ASWM WATERSHED PROJECT INVENTORY DATA SHEET
3.29.19

Name and location of watershed: Beaver Creek Watershed, a sub-watershed within the Upper Cedar River Watershed as defined by the boundary of eight-digit Hydrologic Unit Code (HUC8) 07080201

Size of watershed (in acres): 11328 acres, 17 square miles

Title of Project/Initiative: Iowa Watershed Project

Setting: (please check all that apply)

__ Urban (towns, cities, and suburbs with 2,500 inhabitants or more)
X Rural (anything outside the urban area)
X Inland
__ Coastal

Need/Challenge Addressed (200 word limit):

In Phase I of the project, the Iowa Flood Center carried out a hydrologic assessment of the Upper Cedar River Watershed (Iowa Flood Center, 2014). The assessment characterized the water cycle of the Upper Cedar River using historical observations. It also investigated trends observed for the Upper Cedar River within the broader context of changes in land use and weather patterns. Researchers implemented a hydrologic model of the Upper Cedar River using the Hydrologic Engineering Center Hydrologic Modeling System (HEC-HMS) to identify areas in the watershed with high runoff potential and to run simulations to help understand the potential impact of alternative flood mitigation strategies in the watershed. In Phase II of the project, researchers identified a smaller catchment (known as a HUC12 sub-watershed) for development and construction of flood mitigation projects. In collaboration with the Upper Cedar Watershed Management Improvement Authority, they selected the Beaver Creek Watershed where IFC researchers evaluated the flood mitigation performance of proposed projects through monitoring and detailed hydrologic modeling. The team developed small-scale hydrologic simulations for the Beaver Creek Watershed using a more detailed representation of the watershed and flood mitigation strategies than was used in Phase I.

Goals & Objectives (please include ecosystem services/values focused on):

•Maximize soil water holding capacity from precipitation;
•Minimize severe soil erosion and sand deposition during floods;
•Manage water runoff in uplands under saturated soil moisture conditions;
• Reduce and mitigate structural and nonstructural flood damage

Overall Strategy (i.e., what role do wetlands play in your project?)

A cluster of wetlands have been constructed in the Northeastern Iowa watershed of Beaver Creek. This is a 17 mi^2 watershed that outlets to the main branch of the Cedar River near Bassett. There are nine wetlands in total, with seven funded through HUD and two by the USDA (Conservation Reserve Enhancement Program-CREP).

The demonstration projects constructed through the Iowa Watersheds Project provide multiple benefits both on- and off-site. Landowners enjoy the farm wetlands on their property for the aesthetic beauty, recreation, and wildlife attracted to the habitat. In addition, landowners can use the wetlands to water livestock and control erosion on their land. Wetland structures were strategically placed in areas not suitable for farming and upon completion, gave landowners better, easier access to the rest of their farm.

Projects create storage on the landscape that reduces downstream flooding, protecting both people and infrastructure. The wetland structures provide significant savings in federal, state, and local road and bridge maintenance costs by managing runoff to reduce and mitigate structural and nonstructural flood damage. Constructed projects serve as demonstration sites to encourage other landowners to adopt similar conservation practices.

Structural: (USACE): Channels, Levee/Wall, Dams, Diversions

Non-structural: (USACE) as it relates to flood risk management can be a set of physical or nonphysical measures used for mitigating loss of life as well as existing and future flood damages. The physical measures adapt to the natural characteristics of the floodplain without adversely affecting or changing those natural flood characteristics. These measures are generally compliant with NFIP and cause no adverse effects to the floodplain, flood stages, velocities, or environment. Non-physical measures are typically applied as management measures in the floodplain - Floodwalls, berms, barriers, and levees with closures, rain gardens, planter boxes, green space, porous pavement (land use, low impact development or green infrastructure), FEMA would consider everything structural outside of planning, building code development, environmental surveys, etc. Consideration for these types of measures include: 1) flood characteristics: depth, velocity, duration, rate of rise, debris/ice flows, wave action and 2) site characteristics: location, soil type, topography, site size, urban/rural

Techniques Used (please check all that apply):

__ Restoration (the manipulation of the physical, chemical, or biological characteristics of a site with the goal of returning natural/historic functions to former or degraded wetland.)

X Creation (the manipulation of the physical, chemical, or biological characteristics present to develop a wetland that did not previously exist on an upland or deep-water site, resulting in a gain in wetland acres.)

