IIHR—Hydroscience & Engineering

North Raccoon Flood Resilience Action Plan Screening: City of Gowrie

Contents

Executive Summary 3

North Raccoon Watershed Characteristcs 3

The City of Gowrie 6

Existing BMPs 7

Agricultural Conservation Planning Framework (ACPF) 8

Executive Summary

Flooding is one of the most significant threats to the safety and vitality of many communities, especially in the Midwest. Numerous communities within the central United States have experienced catastrophic flooding events in recent decades causing damages to social, economic, and environmental wellbeing. Community flood resilience is the ability of people living in a common watershed to plan and act collectively, using local capacities to mitigate, prepare for, respond to, and recover from a flood. Flood resilient communities understand that actions can reduce flood risk through mitigation, preparedness, response, and recovery. Flood resilient communities also know how to use local and regional resources that make collective action successful.

The IWA Flood Resilience Program seeks to improve watersheds through connecting local partners and stakeholders, enhancing the presence of social resources in watershed planning efforts, and increasing the awareness and communication of established and novel flood resilience initiatives. The goals of the Flood Resilience Program are to:

- Measure, visualize, and communicate flood resilience resources
- Enhance flood resilience content in formal watershed plans
- Improve social resources of flood resilience

The City of Gowrie was chosen for a flood resilience action plan (FRAP) screening after Iowa Homeland Security and Emergency Management staff and a watershed planning consultant highlighted the occurrence of repetitive flood losses. One commercial building and 12 residential structures were subsequently identified as being in the 500-year flood plain. Additional screening with the IWA Information System (HUC12: 071000061201) suggested only two structures would be impacted by a 500-year flood. Further investigation revealed that Tank Pond Creek may be a significant choke point for surface water flow and discharged stormwater to exit the city to the southwest. The FRAP screening process suggested that localized stormwater conveyance issues may be the leading cause of the reported flood loss damages. Nonetheless, the FRAP screening process was extended to include the possibility of adding modest stormwater detention structures (e.g., flood control wetlands) northeast of Gowrie, potentially in the Lindquist Wildlife Sanctuary and/or marginally productive farmland areas. The Agricultural Planning Framework (ACPF) tool did not identify any viable project sites and the full FRAP processes was not initiated with the City of Gowrie.

North Raccoon Watershed Characteristcs

The North Raccoon River Watershed as defined by the boundary of eight-digit Hydrologic Unit Code (HUC 8) 07100006 is in west-central Iowa and encompasses approximately 2471 square miles (mi^2). The North Raccoon River is joined by South Raccoon River (HUC 8) 07100007 near Van Meter, Iowa, forming the Raccoon River, flowing west to east into the Des Moines River at Des Moines, Iowa. The total drainage area of the Raccoon River at Des Moines is approximately 3608 mi^2. The North Raccoon River Watershed boundary falls within 15 counties in total (Figure 1); however, most of the watershed area lies within Buena Vista, Pocahontas, Sac, Calhoun, Webster, Carroll, Green, Dallas, and Polk Counties.

Figure 1: The North Raccoon River Watershed (HUC 8: 07100006), drains 2471 sq. mi. The North Raccoon River joins the South Raccoon River near Van Meter, Iowa.

The topography of the North Raccoon River Watershed reflects its geologic past. As previously mentioned, much of the watershed lies within the Des Moines Lobe, which characterized as minimally sloping ground, interrupted by many isolated potholes. To facilitate drainage of the region, much of the drainage network is comprised of constructed channels. Topography information was provided by Iowa DNR in the form of bare-earth light detection and ranging (LiDAR) data. Elevations range from approximately 1510 feet above sea level in the uppermost part of the watershed upstream of Storm Lake to 785 feet at the Des Moines River outlet at Des Moines. Typical land slopes are between 0.3 and 1.4% (25th and 75th percentiles), with the steepest areas occurring in along the major stream valleys throughout watershed (Figure 2).

