent lakes with priority sensitivity scores greater than the

75th percentile and between the 50th and 75th percentiles, respectively. The outstanding category for biological significance represents high aquatic plant richness, high floristic quality, and a population of an endangered or threatened plant species.

Table 6. Level of focus on fisheries, phosphorus sensitivity, and biological significance for the three lakes

Lake name	Fisheries focus	Phosphorus sensitivity	Biological significance
Portage	Vigilance	Highest	Outstanding
Steamboat	Protection	Higher	Outstanding
Hart	Protection	--	Outstanding

Swamp Lake is located entirely within the Leech Lake Nation and is being evaluated for its wild rice conditions.

A load reduction goal for phosphorus of five percent to Portage and Steamboat Lakes has been identified to ensure the continued protection of their high-water quality condition through the MPCA/DNR Lakes of Phosphorus Sensitivity Significance Analysis. A load reduction goal for Hart Lake was established assuming the draft northern mixed (shallow) lakes criteria as the goals for the lake. The suite of BATHTUB eutrophication models was used to estimate the existing and predicted total phosphorus (TP) loads needed to achieve the existing lake data values and draft eutrophication criteria. The recommended criteria are 30 micrograms per liter (µg/L) TP, 16 µg/L chlorophyll-a, and 1.1 meters Secchi depth (MPCA, 2022). Event mean concentrations for the watershed land uses were adjusted until two of the three criteria were met. A target load reduction of 48% was calculated using the estimated existing TP load and predicted TP load needed to achieve the criteria. In this case, the chlorophyll-a and Secchi depth criteria would be met with the TP criteria being slightly higher than the recommended 30 µg/L.

Streams

Table 7 identifies the stream reaches in the watershed.

Table 7. Stream reaches in the Steamboat River watershed (MPCA 2016)

Stream name	WID	Reach description	Reach length (miles)	Use class
Necktie River	07010102-550	Unnamed ditch to T145 R32W S16, east line	6.9	1B,2Ag
Necktie River	07010102-503	Bungashing Cr to Pokety Cr	9.1	2Bg
Necktie River	07010102-502	Pokety Creek to Steamboat Lake	6.0	2Bg
Bungashing Creek	07010102-505	T145 R33W S34, south line to Necktie R	7.5	1B,2Ag
Pokety Creek	07010102-527	T144 R33W S24, north line to Necktie R	4.5	1B,2Bdg
Steamboat River	07010102-507	Steamboat Lake to Leech Lake	3.9	2Bg

A summary of the assessment indicators and use support status for aquatic life and aquatic recreation for each reach (WID) is shown in Table 8, Table 9, Table 10, Table 11, Table 12, and Table 13 (MPCA 2016a). Of the six stream reaches identified in the Steamboat River watershed, three WIDs were assessed for aquatic life use support. Bungashing and Pokety Creeks were assessed as fully supporting aquatic life while the headwaters of the Necktie River was assessed for aquatic life as having insufficient information to make a determination. For the three reaches that were not assessed for aquatic life, two were low gradient, wetland dominated reaches for which there is not an appropriate fish Index of

Biological Integrity (IBI) and the third was not assessed due its being channelized. A single reach just upstream of Steamboat Lake was assessed as fully supporting aquatic recreation.

Table 8. Aquatic life and recreation use indicators and assessments for Necktie River, unnamed ditch to T145 R32W S16, east line (WID 07010102-550)

Indicators	Indicator evaluation	Aquatic life use support status	Aquatic recreation use support status
Fish IBI	Meets standard		
Invert IBI	Insufficient information		
DO	Insufficient information		
TSS	Insufficient information		
Chloride	No data		
pH	Insufficient information		
Ammonia	No data	Insufficient information	N/A
Bacteria	No data		Not assessed

Table 9. Aquatic life and recreation use indicators and assessments for Necktie River, Bungashing Cr to Pokety Cr (WID 07010102-503)

Indicators	Indicator evaluation	Aquatic life use support status	Aquatic recreation use support status
Fish IBI			
Invert IBI			
DO			
TSS			
Chloride			
pH	Data not collected given channelization	Not assessed due to channelization	
Ammonia			
Bacteria	No data		Not assessed

Table 10. Aquatic life and recreation use indicators and assessments for Necktie River, Pokety Creek to Steamboat Lake (WID 07010102-502)

Indicators	Indicator evaluation	Aquatic life use support status	Aquatic recreation use support status
Fish IBI	Not assessed given no FIBI for low gradient streams with drainage area less than 50 square miles		
Invert IBI	No data – too deep to wade (sample)		
DO	Not assessed, deferred for future data and analysis		
TSS	Supporting		
Chloride	Supporting		
pH	Supporting		
Ammonia	Supporting	Not assessed	
Bacteria	Supporting		Full support

Table 11. Aquatic life and recreation use indicators and assessments for Bungashing Creek, T145 R33W S34, south line to Necktie R, (WID 07010102-505)

Indicators	Indicator evaluation	Aquatic life use support status	Aquatic recreation use support status
Fish IBI	Meets standard		
Invert IBI	Meets standard		
DO	Insufficient information		
TSS	Insufficient information		
Chloride	No data		
pH	Insufficient information		
Ammonia	No data	Full support	
Bacteria	No data		Not assessed

Table 12. Aquatic life and recreation use indicators and assessments for Pokety Creek, T144 R33W S24, north line to Necktie R (WID 07010102-527)

Indicators	Indicator evaluation	Aquatic life use support status	Aquatic recreation use support status
Fish IBI	Meets standard		
Invert IBI	No data		
DO	Insufficient information		
TSS	Insufficient information		
Chloride	No data		
pH	Insufficient information		
Ammonia	No data	Full support	
Bacteria	No data		Not assessed

Table 13. Aquatic life and recreation use indicators and assessments for Steamboat River, Steamboat Lake to Leech Lake (WID 07010102-507)

Indicators	Indicator evaluation	Aquatic life use support status	Aquatic recreation use support status
Fish IBI	Meets standard		
Invert IBI	No data		
DO	Insufficient information		
TSS	Insufficient information		
Chloride	No data		
pH	Insufficient information		
Ammonia	No data	Full support	
Bacteria	No data		Not assessed

The water quality data collected during biological and stressor identification monitoring indicated that dissolved oxygen concentrations were generally low and phosphorus concentrations were typically higher than expected in the wetland portions of the stream reaches. The SID report concluded that both conditions are likely the results of natural wetland processes along the streams (MPCA 2016b).

Table 14 summarizes the water quality data for the stream sites in the watershed.

Table 14. Summary of water quality data for Necktie and Steamboat Rivers (EQuIS, 2023)

	Necktie River S006-256			Necktie River S008-428		Steamboat River S007-346	
	TSS (mg/L)	**TP (mg/L)**	**DO (mg/L)**	**TP (mg/L)**	**DO (mg/L)**	**TSS (mg/L)**	**TP (mg/L)**
# of samples	41	49	8	9	7	20	29
Average	5	0.057	7.87	0.046	8.17	2.9	0.030
Minimum	1	0.016	4.28	0.027	5.99	1	0.011
Maximum	26	0.174	11.74	0.065	10.04	6	0.13
# years of data	3	8	2	1	1	4	7
Years of data	2010-2012	1995-1997, 2010-2012, 2015-2016	2014-2015	2015	2015	2008, 2010, 2012-2013	1995-1997, 2008, 2010, 2012-2014

TSS and TP data for the stream sites are shown in Figure 11 and Figure 12.

