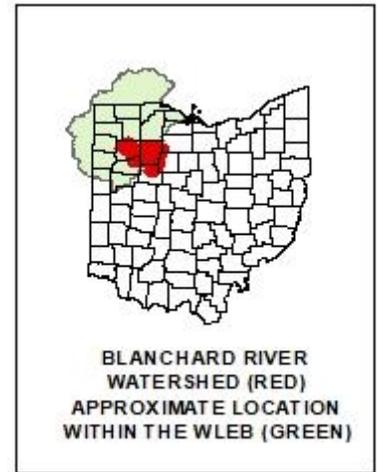


BLANCHARD RIVER WATERSHED SUMMARY

The Blanchard River watershed is located in northwest Ohio in portions of Allen, Hancock, Hardin, Putnam, Seneca and Wyandot counties. The Soil and Water Assessment Tool (SWAT) was used to estimate this watershed's contribution to nutrient loadings to the Western Basin of Lake Erie (WLEB), as well as simulate estimated nutrient outputs when specific best management practices (BMPs) were implemented.

Model results estimated that ~30% of the Blanchard watershed contributes phosphorus outputs that range from 1.71 to 2.97 lbs/acre to the Blanchard River on an annual basis. The Blanchard River SWAT model was used to simulate phosphorus outputs if several agricultural BMPs were adopted at a rate of 50% in the areas that have higher Total P contributions. The scenarios modeled were:

1) subsurface application of fertilizer, 2) no-till practices, 3) P-fertilizer application at half the Baseline scenario rate, and 4) a combination of subsurface application of fertilizer, half P-rate application, no-till practices, and use of cover crops.



Analysis of these scenarios shows:

- ***No single BMP provides optimal nutrient reduction everywhere.***
- ***Not every BMP is best-suited for an area, or as a stand-alone BMP.***
- ***Implementation of some BMPs help nutrient loads reach the Great Lakes Water Quality Agreement 40% reduction goal in some Hydrologic Unit Code (HUC-12) subwatersheds, while even a combination of BMPs is not enough to reach that goal in others.***
- ***For those areas where nutrient reduction goals are not met, an adoption rate of greater than 50% or alternative BMPs may be needed.***

State and federal funding is available for nonpoint source pollution reduction projects, but only if a sub-watershed has an approved Nine Element Plan, also known as a Nonpoint Source Implementation Strategy (NPS-IS). In order to facilitate funding eligibility and fund projects that will make effective progress towards nutrient reduction, the development of NPS-IS should be prioritized for the highest contributing subwatersheds in the Blanchard watershed.

- ***Thirty subwatersheds are in the Blanchard watershed.***
- ***Only five subwatersheds of the Blanchard have plans developed and approved (as of May 2019). Three more are in progress.***
- ***Currently, only two of the top ten highest contributing subwatersheds have an approved plan.***

These planning efforts, and the subsequent implementation of nutrient reduction projects, are led by local stakeholders who are most knowledgeable of the needs of the watershed, such as county, city, township and village governments, soil and water conservation districts and non-governmental organizations. Collaboration between these stakeholders is essential to the implementation of watershed-scale nutrient reduction efforts that will improve water quality within the Blanchard River watershed, as well as in Lake Erie.

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Blanchard River Watershed Background

The Blanchard Watershed (Hydrologic Unit Code 8 (HUC-8) = 04100008, area = 771 sq. mi (493,434 acre)) is located in northwest Ohio in portions of Allen, Hancock, Hardin, Putnam, Seneca and Wyandot counties. The main stem of the Blanchard River flows north from its headwaters in the southeast corner of the watershed, then turns west just upstream of Findlay, and drains into the Auglaize River west of the Village of Dupont. Major tributaries include Cranberry Creek, Riley Creek, Ottawa Creek, Eagle Creek, Lye Creek and The Outlet. The watershed extends across two Major Land Resource Areas (defined by the Natural Resource Conservation Service (NRCS)), and is almost entirely flat-lying, with 81% of the land having an average slope of 2% or less. Glacial lake plain and ground moraine soils overlay dolomite bedrock, and limestone quarries are located throughout the watershed. The largest city located in the watershed is Findlay, with a population of 41,202 (2010 census), and other notable cities and villages include Arlington, Beaverdam, Benton Ridge, Bluffton, Columbus Grove, Continental, Dunkirk, Dupont, Forest, Gilboa, Glandorf, Kenton, Miller City, Mount Blanchard, Ottawa, Pandora, Patterson, Rawson, Vanlue and Wharton. Historically, approximately 42% of the watershed is estimated to have been wetlands, although less than 1% remains today. In the early 1900s, the area was tiled and drained for settlement and agricultural purposes and is now predominantly cultivated cropland (~81%), with small amounts of developed land (~10%) and forest (~6%).