X Enhancement (the manipulation of the physical, chemical, or biological characteristics of a wetland (undisturbed or degraded) site to heighten, intensify, or improve specific function(s) or for a purpose such as water quality improvement, flood water retention or wildlife habitat.)

__ Protection (the removal of a threat to, or preventing decline of, wetland conditions by an action in or near a wetland. Includes purchase of land or easement, repairing water control structures or fences, or structural protection such as repairing a barrier island.)

Team Members:

- **Team leaders (organizations, agencies or individuals that are responsible for overall project direction, outcomes and financing):** University of Iowa IIHR-Hydroscience and Engineering and the Iowa Flood Center
- **Partners (organizations, agencies or individuals that are responsible for implementation of the project by agreement or contract):** Upper Cedar Watershed Management Improvement Authority
- **Collaborators (organizations, agencies or individuals that are involved in an advisory role):** Ducks Unlimited Inc., Floyd County SWCD, Chickasaw County SWCD, Mitchell County SWCD, Iowa Department of Natural Resources, Natural Resources Conservation Service.

Stakeholders (organizations, agencies or individuals that are in some way impacted by the project): Landowners and local communities

Overview/history (200 word limit):
In 2010, Iowa received $8.8 million from the U.S. Department of Housing and Urban Development (HUD) to assist with ongoing disaster recovery programs following these devastating floods. The Iowa Flood Center (IFC), a unit of the University of Iowa's IIHR—Hydroscience & Engineering, led an effort called the Iowa Watersheds Project. Its goal was to evaluate and implement flood reduction methods in Iowa watersheds. The Upper Cedar Watershed, in collaboration with the Upper Cedar River Watershed Management Improvement Authority, was one of four watersheds (see Figure 1.1) selected to demonstrate a watershed approach for flood risk reduction

Prior to the Iowa Watersheds Project, three constructed multi-purpose wetlands-type projects were built in the Beaver Creek Watershed between 2006 and 2013. The Conservation Reserve Enhancement Program (CREP) funded two of the projects for nutrient reduction purposes. The third wetland is located to the south of the CREP wetlands and drains a smaller area than any of the CREP or Iowa Watersheds Project wetlands. Together, the six Iowa Watersheds Project wetlands and three existing wetlands provide total flood storage of 155.2 acre-feet.

Start and end dates (dates can overlap – estimates are acceptable): 2010-2016

- Planning: Not specified.
- Implementation: Not specified.
- Monitoring: Not specified.

Cost – Financing (estimates are acceptable): Beaver Creek was selected to receive $1.5 million to fund the construction of small flood mitigation projects. It is has been quantified to make a measurable reduction of flooding to a HUC 12 watershed one would need to at least invest in $1.5 million of conservation BMP's

- Planning: Not specified.
- Implementation: Not specified.
- Monitoring: Not specified.
- Continual (are there ongoing maintenance costs that will be required?): Not specified.

Resulting benefits (please list what was measured and how:

Flood Control	Water Quality	Discharge	Hydrological Conditions	Wetland Restoration	Biodiversity/ Productivity	Listed Species	Economically Important Species	Pub. Access, Rec, Awareness	Other Economic Benefits	Other
X	X								Cost savings in flood damage	Nitrogen Removal, demonstration sites to encourage landowners to adopt similar practices

Environmental benefits (e.g. water Ecosystem services/benefits (e.g. water quality improvements, habitat protection or improvement, recreational opportunities, etc.)

The table below illustrates average nitrate concentrations at the two sensors. All the constructed wetlands are upstream of the Colwell sensor.

Nitrate-N mg/L		
Year	Bassett (DS)	Colwell (US)
2014	10.1	9.0
2015	9.2	6.2
2016	10.9	11.4
2017	8.5	6.2
2018	9.3	10.2
AVG	9.6	8.4

During the summer of 2017, two IIHR students extensively sampled the wetlands. Inlet and outlet samples were collected on eight days, June-August. These results are shown below. Overall, nitrate concentrations declined 60.6% in the wetlands.