Figure 11. Total suspended solids data for the Steamboat and Necktie River monitoring sites

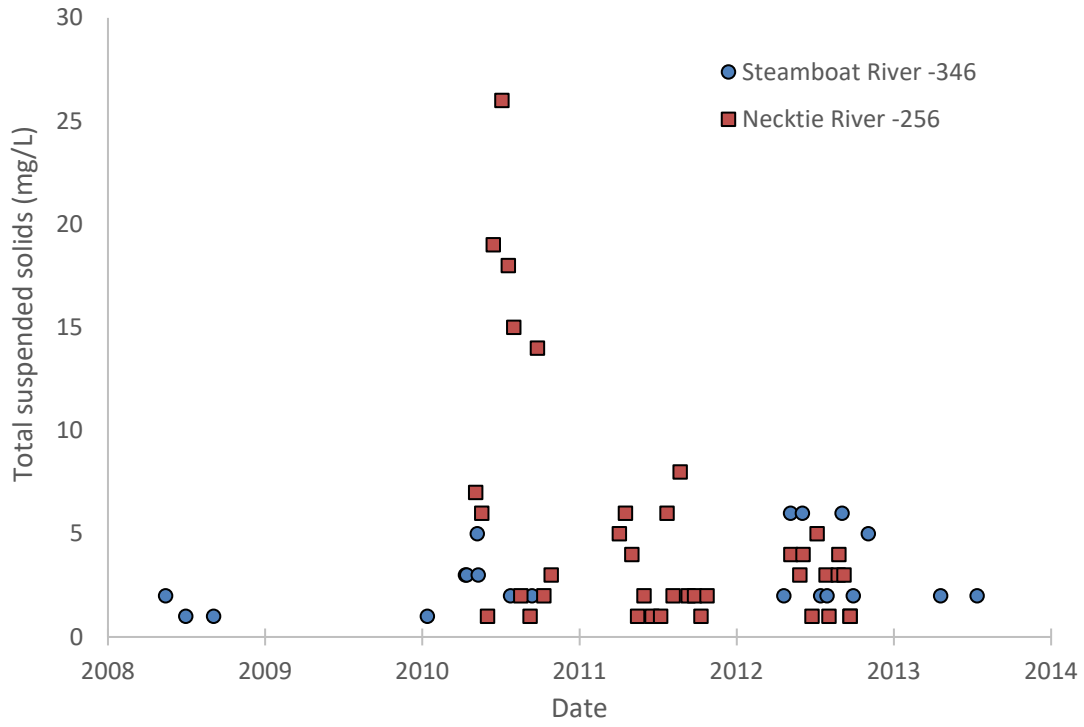
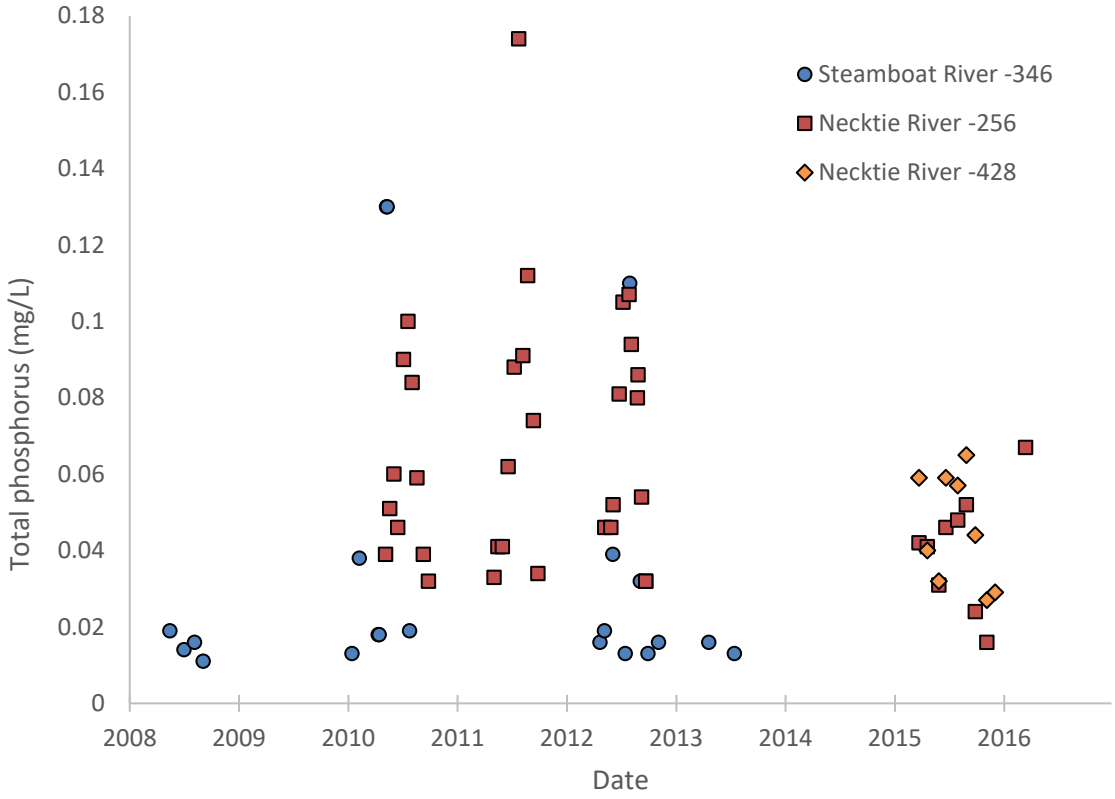


Figure 12. Total phosphorus data for the Steamboat and Necktie River monitoring sites



Secchi disk transparency depth data from three sites between Pokety Creek and Steamboat Lake are almost all greater than 100 cm indicating very clear water (Table 15). The clarity corresponds with a low average total suspended solids (TSS) concentration of 5 milligrams per liter (mg/L) and a maximum TSS concentration of 26 mg/L. Low concentrations of TSS and TP at the monitoring site on the Steamboat River reflect the lake water quality given that the sampling site is located just downstream of the lake outlet.

Table 15. Summary of volunteer monitoring Secchi transparency depth (cm) data for the Necktie River

	S006-256	S007-950	S014-916
# of measurements	70	20	139
Average	>100	>100	>100
Minimum	>100	>100	69
Maximum	>110	>100	>100
# years of data	5	3	6
Years of data	2010-2013, 2015	2017-2019	2017-2022

Ecological Health

The Necktie River and the tributary streams provide stream habitat for a variety of rare species including Native Brook Trout. The upper Necktie River and Bungashing Creek are designated trout streams. The lower reaches between Upper Necktie and Hart Lake are not designated as a trout stream due to the modified stream channel; however, the presence of adult trout in these sections of the Necktie River have been documented through Minnesota Department of Natural Resources (DNR) sampling. The headwaters of the Necktie River and Bungashing Creek are identified as priorities for protection given

the presence of naturally reproducing populations of Brook Trout. The fish and macroinvertebrate communities in Bungashing Creek are at or near undisturbed conditions and the MPCA has designated it an “exceptional use water.” The stream segment upstream of Hart Lake has also been identified as a priority given its historical channelization and the opportunity to restore it to a natural channel. Doing so will improve aquatic habitat, stabilize the channel banks and reduce erosion, and improve the fish and macroinvertebrate communities including Brook Trout. Maintaining and improving the stream health and habitat availability will be very beneficial to maintaining the naturally reproducing trout communities' resilience to impacts of climate change.

Wild Rice

Wild rice is an important resource in the watershed as there are many waterbodies categorized as Wild Rice Lakes/Streams, such as Steamboat Lake and River, Hart Lake, Swamp Lake, and the Necktie River. Many other lakes, ponds, and stream reaches within the watershed also have naturally occurring wild rice. The harvest of wild rice is particularly popular on reaches of the Necktie River and Hart Lake. Hart Lake is impaired for nutrients and experiences elevated turbidity levels. The sediment and nutrient input from historic channelization of the Necktie River to Hart Lake affects the health of the wild rice beds in the lake. Input from the Leech Lake Band of Ojibwe will assist in guiding efforts to enhance and protect the natural resources within the Steamboat River Watershed especially those which produce wild rice.