SWAT Model

The Soil and Water Assessment Tool (SWAT) was developed by the United States Department of Agriculture - Agricultural Research Service (USDA-ARS) “to predict the impact of land management practices on water, sediment and agricultural chemical yields in large complex watersheds with varying soils, land use and management conditions over a long period of time” (Neitsch *et al.*, 2011). The SWAT Model breaks a watershed down into small spatial units called hydrologic response units (HRUs) that contain a unique combination of land use/crop cover, soil properties and slope characteristics. For example, there are over 1,700 HRUs throughout the Blanchard HUC-8. Hydrologic and biologic processes (e.g. precipitation, evaporation, nutrient loss, and plant growth) are modeled in each HRU to increase accuracy and minimize uncertainty. A geographic information system (GIS) interface is used to enter and designate land use, soil, weather, groundwater, water use, management, pond and stream water quality data, and the simulation period (DiLuzio *et al.*, 2002). GIS input files include a digital elevation model (DEM), land use/land cover, soil properties layers and a daily weather database.

SWAT is one of many tools available for assessing watersheds and is regarded as the most versatile and customizable tool available to best achieve real-world scenarios for evaluating best management practices (BMPs) employed within a watershed. It is the most appropriate model to test the effects of BMPs on crop yield and environmental outputs, such as runoff movement, sediment, nutrient and pesticide loadings. These outputs to the Blanchard River and its tributaries are simulated by considering realistic physical processes.

Blanchard River SWAT Model Methodology

Data inputs, include USGS streamgages (active, continuously functioning measuring devices in streams that measure the height of water to calculate average daily streamflow), local weather data, point source nutrient contributors, knowledge of agricultural practices and land management, USDA-NRCS Cropland Data Layer (CDL)

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and USGS National Hydrography Dataset (NHD). These data were used to delineate the Blanchard River HUC-8 and to estimate its loading contribution into Lake Erie.

SWAT Model Input Data

Non-Point Sources

The crops planted for a certain area (i.e., field, farm, or HRU) in a certain year (2014 to 2017) were taken from the USDA-NRCS CDL, which is the most readily available spatial data set. The crop rotation for an area was then estimated by overlaying the CDLs from these years. Tillage practices were identified using prevailing practice and published reports from the area (NRCS WLEB CEAP report). Example tillage practices in the area include: mainly no tillage on wheat and soybeans and approximately 80% conventional tillage (chisel plow) on corn. Fertilizer and manure rate applications were based on the Tri-State Fertility Guide developed by Michigan State University, The Ohio State University and Purdue University in 1995 and values from the Nutrient Use Geographic Information System (NUGIS) nutrient balance report (IPNI, 2014).

Point Sources

National Pollutant Discharge Elimination System (NPDES) permit locations represent point sources that discharge pollutants to waters of the United States. Created in 1972 by the Clean Water Act, the NPDES permit program is authorized to state governments by the US Environmental Protection Agency (EPA) to perform many permitting, administrative, and enforcement aspects of the program. There are 35 NPDES permits located in the Blanchard River watershed at the time this model was prepared (January, 2019). Nutrient loading data from each of the permitted locations are included in the SWAT model with data provided from the Ohio EPA Mass Balance Study and Discharge Monitoring Reports (DMRs) submitted to the US EPA's ECHO (Figure 1).

Some entities also have Municipal Separate Storm Sewer Systems (MS4) NPDES permits, regulating stormwater runoff using six minimum control measures expected to reduce discharge of pollutants to the receiving waterbody. The Ohio EPA has grouped the MS4-permitted entities into two categories (Phase 1 or Phase 2) based upon population and amount of combined sewers within the community. The City of Findlay is the only Phase 2 MS4 community within the Blanchard River watershed.

