

Section 729

Final Watershed Assessment and Watershed Management Plan

Nimishillen Creek Watershed

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Appendix A
Acronyms**

Acronyms

APAP	Agricultural Pollution Abatement Program	NEFCO	Northeast Ohio Four County Regional Planning and Development Organization
ARC	Appalachian Regional Commission	NFIP	National Flood Insurance Program
BMPs	Best Management Practices	NOAA	National Oceanic and Atmospheric Administration
BOD	Biological Oxygen Demand	NPDES	National Pollutant Discharge Elimination System
CFR	Code of Federal Register	NRCS	Natural Resources Conservation Service
CREP	Conservation Reserve Enhancement Program	NWS	National Weather Service
CRP	Conservation Reserve Program	O&M	Operations and Maintenance
CRS	Community Rating System	OAC	Ohio Administrative Code
CWA	Clean Water Act	ODNR	Ohio Department of Natural Resources
DR	Disaster Resolution	ODOT	Ohio Department of Transportation
EC	Engineer Circular	OEEF	Ohio Environmental Education Fund
ER	Engineer Regulation	OEMA	Ohio Emergency Management Agency
FDIC	Federal Deposit Insurance Corporation	OEPA	Ohio Environmental Protection Agency
FEMA	Federal Emergency Management Agency	PAS	Planning Assistance to States
FIRM	Flood Insurance Rate Map	PDT	Project Delivery Team
FPMS	Floodplain Management Services	PL	Public Law
FWA	Final Watershed Assessment	RL	Repetitive Loss
FWEEP	Flood Warning Emergency Evacuation Plan	STAR	Science to Achieve Results
FWS	Flood Warning System	SWMM	Stormwater Management Model
GIS	Geographic Information System	TMDL	Total Maximum Daily Load
HMGP	Hazard Mitigation Grant Program	USACE	U.S. Army Corps of Engineers
HSTS	Home Sewage Treatment System	USDA	U.S. Department of Agriculture
HUC	Hydrologic Unit Code	USEPA	U.S. Environmental Protection Agency
IWA	Initial Watershed Assessment	WMP	Watershed Management Plan
IWR	Institute for Water Resources	WRP	Wetlands Reserve Program
IWRM	Integrated Water Resources Management		
MWCD	Muskingum Watershed Conservancy District		

**Section 729 of the Water Resources Development Act of 1986
Study of Water Resources Needs of River Basins and Regions**

(a) The Secretary, in coordination with the Secretary of the Interior and in consultation with appropriate Federal, State, and local agencies, is authorized to study the water resources needs of river basins and regions of the United States. The Secretaries shall report the results of such study to Congress not later than October 1, 1988.

(b) In carrying out the studies authorized under subsection (a) of this section, the Secretaries shall consult with State, interstate, and local governmental entities.

(c) There is authorized to be appropriated \$5,000,000 for fiscal years beginning after September 30, 1986, to carry out this section.

**Section 202 of the Water Resources Development Act of 2000
Watershed and River Basin Assessments**

Section 729 of the Water Resources Development Act of 1986 (100 Stat. 7164) is amended to read as follows:

“Sec. 729, Watershed and River Basin Assessments.

(a) In General. – The Secretary may assess the water resources needs of river basins and watersheds of the United States, including needs relating to –

- (1) ecosystem protection and restoration;
- (2) flood damage reduction;
- (3) navigation and ports;
- (4) watershed protection;
- (5) water supply; and
- (6) drought preparedness

(b) Cooperation. – An assessment under subsection (a) shall be carried out in cooperation with –

- (1) the Secretary of the Interior
- (2) The Secretary of Agriculture
- (3) The Secretary of Commerce
- (4) The Administrator of the Environmental Protection Agency; and
- (5) the heads of other appropriate agencies

(c) Consultation. – In carrying out an assessment under sub-section (a), the Secretary shall consult with Federal, tribal, State, interstate, and local government entities.

(d) Priority River Basins and Watersheds. – In selecting river basins and watersheds under this section, the Secretary shall give priority to –

- (1) the Delaware River basin;
- (2) the Kentucky River basin;
- (3) the Potomac River basin;
- (4) the Susquehanna River basin; and
- (5) the Willamette River basin.

(e) Acceptance of Contributions. – In carrying out an assessment under subsection (a), the Secretary may accept contributions, in cash or in kind, from Federal, tribal, State, interstate and local governmental entities to the extent that the Secretary determines that the contributions will facilitate completion of the assessment.

(f) Cost-Sharing Requirements. –

(1) Non-Federal Share. – The non-Federal share of the costs of an assessment carried out under this assessment shall be 50 percent.

(2) credit. –

(A) In General. – Subject to subparagraph (B), the Secretary may credit toward the non-Federal share of an assessment under this section the cost of services, materials, supplies, or other in-kind contributions provided by the non-Federal interests for the assessment.

(B) Maximum Amount of Credit. – The credit under subparagraph (A) may not exceed an amount equal to 25 percent of the costs of the assessment.

(g) Authorization of Appropriations – There is authorized to be appropriated to carry out this section \$15,000,000.”

Section 2010 of the Water Resources Development Act 2007 Watershed and River Basin Assessments

Section 729 of the Water Resources Development Act of 1986 (33 U.S.C. 2267a; 114 Stat. 2587-2588; 100 Stat. 4164) is amended –

(1) in subsection (d) –

(A) by striking “and” at the end of the paragraph (4);

(B) by striking the period at the end of the paragraph (5) and inserting a semicolon; and

(C) by adding at the end the following:

“(6) Tuscarawas River Basin, Ohio;

(7) Sauk River Basin, Snohomish and Skagit Counties, Washington

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Appendix B
Study Authorities**

- (8) Niagara River Basin, New York;
 - (9) Genesee River Basin New York; and
 - (10) White River Basin, Arkansas and Missouri.”;
- (2) by striking paragraph (1) of subsection (f) and inserting the following:
- (1) Non-Federal Share.- The non-Federal share of the costs of an assessment carried out under this section on or after December 11, 2000, shall be 25 percent.”; and
 - (3) [sic] by striking subsection (g).

MEMORANDUM FOR RECORD

SUBJECT: Nimishillen Creek Section 729 Final Watershed Assessment, Kickoff Meeting Among Stakeholders

1. On 28 February 2013, a meeting was held at the Stark County Parks Exploration Gateway Center in Canton, Ohio to kickoff the Nimishillen Creek Section 729 Final Watershed Assessment (FWA) Study. The list of the meeting’s participants is at Enclosure 1 and a copy of the presentation slides is at Enclosure 2.

2. Purposes of Meeting. Mark Kessinger opened the meeting and explained its purposes were to provide some background on the Corps-MWCD Nimishillen Watershed Assessment Study, identify regional problems and issues related to water in the watershed, allow the stakeholders to provide input on the problems and issues, begin to establish water resource priorities, and determine the next steps as we move forward with the study.

3. MWCD’s Involvement with the Project. Boris Slogar then described how the Muskingum Watershed Conservancy District (MWCD) came to be involved in the project as the non-Federal cost-share sponsor. He said the MWCD is the largest of about 20 Conservancy Districts across Ohio which was formed following the Flood of 1913 to address a variety of water management issues including flooding. To deal with flooding in the 1930s the MWCD and the Corps partnered to construct 14 dams – the nation’s first system of flood control dams. These projects have prevented nearly \$10B in damages, but they are now more than 70 years old and in need of major repairs to meet current dam safety criteria. So, the MWCD and the Corps are partnering once again to do major construction at the dams to bring them up to today’s dam safety standards. The estimated federal cost is over \$750M and the estimated contribution required from the MWCD is \$120M. In addition, MWCD is providing funding for other types of water-related projects through its “Partners in Watershed Management” Program. Mr. Slogar said nearly \$1M has been provided to Stark County through this program on the following projects:

City of Canton (2009)	\$ 43,200	Fairhope Nature Preserve
City of Canton (2013)*	\$ 60,000	Nimi Creek and Raceway
City of Massillon (2013)*	\$350,000	Levee Repairs (slip lining)
Stark Parks (2010)	\$ 22,080	Watershed Training for Teachers
Stark Parks (2012)	\$250,000	Fry Family Park Acquisition
Stark Parks (2013)	\$ 35,000	Fry Water Quality Education
Village of Brewster	\$116,079	Levee Repairs (slip lining)
YMCA Stark	\$ 25,000	Camp Tippecanoe WWTP
Wilderness Center	\$ 15,785	Land Acquisition – Sugar Creek
TOTAL	\$917,144	

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Among Stakeholders

4. Section 729 Watershed Assessment Overview. Jami Buchanan then gave an overview of the study. She said the Corps' authority for the study comes from Section 729 of the Water Resources Development Act of 1986, and it's intended to address problems, needs, and opportunities within a watershed and look to achieve integrated water resources management. The study uses a watershed approach to solving problems and can result in a general, non-project specific plan and/or strategies to address watershed needs in the Nimishillen Creek Watershed. She stated the intent is to work with all stakeholders to help solve water resources problems in an integrated and sustainable manner using systems approaches to understand the connection between natural and man-made systems. We will be analyzing water resources problems on a large geographic scale and striving to achieve multiple goals in a balanced way.

5. The Study's Products. One of the two main products that come from the study is the Initial Watershed Assessment, which was completed by the Corps at full federal cost last year. It inventoried problems, needs and opportunities in the basin, identified stakeholders and resources, and defined the scope of Final Watershed Assessment (this study). The Final Watershed Assessment will provide a plan for managing water resources in the basin, will reflect the interdependency of water uses and competing demands, will define integrated approaches for dealing with problems in a holistic manner, and can recommend Corps and/or non-Corps projects.

6. Roles of the Advisory Group and the Technical Group. A key component of the study will be understanding the roles of the Advisory Group and the Technical Group. The Advisory Group will assist the Technical Group and the Corps in establishing the water resource priorities in the watershed, will contact the technical group for routine updates on the progress of the study, will pass current and factual information about the study along to the public, and will review and comment on the Draft Report when it is issued. The Technical Group will provide information to the Corps on water resource problems and issues within the Nimishillen Creek Watershed, meet with the Corps on a routine basis to provide input to the study, help the Corps prioritize the water resource problems and issues in the watershed, keep the Advisory Group informed of the Study's progress, and review and comment on the Draft Report when issued.

7. Identification of Water Resource Issues in the Basin. The meeting then went to open discussion for the stakeholders to talk about the water resource issues they are facing in the watershed. Below is a summary of the issues along with anticipated needs:

- a. ***Flooding Issues*** – the flooding areas of the watershed include Zimber Ditch, East Branch of Nimishillen Creek, Middle Branch through Canton, and Fair Hope Ditch in Louisville. There are only 2 stream gages on Nimishillen Creek and none are on the East or West Branches.

Need 1: Review previous rainfall data during historical flood events in 2003, 2005, 2008 and 2011.

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Need 2: Install a gaging system across the watershed to monitor water levels in streams and behind retention ponds.

Need 3: Install a flood warning system with a gaging network.

- b. ***Water Quality Issue*** – the Total Maximum Daily Loads (TMDL) report was completed in 2009 and there is a lot of water quality data in the watershed.

Need 1: Need to incorporate water quality data with water quantity information.

- c. ***Ecosystem Issue*** - there has been a significant loss of aquatic ecosystem habitat due to commercial and residential growth and agricultural development.

Need 1: Better coordination and uniformity of riparian corridor regulations.

Need 2: New education and outreach programs possibly by Stark Parks and the McKinley Museum.

- d. ***Floodplain Issues*** - there are 15 Floodplain Managers in Stark County and Stark County has 4 out of Ohio's 10 largest townships. Steady state models were used by FEMA to determine the floodplains for the Community Rating System.

Need 1: More consistent and coordinated floodplain management regulations. Perhaps our Advisory Group can work with County on this issue. It could be a Regional Planning Commission Initiative.

Need 2: Use unsteady state models to determine floodplains.

- e. ***Wastewater Issue*** - Stark County has the most septic systems of any county in Ohio and they are regulated and monitored by the County's Health Department.

Need 1: A County-wide Watershed Action Plan for septic systems.

8. **Next Steps.** The Technical Group decided to meet again the first week of April to talk about these issues in more detail. We plan to follow up with a meeting among the Technical and Advisory Groups in late May to make sure the Advisory Group agrees with the issues and with the direction the Technical Group is headed.

/s/

Mark D. Kessinger, PMP
Project Manager

MEMORANDUM FOR RECORD

SUBJECT: Nimishillen Creek Section 729 Final Watershed Assessment, First Technical Group Meeting, 3 April 2013

1. On 3 April 2013, the first meeting with just the Technical Group was held at the Stark County Parks Exploration Gateway Center in Canton, Ohio to discuss the Nimishillen Creek Section 729 Final Watershed Assessment (FWA) Study. The list of the meeting's participants is enclosed.
2. Purposes of Meeting. Jami Buchanan began the meeting and said the purposes of this meeting were for the Technical Group Members to further discuss the issues raised during the kickoff meeting last month, and to provide information to the Corps on the specific water resources projects they have been developing, or plan to develop in the future, in the Nimishillen Creek Watershed.
3. Recap of Issues Raised at Kickoff Meeting. Mark Kessinger then opened the discussion on the water resource issues that were raised during the kickoff meeting on 28 February. Below is a summary of the discussion and a list of follow-up action items coming from the discussion:

- a. ***Flooding Issues*** – the flooding areas of the watershed include Zimber Ditch, East Branch of Nimishillen Creek, Middle Branch through Canton, and Fair Hope Ditch in Louisville. There are only 2 stream gages on Nimishillen Creek and none are on the East or West Branches.

Need 1: Review previous rainfall data and flood heights during historical flood events in 2003, 2005, 2008 and 2011. – **Action 1: The Corps agreed to compile the rainfall data for these flood events to determine their flooding frequency, and check with local newspapers and the Stark County Drainage Task Force to see if high water marks could be determined.**

Need 2: Install a gaging system across the watershed to monitor water levels in streams and behind retention ponds. – **The FWA will evaluate this need to determine an estimated cost of the system to see if it is feasible. Boris Slogar said that typically the USGS only installs gages for drainage areas over 10 square miles, and Belinda Weikle added that someone locally would have to assume O&M of the gage which runs between \$10k-15k annually.**

Need 3: Install a flood warning system with a gaging network. - **The FWA will evaluate this need to determine an estimated cost of the system to see if it is feasible. Mark Kessinger noted the Corps has installed flood warning systems in areas of West Virginia and Kentucky and although they do not prevent flooding they allow**

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residents to evacuate ahead of the flooding and often times move their possessions to higher elevations thus minimizing the flood damages.

- b. **Water Quality Issue** – the Total Maximum Daily Loads (TMDL) report was completed in 2009 and there is a lot of water quality data in the watershed.

Need 1: Eric Akin stated in the kickoff meeting there is a strong need to incorporate water quality data with water quantity information. - *The FWA may take this into consideration. **Action 2:** The first step is for the Corps to follow up with Mr. Akin to see how we could go about incorporating water quality and water quantity data and if would be feasible.*

- c. **Ecosystem Issue** - there has been a significant loss of aquatic ecosystem habitat due to commercial and residential growth and agricultural development.

Need 1: Better coordination and uniformity of riparian corridor regulations. – *Perhaps through information gained from this study, the Advisory Group can work with the Regional Planning Commission to develop uniform regulations for all of the watersheds 15 Floodplain Managers to use.*

Need 2: New education and outreach programs. – *These may be possible through the Stark Parks and the McKinley Museum. Both have strong education and outreach programs underway.*

- d. **Floodplain Issues** - there are 15 Floodplain Managers in Stark County and Stark County has 4 out of Ohio's 10 largest townships. Steady state models were used by FEMA to determine the floodplains for the Community Rating System and errors have been found – particularly in Louisville.

Need 1: More consistent and coordinated floodplain management regulations. Who would develop the regulations? Are they already developed and we just need to follow them consistently? - *Perhaps our Advisory Group can work with County on this issue. It could be an initiative undertaken by the Regional Planning Commission.*

Need 2: Use unsteady state models to determine floodplains. - *The FWA will evaluate this need to determine an estimated cost of the modeling to see if it would be feasible as part of a future Corps' feasibility study.*

- e. **Wastewater Issue** - Stark County has the most septic systems of any county in Ohio and they are regulated and monitored by the County's Health Department.

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Need 1: A County-wide Watershed Action Plan for septic systems. *The FWA will evaluate this need to determine an estimated cost for preparing a Watershed Action Plan for septic systems.*

4. Floodplain Management/Repetitive Loss Areas. Kurt Buchanan opened the discussion regarding floodplain management. Bob Fonte stated that Stark Parks is using flood hazard grant funds to remove structures, including the former Ethan Allen Furniture building, on the east end of Wise Avenue this week. He said it will take another grant to remove the fill that has been placed over the years in order to restore the floodplain. Stark Parks has also applied for a grant to remove 10 structures along Zimber Ditch and 2 structures in downtown Louisville. **Action 3:** *Kurt Buchanan agreed to provide FEMA's repetitive flooding data to Mr. Fonte; however, this information can only be used for planning purposes and cannot be made public.* Mr. Fonte said by the end of the summer Stark Parks planned to have digitized mapping of their Master Plan. **Action 4:** *Mr. Fonte will provide the information to the Corps when it is available.* Tom Ault said Louisville has discovered a 5-foot error in FEMA's 100-year flood mapping which affects 20 properties in downtown Louisville. **Action 5:** *Belinda Weikle agreed to contact FEMA about the matter and follow-up with Louisville's Melinda Chase.* There have been 2 previous flooding studies completed: a MS study on Zimber Ditch and a Department of Agriculture study on East Branch. Jim Benekos said North Canton is planning to have a meeting regarding the Zimber Ditch flooding issue on 25 April. **Action 6:** *Mr. Benekos will provide the Corps and the MWCD information on the meeting and possibly invite Chris Toms from the ODNR.* Gary Connor said Stark County plans to do another study on Zimber Ditch later this year and **Action 7:** *he will work to make sure that study is linked to this one.* The Technical Group believes it would be beneficial if this study could **Action 8:** *quantify the financial requirements to address the drainage problems and re-establish the floodplains and estimate a cost benefit of restoring the floodplains.*

5. Riparian Buffers/Agriculture Areas of Concern. It was brought out that 40% of the County is still agriculture. The Farm Bureau's Soil and Water Conservation Service is making water quality a priority focus in the watershed and working to maintain or establish new riparian buffers. **Action 9:** *Mark will contact Nick Kennedy (330-456-4889/330-936-1640 cell) at the Farm Bureau to see if he can participate on the Technical Group.* Greg Mencer said a 5-year Strategic Plan was recently completed to improve water quality and **Action 10:** *Mark will also contact Julie Barberry from the S&WCS to see if she can participate on the Technical Group as well.*

6. Sewage and Septic Systems. Tom Ault said there are two storm sewer entities in the watershed. Mark noted that at the last meeting it was mentioned that Stark County has the most septic systems of any county in Ohio and they are regulated and monitored by the County's Health Department. He said a need was noted during the meeting for a County-wide Watershed Action Plan for septic systems so the Corps plans to look into determining an estimated cost for preparing a Watershed Action Plan for septic systems.

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7. Ditch Maintenance. Gary Connor said the County is going to spend a significant amount of money on the stormwater systems by replacing 1960s-era corrugated metal pipe. The County also plans to hire a consultant to look at bigger flooding issues like Zimber Ditch and the detention basins built in 2004.

8. Potential Locations for Detention Basins. Dan Moeglin stated there are two areas in Canton with a potential to be detention basins. One is near Broadhaven Estates and the other is along Middle Branch off of State Street. In addition, he said every road crossing or undersized culvert presents an opportunity for pooling water. Brian Olson noted that when ODOT undersizes a pipe it makes sure it has an easement for flooding the land upstream of the pipe. [REDACTED]: ***The members of the group will make a list of where each agency's detention basins are located. [REDACTED]: In addition, Mark will contact Joe Underwood at the Regional Planning Commission to see if he already has this information.***

9. Land Banking. Dan Moeglin said the County has a land banking program where a vacant structure in the floodplain with back taxes due can be razed and back taxes waived for the adjacent owner if they agree to mow the grass on the property. Bob Fonte said Stark Parks has asked the Regional Planning Commission to let it know when properties come available in the floodplain so they could be acquired for the County Park System or for Canton's Municipal Park System.

10. Next Step. We plan to follow up with a meeting among the Technical and Advisory Groups on 21 May at the Canton City Garden Center to make sure the Advisory Group agrees with the issues and with the direction the Technical Group is headed.

/s/

Enclosure

Mark D. Kessinger, PMP
Project Manager

MEMORANDUM FOR RECORD

SUBJECT: Nimishillen Creek Section 729 Final Watershed Assessment, 3rd Meeting Among Advisory and Technical Group

1. On 21 May 2013, the third meeting to discuss the Nimishillen Creek Section 729 Final Watershed Assessment (FWA) Study was held at the Canton City Garden Center. The list of the meeting's participants is at Enclosure 1 and a list of issues and strategies identified to date is at Enclosure 2.

2. Purposes of Meeting. Mark Kessinger began the meeting and said the purposes of this meeting were: (1) to make sure the Advisory Group agrees with the issues the Technical Group plans to address, and (2) to make sure we are all in agreement with the direction the study is headed. Jami Buchanan then summarized the previous two meetings and ran down the issues that have been raised.

3. Discussion of Issues. The group then opened the discussion on the water resource issues that were raised during the previous meetings on 28 February and 3 April 2013. Below is a summary of the discussions and a list of follow-up action items coming from the discussion:

- a. ***Flood Related Issues*** – There are only 2 stream gages on Nimishillen Creek and none are on the East or West Branches. Sarah Jamison of NOAA noted that they are moving the North Industry gage upstream about a half mile so they will need time to reactivate and recalibrate the gage. She said NOAA's radar is partially blocked in this watershed so new rain gages would be beneficial. She added that there also is flooding on West Branch and Middle Branch so we need to include these areas in our study, and in North Canton along Zimber Ditch there is little warning time prior to flooding so a flood warning system would be beneficial there.

Bob Fonte of Stark Parks said they have been approved to receive \$1.5M in FEMA funding to remove 10 flood prone homes along Zimber Ditch. A property owner in the Louisville area is looking to increase the capacity of a detention basin there so, **Action 1: the Corps will contact Tom Ault, Louisville's City Manager about it and, Action 2: the Corps will check to see if it has any records of previous studies on Zimber Ditch.** Need 1: Mr. Fonte said we need to hydraulically model the system across the watershed to monitor water levels in streams and behind retention ponds.

- b. ***Water Quality Issues*** – Need 2: Dan Moeglin said we need to map the manholes in the floodplain to make sure they have locking lids to prevent sewage from infiltrating into streams when they are inundated. He said Canton, North Canton and Stark County are working on this issue and the county is mapping the manholes. **Action 3: The County will provide the Corps with the mapping when it's available.**

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Bob Nau of the Regional Planning Commission said OEPA did a TMDL study in 2009 that contains good information and identified agricultural concerns affecting water quality. (We believe Eric Aiken has already provided this study to the Corps.) He added that NEFCO also gave a proposal several years ago to establish a riparian buffer zone but it was not well received. Greg Mencer said some codes and ordinances would have to be implemented to develop and preserve the riparian corridors.

Mr. Nau noted that Kent State is also doing water quality testing and he believes Mr. Aiken has the data. **Action 4: The Corps will check to see if they have the data.** The OEPA has new draft regulations for commercial development out for review. The POC is Bill Zewiski of the Northeast District for Surface Water, so **Action 5: the Corps will contact him to invite him to the group.**

- c. **Floodplain Issues** – There are 15 Floodplain Managers in Stark County so **Recommendation 1:** a recommendation is to pursue is to consolidate the 15 manager positions into 1 position and perhaps consolidate regulations as well. This could possibly be administered by the Regional Planning Commission. Mr. Fonte said Stark Parks has developed expertise in restoring floodplains and they would be willing to help educate other agencies and also assist with grant writing.

Regarding abandoned properties, Stark County has a “side lot program” where abandoned properties are given to adjacent property owners to maintain. Before giving the property to the adjacent owners, first the County determines if the property lies within the floodplain, is adjacent to a park, has historical significance or has some other potential beneficial use. **Recommendation 2:** It was recommended that this type of program be expanded on a more regional watershed basis.

Barbara Bennett noted it would be helpful to educate developers on the benefits of floodplains and to develop consistent storm water regulations. She said there has been lots of flooding problems with the smaller 5, 10 and 15-year rainfall events.

- d. **Wastewater Issues** - Stark County has the most septic systems of any county in Ohio and they are regulated and monitored by the County's Health Department. There are some large areas not covered by sanitary sewers, some areas require two septic systems in case one fails, and some developments are in areas that are not covered by ordinances. Septic systems are addressed under the MS4 Program. The Health Department has a top 10 list of septic system failure areas. **Action 6: The Corps will invite Todd Pauls from the Health Department to attend our meetings.**

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There are two storm sewer entities in the watershed. Through NPDES permitting, a storm water map has been developed for the urbanized area of the Nimishillen watershed. Inspections are being conducted at storm water outfalls and a new permit will require some testing and treatment. The Corps plans to look into determining an estimated cost for preparing a County-wide Watershed Action Plan for septic systems.

- e. **Agriculture Issues.** Previously it was stated that 40% of the County is still agriculture and the Farm Bureau's Soil and Water Conservation Service is making water quality a priority focus in the watershed and working to maintain or establish new riparian buffers. **Action 7:** Mark will contact Nick Kennedy (330-456-7064/330-936-1640 cell) at the Farm Bureau to see if he can participate on the Technical Group and **Action 8:** Mark will also contact Julie Barberry from the S&WCS to see if she can participate on the Technical Group as well.

/s/

2 Enclosures

Mark D. Kessinger, PMP
Project Manager

Meeting Title: Nimishillen Creek Watershed Final Watershed Assessment Advisory/Technical Group Meeting

Meeting Date:
11/20/2013

Time: 1pm-4pm

Location: McKinley Presidential Library &
Museum Canton, Ohio

Facilitators: Mark Kessinger and Jami Buchanan (USACE)

Participants: See Appendix A

Purpose: Collaborating with stakeholders to holistically determine and address water resources problems, needs, opportunities, and priorities within the Nimishillen Watershed. Meeting commenced at 1pm and concluded at 4pm with two 10 minute breaks.

Meeting Agenda

- A. Welcome and Introduction
- B. Brief Project History and Overview
- C. Brief Summary of Problems and Opportunities Identified
- D. Potential Alternatives Identified
 - 1. FWEEP
 - 2. FEMA Floodway Update/ Data Gaps
 - 3. Streamline Floodplain Management Duties
 - 4. Educational Display
 - 5. Unsteady RAS Model
 - 6. Designation of a Flood Plain Restoration Lead
 - 7. Central Repository Website
 - 8. Other Alternatives Identified
- E. Available Opportunities and programs
- F. Path Forward

Discussion Points

- A. All participants stated their names, affiliations and functions
- B. Mark Kessinger (USACE) provided overview. Explained authorities, regulation, and cost-share provisions. Explained Muskingum Watershed Conservancy District and

federal government/ partnering to pay for study. Described the advantages of a comprehensive watershed approach. Explained technical (conducts data analysis and synthesis) versus advisory (helps establish priorities) groups. Advised that at the conclusion of plan a USACE project MAY or MAY NOT come to pass, but a potential/feasible solution would be recommended and parties who can take ownership of the solution identified, i.e. ODNR, USDA, EPA, FEMA. Thanked participants for their constant and frequent communication/cooperation.

- C. Jami Buchanan (USACE) summarized the problems and opportunities including out of bank flooding, significant flooding events with substantial damages, stormwater management, Floodplain management/ managers issues, water quality: degradation.
- D. Jami Buchanan (USACE) discussed “big ticket” alternatives.
 - 1. FWEEP (Flood Warning and Emergency Evacuation) Michael McComas (USACE) explained FWEEP concept using Grundy, VA. case study. FWEEP defines flood warning procedures, emergency notification, evacuation routes, trigger elevations, monitoring, detection and flood fighting. Explained gauging procedures and associated costs. \$30,000 is the approximate cost of installation of gauges. \$13,000 is the approximate annual “subscription” cost per gauge for USGS to monitor gauges/ provide data. This is a hand-off approach wherein USGS takes care of everything once O&M agreement is signed. Cheaper alternative to structural approaches to risk reduction perhaps. Extensive education/public outreach required. Highlighted the need for more gauges to provide more/ better data. McComas said he would provide participants with Grundy, VA. FWEEP document. Boris Slogar, Muskingum Watershed Conservancy District chief engineer, said he was coordinating with USGS about increasing gauging within the watershed. Said he would be happy to share the proposal he is expecting from USGS in the next few weeks with participants. Boris urged the need for increased gauging as it improves the ability to make better decisions since it increases certainty. “Nothing replaces data collected over time.” Muskingum Watershed Conservancy District is looking to fund the entire new gauging projects.
 - 2. Belinda Weikle (USACE) provided a FEMA Floodway Update. The current mapping FEMA has cannot be used to create a useful model. Updating the data will require surveying and it will be expensive. Needed items include underwater

telemetry, cross-section data, precip data and more. Belinda Weikle explained that FEMA provides only steady state RAS model data and unsteady-state RAS modeling is also needed. Questions about county GIS data, 1-foot, 2-foot-interval contours, arose. Belinda Weikle urged everyone to identify and share what information/ mapping/ data all stakeholders had to be used for a master model of the entire watershed. Discussed the “missing” 1997 Zimber study (steady-state RAS model Stark County, Jackson, North Canton). Many participants have the summary, but no one said they had the full report. Belinda Weikle said underwater, cross-sectional flow data would be needed to create a reliable model. Such an undertaking would be in lieu of FEMA updating maps. Explained FEMA prioritizes updating mapping based on population/ urbanization. Discussion ensued about using political pressure to urge FEMA to update mapping. Belinda Weikle urged that once the model, based on accurate, updated data, is setup, all sorts of alternatives can be explored quickly. Capabilities/ programs under which USACE can offer support were discussed. Bob Nau, RPC executive director urged that if it is the domain of FEMA to conduct/ provide mapping, it is required to address the mapping issue with FEMA and determine how to make them do it. Bob Nau RPC executive director also said any recommendations must explain to the public why we need to spend more time studying/ acquiring data/ developing a model instead of actually building structures.

3. Streamline Floodplain Management/ Coordination Duties: Discussion ensued about how sometimes floodplain coordinators do not have the expertise to serve as flood plain coordinators; as often it’s an additional duty to a primary job such as building inspector, regional planning, permitting, etc. Flood plain management group creation/ charter/ task force was discussed. Such a group existed for several years after a flood event, but dissolved when funding (grant) money ended. Stark Council of Governments, SCOG, was discussed to consolidate flood plain management. Jami Buchanan (USACE) will setup a meeting to discuss streamlining floodplain management after the holidays.

4. Education/ Outreach Jami Buchanan (USACE) explained that Jasmine Chopra-Delgadillo (USACE) and Lynette Reiner, Science Director at McKinley Presidential Library would coordinate. Flyers, brochures, static, multi-media displays, etc. were

discussed. Use of interns/ students from local universities was discussed. Use of Engineer Research and Development Center/ other USACE Districts educational materials were discussed.

5. Unsteady RAS Model: See 2.

6. Designation of a Flood Plain Restoration Lead

7. Jami Buchanan (USACE) discussed creation of a Central Repository Website for all watershed data. Questions about operations and maintenance as well as costs, sources of funding associated with the website/ clearinghouse arose. Suggestions arose about housing it at a regional planning office or watershed district.

8. Other alternatives: Establish sewers in un-sewered areas, establish uniformity in stormwater management regulations throughout the watershed. Jami Buchanan (USACE) researched and compiled a document with sample ordinances. HUD-DOT-EPA Partnership for Sustainable Communities was discussed. Stark County Regional Planning Commission representative discussed land-use implications. Develop an Action Plan for Sanitary Sewers (urbanized areas, do not encourage sprawl, use proper language: "existing urbanized area.")

E. Path Forward: What do the stakeholders want to see within this study? Discussion diverted to another possible alternative: governments buying at-risk properties and not developing in those areas. Designation of a Floodplain Restoration Lead was mentioned but not fully discussed. Repetitive Loss properties were briefly discussed.

Due outs

- A. Contact FEMA to discuss updating mapping (no one volunteered)
- B. Clearinghouse/ website (all participants agreed to talk to their agencies about contributing to, housing, and assisting with a central repository for watershed data online.
- C. Kurt Buchanan (USACE) will compile a document listing who has what in terms of watershed data. Will distribute a survey/ questionnaire asking participants to detail what data they have along with their contact info. Clearly explain what data is being provided and how/ when it was obtained.
- D. Invitations for January subgroup meeting to discuss flood plain coordination/management will be emailed by Jami Buchanan.
- E. Water quality data on sewerred and un-sewerred areas will be obtained and distributed by Eric Akin (NEFCO) forward to Michael McComas (USACE)
- F. Setback ordnances will be placed on USACE website. Jami Buchanan will email link.
- G. Kurt Buchanan (USACE) can provide repetitive loss data upon request.
- H. Participants agreed to meet in January for another technical/advisory group meeting.

Nimishillen Creek Watershed Final Watershed Assessment Advisory/Technical Group

Appendix A. Participants

(not all participants signed the sign in sheet so the list below is not reflective of all participants)

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Meeting Title: Nimishillen Creek Watershed Final Watershed Assessment Technical Group Meeting

Meeting Date:
05/28/2014

Time: 9am-noon

Location: Exploration Gateway at Sippo Lake Park (Canton, Ohio)

Facilitator: Jami Buchanan (USACE)

Purpose: Collaborating with stakeholders to review the draft Section 729 Final Watershed Assessment and garner stakeholders' feedback to improve/guide the report. Meeting commenced at 9am and concluded at noon.

Meeting Agenda

- A. Welcome and Introduction
- B. Overview of draft Section 729 Final Watershed Assessment
- C. Open discussion for all participants to share their feedback, questions, concerns and recommendations regarding the draft Section 729 Final Watershed Assessment
- D. Action items resulting from meeting
- E. Path forward

Discussion Points

- A. Opening Remarks. All participants stated their names, affiliations and functions. Mark Kessinger (USACE) remarked about the sustained and outstanding participation/ commitment among all stakeholders after more than one year of collaborating. Mark informed the group that the meeting would be an informal collaborative working session to share concerns/ recommendations in real-time as the group went through the draft Section 729 Final Watershed Assessment.
- B. Draft Report. Jami Buchanan provided a brief overview of the draft Section 729 Final Watershed Assessment and said that the report is meant to reflect the participants/stakeholders water resources priorities and needs. Boris Slogar (MWCD) reiterated Jami Buchanan's statement and asked participants to express what they liked and what they did not like about

the draft because the report may serve as a springboard to gain further funding to address issues and must respond to the needs of stakeholders. Jami Buchanan then opened the floor to participants.

- c. Open Discussion. Open discussion began with Sections 5.0-5.7 (Identified Water Resources Issues through Floodplain Management Issues).

1. Recommendations. [Dan Moeglin](#) (Canton City Engineer) suggested a list of specific action items in the report in priority order with costs, if possible. [Bob Fonte](#) (Stark County Parks District) added it would be good to include actions that have already been taken such as construction of the detention basins. **ACTION 1: Jami Buchanan explained that action items will be addressed in the conclusion section of the report, and the Corps can add a separate comprehensive list detailing actions that have been accomplished. ACTION 2: She said the Corps will also develop rough order of magnitude cost estimates associated with proposed projects in a spreadsheet or appendix to the report.** Boris Slogar said that if action items were prioritized it would give a unified, clear direction and could improve chances of garnering funding/grants. Jami Buchanan recommended participants work together to prioritize action items at a future meeting.

2. Property Damages. [Tim Warstler](#), Director of the Stark County Emergency Management Agency, had concerns about the damage values in table 5.2, "Other Flood Events Impacting Nimishillen Watershed." He thinks it is odd that some values indicated no damage despite there being emergency declarations. **ACTION 3: Jami Buchanan will check with Tim Warstler on all the property damage values listed in Figure 5.2.**

3. Existing Reports. A participant requested copies of all of the reports referenced in Sections 4.0-4.6. of the draft. **ACTION 4: Jami Buchanan said she can provide copies of the Corps' reports but not other agency's reports.** [Joe Underwood](#) (Stark County Subdivision Engineer) provided Jami Buchanan with the names of other relevant past reports. **ACTION 5: Jami Buchanan will follow up with Joe to obtain copies of the full reports and include them in the draft and also will coordinate with Tim Warstler to obtain two additional flood reports, one from 1959 and another from 1999.** **ACTION 6: [Belinda Weikle](#) (USACE) stressed the need to locate the 1997 Zimber Ditch Study.** The summary report is available, but not the detailed hydrology/hydraulic (H&H) appendix. Belinda said the missing appendix appears to have all the components necessary to set up a good H&H River Analysis System model for the entire watershed and would save time and money. Belinda contacted MS Consultants Inc., the authors of the study, but no one at MS Consultants could find the study. **ACTION 7: [Keith Bennett](#) (Stark County Engineers) will contact MS Consultants to try and locate the study since Stark County commissioned it.**

4. Grants. [Sarah Buell](#) (Stark County Park District) talked about grants for activities addressing streams and tributaries, as well as flood mitigation assistance/hazard mitigation assistance for repetitive losses. She shared that it is likely Stark County Park District will receive a grant to relocate 10 repetitive-loss structures, but they won't know until late summer.

