

Table PI 4.1 Plum Creek - Sediment

HUC 041100020301

Plum Creek (PI) Problem Statement 1: Sediment

Siltation has been identified as a cause of non-attainment. Excess sediment is of concern in the Middle Cuyahoga River, downstream in the shipping channel and in Lake Erie, because of the nutrients that enter the water with the sediment. The STEP-L model indicates that the watershed contributes 888 tons of sediment from runoff and eroding streambanks due to excess storm water, inadequate flood storage, and unrestricted livestock access. Mapping indicates alteration of at least 698 acres of wetland, loss of riparian features (floodplain access, riparian zone) of nearly 12.2 miles of streams, and alteration of approximately 50% of riparian corridor within 75 feet. The loss of beneficial watershed features reduces the flood-storage capacity and vertical stability of watershed tributaries. Potential loss of riparian vegetation with further development could result in increased loading and reduced storage in the future.

Goal		Lead/ cooperating organizations	Resources needed/cost	Amount to complete, time frame (contingent on funding, resources, landowner willingness)
Objective	Actions			
Goal PI 1a Reduce streambank erosion, thereby reducing sedimentation by 43 tons per year.				
<i>PI 1a-1 Stabilize 1,000 lf of eroding tributary banks, improve morphology, and restore vertical stability, in order to reduce sediment loading by 5 tons/year.</i>				
Target areas: eroding streams				
	1 Identify target areas using mapping			
	2 Work with partners to determine priorities			
	3 submit grant proposal(s)			
	4 Develop restoration strategies			
	5 Submit grant proposal, design/build, coordination, signage,			
	6 Outreach with neighborhoods			
	7 Restoration work - vertical stability, banks, floodplain		\$100-250/linear foot plus plantings	
	8 Encourage volunteer assistance with riparian plantings etc.		plants, planting plan	
	9 Install signage - riparian buffer, etc.	Partners, WC, communities	\$200-300/sign	
	10 Comment on wetland alteration permit applications concerning impacts to watershed functions/riparian setbacks	WC and partners		on-going
<i>PI 1a-2 Stabilize 3,000 l.f. of stream bank with livestock access, in order to reduce sediment loading by 38 tons/yr</i>				
Focus areas, e.g., Tributaries with livestock access				
	1 Map target areas to investigate for wetland, floodplain, riparian, habitat, or stream corridor restoration/protection/ enhancement	WC, partners	available mapping - compile and build on previous efforts	1 map by 2014, revisit and update if necessary every 3 years
	2 Meet with landowners to determine interest	WC, partners		
	4 Submit grant applications	WC, partners		
	5 Restore floodplain access/flood storage		design-build consultant	
	6 Public outreach			

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Goal		Lead/ cooperating organizations	Resources needed/cost	Amount to complete, time frame (contingent on funding, resources, landowner willingness)
Objective	Actions			
Goal PI 1b Reduce sediment from urban runoff by 3.7 tons/yr.				
<i>PI 1b-1 Install 5,000 sq ft green infrastructure retrofit (e.g., bioinfiltration/permeable pavement) in developed area, to reduce sediment loading by 0.02 tons/yr</i>				
<i>Focus areas, e.g., parking lots public facilities</i>				
	1 Submit grant proposal	WC		
	2 Inventory of green infrastructure opportunities	WC, partners, with guidance from outside consultant?	mapping, intern?	1 inventory of top sites
	3 Design/construct green infrastructure	Communities	engineering capability - outside consultant?	Retrofit 1 by 2022 to treat 10 ac institutional.
	4 Green infrastructure codes workshop	WC, partners, CSU, developers	location, materials, fee	1 workshop series by 2015
	5 Evaluate and update local ordinances for opportunities to reduce pavement, improve use of green infrastructure, conservation development, etc. in new/existing development	WC/communities	Volunteers/ interns can assist - outside funding could be used for consultant and/or work-shop - could be done with Portage zoning official meetings	2 code audits by 2017; update 1 code by 2018 (Kent/Portage??)*
	6 Outreach with developers, local officials			
<i>PI 1b-2 Retrofit stormwater volume devices to improve water quality from 60 acres of residential land, in order to reduce sediment loading by 2.7 tons/yr</i>				
	1 Stormwater retrofit inventory		WC/NEFCO with communities	
	2 Submit grant application			
	3 Design/construct retrofit to improve water quality	Communities	Varies, depending on treatment provided (e.g., \$400/acre treated to \$17,000 per acre treated)	Retrofit 2 by 2022, 1 every 8 years afterward
<i>PI 1b-3 Retrofit 500 lf of roadside ditch in no-mow grass/veg swale/daylighting to reduce sediment loading by 0.5 tons/year.</i>				
	1 Workshop on maintaining ditches/improving drainage for water quality improvements	SWCD	Location, materials	
	2 Install 500 lf of drainage with retrofit			
<i>PI 1b-4 Install 500 lf of vegetated swale at Plum Creek Park to reduce sediment loading by 0.5 tons/yr.</i>				
<i>PI 1b-5 Establish two monitoring efforts for QHEI/chemistry along Plum Creek with volunteer, school, or university groups.</i>				
<i>PI 1b-6 Conduct survey of yard management practices</i>				
<i>PI 1b-7 Develop stormwater management design manual for Portage County</i>				
	1 Stormwater management design manual for Portage County	Portage SWCD	In-house task	1 manual by 2014
<i>PI 1b-8 Maintain Stream database</i>				
				1 database
<i>PI 1b-9 Facilitate review and update of local codes to include measures for green infrastructure</i>				
	1 Green code audit workshop			