Implementation strategies

The implementation strategies, schedule, milestones, assessments, costs, and the estimated pollutant reductions by practice are described in Table 16. The plan is estimated to yield the reductions needed to meet the water quality standard for TP within ten years. The plan will also achieve the significant TSS and nitrogen (N) load reduction. Estimated pollutant reductions by practice were calculated per practice using the EPA's Pollutant Load Estimation Tool (PLET) for decision-making purposes. The complete reductions for this plan were calculated using the PLET combined efficiencies; therefore, the summation of individual practice estimates may not equal the reductions estimated for the entire plan. Complete plan reductions are summarized in Table 20.

Eligibility for funding refers to current practice eligibility in 2023, as described in the EPA's 2014 Guidance and Minnesota's 2021 Nonpoint source management plan (NPSMP). 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. Monitoring to determine the effectiveness of this plan and the best management practices (BMPs) implemented is eligible for Section 319 funding. General diagnostic and exploratory monitoring activities are not eligible for funding or match purposes.

Table 16. Implementation types, eligibility, activities, schedule, milestones, assessment criteria, costs, and estimated per practice pollutant reductions (PLET, 2022)

			Milestones							Reductions		
	319 Eligible	Treatment type	2-year (2025)	4-year (2027)	6-year (2029)	8-year (2031)	10 year (2033)	Assessment	Costs	TSS (t/yr)	P (lbs/yr)	N (lbs/yr)
Stream restoration	Y	Re-meander channelized stream reach to extend length from 26,400 to 35,726 feet			4,800	4,500		# feet of stream length		1,793	939	2,439
	Y	Install 13 ditch plugs to divert water into re-meandered natural stream			7	6		# ditch plugs				
	Y	Remove old roadbed to allow re-meander of the stream			Remove old roadbed			Roadbed removed				
Habitat/ connectivity	Y	Modify/replace dams, culverts & fish passage barriers - 3 barriers		1	1	1		# barriers removed				
	Y	Re-meander channelized stream reaches - 4 reaches		1	1	1	1	# projects # feet				
	Y	Restore riffle substrate - 4 projects		1	1	2		# projects # riffles	$3,800,000	Reductions assumed with Necktie River restoration		
Forest protection	Y*	Increase Steamboat River HUC 10 protected acres through Private Forest Management and Easements by 15% - 3,500 acres - combination of the following three activities	700	700	700	700	700	# acres	Assumed in Easement and Forest Stewardship Categories	271	1,687	11,797
	Y	Develop forest management plans for participations in Sustainable Forest Incentive Act (SFIA) - 10	2	2	2	2	2	# plans		Assumed with the Increased Steamboat River HUC 10 Protection Goal		
	Y	SFIA enrollments - 10	2	2	2	2	2	# SFIA sign-ups	$30,000			
	N*	Forest protection easements through other programs (not eligible for 319 grant funds) - 2 easements, 100 acres		1 easement, 50 acres		1 easement, 50 acres		# easements # acres	$98,000	Assumed with the Increased Steamboat River HUC 10 Protection Goal		

	319 Eligible	Treatment type	Milestones					Assessment	Costs	Reductions		
			2-year (2025)	4-year (2027)	6-year (2029)	8-year (2031)	10 year (2033)			TSS (t/yr)	P (lbs/yr)	N (lbs/yr)
Forest management	Y	Mixed hardwood and conifer tree planting on open land - 250 acres	50	50	50	50	50	# parcels # acres # trees	$100,000	4	27	335
	Y	Mixed hardwood and conifer tree planting on harvested land - 250 acres	50	50	50	50	50	# parcels # acres # trees	$100,000	1	6	79
	Y	Timber harvest using MFRC forest harvest guidelines - 1,000 acres	200	200	200	200	200	# acres # parcels	$90,000	2	11	26
Pasture	Y	Pasture management systems, each including rotational grazing, livestock access control (exclusion), alternative water supply, and critical area planting - 7,000 acres	1,400	1,400	1,400	1,400	1,400	# access controls # acres treated	$3,500,000	201	1,177	14,038
SSTS	N*	SSTS upgrades and replacements - 30 systems	6	6	6	6	6	# systems	$600,000	-	36	93
Lakeshore	Y	Shoreline restoration - 2,175 feet, 22 acres treated	435	435	435	435	435	# feet of lakeshore # properties # acres treated	$250,000	0.5	4	13
Stormwater	Y	Road culverts and road ditch stabilization - 20 acres treated	4	4	4	4	4	#acres	$140,000	4	16	86
	Y	Urban BMPs represented as wet ponds (average of dry detention, grass swales, raingardens, and wet ponds) - 30 acres treated	6	6	6	6	6	# practices # acres treated	$80,000	5	24	113
Education & Outreach	Y	Soil health / water quality workshop - 5 workshops	1	1	1	1	1	# workshops	$5,000			
	Y	Soil Health and Forestry Program sign-up events - 5 events	1	1	1	1	1	# events	$5,000			
	Y	Ag BMP and Forestry Program Landowner mailings - 10 mailings	2	2	2	2	2	# mailings # landowners	$12,000			

319 Eligible	Treatment type	Milestones					Assessment	Costs	Reductions		
		2-year (2025)	4-year (2027)	6-year (2029)	8-year (2031)	10 year (2033)			TSS (t/yr)	P (lbs/yr)	N (lbs/yr)
Y	County Fair booth to promote program - annually	Annually	Annually	Annually	Annually	Annually	# visitors # people expressing interest	$15,000			
Y	Individual landowner meetings BMP - 50 meetings	10	10	10	10	10	# meetings # landowners	$10,000			
Y	Workshops promoting easement programs for forest protection - 10	2	2	2	2	2	# workshops # attendees # new attendees # requesting assistance	$1,000			
Y	Print and electronic mailings, newsletters, and flyers about forest protection - 10 items	2	2	2	2	2	# of items # people receiving items # people responding	$5,000			

* Final determination of Section 319 funding eligibility will be made based on the most current Section 319 guidelines and the NSPMP. Non-eligible expenses may be used as match.

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).

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Pollutant sources contributing phosphorus to the lakes and streams include streambank erosion from the channelized portion of the Necktie River, runoff from pasture, open areas, roads, and timber harvest areas. An increasing risk of forest lands being converted to development represents a potential source of pollutants to the river and lakes. The average pollutant loads using PLET by source and HUC-12 watershed are shown in Table 17.

Table 17. Average phosphorus load (lbs/year) by source and HUC12 watershed in the Steamboat River Watershed using PLET (2023).

Watershed	Urban	Cropland	Pastureland	Forest	Feedlot	Septic	Streambank
070101020101 - Headwaters Necktie River	355	402	650	373	126	42	329
070101020103 - Pokety River	178	50	572	620	69	3	-
070101020105 - Steamboat River	443	140	664	780	212	10	-
070101020104 - Necktie River	273	80	823	856	101	8	659
070101020102 - Bungashing Creek	327	122	1,025	935	127	9	-
Total	1,577	794	3,734	3,565	635	73	988

Streambank erosion and habitat degradation

The primary pollutant source to Hart Lake and downstream to Steamboat Lake is the channelized section of the Necktie River upstream of Hart Lake. Field observations indicate that the predominant source of sediment is streambank erosion. The ditched section of the Necktie River has been studied by the Minnesota Department of Natural Resources for feasibility of restoration and has been found to be contributing excessive sediment into the system due to elevated bank erosion. A Bank Erosion Hazard Index (BEHI) survey conducted by the Minnesota Department of Natural Resources estimated that the ditched section is eroding at around 30 times the rate of the naturally meandering sections. Much of the sediment released in the bank erosion is being transported to Hart Lake. Sediment-attached phosphorus is assumed to be a predominate source of phosphorus in the lake.