5. GIS Info. Geographical Information System shape files were discussed. [Joe Trimboli](#) (USACE) is replacing Kurt Buchanan (USACE) on the study team and will coordinate GIS data. **ACTION 8: Participants were asked to provide Joe with locations, photos and other shape files**

to better determine precise areas experiencing flood problems.

ACTION 9: Keith Bennent will provide Joe Trimboli shape files depicting storm water flooding.

Jami Buchanan asked participants to determine what level of detail they needed: neighborhood, individual street, etc. Participants suggested individual street level is overkill and looking at larger areas such as downtown sections of towns may be more suitable. Sarah Buell asked how the data would be shared and Jami Buchanan reiterated the concept of a central online repository that would serve as a knowledge management tool containing all relevant data for stakeholders to access. No entity has been tasked the responsibility of maintaining such a repository yet. Bob Fonte asked that the maps show political boundaries including townships within the watershed. **ACTION 10: Joe Trimboli said he has**

shapefiles and can produce maps that include political boundaries.

ACTION 11: Jami Buchanan asked participants to provide GIS-related flood data, addresses and pictures to Joe Trimboli.

6. Mapping, Modeling and Gages. Discussion about mapping, modeling and gages ensued. Belinda Weikle reiterated the current mapping FEMA has cannot be used to create a useful model. Belinda warned that there is no real updated floodway model and from her discussions with FEMA, it does not appear FEMA plans to conduct new mapping of the Nimishillen watershed any time soon. She said updating the data will be expensive. The needed items include underwater bathymetry, cross-section data, precip data and more. Joe Underwood asked if the county GIS data needed to be 1-foot or 2-foot-interval contours, and Belinda Weikle urged that if participants are looking to reduce costs, mapping is not where you want to skimp. "Good input in good input out," she said. Belinda Weikle described the differences between theoretical, numerical, and analytical models and explained calibration. She noted real data is better than theoretical data, and calibrated gages are crucial to flood warning

systems, she said. Keith Bennent said at \$10,000/mile it will cost about \$600,000 to model the watershed. Boris Slogar shared the MWCD has contracted with U.S. Geological Survey for GIS, gaging and modeling services in Richmond County. Using USGS instead of consultants saved \$10K per river mile, Boris Slogar said, and the USGS data is real time. See the City of Findlay example here:

<http://water.weather.gov/ahps2/hydrograph.php?wfo=cle&gage=FDYO1>

[Mike McComas](#) discussed the Flood Warning and Emergency Evacuation Plan or FWEPP, and **ACTION 12: said he would provide a case study of how FWEPP was used in another community.** [Mike McComas](#) also

is inventorying gages in the watershed, and Tim Warstler said there is only 4 rain gages in Stark County. He added the Ohio DNR or Ohio EMA should have data on the gages. Boris Slogar said there are MWCD funds available for gages and, **ACTION 13: he will set up a meeting with Tim, Keith, Bob, Bob and Mike to discuss gaging options further.**

Possible locations include Zimber, Lewisville, and Cook Park. [Gus Drum](#) (USACE) discussed consolidation of the County's 16 flood plain managers' duties to one central location and person. Discussion ensued about how sometimes floodplain coordinators do not have the expertise to serve since often, it's an additional duty just tacked on to other primary duties. Discussion ensued about housing a regional flood plain manager within the Stark County Regional Planning office. Bob Nau suggested this duty would be given to Joe Underwood.

7. Other Reports. Discussions about other reports in the local area ensued. Bob Fonte commented that the public may express frustration over the cost of more studies and reports with no actual construction happening. There will need to be a community education effort as part of the overall plan remarked Sarah Buell. **ACTION 14: [Jasmine Chopra-Delgadillo](#) (USACE) will develop a draft communications plan to share with residents, business owners, community organizers and**

reporters using the Enterprise Standard 28000 Strategic Communication Planning Tool.

8. Schedule. Jami Buchanan thanked everyone for their support and participation, reiterated that the draft is meant to address stakeholders' needs and concerns and asked them to please supply her or anyone on the USACE team with comments, requests, concerns and recommendations in person, email or over the phone. The plan is to have the draft report completed by mid-July, distribute it to participants and provide them with two weeks to review the document, then meet again to discuss prioritization of action items and finalization of the document in early August.

D. Summary of Action Items resulting from the meeting:

1. Jami Buchanan will include action items in the conclusion section of the report, and add a separate comprehensive list detailing actions that have already been accomplished.
2. Jami Buchanan said the Corps will develop rough order of magnitude cost estimates associated with proposed projects in a spreadsheet or appendix to the report.
3. Jami Buchanan will check with Tim Warstler on all the property damage values listed in Figure 5.2.
4. Jami Buchanan will provide copies of previous Corps' reports.
5. Jami Buchanan will follow up with Joe Underwood to obtain copies of other reports, and will coordinate with Tim Warstler to obtain two additional flood reports, one from 1959 and another from 1999.
6. Everyone will try to locate the 1997 Zimber Ditch report and appendices.
7. Keith Bennett will contact MS Consultants to try and locate the 1997 Zimber Ditch study since Stark County commissioned it.
8. Everyone will provide Joe Trimboli with locations, photos and other

shape files to better determine precise areas experiencing flood problems.

9. Keith Bennent will provide Joe Trimboli shape files depicting storm water flooding in the watershed.

10. Joe Trimboli will produce maps that include political boundaries.

11. Everyone is to provide GIS-related flood data, addresses and pictures to Joe Trimboli.

12. Mike McComas will provide a case study of how FWEEP was used in another community as an example.

13. Boris Slogar said there are MWCD funds available for gages and he will set up a meeting with Tim Warstler, Keith Bennett, Bob Nau, Bob Fonte and Mike McComas to further discuss gaging options.

14: Jasmine Chopra-Delgadillo will develop a draft communications plan using the Enterprise Standard 28000 Strategic Communication Planning Tool.

15. Sarah Buell and/or Bob Fonte will provide Jami Buchanan information about the status of their Hazard Mitigation Assistance Program grant application.

- E. Path Forward: Participants will coordinate to revise draft document. USACE will provide participants revised draft document in mid July. Participants will have two weeks to review the document. A meeting to discuss prioritization of action items and finalization of the document will be scheduled for early August.

Nimishillen Creek Watershed Final Watershed Assessment Technical Group

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Description of Hydrologic Analysis Needed for Implementation of a Flood Warning System

Hydrologic Analysis

Flooding is a natural hazard that can occur at any time. The frequency and magnitude of the flooding varies from minor flooding, causing only inconvenience, to major flooding, resulting in loss of life and extensive damage to agriculture, industry, transportation, commercial and residential properties. The Flood Warning System (FWS), as described in Section 4.5.3 of the Watershed Management Plan (WMP) can provide early recognition that flooding will occur, though it may not be effective in reducing flood losses in all communities. The following evaluation factors can be used to determine if a FWS is appropriate: (1) hydrologic characteristics of the watershed, (2) frequency of flooding, (3) flood loss potential, and (4) warning time in relation to benefits realized.

Flood warnings are issued to reduce the risk to life and property through public and private channels. Before warnings can be issued, information pathways to the end-users of the warnings must be identified and optimized. Flood warning dissemination is a key element of any flood warning-preparedness program. Warning dissemination is the mechanism by which local officials and the effected public is informed that a flood threat condition exists. Flood warning dissemination provides critical linkage between recognition of an impending flood and execution of emergency response actions. The process consists of the following primary functions:

- provisions for decision on whether or not to issue a warning (usually determined by present criteria for a flood threat);
- formulation of the warning message; and
- identification of the appropriate audience and means (radio, television, sirens, etc.,) of the distribution of the warning message.

The first step in evaluating potential benefits is to identify the various sources of flood threat. Sources vary from large, slowly responding rivers which take days or weeks to crest to small creeks that crest in minutes. Each watershed has a unique set of hydrologic characteristics (topography, stream slope, soil type, amount of channel debris) that describe its response to rainfall.

As rainfall or snowmelt occurs over watershed, runoff begins and streams rise. Depending on characteristics of the watershed, streams can crest within an hour to several hours. Many flashy streams crest immediately after the most intense rainfall, which may be well before the rain ends completely. After the crest, the stream begins to fall and eventually recess to a low level. An effective FWS accounts for the individual areas which will flood and facilitates an advance warning for those areas. A well-calibrated forecast model, working in conjunction with a FWS, also projects the time when flooding is first expected, when the flood will crest, and what the flood crest stage will be. Stream gage information is rarely sufficient for determining warning times. In these cases, a hydrologic model is

Technical Information on Recommended H&H Analysis

needed. The hydrologic model should be calibrated to the data for the study basin or a similar adjoining basin. See the Hydrologic and Hydraulic Modeling Update Section for details regarding a hydrologic model.

Frequency of Flooding

Another factor in evaluating the potential benefits of the FWS is the likelihood of a damaging flood. The key questions are as follows:

- What are the potential damages, including loss of life at various flood levels?
- What is the likelihood that such a flood will occur?

The benefits of a flood warning system increase as the likelihood of damaging floods increases. The rarer a flood event with damaging potential, the more difficult it is to maintain community awareness and operationally ready LFWS.

For the Nimishillen Creek Watershed, an updated frequency analysis should be performed prior to creating a FWS.

Flood Loss Potential

Flood loss potential is simply the economic damages which may occur as a result of a flood. The Corps of Engineers uses the Hydrologic Engineering Center's Flood Damage Analysis (HEC-FDA) computer program to compute flood damages for given flooding scenarios. The program requires several inputs in order to calculate damages. These inputs include:

- Water surface profiles – describes the relative water surface elevation in relation to specific points on the study stream
- Commercial and Residential depth damage curves – describes a percentage of total structure damage per type of structure given the amount of water in the structure.
- Structure inventory¹ – detailed and complete list of all structures in the study area

The output of the program is an estimate of economic damages for an array of flood events. Typically the array of events includes the 1, 5, 10, 25, 50, 75, 100, and 500 year floods. It should be stressed that these calculations can be done in any number of ways. The HEC-FDA program is presented merely as an example. Another program which might be used to compute potential flood damages is FEMA's HAZUS program, referenced above in Section 4.2 of the WMP.

¹ The HEC-FDA program can be used to calculate crop and vehicle damage as well.

Technical Information on Recommended H&H Analysis

Warning Time in Relation to Benefits Realized

Warning times in relation to benefits realized means the amount of damages prevented in relation to the amount of warning time given to affected individuals. For instance, a homeowner with two hours of warning time may be able to evacuate significantly more contents from their home, than the homeowner who is only given a half hour of warning time. Warning times may be established in relation to entire neighborhoods or business districts. These calculations can help decision makers to determine whether the expenses associated with a FWEEP are economically justified.

Flood Warning System H&H Component Overview

The following outlines the steps for establishing the Hydrologic and Hydraulic (H&H) component of a flood warning system.

- Search for existing data (reports, newspaper articles, existing models, etc.);
- Consult with United States Geological Surveys (U.S.G.S);
- Consult with the National Weather Service or National Resources Conservation Service (NRCS);
- Consult with State or Government Organizations. These groups may be able to provide information pertaining to historic floods, stream velocities, rates of rise, and flood stages. Some communities keep flood records on a daily basis;
- Research all gage data that is available, and if it is not available, find the nearest gage with available data and select the larger floods to analyze. Hydrographs of large events will provide storm duration, rate of rise, and time to peak. If the area has been studied at an earlier date, some of the old reports may list the 10 highest floods. If the HEC-2 or the steady HEC-RAS models are available, run them and compute the average channel velocities for a storm in the magnitude of the 100-Year event;
- Convert the channel velocities from feet per second to miles per hour. A flood wave normally travels at a speed of about one-half the channel velocity speed; and
- Determine the number of existing gages in the study area, and design a system which can be installed to provide ample warning time to get damageable property out of harms' way. Rough cost estimates for labor to install flood warning systems are based on U.S.G.S. labor cost which tends to be conservative. The NWS is responsible for making the forecast and getting it out to the public. Any data collection effort will have to be coordinated with the NWS, U.S.G.S., Homelands security, and the Corps of Engineers.

Description of Hydrologic and Hydraulic Components of a Floodway Update

Hydrologic Data

Historical rainfall and stream gage data must be obtained for the watershed in order to complete a Hydrologic and Hydraulic Modeling Update. This provides the basis for the coincidental (actual) frequency approach for the analysis. However, if there is no historical rainfall data, as it appears to be the case for the Nimishillen Creek Watershed, a theoretical rainfall must be calculated and unit hydrographs would be needed to be determined using approved methodology.

To more accurately capture the effects of topography and resultant interior water flow patterns, the area would be divided into six subareas based on the six HUC 12 sub-watershed within the watershed. Theoretical rainfall data would be applied to the subwatershed hydrographs to represent a substantial rainfall event for the proposed interior drainage analysis. The gage stage data from the Middle Branch Creek at Canton, OH, gage (USGS 03118000) and the Nimishillen Creek at North Industry, OH, gage (USGS 03118500) would be used to correlate all of the modeled outfall locations. To model the hydrology of the basin, it is suggested the Hydrologic Engineering Center (HEC) Hydrologic Modeling System (HEC-HMS) be utilized while simultaneously creating a steady flow hydraulic numerical model using HEC River Analysis System (HEC-RAS).

(HEC-HMS)

The program is a product of the USACE research and development program, and is produced by HEC. The program simulates precipitation-runoff and routing processes, both natural and controlled. The program is the successor to and replacement for the Flood Hydrograph Package HEC-1 and for various specialized versions of HEC-1.

Parameters

Parameters are numerical measures of the properties of the real-world system. They may have obvious physical significance, or they may be purely empirical. The parameter values are adjusted so the model accurately predicts the physical system response. The values of these parameters can be adjusted to 'fit' the model to a particular physical system, known as calibration.

Boundary Conditions

The boundary conditions are usually values of the system input, or forces which act on the hydrologic system and cause it to change. The most common boundary condition in the program is precipitation. Applying the precipitation causes runoff from the watershed. The upstream (inflow) flow hydrograph is a boundary condition for routing the model. The Nimishillen Creek Watershed does not appear to have any USGS rainfall gages within the watershed. Therefore, utilization of theoretical rainfall data will be required.

Initial Conditions

All models in HEC-HMS are unsteady-flow models, meaning flow changes over time. This is accomplished by the program solving differential equations which describe a component of the hydrologic system. The solution of these differential equations shows how much the output changes

with respect to changes in the input. The storage-outflow data is imported into HEC-HMS as a HEC-Data Storage System Visual Utility Engine (HEC-DSSVue) file from the completed steady flow HEC-RAS model.

Watershed Delineation and Sub-basin Drainage Areas

The watershed delineation and sub-basin drainage areas for the hydrologic portion of the study should depict one watershed with six sub-basins.

HEC-HMS Calibration

The parameters used to calibrate the HEC-HMS model included sub-basin parameters such as the initial deficit, the constant loss rate, the Modified Clark time of concentration and storage coefficient, the initial discharge (baseflow), the baseflow recession constant and ratio, Manning’s “n” values for the routing reaches and Modified Puls hydrologic flow routing. Other parameters in the model, such as sub-basin area and percentage impervious, were not used as calibration parameters, but were set as described previously. Table D.1 below summarizes the calibration parameters and approach.

Table C.1 HEC-HMS Calibration Approach

Parameter	Calibration Approach
Initial Deficit	The goal is to obtain a single value for the events for each sub-basin.
Constant Loss Rate	The goal is to use a single loss rate for all events for each sub-basin.
Percent Impervious	Attempt to keep percent impervious the same for all events and only allow it to vary slightly from the initial calculated percentage.
Time of Concentration	Time of concentration may not change from the initial calculated value.
Storage Coefficient	Use R values for calibration purposes but make effort to obtain a single value per sub-basin.
Baseflow Parameters	Use baseflow initial discharge, recession constant, and ration to peak for calibration, and change between storm events and initial conditions.

Upon completion of the calibration for the “wet” antecedent condition models, the calibrated parameters are averaged to develop a set of parameters to use in each model sub-basin. These sets of parameters are used during the verification process to determine the usability and reasonableness of the models for real-time forecasting.

The hydrographs produced from the calibrated HEC-HMS model can be used to obtain a rough estimate for timing of volumes of water reaching specific locations within the watershed. The existing steady HEC-RAS numerical model can be modified with the inclusion of these hydrographs to create an

unsteady HEC-RAS numerical model which could be used to ‘fine-tune’ multiple time dependent flow scenarios.

Hydraulic Data

As with the hydrologic data, historical rainfall and stream gage data must be obtained for the Nimishillen Creek Watershed. This provides the basis for the coincidental (actual) frequency approach for the analysis. However, if there is no historical rainfall data, as it appears to be the case, a theoretical rainfall must be calculated. An existing condition and multiple proposed conditions should be modeled for the watershed. Typically, the hydraulic analysis is computed using Hydrologic Engineering Center River Analysis System (HEC-RAS), numerical model. Typically, flood ways are ran using steady HEC-RAS.

River Analysis System (HEC-RAS)

Several components make up an effective numerical model, including detailed mapping and survey data for both overland and bathymetry, or in channel geometry, adequate rainfall and gaged flow data, and detailed bridge data. The state of Ohio had LIDAR mapping flown for the entire state with a contour interval of 2 feet that is sufficient for the Nimishillen Creek Watershed. The LIDAR mapping, newly surveyed cross section and bathymetry data, estimated channel information, cross sectional bridge data, Flood Insurance Studies and approximate stream bed profiles can be used to create a three dimensional surface to ‘cut’ cross section data for the HEC-RAS model.

Model Parameters and Input Variables

Using the table of Manning’s n-values in Chow (1959) as a guide, initial approximations of overbank and channel n-values can be determined. Field investigations and engineering judgment can be utilized to establish coefficients for hydraulic computations associated with bridge and multiple opening analyses. Original topographic survey data, bridge as-built drawings and field survey data should be utilized to obtain pertinent elevations and structural geometry for all bridges in the project area. Starting water surface elevations may be taken from rating curves established from stream gage data.

Input values for the cross sections, bridges and culverts are as follows:

- Cross Sections (Manning’s “n” Channel; Manning’s “n” Overbank; Contraction/Expansion Coefficients)
- Bridges (Weir Coefficient; Maximum Submergence; Pier Drag Coefficient; Pier Shape Coefficient; Inlet and Outlet Coefficient)
- Culverts (Entrance Loss Coefficient; Exit Loss Coefficient; Manning’s “n”; Geometric Configuration)

Model Calibration

A numerical model must be calibrated. Calibration is the process of adjusting the model parameters to ‘fit’ a particular physical system. Historical precipitation data are useful for calibration and verification of model parameters, for real-time forecasting, and analyzing a system. When estimated values or theoretical values are used in a model, in order to have confidence that the model is accurately modeling a physically based system with confidence, it must be calibrated. Verification, or calibration, is typically done by using high water marks, or stream gage data. Calibration uses observed hydro-

meteorological data in a systematic search for parameters that yield the best fit of the computed results to the observed runoff. This search is often referred to as optimization.

Export steady HEC-RAS Data

Once the HEC-RAS model is completed, the existing condition should be modeled. The storage-outflow data created by the steady HEC-RAS model is imported into HEC-HMS as a HEC-Data Storage System Visual Utility Engine (HEC-DSSVue) file. See the HEC-HMS section above. For each new flow scenario, a new storage outflow data is imported into HEC-HMS to create new flow hydrographs. The hydrographs produced from the calibrated HEC-HMS model can be used to obtain a rough estimate for timing of volumes of water reaching specific locations within the watershed.

Unsteady HEC-RAS Numerical Model

The existing steady HEC-RAS numerical model can be modified with the inclusion of these hydrographs from HEC-HMS to create an unsteady HEC-RAS numerical model that can be used to 'fine-tune' multiple time dependent flow scenarios. Unsteady HEC-RAS is a more robust numerical model that will provide more visuals for time dependent flows within the Nimishillen Creek Watershed Study. However, an unsteady HEC-RAS model is very sensitive to radical changes in stream geometry and may take longer to evaluate.

stormwater management for clean rivers

Green Streets

Urban stormwater runoff that isn't properly managed can pollute rivers and streams and contribute to combined sewer overflows (CSOs) to the Willamette River. Green Streets reduce the negative impacts of stormwater runoff. They mimic natural conditions by using soil and vegetation to manage runoff on the surface, at the source.



Green Streets transform impervious street surfaces into landscaped green spaces that capture stormwater runoff and let water soak into the ground as plants and soil filter pollutants. Green Streets convert stormwater from a waste directed into a pipe, to a resource that replenishes groundwater supplies. They also create attractive streetscapes and urban green spaces, provide natural habitat, and help connect neighborhoods, schools, parks, and business districts.

The City of Portland is committed to green development practices and sustainable stormwater management. Green Streets are an innovative, effective way to restore watershed health. They protect water quality in rivers and streams, manage stormwater from impervious surfaces, and can be more cost efficient than new sewer pipes. Green Streets offer many benefits that sewer pipes can't. Green Streets:

- Clean and cool air and water
- Enhance neighborhood livability
- Increase community and property values
- Enhance pedestrian and bicycle access and safety
- Protect valuable surface and groundwater resources
- Add urban green space and wildlife habitat
- Help meet regulatory requirements for pollutant reduction and watershed resource management
- Reduce stormwater in the sewer system
- Save money on wastewater pumping and treatment costs



The plants absorb water and their roots help water soak into the ground. Green Streets can be attractive neighborhood amenities, and a variety of plants can provide a range of looks.

Portland has been designing and building Green Streets for years. Ongoing monitoring proves they effectively reduce peak stormwater flows and runoff volume. Keeping stormwater runoff out of sewer pipes reduces sewer backups in basements, street flooding and combined sewer overflows (CSOs) to the Willamette River.



Types of Green Streets

Green Streets have different shapes and sizes, but they all have stormwater management benefits and help protect watershed health. Here are some examples:



SE 42nd and Belmont



SE 12th and Clay

Stormwater Curb Extension

Extending into the street, stormwater curb extensions transform the curb lane into a landscape area. Curb extensions can conveniently integrate a ramp for safe pedestrian crossing.



SW 12th and Montgomery



SE 92nd street

Stormwater Street Planter

Stormwater Street Planters between the sidewalk and the curb work well in areas with limited space, and they allow for adjacent street parking or travel.



NE 21st and Sandy



SE 55th and Belmont

Rain Gardens

Where there is plenty of space, rain gardens are ideal. They can also transform awkward street intersections into safe pedestrian and bicycle crossings.



N Willamette and Denver



NE 23rd and Irving

Simple Green Street

Excavating an existing planting area behind a reinforced curb, making curb cuts for inflow and outflow, and landscaping with appropriate vegetation is a simple approach to capture and treat street runoff.



Rain Garden Demonstration Site

This site demonstrates and allows EPA to document the capabilities of rain gardens to allow stormwater to seep, or infiltrate, into underlying soil where it will eventually recharge groundwater and nearby streams. Infiltration of stormwater in rain gardens serves to reduce stormwater runoff volumes, improve water quality through removal of stormwater contaminants, and enhance the physical and biological integrity of streams.

Research

Stormwater runoff from Building 205 and the adjacent parking lot is directed through a pipe and curb cuts into the rain garden. The rain garden has six cells of different sizes separated by walls, allowing researchers to study how size affects the ability of rain gardens to infiltrate stormwater runoff created by a wide range of storm sizes. Instruments buried in the media and underlying soil measure how quickly runoff infiltrates through the rain garden profile into the underlying soil.

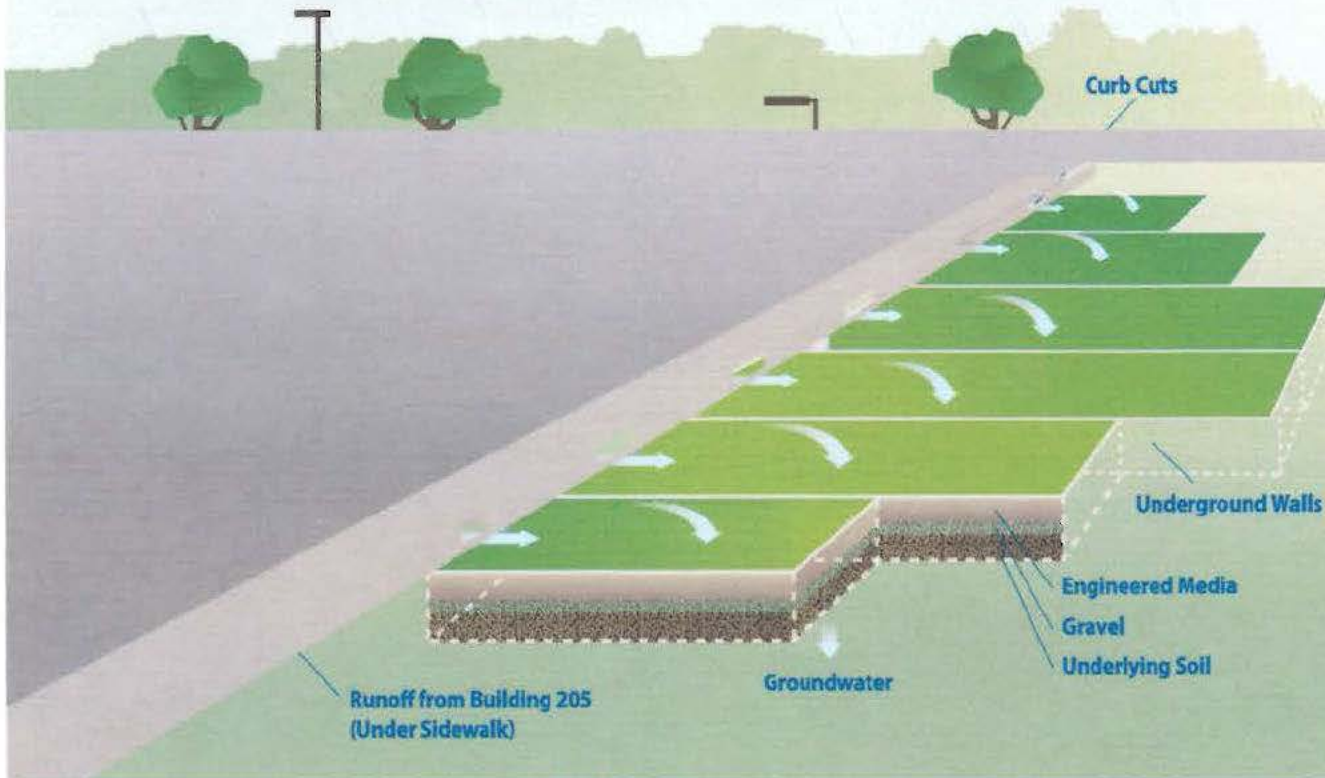
Results

The rain garden will help EPA study:

- How rain gardens mimic natural drainage processes and reduce stormwater runoff volume to the conventional storm sewer system.
- The effects of surface area on drainage properties of rain gardens.

Acknowledgements

This project is a joint research effort between EPA's Office of Administration and Resources Management, Region 2, and the Office of Research and Development.



Native Plants for Mid-Atlantic Rain Gardens



Trees

Red Maple
Redosier
Dogwood



Grasses/Rushes

Switchgrass
Indian Grass
Big Bluestem
Common Rush



Shrubs

Highbush Blueberry
Beach Plum
Winterberry
Black Chokeberry
Groundsel Tree



Herbs

Seaside Goldenrod
Blue Flag
Sunflower
Golden Zizia



Storm Water Technology Fact Sheet Vegetated Swales

DESCRIPTION

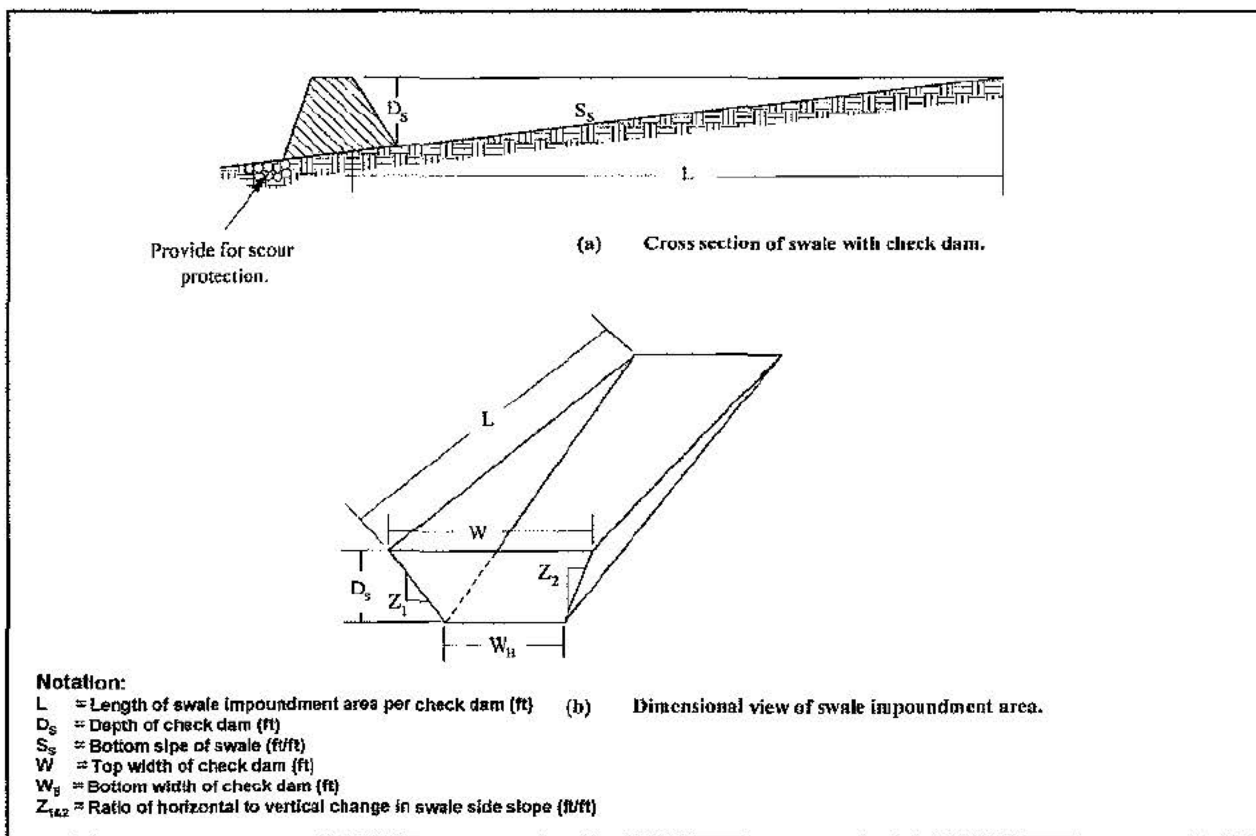
A vegetated swale is a broad, shallow channel with a dense stand of vegetation covering the side slopes and bottom. Swales can be natural or manmade, and are designed to trap particulate pollutants (suspended solids and trace metals), promote infiltration, and reduce the flow velocity of storm water runoff. A typical design is shown in Figure 1.

Vegetated swales can serve as part of a storm water

drainage system and can replace curbs, gutters and storm sewer systems. Therefore, swales are best suited for residential, industrial, and commercial areas with low flow and smaller populations.

APPLICABILITY

Vegetated swales can be used wherever the local climate and soils permit the establishment and maintenance of a dense vegetative cover. The feasibility of installing a vegetated swale at a



Source: NVPDC, 1996.

FIGURE 1 EXAMPLE OF A VEGETATED SWALE

particular site depends on the area, slope, and perviousness of the contributing watershed, as well as the dimensions, slope, and vegetative covering employed in the swale system.

Vegetated swales are easy to design and can be incorporated into a site drainage plan. While swales are generally used as a stand-alone storm water Best Management Practice (BMP), they are most effective when used in conjunction with other BMPs, such as wet ponds, infiltration strips, wetlands, etc.

While vegetated swales have been widely used as storm water BMPs, there are also certain aspects of vegetated swales that have yet to be quantified. Some of the issues being investigated are whether their pollutant removal rates decline with age, what effect the slope has on the filtration capacity of vegetation, the benefits of check dams, and the degree to which design factors can enhance the effectiveness of pollutant removal.

ADVANTAGES AND DISADVANTAGES

Swales typically have several advantages over conventional storm water management practice, such as storm sewer systems, including the reduction of peak flows; the removal of pollutants, the promotion of runoff infiltration, and lower capital costs. However, vegetated swales are typically ineffective in, and vulnerable to, large storms, because high-velocity flows can erode the vegetated cover.

Limitations of vegetated swales include the following:

- They are impractical in areas with very flat grades, steep topography, or wet or poorly drained soils.
- They are not effective and may even erode when flow volumes and/or velocities are high.
- They can become drowning hazards, mosquito breeding areas, and may emit odors.

- Land may not be available for them.
- In some places, their use is restricted by law: many local municipalities prohibit vegetated swales if peak discharges exceed 140 liters per second (five cubic feet per second) or if flow velocities are greater than 1 meter per second (three feet per second).
- They are impractical in areas with erosive soils or where a dense vegetative cover is difficult to maintain.

Negative environmental impacts of vegetated swales may include:

- Leaching from swale vegetation may increase the presence of trace metals and nutrients in the runoff.
- Infiltration through the swale may carry pollutants into local groundwater.
- Standing water in vegetated swales can result in potential safety, odor, and mosquito problems.

DESIGN CRITERIA

Design criteria for implementation of the vegetated swales are as follows:

Location

Vegetated swales are typically located along property boundaries along a natural grade, although they can be used effectively wherever the site provides adequate space. Swales can be used in place of curbs and gutters along parking lots.

Soil Requirements

Vegetated swales should not be constructed in gravelly and coarse sandy soils that cannot easily support dense vegetation. If available, alkaline soils and subsoils should be used to promote the removal and retention of metals. Soil infiltration rates should be greater than 0.2 millimeters per second (one-half inch per hour); therefore, care

must be taken to avoid compacting the soil during construction.

Vegetation

A fine, close-growing, water-resistant grass should be selected for use in vegetated swales, because increasing the surface area of the vegetation exposed to the runoff improves the effectiveness of the swale system. Pollutant removal efficiencies vary greatly depending on the specific plants involved, so the vegetation should be selected with pollution control objectives in mind. In addition, care should be taken to choose plants that will be able to thrive at the site. Examples of vegetation appropriate for swales include reed canary grass, grass-legume mixtures, and red fescue.

General Channel Configuration

A parabolic or trapezoidal cross-section with side slopes no steeper than 1:3 is recommended to maximize the wetted channel perimeter of the swale. Recommendations for longitudinal channel slopes vary within the existing literature. For example, Schueler (1987) recommends a vegetated swale slope as close to zero as drainage permits. The Minnesota Pollution Control Agency (1991) recommends that the channel slope be less than 2 percent. The Storm Water Management Manual for the Puget Sound Basin (1992) specifies channel slopes between 2 and 4 percent. This manual indicates that slopes of less than 2 percent can be used if drain tile is incorporated into the design, while slopes greater than 4 percent can be used if check dams are placed in the channel to reduce flow velocity.

Flows

A typical design storm used for sizing swales is a six-month frequency, 24-hour storm event. The exact intensity of this storm must be determined for your location and is generally available from the U.S. Geological Survey. Swales are generally not used where the maximum flow rate exceeds 140 liters/second (5 cubic feet per second).

Sizing Procedures

The width of the swale can be calculated using various forms of the Manning equation. However, this methodology can be simplified to the following rule of thumb: the total surface area of the swale should be one percent of the area (500 square feet for each acre) that drains to the swale.

Unless a bypass is provided, the swale must be sized both to treat the design flows and to pass the peak hydraulic flows. However, for the swale to treat runoff most effectively, the depth of the storm water should not exceed the height of the grass.

Construction

The subsurface of the swale should be carefully constructed to avoid compaction of the soil. Compacted soil reduces infiltration and inhibits growth of the grass. Damaged areas should be restored immediately to ensure that the desired level of treatment is maintained and to prevent further damage from erosion of exposed soil.

Check Dams

Check dams can be installed in swales to promote additional infiltration, to increase storage, and to reduce flow velocities. Earthen check dams are not recommended because of their potential to erode. Check dams should be installed every 17 meters (50 feet) if the longitudinal slope exceeds 4 percent.

PERFORMANCE

The literature suggests that vegetated swales represent a practical and potentially effective technique for controlling urban runoff quality. While limited quantitative performance data exists for vegetated swales, it is known that check dams, slight slopes, permeable soils, dense grass cover, increased contact time, and small storm events all contribute to successful pollutant removal by the swale system. Factors decreasing the effectiveness of swales include compacted soils, short runoff contact time, large storm events, frozen ground, short grass heights, steep slopes, and high runoff velocities and discharge rates.