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Goal				Amount to complete, time frame (contingent on funding, resources, landowner willingness)
Objective	Actions	Lead/ cooperating organizations	Resources needed/cost	
	2 Review codes in two communities for green infrastructure language 3 update code language	partners	volunteers/consultant possibly outside consultant/funding	1 community by 2022
PI 1b-10 Conduct workshops on use BMPs at urban sites				
	1 Stormwater management design manual for Portage County	Portage SWCD	In-house task	1 manual by 2015
	2 Workshops for community officials on developing/enforcing riparian setbacks	partners, PIPE		2 workshops by 2015; additional workshops - included in general workshop series
	3 Workshops for community officials on enforcing bmp requirements			
PI 1b-11 Conduct Education outreach to encourage golf course operators to adopt Audubon Habitat practices				2 contacts
	1 funding			
	2 outreach			
	3 workshops			
	4 assistance			
PI 1b-12 Conduct public outreach by providing information and studies electronically or in print.				
	1 Continue to compile, centralize, and make available studies, data, information sources on the watershed, including recreational opportunities, volunteer needs, permitting or regulatory issues; green infrastructure information sources, etc.	WC	Website, technical information and outreach materials	Update and develop pages for website by Dec. 2013, then on-going
	2 e-newsletter or article issued 3 times per year	wc	website, share with partners	
	3 Develop/reproduce informational brochure or website article concerning topics of interest, including reducing runoff, recreational opportunities, private wells, septic systems etc.	WC, health depts, SWCDs	technical/outreach materials, possibly printing costs	10 by 2022; 1 each year
PI 1b-13 Conduct 18 outreach/stewardship activities related to non-point source pollution and watershed issues.				
	1 Establish clean-up/monitoring/planting efforts at additional tributaries and lakes	WC, communities, parks, residents, home-owners' associations, lake associations	Funding or donation of trash disposal, refreshments, monitoring supplies, crew leaders, volunteers; training for monitoring/planting	1 new tributary or lake monitoring, clean-up, or other stewardship program by 2018
	2 Distribute 50 rain barrels through workshops	SWCDs/ Communities	Space for workshop; rain barrel kits	50 rain barrels distributed
	3 Survey of yard management practices	WC/partners		

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Goal		Lead/ cooperating organizations	Resources needed/cost	Amount to complete, time frame (contingent on funding, resources, landowner willingness)
Objective	Actions			
	4 Develop/reproduce informational brochure or website article concerning topics of interest, including reducing runoff, recreational opportunities, private wells, septic systems etc.	WC, health depts, SWCDs	technical/outreach materials, possibly printing costs	10 by 2022; 1 each year
	5 Educational outreach workshops on topics of importance, including LID/green infrastructure, restoration, field trips for examples	Partners, WC, communities	Location, speaker, supplies	5 workshops by 2022; 1 every 2 years (listed under other topics)
	6 Work with schools or city day camps to develop/encourage use of watershed care activities/curricular items	WC, SWCDs, partners, schools		1 educational outreach program/curriculum item by 2018
	7 River Day festivities	Portage Parks, partners		3
	8 Watershed "brand," logo, art project	WC, Kent State/ Standing Rock Gallery/River Day communities	Host for project, graphic design capabilities	1 logo or art project by 2015, then 1 every 3 years;
	9 Create social network or google presence	WC		1 by 2014
<i>MCR-1 Establish 1 neighborhood-scale green infrastructure projects as demonstration within the developed areas of one of the Middle Cuyahoga River subwatersheds, where suitable neighborhoods are identified, reducing loading of nitrogen by 200 lb/year, phosphorous by 25 lb/yr, and sediment by 5 tons/yr</i>				
	1 Work with communities to identify suitable target WC, partners neighborhoods			
	2 Meetings to gauge neighborhood support			
	3 Determine/establish maintenance framework (e.g., easements, homeowner participation)	partner community		
	4 Get grant(s)			
	5 Design/build	outside consultant	Site, outside funding. Design ~\$25-50,000; Rain gardens \$15-20/sq. foot; Green street bump-outs \$20,000 each; per-meable concrete \$12-15/ sq. ft	1 project by 2022
	6 Outreach, neighborhood participation			
Goal PI 1c Reduce sediment loading from agricultural runoff by 244 tons/yr				
<i>PI 1c-1 Install 3,000 lf of livestock exclusion and accompanying measures to reduce sediment loading by 7 tons per year</i>				
	1 Contact landowners to determine willingness			
	2 Submit proposal for grant funds			
	3 Work with landowners to install measures			
	4 Outreach			
<i>PI 1c-2 Conduct survey of existing agricultural practices</i>				
	1 Develop survey of existing practices			
	2 Administer survey to willing landowners			
	3 Windshield survey of visible practices			