The channelization and streambank erosion results in degraded habitat in the river. Channelization efforts in the early 1900s shortened an eight-and-a-half-mile section of natural stream channel down to

five miles of straight, channelized stream. The loss of stream length and increased channel slope increased erosion rates and downstream sedimentation. The channelization resulted in the loss of the natural pattern of riffles, runs, and pools with varying widths and depths resulting in a loss of habitat areas for many species and their different life stages.

Landscape sources

The Steamboat River Watershed is comprised of a mix of forest, wetlands, pasture, and developed areas (Table 18). Forests and wetlands dominate the land cover in each HUC-12 watershed with a combined range of 68 to 81 percent. Wetland area is combined with forest areas in the PLET model. Cropland and pasture make up 7 to 26 percent of the land use in the HUC-12 watersheds, while developed land uses account for less than five percent of the areas.

Table 18. Land use (acres) in Steamboat River Watershed (PLET, 2023).

Watershed	Urban	Cropland	Pastureland	Forest	Feedlots	Water	Other	Total
Headwaters Necktie River (70101020101)	735	914	3,215	9,111	0.2	10	31.6	14,018
Necktie River (70101020104)	465	121	2,802	12,723	0.2	238	-	16,350
Pokety River (70101020103)	304	62	1,927	9,177	0.1	70	-	11,540
Bungashing Creek (70101020102)	556	187	3,503	13,913	0.2	102	-	18,261
Steamboat River (70101020105)	918	212	3,106	18,670	0.4	2,777	1.6	25,685
Total	2,980	1,496	14,552	63,594	1.2	3,198	33	85,854

Land use and cover in the watershed is shown in Figure 13.

Figure 13. Steamboat River Watershed land use and cover (WHAF, DNR, 2023).

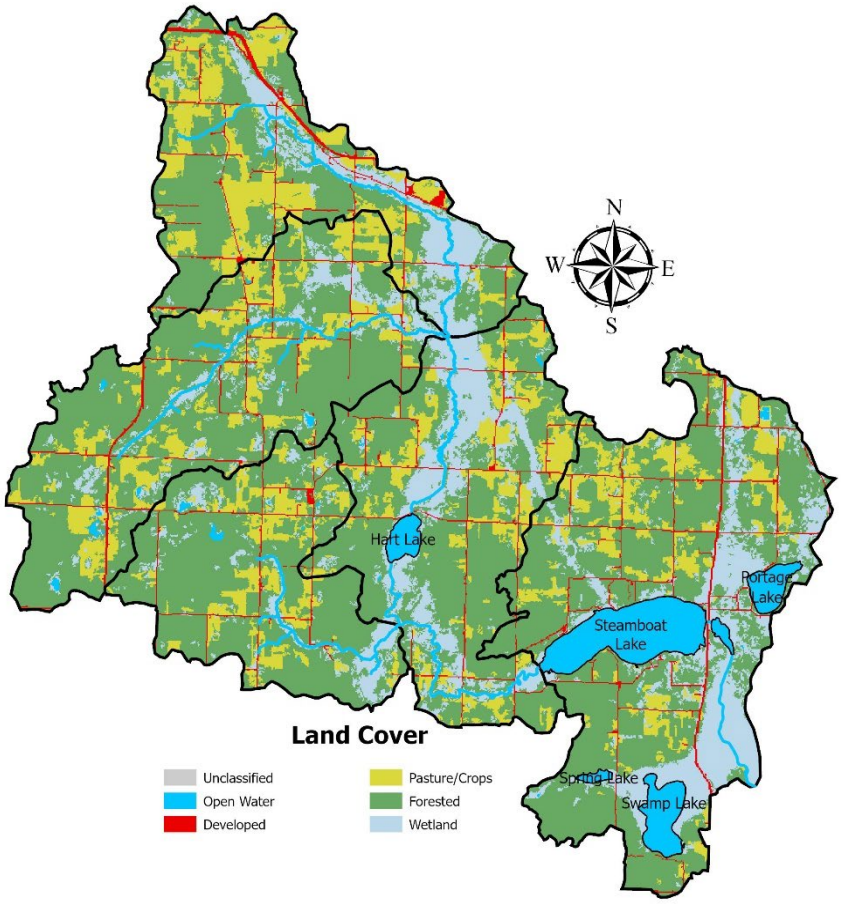


Figure 14. Leech Lake River Watershed land use conversion Risk (MPCA 2017 LLR WRAPS).

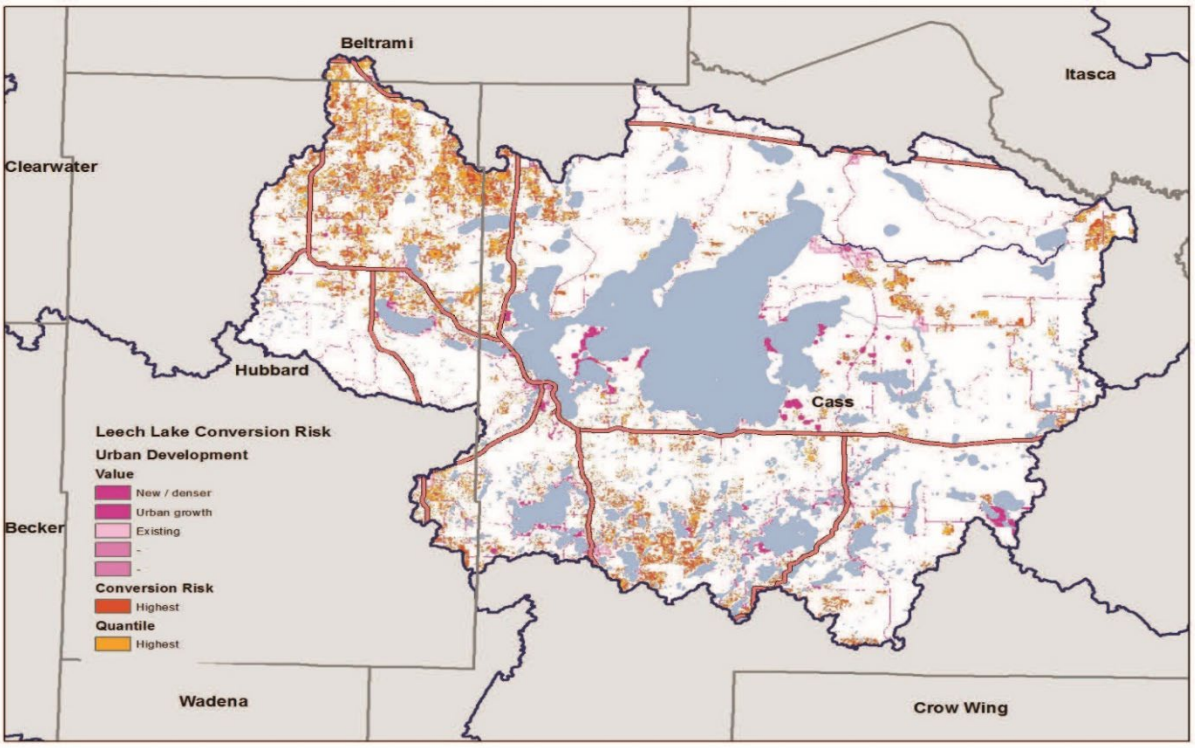
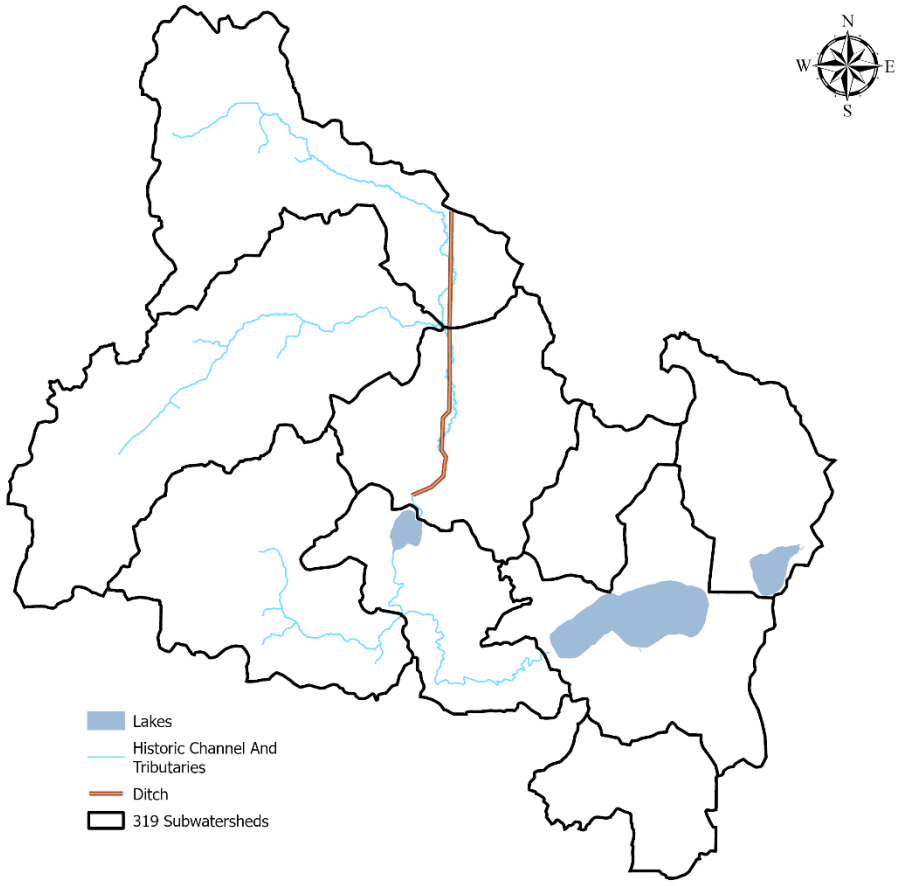