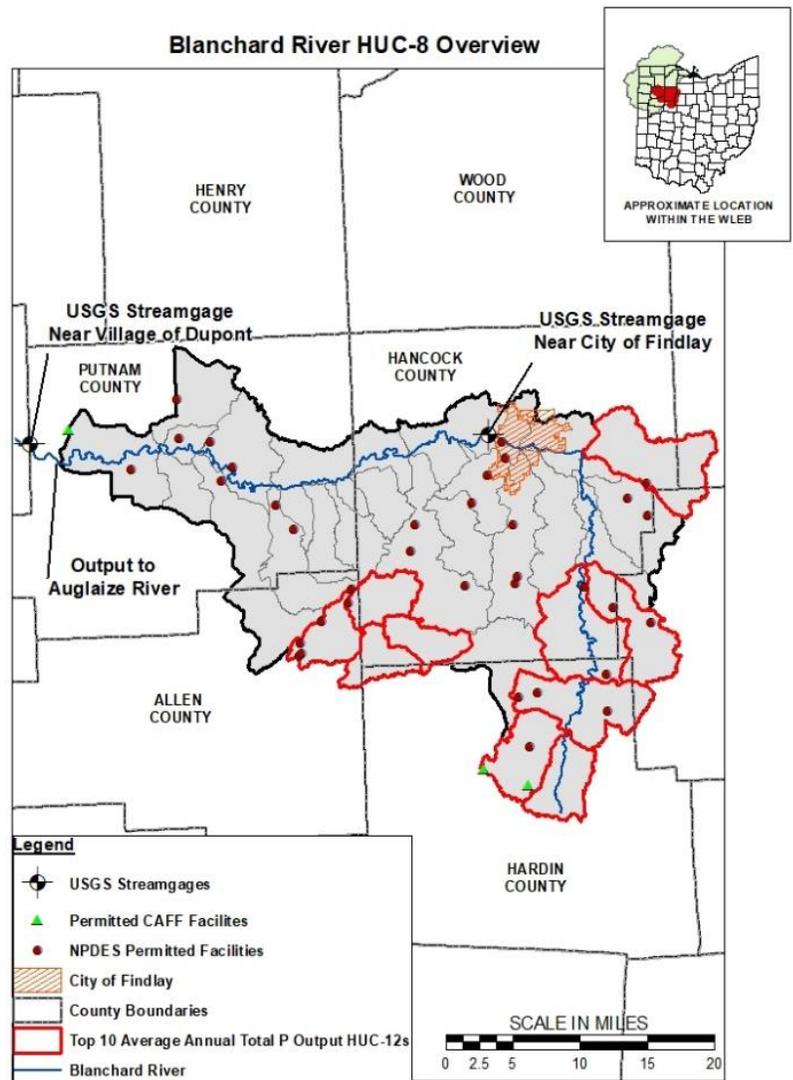


Figure 1: Blanchard River HUC-8 streamgages, point sources and priority HUC-12s.

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Confined animal feeding operations (CAFOs) are considered point source pollutants due to their production of animal waste. Currently, no CAFOs with NPDES permits are present in the Blanchard River Watershed (Ohio EPA, 2019). Published estimates in 2008 estimated the watershed was home to over 148 confined livestock operations of varying sizes, generating enough waste to supply 17 percent of the total phosphorus needed to fertilize crops in the watershed (NRCS, 2008). A listing provided by the Ohio Department of Agriculture in January showed three permitted facilities throughout the watershed (ODA, 2019).

Nutrients, Sediments, and Flow Observed Data

The SWAT model was calibrated for a three-year period (2014-2016) with the observed nutrients (phosphorus and nitrogen), total suspended solids and flow data from the USGS monitoring station (Station No. 04190000) in the Blanchard River at Dupont (Figure 1).

Blanchard River SWAT Model Findings

Table 1 lists the HUC-12 watersheds with the ten highest Total Phosphorus (Total P) and Dissolved Reactive Phosphorus (DRP) simulated yields from the Blanchard River SWAT model. These priority watershed locations are outlined in **Figure 1**.

TABLE 1: HUC-12 watersheds with highest simulated Total P and DRP yield				
HUC-12 Number	HUC-12 Name	Area (acres)	Total P yield (lbs/acre)	DRP yield (lbs/acre)
4100008 01 02	Headwaters Blanchard River	12,593.23	2.97	0.31
4100008 01 01	Cessna Creek	14,866.07	2.61	0.21
4100008 04 01	Binkley Ditch-Little Riley Creek	9,196.66	2.55	0.22
4100008 01 05	Ripley Run-Blanchard River	23,660.87	1.89	0.22
4100008 04 04	Middle Riley Creek	9,998.70	1.87	0.20
4100008 04 02	Upper Riley Creek	9,189.10	1.83	0.19
4100008 02 02	The Outlet-Blanchard River*	24,570.56	1.79	0.21
4100008 04 03	Marsh Run-Little Riley Creek*	10,406.28	1.77	0.18
4100008 01 04	Potato Run	17,841.54	1.75	0.19
4100008 02 02	The Outlet	24,570.60	1.71	0.16