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Goal		Lead/ cooperating organizations	Resources needed/cost	Amount to complete, time frame (contingent on funding, resources, landowner willingness)
Objective	Actions			
	4 Tally and summarize survey results			
	5 Outreach with property owners based on results, use results to target practices			
PI 1c-3 Install grassed waterway/buffer strips to treat 50 ac and reduce sediment by 72 tons/yr.				
PI 1c-4 Install cover crops to treat 100 ac and reduce sediment by 110 tons/yr				
PI 1c-5 Increase use of residue on ag fields by an additional 50 acres, reducing sediment loading by 55 tons/yr				
Goal PI 1d Restore riparian features to reduce sediment loading by 33 tons/yr.				
PI 1d-1 Plant 8 ac of deep-rooted riparian vegetation, reducing loading of sediment by 4 tons/yr Focus areas: large parcels single ownership, headwaters.				
	1 Submit grant applications e.g., OEEF	WC/SWCDs/partners		
	2 Targeted outreach to public, institutional, and other owners of large properties	WC**/SWCDs/ Communities	Lists of golf courses, lake associations, homeowners' associations; maps of large parcels; printed outreach materials.	Target 1 group every 3 years (3 by 2022); improvements to best management practices or riparian management at one site every 4 years(2 sites by 2020); 2 outreach contacts per year
	3 Outreach to golf course owners encouraging Audubon-certification		labor, printing	
	4 Assist with plantings	SWCDs, master gardeners	native plants/trees and shrubs \$250 (\$500-1,000 per acre);	
	5 Construct and install signage	communities, partners,	\$300-500/sign	
	6 Follow-up outreach (individualized guide to riparian zone) and publicize		funding for handouts/brochures	
PI 1d-2 Restore 25 ac of wetland, in order to reduce sediment loading by 25 tons/year.				
	1 Map target areas to investigate for wetland, floodplain, riparian, habitat, or stream corridor restoration/protection/ enhancement	WC, partners	available mapping - compile and build on previous efforts	1 map by 2013, revisit and update if necessary every 3 years
	2 Meet with landowners to determine interest	WC, partners		
	3 Identify wetland restoration site for clearinghouse	WC, Communities, other partners	meetings with landowners; readily available mapping, outside assistance from consultant, possible assistance from Kent State University wetland ecology class	5 concept plans by 2020; 1 every 2 years afterward.
	4 Submit grant application			
	5 Restore/protect/enhance wetlands	Partners	\$5,000-\$100,000 per acre, design/build consultant, sites -protection by ease- ments would be at the low end of the range	25 acres by 2024

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Goal		Lead/ cooperating organizations	Resources needed/cost	Amount to complete, time frame (contingent on funding, resources, landowner willingness)
Objective	Actions			
PI 1d-3 Restore 10 acre-ft of floodplain access, in order to store 4 tons of sediment per year.				
	1 Map target areas to investigate for wetland, floodplain, riparian, habitat, or stream corridor restoration/protection/ enhancement	WC, partners	available mapping - compile and build on previous efforts	1 map by 2014, revisit and update if necessary every 3 years
	2 Hold meetings with landowners to determine interest	WC, partners		
	3 Submit grant proposals			
	4 Design & Restore floodplain access/flood storage			
	5 Public outreach			
Goal PI 1e Reduce causes of streambank erosion by reducing channel loading/increasing flood storage by 98,000 cu ft. in a 3/4 in storm.				
PI 1e-1 Conduct 6 meetings/workshops among neighboring communities regarding watershed approaches to reducing stormwater effects				
	1 Coordinate with nearby communities/schools to identify areas of concern or opportunity			4 meetings
	3 Coordinated stormwater study on target areas??		outside funding or assistance	
	2 Workshops with public officials to address shared stormwater concerns			2 workshops
PI 1e-2 Install 5,000 sq ft of permeable pavement/biofiltration in a developed site to reduce runoff by 937 cubic feet in a 3/4-inch storm.				
	Actions: See PI 1b-1			
PI 1e-3 Plant 8 ac of deep-rooted riparian vegetation, reducing channel loading by 5,800 cu ft in a 3/4 in storm.				
	Actions: See PI 1d-1			
PI 1e-4 Conduct outreach education with 2 golf courses to encourage use of Audubon International techniques.				
	Actions: See PI 1b-11			
PI 1e-5 Restore 25 ac of wetland, reducing channel loading by 16,500 cu ft in a 3/4 in event.				
	Actions: See PI 1d-2			
PI 1e-6 Restore 10 acre-ft of floodplain access, increasing storage volume by 435,600 cu ft.				
	Actions: See PI 1d-3			
PI 1e-7 Install 6,000 square feet of rain gardens, to reducing channel loading by 262 cu ft in a 3/4 in storm				
	1 Identify partners	WC, partners		
	2 Submit grant application	WC/partners		
	3 Workshop/installation	WC/partners		

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Goal		Lead/ cooperating organizations	Resources needed/cost	Amount to complete, time frame (contingent on funding, resources, landowner willingness)
<i>Objective</i>	<i>Actions</i>			
PI 1e-8 Facilitate review and update of 2 local codes to include measures for green infrastructure				
	Actions: See PI 1b-9			
PI 1e-9 Update, increase, and disseminate available information concerning sediment from urban runoff				
	Actions: See PI 1b-12			
PI 1e-10 Increase/sponsor 18 stewardship activities related to non-point source pollution and watershed issues.				
	Actions: See PI 1b-13			
Goal PI 1-f Protect wetlands and beneficial watershed features to reduce future loading of sediment by 100 tons/yr				
PI 1f-1 Protect 100 acres of wetlands, through acquisition of land or easements, preventing increased loading of sediment by 100 tons/yr				
Target areas: Plum Cr. Riparian corridor, other remaining wetlands				
	1 Mapping			
	2 Contact landowners/partner land trusts			
	3 Submit grant proposal			
	4 Acquire wetlands/easements			
PI 1f-2 Conduct 2 workshops on effectively implementing riparian setbacks				