Figure 15. Map of Historic Channels and Ditch Along Necktie River and Tributaries



Conversion of forest to development

The Steamboat River watershed is at an increased risk to conversion of forest lands to development due to its adjacency to Bemidji, an increasingly populous city along with adjacency to tourism hubs like Walker. Increased industrial development along Highway 2 is also putting pressure on the northwestern sub-watersheds (Figure 14). This makes protecting ecologically and biologically beneficial land uses vital to meet long term water quality and habitat goals. Through research conducted by the DNR and the University of Minnesota, landscape disturbance above 25% starts to have a negative impact on water quality (Jacobson et al., 2016). Landscape disturbance of over 40% has been identified to substantially impact water quality. This makes proactively protecting the beneficial landcovers vital for long-term health of the watershed. Table 19 summarizes the land protection status and the number of acres needed to achieve a 75% land protection goal in the HUC-12 watersheds of the Steamboat River Watershed. Protected lands are public owned forests, private forestland in easements (federal, state, local, and nongovernment organizations), and wetlands.

Table 19. Summary of landscape protection potential in the Steamboat River Watershed (Technical Service Area 8 calculations).

HUC-12 watershed	Percent protected	Percent protectable	Acres to 75% protection
Headwaters Necktie River	23	71	7,185
Bungashing Creek	29	89	7,725
Pokety River	38	93	4,110
Necktie River	38	94	5,103
Steamboat River	47	94	6,506

Road Runoff

Runoff from township roads has been identified as a source of sediment and salt to the rivers, wetlands, and lakes across the area. Many of the township roads around the lakes and rivers were put in many decades ago with little or no regard to stormwater or erosion. A Geographic Information System (GIS) based analysis of road crossings in the work area has identified several locations where stormwater runoff is expected to be an issue especially during spring melt and high intensity rain events. There are 12 crossings that have been identified as areas for further study and ranking for possible stormwater treatment practices.

Pasture

While the agricultural footprint in the watershed is small, cattle in pastures adjoining the river and streams can be sources of nutrients. Pasture area located in the riparian area of the river and streams is the critical area to be addressed for pasture pollutant contributions.

Timber harvest and open land

Land harvested for timber can be a source of sediment and nutrients if erosion control practices are not used. Sediment and nutrients loads are greatly reduced within a few years of harvest, but active tree planting to encourage a mixed hardwood and conifer forest lessens the loading even more. In the same manner, tree planting in open areas will decrease nutrient and sediment loading while encouraging long-term protection with the growth of a forest.

The number and area of timber harvests each year generally are small such that each will be targeted with outreach for forest management if they are not already following a forest management plan. Critical areas for open lands are the open lands near waterbodies and susceptible to development.

Lakeshore best management practices

Reducing impacts of land conversion is vital for long term health due to the high pressure on lakes and rivers from shoreline development for commercial and residential uses. Much historical development has already happened along the shores of Steamboat Lake so addressing existing land use will be beneficial to reduce impact of existing development. Best management practices (BMPs) designed to address runoff from road, buildings, and lawns will be beneficial in nutrient loading from nearshore parcels. Lakeshore BMP activities will be focused on Steamboat and Portage Lakes given that there is little to no development along Hart and Swamp Lakes.

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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A BATHTUB model (Walker, 1986) was developed to estimate the TP load of the lake from simple water quality data and default variables. The estimated load was distributed among the BATHTUB input variables to identify the estimated loads to the lake. The loads were then compared to PLET calculated TP loads to provide estimated loads by land use. For the purposes of this NKE plan, the percent TP load reduction needed to achieve the draft northern mixed lakes criteria was calculated to be 48% from the BATHTUB loads. The load reduction needed is based on this percentage combined with the load estimates using the PLET model.

The PLET model estimates the TP load to Hart Lake as 6,573 pounds per year. A 48% load reduction goal for Hart Lake is 3,155 pounds per year. The estimated P reductions in this NKE Plan for the Steamboat River Watershed are 3,928 pounds per year. Assuming that most of the BMP activities will occur in the watershed area contributing to Hart Lake, the estimated reductions would be 60%. The estimated reductions for individual activities are listed in Table 16 and summarized in Table 20.

A majority of the work along the Necktie River is focused on reducing the sedimentation to Hart Lake and the Necktie River. The landscape work will be completed to maintain or improve the Necktie River, Bungoshing Creek, Pokey Creek, and Steamboat Lake. Along with protecting the wild rice lakes from degradation.

Most of these funds expended from 319 funds and other sources will be used on a major river restoration work which would fall exclusively in the Hart Lake Drainage area.

Table 20. Summary of estimated load reductions by activity.

BMP/Activity	TSS load reduction (t/yr)	P reduction (lbs/year)	N reduction (lbs/year)
Stream channel restoration and channel re-meandering	1,793	939	2,439
Forest protection	271	1,687	11,797
Tree planting on harvested land	1.0	6.3	79
Tree planting on open land	4	27	335
MFRC forest harvest guidelines	1.6	11	26
Pasture management systems	201	1,177	14,038
Roads culvert replacements and road ditch stabilizations	3.9	16	86
SSTS upgrades and replacements	0.0	36	93
Shoreline restoration	0.5	4.4	12.8
Stormwater	4.8	24	113
Total	2,282	3,928	29,018

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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The BMPs and associated implementation activities are described in Table 16. Core activities will include the stream channel restoration, forest land protection, streambank and lakeshore stabilization, pasture management near waterways, and SSTS improvements.