Conventional vegetated swale designs have achieved mixed results in removing particulate pollutants. A study performed by the Nationwide Urban Runoff Program (NURP) monitored three grass swales in the Washington, D.C., area and found no significant improvement in urban runoff quality for the pollutants analyzed. However, the weak performance of these swales was attributed to the high flow velocities in the swales, soil compaction, steep slopes, and short grass height. Another project in Durham, NC, monitored the performance of a carefully designed artificial swale that received runoff from a commercial parking lot. The project tracked 11 storms and concluded that particulate concentrations of heavy metals (Cu, Pb, Zn, and Cd) were reduced by approximately 50 percent. However, the swale proved largely ineffective for removing soluble nutrients. A conservative estimate would say that a properly designed vegetated swale may achieve a 25 to 50 percent reduction in particulate pollutants, including sediment and sediment-attached phosphorus, metals, and bacteria. Lower removal rates (less than 10 percent) can be expected for dissolved pollutants, such as soluble phosphorus, nitrate, and chloride. Table 1 summarizes some pollutant removal efficiencies for vegetated swales.

The effectiveness of vegetated swales can be enhanced by adding check dams at approximately 17 meter (50 foot) increments along their length (See Figure 1). These dams maximize the retention time within the swale, decrease flow velocities, and promote particulate settling. Structures to skim off floating debris may also be added to the swales. Finally, the incorporation of vegetated filter strips parallel to the top of the channel banks can help to treat sheet flows entering the swale.

OPERATION AND MAINTENANCE

The useful life of a vegetated swale system is directly proportional to its maintenance frequency. If properly designed and regularly maintained, vegetated swales can last indefinitely.

The maintenance objectives for vegetated swale systems include keeping up the hydraulic and removal efficiency of the channel and maintaining a dense, healthy grass cover. Maintenance activities

TABLE 1 EFFECTIVENESS OF DESIGN SWALES

Pollutant	Median % Removal
Total Suspended Solids	81
Oxygen Demanding Substances	67
Nitrate	38
Total Phosphorus	9
Hydrocarbons	62
Cadmium	42
Copper	51
Lead	67
Zinc	71

should include periodic mowing (with grass never cut shorter than the design flow depth), weed control, watering during drought conditions, reseeding of bare areas, and clearing of debris and blockages. Cuttings should be removed from the channel and disposed in a local composting facility. Accumulated sediment should also be removed manually to avoid the transport of resuspended sediments in periods of low flow and to prevent a damming effect from sand bars. The application of fertilizers and pesticides should be minimal.

Another aspect of a good maintenance plan is repairing damaged areas within a channel. For example, if the channel develops ruts or holes, it should be repaired utilizing a suitable soil that is properly tamped and seeded. The grass cover should be thick; if it is not, reseed as necessary.

Any standing water removed during the maintenance operation must be disposed to a sanitary sewer at an approved discharge location. Residuals (e.g., silt, grass cuttings) must be disposed in accordance with local or State requirements.

COSTS

Vegetated swales typically cost less to construct than curbs and gutters or underground storm

sewers. Schueler (1987) reported that costs may vary from \$16-\$30 per linear meter (\$4.90 to \$9.00 per linear foot) for a 4.5 meter (15-foot) wide channel (top width).

The Southeastern Wisconsin Regional Planning Commission (SEWRPC, 1991) reported that costs may vary from \$28 to \$164 per linear meter (\$8.50 to \$50.00 per linear foot) depending upon swale depth and bottom width. These cost estimates are higher than other published estimates because they include the cost of activities (such as clearing, grubbing, leveling, filling, and sodding) that may not be included in other published estimates. Construction costs depend on specific site considerations and local costs for labor and materials. Table 2 shows the estimated capital costs of a vegetated swale.

Annual costs for maintaining vegetated swales are approximately \$1.90 per linear meter (\$0.58 per linear foot) for a 0.5 meter (1.5-foot) deep channel, according to SEWRPC (1991). Average annual operating and maintenance costs of vegetated swales can be estimated using Table 3.

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7. Washington State Department of Ecology. February, 1992. *Storm Water Manual for the Puget Sound Basin*.

ADDITIONAL INFORMATION

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TABLE 2 ESTIMATED CAPITAL COST OF A 1.5- FOOT DEEP, 10-FOOT-WIDE GRASSED SWALES^a

Component	Unit	Extent	Unit Cost			Total Cost		
			Low	Moderate	High	Low	Moderate	High
Mobilization / Demobilization-Light	Swale	1	\$107	\$274	\$441	\$107	\$274	\$441
Site Preparation								
Clearing ^b	Acre	0.5	\$2,200	\$3,800	\$5,400	\$1,100	\$1,900	\$2,700
Grubbing ^c	Acre	0.25	\$3,800	\$5,200	\$6,600	\$950	\$1,300	\$1,650
General	Yd ^d	372	\$2.10	\$3.70	\$5.30	\$781	\$1,376	\$1,972
Excavation ^d	Yd ^e	1,210	\$0.20	\$0.35	\$0.50	\$242	\$424	\$605
Level and Till ^e								
Sites Development								
Salvaged Topsoil	Yd ^f	1,210	\$0.40	\$1.00	\$1.60	\$484	\$1,210	\$1,936
Seed, and Mulch ^f ..	Yd ^f	1,210	\$1.20	\$2.40	\$3.60	\$1,452	\$2,904	\$4,356
Sod ^g								
Subtotal	—	—	—	—	—	\$5,116	\$9,388	\$13,660
Contingencies	Swale	1	25%	25%	25%	\$1,279	\$2,347	\$3,415
Total	—	—	—	—	—	\$6,395	\$11,735	\$17,075

Source: (SEWRPC, 1991)

Note: Mobilization/demobilization refers to the organization and planning involved in establishing a vegetative swale.

^a Swale has a bottom width of 1.0 foot, a top width of 10 feet with 1:3 side slopes, and a 1,000-foot length.

^b Area cleared = (top width + 10 feet) x swale length.

^c Area grubbed = (top width x swale length).

^d Volume excavated = (0.67 x top width x swale depth) x swale length (parabolic cross-section).

^e Area tilled = (top width + $\frac{8(\text{swale depth}^2)}{3(\text{top width})}$) x swale length (parabolic cross-section).

^f Area seeded = area cleared x 0.5.

^g Area sodded = area cleared x 0.5.

TABLE 3 ESTIMATED OPERATION AND MAINTENANCE COSTS

Component	Unit Cost	Swale Size (Depth and Top Width)		Comment
		1.5 Foot Depth, One-Foot Bottom Width, 10-Foot Top Width	3-Foot Depth, 3-Foot Bottom Width, 21-Foot Top Width	
Lawn Mowing	\$0.85 / 1,000 ft ² / mowing	\$0.14 / linear foot	\$0.21 / linear foot	Lawn maintenance area=(top width + 10 feet) x length. Mow eight times per year
General Lawn Care	\$9.00 / 1,000 ft ² / year	\$0.18 / linear foot	\$0.28 / linear foot	Lawn maintenance area = (top width + 10 feet) x length
Swale Debris and Litter Removal	\$0.10 / linear foot / year	\$0.10 / linear foot	\$0.10 / linear foot	--
Grass Reseeding with Mulch and Fertilizer	\$0.30 / yd ²	\$0.01 / linear foot	\$0.01 / linear foot	Area revegetated equals 1% of lawn maintenance area per year
Program Administration and Swale Inspection	\$0.15 / linear foot / year, plus \$25 / inspection	\$0.15 / linear foot	\$0.15 / linear foot	Inspect four times per year
Total	--	\$0.58 / linear foot	\$ 0.75 / linear foot	--

Source: SEWPRC, 1991.

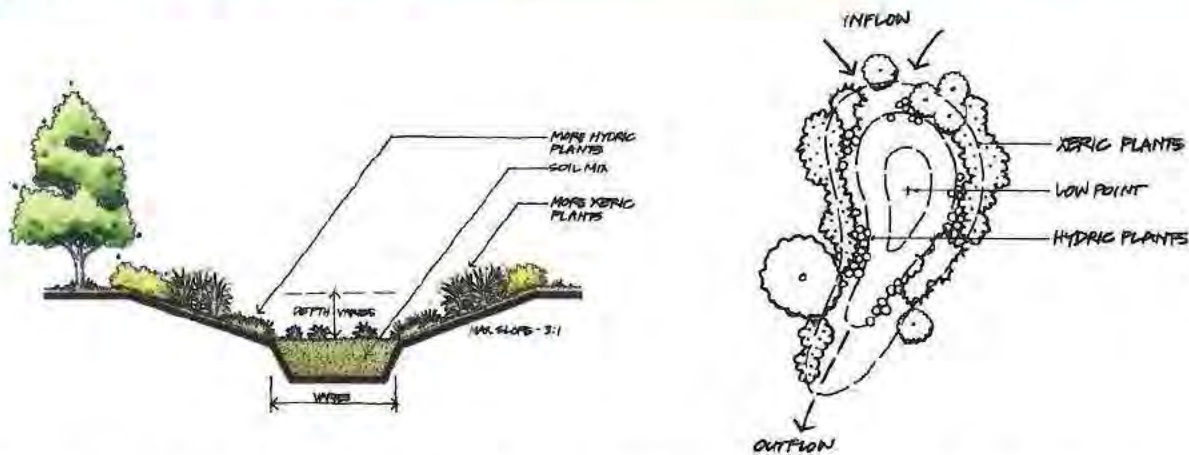
The mention of trade names or commercial products does not constitute endorsement or recommendation for the use by the U.S. Environmental Protection Agency.

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Bioretention Basins/Rain Gardens



Depiction of typical bioretention area design illustrating shallow slopes, well drained soil profile and location of plant material along hydrologic gradient. Basins with large catchments should include an over drain or provide a spillway in case of high flow event, and underdrains can be used in areas with low conductivity soils.

Definition:

A bioretention area or rain garden is a shallow planted depression designed to retain or detain stormwater before it is infiltrated or discharged downstream. While the terms “rain garden” and “bioretention basin” may be used interchangeably, they can be considered along a continuum of size, where the term “rain garden” is typically used to describe a planted depression on an individual homeowner’s lot, where the lot comprises the extent of the catchment area. Bioretention basins serve the same purpose but that more technical term typically describes larger projects in community common areas as well as non-residential applications.

Applications

- Residential yards (most common in smaller, urban sites)
- Commercial developments
- Parking lot islands
- Roadways (off-line cells adjacent to roadways accessed by curb cut)

Objectives:

Bioretention basins/rain gardens retain, filter, and treat stormwater runoff using a shallow depression of conditioned soil topped with a layer of mulch or high carbon soil layer and vegetation tolerant of short-term flooding. Depending on the design, they can provide retention or detention of runoff water and will trap and remove suspended solids and filter or absorb pollutants to soils and plant material.

Overview:

Bioretention basins can be installed at various scales, for example, integrated with traffic calming measures in suburban parks and in retarding basins. In larger applications, it is considered good practice to have pretreatment measures (e.g. vegetated strips and swales) upstream of the basin to capture sediment and reduce the maintenance frequency of a bioretention basin.

The size of the rain garden or bioretention area will determine the volume of runoff that can be stored or reduced, as well as the treatment benefits. Where the volume of runoff exceeds that of the bioretention area, additional stormwater devices will be required in the treatment train to handle the design storm.

Benefits

- **Pollutant removal through infiltration and plant absorption**
- **Reduction of water runoff from site**
- **Reduced irrigation for planting beds**
- **Increased biodiversity in the landscape with wildlife and aesthetic values**

Water Protection Benefits:

Bioretention basins use vegetation in retention areas to reduce nutrient export through plant uptake, filtering and sorption. The vegetation also improves soil infiltration.

Water conservation implications – Bioretention basins are designed to capture and retain stormwater in recessed gardens that typically do not need irrigation beyond plant establishment.

Stormwater implications – Infiltration processes and adsorption to plant roots remove pollutants from the flow stream. This is a key practice in the LID suite for improving stormwater quality. This also reduces the quantity of water flowing off-site into the larger municipal stormwater system.

Design Considerations:

This is an infiltration dependent practice affected by soil type and groundwater table. Where soils are well drained and groundwater tables are well below the surface, an under drain is not required. Where soils have low conductivity, underdrains can be used to reduce ponding time and increase treated volume. There is no specific slope requirement for bioretention, although size of the basin will typically decrease or become narrower and follow the elevation contour as slopes increase above 5%.

Determination of ponding depth should consider inflow characteristics (inflow rate, total volume, etc.), soil infiltration rate, and total ponding volume available. The ponding depth should not be greater than 12 inches, with 6-8 inch depths preferred. The duration of ponding after a storm should also not exceed 24 hours to reduce the likelihood of mosquito breeding or safety hazards.

A bioretention area/rain garden is used to encourage infiltration, so place it in an area where infiltration is good, not where water normally pools. It should be at least 10 ft. from any building, to avoid moisture around the building's foundation. Don't place a rain garden over a septic system. Consider how it can be integrated into existing and future landscaping. When adding plant material, do not place woody plants in the inflow path. Use native plants to improve the site's biodiversity.

Operations and Maintenance:

When rain gardens are installed on individual lots, it is important to implement educational programming to homeowners on proper maintenance. It is also important that the storage capacity of the rain garden/bioretention area be maintained through regular maintenance of vegetation and removal of debris that may compromise any structures during a high flow event. Regular visual inspection of the basin, looking for signs of erosion, excessive sediment deposits or dead and diseased vegetation, should be conducted. Mulch in the bioretention area should also be monitored for bare spots and should be replaced every 2-3 years. Plant selection is critical to aid operation, and other considerations may include gravel or stone to limit volunteer growth that can reduce storage area.

Design Keys

- **The design of a bioretention area/rain garden is a balance of stormwater function with biological functions. That means there must be consideration of:**
- **Basin design (soil type, drainage, groundwater table, slope, outfall device)**
- **Location in the treatment train**
- **Plant material selection and placement**
- **On-going management**

HOA or Regulatory Considerations:

There is presently no regulatory "presumption of compliance" granted to rain gardens or bioretention basins in stormwater permits. Although not significantly different than a conventional dry retention basin except for size, spatial distribution and landscape integration of this practice requires them to be submitted as an "alternative" management practice during the permitting process. Water management districts are also cautious about giving credit toward volume storage for any structure installed on a homeowner's property without sufficient guarantee that the structure will be adequately maintained in the long-term.

Credits in Green Building Certification Programs:

- ◆ FGBC-Home Standard (S-15 onsite designated retention areas)
- ◆ Florida Yards & Neighborhoods (stormwater runoff: swales, terraces and/or rain gardens created to catch and filter stormwater)
- ◆ LEED for Homes (SS 4.3 management of runoff from roof)
- ◆ LEED for Neighborhood Development Pilot (GCT Credit 9: Stormwater Management)
- ◆ NAHB Model Green Home Building Guidelines (1.3.5 Manage storm water using low-impact development when possible)

Relative Costs:

While this practice may create additional site work costs as compared to conventional practices, it can be offset by reduced infrastructure such as stormwater pipes, storm drains and stormwater ponds. Costs per acre of development range from \$5,000 to \$10,000 for larger areas and costs per square foot range from \$3 to \$15. In some cases it has been found that bioretention can yield a 50% savings over conventional systems for overall site drainage. In most cases the area would have been landscaped, so the cost of installing and maintaining a bioretention area should be compared to the cost of otherwise landscaping the area.

References and Resources:

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Community Rating System

March 2014

The National Flood Insurance Program (NFIP) Community Rating System (CRS) was implemented in 1990 as a voluntary program for recognizing and encouraging community floodplain management activities exceeding the minimum NFIP standards. Any community in full compliance with the minimum NFIP floodplain management requirements may apply to join the CRS.

1,296 Communities Participate in the CRS

Nearly 3.8 million policyholders in 1,296 communities participate in the CRS by implementing local mitigation, floodplain management, and outreach activities that exceed the minimum NFIP requirements.

Under the CRS, flood insurance premium rates are discounted to reward community actions that meet the three goals of the CRS, which are: (1) reduce flood damage to insurable property; (2) strengthen and support the insurance aspects of the NFIP; and (3) encourage a comprehensive approach to floodplain management.

Although CRS communities represent only 5 percent of the over 22,000 communities participating in the NFIP, more than 67 percent of all flood insurance policies are written in CRS communities.

CRS Classes

The CRS uses a Class rating system that is similar to fire insurance rating to determine flood insurance premium reductions for residents. CRS Classes* are rated from 9 to 1. Today, most communities enter the program at a CRS Class 9 or Class 8 rating, which entitles residents in Special Flood Hazard Areas (SFHAs) to a 5 percent discount on their flood insurance premiums for a Class 9 or a 10 percent discount for Class 8. As a community

engages in additional mitigation activities, its residents become eligible for increased NFIP policy premium discounts. Each CRS Class improvement produces a 5 percent greater discount on flood insurance premiums for properties in the SFHA.

Best of the Best

Four communities occupy the highest levels of the CRS. Each has developed a floodplain management program tailored to its own particular hazards, character, and goals. Under these programs, each community carries out numerous and varied activities, many of which are credited by the CRS. The average discount in policyholder premiums varies according to a community's CRS Class and the average amount of insurance coverage in place. Some highlights:

Roseville, California was the first to reach the highest CRS rating (Class 1). Damaging floods in 1995 spurred Roseville to strengthen and broaden its floodplain management program. Today the City earns points for almost all CRS creditable activities. The average premium discount for policies in the Special Flood Hazard Area (SFHA) is \$832.

Comprehensive planning for floodplain management has been a key contributor to **Tulsa, Oklahoma's** progress in reducing flood damage from the dozens of creeks within its jurisdiction. The City (Class 2) has cleared more than 900 buildings from its floodplains. The average premium discount for policies in the SFHA is \$583.

King County, Washington (Class 2) has preserved more than 100,000 acres of floodplain open space and receives additional CRS credit for maintaining it in a natural state. The average premium discount for policies in the SFHA is \$650.

Pierce County, Washington (Class 2) maintains over 80 miles of river levees. County officials annually mail informational brochures to all floodplain residents. The average premium discount for policies in the SFHA is \$666.

* CRS Class changes occur on May 1 and October 1 of each year. The data contained in this fact sheet were current through May 2014.

CRS Credit

A community accrues points to improve its CRS Class rating and receive increasingly higher discounts. Points are awarded for engaging in any of 19 creditable activities, organized under four categories:

- Public information
- Mapping and regulations
- Flood damage reduction
- Warning and response.

Formulas and adjustment factors are used to calculate credit points for each activity.

The communities listed below are among those that have qualified for the greatest premium discounts:

Class 1: Roseville, California

Class 2: Tulsa, Oklahoma
King County, Washington
Pierce County, Washington

Class 3: Sacramento County, California

Class 4: Fort Collins, Colorado
Skagit County, Washington
Snohomish County, Washington
Charleston County, South Carolina
Maricopa County, Arizona
Louisville-Jefferson County, Kentucky
Thurston County, Washington

Benefits of the CRS

Lower cost flood insurance rates are only one of the rewards a community receives from participating in the CRS. Other benefits include:

- Citizens and property owners in CRS communities have increased opportunities to learn about risk, evaluate their individual vulnerabilities, and take action to protect themselves, as well as their homes and businesses.
- CRS floodplain management activities provide enhanced public safety, reduced damage to property and public infrastructure, and avoidance of economic disruption and loss.
- Communities can evaluate the effectiveness of their flood programs against a nationally recognized benchmark.

- Technical assistance in designing and implementing some activities is available to community officials at no charge.
- CRS communities have incentives to maintain and improve their flood programs over time.

How to Apply

To apply for CRS participation, a community must initially inform the Federal Emergency Management Agency (FEMA) Regional Office of its interest in applying to the CRS and will eventually submit a CRS application, along with documentation that shows it is implementing the activities for which credit is requested. The application is submitted to the Insurance Services Office, Inc. (ISO)/CRS Specialist. ISO works on behalf of FEMA and insurance companies to review CRS applications, verify communities' credit points, and perform program improvement tasks.

A community's activities and performance are reviewed during a verification visit. FEMA establishes the credit to be granted and notifies the community, the State, insurance companies, and other appropriate parties.

Each year, the community must verify that it is continuing to perform the activities that are being credited by the CRS by submitting an annual recertification. In addition, a community can continue to improve its Class rating by undertaking new mitigation and floodplain management activities that earn even more points.

CRS Training

CRS Specialists are available to assist community officials in applying to the program and in designing, implementing, and documenting the activities that earn even greater premium discounts. A week-long CRS course for local officials is offered free at FEMA's Emergency Management Institute (EMI) on the National Emergency Training Center campus in Emmitsburg, Maryland, and can be field deployed in interested states. A series of webinars is offered throughout the year.

For More Information

A list of resources is available at the CRS website: www.fema.gov/national-flood-insurance-program-2/community-rating-system For more information about the CRS or to obtain the CRS application, contact the Insurance Services Office by phone at (317) 848-2898 or by e-mail at nfipcrs@iso.com



OHIO

STREAM MANAGEMENT GUIDE

Trees for Ditches

Guide No. 08

Trees along ditches? What was once seldom recommended is now considered a responsible approach to drainage management and, when done properly, very compatible with drainage objectives. Trees planted or maintained along ditches can: 1) save money, 2) meet environmental regulations, 3) improve water quality and 4) provide wildlife habitat.

SAVE MONEY

When constructing a new ditch or maintaining an existing one, clearing and grubbing costs can be reduced substantially by leaving at least one side vegetated. Leaving woody vegetation minimizes wind and water erosion which affects crop yields and reduces the accumulation of sediment in the channel. Where one or both sides remain vegetated, shading inhibits nuisance cattail growth, thereby reducing dip-out or spraying maintenance costs. Ditch berms can grow marketable trees or firewood if selected and managed properly and provide income in later years. If land adjacent to ditches is already out of crop production and taxed at a lower rate trees are a bonus.

MEET ENVIRONMENTAL REGULATIONS

When ditch construction must meet environmental protection standards or require a Section 401 or 404 permit under the Clean Water Act, preserving or planting trees will help mitigate water quality and wildlife damages, often making permit issuance easier.

IMPROVE WATER QUALITY

Tree cover, especially on the south or west side of a ditch, shades the water, keeping water temperatures cooler which increases oxygen levels needed for fish and other aquatic life. Shading also controls nuisance algae growth, which often results in fish kills and other water quality problems. Tree leaves and leaf litter help reduce soil erosion

and resulting sedimentation. Tree roots also provide some erosion control by protecting ditch banks from high velocity water.

PROVIDE WILDLIFE HABITAT

Upland and aquatic wildlife benefit from trees. Upland wildlife benefits from cover, food, access to travel lanes and greater number of species which habitat diversity supports. In-stream, leaf litter is the base of the aquatic food chain. Leaves are eaten by aquatic insects which in turn feed minnows and fish. Fallen branches provide cover for fish and smaller aquatic life. Undisturbed vegetation, like that found on one-sided construction, provides better wildlife food and cover than leaving selected trees growing among planted grass.

TREE USE

Trees are suitable for all drainage projects constructed under Ohio Drainage Law (Sections 6131, 6133, 6135 or 6137 of the Ohio Revised Code), Conservation Works of Improvement (Section 1515 of the Ohio Revised Code), mutual group process, by developers or by individual landowners. With proper tree selection and maintenance, both drainage and environmental benefits can often be achieved.

The recommended width of woody vegetation on "berms" of natural or unmodified channels is two and one-half times the width of the ditch or fifty feet, whichever is less. However, for ditches constructed under Ohio Drainage Law, a minimum of four feet or a maximum of 25 feet width may be "constructed and maintained" and not subject to typical property taxes.

TREE SELECTION

When preserving trees along a ditch, protect those with hardwood, minimal branching, deep rooting and non-brittle characteristics. Where possible, protect trees and their adjacent vegetation from

root and soil compaction from heavy equipment for a 10 foot radius around the trunk. When spreading dredged material near trees, never spread more than one inch of soil per year over the roots to avoid feeder root suffocation. The feeder roots are mostly within the tree canopy drip line. When planting trees, choose those that are suitable to the soil drainage and pH conditions. Dredged sediment and compaction from construction access may drastically alter pH and drainage conditions; soil testing may be helpful. Native trees may be a first choice for planting or preserving as listed below, but many other species may be suitable as listed in most county soil survey reports or nursery catalogs.

If future income is desired, select trees with expected high market value. If wildlife management is a goal, select a species with food and cover characteristics. The following table lists recommended trees in Ohio for use along drainage ditches. These trees can withstand periodic flooding and are less likely to cause maintenance problems. High market value trees like Black Walnut (*Juglans nigra*), White Oak (*Quercus alba*), Red Oak (*Quercus rubra borealis*), Sugar Maple (*Acer saccharum*), White Ash (*Fraxinus americana*), and Basswood (*Tilia americana*) are not listed since they are typically found on better drained soils or upland sites. The table also illustrates their suitability to different soil/climate conditions and desirable characteristics. Short lived, brittle and shallow rooted species like Willow (*Salix* species) are not listed, with the exception of Box Elder (*Acer negundo*) and Silver Maple (*Acer saccharinum*) which are common and less problematic trees.

Planted shrubs are fast growing and provide more immediate erosion control and habitat than planted trees. Shrubs may complement tree planting well by establishing a dense vegetative planting. Shrubs and bank erosion control species like Bankers Willow (*Salix X cotteti*) or

Dogwoods (*Cornus* species) have beneficial uses in ditch management, but are not covered in this publication.

TREE MAINTENANCE

Wooded ditch berms require maintenance. Regular inspections are needed, especially after ice storms to locate and remove damaged trees which may become water flow obstructions. When dead, leaning or other trees susceptible to breakage are removed, future maintenance costs can be reduced. While the listed species are not likely to cause problems, certain weather damages are not preventable. Trees should be kept away from subsurface drainage outlets so that roots do not plug the drainage pipes and outlets can be located for inspection and maintenance. Trees affected by insects or disease should be treated or removed before problems spread to other trees or they die, fall in and become obstructions.

When trees are managed properly they can provide income, benefit water quality and wildlife, protect crops from wind erosion and beautify the landscape. For more information on tree selection or site suitability contact your local Soil and Water Conservation District (SWCD), ODNR Divisions of Forestry or Wildlife, Ohio State University Extension, or qualified private consultant. For more information on drainage laws and standards contact your County or City Engineer, City Manager, Township Trustee or SWCD.

TreeSource—Ohio's Greenprint for the Future— is a strong new partnership between state and local government, private businesses and citizen volunteers renewing Ohio's commitment to planting and nurturing trees across the state.

For more information on TreeSource, contact the Ohio Department of Natural Resources, Division of Forestry (614) 265-6694.

Common/Scientific Name	Average Mature Height	pH Preference	Specific Characteristics
Highly Flood Tolerant Trees			
American Sycamore <i>Platanus occidentalis</i>	100+	6.6-8.0	Adaptable to many soils, streambanks, bottomlands, windfirm, long-lived, fast growth, urban tolerant.
Swamp White Oak <i>Quercus bicolor</i>	60-70	6.0-6.5	Lowlands, stream edges, swamps, long-lived, fast growth, wildlife food, sprouts, timber, firewood.
Bur Oak <i>Quercus macrocarpa</i>	70-80	4.6-8.0	Adaptable to many soils, very drought resistant, deep-rooted long-lived, sprouts, wildlife food, timber, firewood.
Pin Oak <i>Quercus palustris</i>	70-80	5.5-6.5	Bottomlands or moist uplands, tolerant of urban stresses, moderately long-lived (100-150 years), firewood, wildlife food, sprouts, fast growth.
Bald Cypress <i>Taxodium distichum</i>	60-80	6.1-6.5	Highly flood tolerant, grows on flooded, poorly drained to upland soils, extensive root system, very windfirm slow-growing, long-lived, sensitive to drought and heat, loses leaves in winter, not native although widely planted in Ohio.
Red Maple <i>Acer rubrum</i>	50-70	4.5-6.5	Adaptable to many soil types, some susceptibility to ice and snow damage, moderately long-lived (100-150 years), sprouts, resistant to herbicides, wildlife food, firewood, brilliant fall color.
Silver Maple <i>Acer saccharinum</i>	60-80	4.5-6.5	Bottomlands, streambanks, alluvial floodplains, moist sites, drought resistant, branches are somewhat brittle, susceptible to ice damage, can tolerate temporary flooding, sprouts.
Box Elder <i>Acer negundo</i>	30-40	6.5-7.5	Adaptable to many soils, tolerant to drought and cold, short-lived (60-80 years), fibrous root system provides good erosion control, susceptible to wind/ice damage.
Honey Locust <i>Gleditsia triacanthos</i>	70-80	6.1-7.5	Alluvial floodplains, bottomlands, drought resistant, shelter-belt series, windfirm, used to pioneer strip-mine spots, initially fast growing, thorns.
Moderately Flood Tolerant Trees			
Shellbark Hickory <i>Carya laciniosa</i>	80-100	6.1-6.5	Bottomlands & alluvial floodplains, sprouts, long-lived, slow growing, some susceptibility to frost damage, wildlife food, firewood.
Green Ash <i>Fraxinus pennsylvanica</i>	50-70	6.1-7.5	Bottomlands, strip-mine reclamation species, windfirm, alluvial soils along streams, wildlife food, firewood, sprouts, timber.
Hackberry <i>Celtis occidentalis</i>	30-50	6.6-8.0	Bottomland, limestone outcrops or soils, drought resistant, fast growing, long-lived (150-200 years), wildlife food.
Slippery Elm <i>Ulmus rubra</i>	60-70	6.6-8.0	Moist, rich soils of lower slopes, streambanks, terraces, and bottomlands, moderately fast growing, fairly long-lived, sprouts. Dutch Elm disease, urban tolerant.
Black Tupelo (Gum) <i>Nyssa sylvatica</i>	40-60	6.1-6.5	Adaptable to many soil types, alluvial stream bottoms, shade tolerant, wildlife food, wildlife den tree, moderately long-lived.
River Birch <i>Betula nigra</i>	60-80	<6.5	Alluvial soils, stream bottoms, highly tolerant of acid soils, sprouts, firewood, most common in South Central Ohio.

This Guide is one of a series of Ohio Stream Management Guides covering a variety of watershed and stream management issues and methods of addressing stream related problems. The overview Guides listed below, are intended to give the reader an understanding of the functions and values of streams. For more information about stream management programs, issues and methodologies, see Guide 05 Index of Titles or call the ODNR Division of Soil and Water Resources at 614/265-6739. All Guides are available from the Ohio Department of Natural Resources. Single copies are available free of charge and may be reproduced. Please contact:

ODNR
Division of Soil and Water Resources
2045 Morse Road, Bldg B
Columbus, Ohio 43229-6693

The guides are also available on-line as web pages and PDF files so you may print high quality originals at your location. You will find the guides on-line at: <http://www.ohiodnr.gov/soilandwater/>

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Prepared by the Ohio Department of Natural Resources, Dave Bergman, Division of Real Estate and Land Management, principal author. Input from staff of several ODNR divisions, state and federal agencies are used in the development of the Ohio Stream Management Guides.

Guides are available on-line at: <http://www.ohiodnr.gov/soilandwater/>



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OHIO

STREAM MANAGEMENT GUIDE

Stream Debris and Obstruction Removal

A Proactive Landowner's Guide to Maintaining a Free-Flowing Stream

Guide No. 18

PREFACE

Over the years, Ohio citizens have frequently contacted the Department of Natural Resources seeking assistance in the resolution of problems they have encountered related to water resources. One of the most common concerns raised by private landowners involves the situation in which trees and other debris accumulate in stream channels and obstruct stream-flow through their properties. These obstructions, sometimes referred to as logjams, may become large enough to disrupt existing drainage patterns and contribute to flooding. In-stream debris often gets lodged behind bridge and culvert openings, which can cause higher flood levels and result in additional land inundation and property damage. Some streams also serve as recreational boating resources, and logjams may interfere with canoeing or other small watercraft navigation. This fact sheet poses some of the frequently raised questions regarding logjams, and provides responses from the Ohio Department of Natural Resources.

WHAT IS A LOGJAM?

A logjam is any woody vegetation, with or without other debris, which obstructs a stream channel and creates a backwater condition. Logjams occur naturally, providing beneficial stream structure and cover for fish and wildlife and allowing nutrient-rich sediment to be deposited on adjacent floodplains. However, Ohio's streams are also expected to function as efficient drainage outlets, conveying water off the land in a timely manner. Logjams may inhibit this drainage function.

DO LOGJAMS CONTRIBUTE TO FLOODING?

Yes, especially during small-scale floods. Since a logjam and the backwater pool created behind it take up volume in the stream channel or floodplain, less natural storage is available when a flood event occurs. This can elevate the level of small-scale flood events, those that occur several times a year. Such impacts can be significant to farm fields and residences in the floodplain and to particularly low-lying, flood-prone areas. A logjam can also lengthen the duration of inundation during these floods, which can have a significant impact on crops planted in floodplain fields.

The amount by which a logjam reduces the floodplain's natural storage capacity is inadequate to make a significant difference in flood elevation during large-scale flood events. Thus, removing logjams is generally not considered an effective measure to mitigate large-scale floods. Large-scale flood events can create, relocate, or enlarge logjams, though, by carrying debris from the floodplain into the stream channel and blocking bridge and culvert openings, resulting in localized impacts.

HOW DOES A LOGJAM FORM?

A logjam most commonly forms when a relatively large object, often a tree that has fallen into a stream channel, becomes wedged or blocked across the streambed. Sometimes human activities induce stream obstructions, like when trimmings from tree pruning or large appliances and other litter are dumped in a stream or left in a floodplain and subsequently are carried into the stream by high water. When

an object obstructs the channel, it slows the flow and creates a pool of water behind it. As the water slows or stops behind the object, sediment suspended in the water settles out. The deposited sediment adds to the obstruction and causes additional debris to be trapped on and behind it. As more sediment and debris accumulate around and behind the obstruction, the logjam becomes larger and more tightly packed, forming a natural dam across the stream.

WHY SHOULD LOGJAMS BE REMOVED?

The formation of a logjam is a natural phenomenon and there are beneficial as well as detrimental impacts. A logjam provides structure and cover for fish and other aquatic organisms. The pool created behind the logjam provides critical aquatic habitat during low flow conditions, and the stirring and mixing oxygenates the water as it cascades over, around, and through the logjam.

A logjam may also negatively impact the stream. A tightly packed stream obstruction can act as a barrier to fish migration. Other problems caused by logjams are more insidious. A stream's energy is naturally channeled toward the route of least resistance, which is often around the obstruction. As the stream's flow is directed around an obstruction, it scours away the stream bank until a new channel is created. As the stream flows in its new channel around the logjam, it is re-directed toward the opposite bank. This begins a process, depicted in Figure 1, in which the stream's energy is directed subsequently from one bank to the other as the water flows downstream, eroding the stream banks and undercutting riparian vegetation as it creates a series of meanders. In an undeveloped watershed, where the streamside vegetation

on a newly cut channel is similar to the vegetation on the original channel, such meandering and channel relocation is not really a problem. In a developed watershed, where the streamside vegetation consists of a narrow corridor with adjacent farm fields and housing tracts, stream meandering and relocation can inflict considerable riparian property damage and also degrade the quality of the stream habitat as the limited riparian habitat is destroyed.

IS THERE A GOVERNMENT AGENCY RESPONSIBLE FOR REMOVING LOGJAMS IN ORDER TO KEEP OHIO STREAMS FREE FLOWING?

No. Governmental entities at the municipal, county, state, and federal levels have the statutory authority to undertake stream clearing and drainage improvement projects, but no governmental entity at any level has been assigned by statute the responsibility for such logjam removal activities. For more information on legal responsibilities regarding logjams see Guide 02, *Who Owns Ohio Streams?* The Ohio Department of Natural Resources recommends that, before an obstruction removal project is begun, there should be consultation with the applicable local, state, and federal regulatory agencies listed in Guide 06, *Permit Checklist for Stream Modification Projects*. The extent of permit requirements will depend on the location and design of the particular project.

Technical, educational, and other assistance may be available for obstruction removal projects. Township trustees, county engineers, soil & water conservation districts, conservancy districts, local emergency management agency and floodplain management coordinators, and staff with The Ohio State University Extension may all be possible sources of information or assistance to individuals. State agencies (e.g., the Ohio Department of Natural Resources, the Ohio Environmental Protection Agency) and federal agencies (e.g., the USDA Natural Resource Conservation Service) may also provide assistance to organized groups.

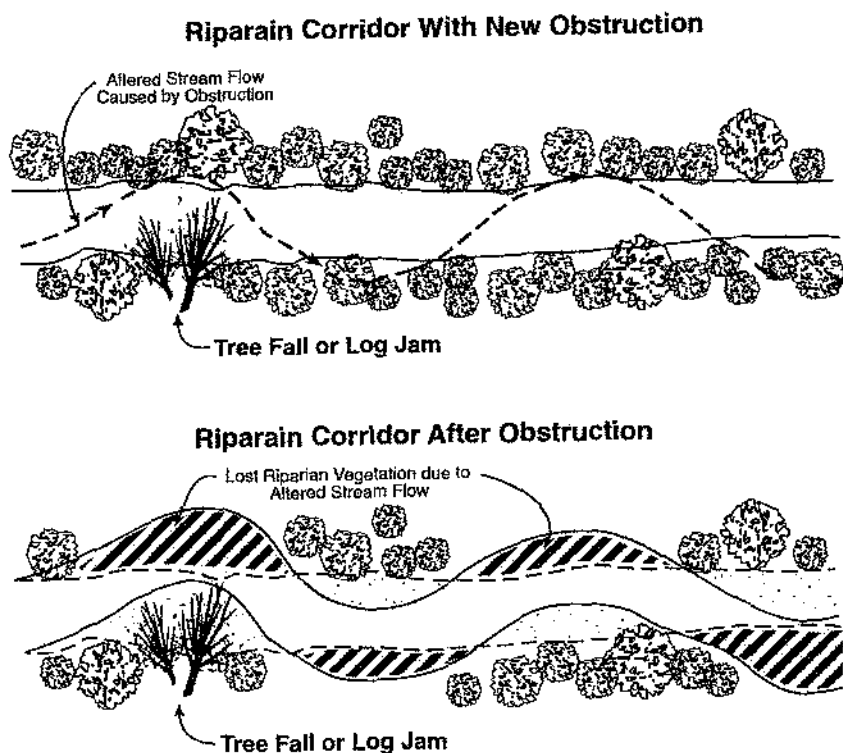


Figure 1. Effects of Obstruction on Riparian Corridor

Successful logjam removal projects have been undertaken in Ohio on many streams, some by volunteers and others using state and local appropriations and/or landowner assessments.