Table PI 4.2 Plum Creek Nitrogen

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Plum Creek (PI) Problem Statement 2: Nitrogen

Nutrients are listed as a cause of non-attainment in Plum Creek. While Nitrate+nitrite levels are below state EOLP median for WWH (0.4 mg/l) and state guidelines (1.0 mg/l), measurements generally increased from approximately 0.1 mg/l to 0.2 mg/l from 2000 to 2007, a period of rapid growth in the subwatershed. Middle Cuyahoga nitrate+nitrogen levels measured in 2007 frequently exceed the EOLP median (1.0 mg/l) and the state guidelines (1.5 mg/l), ranging from 0.9 mg/l to 6 mg/l.

The STEP-L model indicates that the watershed contributes 30,725 lb of nitrogen from runoff, failing septic systems, unrestricted livestock access and eroding streambanks, related to excess stormwater and loss of flood storage. Mapping indicates alteration of at least 698 acres of wetland, loss of riparian features (floodplain access, riparian zone) along nearly 12.2 miles of streams, and alteration of approximately 50% of riparian corridor within 75 feet. Altered riparian features increases streambank erosion and associated nutrient loading, and reduced pollutant uptake. Continued development, increased imperviousness, and altered/degraded watershed features could result in increased loading and reduced storage in the future.

Goal		Lead/ cooperating organizations	Resources needed/cost	Amount to complete, time frame (contingent on funding, resources, landowner willingness)
Objective	Actions			
Goal PI 2a Reduce streambank erosion, thereby reducing nitrogen loading by 50.5 lb per year.				
<i>PI 2a-1 Stabilize 1,000 lf of eroding tributary banks, improve morphology, and restore vertical stability, in order to reduce nitrogen loading by 12.5 lb/year.</i>				
Actions: See PI 1a-1				
<i>PI 2a-2 Stabilize 3,000 lf. of stream bank with livestock access, in order to reduce nitrogen loading by 38 lb/yr</i>				
Focus areas, e.g., Tributaries with livestock access				
Actions: See PI 1a-2				
Goal PI 2b Reduce nitrogen loading from urban runoff by 15 lb/yr.				
<i>PI 2b-1 Install 5,000 sq ft green infrastructure retrofit (permeable pavement/bioinfiltration) in developed area, to reduce nitrogen loading by 0.14 lb/yr</i>				
Focus areas, e.g., parking lots public facilities				
Actions: See PI 1b-1				
<i>PI 2b-2 Install 6,000 square feet of rain gardens, reducing nitrogen loading by 0.5 lb/yr</i>				
Actions: See PI 1e-7				
<i>PI 2b-3 Retrofit stormwater volume devices to improve water quality from 60 acres of residential land, in order to reduce nitrogen loading by 12 lb/yr</i>				
Actions: See PI 1b-3				
<i>PI 2b-4 Plant 500 lf of roadside ditch with no-mow grass to reduce nitrogen loading by 0.2 lb/yr.</i>				
Actions: See PI 1b-4				
<i>PI 2b-5 Install 500 lf of vegetated swale at Plum Creek Park to reduce nitrogen loading by 2 lb/yr.</i>				
<i>PI 2b-6 Establish two chemical/QHEI monitoring efforts along Plum Creek with volunteer, school, or university groups.</i>				
<i>PI 2b-7 Conduct survey of yard management practices</i>				
<i>PI 2b-8 Develop stormwater management design manual for Portage County</i>				
<i>PI 2b-9 Maintain Stream database</i>				1 database
<i>PI 2b-10 Conduct outreach education with 4 golf courses to encourage use of Audubon International practices</i>				
<i>PI 2b-11 Conduct workshops on use BMPs at urban sites</i>				
Actions: See PI 1b-7				
<i>PI 2b-12 Conduct public outreach by providing information and studies electronically or in print.</i>				
Actions: See PI 1b-9				