Channel restoration

Returning the ditched section of the Necktie River to a more natural sinuous stream will drastically improve the available habitat in the lower reaches. Because of warmer stream temperatures in this reach, it will provide important habitat for the Brook Trout through the cooler seasons, especially overwintering habitat. Maintaining and improving the stream health and habitat availability will be very beneficial to maintaining the naturally reproducing trout communities' resilience to impacts of climate change. Restoring the streams length and sinuosity will also improve the systems ability to properly deal with high intensity rain events and peak flow which are expected to increase over time.

Channel restoration will increase the length and sinuosity of the channelized stream section by re-meandering the river through its historical channel using ditch plugs, moving a road crossing culvert, and bioengineering of the restored channel banks. The overall goal of this work will be to restore proper stream function along with reducing bank erosion and sediment transport to Hart Lake and improving water quality and fish habitat.

Preliminary (30%) design plans have been drafted and have received initial review by the DNR. Final restoration designs and implementation plans are being developed and will be completed as the implementation of this NKE Plan is undertaken.

Figure 16. Overview of Necktie River restoration project (AECOM, 2023).

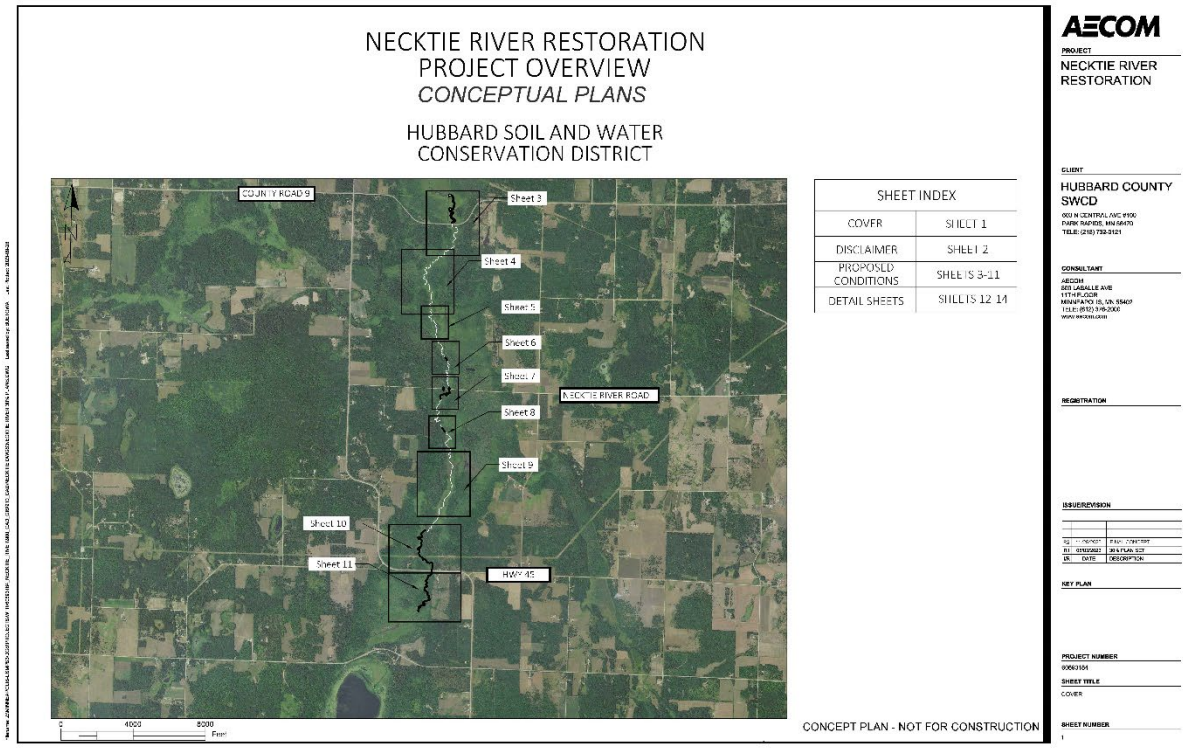
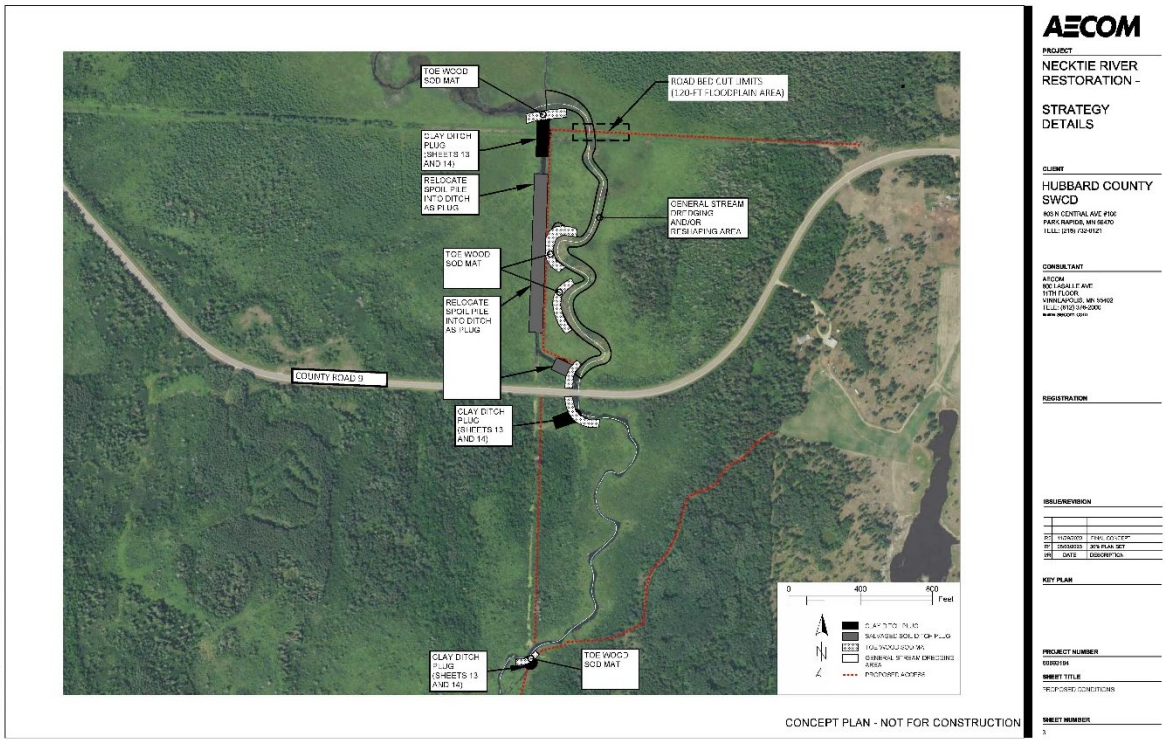


Figure 17. Example design sheet from 30% design plan for Necktie River (AECOM, 2023)



Landscape based (forest) protection

The protection of forest land is critical to protecting water resources, especially in the lakes areas of northern Minnesota. Land that is protected are areas that are not likely to be converted from an intact natural ecosystem to an open or disturbed state. Protected land is commonly defined as public lands (local, state, federal), public waters (lands & streams), wetlands on private lands, and perpetual conservation easements on private lands (Local Forestry Technical Team, 2020).