Site	Inlet NO3-N (mg/L)	Outlet NO3-N (mg/L)
1	16.5	4.3
2	5.8	3.0
3	7.2	3.1
4	14.5	6.5
5	14.7	2.0
6	12.2	7.1
Floyd	13.1	7.0
Wohlers	9.2	3.7
Average	11.6	4.6

Monitoring: In the spring of 2014, researchers installed instrumentation throughout the Beaver Creek Watershed to monitor water quantity and water quality. The Iowa Flood Center deployed sensors to measure hydrologic variables, such as stream stage and rainfall/soil moisture, and IIHR— Hydroscience & Engineering led the water quality monitoring. The instrumentation includes three rain gauge and soil moisture (RGSM) platforms, three stage sensors, six shallow groundwater wells, and two water quality sensors. Each monitoring system consists of an IIHR—Hydroscience & Engineering developed datalogger, battery, solar panel, and cellular modem. Data were collected, transmitted, and ingested into servers at the University of Iowa on a 15-minute schedule.

The Iowa Flood Center's Iowa Flood Information System (IFIS) online suite of tools provides realtime information on watersheds, precipitation, and stream levels for more than 1,000 Iowa communities. Data collected from the rain gauge and soil moisture platforms, shallow groundwater wells, and stream

sensors deployed in the Beaver Creek Watershed can be accessed at http://ifis.iowafloodcenter.org/ifis/app. IIHR—Hydroscience & Engineering's Iowa Water-Quality Information System (Iowa WQIS) online tool is built on the same user-friendly Google Maps interface as IFIS, which was developed by the IFC. Iowa WQIS integrates data gathered by IIHR and the U.S. Geological Survey (USGS) and allows users to track water-quality conditions in real-time. Water-quality data for Beaver Creek can be accessed from the site at http://iwqis.iowawis.org/app. The Iowa Flood Information System (IFIS) and the Iowa Water-Quality Information System (Iowa WQIS) provide extensive and critical information needed by scientists, policy-makers, and other Iowans to make science-based decisions that will help us accomplish Iowa's water-quality objectives

In 2015, six wetlands were built in the Beaver Creek Watershed through the Iowa Watersheds Project. The wetlands are designed to serve two purposes: flood mitigation and nitrogen removal. The six wetlands provide a total flood storage of 90.9 acre-feet. The total drainage area regulated by these wetlands is 1,196 acres, or about 10.6% of the Beaver Creek Watershed. (Overall, the flood storage volume of the wetlands is equal to 0.91 inches of runoff from their upstream drainage areas.

Financial or Economic Impact Benefits (e.g., avoided damage costs, increase in commercial fish revenue, increase in tourism revenue, etc.):
The wetland structures provide significant savings in federal, state, and local road and bridge maintenance costs by managing runoff to reduce and mitigate structural and nonstructural flood damage. Constructed projects serve as demonstration sites to encourage other landowners to adopt similar conservation practices.

Non-Market Economic Benefits (may be monetized - e.g., increased value of recreation or aesthetics or other improvements using dollar values; or non-monetized descriptions of benefits – e.g., number of people who may benefit from improved recreation or aesthetics or other resulting improvements):
The demonstration projects constructed through the Iowa Watersheds Project provide multiple benefits both on- and off-site. Landowners enjoy the farm wetlands on their property for the aesthetic beauty, recreation, and wildlife attracted to the habitat. In addition, landowners can use the wetlands to water livestock and control erosion on their land. Wetland structures were strategically placed in areas not suitable for farming and upon completion, gave landowners better, easier access to the rest of their farm. Projects create storage on the landscape that reduces downstream flooding, protecting both people and infrastructure.

Other: Information not provided.

Are benefits based on actual measures or did you use a model to predict benefits? Information not provided.

Is there a cost-benefit analysis available? Yes or No (If yes, include a copy with your response) No

If you do not have any data currently available in regard to benefits, how do you plan to measure them? Information not provided.

Where there any innovative designs/technologies/policy changes created to enable the project or that resulted from the project? (If so, please describe): Information not provided.

Lessons Learned: Information not provided.

Do you have any images or photos to share?