ARE RIPARIAN PROPERTY OWNERS REQUIRED TO REMOVE LOGJAMS FROM STREAMS ON THEIR PROPERTY?

Landowners generally are not required by statute to remove logjams from streams on their properties. Statutes do exist that grant county commissioners (Ohio Revised Code § 6151.14) and township trustees (Ohio Revised Code § 505.82) the authority to remove stream obstructions on private property and charge the costs of removal back to the property owner; however, these statutes are rarely used. The common law also does not specify that landowners must keep the streams flowing through their properties clear of natural obstructions. An obstruction to streamflow on one property can result in damages to upstream properties by reducing the stream's capacity for conveying runoff, contributing to flooding,

or reducing the effectiveness of artificial drainage systems. Landowners have the right to pursue civil litigation for damages to their property caused by the unreasonable actions of others, but it is unclear whether a landowner's inaction in failing to remove natural stream obstructions could be successfully litigated. For more information on this subject, see Guide 02, *Who Owns Ohio Streams?*

While they are not required to remove logjams, landowners can contribute to the stability and overall health of their streams by proactively removing obstructions to flow. Such activities, especially on streams with limited riparian habitat, help maintain the multiple use nature of streams for fish and wildlife, drainage, recreation, and other purposes. A regular program for stream maintenance and obstruction removal may alleviate the need for a large, expensive channel restoration project later on.

HOW SHOULD IT BE DETERMINED WHAT ACTIVITIES ARE NEEDED ON A STREAM?

The easiest way to deal with log-

jams is to remove them before significant sediment and debris has been deposited. Riparian landowners should conduct routine stream inspections twice a year to identify fallen trees and other debris on their properties that need to be removed from the stream and floodplain. Special inspections should be made following large storm events, during which debris is commonly deposited. A volunteer organization could be formed to undertake annual stream walks or canoe trips of the entire stream (with landowner permission and support) to identify obstructions that need to be removed, develop a work plan of needed activities, and perhaps even assist landowners in the obstruction removal. Such a group can serve a valuable function to riparian landowners by building support throughout the watershed for a regular inspection and maintenance program.

HOW SHOULD STREAM OBSTRUCTIONS BE REMOVED AND WHAT TOOLS ARE NEEDED?

Fallen trees and other debris in the floodplain should be removed, buried, or secured as soon as possible. Fallen trees and other debris encountered in the stream should be removed at the earliest appropriate time. Standing trees should be left as they are. All debris should be buried, secured, or removed from the floodplain so that it won't be re-deposited during the next flood. Debris removal should be conducted only during low flow periods, which typically occur during late summer, autumn, and winter. Small debris can be removed from the channel without any tools or equipment. Larger logs and trees across the channel will need to be cut into manageable pieces and dragged out of the stream. Accumulated sediment can be raked and grubbed to remove vegetation. Large equipment should not be placed within the stream channel. Any disturbed areas along the stream channel should be seeded immediately to avoid unnecessary streambank erosion. If stream bank erosion has already occurred where a logjam has been removed, bank stabilization may be appropriate. For more information on bank stabilization methods, see Guide 07,

Restoring Stream Banks With Vegetation, Guide 08, Trees for Ditches, Guide 11, Tree Kickers, Guide 12, Evergreen Revetments, Guide 13, Forested Buffer Strips, Guide 14, Live Fascines, Guide 15, Gabion Revetments, Guide 16, Rip Rap Revetments, and Guide 17, Live Cribwalls.

The following equipment is typically used for logjam removal projects: hand tools to facilitate removal of small debris; articulated log skidders with cable winches to remove larger logs; a chain saw or reciprocating saw to cut large logs and trees to manageable size; an adequate length of cable, chain, or rope to attach to the logs to facilitate their removal; a tractor, truck, or team of draft horses on the top of the stream bank to pull the logs out of the stream; and a wagon or truck on which to load the debris for subsequent removal from the floodplain.

Large logjams that are already well established need to be left for properly trained and equipped crews to remove. Specialized power equipment and explosives should never be used by anyone other than highly trained experts. The use of expensive and elaborate equipment is often not necessary when landowners take the time to perform routine maintenance and upkeep on their properties.

WHAT PRECAUTIONS SHOULD BE TAKEN BEFORE AND DURING AN OBSTRUCTION REMOVAL PROJECT?

The Ohio Department of Natural Resources recommends a consultation with the county engineer and local floodplain coordinator prior to initiation of an obstruction removal project. All tractors and other wheeled or tracked vehicles need to be kept out of the stream channel and well away from the top of the bank. Logjam removal activities should never be attempted alone, and a crew leader should be appointed to keep visual contact with everyone on the crew. The utmost caution should be taken to protect the personal safety of all workers. To avoid unnecessary damage to the streambank or riparian corridor, a single route to and from the project site should be utilized.

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This Guide is one of a series of Ohio Stream Management Guides covering a variety of watershed and stream management issues and methods of addressing stream related problems. All Guides, including an Index of Titles, are available from the Ohio Department of Natural Resources. To obtain copies contact the ODNR Division of Soil and Water Resources at 2045 Morse Road, Building B-2, Columbus, Ohio 43229-6693 or 614/265-6740 or mailto: water@dnr.state.oh.us.

For more information about the project call ODNR, Division of Soil and Water Resources at 614/265-6740. Each Guide is designed to be easily and clearly reproduced and can be bound in a notebook. Single copies are available free of charge. When distributing guides at meetings or in mailings, please use printed editions as a master for reproducing the number of copies you need, or you may print high quality originals from PDF files available on-line at: <http://www.ohiodnr.gov/soilandwater/>

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OHIO

STREAM MANAGEMENT GUIDE

Forested Buffer Strips

Guide No. 13

Trees along streams are so vital to the integrity of streams in climates like Ohio's, they are given the name "forested buffer strips." This Ohio Stream Management Guide is designed to give landowners, land managers and volunteer groups general guidance on the creation, protection and enhancement of forest areas along streams.

BENEFITS PROVIDED BY FORESTED BUFFER STRIPS

Streamside forests nurture Ohio's streams. The stream and its adjacent land (riparian area) together form the most vital and diverse feature of Ohio's landscape. Without trees in this land-water transition zone, streams typically become wide and shallow, habitat is degraded and water quality drops.

Riparian ecosystems with forest vegetation:

- remove pollutants from stream flows during periods of over-bank flow;
- reduce water temperatures by sheltering and shading;
- provide wildlife habitat and protect and create aquatic habitat;
- provide detritus (leaves and woody debris), which is the basic source of energy for the stream ecosystem; and
- reduce streambank erosion through the high durability of tree root mass.



Figure 1. A forested buffer strip as seen from the air.

THREATS TO FORESTED STREAM BUFFERS

Encroachment — Meandering ribbons of trees often show up on aerial photos. Clearing trees has historically occurred last along streams and rivers leaving forested riparian strips winding through farm fields and suburbs. From a stream management perspective, we are fortunate that these areas are rough, steep and subject to flooding, making them generally less desirable for intensive land uses. However, most forested buffer strips only remain today because of decisions made independent

of stream benefits. Until the importance of riparian areas is understood, forested buffer strips will be extremely vulnerable to encroachment as adjacent land uses become more intense. In fact, a major cause of buffer strip loss and stream degradation continues to be encroachment.

Overuse — Stream-side areas are often popular recreation areas, but overuse can reduce the integrity of the buffer through soil compaction and vegetation loss. High use can coexist with water quality objectives and damage limited by establishing trails and stabilized access points to the stream. Trails parallel to a stream should be set away from the banks. Provide viewing and lounging access to the stream through branches of trail which access the inside of meander bends.



Figure 2. A forested buffer between a stream and other land uses

This will minimize impacts and leave the critical vegetation on the outside banks undisturbed.

Grazing — Forested buffers are degraded by livestock. Not only is vegetation and soil damaged on the banks and uplands areas, but livestock trample and degrade the stream channel. Typical impacts include wide shallow channels with less cover, less shade, increased nitrates, increased turbidity, compacted soils and poor ground cover and understory. One Ohio study cited a 40% reduction in soil loss after livestock were fenced from a stream.

PROTECTING STEAMSIDE FORESTS

Define the Buffer Strip Width — Riparian areas are definitive land forms. They are transition zones between channels and uplands where the land influences the stream and the stream influences the land. It is in this zone that 'buffer strips' of forest vegetation have special importance for

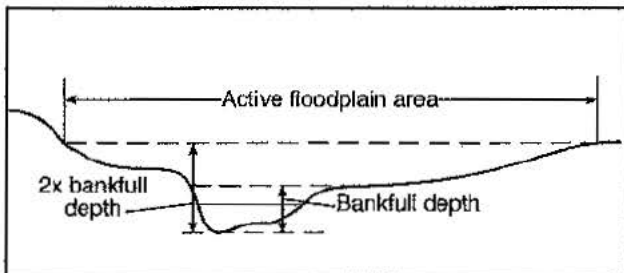


Figure 3. Buffer strip width defined by the active floodplain

the quality of streams. Riparian areas correspond very well with the active flood plain. The active floodplain is the area that would become flooded if stream levels rose above the maximum bankfull depth (see Figure 3). Estimations of riparian area boundaries may also be based on floodplains identified on federal Flood Insurance Rate Maps. Lastly, county soil survey reports list soils 'subject to frequent flooding' which may help delineate some riparian areas.

It is not always feasible to base buffer strip width on the riparian area. For example, highly entrenched channels may have a riparian area hardly wider than the channel itself and in other places floodplains and riparian areas may be so extensive that encroachment is inevitable. For these conditions a generic minimum standard may be useful. One such standard is based on a dimension equal to two and one-half times the bankfull channel width or 50 feet, whichever is less (see Figure 4). This distance is then measured away from the bankfull channel to arrive at the standard buffer width.

Fence livestock from the stream — Stream

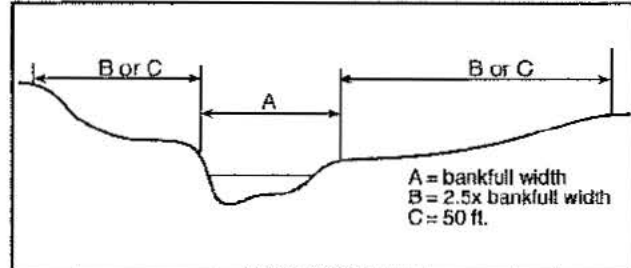


Figure 4. Buffer strip width defined by a minimum standard

fencing is a practice which keeps livestock away from the stream channel. Stream fencing projects often include stock tanks and water lines. Assistance for fencing livestock from streams may be sought through:

- Ohio State University Extension, Grazing Coordinator, 614/ 397-0401.
- USDA-Natural Resources Conservation Service (NRCS), Grazing Coordinator, 614/ 653-1559.
- County offices for the NRCS and local Soil & Water Conservation Districts, listed under County Government in local phone directories.

Establish a Legal Easement — One of the best ways to protect riparian areas is to establish legal easements, also known as conservation easements. Easements allow you to protect your streamside forests without giving up ownership. An easement is a legal agreement that protects a land's conservation value by restricting certain actions which can be taken, even by future owners. Among other things, riparian protection easements can prohibit or restrict timber harvesting, pesticide spraying and development in the buffer strip. The landowner may receive or waive compensation. The easement is held by a legally qualified conservation organization (such as a land trust) or a government agency. Conservation easements can be tailored for each landowner and situation, so may differ from property to property.

The following private organizations and public agencies are among those who can provide you information or assistance in creating a legal easement:

- The Trust for Public Land, 612/ 338-8494
- American Farmland Trust, 202/ 659-5170
- Land Trust Alliance, 202/ 638-4725
- The Nature Conservancy, 614/ 717-2770
- Ohio Department of Natural Resources, Division of Natural Areas and Preserves, 614/265-6460
- Ohio Department of Natural Resources, Division of Soil and Water Conservation, 614/265-6637
- Soil and Water Conservation Districts, listed under County Government in local phone directories

Erect Visual Barriers — Easements alone are only lines on paper which have proven to be ineffective against encroachment. One study found that 90% of easement protected forested buffers had been encroached upon to some extent, with 45% severely degraded. Visual barriers such as fences or signs appeared to be most effective at stopping encroachment.

REFORESTATION METHODS

Allow Natural Regeneration — Simply establishing a preservation area or "no-mow" zone may be enough to allow natural forest regeneration if there are some trees nearby to provide a seed

source. This may not work in areas without trees which have been farmed or have managed turf. Areas with intrusive species or dense turf may require some site preparation to improve regeneration potential.

Transplant Woody Plants — A number of sources for trees exist including commercial nurseries, the ODNR Division of Forestry, and compatible sites where you obtain permission to harvest plants. A list of flood tolerant tree species is found in Guide No. 08, Trees for Ditches. Planting dormant cuttings such as willow posts and stakes is discussed in Guide No. 07, Restoring Streambanks with Vegetation.

A combination of tree planting and natural regeneration may be a good choice for certain areas. For example, natural regeneration may be adequate for the majority of a buffer strip but trees may need to be planted adjacent to the stream to expedite streambank stabilization or to restore a tree canopy over the stream.

Species Selection:

- It is best to use a diverse mix of tree and shrub species with an emphasis on native species.
- Species should be mixed randomly across the site.
- In areas of partial shade, use a large proportion of shade-tolerant species.
- Ideally a mix of dominant tree species, understory trees and shrubs, and herbaceous plants should be planted.
- In open areas, it may be useful to mix hardier pioneer species (two-thirds) with later successional species (one-third) in recognition of the difficult environment for new plants.

Pioneer Species	Later Successional Species
Cottonwood	Swamp white oak
Box elder	Pin oak
Red maple	Black walnut
Ash (green)	Silver maple
Red osier dogwood	Hawthorn
Gray dogwood	Black haw viburnum
Silkey dogwood	Maple leaf viburnum
Sycamore	

Stocking Rates — Common reforestation stocking rates are 600 -1,000 seedlings per acre or 500 containerized stock per acre. If planting in the fall or in high use areas, seedlings are generally not recommended. Seedlings are best planted after the ground thaws and before April 14.

Soil Preparation — Depending on soil conditions, the site may benefit from pre-planting preparation, including lime and/or fertilizer, and disking or plowing.

Stabilization — A cover of annual grains such as wheat, rye or oats at 1 to 1 1/2 bushel per acre may need to be planted to temporarily stabilize soil during the establishment period. Perennial grasses are not recommended because of their competition with woody vegetation.

Maintenance — Within the first two years, monitor at least monthly during the spring and summer. Once per month in the fall and winter should be adequate. On these monitoring visits check the planted sites for soil moisture, competing vegetation, mulch and pruning needs; maintain as needed. Fertilizing is not recommended during the first two years of plant growth.

Competing Vegetation — Competing vegetation is a critical factor to monitor for during the first two years. Minimize competition from weeds and grasses through hand weeding where feasible, or mowing, mulching and use of selected herbicides.

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Mecklenburg, Dan, 1996, "Rainwater and Land Development, Ohio's Standards for Stormwater Management, Land Development and Urban Stream Protection," Ohio Department of Natural Resources.

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This Guide is one of a series of Ohio Stream Management Guides covering a variety of watershed and stream management issues and methods of addressing stream related problems. The overview Guide listed below, is intended to give the reader an understanding of the functions and values of streams. For more information about stream management programs, issues and methodologies, see Guide 05 Index of Titles or call the ODNR Division of Soil and Water Resources at 614/265-6740. All Guides are available from the Ohio Department of Natural Resources. Single copies are available free of charge and may be reproduced. Please contact:



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Prepared by the Ohio Department of Natural Resources, Dan Mecklenburg, Division of Soil and Water Conservation, principal author. Input from staff of several ODNR divisions, and local, state and federal agencies are used in the development of the Ohio Stream Management Guides. Funding for the production of the Ohio Stream Management Guides is provided in part through a federal grant under Section 319 of the Clean Water Act.

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GREEN INFRASTRUCTURE RESEARCH PROGRAM

Providing Research Solutions to Manage Wet-Weather Flow

Rain Garden Hydrology Introduction

Rain gardens are vegetated surface depressions, often located at low points in landscapes, designed to receive stormwater runoff from parking lots, roofs and roads. Typically constructed with sandy soils, the gardens allow stormwater to infiltrate quickly to underlying native soil and eventually contribute to groundwater recharge. Vegetation and soils within the rain garden remove stressors in stormwater runoff through biological and physical processes such as plant uptake and sorption to soil particles. Compared with stormwater release to receiving waters through conventional storm drains, infiltrating stormwater through rain gardens reduces peak flow rates and volumes with stressor loadings. This reduction improves the physical and biological integrity of receiving streams by reducing stream bank erosion and negative effects on aquatic communities.

Background

The National Risk Management Research Laboratory (NRMRL) is evaluating rain gardens as part of a larger collection of long-term research examining multiple stormwater management practices. The U.S. EPA recognizes the potential of rain gardens as a green infrastructure management tool to lessen the effects of peak flows on

aquatic resources. While local governments and individual homeowners are building many of these systems, relatively few studies have quantified rain gardens' ability to infiltrate stormwater to groundwater, thereby reducing peak flows.

Objectives

The Green Infrastructure Research Program's long-term rain garden research addresses two objectives to meet these challenges:

- Quantify the hydrologic performance of rain gardens accepting parking lot and roof runoff and changes with season and rain garden age.
- Test multiple ratios of impervious surface area to rain garden area in terms of hydrologic performance.

Experimental Approach

Controlled-condition research enables NRMRL investigators to collect high-quality information. Collecting data and performing experiments at field sites away from the laboratory limits research due to uncertainties in weather forecasts, site access, utility locations, vandalism, and other logistical issues that collectively add greatly to the costs and timelines of research projects.

Using on-site, experimental rain

gardens enables NRMRL to collect high-quality data necessary for evaluating engineered structures. The laboratory facilities and space available at the Edison Environmental Center also allow for construction and monitoring of functioning, full-scale rain gardens, producing data directly relevant to real world applications while avoiding unnecessary risks to people and equipment.

Research Background

Cities and towns across the nation are building or planning to install rain gardens to accept and infiltrate stormwater runoff from parking lots, roofs, and roads in high-density urban settings. Although hydrologic properties such as infiltration rates, surface ponding depths and duration, and overflow have been well-researched at the bench and pilot scale, few studies have been conducted in full-scale rain garden applications. As a result, current sizing criteria in federal and state rain garden manuals range between 5% and 50% of the impervious area draining to the rain garden (NC Coop. Ext. Serv., 2005; UW-Extension, 2003; U.S. EPA, 2009), leaving designers with little clear guidance when making decisions about rain garden sizing. This is a critical need given the importance of avoiding excessively long periods of flooding and overflow, particularly during the more common small- and moderately-sized storm events. The question of how large to make a rain garden in a

given location relative to the impervious area draining to it takes on added significance in urban settings where land is expensive and highly valued for a variety of uses.

An additional area of uncertainty in full-scale rain gardens involves the mechanics of acquiring high-quality monitoring data. Previous experiences of EPA researchers and the wider scientific community have shown that green stormwater management practices like rain gardens and pervious parking lots must be designed with the capacity for long-term monitoring, as retroactively equipping an existing structure to collect monitoring data is impractical. In this study replicated rain garden cells are outfitted with buried instrumentation to collect long-term hydrologic data. This data will be analyzed to evaluate the effectiveness of the monitoring plan in terms of the location, number, and types of instruments employed as well as the measurement frequency, storage and analyses techniques.

Current Research

The schematic on the following page details the design of the rain garden cells located south of a newly-constructed green parking lot. The rain garden consists of six separate cells that are hydrologically isolated from each other using 3/8 inch-thick plastic sheeting installed to a depth of 4 feet (see figure on next page). The six cells receive stormwater runoff from an impervious section of the parking lot and adjoining sidewalk through curb cuts at the south end of the parking lot. Stormwater runoff from the roof of the adjacent building is collected from multiple downspouts and conveyed beneath the sidewalk in a common 8 inch-diameter pipe. A dedicated 4 inch-diameter pipe

distributes the roof runoff upward into each rain garden cell just south of the curb cuts. The drainage area to all six cells is roughly equal (12,500 m²), but because the rain gardens are different sizes, they represent different percentages of their drainage areas. The two smallest cells are 2%, the two medium-sized cells 4%, and the two largest cells are 8% of their drainage areas, respectively. Each cell size is duplicated for statistical purposes. All cells are equipped with soil water content reflectometers and thermistors (to measure soil moisture and temperature, respectively) at multiple depths in the soil profile at the north and south ends of each cell. A cluster of piezometers and wells at various depths is located in the center of each cell. All instrumentation contributes to quantifying the timing and size of the wetting front in the rain garden during and following storm events.

In addition to the rain gardens and associated pervious pavement parking lot, NRMRL operates the 20-acre Urban Watershed Research Facility that includes stormwater mesocosms, laboratories, greenhouses, fabrication space, a pipeline testing facility, swale and pervious parking lot performance testing, and storage for equipment and supplies. This unique facility is part of the larger 200-acre Edison Environmental Center operated by the U.S. EPA Region 2. This land area allows NRMRL to undertake research on a scale that cannot be executed at any other U.S. EPA facility. Additional rain garden research at the pilot-scale is ongoing at the research facility (U.S. EPA, 2008). This work focuses on stressor removal in rain garden media and vegetation.

Impacts

The successful application of bioretention and pervious pavement systems at the Edison Environmental Center's pervious pavement parking lot demonstration site, as determined by the results of the research and monitoring effort, will allow for technology transfer to other federal facilities and to municipalities considering adopting green infrastructure to alleviate CSO problems. A more complete understanding of how rain gardens function will enable the U.S. EPA to provide national guidelines on rain garden design, construction, maintenance, and monitoring which local organizations can use to reduce peak flows to receiving waters. Reducing stormwater peak flows will help maintain the function and integrity of aquatic resources. Rain gardens and other management tools will help watershed managers assure that receiving waters meet the "fishable and swimmable" goals that Congress outlined in the Clean Water Act and better assure the continuing supply of high-quality, potable water needed for human life.

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Urban Watershed Management Research

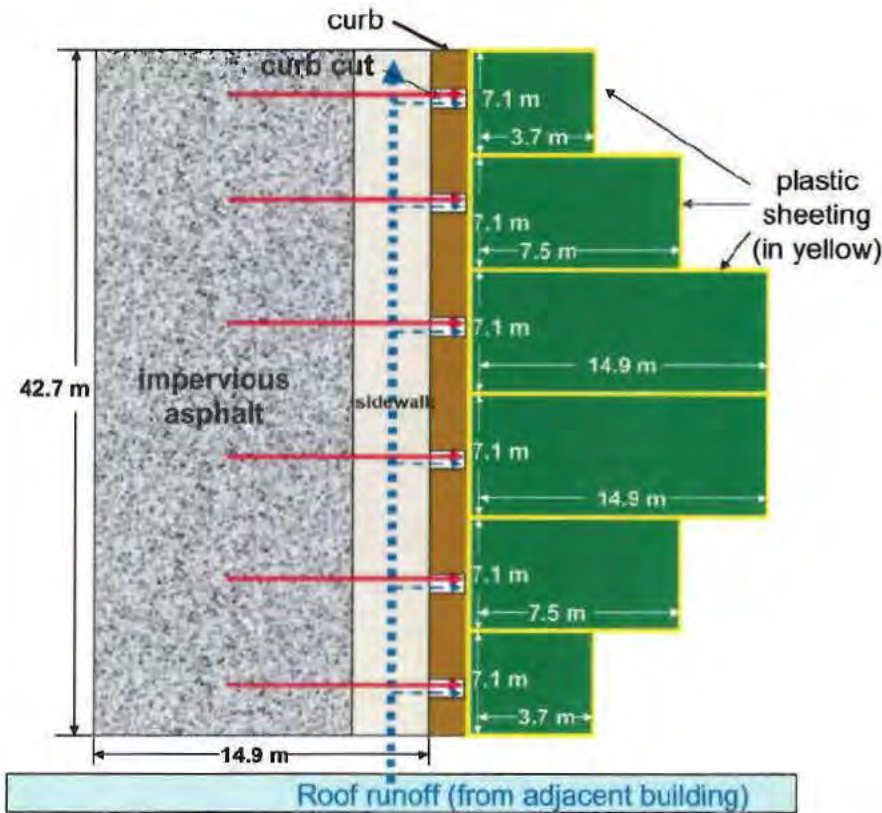
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U.S. EPA (2009).

http://www.epa.gov/nps/toolbox/other/cwc_raingard_enbrochure.pdf



This schematic shows the rain garden cells (in green) located south of the impervious section and sidewalk associated with the newly-constructed parking lot. All rain garden cells are hydrologically isolated from each other; the yellow lines represent the plastic walls which separate the cells. All six cells receive stormwater runoff (represented by red arrows) from the impervious section of the parking lot through curb cuts. Stormwater runoff from the adjacent building is conveyed to the six rain garden cells through an underground pipe manifold system (represented by the dotted blue arrows).



OHIO

STREAM MANAGEMENT GUIDE

An Introduction to Stream Management

Guide No. 01

STREAMS ARE CONNECTED TO THE LAND

The character of Ohio's rivers, streams and ground water has changed greatly over the last 200 years due to human activities. Forests and prairie lands once kept our streams narrow and deep by holding the banks intact. Stream water was cooler, cleaner and clearer, with a greater diversity of species than is found today.

Over the years agricultural production has increased through artificial land drainage. Crops are often planted up to streambanks, eliminating a crucial forested buffer zone for streams. Many of Ohio's streams were straightened to allow water to flow faster. Urbanization increases watertight surfaces (streets, roofs, and parking lots), and our streams receive greater amounts of runoff and the pollution it carries from crossing land surfaces. The increased runoff resulted in streambanks and beds being scoured and nearby cropland being lost. Downstream flood damage also increases as streams carry more water at a faster rate.

The changes we make to each watershed or drainage basin's land use, changes the character of our streams. The loss of trees and their streambank root structures allow streams to run wider and shallower, allowing sediment to fall out, silting-over important biological habitats within the stream. Sediments and pollutants must be filtered from raw water before it is used for industry and drinking. And millions of dollars are spent each year dredging sediment from channels, harbors and reservoirs.

Few people realize the overall importance of watershed-based land use practices, such as increasing the ability of surface areas to absorb water and retaining streamside forested buffer zones. Suitable streamside and in-stream habitat is the single most important factor determining the existence of diverse fish and wildlife populations. Healthy aquatic populations indicate good water quality which results in fewer

external costs to society. The quality and productivity of our rivers and lakes can be improved if we retain and restore their natural characteristics.

During the 1960's and 1970's people started to see that our prosperous and productive life style was seriously impacting the quality of the environment around us, including the resource-base which supports that life style. As a society we have started to make choices to alter our land use practices in order to preserve and restore habitat that are critical for the survival of plants and animals whose continued existence we once took for granted.

Each year new information and practices help us stay productive and prosperous while protecting the natural environment. This series of Ohio Stream Management Guides is designed to make practical advice available to landowners and others responsible for land use decisions involving streams.

WHAT IS STREAM MANAGEMENT?

Stream management includes all land use activities which affect stream environments, particularly their physical structure. Streams and their watershed lands should be managed in ways that work toward finding and maintaining healthy balances between our various land uses and the needs of fish and wildlife. The Ohio Stream Management Guides will focus on the physical structure of streams and management practices which support the search for healthy balances.

More intensive land use and development tends to disrupt natural processes which protect and preserve water resources. Therefore, land uses and the design and maintenance of stream modifications and storm water structures must be managed responsibly. This means minimizing the disruption of those natural processes, and mitigating necessary disruptions as much as possible.

STREAMS ARE PART OF THE HYDROLOGIC CYCLE

Stream systems drain the land as a key part of nature's water cycle. The water cycle contains the following elements:

1. precipitation of all forms of water which falls from the atmosphere to the earth's surface;
2. infiltration and percolation of precipitation deep into the ground, replenishing the ground water supply;
3. overland flow or runoff of precipitation across land surfaces and through drainageways to streams, lakes and eventually, the ocean;
4. evaporation from surface water, soil and vegetation, returning water vapor to the atmosphere; and
5. transpiration by plants through their roots to their leaves, returning water vapor to the atmosphere.

The cycling of water from the earth's surface to the atmosphere and then returning to the earth, is called the hydrologic cycle. Hydrology is the study of the various waters of the earth, their occurrence, circulation, distribution, chemical and physical properties and reaction with the environment, including their relationships with living things.

STREAMS AND OTHER WATER RESOURCE FEATURES

Stream systems are related to other water resource features such as watersheds, lakes and reservoirs, wetlands, ground water, floodplains, riparian zones and fish and wildlife habitats.

Watersheds, or drainage basins, are areas of land which drain to a single outlet. The term watershed is also used for the outline of the drainage basin. Precipitation falling on one side of a

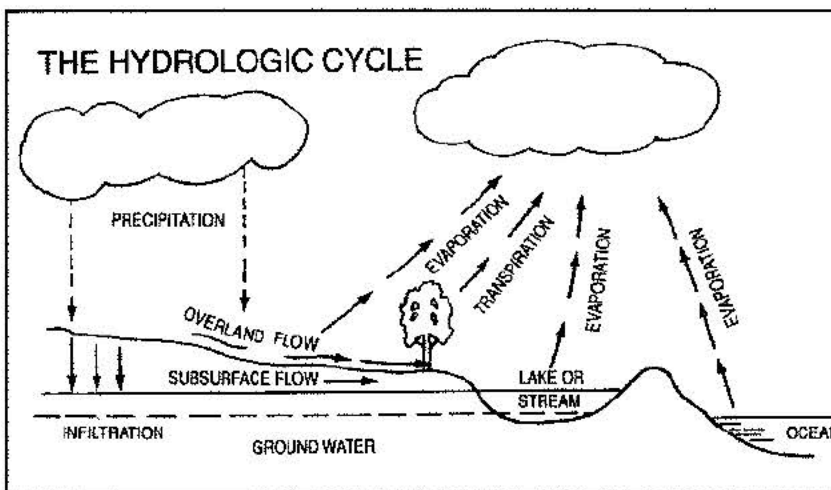
watershed line will drain to one outlet while precipitation falling on the other side of the line will drain to another outlet. The peak of a roof functions in the same way, dividing which direction runoff will flow off the roof. A watershed area may be as small as a farm field draining toward a gully, or as big as the Ohio River drainage basin, which is a combination of thousands of smaller watersheds across several states. Every river, stream and tributary is part of a watershed. The geography, geology and land uses in a watershed greatly influence a stream's character.

Lakes are naturally occurring impoundments of water, while reservoirs are made by humans. Lakes and reservoirs both serve as sinks where the sediment load that streams carry are deposited. These areas can provide water supply, flood control, fish and wildlife habitat, recreational opportunities and other benefits.

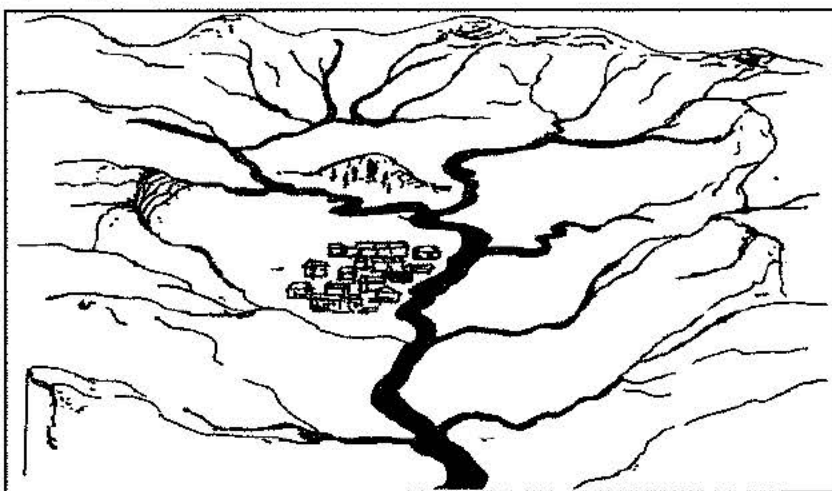
Wetlands are transitional areas between dry land and streams, ponds or lakes. Bogs, fens, marshes and swamps are examples of different types of wetlands. Wetlands are one of nature's ways of managing water quantity and quality. Wetlands provide a variety of no-cost, maintenance-free benefits such as, cleaning water, storing and slowing flood waters, providing ground water recharge and discharge, and providing wildlife habitat. Wetlands also have recreational, educational and aesthetic values which are enjoyed by more and more people.

Ground water, a valuable source of drinking water, is water stored underground in porous, permeable layers of sedimentary rock or unconsolidated sand and gravel deposits, known as aquifers. Replenishment, or recharge, of the ground water supply occurs when precipitation penetrates deep into the subsurface and becomes part of the ground water system. Shallow ground water discharges into streams where water tables intersect stream channels, providing base flow to the stream. Streams may also exist as areas of discharge for deeper ground water aquifer systems.

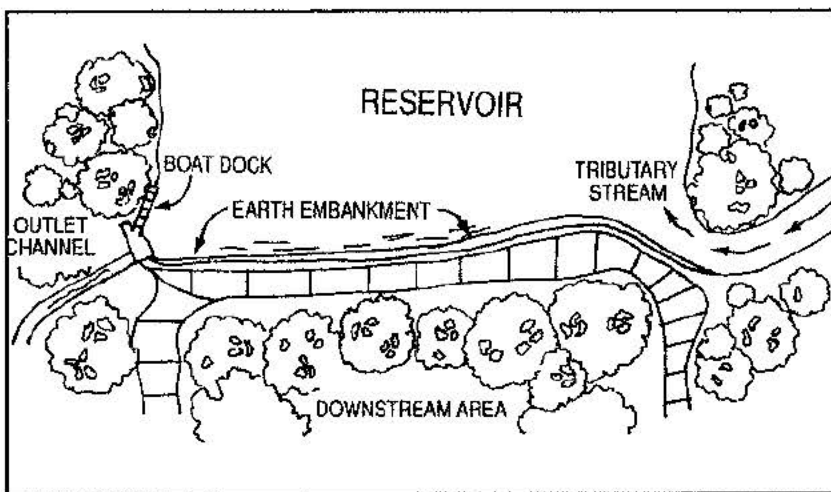
Floodplains are the valley floors adjacent to stream channels which may be inundated during flood events. Flooding is a natural and unavoidable characteristic of all streams. Floodplains function as nature's safety valve by providing a place for floodwater to spread out, thus slowing the speed of floodwater discharge. Floodplains provide other valuable functions too, including



Hydrologic Cycle



Watershed



Reservoir

wildlife habitat, ground water recharge, water quality maintenance and sediment control. They also have recreational, aesthetic and scientific values.

Riparian zones are lands immedi-

ately adjacent to streams, sometimes called stream corridors, usually within floodplains. The term riparian zone is often used to mean a streamside forested buffer area, particularly in water

quality programs and local ordinances. The width of the zone is then defined according to the program's purpose. Indeed, one of the best uses of stream side land is as a forested buffer area between the stream and other land uses. Retaining or restoring riparian land to forest provides many water quality and floodplain benefits. The riparian area provides a transition between aquatic habitat and upland habitat and may contain wetlands. The relative health of the riparian zone, or stream corridor, directly affects fish and wildlife survival.

The quality of fish and wildlife habitat is a function of the physical, chemical, and biological features of the entire watershed as well as the stream corridor. It indicates the capacity of the stream to support viable, diverse populations of both aquatic and terrestrial organisms.