Table PI 4.2 Plum Creek Nitrogen
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Goal				Amount to complete, time frame (contingent on funding, resources, landowner willingness)
Objective	Actions	Lead/ cooperating organizations	Resources needed/cost	
PI 2b-13 Conduct 18 outreach activities related to non-point source pollution and watershed issues.				
Actions: See PI 1b-10				
MCR-1 Establish 1 neighborhood-scale green infrastructure projects as demonstration within the developed areas of one of the Middle Cuyahoga River subwatersheds, where suitable neighborhoods are identified, reducing loading of nitrogen by 200 lb/year, phosphorous by 25 lb/yr, and sediment by 5 tons/yr				
Goal PI 2c Reduce nitrogen loading from agricultural runoff by 754 lb/yr				
PI 2c-1 Install 3000 lf of livestock exclusion and accompanying measures to reduce nitrogen loading by 12 lb per year				
Actions: See PI 1c-1				
PI 2c-2 Conduct survey of existing agricultural practices				
Actions: See PI 1c-2				
PI 2c-3 Install grassed waterway/buffer strips to treat 50 ac and reduce nitrogen by 211 lb/yr.				
PI 2c-4 Install cover crops to treat 100 ac and reduce nitrogen by 256 lb/yr				
PI 2c-5 Increase use of residue on ag fields by an additional 50 acres, reducing nitrogen loading by 128 lb/yr				
PI 2c-6 Construct 500 lf of 2-stage/overwide ditch along existing ditched channel, to reduce nitrogen loading by 147 lb/yr.				
Goal PI 2d Reduce nitrogen loading from failing septic systems by 300 lb/yr				
PI 2d-1 Correct 1 failing HSTS per year, reducing nitrogen loading by 300 lb/yr Focus areas: vicinity of water courses				
	1 Inspect systems	PCHD		
	2 Correct failing/discharging home sewage treatment systems	Portage County Health District, landowners	Continued inspection and enforcement of illicit discharge regulations. Remedies depend on cause of failure and proximity of sewer service.	10 by 2022; 1 per year afterward
	3 Continue to investigate funding sources	PCRPC, PCHD, wc		
	4 Outreach:			
Goal PI 2e Restore riparian features to reduce nitrogen loading by 827 lb/yr.				
PI 2e-1 Plant 8 ac of deep-rooted riparian vegetation, reducing loading of nitrogen by 67 lb/yr Focus areas: large parcels single ownership, headwaters.				
Actions: See PI 1d-1				
PI 2e-2 Restore 25 ac of wetland, in order to reduce nitrogen loading by 700 lb/year.				
Actions: See PI 1d-2				
PI 2e-3 Restore 10 acre-ft of floodplain access, in order to store 60 lb of nitrogen per year.				
Actions: See PI 1d-3				
Goal PI 2f Reduce causes of streambank erosion by reducing channel loading/increasing flood storage by 458,962 cu ft. in a 3/4 in storm.				
PI 2f-1 Increase coordination between communities to reduce stormwater effects				
Actions: See PI 1e-1				
PI 2f-2 Install 5,000 sq ft of permeable pavement/biofiltration in a developed site to reduce runoff by 800 cubic feet in a 3/4-inch storm.				
Actions: See PI 1e-2				
PI 2f-3 Construct 6,000 sq ft of rain gardens, to reduce runoff by 262 cu ft in a 3/4 in event				

Table PI 4.2 Plum Creek Nitrogen

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Goal		Lead/ cooperating organizations	Resources needed/cost	Amount to complete, time frame (contingent on funding, resources, landowner willingness)
Objective	Actions			
	Actions: See PI 1e-7			
PI 2f-4 Plant 8 ac of deep-rooted riparian vegetation, reducing channel loading by 5,800 cu ft in a 3/4 in storm.	Actions: See PI 1d-1			
PI 2f-5 Restore 25 ac of wetland, reducing channel loading by 16,500 cu ft in a 3/4 in event.	Actions: See PI 1e-6			
PI 2f-6 Restore 10 acre-ft of floodplain access, increasing storage volume by 435,600 cu ft.	Actions: See PI 2b-3			
PI 2f-7 Conduct outreach education with 2 golf courses to encourage use of Audubon International techniques.	Actions: See PI 1b-11			
PI 2f-8 Facilitate review and update of 2 local codes to include measures for green infrastructure	Actions: See PI 1b-9			
PI 2f-9 Update, increase, and disseminate available information concerning nitrogen from urban runoff	Actions: See PI 1b-12			
PI 2f-10 Increase/sponsor 18 stewardship activities related to non-point source pollution and watershed issues.	Actions: See PI 1b-13			
Goal PI 2g Protect wetlands and beneficial watershed features to reduce future loading of nitrogen by 2,800 lb/yr				
PI 2g-1 Protect 100 acres of wetlands, preventing increased loading of nitrogen by 2,800 lb/yr Target areas: large wetland complexes along Plum Cr. other remaining wetlands, areas containing habitats of concern	Actions: See PI 1f-1			
PI 2g-2 Conduct 2 workshops on effectively implementing riparian setbacks	Actions: See PI 1f-2			

Table PI 4.3 Plum Creek Phosphorous

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Plum Creek (PI) Problem Statement 3: Phosphorous

Nutrients are listed as a cause of non-attainment in Plum Creek. Phosphorous (P) levels measured in 2000 and 2007 ranged from 0.027-0.8 mg/l, occasionally exceeding the state median for EOLP headwaters of 0.5 mg/l. The Middle Cuyahoga exhibits signs of slight nutrient enrichment, with large diurnal oxygen swings suggesting increased algal activity. Cuyahoga River Total P levels measured in 2007 ranged from 0.044 to 0.37, occasionally exceeding EOLP targets for medium rivers (0.12 mg/l), especially in wet weather and downstream of Breakneck Cr. The STEP-L model indicates that the Plum Cr. watershed contributes 5,799 lb of phosphorous from runoff, failing septic systems, unrestricted livestock access and eroding streambanks, related to excess stormwater and loss of flood storage. Mapping indicates alteration of at least 698 acres of wetland, loss of riparian features (floodplain access, riparian zone) of 12 miles of streams, and alteration of approximately 50% of riparian corridor within 75 feet. The alteration of watershed features reduces the flood-storage capacity and vertical stability of watershed tributaries. Further development and loss of riparian vegetation could result in increased loading and reduced storage in the future.