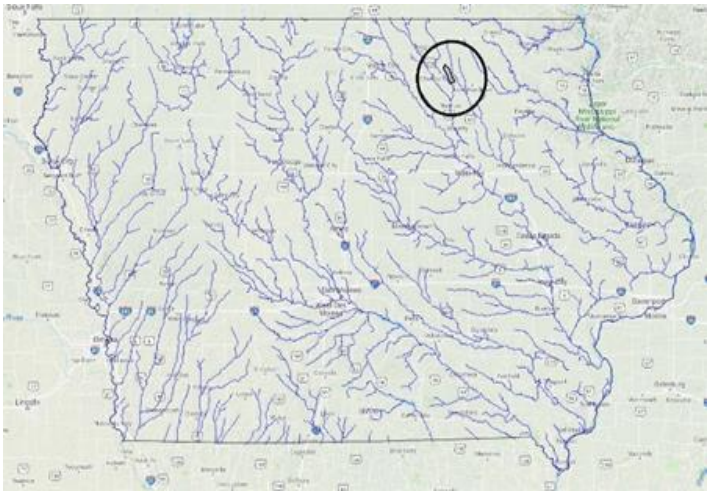

Figure 1: Location of the Beaver Creek Watershed

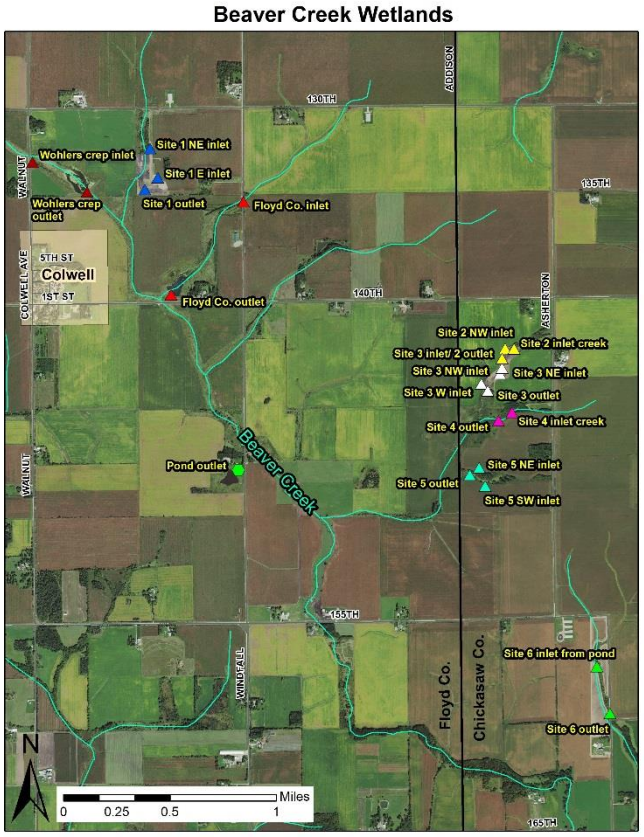

Figure 2: Wetland Locations

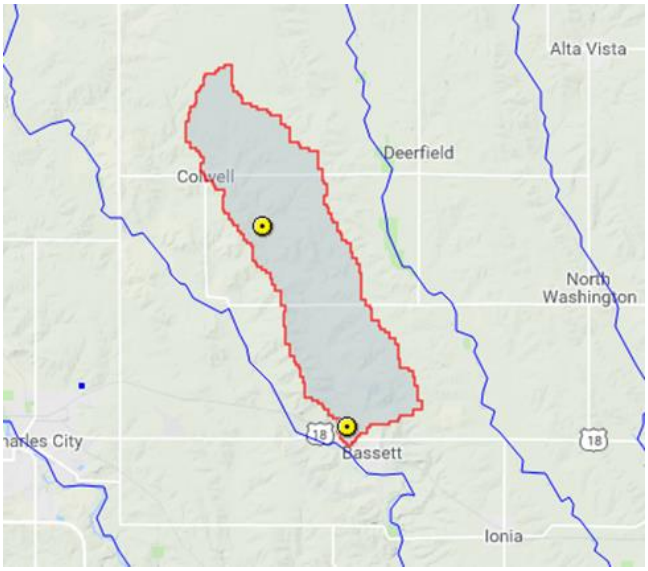

Figure 3: Water quality sensor locations in Beaver Creek

FMI (please include contact name, organization, website, phone number and/or email address):

Beaver Creek Watershed Management Authority

- Bob Rice - Director of Polk County Public Works, 515-286-3705, Robert.Rice@polkcountyiowa.gov
- Jennifer Welch - Polk County Soil and Water Conservation District, 515-964-1883x3, Jennifer.Welch@ia.nacdnet.net