*has an approved Nonpoint Source Implementation Strategy

Recommendations

As outlined in the previous section, the Blanchard River SWAT Model shows the ten HUC-12 watersheds that have the highest potential to contribute the largest loading of Total P within the Blanchard watershed. ***In order to make progress towards the goal of a 40% reduction in nutrient loadings coming from the Blanchard River watershed, attention should be focused on prioritizing BMP implementation within these HUC-12 watersheds. A key “first step” to implementing BMPs is to identify and coordinate with stakeholders within these HUC-12 watersheds.*** A list of organizational stakeholders working in and around these prioritized HUC-12s in the Blanchard River watershed are listed in Table 2.

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TABLE 2: Stakeholders Located or Working in the Blanchard HUC-8

Organization Name	Type of Organization
Blanchard River Watershed Partnership	Non-governmental Organization
Ohio Pheasants Forever	Non-governmental Organization
Black Swamp Conservancy	Non-governmental Organization
The Nature Conservancy	Non-governmental Organization
West Central Ohio Land Conservancy	Non-governmental Organization
Conservation Action Project	Non-governmental Organization
Colleges and Universities (University of Findlay, National Center for Water Quality Research (NCWQR) at Heidelberg University)	Higher Education Institution
Soil and Water Conservation Districts (Allen, Hancock, Hardin, Putnam, Seneca and Wyandot)	Government
Boards of County Commissioners (Allen, Hancock, Hardin, Putnam, Seneca and Wyandot)	Government
Cities and Towns (Findlay, Ottawa, Glandorf, Bluffton, Dunkirk, Continental, Dupont, Forest, Kenton, Wharton, Arlington, Mount Cory, Benton Ridge, Pandora, Mount Blanchard, Vanlue, Gilboa, Columbus Grove, Rawson)	Government
Townships (Greensburg, Ottawa, Blanchard, Riley, Orange, Van Buren, Washington, Jackson, Delaware, Amanda)	Government

Implementation of BMPs within the prioritized HUC-12s can be facilitated through the development of Nonpoint Source-Implementation Strategies (NPS-IS), which are condensed watershed planning documents that include the nine key elements required by the US EPA for nonpoint source pollution projects. NPS-IS delineate critical areas in individual HUC-12s that affect water quality, outline goals and objectives to attain water quality standards and describe projects meant to reduce impairment from nonpoint source pollution, both within the streams of the HUC-12 (near-field) and Lake Erie (far-field). ***The need for the preparation of approved NPS-IS plans in the Blanchard River watershed is evident in the fact that of its 30 constituent HUC-12s, only five have approved plans in place. Only two of those currently approved plans are among the top ten highest contributing HUC-12s. Three plans are under development; however those watersheds are not within the top ten highest contributing HUC-12s. Once the plans are approved, the projects detailed within become eligible and prioritized for nonpoint source funding opportunities through government agencies and other funding sources, thus, reducing costs of implementation and expediting the implementation of projects.***

The Blanchard River SWAT model also includes scenarios of agricultural BMPs that would reduce the loading of Total P coming from the Blanchard River watershed. The scenarios are: 1) subsurface application of fertilizer, 2) no-till practices, 3) P-fertilizer application at half the Baseline scenario rate, and 4) a combination of subsurface application of fertilizer, half P-rate application, no-till practices, and use of cover crops. Within the model, these scenarios were implemented to the top 50% of HRUs that have the highest P output across the entire HUC-8. This approach includes a realistic adoption rate, and focuses implementation efforts in the areas that could most benefit from those efforts for maximum Total P reduction. ***The selection and implementation of BMPs is a complex process, and no single BMP provides optimal nutrient reduction everywhere. Not every BMP is best-suited for an area, or as a stand-alone BMP, as evidenced by the increase in Total P loads with only no-till practices in place. Some BMPs help nutrient loads meet the 40% reduction goal in some HUC-12s, while even a combination of BMPs is not enough to reach that goal in others. For those areas where reduction goals are not met, an adoption rate of greater than 50% or alternative BMPs may be needed.***

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