The introduction of the *Leech Lake River Watershed Landscape Stewardship Plan* states that "Forests play a critical role in keeping water clean by absorbing and filtering water, preventing erosion through soil stabilization, and allowing for groundwater recharge. The National Association of State Foresters recognized the connection of healthy forests to clean water with its policy statement: *"Water, in all its uses and permutations, is by far the most valuable commodity that comes from the forest land that we manage, assist others to manage, and/or regulate.*" The stewardship plan provides direction in protecting and managing working forests on private lands at a small watershed scale. The purpose of the document is to enable teams of service providers to work together with private landowners and land managers to protect working forest lands and promote private forest stewardship to enhance both private and public forest benefits. Service providers in the Steamboat River watershed include Hubbard SWCD, consulting foresters, DNR, NRCS and conservation organizations. Private landowners are the ultimate decision makers on the level of forest protection that works for them and how active they wish to be in managing their woods. The document is intended to increase the intentionality of service providers in growing their delivery of forest management services to landowners (Local Forestry Technical Team, 2020).

Table 21 lists the number of acres of land that would have to be protected to achieve 75% protection in the HUC-12 watersheds. Barriers to reaching the 75% goal will be active and willing landowners. There is enough funding through 319 funds and State One Watershed One Plan funds to reach this goal but engaging enough landowners may be difficult as many plots in this region have absentee landowners. Absentee landowners have historically been more difficult to engage then landowners active in the area. Adaptive management will be used to help achieve this goal.

Table 21. Acres of land needed to achieve 75% protection in each HUC-12 watershed in the Steamboat River Watershed (Technical Service Area 8 calculations).

HUC-12 watershed	Acres to 75% protection
Headwaters Necktie River	7,185
Bungashing Creek	7,725
Pokety River	4,110
Necktie River	5,103
Steamboat River	6,506

Investing resources for private forest management in the parts of the watershed where the public benefits can be stacked (e.g. tourism, timber, habitat, etc.) provides the greatest return on investment for the citizens of Minnesota.

Stream Connectivity

The repair or replacement of three road crossing culverts and the removal of an old roadbed have been identified as critical for the restoration of stream connectivity in the river and its tributaries. The culverts noted have been identified in the 2017 WRAPS Report for the Leech Lake River and Leech Lake River

One Watershed, One Plan (1W1P) as issues. The County 9 stream crossing has been moved south approximately ¼ of a mile. The historic roadbed still persists and is substantially restricting the stream's ability to meander. This has caused the stream to make a sharp turn, causing significant and persistent erosion. Partial removal of this historic roadbed will allow the stream to properly meander. Improving these crossings and removing the roadbed will substantially reduce streambank erosion and improve stream functions.

Pasture

Pasture management practices will be targeted to critical pasture areas in the watershed. Critical pasture area is identified as pastures along waterways that have been observed to have bank erosion and cattle trampling in the streams. Pasture management systems will include rotational grazing, livestock access control (exclusion), alternative water supply, and critical area planting.

Tree planting

Tree planting on open areas and harvested forest areas will support the development a healthy, mature, long-lived and diverse forest. Priority for forest restoration and management will be given to open land and stormwater hotspots. Riparian and upland forest management will reduce both the amount and velocity of overland stormwater runoff since forests capture and hold stormwater more effectively than existing grasslands or impervious/eroded surfaces. As open areas are converted to forest, and as existing aspen stands are converted to diverse forest stands through timber stand improvement, two stream sediment-balance mechanisms will reduce sediment inputs into the river: 1) lower peak flows will cause less shear stress on stream banks, thus reducing in-channel sediment sources, and 2) tree roots will provide greater resistance to overland erosion compared to grass roots.

Forest management plans on both private land and public land should follow the Minnesota Forest Resources Council (MFRC) Forest Management Guidelines (MFRC, 2022) with some additional recommendations to be considered on a site-specific basis. These recommendations include:

- Evaluate, and where feasible manage, on a site-specific basis, a "Long-Lived Tree zone" (LLT), extending 300 ft from the stream for long-lived conifer and hardwood species (including red pine and white pine, white cedar, white spruce and black spruce, tamarack and oak) through targeted timber harvesting and planting.
- Enhance collaboration with Department of Natural Resources Fishery staff on LLT management.

Septic system upgrades and replacement

Subsurface Sewage Treatment System (SSTS) evaluations, surveys and follow-up visits and mailings will be used to address failing SSTS.

Risk for conversion in the Bemidji area

The abundant resources in the LLR Watershed also draw a growing population. Currently, approximately 14,500 residents live in the watershed; however, the state demographer's office projects that the area could experience as much as a 60 percent population increase by 2030 [Minnesota Pollution Control Agency (MPCA), 2016]. So far, lake and stream water quality within the watershed has been largely unimpacted by human disturbances. However, the Minnesota Department of Natural Resources (DNR) research indicates that when watersheds have more than 25 percent disturbance, water quality begins to decline. To prevent this decline and mitigate land-use pressures, planning and protection measures must be implemented.

Wild rice

Multi-agency collaboration of the protection and preservation of wild rice habitat is needed to ensure the viability of the resource for future generations. Monitoring, management, and education efforts are important tools for the management of the resource. The Leech Lake Band of Ojibwe has identified concerns from chemical and road salt runoff to wild rice bodies. Herbicide and pesticide carryover is also identified as a concern to wild rice habitat. Past and present agricultural practices have the potential to harm wild rice through nutrient and pesticide runoff, and erosion and sedimentation.

A review of the herbicide selection and application practices performed by government agencies would help identify opportunities to address harm to wild rice caused by herbicides used for roadside maintenance and other purposes. Shoreline buffers along lakes and rivers protect riparian vegetation, allowing it to intercept and slow runoff, reducing erosion and nutrient contribution to waterbodies.

An important aspect of public education and awareness is the opportunity to participate in harvesting wild rice. This can be supported by public outreach and demonstration of wild rice harvest and process techniques. The Leech Lake Band of Ojibwe has been attending monthly check in meetings frequently and have provided input across the planning process. Demonstrating proper methods of harvest to protect wild rice beds and ensuring access to wild rice waters can help provide a connection to the resource and encourage adoption of practices, such as placing land in a conservation easement and limiting herbicide use, which will help protect wild rice.

Shoreline

Public education is an important tool for encouraging voluntary adoption of shoreline buffers. Alternatively, riparian vegetation can be protected using conservation easements.

Conservation easements are used to protect sensitive areas from development and parcellation. Increasing the acreage of shoreland protection through easements, long term forest stewardship plans has shown to improve water quality of lakes and streams. Easements such as the BWSR Reinvest in Minnesota Wild Rice Conservation Easement Program or the RIM Pine and Leech Watershed Shoreland Protection Easement Program are options in the Steamboat River Watershed when funding is available as well as easements provided by associated partners.

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.

The cost to implement this plan fully is estimated at approximately $8,671,000.00. Costs by practices and activities are itemized in Table 16. This estimate includes implementation of BMPs, staff time, education and outreach, studies, inventories, and monitoring. The implementation of this plan will be funded by local funding, state and federal grants, and support from private organizations. Section 319 grant funding will serve as the foundation for implementing this plan. Additional funding includes local SWCD operational funding, State Clean Water Funds (CWF) through the Minnesota Board of Water and Soil Resources (BWSR), and U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS), and Environmental Quality Incentives Program (EQIP) funding. Landowners will contribute funds for grant match requirements. Private organization and foundation funding opportunities will also be pursued.

Partnerships in the watershed include the Hubbard SWCD, Leech Lake Band of Ojibwe, and Steamboat Lake Association. There are also long-established partnerships with Hubbard County, the Minnesota Department of Natural Resources, and other state agencies.