Goal		Lead/ cooperating organizations	Resources needed/cost	Amount to complete, time frame (contingent on funding, resources, landowner willingness)
Objective	Actions			
Goal PI 3a Reduce streambank erosion, thereby reducing phosphorous associated with sedimentation by 15 lb per year.				
<i>PI 3a-1 Stabilize 1,000 lf of eroding tributary banks, improve morphology, and restore vertical stability, in order to reduce phosphorous loading by 5 lb/year.</i>				
Target areas: eroding streams				
Actions: See PI 1a-1				
<i>PI 3a-2 Stabilize 3,000 lf. of stream bank with livestock access, in order to reduce phosphorous loading by 10 lb/yr</i>				
Focus areas, e.g., Tributaries with livestock access				
Actions: See PI 1a-2				
Goal PI 3b Reduce phosphorous loading from urban runoff by 13.2 lb/yr.				
<i>PI 3b-1 Install 5,000 sq ft green infrastructure retrofit (permeable pavement) demo project to reduce phosphorous loading by 0.14 lb/yr</i>				
Focus areas, e.g., parking lots public facilities				
Actions: See PI 1b-1				
<i>PI 3b-2 Install 6,000 sq ft of rain garden to reduce phosphorous loading by 0.1 lb/yr</i>				
Actions: See PI 2b-2				
<i>PI 3b-3 Retrofit stormwater volume devices to improve water quality from 60 acres of residential land, in order to reduce phosphorous loading by 12 lb/yr</i>				
Actions: See PI 1b-2				
<i>PI 3b-4 Plant 500 lf of roadside ditch with no-mow grass to reduce phosphorous loading by 0.2 lb/yr.</i>				
Actions: See PI 1b-4				
<i>PI 3b-5 Install 500 lf of vegetated swale at Plum Creek Park to reduce nitrogen loading by 0.8 lb/yr.</i>				
<i>PI 3b-6 Establish two chemistry/QHEI monitoring efforts along Plum Creek with volunteer, school, or university groups.</i>				
<i>PI 3b-7 Conduct survey of yard management practices</i>				
<i>PI 3b-8 Develop stormwater management design manual for Portage County</i>				
<i>PI 3b-9 Maintain Stream database</i>				1 database
<i>PI 3b-10 Conduct Education outreach to encourage golf course operators to adopt Audubon Habitat practices</i>				2 contacts

Note: Select practices will be monitored for effectiveness

Table PI 4.3 Plum Creek Phosphorous

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Goal			Amount to complete, time frame
Objective	Actions	Lead/ cooperating organizations	(contingent on funding, resources, landowner willingness)
PI 3b-11 Conduct 2 workshops on use of BMPs at urban sites			
Actions: See PI 1b-7			
PI 3b-12 Conduct public outreach by providing information and studies electronically or in print.			
Actions: See PI 1b-9			
PI 3b-13 Conduct 18 outreach activities related to non-point source pollution and watershed issues.			
Actions: See PI 1b-10			
MCR-1 Establish 1 neighborhood-scale green infrastructure projects as demonstration within the developed areas of one of the Middle Cuyahoga River subwatersheds, where suitable neighborhoods are identified, reducing loading of nitrogen by 200 lb/year, phosphorous by 25 lb/yr, and sediment by 5 tons/yr			
Actions: See MCR-1 Problem Statement 1			
Goal PI 3c Reduce phosphorous loading from agricultural runoff by 353 lb/yr			
PI 3c-1 Install 3000 lf of livestock exclusion and accompanying measures to reduce phosphorous loading by 12 lb per year			
Actions: See PI 1c-1			
PI 3c-2 Conduct survey of existing agricultural practices			
Actions: See PI 1c-2			
PI 3c-3 Install grassed waterway/buffer strips to treat 50 ac and reduce phosphorous by 113 lb/yr.			
PI 3c-4 Install cover crops to treat 100 ac and reduce phosphorous by 128 lb/yr			
PI 2c-5 Increase use of residue on ag fields by an additional 50 acres, reducing nitrogen loading by 64 lb/yr			
PI 2c-6 Construct 500 lf of 2-stage/overwide ditch along existing ditched channel, to reduce phosphorous loading by 46 lb/yr.			
Goal PI 3d Reduce septic system failure to reduce annual loading of phosphorous by 122 lb			
PI 3d-1 Correct 1 failing HSDS per year, reducing nitrogen loading by 122 lb/yr Focus areas: vicinity of water courses			
Actions: See PI 2d-1			
Goal PI 3e Restore riparian features to reduce phosphorous loading by 43 lb/yr.			
PI 3e-1 Plant 8 ac of deep-rooted riparian vegetation, reducing loading of phosphorous by 12 lb/yr Focus areas: large parcels single ownership, headwaters.			
Actions: See PI 1d-1			
PI 3e-2 Restore 25 ac of wetland, in order to reduce phosphorous loading by 316 lb/year.			
Actions: See PI 1d-2			
PI 3e-3 Restore 10 acre-ft of floodplain access, in order to store 8 lb of phosphorous per year.			
Actions: See PI 1d-3			
Goal PI 3f Reduce causes of streambank erosion by reducing channel loading/increasing flood storage by 458,700 cu ft. in a 3/4 in storm.			
PI 3f-1 Increase coordination between communities to reduce stormwater effects			
Actions: See PI 1e-1			
PI 3f-2 Install 5,000 sq ft of permeable pavement/biofiltration in a developed site to reduce runoff by 800 cubic feet in a 3/4-inch storm.			
Actions: See PI 1e-2			
PI 3f-3 Construct 6,000 sq ft of rain gardens, to reduce runoff by 262 cu ft in a 3/4 in event			