HOW LAND USE AFFECTS WATER QUANTITY AND QUALITY

Land use changes affect the hydrology of an area in three ways:

1. Peak Flow Characteristics

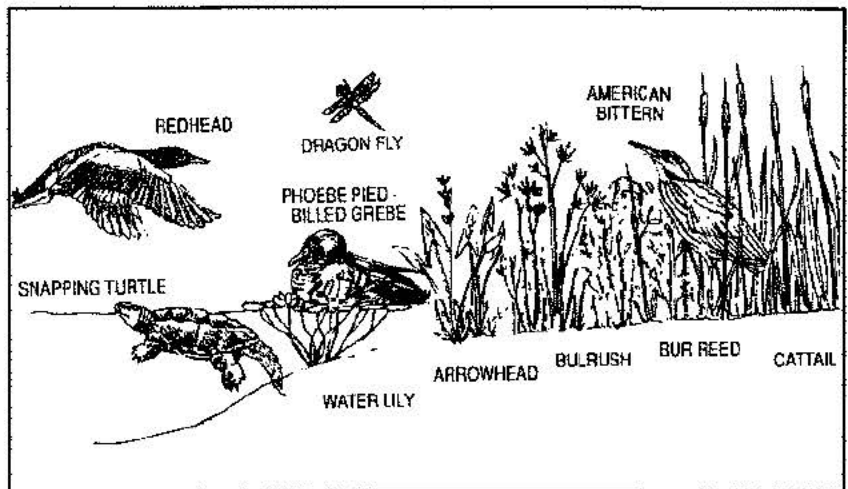
After rainfall events, runoff reaches streams and rises to reach a peak before subsiding. As land uses change from natural to agricultural or urban, the total amount of flow, peak flow height and stream flow speed increases. Streams rise higher, flow faster, and reach peak flows more quickly than under natural conditions. These effects are due to an increase in impervious area (streets, parking lots, roofs, etc.); a reduction in the opportunity for infiltration, evaporation, transpiration and depression storage; and the modification of surface drainage patterns.

2. Water Quality

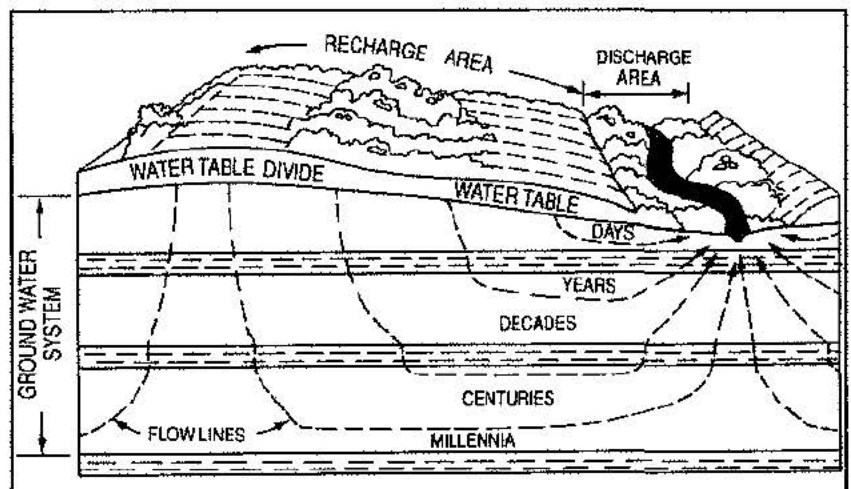
As the human use of land intensifies, the naturally occurring physical, chemical and biological activities which normally interact to recycle most of the materials found in runoff are disrupted. Human activities add pollutants such as pesticides, fertilizers, animal wastes, oil, grease and heavy metals to the land surface. Construction activities expose soil directly to precipitation. Soil and pollutant particles are washed downhill by rainfall and runoff, and increase the pollutant and sediment loads carried by receiving streams.

3. Stream Amenities

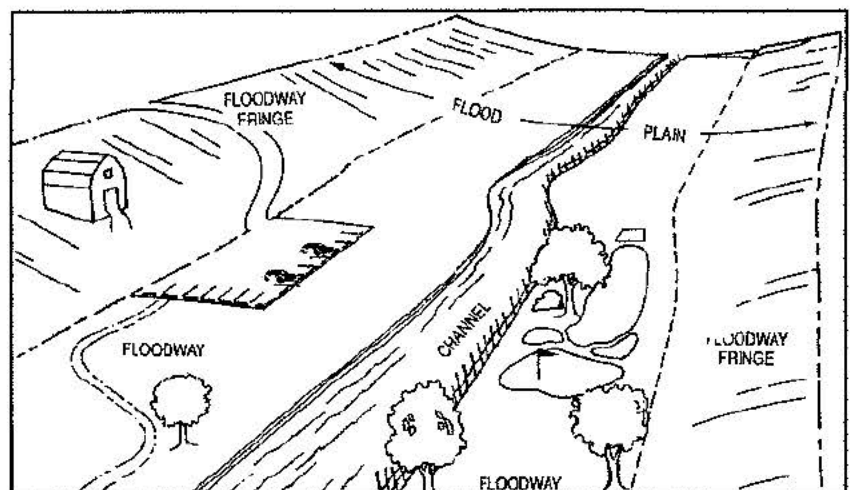
The value of natural stream corridors, as both a public and private good, reflects a higher land value near wooded stream corridors. A channel which has gradually enlarged due to increased



Wetland



Ground Water



Floodplain

flooding tends to possess unstable and un-vegetated banks, scoured or muddy channel beds, and accumulations of sediment and debris. In addition to being unsightly, these factors disrupt the

natural balance in stream organisms. The addition of nutrients, organics and sediment caused by changes in hydrology tend to increase algae growth and turbidity (green- and brownish water),

lower the oxygen content of the water and thereby reduce the variety of organisms supported by the stream. The beauty and value of the stream corridor is negatively affected when the stream channel is unstable, trash accumulates, and fish and wildlife communities are disrupted.

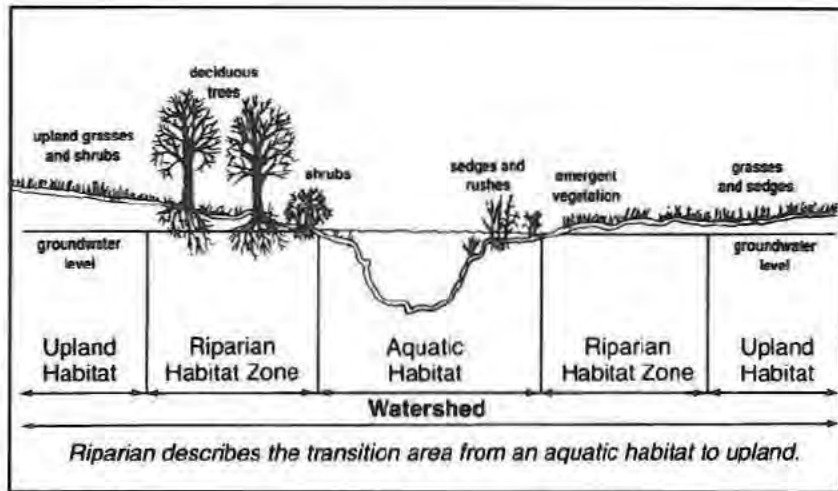
We are all land managers, so we are all stream managers. How we handle that responsibility—directly or indirectly—affects our neighbors in the watershed and along our stream. Our actions both reflect and change the society and environment around us. We should seek to improve the balance between aquatic organisms, water quality, water quantity, and land development in our Ohio watersheds and streams.

This Guide is one of a series of Ohio Stream Management Guides covering a variety of watershed and stream management issues and methods of addressing stream related problems. The first several guides in the series are overview guides intended to give the reader an understanding of the functions and values of streams. For more information about stream management programs, issues and methodologies, see Guide 05 Index of Titles or call the ODNR Division of Soil and Water Resources at 614/265-6739. All Guides are available from the Ohio Department of Natural Resources. Single copies are available free of charge and may be reproduced. Please contact:

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Riparian Zone



Wildlife Habitat

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Prepared by the Ohio Department of Natural Resources, Kim Baker, Division of Real Estate and Land Management, principal author. Input from staff of several ODNR divisions, state and federal agencies are used in the development of the Ohio Stream Management Guides.

Guides are available on-line at: <http://www.ohiodnr.gov/soilandwater/>




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Homeowner's Guide to Flood Plain Management

What Are Flood Plains?

Flood plains are lands that border rivers and streams. They normally are dry but can be covered with water during or after storms.

Flood plains serve a critical function during severe storms — they provide storage capacity for excess water until downstream water courses can accept it.

Why Is Flood Plain Management So Important?

Floods can damage buildings or other structures that are placed in flood plains. Placing structures in a flood plain can increase flooding and flood damage on adjacent property. That's because structures in flood plains can change the pattern of water flow by blocking the flow of water and increasing the width, depth, or velocity of flood waters.

In addition to storing excess water during severe storms, flood plains (if they are properly managed) have the secondary benefit of protecting the water quality of our streams. Flood plains, in the form of vegetated land cover, act as buffer zones between streams and nearby development.

As stormwater flows over developed areas, it picks up pollutants such as motor oil from roads, soil from construction areas, and fertilizers and pesticides from lawns. A vegetated buffer can effectively remove these pollutants, through the filtering action of grasses, shrubs, and trees and by allowing stormwater to soak into the soil.

Flood Plain Ordinance

In March 1983, Chesterfield County adopted the *Flood Plain Management Ordinance*. The Ordinance prohibits certain uses, activities, and residential development from locating within areas that are subject to flooding. The purpose of the Ordinance is to prevent loss of life and damage to dwellings.

A copy of the complete *Flood Plain Management Ordinance* can be picked up from the Department of Environmental Engineering at 6806 West Krause Road.



Do's and Don'ts of Flood Plain Management

Please DO:

- ☺ Leave natural vegetation, including undergrowth, in flood plains.
- ☺ Remove significant blockages, such as fallen trees, from flood plains and water courses.
- ☺ Maximize the distance between lawns or vegetable gardens and flood plains.
- ☺ Contact the Department of Environmental Engineering at 748-1035 with questions about flood plains.

Please DON'T:

- ☹ Clear-cut or fill in flood plains.
- ☹ Deposit leaves, grass clippings, brush, or other debris in flood plains.
- ☹ Stockpile firewood in flood plains.

Frequently Asked Questions

Q. Can I put a fence in the flood plain?

A. The Ordinance doesn't prohibit fences. However, the practice is discouraged because fences located in flood plains are very often damaged by flooding, are prone to collect debris, and can alter flood plains.

Q. Is filling in the Flood Plain recommended?

A. No! Filling in the flood plain can permanently alter the flow of water, compromise the storage capacity and water quality benefits of the flood plain, and potentially affect adjacent properties.

Q. Can I clear-cut trees in the flood plain?

A. The Flood Plain Ordinance does not expressly prohibit clear-cutting trees in a flood plain. However, the Department of Environmental Engineering **strongly discourages** this practice because clear-cutting can permanently alter the flood plain and result in the release of excess sediment into a stream.

Q If a flood plain is located in the Chesapeake Bay Resource Protection Area, can I clear-cut trees?

A **No.** The *Chesapeake Bay Preservation Ordinance* prohibits clear-cutting trees in Resource Protection Areas. If trees are to be removed, it should be done selectively, removing only trees that are dead, dying, or diseased.

Q Can I build a swimming pool in the flood plain?

A The Flood Plain Ordinance does not expressly prohibit swimming pools. However, the County's *Chesapeake Bay Preservation Ordinance* prohibits the location of swimming pools in a flood plain that is part of a **Resource Protection Area**. The Department of Environmental Engineering strongly discourages swimming pools in flood plains, because they will be subject to periodic flooding and will collect debris.

Q Can I build structures such as sheds and detached garages in the flood plain?

A You can do so in some cases, as determined by the Department of Environmental Engineering. The entrance or "front" of the structure must be located along the landward edge of the flood plain (the edge farthest from the stream).

Q What kind of drainage improvements will the County make in a flood plain?

A **None.** Flood plains are natural areas that serve as a "storage area" for excess water in streams and other waters during severe storms. The County will assist in assessing any problems that may be occurring on a homeowner's property due to the existence of a flood plain.

Q How will the County help with erosion problems in the flood plain or watercourse?

A If a man-made channel is located in a County easement, the County will assess the problem and take any necessary corrective measures. If there is erosion in a stream or drainage-way that is not in a County easement, the County may provide rip-rap (large rock) to the homeowner or Homeowners' Association to help correct the problem.

Q What can I do about beavers in the flood plain?

A Call the Drainage Superintendent at 748-1035 with specific questions about beavers. Before trapping beavers, the State Department of Game & Inland Fisheries must be contacted, and a permit must be obtained.



What You Should Know if a Flood Plain Is Located on Your Property

Fact: A 100-year flood plain is defined as an area with a 1% chance of being flooded in any given 12-month period. This means that, during periods of wet weather such as spring or fall, or during severe summer storms, water might frequently flow over the stream banks and spread onto the land next to the stream.

When purchasing property, it is important to look for flood plains. Flood plains are most often delineated on final record plats for subdivisions recorded after 1979.

Fact: A 100-year "backwater" refers to a temporary, artificially created ponded area, caused by the backup of stormwater from a culvert or pipe. Such areas are designed to pond water during severe storms, because the culverts and pipes are designed to handle only average storms. To handle the most severe storms, those culverts and pipes would have to be designed as excessively large structures.

And More Facts:

- ✓ Houses that were built before 1983 (when the *Flood Plain Management Ordinance* was adopted) were not required to be set back from flood plains.
- ✓ Houses built between 1983 and 1989 were required to be set back 5 feet from flood plains.
- ✓ Houses built from 1989 to the present are required to be set back 20 feet from flood plains.

This is one of a series of fact sheets about surface water quality issues in Chesterfield County. Copies are available in the Department of Environmental Engineering offices at 6806 West Krause Road. The series includes:

- *Chesterfield County's Stormwater Management Program* (August 1997)
- *Household Guide to Chesterfield County's Illicit Discharge Ordinance* (October 1997)
- *Business and Industry Guide to Chesterfield County's Illicit Discharge Ordinance* (October 1997)
- *Chesapeake Bay Resource Protection Areas and Flood Plains* (December 1997)
- *The Streams of Chesterfield County* (September 1998)

These fact sheets are produced by the Water Quality Section of the Department of Environmental Engineering. Our mission is to protect, maintain, and restore the chemical, physical, and biological integrity of Chesterfield County's waters. This mission furthers one of the County's Strategic Goals: to maintain an extraordinary quality of life in the County by protecting and preserving our natural and historical resources. For more information, call 804-748-1035.

Guidance for Collecting High Water Marks

High water marks should be collected after a flooding event has occurred and as soon as the flood waters have receded as possible as clean-up efforts will quickly remove the traces needed to set the marks. After the event, officials should make a list of areas where flooding occurred and try to rank them in priority. Teams of at least two should be sent into the field equipped with survey books, cameras, levels and GPS units, if available. Flooded streams with historical high water marks should be looked at first and high water marks on those streams should be placed in similar locations so that events can be compared, tables from Appendix H can be used.

Once in the field, a high water mark team should look for areas of access to the stream where flooding occurred. High water marks should be placed on telephone poles, trees or any other structure that is more or less permanent. If possible, multiple points of reference should be collected when setting a high water mark. Multiple debris, mud or trash lines can be referenced to the same high water mark location using a level.

The best place to look for high water marks is on structures. High water marks can be set at these locations by measuring the height of the mud line from a fixed feature such as a step or window ledge or by using a level to transfer the high water mark onto a nearby tree or telephone pole.



Figure G - 1. Example picture of a mud line on the outside of a building.



Figure G - 2. Example picture of a mud line on the inside of a building.

Debris lines can also be found on fences. These debris lines are usually not as accurate as those on structures but can be used as a check or in areas where there are no structures in the vicinity.



Figure G - 3. Example of a debris line on a chain link fence.



Figure G - 4. Example of a debris line on farm fencing.



Figure G - 5. Example of a debris line on farm fencing.

Less accurate but still worth noting are debris lines or trash lines on the ground or in trees. These should be used as a check or in rural locations where no structures or fences can be found.



Figure G - 6. Example of a debris line on the ground.



Figure G - 7. Example of a debris line on the ground.



Figure G - 8. Example of a debris line in a single tree.



Figure G - 9. Example of a debris line in a group of trees.

Once the high water mark team has arrived at a location, they should look for any structures in the area with clear mud or seed lines on them. If multiple debris lines are found in the area they should all be looked at to determine which one is thought to be the most accurate. Shooting multiple debris line elevation back to the point where the high water mark will be placed helps to increase accuracy of the high water mark.

Once the location of the high water mark is identified, a means of marking the location such as a nail and cap with flagging should be placed, making the high water mark more easily found at a later date. If you are putting the high water mark on a structure and a nail cannot be placed, measure the height from the first floor elevation to the high water mark location and document this measurement. If the high water mark is being placed higher than is feasible to drive a nail, place a nail at a more reasonable height and include the measurement up to the high water mark in your description. Once the nail is set, write a detailed description in your field book about the location of the nail, debris lines that it was set from, accuracy of the high water mark, and any other details about the area as well as GPS coordinates. Pictures can also be taken or drawn in the field books to help illustrate locations. Examples to the right show the proper way to document a high water mark.

After a detailed description is written, take pictures of the location of the high water mark as well as the debris line if they are in different locations. If possible, collect a point using a GPS unit in the location so that an electronic location can be created of all of the high water mark points. The point should be named appropriately. A good way to name high water mark points is by a two or three letter abbreviated stream name and a number that identifies that high water mark on the stream. If an abbreviated stream name was used in previous events, default to that. (Example: Sunset Branch – SB023)

36° 07' 41.880" N
 86° 42' 49.508" W
 Excellent Mud Line on Window of Berry's Jewelry
 PK Nail set in light pole 354 on upstream
 side 3' above ground
 Pole 60' landward of Med Diet Clinic
 and approx. 80 ft upstream of Murfreesboro Rd

Figure G - 10. Example of a mud line high water mark description.

Good mud line in
 fence at entrance to
 maintenance bldg in
 Drakes Creek Park -
 PK nail w/washer set
 1' from edge of pavement
 at far side of rd from
 creekward entrance
~~that~~ mud line is
 3.46' abv PK nail
 86° 36' 38.34" W

Figure G - 11. Example of a debris line on a fence high water mark description.

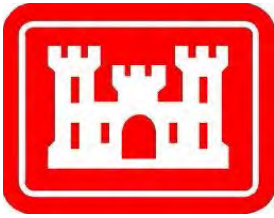
MC22
 POWER POLE
 11755191
 36° 04' 19.162" N
 86° 40' 49.58" W
 NAIL IS ABOUT 5.2 FEET
 ABOVE GROUND
 NAIL FACING RYDER
 COMPLEX
 POWER POLE INSIDE
 FENCED AREA
 GOOD LINE
 SPOKE WITH RYDER
 EMPLOYEE WHO SAID
 WATER GOT UP TO THE
 TOP OF THE DOCKS
 BUT DID NOT GET IN
 THE BUILDING

Figure G - 12. Example of high water mark that was transferred from a building to a power pole.

Once high water marks have been set, a survey crew can go back out and assign elevations to the high water marks. The survey crew will need to take the GPS points as well as copies of the high water mark books to help locate all placed high water marks. Place these elevations into an electronic format (such as an ESRI shapefile or CADD) for later use.

High water marks can be used to calibrate hydraulic computer models, determine the variance in current and historical events and help to determine inundated areas after an event occurs.

**Final Watershed Assessment
Nimishillen Creek Watershed
Appendix F
USACE Fact Sheets and Sample Letters of Intent**



CONTINUING AUTHORITIES PROGRAM

SECTION 14

EMERGENCY STREAMBANK AND SHORELINE PROTECTION

WHAT CAN THE CORPS DO?

Section 14 of the Flood Control Act of 1946, as amended, provides authority for the Corps of Engineers to plan and construct emergency streambank and shoreline protection projects to protect endangered highways, highway bridge approaches, public facilities such as water and sewer lines, churches, public and private nonprofit schools and hospitals, and other nonprofit public facilities.

The unstable conditions caused by flood induced streambank and shoreline erosion call for prompt action to eliminate the threat to public safety and to prevent interruption of vital services. This is recognized in the streamlined study and shortened time frame of the Section 14 Program. Federal costs are limited to not more than \$1,500,000 in one locality during any fiscal year.

A Section 14 project may include new streambank or shoreline protection works, or it may repair, restore, or modify existing works. Each project must constitute a complete solution to the problem and not commit the Federal government to additional improvements to ensure effective protection. A project is accepted for construction only after an investigation shows its engineering feasibility, environmental acceptability, and economic justification.

After a state or local agency requests Federal assistance, the Corps will conduct a feasibility study pending potential Federal interest and available funding. The feasibility study begins at Federal expense. Study costs in excess of \$100,000 are shared 50/50 with the non-Federal sponsor according to a Feasibility Cost Sharing Agreement (FCSA). In the feasibility study, the problem is defined, project viability is determined, potential solutions are identified, and the most feasible plan is selected for implementation. The costs, benefits, and environmental impacts of the potential project are analyzed. A draft project partnership agreement (PPA) is drawn up by which the Federal government and the sponsor agree to share project construction costs. No more than 12 months should pass between the start of the feasibility study and the time the project is ready for construction.

WHAT ARE THE LOCAL RESPONSIBILITIES?

Costs for emergency streambank and shore protection projects are shared between the Federal government and a non-Federal sponsor in accordance with the Water Resources Development Act of 1986, as amended. During construction the local sponsor must contribute a minimum of 35% of the total cost of a project, with credit granted toward the amount for providing lands, easements and rights-of-way, and pay a minimum cash requirement of 5% of the total project cost. The local sponsor (a state or local government) must have the legal and financial capability to fulfill the requirements of cost sharing and local cooperation.

Formal assurances of cooperation must be furnished by the local sponsor. The sponsor generally must agree to the following:

- Contribute a minimum of 5% of the total project cost in cash;
- Provide all lands, easements, rights-of-way, and relocations;
- Provide any additional cash contributions needed to make the local sponsor's share of the project costs 35%;
- Assume the full responsibility for all project cost above the Federal cost limit of \$1,500,000;
- Hold and save the United States free from claims for damages due to the construction and maintenance of the project, except damages due to fault or negligence of the United States or its contractors;
- Provide all access routes and relocations of utilities necessary for project construction and subsequent operation and maintenance;
- Operate, maintain, repair, replace, and rehabilitate the project as long as the project is authorized; and
- Comply with provisions of pertinent Federal acts in carrying out the specified non-Federal responsibilities of the project

HOW CAN HELP BE REQUESTED?

An investigation under Section 14 may be initiated after receipt of a formal request from the prospective sponsoring agency. A sample letter is offered below. This letter is generally referred to as a Letter of Intent (LOI) and must be received by the Corps from a prospective non-Federal sponsor prior to initiating the feasibility phase.

District Engineer
U.S. Army Corps of Engineers, Huntington District
502 8th Street
Huntington, West Virginia 25701

Dear Sir:

In accordance with the provisions of Section 14 of the Flood Control Act of 1946, the (name of local sponsor, i.e. Town of Newberry) requests Corps of Engineers assistance in addressing a streambank erosion problem (briefly state problem) on (name of site, i.e. street or park name) along (name of stream).

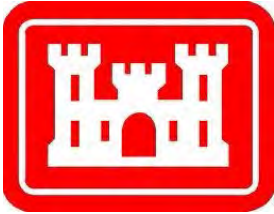
We are aware of the following cost sharing requirements associated with projects undertaken under this authority and are able to meet these obligations within 12 months.

- a) Feasibility Phase is Federally funded up to \$100,000. Costs in excess of \$100,000 are shared on a 50/50 basis with the local sponsor. The sponsor's 50% share of any costs over \$100,000 may be provided by in-kind services.
- b) Sponsor's Share of Construction consists of provision of land, easements, rights-of-way, relocations and disposal areas, plus a cash contribution of at least 5% of the total project cost. If this amount is less than 35% of the total project cost, the sponsor will provide any additional cash contribution required to equal 35%. The Federal limit is \$1,500,000.
- c) The sponsor is responsible for removal of all Hazardous, Toxic, and Radioactive Wastes prior to any construction and for the operation and maintenance of the project after it is completed.

We are aware that this letter serves as an expression of intent and is not a contractual obligation and that either party may discontinue the study process at any stage prior to construction.

Sincerely,

(Name and title of public official authorized to request study)



CONTINUING AUTHORITIES PROGRAM

SECTION 205

Flood Damage Reduction

WHAT CAN THE CORPS DO?

Section 205 of the Flood Control Act of 1948, as amended, provides authority to the Corps of Engineers to plan and construct small flood damage reduction projects not specifically authorized by Congress. A project is accepted for construction only after detailed investigation clearly shows its engineering feasibility, environmental acceptability, and economic justification. Each project must be complete within itself, not a part of a larger project. The maximum Federal expenditure per project is \$7,000,000, which includes both planning and construction costs. Costs of lands, easements, and operation and maintenance must be non-Federal.

There are two types of projects: structural and nonstructural. Structural projects may include levees, flood walls, diversion channels, pumping plants, and bridge modifications. Nonstructural alternatives, which have little or no effect on water surface elevations, might include measures such as floodproofing, relocation of structures, and flood warning systems.

After a state or local agency requests Federal assistance, the Corps will conduct a feasibility study pending potential Federal interest and available funding. The feasibility study begins at Federal expense. Study costs in excess of \$100,000 are shared 50/ 50 with the non-Federal sponsor according to a Feasibility Cost Sharing Agreement (FCSA).

In the feasibility study, the problem is defined, project viability is determined, potential solutions are identified, and the most feasible plan is selected for implementation. The costs, benefits, and environmental impacts of the potential project are analyzed. If there is a feasible solution to the flooding problem recommended by the study, a draft project partnership agreement (PPA) is drawn up by which the Federal government and the sponsor agree to share project construction costs. No more than 3 years should pass between the start of the feasibility study and the time the project is ready for construction.

WHAT ARE THE LOCAL RESPONSIBILITIES?

Costs for Section 205 flood damage reduction projects are shared between the Federal government and a non-Federal sponsor in accordance with the Water Resources Development Act of 1986, as amended. During construction the local sponsor must contribute a minimum of 35% of the total cost of a project, with credit granted toward the amount for providing lands, easements and rights-of-way, and for structural projects, pay a minimum cash requirement of 5% of the total project cost. The local sponsor (a state or local government) must have the legal and financial capability to fulfill the requirements of cost sharing and local cooperation. The sponsor generally must agree to the following:

- Contribute the local share of project planning and construction costs;
- Provide all lands, easements, rights-of-way, relocations, and dredged material disposal area;
- Provide any additional cash contributions needed to make the local sponsor's share of the flood damage reduction cost at least 35%;

- Hold and save the United States free from damages due to the construction and maintenance of the project, except damages due to fault or negligence of the United States or its contractors;
- Prepare a floodplain management plan designed to reduce the impact of future flood events in the project area;
- Comply with provisions of pertinent Federal acts in carrying out specified non-Federal responsibilities of the project; and
- Operate, maintain, repair, replace, and rehabilitate the project.

HOW CAN A STUDY BE REQUESTED?

An investigation under Section 205 may be initiated after receipt of a formal request from the prospective sponsoring agency. A sample letter is offered below. This letter is generally referred to as a Letter of Intent (LOI) and must be received by the Corps from a prospective non-Federal sponsor prior to initiating the feasibility phase.

District Engineer
U.S. Army Corps of Engineers, Huntington District
502 8th Street
Huntington, West Virginia 25701

Dear Sir:

In accordance with the provisions of Section 205 of the Flood Control Act of 1948, as amended, the (name of local sponsor) requests the Corps of Engineers to undertake a flood control study for (name of site) along (name of stream).

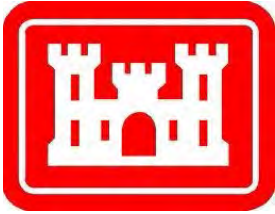
We are aware of the following cost sharing requirements associated with projects undertaken under this authority.

- a) Feasibility Phase is Federally funded up to \$100,000. Costs in excess of \$100,000 are cost shared on a 50/ 50 basis with the local sponsor. The sponsor's 50% share of any costs over \$100,000 may be provided by in-kind services.
- b) Preparation of Plans and Specifications is cost-shared in the same proportion as construction and is collected with the construction cost share.
- c) Sponsor's Share of Construction for structural measures consists of provision of land, easements, rights-of-way, relocations and disposal areas, plus a cash contribution of at least 5% of the total project cost. If this amount is less than 35% of the total project cost, the sponsor is required to provide additional cash contribution to equal 35%. The sponsor's cost share is limited to a maximum of 50% of the total cost when the project is under the Federal limit of \$7,000,000. The sponsor's share for nonstructural measures such as flood proofing is 35%.
- d) The sponsor is responsible for the operation and maintenance of the project after it is completed.

We are aware that this letter serves as an expression of intent and not a contractual obligation and either party may discontinue the study process at any stage prior to construction.

Sincerely,

(Name and title of public official authorized to request study)



CONTINUING AUTHORITIES PROGRAM

SECTION 206

Aquatic Ecosystem Restoration

WHAT CAN THE CORPS DO?

Section 206 of the Water Resources Development Act of 1996, provides authority for the Corps to restore aquatic ecosystems. A project is accepted for construction after a detailed investigation shows it is technically feasible, environmentally acceptable, and provides cost effective environmental benefits. Each project must be complete within itself, not a part of a larger project. The maximum Federal expenditure per project is \$5,000,000, which includes both planning and construction costs.

The Corps does restoration projects in areas that affect water, such as rivers, lakes, and wetlands. We evaluate projects that benefit the environment through restoring, improving, or protecting aquatic habitat for plants, fish and wildlife.

After a state or local agency requests Federal assistance, the Corps will conduct a feasibility study pending potential Federal interest and available funding. The feasibility study begins at Federal expense. Study costs in excess of \$100,000 are shared 50/50 with the non-Federal sponsor according to a Feasibility Cost Sharing Agreement (FCSA). In the feasibility study, the problem is defined, project viability is determined, potential solutions are identified, and the most feasible plan is selected for implementation. The costs, benefits, and environmental impacts of the potential project are analyzed. A draft project partnership agreement (PPA) is drawn up by which the Federal government and the sponsor agree to share project construction costs. No more than two years should pass between the start of the feasibility study and the time the project is ready for construction.

WHAT ARE THE LOCAL RESPONSIBILITIES?

Costs for Section 206 projects are shared between the Federal government and a non-Federal sponsor in accordance with the Water Resources Development Act of 1986, as amended. During construction the non-Federal sponsor must contribute a minimum of 35% of the total cost of a project, with credit granted toward the amount for providing lands, easements and rights-of-way, and pay a minimum cash requirement of 5% of the total project cost. Section 206 also allows credit for certain works in-kind, including design work, provision of materials, and construction activities. Contributions, such as volunteer labor, can also be accepted to reduce the overall project cost. The local sponsor (a state or local government) must have the legal and financial capability to fulfill the requirements of cost sharing and local cooperation. The sponsor generally must agree to the following:

- Provide all lands, easements, rights-of-way, relocations, and dredged material disposal areas;
- Provide any additional cash contributions needed to make the local sponsor's share
- of the cost 35%;

- Hold and save the United States free from damages due to the construction and maintenance of the project, except damages due to fault or negligence of the United States or its contractors;
- Provide all access routes and relocations of utilities necessary for project construction and subsequent operation and maintenance;
- Comply with provisions of pertinent Federal acts in carrying out the specified non- Federal responsibilities of the project;
- Contribute in cash the local share of project planning and construction cost; and
- Maintain and operate all the non-Federal works after completion in accordance with regulations prescribed by the Secretary of the Army.

HOW CAN A STUDY BE REQUESTED?

An investigation under Section 206 may be initiated after receipt of a formal request from the prospective sponsoring agency. A sample letter is offered below. This letter is generally referred to as a Letter of Intent (LOI) and must be received by the Corps from a prospective non-Federal sponsor prior to initiating the feasibility phase.

District Engineer
U.S. Army Corps of Engineers, Huntington District
502 8th Street
Huntington, West Virginia 25701

Dear Sir:

In accordance with the provisions of Section 206 of the Water Resources Development Act of 1996, as amended, the (name of local sponsor) requests the Corps of Engineers to undertake a study of aquatic ecosystem restoration at (name of site) along (name of stream(s)).

(Briefly describe the nature of the aquatic ecosystem restoration and any issues that might affect the acceptability of any recommended solutions, from the perspective of local government and/or the public.)

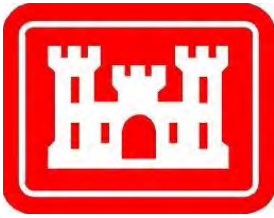
We are aware of the following cost sharing requirements associated with projects undertaken under this authority.

- a) Feasibility Phase is Federally funded up to \$100,000. Costs in excess of \$100,000 are cost shared on a 50/50 basis with the local sponsor. The sponsor's 50% share of any costs over \$100,000 may be provided by in-kind services.
- b) Preparation of Plans and Specifications is cost-shared in the same proportion as construction and is collected with the construction cost share.
- c) Non-federal interests shall provide 35% of the cost of construction including the provision of all lands, easements, rights-of-way, and necessary relocations.
- d) The non-Federal share of construction costs shall be paid after the project is approved for implementation and before a construction contract is awarded.
- e) The non-Federal Sponsor is responsible for all operation, maintenance, repair, rehabilitation and replacement of the project.

We are aware that this letter serves as an expression of intent and not a contractual obligation and either party may discontinue the study process at any stage prior to construction.

Sincerely,

(Name and title of public official authorized to request study)



Planning Assistance to States

Authority and Scope.

Section 22 of the Water Resources Development Act (WRDA) of 1974, as amended, provides authority for the Corps of Engineers to assist the States, local governments, and other non-Federal entities in the preparation of comprehensive plans for the development, utilization, and conservation of water and related land. Section 208 of the Water Resources Development Act of 1992 amended the WRDA of 1974 to include Native American Tribes as equivalent to a State.

Funding.

The Planning Assistance to States (PAS) Program is funded annually by Congress. Federal allotments for each State or Tribe from the nation-wide appropriation are limited to \$500,000 annually, but typically are much less. Individual studies, of which there may be more than one per State or Tribe per year, generally cost \$25,000 to \$75,000. These studies are cost shared on a 50 percent Federal-50 percent non-Federal basis.

Program Development.

The needed planning assistance is determined by the individual States and Tribes. Every year, each State and Indian Tribe can provide the Corps of Engineers its request for studies under the program, and the Corps then accommodates as many studies as possible within the funding allotment. Typical studies are only planning level of detail; they do not include detailed design for project construction. The studies generally involve the analysis of existing data for planning purposes using standard engineering techniques although some data collection is often necessary. Most studies become the basis for State or Tribal and local planning decisions. To assist in expediting a request for Planning Assistance to States activities, a sample letter and Cost Sharing Agreement are included.

Typical Studies. The program can encompass many types of studies dealing with water resources issues. Types of studies conducted in recent years under the program include the following:

- Water Supply and Demand Studies
- Water Quality Studies
- Environmental Conservation/Restoration Studies
- Wetlands Evaluation Studies
- Dam Safety/Failure Studies
- Flood Damage Reduction Studies
- Flood Plain Management Studies
- Coastal Zone Management/Protection Studies

- Harbor/Port Studies

How to Request Assistance. State, local government, and Tribal officials who are interested in obtaining planning assistance under this Program can contact the appropriate Corps office for further details. Alternatively, interested parties can contact the appropriate State or Tribal Planning Assistance to States coordinator to request assistance. In either case, the Corps will coordinate all requests for assistance with the State or Tribal Planning Assistance to States coordinator to ensure that studies are initiated on State or Tribal prioritized needs.

**SAMPLE COST SHARING AGREEMENT
FOR
PLANNING ASSISTANCE BETWEEN
THE U.S. ARMY CORPS OF ENGINEERS
AND
(SPONSOR'S NAME)**

THIS AGREEMENT, entered into this ____ day of _____, by and between the United States of America (hereinafter called the "Government"), represented by the Contracting Officer executing this Agreement, and (Name of the Requesting State Entity or Tribe)(hereinafter called the "Sponsor").

WITNESSETH, that

WHEREAS, the Congress has authorized the Corps of Engineers in Section 22 of the Water Resources Development Act of 1974 (Public Law 93-251) as amended to assist the States in the preparation of comprehensive plans for the development, utilization and conservation of water and related land resources; and whereas, Section 319 of the Water Resources Development Act of 1990 (Public Law 101-640) authorized the Government to collect from non-Federal entities fees for the purpose of recovering fifty (50) percent of the cost of the program; and,

WHEREAS, the Sponsor has reviewed the State's comprehensive water plans and identified the need for the planning assistance as described in a Scope of Studies; (Name of the study which is described in Appendix A), incorporated into this agreement; and

WHEREAS, the Sponsor has the authority and capability to furnish the cooperation hereinafter set forth and is willing to participate in study cost-sharing and financing in accordance with the terms of this agreement;

NOW THEREFORE, the parties agree as follows:

1. The Government, using funds contributed by the Sponsor and appropriated by the Congress, shall expeditiously prosecute and complete the Study, estimated to be completed within twelve (12) months, substantially in compliance with the Scope of Studies attached as Appendix A and in conformity with applicable Federal laws and regulations and mutually acceptable standards of engineering practice.

2. The Government and the Sponsor shall contribute in cash, fifty (50) percent and fifty (50) percent, respectively, of all study costs, the total cost of which is currently estimated to be \$____, as specified in the cost estimate attached as Appendix B. The Sponsor agrees to provide a cashier or certified check in the amount of \$____ which shall be made payable to FAO, USAED, (**District Office**), prior to any work being performed under this Agreement.

3. No Federal funds may be used to meet the local Sponsor share of study costs under this Agreement unless the expenditure of such funds is expressly authorized by statute as verified by the granting agency.

4. Before any Party to the Agreement may bring suit in any court concerning any issue relating to this Agreement, such Party must first seek in good faith to resolve the issue through negotiation or another form of nonbinding alternate dispute resolution mutually acceptable to the Parties.