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.

Agricultural areas

The agricultural activity in this watershed is mainly dominated by relatively small-scale family farms which have shown to respond very well to direct outreach. Many of these small-scale farms wish to be more self-sufficient and not rely heavily on purchasing fertilizers or forage for livestock. Education and outreach on practices to improve soil health and livestock forage will be conducted across the watershed to increase vegetation on the landscape and reduce fertilizer usage. The long-term goal of this outreach will be producers who are well educated in soil health and vegetation management practices. This will hopefully increase enrollment in SWCD, NRCS, and State AG BMP programs like Minnesota Agricultural Water Quality Certification Program and adoption of these practices on their own.

Forested areas

This watershed has a long history of forestry with many acres of woodland managed for production and recreation. Hubbard SWCD has had great success doing targeted outreach through mailings and post cards and hosting workshops for forestland owners. The landowner demographic for this area are prime candidates for forestry and habitat programs and practices as the primary usage of these lands are recreation. This makes the area ideal to promote sustainable stewardship practices that promote wildlife, sustainable harvests, and keeping forests as forests. The SWCD provides assistance for landowners to get a Forest Stewardship Plan to help manage their forest to meet their goals along with sustainability goals. These mailings focus on leveraging a variety of forestry programs like the states Sustainable Forest Incentive Act and how to manage forest lands for wildlife habitat. A focused education campaign targeting forest landowners will be conducted to inform them of forest management opportunities and programs to promote keeping forests forested.

Shoreland areas

Much of the shoreland in the major lakes has already been developed for many decades. This makes shoreline stewardship education important to protect the lake in the long term. The Hubbard SWCD has had great success and high interest when working with shoreline owners and lake associations as water quality is often a high priority. We will conduct outreach to lake association groups and shoreline landowners to promote shoreline stewardship practices like buffers, filter strips, and rain gardens. The Hubbard SWCD has seen great success with neighbor-to-neighbor interactions when it comes to shoreline stewardship so engaging lake association and passionate shoreland owners can provide many ancillary benefits.

River restoration education

There are two reaches of the Necktie River (07010102- 551, 07010102-503) that have been ditched historically and have not been maintained. This is causing a variety of issues in many downstream systems as the ditched sections have been eroding and channel stability is low. Most of these projects

cross many landowners' properties so public engagement is key. Using the Necktie River restoration efforts as examples to educate other landowners will improve our ability to restore other river systems across the county.

Wild rice

An important aspect of public education and awareness is the opportunity to participate in harvesting wild rice. This can be supported by public outreach and demonstration of wild rice harvest and process techniques. Demonstrating proper methods of harvest to protect wild rice beds and ensuring access to wild rice waters can help provide a connection to the resource and encourage adoption of practices, such as placing land in a conservation easement and limiting herbicide use, which will help protect wild rice.

Element f. Reasonably expeditious schedule

A schedule for implementing the activities and NPS management measures identified in this plan that is reasonably expeditious.

Timelines for the proposed implementation are shown in Table 16.

Implementation activities described in Table 16 will yield estimated reductions greater than the estimated reductions needed to reach the lake eutrophication standard for Hart Lake and protect the streams and rivers and other lakes in the watershed within 10 years. The activities will also restore the ecological health of the Necktie River through channel restoration and BMP implementation. This schedule will be updated using adaptive management as funding, partnerships, effectiveness of implementation, and new information becomes available.

Adaptive management

Adaptive management is an approach to water quality protection efforts where BMP implementation efforts are combined with an on-going evaluation of 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 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).

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 recreation goals for Steamboat watershed. As this work is completed, the implementation goals, priorities, and BMPs will be examined and revised, as needed.

Element g. Milestones

A description of interim, measurable milestones for determining whether NPS management measures or other control actions are being implemented.

The milestones table 22 provide interim, measurable milestones for determining successful implementation of practices in Table 16. The milestones in this plan serve the purpose of measuring continuous progress toward the restoration and protection of the Steamboat River Watershed.

Table 22. Milestone table Steamboat River Watershed (PLET, 2023).

		Milestones			
Steamboat River Watershed	**Indicator**	**Short Term (Yrs 0-4)**	**Mid Term (Yrs 4-8)**	**Long Term (Yrs 8-10)**	**Total**
	Total Suspended Solids (t/yr)	195	1988	98	2282
	Phosphorus (lbs/yr)	1195	2134	598	3927
	Nitrogen (lbs/yr)	10632	13071	5316	29019

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.

The reduction milestones in Table 16 focus on measuring the forward progress of the implementation of practices and BMPs. The assessment criteria and achievement of milestone goals will be used to measure the accomplishment of this NKE plan.

It is difficult to anticipate the response of the lakes and streams 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 and assessment criteria described in Table 16 offer 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 will demonstrate success.

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.

The MPCA Intensive Watershed Monitoring (IWM) program for the Leech Lake River HUC-8 Watershed provides baseline water quality data for the Steamboat River Watershed. The IWM monitoring was first completed in 2012 and 2013. The second cycle of IWM monitoring is being completed in 2023 and 2024.

The Hubbard County Surface Water Monitoring Leech Lake River Watershed 2023-2024 Project will include water quality and temperature profile monitoring of three lakes, water quality sampling at two stream sites, and biological monitoring at nine sites (Table 23). Water quality sampling will be conducted according to the MPCA Surface Water Assessment Grant (SWAG) workplan parameters, samples will be submitted to RMB Environmental Laboratories for analysis, and Hubbard County SWCD will document the data and field conditions at each site according to the sampling schedule outlined in the SWAG workplan from May through September of 2023 and 2024. Temperature profiles will be collected at the lake sites during each visit and photographs will be taken to compliment the data and descriptions documented for each sampling session at each site.

One of the major goals of IWM sampling along the Necktie River System is focused on getting additional baseline data as it had been overlooked in the past due to the man-made disturbances.

Table 23. 2023 – 2024 IWM sampling sites in Steamboat River Watershed. (Background Data)

Waterbody name	Site ID	Sample type	Sampler
Portage Lake	11-0134-00	Lake	Hubbard SWCD
Portage Lake	11-0134-00-*	Lake	Leech Lake Band of Ojibwe
Portage Lake	11-0204-00	Lake	Hubbard SWCD
Portage Lake	11-0204-00-201	Lake	Leech Lake Band of Ojibwe
Steamboat Lake	11-0504-00	Lake	Hubbard SWCD
Steamboat Lake	11-0504-00-203	Lake	Leech Lake Band of Ojibwe
Hart Lake	29-0063-00	Lake	Hubbard SWCD
Necktie River	S006-256	Stream water quality	Hubbard SWCD
Necktie River	S008-428	Stream water quality	Hubbard SWCD
Bungashing Creek	12UM096	Stream biological	Hubbard SWCD
Necktie River	09UM085	Stream biological	Hubbard SWCD
Necktie River	12UM088	Stream biological	Hubbard SWCD
Necktie River	23UM119	Stream biological	Hubbard SWCD
Necktie River	23UM120	Stream biological	Hubbard SWCD
Necktie River	23UM121	Stream biological	Hubbard SWCD
Pokety Creek	23UM118	Stream biological	Hubbard SWCD
Pokety Creek	23UM122	Stream biological	Hubbard SWCD
Steamboat River	12UM138	Stream biological	Hubbard SWCD

* To be established

A monitoring schedule has not been decided upon for the continued monitoring, but the goals have been discussed. Continued monitoring will be focused on better understanding the impacts of the landscape management practices and the major stream restoration activities. A large emphasis will be put on understanding how each reach responds to the restoration as the system settles into the new pathway.

Water quality monitoring will continue in following years to evaluate the waterbodies for changes in water quality.

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