Note: Select practices will be monitored for effectiveness

Table PI 4.3 Plum Creek Phosphorous
HUC 041100020301

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Goal		Lead/ cooperating organizations	Resources needed/cost	Amount to complete, time frame (contingent on funding, resources, landowner willingness)
Objective	Actions			
	Actions: See PI 1e-7			
PI 3f-4 Plant 8 ac of deep-rooted riparian vegetation, reducing channel loading by 5,800 cu ft in a 3/4 in storm.	Actions: See PI 1d-1			
PI 3f-5 Restore 25 ac of wetland, reducing channel loading by 16,500 cu ft in a 3/4 in event.	Actions: See PI 1d-2			
PI 3f-6 Restore 10 acre-ft of floodplain access, increasing storage volume by 435,600 cu ft.	Actions: See PI 1d-3			
PI 3f-7 Conduct outreach education with 2 golf courses to encourage use of Audubon International techniques.	Actions: See PI 1b-11			
PI 3f-8 Facilitate review and update of 2 local codes to include measures for green infrastructure	Actions: See PI 1b-9			
PI 3f-9 Update, increase, and disseminate available information concerning phosphorous from urban runoff	Actions: See PI 1b-12			
PI 3f-10 Increase/sponsor 18 stewardship activities related to non-point source pollution and watershed issues.	Actions: See PI 1b-13			
Goal PI 3-g Protect wetlands to reduce future loading of phosphorous by 632 lb/yr				
PI 3g-1 Protect 100 acres of wetlands, preventing increased loading of phosphorous by 632 lb/yr Target areas: Plum Creek riparian area, vicinity of Kent Bog	Actions: See PI 1f-1			
PI 3g-2 Conduct 2 workshops on effectively implementing riparian setbacks				

Table PI 4.4 Plum Creek - Groundwater Supplies/Contamination

HUC 041100020301

Plum Creek Problem Statement 4, Groundwater/public water supply contamination

The subwatershed contains the Portage County wellfield, both of which is susceptible to contamination from surface spills and leaks to groundwater. The public water supply has a source water protection plan, but the contributing groundwater zone is largely privately owned and susceptible to contamination from uses or spills.

Plum Cr. HUC 041100020301

Goals	Amount to complete, time frame	
<i>Objectives</i>	<i>Lead/ cooperating</i>	<i>(contingent on funding, resources,</i>
<i>Actions</i>	<i>Organizations</i>	<i>Resources needed/cost</i>
<i>landowner willingness)</i>		
Goal PI 4a Conduct coordination and public outreach to provide information concerning potential risks to groundwater quality and protective measures.		
<i>PI 4a-1 Develop fact sheet(s) or web page describing how to obtain information concerning oil/gas wells, and the related permitting process, safeguards, and inspections.</i>		
1 Coordinate with state agencies and communities concerning fracking and controls		
2 Coordinate with state agencies to receive notification of drilling permit requests		
3 Outreach to communities and property owners - website, brochures, etc., concerning permitting process, protective measures that can be taken, etc.		
<i>PI 4a-2 Conduct outreach with community officials and property owners within the 5-year time of travel to provide education concerning reducing groundwater contamination from land use</i>		
1 Coordinate with water suppliers concerning outreach needs		
2 Apply for funding if needed		
3 Develop and disseminate outreach materials - written, website		
<i>PI 4a-3 Conduct baseline monitoring for groundwater contamination from or near wells</i>		
1 Baseline monitoring for groundwater contamination from or near wells	Portage Water Supply	funding for certain analyses, others in-house?
<i>PI 4a-4 Conduct outreach education with 2 golf courses to encourage use of Audubon International techniques.</i>		
Actions: See PI 1b-11		
<i>PI 4a-5 Update, increase, and disseminate available information concerning watershed protection</i>		
Actions: See PI 1a-12		
<i>PI 4a-6 Increase/sponsor 18 stewardship activities related to non-point source pollution and watershed issues.</i>		
Actions: See PI 1a-13		

Table PI 4.5 Plum Creek - Habitat

HUC 41100020301

Plum Creek (PI) Problem Statement 5: Habitat Loss

Alteration of approximately 700 acres of wetland, 50% of vegetated riparian corridor, and loss of riparian features (e.g., riparian zone, channel form, floodplain access) along approx. 12 miles of watercourses has degraded riparian and wetland habitat in the subwatershed. Stream channel erosion degrades channel form and causes embedded substrate. The undisturbed riparian corridor and wetlands fringing much of lower Plum Creek have helped maintain the high quality of the creek in spite of agricultural and urban influences. A portion of the Kent bog wetland complex is protected as a nature preserve, but other Brimfield and Kent have wetland and riparian setback ordinances. However, to avoid the risk of encroachment or fragmentation, and conflicts related to private ownership, high value wetland complexes should be protected through easements or purchase.

