

A web-based tool for guiding watershed management planning for improved water quality

The *Clean Water Roadmap* is an interactive, web-based tool that allows watershed stakeholders to visualize and evaluate baseline pollutant loadings from specific catchment areas, and to explore the relative benefits of implementing specific best management practices at various spatial scales.

What is the Clean Water Roadmap?

The *Clean Water Roadmap* (CWR) is a web-based tool that provides an intuitive, interactive interface for visualizing and reviewing results associated with specific subbasins and combinations of land use, soils, and slope conditions within a larger (e.g., HUC-8) watershed unit. The tool was specifically developed for stakeholders who are interested in leveraging existing watershed model results to develop optimized combinations of best management practices (BMPs) that will achieve the greatest "bang for the buck" with respect to pollutant loading reductions.

The CWR was originally developed to support Vermont's basin planning efforts to achieve load reductions under the Lake Champlain Total Maximum Daily Load (TMDL) for phosphorus. However, the tool and its supporting database can be readily adapted to any watershed for which detailed modeling results are available.



Aggregate \rightarrow Map \rightarrow Analyze \rightarrow Implement

The CWR provides a wide range of features that can allow users to rapidly visualize and engage with detailed watershed modeling results and supporting information that would otherwise be difficult and inefficient for stakeholders to work with and use. The CWR aggregates and maps information at various catchment scales, which allows users to analyze and use the information to identify optimal management strategies for implementation within the watershed. The intuitive map interface and layer list incorporates key spatial layers, including multiple basin scales (e.g., HUC-12 units, NHDPlus catchments), political boundaries, instream water quality condition, and other information relevant for planning, such as conservation value. In addition to the map viewport and layer list, the CWR provides a "tools" pane where users can select specific map views, toggle between baseline and scenario modes, and export results to a spreadsheet format. The "Catchment Dashboard" summarizes loading and other information for whichever catchment is selected on the map, and also provides a point of entry for exploring catchment loadings in greater detail and assigning BMPs to the catchment.

Aggregate · Map · Analyze · Implement





Work with Watershed Data or Model Output

The CWR's "Visualize Basin Results" pane allows a user to map pollutant yield or loading rates at multiple basin/catchment scales. Maps can represent the overall loading condition for the selected basin scale or for specific land use types, such as cropland and developed land. If available, supporting management information such as conservation value can also be visualized at the selected catchment scale. Modifying any of the available visualization options will immediately refresh the map, which makes it easy to rapidly compare watershed model results to other data aggregated at the basin scale. Once a particular basin map has been created, clicking on a specific basin will populate the "Catchment Dashboard" with pollutant load, yield, and conservation metrics, percent rank statistics for those metrics, and pie charts summarizing the distribution of pollutant loading across land use/cover groups.

Work with watershed data or model output...





Create a Cohesive Watershed Priority Scheme

Priority areas for BMP implementation can be identified using a combination of the map and the "Catchment Dashboard." As priority catchments are identified, more detailed breakdowns of the pollutant loading distribution within a basin can be generated by clicking the "[show subbasins]" option or clicking on the loading pie chart in the dashboard. The "show subbasins" option will generate a sortable list of subbasins within the selected basin, including fields for pollutant loading and yield and surface area. This table can be used directly to identify priority subbasins within the parent basin of interest and/or the information can be exported to a spreadsheet for further analysis. Clicking on a pie slice will launch a loading "tree" view that allows the user to drill down into loading information by land use/cover type, hydrologic soils group, and slope category.

Create a cohesive watershed priority scheme...