5. In the event that any one or more of the provisions of this Agreement is found to be invalid, illegal, or unenforceable, by a court of competent jurisdiction, the validity of the remaining provisions shall not in any way be affected or impaired and shall continue in effect until the Agreement is completed.

6. This Agreement shall become effective upon the signature of both Parties.

For the Sponsor:

By: _____

Title: _____

Date: _____

For the Corps:

By: _____

Title: _____

Date: _____

District Engineer
U.S. Army Corps of Engineers, Huntington District
502 8th Street
Huntington, West Virginia 25701

Dear Sir:

This is in reference to the Corps of Engineers' Planning Assistance to States Program. We understand that the provisions of Section 22 of the Water Resources Development Act of 1974, as amended, provides authority for the Corps to assist in the preparation of comprehensive plans for the development, utilization, and conservation of water and related land resources. The **[name of State, Indian Tribe, local government, or other non-Federal entity]** requests planning assistance for **[briefly describe problem or need, including if appropriate, the name of the body of water or waterway, and City, Township, etc.]**, in **[County and State]**.

We would like to discuss the availability of information, required schedule, and level of effort required in order to negotiate the appropriate Letter of Agreement to initiate a Section 22 study. Please contact **[Name, title, phone number]** to arrange a further discussion of this inquiry.

Signature of Cooperating Agency or Individual

**SAMPLE COST SHARING AGREEMENT
FOR
PLANNING ASSISTANCE BETWEEN
THE U.S. ARMY CORPS OF ENGINEERS
AND
(SPONSOR'S NAME)**

THIS AGREEMENT, entered into this ____ day of _____, by and between the United States of America (hereinafter called the "Government"), represented by the Contracting Officer executing this Agreement, and (Name of the Requesting State Entity or Tribe)(hereinafter called the "Sponsor").

WITNESSETH, that

WHEREAS, the Congress has authorized the Corps of Engineers in Section 22 of the Water Resources Development Act of 1974 (Public Law 93-251) as amended to assist the States in the preparation of comprehensive plans for the development, utilization and conservation of water and related land resources; and whereas, Section 319 of the Water Resources Development Act of 1990 (Public Law 101-640) authorized the Government to collect from non-Federal entities fees for the purpose of recovering fifty (50) percent of the cost of the program; and,

WHEREAS, the Sponsor has reviewed the State's comprehensive water plans and identified the need for the planning assistance as described in a Scope of Studies; (Name of the study which is described in Appendix A), incorporated into this agreement; and

WHEREAS, the Sponsor has the authority and capability to furnish the cooperation hereinafter set forth and is willing to participate in study cost-sharing and financing in accordance with the terms of this agreement;

NOW THEREFORE, the parties agree as follows:

1. The Government, using funds contributed by the Sponsor and appropriated by the Congress, shall expeditiously prosecute and complete the Study, estimated to be completed within twelve (12) months, substantially in compliance with the Scope of Studies attached as Appendix A and in conformity with applicable Federal laws and regulations and mutually acceptable standards of engineering practice.

2. The Government and the Sponsor shall contribute in cash, fifty (50) percent and fifty (50) percent, respectively, of all study costs, the total cost of which is currently estimated to be \$____, as specified in the cost estimate attached as Appendix B. The Sponsor agrees to provide a cashier or certified check in the amount of \$____ which shall be made payable to FAO, USAED, (**District Office**), prior to any work being performed under this Agreement.

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5. In the event that any one or more of the provisions of this Agreement is found to be invalid, illegal, or unenforceable, by a court of competent jurisdiction, the validity of the remaining provisions shall not in any way be affected or impaired and shall continue in effect until the Agreement is completed.

6. This Agreement shall become effective upon the signature of both Parties.

For the Sponsor:

By: _____

Title: _____

Date: _____

For the Corps:

By: _____

Title: _____

Date: _____

District Engineer
U.S. Army Corps of Engineers, Huntington District
502 8th Street
Huntington, West Virginia 25701

Dear Sir:

This is in reference to the Corps of Engineers' Planning Assistance to States Program. We understand that the provisions of Section 22 of the Water Resources Development Act of 1974, as amended, provides authority for the Corps to assist in the preparation of comprehensive plans for the development, utilization, and conservation of water and related land resources. The **[name of State, Indian Tribe, local government, or other non-Federal entity]** requests planning assistance for **[briefly describe problem or need, including if appropriate, the name of the body of water or waterway, and City, Township, etc.]**, in **[County and State]**.

We would like to discuss the availability of information, required schedule, and level of effort required in order to negotiate the appropriate Letter of Agreement to initiate a Section 22 study. Please contact **[Name, title, phone number]** to arrange a further discussion of this inquiry.

Signature of Cooperating Agency or Individual



Planning Assistance to States

U.S. ARMY CORPS OF ENGINEERS

BUILDING STRONG®

States, local governments and Native American Tribes often have needs in planning for water and related resources of a drainage basin or larger region of a state, for which the Corps of Engineers has expertise.

Authority and Scope. Section 22 of the Water Resources Development Act (WRDA) of 1974, as amended, provides authority for the Corps of Engineers to assist the States, local governments, Native American Tribes and other non-Federal entities, in the preparation of comprehensive plans for the development and conservation of water and related land resources.

Program Development. The needed planning assistance is determined by the individual States and Tribes. Typical studies are only undertaken at the planning level of detail; they do not include detailed design for project construction. The studies generally involve the analysis of existing data for planning purposes using standard engineering techniques although some data collection is often necessary. Most studies become the basis for State or Tribal and local planning decisions.

Typical Studies. The program can encompass many types of studies, dealing with water resources issues. Types of studies conducted in recent years under the program include the following:

- Water Supply and Demand Studies
- Water Quality Studies
- Environmental Conservation/Restoration Studies
- Wetlands Evaluation Studies
- Dam Safety/Failure Studies
- Flood Risk Management Studies
- Flood Plain Management Studies
- Coastal Zone Management/Protection Studies
- Harbor/Port Studies



Redwood Creek flow capacity study



Eau Galle River nutrient study for water quality

Funding. The Planning Assistance to States program is funded annually by Congress. Federal allotments for each State or Tribe from the nation-wide appropriation are limited to \$2,000,000 annually, but typically are much less. Individual studies, of which there may be more than one per State or Tribe per year, are cost shared on a 50 percent Federal - 50 percent non-Federal basis (may include 100% work in kind).

How to Request Assistance. State, local government and Tribal officials who are interested in obtaining planning assistance under this Program can contact the appropriate USACE office for further details. Alternatively, interested parties can contact the appropriate State or Tribal Planning Assistance to States coordinator to request assistance. In either case, USACE will coordinate all requests for assistance with the State or Tribal Planning Assistance to States coordinator to ensure that studies are initiated on State or Tribal prioritized needs.

Point of Contact for Factsheet:

Maria Wegner-Johnson
USACE Headquarters
202-761-5541



Flood Plain Management Services Program

U.S. ARMY CORPS OF ENGINEERS

BUILDING STRONG®

People that live and work in the flood plain need to know about the flood hazard and the actions that they can take to reduce property damage and to prevent the loss of life caused by flooding.

The Flood Plain Management Services (FPMS) Program was developed by the Corps of Engineers specifically to address this need.

Authority, Objective, and Scope. The program's authority stems from Section 206 of the 1960 Flood Control Act (PL 86-645), as amended. Its objective is to foster public understanding of the options for dealing with flood hazards and to promote prudent use and management of the Nation's flood plains.

Land use adjustments based on proper planning and the employment of techniques for controlling and reducing flood damages provide a rational way to balance the advantages and disadvantages of human settlement on flood plains. These adjustments are the key to sound flood plain management.

Types of Assistance. The FPMS Program provides the full range of technical services and planning guidance that is needed to support effective flood plain management.

a. General Technical Services. The program develops or interprets site-specific data on obstructions to flood flows, flood formation and timing; and the extent, duration, and frequency of flooding. It also provides information on natural and cultural flood plain resources of note, and flood loss

potentials before and after the use of flood plain management measures.

b. General Planning Guidance. On a larger scale, the program provides assistance and guidance in the form of "Special Studies" on all aspects of flood plain management planning including the possible impacts of off-flood plain land use changes on the physical, socio-economic, and environmental conditions of the flood plain.

This can range from helping a community identify present or future flood plain areas and related problems, to a broad assessment of which of the various remedial measures may be effectively used.

Some of the most common types of Special Studies include:

- **Flood Plain Delineation/Flood Hazard Evaluation Studies**
- **Dam Break Analysis Studies**
- **Hurricane Evacuation Studies**
- **Flood Warning/Preparedness Studies**
- **Regulatory Floodway Studies**
- **Comprehensive Flood Plain Management Studies**
- **Flood Risk Management Studies**
- **Urbanization Impact Studies**
- **Stormwater Management Studies**
- **Flood Proofing Studies**
- **Inventory of Flood Prone Structures**
- **Evaluation of Levees for Potential FEMA Certification**



Flood Plain Management Services Program

U.S. ARMY CORPS OF ENGINEERS

BUILDING STRONG®



Example of a typical flood proofed structure

The program also provides guidance and assistance for meeting standards of the National Flood Insurance Program, flood risk communication and for conducting workshops and seminars on non-structural flood plain management measures, such as Flood Proofing.

c. Guides, Pamphlets, and Supporting Studies. Studies are conducted under the program to improve the methods and procedures for mitigating flood damages. Guides and pamphlets are also prepared on flood proofing techniques, flood plain regulations, flood plain occupancy, natural flood plain resources, and other related aspects of flood plain management.

The study findings and the guides and pamphlets are provided free-of-charge to Federal agencies, Indian Tribes, State, regional and local governments and private citizens for their use in addressing the flood hazard.

Charges for Assistance. Upon request, program services are provided to State, regional, and local governments, Indian Tribes, and other non-Federal public agencies without charge.

State, regional, local government, non Federal public agencies and Tribes can

request activities/assistance under this program and provide voluntary funding. For most of these requests, payment is required before services are provided. Letter requests or signed agreements are used.

All requestors are encouraged to furnish available field survey data, maps, historical flood information and the like, to help reduce the cost of services.



Meeting with local governmental officials

How to Request Assistance. Agencies, governments, organizations, and individuals interested in flood-related information or assistance should contact the appropriate Corps office. Information that is readily available will be provided in response to a telephone request. A letter request is required for assistance that involves developing new data, making a map, or preparing a report.

Point of Contact for Factsheet:

Maria Wegner-Johnson
USACE Headquarters
202-761-5541

Prior Studies, Reports and Existing Water Projects

Several investigations concerning the study area have been made by various organizations since the 1930's. To gain a better understanding of problems, needs and opportunities within the watershed, the findings and results of prior studies and reports – along with implemented water resources projects – were considered as part of the FWA. Prior studies, reports and existing projects are summarized below:

Section 905(b) Reconnaissance Study, Muskingum River Basin, Ohio System Study (2000)

A Section 905(b) reconnaissance study for the Muskingum River Basin was conducted under USACE's General Investigations Program and was authorized by the US House of Representatives' Resolution Comprehensive Flood Control Plan for Ohio and Lower Mississippi Rivers, Committee on Flood Control, House of Representatives Committee Document No. 1, 75th Congress, 1st session. The purpose of the study was to evaluate potential federal interest in implementing solutions to flooding, ecosystem degradation, water supply, recreation and other related water resource problems and opportunities in the Muskingum River Basin, Ohio. In addition to infrastructure issues with existing Corps reservoirs, this study identified as significant issues in the Basin:

- residual flood damages;
- lack of floodplain management enforcement;
- ecosystem degradation; and
- recreation issues stemming from sedimentation resulting in loss of recreation pool acreage.

Some potential flood damage reduction measures recommended by the study included a limited nonstructural project and an early flood warnings system. The reconnaissance study went on to identify several Local Flood Protection Projects for further study. One was located on the East Branch of Nimishillen Creek upstream of the mouth of West Branch. All alternatives for this Local Protection Project consisted of varying levels of channel modifications; however the project was never constructed.

Muskingum River Basin System Operations Study (2006)

The goal of the study was to develop a comprehensive plan to revitalize the aging flood control system through infrastructure renewal, to ensure public safety and to improve water quality and other environmental resources through ecosystem restoration. The report served as the initial phase of work in the Basin; its purpose was to develop a preliminary plan of action for proceeding with projects under existing Corps authorities, as well as supporting a legislative initiative for a comprehensive study with General Investigations funding.

The report identified a number of water-resources problems in the Basin, many associated with USACE dams and reservoirs. These issues currently are being addressed under the Dam Safety Modification Program, which is discussed in more detail in the IWA. Other watershed problems identified by the report include acid mine drainage, residual flood damages, floodplain development, and water and sewer infrastructure needs.

The study also identified a number of potential measures for improving water resources within the Basin, such as:

- improve stream channels that have extensive erosion problems through a comprehensive program of bank stabilization and environmental restoration;
- reduce flood damages at several identified locations in the Muskingum Basin by implementing feasible structural or non-structural measures;
- renovate water and sewage treatment plants where infrastructure problems exist, if facilities are inadequate;
- review the accuracy of ten river gages downstream of the Muskingum reservoirs and determine whether floods have higher stages now than originally established, because of changes in downstream channel capacity;
- determine the need for and the economic feasibility of installing a flood warning system in the Muskingum River Basin in cooperation with state and local officials; and
- conduct surveys of the Muskingum River Basin to identify environmental problems or needs that can be addressed as part of a comprehensive environmental restoration program.

The scope of the renewal and revitalization program was described as “robust and multi-faceted,” estimated to cost more than \$2.4 billion (FY 06 price level) and to take several decades to complete. The report recommended that the Corps move on to a more detailed phase of study, to further define and quantify the potential scope of problems and opportunities. However, a more detailed study phase was never undertaken, and none of the

projects are currently budgeted, with the exception of those related to dam safety. Dam safety issues are being pursued under the USACE Dam Safety authority, an effort led by the USACE Risk Management Center.

Nimishillen Creek Watershed Action Plan (2007)

The Nimishillen Creek Watershed Action Plan was developed by the Northeast Ohio Four County Regional Planning and Development Organization (NEFCO). The purpose of the report was to develop a plan to protect and restore the water quality the Creek and its tributaries to meet state water quality standards and ensure the health and safety of watershed residents. It also endeavored to raise public awareness of pollution sources and solutions, as well as to consolidate existing watershed information previous reports and studies into a single, stand-alone report. The report is available online at: www.nefcoplanning.org/nimi_creek_wap.

Zimber Ditch Study (1997)

This study was undertaken by Stark County, Ohio as well as the City of North Canton and Jackson Township in March of 1997. Growth had been rapid in the North Canton area at the time and there was concern the new growth may have increased the risk of flooding. An array of alternatives was evaluated with the final recommendation including:

- Removal of pockets of siltation at most structures and restoration of the original grade line of the Zimber Ditch;
- Development of detention basins for the upper part of the drainage basin;
- Replacement of the bridge at Strausser Street;
- Replacement/construction of several culverts; and
- Construction of some bank stabilization.

With the exception of the detention basins, none of these alternatives were ever implemented.

Zimber Ditch Section 205 Study (2006)

This recon-level study was undertaken by the Huntington District in 2006 and focused primarily on the West Nimishillen drainage basin, including Zimber Ditch. Flooding issues along Zimber Ditch seemed to stem from stormwater run-off, resulting from rapid development in the area. The final recommendation (referencing the 1997 Zimber Ditch Study previously mentioned) was the development of a series of detention basins in the upper portion of the Basin. The recommended plan included approximately 6,000 feet of channel work along the Ditch, as well as the replacement of several culverts with larger culverts and bridges. The study did not progress to implementation/construction.

Section 594 Zimber Ditch Flood Control Project (2005)

The Section 594 project was undertaken by the Huntington District in 2005, and also referenced the previously aforementioned 1997 Zimber Ditch Study and the flooding issues thought to be a result of rapid growth in the area. As part of this effort, alternative locations for construction detention basins with the Zimber Ditch drainage basin were evaluated. The preferred alternative was the construction of two upstream detention basins (referred to as Basin A and Basin B) in areas which would not require the relocation of any businesses or residents. The construction of the detention basins was completed in 2010.

Flood Plain Study Main Report and Summary (1967)

This document was prepared by the USACE for the Ohio Department of Natural Resources (ODNR) and the Stark County Regional Planning Commission. The study provided planners and local governments with technical information on flooding along approximately 16 miles of the Nimishillen Creek and its West, East and Middle Branches.

Storm Drainage Facilities Plan Part II (1970)

This report was prepared by the Stark County Engineer for the Stark County Regional Planning Commission. The purpose of the report, together with the Storm Drainage Facilities Plan Part I, was to provide the foundation of a master drainage plan for future construction projects and to provide advance drainage information to land developers.

Flood Hazard Analysis Report (1975)

This report was prepared by the U.S. Department of Agriculture (USDA), Soil Conservation District in cooperation with the ODNR. The report was intended to serve as a technical base from which local floodplain management decision could be made along the East Branch of Nimishillen Creek.

Master Drainage Program Phase I (1975)

This report was prepared by Mosure & Syrakis, Ltd. for the Stark County Engineer. The report represented the first phase of the development of a two phase master flood control and drainage plan for Stark County, Ohio with the objective of Phase I describing the engineering scope of work, costs and priorities for each drainage basin within the County. Note: The Master Drainage Program Phase II was completed to outline the actual projects associated with the recommendations of the overall master drainage plan.

Flood Hazard Analysis Report (1977)

This report was prepared by the USDA, Soil Conservation District for the Stark County Commissioners, Stark County Regional Planning Commission and the ODNR. The report was intended to serve as a technical base from which local floodplain management decisions could be made along the Middle Branch of the Nimishillen Creek.

Flood Insurance Study (1983)

The report was prepared by Malcolm Pirnie, Inc. for the Federal Emergency Management Agency (FEMA). The report investigated the existence and severity of flood hazards in the unincorporated areas of Stark County including the Nimishillen Creek watershed. The study was to provide aid in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973, as well as to assist regional planners in their efforts to promote sound floodplain management.

**Final Water Assessment
Nimishillen Creek Watershed
Appendix H
Quality Control**

District Quality Review Comments	Type: DQC - FWA	Page 1 of 1
	Concept: Final: Other:	Date: 7/25/2014
Project: Final Watershed Assessment	Reviewer:	
Location: Nimishillen Watershed, Ohio	Name: Karen V. Miller	
	Organization: CELFH-PM-PD	

Comment Number	Report Section	Page/Space	COMMENT	RESPONSE
1	FWA	Header	General preference comment but do not see the need to take up 4 lines on each page with the Header. Would limit it to 2 lines at most.	Concur. Header was reduced to two lines.
2.	FWA	All	General. Ensure the size and quality of all maps that are being used in the report. Do not hesitate to make the map a full page or to have a fold-out map if it helps to show the details, etc.	Concur. Checked all the maps of the documents, replaced where necessary and made sure all were appropriately sized.
3.	FWA Sec 4.0		General. This section provides information on previous studies but does not present information to tell why they were relevant or how they were used in the completion of the analysis. Also, they are not well organized and if not heavily relied on could be put into an appendix for reference by others if necessary.	Concur. This chapter has been moved to its own Appendix.
4.	FWA	All	General. Suggest looking at areas where the document is Corps-centric and re-writing to show a more collaborative approach. For example, calling out the PDT and stakeholders separately shows that it is Corps and everyone else. Everyone collaborated on the effort so everyone should be considered a part of the PDT. After the introduction of how the groups were formed, the rest of the document should read that collectively these decisions were arrived at and not separately as in "the PDT" and "the stakeholders" agreed to something.	<p>Concur. Language in the report was changed to reflect a more collaborative approach.</p> <p>Note: During the study we did not consider the PDT part of the Technical group. It was more of a nomenclature decision than a reflection on the importance of that group.</p> <p>However, Technical group is used in the report to represent both the PDT and Technical group.</p>
5.	FWA	Figure 3.2	On the map there is no need to have a "red dot" in the legend representing a city with over 1 M pop if there are none in the watershed. Also, the dots on the map are very small and difficult to see for the small, less than 10K populations. Suggest using the same size circle with the color code in the legend to distinguish the sizes.	Concur. We are re-working this map to reflect the suggested changes.
6.	FWA Sec 3.0	Table 3.2	This table merely lists the Cities, Villages and Townships with no other data so it is really not necessary to show in table form. However, it	Concur. I listed the townships and included the cities and villages in a table along with the population.

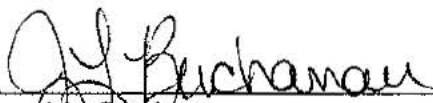
			would be an easy addition to put a column in with population, % growth, and/or other pertinent data. If you are going to have a table, make it useful for more than one thing, otherwise simply list the names in paragraph form. Another suggestion if you don't add more data is to make the table with 3 columns and put the types of communities across the top and list the names underneath. This just seems like a missed opportunity to provide information for the watershed in one location.	
7.	FWA Sec 5.1		The Section is titled Historical Flooding but begins with a statement and reference to a Figure showing stormwater detention basins. Suggest deleting from this section and finding a more appropriate location in the Stormwater Management Section or move it to 5.4.6.	Concur. I removed the language about the existing stormwater retention basins to the stormwater section.
8	FWA Sec 5.4.1		This section portrays FEMA in a negative light. They only get so much funding and have to prioritize updates just as all Fed agencies have to consider how to use their funding to accomplish the mission. If updating the FEMA defined floodway for FIRMs is the goal, then it should be recognized as such and instead of saying it is typically FEMA's responsibility to update the H&H etc, state that FEMA updates them on a cycle and Nimishillen isn't in the near-term. Therefore, local entities could advance the work to update it to submit to FEMA for adoption. Since the issue is really that the FIRMs are based on the floodway as FEMA defines it, it is in FEMA's purview and delete the wording that says "Typically..."	Concur. Reworded: However, FEMA, it is unknown when FEMA may have the resources available to update their models and mapping for the Nimishillen Creek Watershed. Therefore, the Floodway Update may need to be completed by the local communities within the watershed.
9	FWA Sec 5.4.2		"There is an ongoing effort underway..." needs more explanation. Who is leading this effort and what is the timeframe for installation?	Concur. Reworded: During the stakeholder collaboration meetings several of the MWCD and local representatives from several of the cities and villages began working together to install more stream and rain gages.
10	FWA Sec 6.0		The caveat about water quality efforts not being as urgent begs the question why this section follows flooding and isn't put last before the Miscellaneous topics. Perhaps this disclaimer should be put in the Water Resources Section so the reader is already aware that there are really 3 issues being focused on for the WMP and this issue is	Concur. This statement was removed from the FWA. The statement was made without any real buy in or concurrence from the PDT and/or stakeholders. We don't have anything to say that water quality isn't as urgent an issue as the others.

			actually so urgent that it is being worked by other entities now because of both its importance and that there is an abundance of programs to assist with improving water quality.	
11	FWA Overall		General. There are several areas of solutions within flooding and urban stormwater management that also cross over into improving water quality. However, throughout the FWA these are kept fairly separate and the synergy between them gets lost. Collaborative planning takes advantage of all the programs out there and applies them so that the focus can be broader. Would like to see some type of table or display that shows how the final solutions affect more than one issue.	Concur. I have added a column to the Table showing top priority recommendations, which identifies which water resource issues could be impacted by the recommendation's implementation.
12	FWA Sec 7.0		<p>Urban growth is shown through 2 Land Use maps. Suggest that the 2013 Land Use map should be a part of the basin description, along side population and other identifying characteristics and could be referred to for each of the water resource issues.</p> <p>The 2nd Land Use map which is supposed to show land use changes over 4 years is annotated from 2010-2013 which represents 3 years unless it is from Jan 1, 2010 to Dec 31, 2013 and truly includes all 4 years of data. Also, there are small graphs to indicate relative change but no way to know the percentage range and whether they are very large or not. The colors in the sub-basins should be eliminated as they look like they correlate to the types of land use (same color scheme). If those colors are left in, the legend colors representing the various land use types need to match the bright colors used in the graphs. Also, there is no additional information derived from this map and discussed within the write-up. Narrative describing what this map displays and which areas are of most concern would complement the readers understanding of the issue being presented.</p>	<p>Concur. I have moved the 2013 land use map to the study area description chapter.</p> <p>I have removed this map. It is not used to demonstrate any of the text in the document.</p>
13	FWA 9.0	Section title	Suggest changing "Miscellaneous Solutions" to "General Considerations for Improvements in the Watershed" or "Other Solutions" to portray these as important components of the FWA and WMP.	Concur. This section was re-titled "Miscellaneous Recommendations."

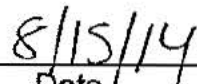
14	FWA Sec 10.1		<p>This section shows the prioritization of the recommendations made through the process of the FWA. The prioritization is made in the four separate issue areas and then a top ten list is made from those. However, there is no information for who is leading each effort, what the timeframe would be for accomplishing the recommendation and how the recommendation might be a solution that crosses several areas in a synergistic effect.</p>	<p>Concur. With a few exceptions we do not have firm commitments from our stakeholders about who would be willing to take the lead in implanting the recommendations. I have added a column to the tables, showing the ones whom have voiced an interest, or have been identified in the FWA. We have not discussed timelines for implementation for any of the recommendations.</p> <p>See the response to comment 11 for how we have addressed a recommendation crossing across line items.</p>
15	FWA Sec 10.2- 10.3		<p>These two sections are Corps and everyone else. Again this puts the Corps at the forefront and leaves out the collaborative process. I expected to see a list of problems and potential solutions in a table form where the Corps might be one option. Instead it appears that this report was done in order to get Corps projects. All of what is in these two sections is good information, however it is displayed in such a way that it does not seem the Sec 729 authority or process is any different than any other Corps authority.</p>	<p>Concur. This section was reworked. Rather than organizing potential projects as Corps and NonCorps they're now organized by line item. FRM, Water Quality, Stormwater Management and Floodplain Management.</p>
16	WMP		<p>General. Did not see a marked difference in the WMP and the same sections found in the FWA. It is not clear what the value of the WMP has for the stakeholders as it is not really a plan for management of water resources within the watershed that discusses what will be done, by whom and when. It gives recommendations and priorities but does not take the next step to add teeth or a framework for accomplishing the recommendations.</p>	<p>Concur. The two documents have been combined into a single "Final Watershed Assessment and Watershed Management Plan."</p> <p>During our stakeholder meetings we have not discussed a timeline for the implementation of recommendations. We've been told that funding is very tight, and they plan to use the document as a long term tool – coming back to it when resources become available.</p>
16	ALL		<p>Other grammatical and suggestions provided through tracked changes to the word document.</p>	<p>Concur. I appreciate the second set of eyes and have made the changes.</p>

CERTIFICATION OF DISTRICT QUALITY CONTROL

All comments made as part of the District Quality Control Review of the Section 729 Nimishillen Creek Final Watershed Assessment and Watershed Management Plan have been addressed. No outstanding comments remain.



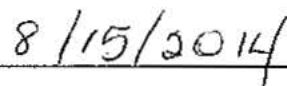
Jami L. Buchanan
Author (Planning Lead)



Date



Karen Miller
Great Lakes and Ohio River Division
Regional Technical Specialist
Flood Risk Management



Date

**Nimishillen Creek Watershed
Section 729
Final Watershed Assessment and Water
Management Plan**

ATR Review Report

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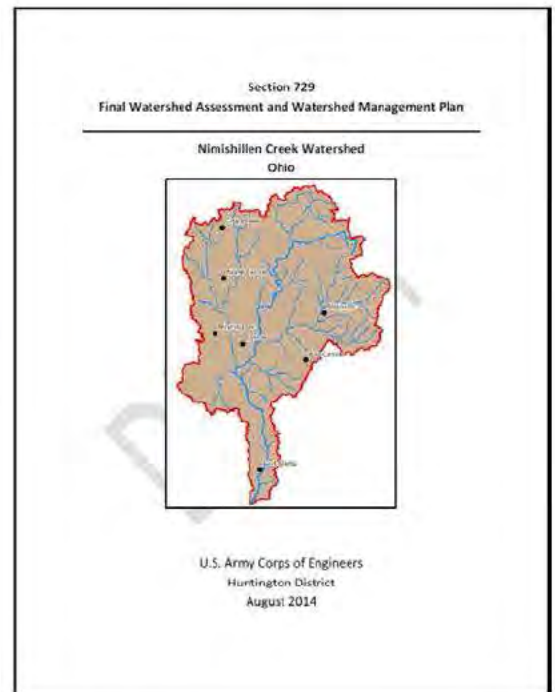
Agency Technical Review Report

Subject: Review report for the Final Watershed Assessment and Watershed Management Plan for the Section 729 Nimishillen Creek Watershed, Ohio, August 2014, Huntington District.

1. Scope and Purpose of Review. The purpose of this review report is to document one phase of agency technical review (ATR) for the subject product. The review was conducted for the Huntington District. The primary point of contact for the District was Jami Buchanan, CELRH. The ATR team (ATRT) was lead by Janet Cote, CENAO. The Great Lakes and Ohio River Division Review Management Organization (RMO) was the lead center for managing this ATR.

2. References. This review report was prepared in response to EC 1165-2-209, 31 January 2010, Water Resources Policies and Authorities, CIVIL WORKS REVIEW POLICY. The review documents reside online at ProjNet (www.projnet.org), DrChecks Project and Review titles: (NIMISHILLEN) Nimishillen Watershed Ohio, ATR of Section 729 Nimishillen Final Watershed Assessment.

3. Project Description. The Section 729 Nimishillen Creek Final Watershed Assessment (FWA) was completed under the authority of Section 729 of the Water Resources Development Act (WRDA) of 1986 (Public Law 99-662), which later was amended by Section 202 of WRDA 2000 and Section 2010 of WRDA 2007 and a resolution (adopted May 16, 1955) of the US Senate Committee on Public Works. It was a follow on study to the Section 729 Initial Watershed Assessment (IWA) for the Muskingum River Basin prepared by the Huntington District in 2011. The Nimishillen Creek Watershed is a part of the Muskingum River Basin, which lies in the eastern portion of Ohio. Nimishillen Creek is 23.5 miles long, and drains approximately 187 square miles, including the entire City of Canton. The watershed covers portions of Stark, Summit and Tuscarawas Counties. The goal of the FWA was the development of a Watershed Management Plan (WMP) for the Nimishillen Creek Watershed which addresses water resources related issues pertaining to flooding, water quality, stormwater management and floodplain management. These issues were identified through extensive stakeholder involvement, including meetings and workshops held with local officials such as mayors, city managers and city and county engineers, as well as representatives from various State of Ohio resource agencies. Once these issues were identified, the Huntington District Project Delivery Team (PDT), in continued partnership with the stakeholders, began to identify potential solutions for each issue. The Huntington District developed each potential solution and finally developed a prioritization of recommendations for implementation. While 21 recommendations were made, 10 were identified as the most critical. They include:



- Installation of additional rain/stream gages through the watershed;
- A Floodway Update for the Nimishillen Creek Watershed;
- Development of a Flood Warning System;
- Consolidation of floodplain management duties;
- Addressing sewage treatment in the watershed;
- Establishing consistency in stormwater management regulations across the watershed;
- Addressing manholes inundated during high water events;
- Development of a Flood Warning Emergency Evacuation Plan;
- Connecting water related networks; and
- Making improvements to local land use zoning.

The two most critical recommendations made by the WMP are the installation of additional rain/stream gages and development of a Floodway Update. The implementation of these two alternatives will provide information that will help with the efficient and effective implementation of the other recommended alternatives. The WMP describes a comprehensive plan for managing land and water resources within the watershed via a holistic process which reflects the interdependency of land owners and water users, competing demands on water resources and the desires of the stakeholders.

4. Required Disciplines for Technical Review.

ATR Team Lead. The team lead should understand the requirements of EC 1165-2-209, 31 January 2010, Water Resources Policies and Authorities, CIVIL WORKS REVIEW POLICY; have a thorough understanding of Projnet's DrChecks; be accomplished in the management of multidisciplinary teams and issue resolution; be proficient in developing the review report to document the ATR; and have extensive knowledge of the authorities, regulations, and policies of the Corps of Engineers.

Planning Formulation. The Planning reviewer should be a senior water resources planner with experience in flooding and water quality issues. There will be extensive alternative analyses within the plan that would need to be reviewed along with determinations of likely interested parties for project implementation.

Environmental. The Environmental reviewer should be well versed on ecosystems. Although the watershed plan will not include any National Environmental Policy Act (NEPA) evaluations, the concepts and principles behind NEPA will be used to determine the appropriateness of recommended actions. Due to the possibility of future Corps projects being indentified, this reviewer should also be familiar with actions requiring review in accordance with environmental policies, procedures, laws and regulations that apply to Corps projects.

Hydrology & Hydraulics. The interaction between water management and its

impact on streams is of paramount importance in this investigation. Familiarity with standard hydrologic and hydraulic modeling and its application may be required.

5. Review Team.

Name	Role	Office Symbol	Phone	Email
Janet Cote	ATRT Lead	CENAO-WR-PE	757-201-7837	Janet.Cote@usace.army.mil
Sue Ferguson	Plan Formulation	CELRN-PM-P	615-736-7192	
Janet Cote	Environmental	CENAO-WR-PE	757-201-7837	Janet.Cote@usace.army.mil
Phyllis Kohl	Hydraulics & Hydrology	CELRN-EC-H	615-736-5948	Phyllis.Kohl@usace.army.mil

6. Charge to Reviewers. Enclosure 1 includes the document entitled “Charge to Project Delivery Team and Reviewers”.

7. Summary.

a. Critical.

No comments submitted during the ATR were identified as being Critical.

b. Unresolved

No comments were left unresolved upon completion of the review.

c. Lessons Learned.

The watershed assessment was well written and provided an excellent summary of the problems that the watershed is experiencing, while presenting a thoughtful plan to move forward in addressing those problems. The more significant of the ATR comments addressed a variety of topics. These included providing additional background information about conditions within the watershed, increasing involvement with local educational institutions and other agencies and organizations in the watershed planning process, and the amount of existing data that was available to the planning team.

8. Dr Checks Report. A report of all Dr. Checks comments is attached as Enclosure A.

9. ATR Completion and Certification. Enclosure 3 contains completion and certification statements.

Janet Cote
Norfolk District
Ecologist

Enclosure 1
**CHARGE TO PROEJCT DELIVERY TEAM AND
REVIEWERS**

**AGENCY TECHNICAL REVIEW
CHARGE TO PROJECT DELIVERY TEAM AND REVIEWERS
Section 729 Nimishillen Creek
Huntington District
Final Management Plan**

**Prepared by: Janet Cote
Date: August 15th 2014**



**US Army Corps
of Engineers®**

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AGENCY TECHNICAL REVIEW
CHARGE TO THE PROJECT DELIVERY TEAM & REVIEWERS

1. General. EC 1165-2-209 “Civil Works Review Policy” establishes procedures to ensure the quality and credibility of Corps documents and work products. The Corps’ Planning Centers of Expertise (PCX) are generally responsible for the accomplishment and quality of Agency Technical Review (ATR) for decision documents. Reviews will be assigned to the appropriate Corps PCX based on business programs. A Review Plan (RP) describes the scope of review for the current and/or upcoming phase of work (Feasibility, Preconstruction Engineering and Design, construction, etc.) and is a component of the Quality Management Plan (QMP) in the Project Management Plan (PMP) or Program Management Plan (PgMP). This charge to the Project Delivery Team (PDT) and reviewers is an attachment to the RP and serves as the scope of work for the conduct of the PDT and ATRT for this specific review.

ATR is a critical examination by a qualified agency technical review team (ATRT) whose members were not involved in the day-to-day technical work that supports the decision document. ATRT members should not work within the supervisory structure of anyone conducting the technical work. The intent of ATR is to not only ensure technical analyses meet the requirements of technical regulations, but also to ensure policy compliance. The ATR process should ensure that appropriate problems and opportunities are addressed; confirm that a reasonable array of solutions are considered; confirm that an appropriate solution is recommended; assure that appropriate costs, schedules, and risks are presented; confirm the recommended solution warrants Corps participation; is in accord with policies; can be implemented in accordance with environmental laws and statutes; and has a sponsor willing and able to fulfill the non-Federal responsibilities; and ensure that the decision document appropriately represents the views of the Administration.

The ATRT is charged with the detailed review of the materials in the submission package, both directly and indirectly related to their field of expertise. The ATRT is to review all documents in the submission package for the intent of verifying overall consistency of the report information among their respective disciplines.

ATR on decision documents should address the basic communication aspects of the submission package. Quality decision documents allow the public and stakeholders to understand the planning effort, process, and its results. The decision document should enable decision makers to reach the same conclusions and recommendations as the PDT.