Goals	Amount to complete, time frame
<i>Objectives</i>	<i>(contingent on funding, resources,</i>
<i>Actions</i>	<i>landowner willingness)</i>
<i>Lead/ cooperating</i>	
<i>Organizations</i>	<i>Resources needed/cost</i>
Goal PI 5a Restore/improve 93 acres of altered habitat/stream channel morphology.	
<i>PI 5a-1 Plant 8 ac. of deep-rooted riparian vegetation. Focus areas: large parcels single ownership, headwaters.</i>	
<i>Actions: See PI 1a-1</i>	
<i>PI 5a-2 Restore/improve 25 acres of wetland habitat. Focus: altered wetlands.</i>	
<i>Actions: See PI 1b-3</i>	
<i>PI 5a-3 Restore 10 acre-ft of floodplain access/storage. Focus areas - areas with modified floodplain access.</i>	
<i>Actions: See PI 1b-2</i>	
<i>PI 5a-4 Remove/treat 50 acres of invasive species.</i>	
<i>PI 5a-5 Conduct outreach education with 2 golf courses to encourage use of Audubon International techniques.</i>	
<i>Actions: See PI 1b-11</i>	
Goal PI 5b Reduce bank erosion from overloaded channels.	
<i>PI 5b-1 Stabilize 4,000 lf of eroding tributary banks, improve morphology, restore vertical stability, and reduce sedimentation.</i>	
<i>Target areas: eroding streams</i>	
<i>Actions: See PI 1a-1</i>	
<i>PI 5b-2 Increase coordination between communities to reduce stormwater effects</i>	
<i>Actions: See PI 1e-1</i>	
<i>PI 5b-3 Install 5,000 sq ft of permeable pavement/biofiltration in a developed site to reduce runoff by 800 cubic feet in a 3/4-inch storm.</i>	
<i>Actions: See PI 1e-2</i>	
<i>PI 5b-4 Construct 6,000 sq ft of rain gardens, to reduce runoff by 262 cu ft in a 3/4 in event</i>	
<i>Actions: See PI 1e-7</i>	
<i>PI 5b-5 Facilitate review and update of 2 local codes to include measures for green infrastructure</i>	
<i>Actions: See PI 1b-9</i>	
Goal PI 5c Protect 50 acres of landscape features to prevent future habitat degradation.	
<i>PI 5c-1 Protect 50 acres of wetlands through acquisition or easement. Focus areas: vicinity of Kent Bog, other high-value habitat areas noted in WAP, resources providing multiple ecological functions and habitat connectivity.</i>	
<i>Actions: See PI 1f-1</i>	
<i>PI 5c-2 Update, increase, and disseminate available information concerning watershed habitats</i>	
<i>Actions: See PI 1b-12</i>	
<i>PI 5c-3 Increase/sponsor 18 stewardship activities related to stream channel health, non-point source, runoff, erosion, habitats, etc.</i>	
<i>Actions: See PI 1b-13</i>	

Note: Select practices will be monitored for effectiveness

Table PI 4.6 Plum Creek - Recreation

HUC 041100020305 (part)

Problem Statement Fi-6: Recreational Opportunities

Along Plum Creek and its tributaries are several public and private recreation, institutional, and open space parcels, including JayCee Park, Plum Creek Park, Tallmadge City/Schools parcels two golf courses, and the Portage bike-hike trail. In addition the Tom S. Cooperrider Kent Bog preserve offers passive recreation hiking through a tamarack bog.

These provide the opportunity for a watershed-wide system of access or education.

Goal		Lead/ cooperating organizations	Resources needed/cost	Amount to complete, time frame (contingent on funding, resources, landowner willingness)
<i>Objective</i>	<i>Actions</i>			
Goal Fi-6a: Increase recreational opportunities along Plum Creek and in the subwatershed by 1 mile/2 access points.				
<i>Fi-6a.1 Expand hiking opportunities along Plum Creek and its tributaries by 1 mile.</i>				
	1 Submit grant proposal	City of Kent	funding, plans, design - Kent State University students could help with assessments, etc.	
	2 Wetland delineations		Assistance from KSU classes	
	3 Design/build			
	4 signs			
	5 Brochure/outreach			
<i>PI 6a-2. Develop 1 River Quest or virtual watershed tour</i>				
	1 Determine appropriate River Quest structure (cuyahoga canalway or new one)	WC, partners, volunteers, parks	Permission to develop quests, printing costs	2 quests by 2017 or 1 watershed tour by 2017
	2 Public workshop concerning River quests			
	3 Seek quests from volunteer groups			
	4 Review, print, distribute		funding for printing, place on website	
<i>PI 6a-3 Improve access points at 2 locations</i>				
Goal PI 6b: Increase awareness of recreational opportunities, stewardship, and watershed issues.				
<i>PI 6b-1. Economic impact study recreational uses</i>				
	1 Coordinate with KSU and others on study	WC with KSU	outside funding	1 study by 2018
	2 Submit grant proposal			
	3 Conduct study			
	4 Publicize			
<i>PI 6b-2. Increase signage related to Plum Creek or watershed at local parks/conservation/recreation sites.</i>				
	1 apply for funding			
	2 Design, install signs			8 signs by 2022
	3 Continued outreach with local communities			
<i>PI 6b-3 Update, increase, and disseminate available information concerning recreational opportunities and care of Plum Creek, its tributaries, and watershed.</i>				
	1 Web page of recreational opportunities/access wc			
	2 Other Actions - see PI 1b-12			
<i>PI 6b-4. Increase stewardship activities related to watershed issues</i>				
	Actions - PI 1b-13			
<i>PI 6b-5. Acquire conservation land, targeting important resource protection areas (e.g., wetland complexes in vicinity of Plum Creek/Kent Bog)</i>				
	Actions - See PI 1f-1			

Note: Select practices will be monitored for effectiveness