	Hon	ne Docu	ments	Contact	CWR Out	treach	Mana	ige Accou	nt	Log out		the subcatchment(s) with the higher the subcatchment (s) with the	
Clean Water Roadmap Tools	•	Map Layers	Subbasin Towentery for HIIC-12 Unit: 0/150/0/20109									value, etc.	
Visualize Basin Results	1	Streams	Subbash		00 12 011		020105				1	304 mg	
Select map options:	(Villages	NHDPlus ID Ø	NHDPlus Name	Area (ha) 4	Base TP Load (kg/y)	Base TP Yield (kg/ha/y)	Scen TP Load (kg/y)	Scen TP Yield (kg/ha/y)	Conserv. Ø	WQ Impact d	598 mg 374 m 144	
Map type: Baseline •	1	Towns	22220901	Unnamed	429.51	97.82	0.230	97.82	0.230	14.30	26.49	► ×	
Basin scale: HUC-12 *	1	Counties	22220907	Otter Creek	58.12	32.78	0.560	32.78	0.560	52.67	16.46	041504020109	
Land type(c): All Land Types		🖉 Lake Champlain Ba	22220909	Unnamed	375.28	344.27	0.920	344.27	0.920	11.86	7.43	Moon Brook-Otter Creek	
Condicype(s). An candicypes	H	Tactical Pacing	22220911	Moon Brook	243.93	65.33	0.270	65.33	0.270	13.02	34.08	472 m 377 m 279 m	
Variable: Yield (kg/ha/y) *	H		22220913	Moon Brook	105.71	69.91	0.660	69.91	0.660	19.02	27.05		
Color scheme: Green to red	1	HUC-12 Basins	22220915	Moon Brook	102.83	127.51	1.240	127.51	1.240	20.85	1.42	755 m	
	i	NHDPlus Catchmer	22220917	Mussey Brook	313.97	53.83	0.170	53.83	0.170	15.22	17.20	10 ho 11 + 10 m	
 Manage Scenarios 		Water Quality	22220919	Moon Brook	56.41	59.15	1.050	59.15	1.050	24.85	8.40	Astrophysics S25m Part	
Baseline mode		Conservation View			115.76	71.05	0.610	71.05	0.610	42.84	26.38	Ludow a 2409 m.	
© Scenario mode	1	Water Quality	Click on	the "show	98.30	112.62	1.150	112.62	1.150	18.15	2.71	Perkniville 415m g Claremor	
		Blueprint (WQ Water Quality	list/ta	iink to open a ible of all	1.51	0.51	0.340	0.51	0.340	10.13	38.09	Non 11/	
Export Options			ubcatchme	nts within the	155.96	19.80	0.130	19.80	0.130	17.59	15.97	Springheld	
Click on a subcatchmen metric summaries an Catchment Dashboard	nt to nd rani	view ks	Tactical Bas Basin	sin or HUC-12 selected		Expor E	t data to Excel file	an	Exp	oort Table	Close	HERE, DeLorme, USGS, NGA, EPA, USDA, NPS	
HUC-12 Basin HUG Moon Brook-Otter Creek	C-12 Ba	sin: Baseline Sum	mary [®] [show	v subbasins]		Annual T	'P Load by LU	ILC Group	=	Lar	nd Area (ha)	by LULC Group	
(041504020109)	Metrie	c Value	Percent Ra	ink Percent Rank	Cro Pas	opland sture / Hay							
Tactical Basin Name Otter Creek - Little Otter	TP Load (k	g/y) 4,047	62	54	Far De	msteads veloped							
Cr Lewis Cr. Me	an Yield (k	g/ha/y) 0.37	62	52	Ro	ads							
	Area (h	a) 10,950	54	55	Gra	rest ass/Shrub Land							
	onservation	Value 38.22	42	69	We	tlands							



Develop Implementation Strategies

When working in scenario mode, the loading dialog and "tree" view can be used to assign specific BMPs and associated load reduction efficiencies to specific land use/cover types, soils, and/or slope categories. As BMPs are interactively assigned, the CWR calculates and reports the percent reduction in load for the selected land type and then aggregates the reductions up to the basin level. Specific management strategies can be formulated by developing different CWR scenarios and comparing the relative benefits of each based on their unique combination of basin- and land-specific BMP assignments.



Develop implementation strategies...