2. Project Delivery Team (PDT) Responsibilities. The PDT, as identified in the RP, is comprised of those individuals directly involved in the development of the decision

document. The members of this team have the following responsibilities during the ATR process:

- a. A PDT Lead from the PDT shall be designated for the ATR process. Jami Buchanan will serve as the PDT Lead for this review.
- b. The PDT Lead shall provide the ATRT with contact information for any PDT member as required.
- c. An electronic version of the submission package in Word or searchable Adobe Acrobat format shall be uploaded to DrChecks at least one business day prior to the start of the comment period.
- d. Other submission documentation and technical products required by the Directory of Expertise (DX) or Mandatory Center of Expertise (MX) representative(s) on the ATRT may be submitted directly to the DX or MX.
- e. The review shall be established in DrChecks to allow access by all PDT and ATRT members. The ATRT Lead shall be assigned the role of review manager and at the discretion of the lead PCX, have the PCX POC assigned access.
- f. The Project Manager (PM) shall provide labor funding by cross charge labor codes to the ATRT as indicated below. See Table in section 3.b.
- g. The PDT is responsible for the ATR kick-off meeting in coordination with the ATR Lead to orient the ATRT no later than the first week of the comment period. [Travel funding will be provided for a site visit if a site visit is warranted to understand the problems, opportunities and conditions of the project area.
- h. The PDT will evaluate comments provided by the ATRT in DrChecks. Responses of *Concur* must include a discussion of what action was taken and provide revised text from the submission package if applicable. *Non-Concur* responses shall state the basis for the disagreement or clarification of the concern and suggest actions to negotiate the closure of the comment. PDT members shall coordinate all “Non-Concur” responses with the PDT Lead who will consolidate then discuss these “Non-Concur” responses directly with and the ATRT Lead to attempt to resolve any *Non-Concur* responses prior to submission of evaluation responses.
- i. The PDT Lead shall inform the ATRT Lead when all evaluations have been entered into DrChecks.

j. The PDT Lead may conduct an in progress review to summarize comment evaluations as needed in cases of complex, interrupted, or extended reviews to facilitate the review process .

k. PDT members shall contact ATRT members or Lead as appropriate to seek clarification of a comment’s intent or provide clarification of information in the submission package. These discussions shall occur outside of DrChecks, but a summary of significant discussions should be provided in DrChecks.

l. The PDT Lead shall coordinate the proposed schedule and time for the relevant milestone such as AFB and CWRB with the ATRT Lead to ensure that the ATRT Lead will be able to participate.

3. Agency Technical Review Team Responsibilities. The ATRT is comprised of individuals that have not been involved in the development of the decision document and were chosen based on expertise, experience, and or skills. The members compliment the composition of the PDT. The responsibilities of this team are as follows:

a. An ATRT Lead shall be designated for the ATR process. Janet Cote of the Norfolk District will serve as the ATRT Lead for this review.

b. The ATRT Lead shall provide the PDT Lead with a roster of contact and financial information for ATRT members. Information is below:

Table 1: ATRT Roster

Name	Role	Office Symbol	Phone	Email	Org CELRN-	Amount
Janet Cote	ATRT Lead	CENAO-WR-PE	757-201-7837	Janet.Cote@usace.army.mil	E4W1K01	\$1500
Sue Ferguson	Plan Formulation	CELRN-PM-P	615-736-7192	Sue.L.Ferguson@usace.army.mil	H3H4D00	\$3300
Janet Cote	Environmental	CENAO-WR-PE	757-201-7837	Janet.Cote@usace.army.mil	E4W1K01	\$3000
Phyllis Kohl	Hydraulic s & Hydrology	CELRN-EC-H	615-736-5948	Phyllis.Kohl@usace.army.mil	H3L1FB0	\$3300

- c. The ATRT Lead shall provide organization codes for each team members (see above) and a responsible financial point of contact (CEFMS responsible employee) as needed to the PDT Lead for creation of cross charge labor codes.
- d. The ATRT shall review the submission package documents to confirm that work was done in accordance with established professional principles, practices, codes, and criteria and for compliance with laws and policy.
- e. The ATRT members shall focus on their respective disciplines, but should review other submission package sections to ensure consistency throughout the documents. Reviewers that do not have any significant comments pertaining to their assigned discipline shall provide a comment stating this.
- f. Review comments shall follow the four part comment structure as stated in EC 1165-2-209:
 1. The review concern
 2. The basis for the concern
 3. The significance of the concern
 4. The probable specific action needed to resolve the concern
- g. In some situations, especially addressing incomplete or unclear information, comments entered into DrChecks may seek clarification in order to then assess whether further specific concerns may exist. For these instances, the ATRT member will coordinate the comment with the ATRT Lead prior to submission into DrChecks.
- h. Flagging a comment as “*Critical*” in DrChecks indicates that the concern could have significant impacts on the study schedule or results. The use of the “*Critical*” comment flag should be reserved for those comments that the reviewer feels are of high significance.
- i. Grammatical comments shall not be submitted into Dr Checks. Grammatical comments should be submitted to the ATRT Lead via electronic mail as a Word document in track changes or as a separate Word document that outlines the comments. The ATRT Lead should consolidate and shall provide these grammatical comments to the PDT Lead outside of Dr Checks.
- j. The ATRT shall backcheck PDT evaluations to the review comments and either closes the comment or attempt to resolve any disagreements. Conference calls shall be used to resolve any conflicting comments and responses. A summary of these discussions will be included in backcheck documentation in DrChecks. ATRT members may “agree to disagree” with any comment response and close the comment with a detailed explanation for “*Non-Critical*” comments.
- k. ATRT members shall keep the ATRT Lead aware of the status of “*Critical*” and unresolved comments. If the ATRT and the PDT are not able to reach agreement on

those comments, the Review Management Organization will be engaged to provide direction and facilitate resolution of the comments. If a comment cannot be resolved, then it shall be documented and brought to the attention of the Regional Integration Team as part of the submission package.

I. The ATRT members shall regularly monitor their respective labor code balances and alert the ATRT Lead to any possible funding shortages. Additional funding requirements by the ATRT will be coordinated through the ATRT and PDT Leads in advance of a negative charge occurring.

4. Considerations for Review. Products will be reviewed for compliance with guidance, including Engineer Regulations, Engineer Circulars, Engineer Manuals, Engineer Technical Letters, Engineering and Construction Bulletins, Policy Guidance Letters, implementation guidance, project guidance memoranda, and other formal guidance memoranda issued by HQUSACE. As an initial guide, the ATRT should consider the Project Study Issue Checklist in Exhibit H-2, Appendix H, ER 1105-2-100 (20 Nov 07), which includes many of the more frequent and sensitive policy areas encountered in studies.

a. Project Specific Review Considerations:

- Include any project specific issues, concerns, or questions that the PDT or RMO has identified for particular consideration by the ATRT.

b. Key Review Considerations include:

- Are there any deviations from USACE policy documented in the submission package?
- Does the study conform to the intent of the cited study authority?
- Is the formulation and evaluation of alternatives consistent with applicable regulations and guidance?
- Was the selection of models appropriate for use in evaluations?
- Was the application of data within those models appropriate?
- Was the interpretation of and conclusions drawn from model results reasonable?
- What is the status of the certification/approval for use of the planning models used in the study?
- Are the sources, amounts, and levels of detail of the data used in the analysis appropriate for the complexity of the project?
- Do the main decision document and appendices form an integrated and consistent product?

5. Schedule.

Table 2: ATR Schedule

Task	Date
Kickoff Meeting / Review Begins	August 18, 2014
ATRT Comments due	September 1, 2014
PDT Responses due	September 8, 2014
Backcheck	September 15, 2014
Resolution of Comments (if required)	September 22, 2014
Review Report/Certification	September 24, 2014
After Action Report	October 6, 2014

Enclosure 2
DRCHECKS REPORT OF ALL COMMENTS

Public / SBU / FOUO

Comment Report: All Comments

Project: (NIMISHILLEN) Nimishillen Watershed Ohio Review: ATR of Section 729 Nimishillen Final Watershed Assessment

Displaying 51 comments for the criteria specified in this report.

382 ms to run this page

Id ▲	Discipline	Section/Figure	Page Number	Line Number
5774712	Planning - Plan Formulation	n/a	n/a	n/a

Comment Classification: **Public (Public)**

Executive Summary and throughout - a "floodway update" is an unusual name for an update of a Flood Insurance Study. It implies that not the entire study is being updated. Use of the more standard FIS term is suggested to better clarify what is being recommended.

Submitted By: Sue Ferguson (615-736-7192). Submitted On: Aug 22 2014

Revised Aug 25 2014.

1-0 Evaluation Non-concurred

We are not simply recommending a Flood Insurance Study. That would imply that only a 100-yr event was being hydraulically modeled. This is not the case. The 100-yr frequency, or 1% chance exceedance, is one product that could be provided to FEMA to update the FIS. As part of the floodway update, both a hydrologic model and hydraulic model would be created with at least nine storm frequencies included in the hydraulic modeling, using both steady and unsteady states, of existing and proposed conditions. Once the models have been created, they become a tool for the communities to determine the best locations for detention/retention areas, gage locations, etc. to assist with reducing flooding issues within the entire basin. A floodway update is all inclusive and is much more involved than a simple FEMA FIS and would more than satisfy FEMA's specific requirements for a FIS. To avoid confusion, the term 'floodway update' will be changed to 'Hydrologic and Hydraulic Modeling Update'.

Submitted By: Belinda Weikle (304-399-5808) Submitted On: Sep 15 2014

1-1 Backcheck Recommendation Close Comment

Closed without comment.

Submitted By: Sue Ferguson (615-736-7192) Submitted On: Sep 16 2014

Current Comment Status: **Comment Closed**

5774731	Planning - Plan Formulation	n/a	n/a	n/a
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Comment Classification: **Public (Public)**

Executive Summary - The bullet discussing connecting related networks is not very clear. It should be reworded and may need some additional description.

Submitted By: Sue Ferguson (615-736-7192). Submitted On: Aug 22 2014

1-0 Evaluation **Concurred**
 Concur; The Executive Summary bullet has been reworded and further described in the text below the bullet to better define the floodplain network (hydrologic) being targeted for action in the FWA and Management Plan.

 Submitted By: Jami Buchanan (304-399-5347) Submitted On: Sep 08 2014

1-1 Backcheck Recommendation **Close Comment**
 Closed without comment.

 Submitted By: Sue Ferguson (615-736-7192) Submitted On: Sep 16 2014

Current Comment Status: **Comment Closed**

5774791	Planning - Plan Formulation	Figure 2.2	n/a	n/a
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Comment Classification: **Public (Public)**

It would be nice to see the Nimishillen watershed outlined on the Muskingum map. It would help provide perspective on the watershed's size in relation to Stark county, the Muskingum basin and the state of ohio.

Submitted By: Sue Ferguson (615-736-7192). Submitted On: Aug 22 2014

Revised Aug 25 2014.

1-0 Evaluation **Concurred**
 Concur. The map has been revised.

 Submitted By: Jami Buchanan (304-399-5347) Submitted On: Sep 09 2014

Backcheck not conducted

Current Comment Status: **Comment Open**

5774801	Planning - Plan Formulation	n/a	n/a	n/a
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Comment Classification: **Public (Public)**

All photos should be labeled and described for clarity.

Submitted By: Sue Ferguson (615-736-7192). Submitted On: Aug 22 2014

1-0	<p>Evaluation Concurred Concur. All photos have been labeled and described.</p> <p>Submitted By: Jami Buchanan (304-399-5347) Submitted On: Sep 04 2014</p>
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Backcheck not conducted

Current Comment Status: **Comment Open**

5774807	Planning - Plan Formulation	n/a	n/a	n/a
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Comment Classification: **Public (Public)**

Description of Figure 2-3 above the figure may be backwards. The figure shows western portion of the watershed as urbanized and the eastern more agricultural. Conflict should be resolved.

Submitted By: Sue Ferguson (615-736-7192). Submitted On: Aug 22 2014

Revised Aug 25 2014.

1-0	<p>Evaluation Concurred Concur. The text has been corrected.</p> <p>Submitted By: Jami Buchanan (304-399-5347) Submitted On: Sep 04 2014</p>
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Backcheck not conducted

Current Comment Status: **Comment Open**

5774811	Planning - Plan Formulation	Table 4.2 and 4.3	n/a	n/a
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Comment Classification: **Public (Public)**

Property damage in Table 4.2 should include dollar sign and both 4.2 and 4.3 should include the year of the data. Also, the description of the 7-27-2003 flood seems like there was property damage, but it says "0" in the table. If damage estimates are not available the table should include NA rather than 0 to improve clarity.

Submitted By: Sue Ferguson (615-736-7192). Submitted On: Aug 22 2014

Revised Aug 22 2014.

1-0	<p>Evaluation Concurred Concur.</p> <p>Dollar signs were added to the Table in 4.2. Additionally, changed the 0 to N/A.</p> <p>In Table 4.3 there isn't a year for the data. It's only reporting expected flood damages per year.</p> <p>Submitted By: Jami Buchanan (304-399-5347) Submitted On: Sep 04 2014</p>
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Backcheck not conducted

Current Comment Status: **Comment Open**

5774830	Planning - Plan Formulation	Figure 4.1	n/a	n/a
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Comment Classification: **Public (Public)**

This same map is shown multiple times with little information added. Suggest combining several of the figures by showing more data on one.

Submitted By: Sue Ferguson (615-736-7192). Submitted On: Aug 22 2014

Revised Aug 25 2014.

1-0	<p>Evaluation Non-concurred Non-concur. As per our conversation, we have already consolidated maps several times. Our stakeholders were very pleased with the mapping in the report. We are hesitant to change it further.</p> <p>Submitted By: Jami Buchanan (304-399-5347) Submitted On: Sep 08 2014</p>
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1-1	<p>Backcheck Recommendation Close Comment Closed without comment.</p> <p>Submitted By: Sue Ferguson (615-736-7192) Submitted On: Sep 16 2014</p>
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Current Comment Status: **Comment Closed**

5774836	Planning - Plan Formulation	4.3.5 Urban Growth and Development	n/a	n/a
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Comment Classification: **Public (Public)**

Suggest also discussing the importance of preventing development from infringing into the floodway which can significantly increase flooding on existing properties.

Submitted By: Sue Ferguson (615-736-7192). Submitted On: Aug 22 2014

Revised Aug 25 2014.

1-0	<p>Evaluation Concurred Concur. The following language in section 4.4.2 has been modified:</p> <p>First, as land use in the watershed changes and additional development occurs, the floodway and floodplain are changed as well. Significant encroachment upon the floodway has occurred along with recent development. Development in the floodway is a significant source of flooding in urban areas. The Floodway Update would clearly delineate the floodway associated with the Nimishillen Creek Watershed and its tributaries, as well as the associated 100-year floodplain. This would allow for better floodplain management by ensuring that new construction does not occur in the 100-year, especially the floodway portion of the floodplain.</p> <p>Submitted By: Jami Buchanan (304-399-5347) Submitted On: Sep 08 2014</p>
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Backcheck not conducted

Current Comment Status: **Comment Open**

5775941	Planning - Plan Formulation	n/a	n/a	n/a
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Comment Classification: **Public (Public)**

4.4.2 Floodway Update - Use of the term "floodway update" is nonstandard and should be more properly called Flood Insurance Study (FIS) update to correspond with official FEMA publications and literature. An FIS has specific requirements while the definition of floodway update is more vague. Suggest switching to the term FIS update to better relate other federal and state agencies.

Submitted By: Sue Ferguson (615-736-7192). Submitted On: Aug 25 2014

1-0	<p>Evaluation Non-concurred See response for Comment #5774712.</p> <p>Submitted By: Belinda Weikle (304-399-5808) Submitted On: Sep 15 2014</p>
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1-1	<p>Backcheck Recommendation Close Comment Closed without comment.</p>
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Submitted By: Sue Ferguson (615-736-7192) Submitted On: Sep 16 2014				
Current Comment Status: Comment Closed				
5775949	Planning - Plan Formulation	n/a	n/a	n/a
<p>Comment Classification: Public (Public)</p> <p>4.4.2 Although FEMA is responsible for FIS and the NFIP, they work through a state's NFIP coordinator. The states set the priorities for FIS updates. Suggest adding mention of coordination with the state. In FEMA region 4, we have been able to work with the state and FEMA to leverage modeling done under PAS for a local sponsor into both FIS updates and inundation mapping for flood forecasting and preparedness.</p> <p>Submitted By: Sue Ferguson (615-736-7192). Submitted On: Aug 25 2014</p> <p>Revised Aug 25 2014.</p>				
<p>1-0 Evaluation Concurred</p> <p>Concur; Coordination of the Floodway Update modeling through the state NFIP coordinator would most likely result in leveraging a higher priority for the FIS update in the watershed and perhaps Corps supporting work through a PAS study. Our Ohio Silver Jackets team would be a good program through which that coordination could take place. Accordingly, Section 4.2.2 has been revised to mention the need to coordinate with the State NFIP coordinator regarding the proposed modeling updates of the floodway and using that coordination as a method of leveraging a higher priority for an FIS update for the watershed.</p> <p>Submitted By: Jami Buchanan (304-399-5347) Submitted On: Sep 08 2014</p>				
<i>Backcheck not conducted</i>				
Current Comment Status: Comment Open				
5775958	Planning - Plan Formulation	n/a	n/a	n/a
<p>Comment Classification: Public (Public)</p> <p>4.4.2 Adequate recent mapping is very important to FIS, flood preparedness, and warning activities. Suggest adding discussion of the existing mapping and whether new mapping is required.</p> <p>Submitted By: Sue Ferguson (615-736-7192). Submitted On: Aug 25 2014</p>				

<p>1-0 Evaluation Concurred Concur</p> <p>Submitted By: Belinda Weikle (304-399-5808) Submitted On: Sep 15 2014</p>				
<p><i>Backcheck not conducted</i></p>				
<p>Current Comment Status: Comment Open</p>				
<p>5775982 Planning - Plan Formulation n/a n/a n/a</p>				
<p>Comment Classification: Public (Public)</p> <p>4.4.2 Flood Warning System - FWS can also inform emergency responders and their need for accurate information should also be mentioned. Including their needs in the description would strengthen the case for the FWS.</p> <p>Submitted By: Sue Ferguson (615-736-7192). Submitted On: Aug 25 2014</p>				
<p>1-0 Evaluation Concurred Concur. The following language was added: Additionally, FWSs also provide first responders with critical information during emergency situations. Accurate predictions about flood severity and crest times allows first responders to identify areas which would be inundated during high water events and appropriate stage their vehicles and equipment for faster response times.</p> <p>Submitted By: Jami Buchanan (304-399-5347) Submitted On: Sep 04 2014</p>				
<p><i>Backcheck not conducted</i></p>				
<p>Current Comment Status: Comment Open</p>				
<p>5776003 Planning - Plan Formulation n/a n/a n/a</p>				
<p>Comment Classification: Public (Public)</p> <p>4.4.2 Flood Warning System - Rain and stream gages don't actually forecast, however, they can report data in real time. The real time data can then be used for forecasting. Suggest adding discussion of the data collection and processing parts of a flood warning system to provide better clarity for local officials.</p> <p>Submitted By: Sue Ferguson (615-736-7192). Submitted On: Aug 25 2014</p>				
<p>1-0 Evaluation Concurred Concur. The following text was modified: Most FWSs are based on a system of rain and stream gages which report data which make it possible</p>				

to develop flood forecasting information.

The following text was footnoted in the document to give a more technical explanation of a FWS: Flood warning dissemination provides critical linkage between recognition of an impending flood and execution of emergency response actions. The process consists of the following primary functions: provisions for decision on whether or not to issue a warning (usually determined by present criteria for a flood threat); formulation of the warning message; and identification of the appropriate audience and means (radio, television, sirens, etc.,) of the distribution of the warning message.

Submitted By: Jami Buchanan (304-399-5347) Submitted On: Sep 10 2014

Backcheck not conducted

Current Comment Status: **Comment Open**

5776017	Planning - Plan Formulation	n/a	n/a	n/a
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Comment Classification: **Public (Public)**

4.4.5 - Last paragraph - Another way for locals to use the list of problematic culverts is for routine maintenance and periodic inspection. Accumulating debris can add to the narrowing of the openings and greatly increase flooding. Additional discussion could be added to the paragraph to cover routine maintenance.

Submitted By: Sue Ferguson (615-736-7192). Submitted On: Aug 25 2014

Revised Aug 25 2014.

1-0 Evaluation **Concurred**
 Concur. The following language has been modified in the report:

The first step to addressing this problem should include the development of a list of problematic bridges and culverts. In addition to using the list to develop site specific plans for correction, the list could also be used to develop a schedule for routine inspections and maintenance. Routine maintenance on undersized culverts could reduce the amount of debris which has accumulated near the openings, allowing for greater flow (and less chance of flooding) during high water events.

Submitted By: Jami Buchanan (304-399-5347) Submitted On: Sep 08 2014

Backcheck not conducted

Current Comment Status: **Comment Open**

5776037	Planning - Plan Formulation	n/a	n/a	n/a
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Comment Classification: **Public (Public)**

5.2.1 If fill material is placed up against streams, it impacts flooding as well as riparian cover because the floodway is being filled. If this is a widespread problem it should also be mentioned under the flood plain management discussions.

Submitted By: Sue Ferguson (615-736-7192). Submitted On: Aug 25 2014

1-0 Evaluation Concurred

The following language was added/modified under Section 5.2.1:
As previously stated, portions of the Nimishillen Creek Watershed have seen rapid urban growth in recent years. In addition to increasing stormwater flows, this growth in development has encroached upon the floodplain and riparian areas.

Additionally, the following language was also added to Section 7.6.1.1:
Given the amount of floodplain encroachment which has occurred over recent years within the watershed, and the impact the encroachment has had on both flooding and water quality, it would benefit the watershed to have floodplain management responsibilities consolidated into one role. This would help to ensure the consistent and efficient enforcement of floodplain management ordinances, to the maximum benefit of the watershed. Consolidating these duties into one role would also help the person(s) responsible build a working knowledge of floodplain management, which would in turn lead to more efficient and effective decision making in the future.

Submitted By: Jami Buchanan (304-399-5347) Submitted On: Sep 08 2014

Backcheck not conducted

Current Comment Status: **Comment Open**

5776043	Planning - Plan Formulation	n/a	n/a	n/a
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Comment Classification: **Public (Public)**

Table 9.1 USGS can also provide technical and financial assistance for gages. Suggest they be added to the table in the first priority. USGS can also provide technical and financial assistance for mapping and FWS data collection, storage and management. Suggest adding them to the 2 and 3rd priorities also.

Submitted By: Sue Ferguson (615-736-7192). Submitted On: Aug 25 2014

Revised Aug 25 2014.

1-0	Evaluation Concurred Concur. USGS has been added to the first three priorities in Table 9.1. Submitted By: Jami Buchanan (304-399-5347) Submitted On: Sep 08 2014
	<i>Backcheck not conducted</i>
	Current Comment Status: Comment Open

5776046	Planning - Plan Formulation	n/a	n/a	n/a
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Comment Classification: **Public (Public)**

9.2.1 Consider mentioning the state in the FIS update since the NFIP coordinator provides input into FEMA priorities.

Submitted By: Sue Ferguson (615-736-7192). Submitted On: Aug 25 2014

1-0	Evaluation Concurred Concur; Section 9.2.1 has been revised to mention coordination of modeling activities and an FIS update through the state NFIP coordinator and using the Silver Jackets program for that coordination process. Submitted By: Jami Buchanan (304-399-5347) Submitted On: Sep 08 2014
	<i>Backcheck not conducted</i>
	Current Comment Status: Comment Open

5783219	Environmental	5.2.1	n/a	n/a
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Comment Classification: **For Official Use Only (FOUO)**

Concern: EC 1105-2-411 describes the watershed planning process, which includes "inventory and forecasting". The discussion of the "loss of aquatic habitat" is does not adequately inventories the aquatic resources of the study area. The report does not describe habitat has been lost or describe the current condition of aquatic habitat present in the watershed? The report also does not completely identify the problem, another step in the watershed planning process. What is exactly meant by "loss of aquatic habitat"? Has habitat actually changed from one type to another (e.g. aquatic to terrestrial or one aquatic habitat type to another)? Or has the habitat quality changed?

Basis: EC 1105-2-411

Significance: Moderate

Probably Action to Resolve: Identify the original and current conditions of the system. Define what is meant by "loss".

Submitted By: Janet Cote ((757)-201-7837). Submitted On: Sep 01 2014

1-0 Evaluation Concurred
 Concur. Text has been changed and updated report will be provided to the ATR team.
 Submitted By: Jami Buchanan (304-399-5347) Submitted On: Sep 26 2014

Backcheck not conducted

Current Comment Status: **Comment Open**

5783220	Environmental	5.2.1	n/a	n/a
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Comment Classification: **For Official Use Only (FOUO)**

Concern: This section suggests that the loss of aquatic habitat is the driver that caused the decline in water quality. Poor quality habitat will have some effect on water quality (e.g excess periphyton will typically result in diurnal drops in DO). However, aquatic habitat quality is not typically the underlying cause of the water quality issues in an aquatic system. While, reduced water quality is in most cases a primary cause of poor aquatic habitat quality.

Basis: EC 1105-2-411, Identify Problems and Opportunities

Significance: Moderate

Probably Action to Resolve: If aquatic habitat loss or decline in habitat quality is truly a primary driver of water quality, then describe this relationship in more detail. If not, rewrite the section to accurately describe the problem and opportunity.

Submitted By: Janet Cote ((757)-201-7837). Submitted On: Sep 01 2014

Revised Sep 01 2014.

1-0 Evaluation Concurred
 Concur. Text has been changed and updated report will be provided to the ATR team.
 Submitted By: Jami Buchanan (304-399-5347) Submitted On: Sep 26 2014

Backcheck not conducted

Current Comment Status: **Comment Open**

5783222	Environmental	5.2.1	n/a	sentence 4,
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Comment Classification: **For Official Use Only (FOUO)**

Concern: This sentence suggests that the reduction of the diversity and productivity caused by the "loss of aquatic habitat" impacts water quality. Degraded aquatic systems are typically less productive and diverse as higher quality system. And some aquatic habitat types may be more or less productive and diverse than others. But the connection between the productivity

and diversity of a riverine system significantly effecting water quality is tenuous. This relationship may be true in a system that relies heavily on filter feeders, such as an oyster reef. In these systems, increased productivity (i.e. more oysters) will have a larger impact on water quality. But I don't believe the same can be said for a river system.

The opposite relationship – the water quality of a stream/river impacts the productivity and diversity of a habitat type – much stronger.

Basis: EC 1105-2-411, Identify Problems and Opportunities

Significance: Moderate

Probably Action to Resolve: Either rewrite the section to clearly explain the problem or provide evidence that supports the relationship as it is currently described in the report.

Submitted By: Janet Cote ((757)-201-7837). Submitted On: Sep 01 2014

1-0	<p>Evaluation Concurred Concur. Text has been changed and updated report will be provided to the ATR team.</p> <p>Submitted By: Jami Buchanan (304-399-5347) Submitted On: Sep 26 2014</p>
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	<i>Backcheck not conducted</i>
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	Current Comment Status: Comment Open
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5783223	Environmental	5.2.2	n/a	sentence 3
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Comment Classification: **For Official Use Only (FOUO)**

Concern: Failed residential sewage treatment systems are typically identified as non-point sources of pollution, because these pollutants tend to leach into the ground and then are discharged into the aquatic system over a wide area. When the pollutant enters the system from a discrete point, such as a pipe or outfall, then it is a point source.

Basis: US Geological Survey http://toxics.usgs.gov/definitions/nonpoint_source.html

Significance: Minor

Probably Action to Resolve: Change the sentence to state that failed residential sewage treatment systems.

Submitted By: Janet Cote ((757)-201-7837). Submitted On: Sep 01 2014

1-0	<p>Evaluation Concurred Concur. Clarified that the failed HSTSs are a non-point source.</p> <p>Submitted By: Jami Buchanan (304-399-5347) Submitted On: Sep 04 2014</p>
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1-1	Backcheck Recommendation Close Comment
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Submitted By: Janet Cote ((757)-201-7837) Submitted On: Sep 05 2014				
Current Comment Status: Comment Closed				
5783224	Environmental	5.2.2	n/a	last sentence
<p>Comment Classification: For Official Use Only (FOUO)</p> <p>Concern: The paragraph does not explain the impacts of allowing untreated sewage into an aquatic system. What is the impact on water quality and the system as a whole? If this document is going to be used by the public, then it should "connect the dots" between a problem and the cause of the problem.</p> <p>Basis: EC 1105-2-411, Identify Problems and Opportunities</p> <p>Significance: Moderate</p> <p>Probably Action to Resolve: Consider added a final sentence that describes the pollutants in untreated sewage and how they impact water quality and the aquatic system</p> <p>Submitted By: Janet Cote ((757)-201-7837). Submitted On: Sep 01 2014</p>				
<p>1-0 Evaluation Concurred</p> <p>Concur. The following wording was added: If the HSTS is not working properly, it can be leaching pathogens (including bacteria, parasites and viruses) into groundwater and nearby streams for long periods of time without notice. These pathogens can not only harm the aquatic habitat of species living in the water, but also impact terrestrial species which depend on the stream for a source of water. Additionally, humans which come into contact with contaminated surface water may also become ill, exhibit symptoms such as diarrhea, fever, gastritis and vomiting.</p> <p>Submitted By: Jami Buchanan (304-399-5347) Submitted On: Sep 04 2014</p>				
<i>Backcheck not conducted</i>				
Current Comment Status: Comment Open				
5783225	Environmental	5.3.4	n/a	1st sentence
<p>Comment Classification: For Official Use Only (FOUO)</p> <p>Concern: The word "toxin" is not interchangeable with "pollutant" or "contaminant". Toxins are very specific groups of substances. For example, toxin is defined as "a colloidal proteinaceous poisonous substance that is a specific product of the metabolic activities of a living organism".</p> <p>Basis: Merriam Webster Dictionary</p> <p>Significance: Minor</p> <p>Probably Action to Resolve: Replace the word "Toxin" with another either pollutant or contaminant.</p>				

Submitted By: Janet Cote ((757)-201-7837). Submitted On: Sep 01 2014

1-0 Evaluation **Concurred**
 Concur. The word "toxin" was replaced with "pollutant."
 Submitted By: Jami Buchanan (304-399-5347) Submitted On: Sep 04 2014

1-1 Backcheck Recommendation **Close Comment**
 Closed without comment.
 Submitted By: Janet Cote ((757)-201-7837) Submitted On: Sep 05 2014

Current Comment Status: **Comment Closed**

5783227	Environmental	5.3.4	n/a	n/a
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Comment Classification: **For Official Use Only (FOUO)**

Concern: This section only includes a discussion of agricultural practices which result in the loss of riparian habitat and wetlands. The report describes large parts of the watershed as being highly developed. Many residential and urban land use practices also cause significant losses of these important habitat types. Suburban land owners often clear the riparian fringe to grow lawn up to the river bank. Wetlands are often filled in to allow land development. In urban settings, river banks are hardened and bank vegetation is removed to control erosion. Were these practices considered?
 Basis: : EC 1105-2-411, Identify Problems and Opportunities
 Significance: Moderate
 Probably Action to Resolve: Broaden the discussion of land use practices that result in riparian and wetland habitat loss.

Submitted By: Janet Cote ((757)-201-7837). Submitted On: Sep 01 2014

Revised Sep 01 2014.

1-0 Evaluation **Concurred**
 Concur. The text was reworded as follows:
 Educating the public on water quality threats associated with urban development and agricultural practices could go a long way towards enlisting residents, business owners and farmers' help to improve water quality. This information can be developed at a local level and made available through a wide variety of venues, such as chambers of commerce, county fairs, 4-H clubs, and local feed stores. Existing programs offered through USDA (see Section 10.2 below) can be presented to the agricultural community through local conservation offices. More urban users could be reached via school programs, and by the creation of local environmental and/or watershed groups.

	Submitted By: Jami Buchanan (304-399-5347) Submitted On: Sep 04 2014			
1-1	Backcheck Recommendation Close Comment Closed without comment.			
	Submitted By: Janet Cote ((757)-201-7837) Submitted On: Sep 05 2014			
	Current Comment Status: Comment Closed			
5783228	Environmental	5.3.5	n/a	n/a
<p>Comment Classification: For Official Use Only (FOUO)</p> <p>Concern: This section limits the discussion to agricultural practices. Educating suburban and urban land owners on land use methods that would protect water quality, riparian habitat and the riverine ecosystem would also help meet the goals of the watershed plan. Basis: : EC 1105-2-411, Identify Problems and Opportunities Significance: Moderate Probably Action to Resolve: Expand the discussion to include education of urban and suburban land owners and residence on ways they could improve water quality and the health of the watershed. Include school programs and the creation of local environmental advocacy groups.</p> <p>Submitted By: Janet Cote ((757)-201-7837). Submitted On: Sep 01 2014</p>				
1-0	Evaluation Concurred Discussion has been re-worded so that it is not exclusive to agriculture.			
	Submitted By: Jami Buchanan (304-399-5347) Submitted On: Sep 11 2014			
	<i>Backcheck not conducted</i>			
	Current Comment Status: Comment Open			
5783229	Environmental	Section: 5.4 (bullet 4) and Table 9.2	n/a	n/a
<p>Comment Classification: For Official Use Only (FOUO)</p> <p>Concern: The use of the word "develop" could be taken to mean to opposite of your intent, especially in the context of land use practices. Significance: Minor Probably Action to Resolve: Replace the word "develop" with "increase the amount of" of "restore and preserve".</p> <p>Submitted By: Janet Cote ((757)-201-7837). Submitted On: Sep 01 2014</p>				

<p>1-0</p>	<p>Evaluation Concurred Concur. Text has been changed to: Preservation/Restoration of Riparian/Wetland Areas</p> <p>Submitted By: Jami Buchanan (304-399-5347) Submitted On: Sep 09 2014</p>
<p>1-1</p>	<p>Backcheck Recommendation Close Comment Closed without comment.</p> <p>Submitted By: Janet Cote ((757)-201-7837) Submitted On: Sep 15 2014</p>
<p>Current Comment Status: Comment Closed</p>	
<p> </p>	
<p>5783300</p>	<p>General n/a n/a n/a</p>
<p>Comment Classification: For Official Use Only (FOUO)</p> <p>I have attached a copy of the document with editorial comments.</p> <p>(Attachment: Section_729_Nimishillen_Creek_Watershed_FWA_and_WMP_(ATR_version)_JC.docx)</p> <p>Submitted By: Janet Cote ((757)-201-7837). Submitted On: Sep 01 2014</p>	
<p>1-0</p>	<p>Evaluation Concurred Editorial comments have been incorporated.</p> <p>Submitted By: Jami Buchanan (304-399-5347) Submitted On: Sep 11 2014</p>
<p>1-1</p>	<p>Backcheck Recommendation Close Comment Closed without comment.</p> <p>Submitted By: Janet Cote ((757)-201-7837) Submitted On: Sep 15 2014</p>
<p>Current Comment Status: Comment Closed</p>	
<p> </p>	
<p>5783301</p>	<p>Environmental 5.2.1 n/a n/a</p>
<p>Comment Classification: For Official Use Only (FOUO)</p> <p>Concern: This section includes two ideas, the loss of aquatic habitat and the loss of riparian habitat. They are significantly different issues. The loss of the two habitat types are typically the result of different stressors, have different solutions and result in significantly different impacts to the ecosystem. More importantly, in this case, the loss of one habitat type, riparian habitat, has a significant impact on water quality; while the other, loss of aquatic habitat, is most likely a result of degraded water quality.</p> <p>Significance: Moderate Probably Action to Resolve: The loss of riparian habitat and the loss of aquatic habitat should be addressed separately.</p>	

Submitted By: Janet Cote ((757)-201-7837). Submitted On: Sep 01 2014

1-0 Evaluation Concurred
 Concur. Text has been changed and updated report will be provided to the ATR team.

 Submitted By: Jami Buchanan (304-399-5347) Submitted On: Sep 26 2014

Backcheck not conducted

Current Comment Status: **Comment Open**

5783302	Environmental	Section: 6.4.2 and table 9.3	n/a	n/a
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Comment Classification: **For Official Use Only (FOUO)**

Concern: This alternative is not fully described. This section consists of a description of one specific water related network. Table 9.3 identify Stark Park as the only potential lead organization that could take on this recommendation.

Basis: EC 1105-2-411

Significance: Moderate

Probably Action to Resolve: Include a paragraph that introduces the general concept of water related networks and give examples of water related networks. Other networks may include the networks of researchers who are studying the watershed, lead by local educational institutes or a network of local environmental advocacy groups. The specific example of the Stark Park should be included in the discussion as an example of a network that has already been established. With identification of additional networks, other organization may also act as lead organizations.

Submitted By: Janet Cote ((757)-201-7837). Submitted On: Sep 01 2014

1-0 Evaluation Concurred
 Concur; The alternative required better definition and recognition of other networks in play within the watershed. Section 6.4.2 has been revised to point out the existence of other water related networks in the watershed and to better define the particular floodplain hydrologic network that is being recommended for restoration by the Stark County Park District. Additional verbiage has been added to identify Stark Parks as the appropriate lead entity to continue restoration of the floodplains in the watershed. Table 9.3 has also been revised to better define the network in question and to solidify Stark Parks as the recommended lead agency.

 Submitted By: Jami Buchanan (304-399-5347) Submitted On: Sep 08 2014

Backcheck not conducted

Current Comment Status: **Comment Open**

5783304	Environmental	7.6.2	n/a	n/a
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Comment Classification: **For Official Use Only (FOUO)**

Concern: 1. The majority of this section seems to describe Floodplain Restoration techniques and not leading the restoration efforts as the title of the section suggests. 2. Is the only reason to recommend Stark Parks as the FR lead is the actions that they have already have taken and have planned to take in the future? If so, is that enough to give this agency that lead role? Is the organization large enough to effectively lead restoration efforts in the entire watershed.

Significance: Moderate

Probably Action to Resolve: Rewrite this section to describe the role of the FR lead and further describe the attributes that make Stark Parks the best organization to take on this role.

Submitted By: Janet Cote ((757)-201-7837). Submitted On: Sep 01 2014

1-0 Evaluation Concurred

Concur; 1. The section was misleading in its original formulation and has been revised as recommended to identify the key components of capability and leadership that would be required to best lead the floodplain restoration effort. 2. Stark Parks current activities aren't the only reason to identify them as the lead for floodplain restoration and the section has been revised to display the apparent capabilities of Stark Parks as the current developer and maintainer of an extensive county-wide park system and their ongoing demonstrated capability to leverage an array of Federal, State, regional and city funds in the pursuit of restoring the watershed's floodplains through an approved county-wide Greenway Plan. The areal extent of the parks operations, current programs, funding sources and partnerships has been added to support the FWA's recommendation.

Submitted By: Jami Buchanan (304-399-5347) Submitted On: Sep 08 2014

Backcheck not conducted

Current Comment Status: **Comment Open**

5783305	Environmental	5.1	n/a	n/a
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Comment Classification: **For Official Use Only (FOUO)**

Concern: While the paragraph regarding water quality regulation is factually correct, it is confusing and a little misleading.

Basis: USEPA

Significance: Moderate

Probably Action to Resolve: Will add a possible rewrite of this paragraph.

Submitted By: Janet Cote ((757)-201-7837). Submitted On: Sep 01 2014				
1-0		Evaluation Concurred Concur. Text has been changed and updated report will be provided to the ATR team. Submitted By: Jami Buchanan (304-399-5347) Submitted On: Sep 26 2014		
<i>Backcheck not conducted</i>				
Current Comment Status: Comment Open				
5784467	Planning - Plan Formulation	General comment	n/a	n/a
Comment Classification: For Official Use Only (FOUO) In general, the report is well laid out and easy to follow. Combining the FWA and WMP makes sense and was well done. There were a few instances where I have a comment about execution of current watershed planning guidance and policy. These will be provided as separate DrChecks comments. There were also a number of places where some editing would improve understanding or just make the report flow better. The main report WORD document was edited with the "track changes" option while the PDF document with the appendices was edited with strikethroughs, inserted text, and sticky notes. Both will be provided separately for your consideration. Some of the more important issues noted will also be entered as DrChecks comments.				
Submitted By: Phyllis Kohl ((615) 736-2022). Submitted On: Sep 02 2014				
1-0		Evaluation Concurred DRChecks specific comments have/will be addressed. The majority of the edits were accepted. Some edits were already addressed by the resolution of other comments and the stakeholder review. Submitted By: Jami Buchanan (304-399-5347) Submitted On: Sep 11 2014		
1-1		Backcheck Recommendation Close Comment Closed without comment. Submitted By: Phyllis Kohl ((615) 736-2022) Submitted On: Sep 15 2014		
Current Comment Status: Comment Closed				
5784469	Planning - Plan Formulation	General comment	n/a	n/a
Comment Classification: For Official Use Only (FOUO) The review concern: Part of the purpose of a watershed assessment and management plan				

is to gather together existing data. The report does have some data such as historical flood information but in other areas it appears little existing data was gathered. For example, undersized culverts and bridges are mentioned as a problem but no data is provided to support this claim, not even a map showing the location of those at which past problems have been identified.

The basis for the concern: EC 1105-2-411, Part 8.b (expired JAN 2012 but best available guidance on watershed planning) – "Reasonable efforts must be made to obtain and analyze relevant data, even where available data may be limited at the outset. Inventory is not limited to those areas used to develop analyses directly related to site-specific project planning."

Significance of the concern: It's possible research of available data could affect one or more recommendation but also equally possible recommendations would not change.

Action needed: If research of available data was done, just not documented, then document the data collected. If research of available data was not done, then research should be performed and documentation added to the document. One item of particular interest is research into existing hydrologic, hydraulic, and water quality modeling available. Available models should be located and their relevance and extent documented.

Submitted By: Phyllis Kohl ((615) 736-2022). Submitted On: Sep 02 2014

1-0 Evaluation Non-concurred

Most of the PDT research and data gathering done for this study was conducted via our stakeholder involvement process. In terms of the four water resources issues addressed in the FWA/WMP, the stakeholders are only now beginning the process of gathering data to begin to try to address the identified issues. The recommended early action item of local installation of additional rain and steam gages is an example of that data gathering process needed to address flooding and other issues.

The "data" gathered was done anecdotally through conversations with our Technical Group. This group consisted of city and county engineers, city AE consultants and city managers who are well aware of the water resource issues present in the watershed. For decision makers in the watershed, this FWA/WMP is the first step that will hopefully lead to the collection and analysis of data which will help them to make efficient and effective water resource management decisions in the future.

Specifically, for flooding issues, the information the PDT received was marked on maps, and/or identified via site visits led by advisory group members, but generally lacked any photo documentation. For water quality, TMDLs (as available) were utilized in the development of the plan. Stormwater management at a regional scale has had the least amount of consideration in the watershed to date. Locally proposed stormwater "fixes" had concentrated on individual intersection drains or undersized culverts. With the limited amount of data available specific to the project area and a budget constrained by partner and program limits, the best the PDT was able to do with the information available was to make broad and

overarching suggestions concerning methods to manage stormwater runoff.

Finally, in terms of floodplain management, there wasn't much quantifiable data available. Unfortunately, it was identified early on that there were individuals identified as floodplain coordinators who were unaware that they held this title. This dispersal and ignorance of responsibility and accountability for NFIP data collection did not make useful data available to the PDT's for the study. As previously stated, this FWA/WMP is really just a first step to get locals thinking in terms of making water resources decisions on a holistic scale.

The exception would be existing H&H models and data. During our literature review, and during meetings with our stakeholders, we were made aware of and found several studies in which H&H information had been generated. Extensive coordination between the stakeholders, their contractors and the district has failed to unearth any previously developed detailed modeling data, just summaries. The stakeholders continue to try to locate this model data.

Submitted By: Jami Buchanan (304-399-5347) Submitted On: Sep 10 2014

Backcheck not conducted

Current Comment Status: **Comment Open**

5784471	Planning - Plan Formulation	General comment	n/a	n/a
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Comment Classification: For Official Use Only (FOUO)

The review concern: The report contains little or no forecasting of future conditions.

The basis for the concern: Implementation Guidance for Section 202 of the Water Resources and Development Act (WRDA) 2000, Watershed and River Basin Assessments, which Amends Section 729, WRDA 86, Study of Water Resources Needs of River Basins and Regions (May 29, 2001) directs as part of the Watershed Assessment Process to "determine the likely future conditions based upon proposed activities and developments". Lastly, EC 1105-2-411, Part 8.b (expired JAN 2012 but best available guidance on watershed planning) calls for "examination of anticipated future activities that reflect reasonable outcomes allows consideration of the likely effects of a range of activities, decisions, or other courses of action."

Significance of the concern: It is unlikely that consideration of future conditions would change the recommendations made.

Action needed: Provide a brief description of anticipated future conditions in the watershed.

Submitted By: Phyllis Kohl ((615) 736-2022). Submitted On: Sep 02 2014

1-0 Evaluation Concurred

The follow paragraphs have been added:

As previously discussed, flooding is a significant issue in the Nimishillen Creek Watershed. Given the ongoing growth and development in the watershed, it is likely without intervention flooding will continue to be an issue in the future. The placement of additional impervious surface will continue to increase the amount of runoff in the watershed, which will likely exacerbate ongoing issues with undersized bridges and culverts in terms of being able to pass higher flows. Lack of sufficient rain and stream gages will continue to make it difficult to make accurate forecasts during high water events. Finally, with no change in land management practices in the north (in the agricultural portion of the watershed) stream sedimentation will continue and possibly worsen.

Without future intervention, water quality will continue to be degraded within the watershed. As with flooding issues, urban growth and development in the watershed will continue to be a driving factor associated with water quality. As development encroaches on the floodplain there could be continued loss of the riparian zone, which will in turn have adverse impacts on adjacent aquatic habitat. Failing HSTSs, gone unchecked, will continue to leach pollutants into groundwater and nearby surface waters. Likewise, sanitary sewer manholes which are inundated during high water events will also continue to release pollutants into nearby surface waters. Finally, (as with flooding issues) with no change in land management practices in the northern agricultural area of the watershed, water quality will continue to be adversely affected by pollution sources such as (but not limited to): increased sedimentation, organic enrichment, nutrients, metals and flow alterations.

Without future intervention stormwater within the Nimishillen Creek Watershed will likely continue to contribute to flooding issues. The runoff generated by precipitation events will likely increase with the amount of development and impervious surfaces places. This runoff, as explained above, will continue to negatively impact water quality and aquatic habitat. Additionally, without future intervention, stormwater management within the watershed will continue to be disjointed and inconsistent as each municipality enforces separate ordinances.

Without future intervention, floodplain management within the Nimishillen Creek Watershed will likely continue to be a disjointed effort managed by an inefficient number of designated floodplain managers. This piece-meal approach reduces the likelihood that funding to support necessary FEMA training for a single (or few) effective and efficient floodplain manager(s) will be budgeted. While municipalities may continue to be eligible to participate in the NFIP, they will not be able to devote the appropriate resources to the other aspects of a holistic floodplain management program.

Submitted By: Jami Buchanan (304-399-5347) Submitted On: Sep 10 2014				
1-1		Backcheck Recommendation Close Comment Excellent!		
Submitted By: Phyllis Kohl ((615) 736-2022) Submitted On: Sep 15 2014				
Current Comment Status: Comment Closed				
5784476	Planning - Plan Formulation	General comment	n/a	n/a
<p>Comment Classification: For Official Use Only (FOUO)</p> <p>The review concern – Little was mentioned on local community groups dedicated to the Muskingum/Nimishillen watershed nor on non-governmental conservation and educational organizations. For example, I read that Kent State University at Stark has provided education for elementary and high school teachers to help them and their students understand storm water issues and devise solutions to existing problems but I see no indication that they were included.</p> <p>The basis for the concern – Policy Guidance Letter #61, Application of Watershed Perspective to Corps of Engineers Civil Works Programs and Activities (dated 27JAN1999), states "The Corps will solicit participation from Federal, tribal, state, and local agencies, organizations, and the local community to ensure that their interests are considered in the formulation and implementation of the effort."</p> <p>Significance of the concern: It's possible inclusion of other stakeholders could affect one or more recommendation but also equally possible recommendations would not change.</p> <p>Action needed: If coordination with other stakeholders was done, just not documented, then document the data collected. If coordination with other stakeholders was not done, then other stakeholders should be consulted. This consultation should be documented and recommendations/conclusions updated as needed.</p> <p>Submitted By: Phyllis Kohl ((615) 736-2022). Submitted On: Sep 02 2014</p> <p>Revised Sep 02 2014.</p>				
1-0		Evaluation Concurred Concur.		
As per our conversation, we reached out to local watershed groups during our stakeholder collaboration process. Unfortunately, the groups do not seem to be active at this time.				
Submitted By: Jami Buchanan (304-399-5347) Submitted On: Sep 09 2014				

<p>1-1 Backcheck Recommendation Open Comment Good to hear. Please document this in the report.</p> <p>Submitted By: Phyllis Kohl ((615) 736-2022) Submitted On: Sep 15 2014</p>				
<p>2-0 Evaluation Concurred The following text was added to the report:</p> <p>Stakeholder involvement is critical to the success of the development of a FWA and WMP. Stakeholders include (but are not limited to) community leaders, city and county engineers, public service directors, floodplain managers, and watershed groups. These local stakeholders have a working knowledge of the watershed and deal with watershed issues on a day to day basis.</p> <p>Submitted By: Jami Buchanan (304-399-5347) Submitted On: Sep 26 2014</p>				
<p><i>Backcheck not conducted</i></p>				
<p>Current Comment Status: Comment Open</p>				
<p>5784481 Planning - Plan Formulation Figure 2.1 n/a n/a</p>				
<p>Comment Classification: For Official Use Only (FOUO)</p> <p>Since the text references the basins listed in Table 2.1 to the basins shown in this figure, I recommend using the basin name used here in the table. Also, since not all readers will be familiar with the area, please add "County" after the county name and reverse Figures 2.2 (localized basin map) and 2.3 (overall state map).</p> <p>Submitted By: Phyllis Kohl ((615) 736-2022). Submitted On: Sep 02 2014</p>				
<p>1-0 Evaluation Concurred Concur. Table was revised. County added. Maps flipped.</p> <p>Submitted By: Jami Buchanan (304-399-5347) Submitted On: Sep 10 2014</p>				
<p>1-1 Backcheck Recommendation Close Comment Closed without comment.</p> <p>Submitted By: Phyllis Kohl ((615) 736-2022) Submitted On: Sep 15 2014</p>				
<p>Current Comment Status: Comment Closed</p>				
<p>5784482 Planning - Plan Formulation Figure 4.1 n/a n/a</p>				
<p>Comment Classification: For Official Use Only (FOUO)</p>				

It would be helpful to show and label in this figure the waterways mentioned in the preceding paragraph.

Submitted By: Phyllis Kohl ((615) 736-2022). Submitted On: Sep 02 2014

1-0 Evaluation **Concurred**
 Concur. Map has been replaced, new map highlights discussed areas.
 Submitted By: Jami Buchanan (304-399-5347) Submitted On: Sep 10 2014

1-1 Backcheck Recommendation **Close Comment**
 Closed without comment.
 Submitted By: Phyllis Kohl ((615) 736-2022) Submitted On: Sep 15 2014

Current Comment Status: **Comment Closed**

5784485	Planning - Plan Formulation	Part 4.3	n/a	n/a
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Comment Classification: **For Official Use Only (FOUO)**

It is stated that there are no rain gages in the Nimishillen watershed. However, I find that NOAA has a rain gage at the Akron-Canton Airport on the northwest edge of the basin. Were agencies and groups other than USGS checked?

Submitted By: Phyllis Kohl ((615) 736-2022). Submitted On: Sep 02 2014

Revised Sep 02 2014.

1-0 Evaluation **Non-concurred**
 No, only USGS gages were located– The stakeholder consensus was that they wanted to work with USGS in establishing and maintaining the precipitation and flow gages in the watershed.
 Submitted By: Belinda Weikle (304-399-5808) Submitted On: Sep 15 2014

1-1 Backcheck Recommendation **Open Comment**
 That may be so but if another agency already operates and maintains a stream gage in the basin or a rain gage in or near the basin then it doesn't make sense not to use this data and/or to install and maintain another gage nearby.
 Submitted By: Phyllis Kohl ((615) 736-2022) Submitted On: Sep 15 2014

Current Comment Status: **Comment Open**

5784486	Planning - Plan	Part 4.3.3	n/a	n/a
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	Formulation			
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Comment Classification: **For Official Use Only (FOUO)**

The report states that "undersized culverts and bridge abutments can significantly contribute to flooding issues." It should be noted that road/railroad embankment fill is often of equal or greater concern. Also, this paragraph lays most of the blame for problems with bridges and culverts on increased development but it is often just that bridges and culverts weren't designed to pass large floods.

Submitted By: Phyllis Kohl ((615) 736-2022). Submitted On: Sep 02 2014

1-0 Evaluation Concurred

Concur. With regard to culverts/bridges which weren't designed to pass large floods the following language has been added under Section 4.3.3:

Many of the bridges and culverts in the Nimishillen Creek Watershed were constructed when the area was much less developed, and consequently cannot accommodate the amount of flow that is now generated during high water events.

With regard to railroad crossings and bridges - we have expanded "bridge abutments" to include railroad crossings and bridges.

Submitted By: Jami Buchanan (304-399-5347) Submitted On: Sep 08 2014

1-1 Backcheck Recommendation Close Comment

Better but the terms "bridges" and "culverts" brings to mind just the structure itself. It would be helpful to laymen to include mention of embankment fill.

Submitted By: Phyllis Kohl ((615) 736-2022) Submitted On: Sep 15 2014

Current Comment Status: **Comment Closed**

5784488	Planning - Plan Formulation	Part 4.4.2	n/a	n/a
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Comment Classification: **For Official Use Only (FOUO)**

The term "Floodway Update" seems a little restrictive. In order to better illustrate all the beneficial uses you describe, I suggest using "Hydrologic and Hydraulic Modeling Update" instead. In the 2nd paragraph, less emphasis should be placed on the 100-year flood and more emphasis should be put on the fact that H&H modeling provides information on flood risk throughout a full range of events. In the third paragraph, include information on FEMA's ongoing RiskMAP effort and how updated H&H modeling could contribute to this effort.

Submitted By: Phyllis Kohl ((615) 736-2022). Submitted On: Sep 02 2014

1-0 Evaluation **Concurred**
 Concur
 Submitted By: Belinda Weikle (304-399-5808) Submitted On: Sep 15 2014

1-1 Backcheck Recommendation **Close Comment**
 Closed without comment.
 Submitted By: Phyllis Kohl ((615) 736-2022) Submitted On: Sep 15 2014

Current Comment Status: **Comment Closed**

5784489	Planning - Plan Formulation	Part 5.3.3	n/a	n/a
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Comment Classification: **For Official Use Only (FOUO)**

In the 1st sentence of the 1st paragraph, it is important to include the counties as much development often occurs before an area is annexed into a community.

Submitted By: Phyllis Kohl ((615) 736-2022). Submitted On: Sep 02 2014

1-0 Evaluation **Concurred**
 Concur. The sentence now reads: To address water quality impairments stemming from land development practices, the communities and counties in the watershed should establish more effective land-use zoning ordinances.
 Submitted By: Jami Buchanan (304-399-5347) Submitted On: Sep 08 2014

1-1 Backcheck Recommendation **Close Comment**
 Closed without comment.
 Submitted By: Phyllis Kohl ((615) 736-2022) Submitted On: Sep 15 2014

Current Comment Status: **Comment Closed**

5784490	Planning - Plan Formulation	Part 5.3.4	n/a	n/a
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Comment Classification: **For Official Use Only (FOUO)**

While this part is entitled "Preserving/Restoration of Riparian/Wetland Areas," no details on the status of riparian and wetland areas is provided nor is anything included on how to preserve or restore them. It would be helpful to do so.

Submitted By: Phyllis Kohl ((615) 736-2022). Submitted On: Sep 02 2014

<i>Evaluation not conducted</i>				
5784491	Planning - Plan Formulation	Part 6.4.5	n/a	n/a
<p>Comment Classification: For Official Use Only (FOUO)</p> <p>This part recommends development of a SWMM model. Provide some discussion as to who would be best to develop such a model, how it would be kept up-to-date, and who would use it. But first, it should be determined if there are any existing water quality models. It would also be helpful to provide a short explanation on how this model is different than the H&H models recommended earlier.</p> <p>Submitted By: Phyllis Kohl ((615) 736-2022). Submitted On: Sep 02 2014</p>				
<p>1-0 Evaluation Check and Resolve Based upon the feedback from our stakeholders, we have pulled the SWMM recommendation from the FWA and WMP. Submitted By: Jami Buchanan (304-399-5347) Submitted On: Sep 09 2014</p>				
<p>1-1 Backcheck Recommendation Open Comment OK but should still document existing water quality models that could be used to evaluate AMD remediation proposals. Submitted By: Phyllis Kohl ((615) 736-2022) Submitted On: Sep 15 2014</p>				
<p>2-0 Evaluation Non-concurred After discussing with Jami Buchanan - this section will remain in the FWA and WMP. The SWMM model would be using the hydrologic and hydraulic components for a more detailed look at the urban sections within the watershed to incorporate and analyze the intricate storm drainage system as it relates to timing and ponding issues. The water quality function of the SWMM model was not necessary for this phase of the analysis. However, this could be added at a later date if the communities deemed it necessary. The primary function of the SWMM model is to address flooding issues, whereas, a tertiary concern is water quality. Verbiage will be added to address who should develop the SWMM model, how it will be kept up-to-date, who would use it, and a short explanation on how this model is different than the H&H models recommended earlier. Submitted By: Belinda Weikle (304-399-5808) Submitted On: Sep 15 2014</p>				
<p>2-1 Backcheck Recommendation Close Comment OK. Submitted By: Phyllis Kohl ((615) 736-2022) Submitted On: Sep 15 2014</p>				

Current Comment Status: Comment Closed				
5784492	Planning - Plan Formulation	Part 7.1	n/a	n/a
<p>Comment Classification: For Official Use Only (FOUO)</p> <p>At the end of the 3rd paragraph, I recommend adding that communities that don't participate in the NFIP are not eligible to participate in federally cost-shared flood risk management projects.</p> <p>Submitted By: Phyllis Kohl ((615) 736-2022). Submitted On: Sep 02 2014</p>				
	1-0	<p>Evaluation Concurred Concur. The following text has been added to the end of the third paragraph: It should also be noted that communities which do not participate in the NFIP are not eligible to participate in federally cost-shared flood risk management projects.</p> <p>Submitted By: Jami Buchanan (304-399-5347) Submitted On: Sep 08 2014</p>		
	1-1	<p>Backcheck Recommendation Close Comment Closed without comment.</p> <p>Submitted By: Phyllis Kohl ((615) 736-2022) Submitted On: Sep 15 2014</p>		
Current Comment Status: Comment Closed				
5784494	Planning - Plan Formulation	Part 7.5 and Part 7.6.1.4	n/a	n/a
<p>Comment Classification: For Official Use Only (FOUO)</p> <p>Since the purpose of this study is to improve conditions, not just save property owners money on flood premiums, more emphasis should be placed on additional actions communities can take under the CRS program.</p> <p>Submitted By: Phyllis Kohl ((615) 736-2022). Submitted On: Sep 02 2014</p>				
	1-0	<p>Evaluation Concurred Concur; The monetary benefit of CRS participation was highlighted so that advisory team and technical team participants could promote the CRS program to the general public by virtue of the policy savings. Section 7.5 has been revised to emphasize the other benefits of actions that the communities can take under the CRS to improve conditions of flood damages, restore floodplain functioning and improve NFIP education. Section 7.6.1.4 has also been revised to point out a broader spectrum of</p>		

	benefits to watershed residents as a result of participating in the CRS. Submitted By: Jami Buchanan (304-399-5347) Submitted On: Sep 08 2014			
1-1	Backcheck Recommendation Close Comment Closed without comment. Submitted By: Phyllis Kohl ((615) 736-2022) Submitted On: Sep 15 2014			
	Current Comment Status: Comment Closed			
5784495	Planning - Plan Formulation	Part 7.6.1.2	n/a	n/a
<p>Comment Classification: For Official Use Only (FOUO)</p> <p>The goal of this watershed study is not to make it "easier" for potential developers and private landowners to use but rather to make floodplain management more effective at preventing flood damages and adverse water quality impacts.</p> <p>Submitted By: Phyllis Kohl ((615) 736-2022). Submitted On: Sep 02 2014</p>				
1-0	<p>Evaluation Concurred Concur. The text has been modified as follows:</p> <p>Following discussions between the advisory and technical groups, two changes were considered to make floodplain management more effective at preventing flood damages and adverse water quality impacts. A secondary benefit of these changes would be the program would be easier for potential developers and private landowners to use and be more efficient in terms of financial requirements.</p> <p>Submitted By: Jami Buchanan (304-399-5347) Submitted On: Sep 08 2014</p>			
1-1	<p>Backcheck Recommendation Close Comment Excellent! Submitted By: Phyllis Kohl ((615) 736-2022) Submitted On: Sep 15 2014</p>			
	Current Comment Status: Comment Closed			
5784496	Planning - Plan Formulation	Table 9.3	n/a	n/a
<p>Comment Classification: For Official Use Only (FOUO)</p> <p>Why isn't the EPA included as a potential lead for using their SWMM model?</p>				

Submitted By: Phyllis Kohl ((615) 736-2022). Submitted On: Sep 02 2014				
1-0		Evaluation Concurred Concur. Oversight on our part. They have been added as a potential lead. Submitted By: Jami Buchanan (304-399-5347) Submitted On: Sep 10 2014		
1-1		Backcheck Recommendation Close Comment Closed without comment. Submitted By: Phyllis Kohl ((615) 736-2022) Submitted On: Sep 15 2014		
Current Comment Status: Comment Closed				
5784499	Planning - Plan Formulation	Part 9.2.4	n/a	n/a
Comment Classification: For Official Use Only (FOUO) Under ODNR – Wetland Restoration Assistance, please explain what is referred to as "tile cuts." Under ODNR – Watershed Coordinators Grant, please explain what a water coordinator would do to realize the goals of this watershed study. Submitted By: Phyllis Kohl ((615) 736-2022). Submitted On: Sep 02 2014				
1-0		Evaluation Concurred Concur. The following text has been added to the document. Non-profit organizations, local and regional municipalities are eligible for these grants. They provide up to \$35,000 a year for up to four years to support local employment of a watershed coordinator. A watershed coordinator for the Nimishillen Creek Watershed could help to manage the data in the Central Repository (see Section 8.2), as well as oversee updates to the Hydraulic and Hydrologic Model. The watershed coordinator could play a crucial role in public outreach, in terms of the education recommendation made above in Chapter 8. Overall, a watershed coordinator could serve a point person for joint efforts on water resources projects in the watershed. Submitted By: Jami Buchanan (304-399-5347) Submitted On: Sep 10 2014		
1-1		Backcheck Recommendation Close Comment Closed without comment. Submitted By: Phyllis Kohl ((615) 736-2022) Submitted On: Sep 15 2014		
Current Comment Status: Comment Closed				

5784508	Planning - Plan Formulation	Appendix D	n/a	n/a
<p>Comment Classification: For Official Use Only (FOUO)</p> <p>The Flood Warning System H&H Component Overview should include hydrologic modeling of the basin as stream gage information is rarely sufficient for determining warning times. The hydrologic model should be calibrated to data from the basin and/or a similar adjoining basin.</p> <p>Submitted By: Phyllis Kohl ((615) 736-2022). Submitted On: Sep 02 2014</p>				
	1-0	Evaluation Concurred Concur		
Submitted By: Belinda Weikle (304-399-5808) Submitted On: Sep 15 2014				
	1-1	Backcheck Recommendation Close Comment Closed without comment.		
Submitted By: Phyllis Kohl ((615) 736-2022) Submitted On: Sep 15 2014				
Current Comment Status: Comment Closed				
5784514	Planning - Plan Formulation	Appendix D	n/a	n/a
<p>Comment Classification: For Official Use Only (FOUO)</p> <p>Description of Analysis Needed for Implementation of a Flood Warning System - A hydrologic model is needed to prepare a good flood warning system. Recommend you revise this part to include discussion of hydrologic model then, in the section on Flood Warning System H&H Component below you can simply reference this section when discussing flows.</p> <p>Submitted By: Phyllis Kohl ((615) 736-2022). Submitted On: Sep 02 2014</p>				
	1-0	Evaluation Concurred Referenced the Hydrologic and Hydraulic Modeling Update Section below in the Flood Warning System discussion		
Submitted By: Belinda Weikle (304-399-5808) Submitted On: Sep 15 2014				
	1-1	Backcheck Recommendation Close Comment Closed without comment.		
Submitted By: Phyllis Kohl ((615) 736-2022) Submitted On: Sep 15 2014				
Current Comment Status: Comment Closed				
5784518	Planning - Plan Formulation	Appendix D	n/a	n/a

Comment Classification: **For Official Use Only (FOUO)**

I suggest discussion on setting of High Water Marks be included since this information is key to accurate hydrologic and hydraulic models and it is also something that should be well within the capability of local governments to do. This could include a short "How-to" document that local governments could start using right away (we have a draft we'd be happy to share).

Submitted By: Phyllis Kohl ((615) 736-2022). Submitted On: Sep 02 2014

<p>1-0</p>	<p>Evaluation Concurred The importance of high water marks as related to numerical model calibration and setting of high water marks was discussed at one of the stakeholder meetings. A discussion will be added. Please provide a draft of the 'How-to' document for the local government use to be incorporated in this report.</p> <p>Submitted By: Belinda Weikle (304-399-5808) Submitted On: Sep 15 2014</p>
<p>1-1</p>	<p>Backcheck Recommendation Close Comment Attached is rudimentary guidance on setting HWM. This is currently being expanded. Will provide the revised document when available.</p> <p>Submitted By: Phyllis Kohl ((615) 736-2022) Submitted On: Sep 18 2014 (Attachment: Cheatham_County_AppG_HWM_Guide.docx)</p>
<p>Current Comment Status: Comment Closed</p>	
<p> </p>	

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Patent 11/892,984 ProjNet property of ERDC since 2004.

ENCLOSURE 3

**COMPLETION AND CERTIFICATION
STATEMENTS OF AGENCY TECHNICAL
REVIEW**

COMPLETION OF AGENCY TECHNICAL REVIEW

The Agency Technical Review (ATR) has been completed for the Nimishillen Creek Watershed Section 729 Final Watershed Assessment and Water Management Plan, for the Huntington District. The ATR was conducted as defined in the project's Review Plan to comply with the requirements of EC 1165 2-209. During the ATR, compliance with established policy principles and procedures, utilizing justified and valid assumptions, was. This included review of: assumptions, methods, procedures, and material used in analyses, alternatives evaluated, the appropriateness of data used and level obtained, and reasonableness of the results, including whether the product meets the customer's needs consistent with law and existing US Army Corps of Engineers policy. The ATR also assessed the District Quality Control (DQC) documentation and made the determination that the DQC activities employed appear to be effective. The review report notes that all comments have been closed.

Janet Cote
ATR Team Leader
CENAO-WR-PE

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Signature and Date

Jami Buchanan
Project Manager
CELRH-PM-PD-R

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Signature and Date

Amy Franz
Chief, Planning Branch,
CELRH-PM-PD

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Date: 2014.10.09 16:10:48 -04'00'

Signature and Date

John Zimmerman
Planning and Policy Division,
Great Lakes and Ohio River Division
CELRD-PDS-P

Signature and Date

CERTIFICATION OF AGENCY TECHNICAL REVIEW

Significant concerns and the explanation of the resolution are as follows:

As noted above, all concerns resulting from the ATR of the project have been fully resolved.

Sue Ferguson
Plan Formulation
CELRN-PM-P

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Date: 2014.10.09 14:43:54 -0500

Signature and Date

Phyllis Kohl
Hydraulics & Hydrology
CELRN-EC-H

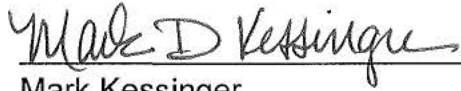
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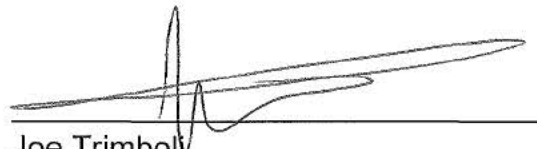
Signature and Date

Project Delivery Team (PDT) Certification of Document

The undersigned, as members of the PDT, hereby acknowledge the completion of the Section 729 Final Watershed Assessment for the Nimishillen Creek Watershed in the State of Ohio. Methodology employed during this planning effort is in accordance with current Corps policy and regulations.



Mark Kessinger
Project Manager, CELRH-PM-PP-P



Joe Trimboli
GIS Specialist, CELRH-PM-PD-F



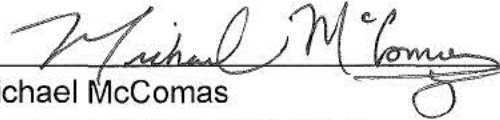
Jami L. Buchanan
Lead Planner, CELRH-PM-PD-R



Belinda Weikle
H&H Engineer, CELRH-EC-WH



R. Gus Drum
Plan Formulation, CELRH-PM-PD-R



Michael McComas
Ecologist, CELRH-PM-PD-R

Program & Policy Compliance Certification

I hereby certify the recommendation for approval of the Section 729 Final Watershed Assessment for the Nimishillen Creek Watershed in the State of Ohio. This document, which was prepared using a watershed approach, is in compliance with Corps policy and regulations (including the P&G and ER 1105-2-100), which govern formulation, economic analysis and environmental assessment.



Amy K. Frantz
Chief, Planning Branch

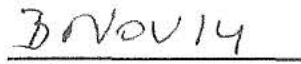
16 Oct 2014
Date

Certification of Legal Review

This Section 729 Final Watershed Assessment for the Nimishillen Creek Watershed in the State of Ohio has been reviewed by the Huntington District Office of Counsel and is approved as legally sufficient.



Henry J. Iarrusso
District Counsel
Office of Counsel, Huntington District



Date

Final Watershed Assessment
Nimishillen Creek Watershed
Appendix I
Outreach Materials

Final Watershed Assessment for the Nimishillen Creek Watershed

The U.S. Army Corps of Engineers, Huntington District, announces that it has completed an effort to help community leaders in the Nimishillen Creek Watershed to make efficient and effective decisions regarding flooding, water quality, storm water management and floodplain management.

Under the authority of Section 729 of the Water Resources Development Act of 1986, the Huntington District has completed a Final Watershed Assessment (FWA) and Watershed Management Plan (WMP) for the watershed. The goal of the FWA was the development of a WMP for the Nimishillen Creek Watershed which addresses water resources related issues pertaining to flooding, water quality, stormwater management and floodplain management. These issues were identified through extensive stakeholder involvement, including meetings and workshops held with local officials such as mayors, city managers and city and county engineers, as well as representatives from various State of Ohio resource agencies, and the project cost share partner, the Muskingum Watershed Conservancy District (MWCD).

The outcome of the FWA/WMP is a series of recommendations including (but not limited to) installation of additional rain and stream gages, a hydrologic and hydraulic model for the watershed, consolidation of floodplain management duties, and addressing sewage treatment throughout the watershed.

Watershed planning under the Section 729 authority addresses identified water resources related problems and opportunities in the watershed and helps to shape a joint vision for managing those water resources. Questions or concerns may be directed to the Huntington District of the USACE:

ATTN: Planning Branch
502 8th Street
Huntington, WV 25701
304.399.5211
public.affairs@lrh01.usace.army.mil

For More Information Contact:

Jami L. Buchanan
Community Planner
Huntington District USACE

502 8th Street
Huntington
West Virginia 25701

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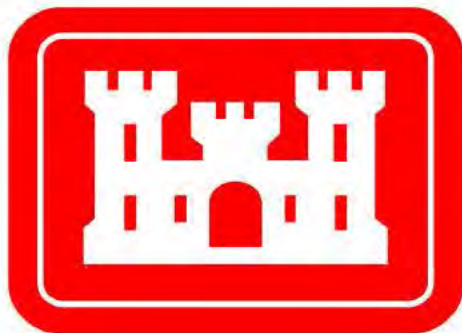
**Nimishillen Creek Watershed
Stark, Summit and Tuscarawas Counties, Ohio**

**Section 729
Final Watershed Assessment
and
Watershed Management Plan**



**U.S. Army Corps of Engineers
Huntington District**

March 2015



**US Army Corps of Engineers
Huntington District**

The Nimishillen Creek Watershed

The Nimishillen Creek Watershed is part of the Muskingum River Basin, which lies in the eastern portion of Ohio. Nimishillen Creek is 23.5 miles long, and drains approximately 187 square miles, including the entire City of Canton, and portions of the Cities of Green, North Canton, Louisville, East Canton, East Sparta, Hartville, Hills and Dales and Meyers Lake. The watershed covers portions of Stark, Summit and Tuscarawas Counties.



What is Watershed Planning?

Watershed planning addresses problems, needs, and opportunities within a watershed, strives to achieve integrated water resources management and results in holistic plans or strategies to address watershed needs. The goal is to look at the entire watershed to see what solutions could be implemented to address problems including but not limited to: flooding, water supply, agricultural runoff, stormwater runoff, water pollution, and floodplain management. The watershed planning process takes into account a broad range of stakeholders to accurately define the problems, as well as a broad range of federal, state and non-governmental agencies in order to provide a wide range of solutions.

Nimishillen Creek Watershed Management Plan

The goal of the FWA was the development of a Watershed Management Plan (WMP) for the Nimishillen Creek Watershed which addresses water resources related issues pertaining to flooding, water quality, stormwater management and floodplain management. These issues were identified through extensive stakeholder involvement, including meetings and workshops held with local officials such as mayors, city managers and city and county engineers, as well as representatives from various State of Ohio resource agencies, and the project cost share partner, the Muskingum Watershed Conservancy District (MWCD).

Once these issues were identified, the Huntington District Project Delivery Team (PDT), in continued partnership with the stakeholders, began to identify potential solutions for each issue. The Huntington District developed each potential solution and finally developed a series of recommendations for implementation.

Priority Recommendations

Flood Risk Management Recommendations

- Installation of Additional Rain/Stream Gages
- Flood Warning System
- Flood Warning Emergency Evacuation Plan
- Hydrologic and Hydraulic Modeling Update

Water Quality Recommendations

- Addressing Sewage Treatment in the Watershed
- Addressing Inundated Manholes
- Improvements to Local Land Use Zoning

Stormwater Management

Recommendations

- Connect Hydrologic Network of Streams & Adjoining Floodplains
- Establish Consistency in Stormwater Management Regulations

Floodplain Management Recommendations

- Consolidation of Floodplain Management Duties

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