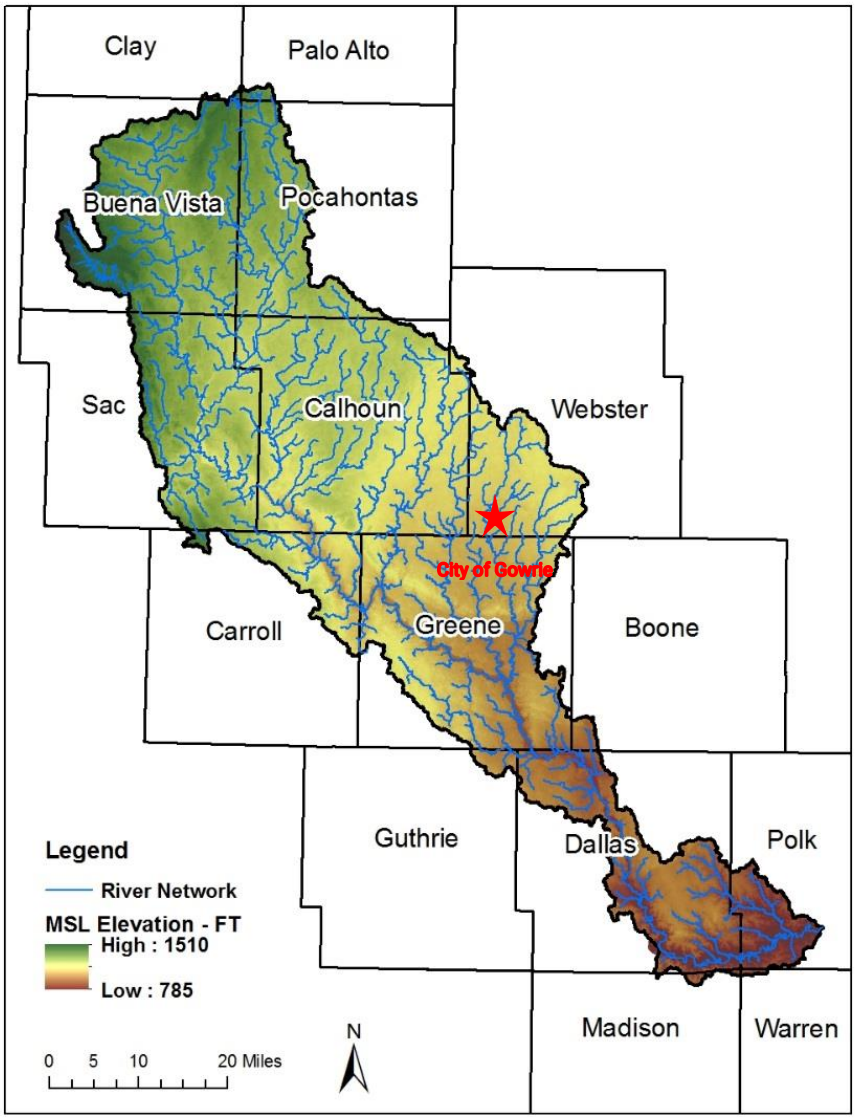

Figure 2: Topography of the North Raccoon River Watershed.

Land use in the North Raccoon River Watershed is predominantly agricultural, dominated by cultivated crops (corn/soy beans) on approximately 77.7% of the acreage (approximately 1,228,250 acres), followed by grass/hay/pasture at approximately 11.9%. The remaining acreage in the watershed is about 4.6% forest (primarily deciduous forest), 3.2% developed land, and 2.6% open water and/or wetlands, per the 2009 High Resolution Land Cover (HRLC) dataset provided by Iowa DNR (Figure 3).

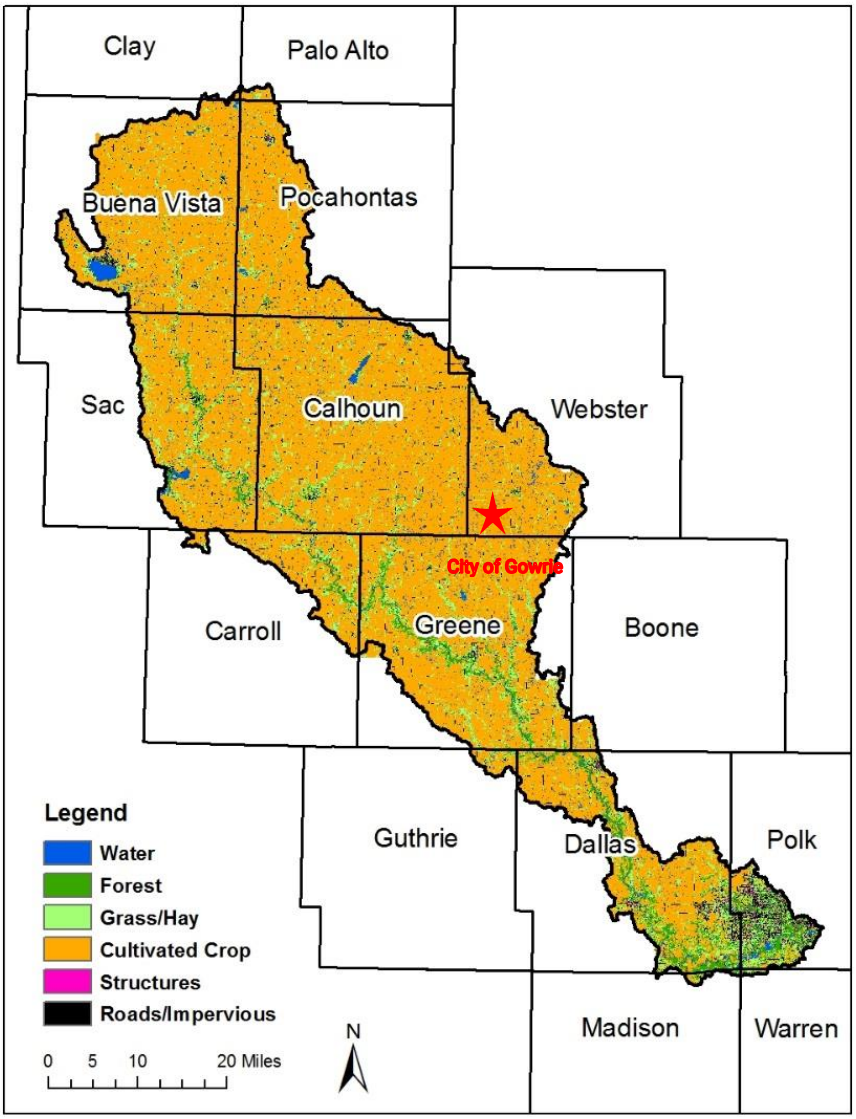

Figure 3: Land use composition in the North Raccoon River Watershed, according to the 2009 HRLC dataset provided by Iowa DNR.

The City of Gowrie

The City of Gowrie is in Webster County, Iowa, with a population of 952 at the time of the 2020 census. Gowrie was chosen for an IWA flood resilience action plan (FRAP) screening after Iowa Homeland Security and Emergency Management staff and a watershed planning consultant highlighted the occurrence of repetitive flood losses. Information on the probability, location, and extent of future floods and their impacts on populations and built environments are available on the Iowa Flood Information System (IFIS). Researchers from Iowa Department of Natural Resources, Iowa Flood Center, and U.S. Army Corp of Engineers have modeled inundation depths for the 1% annual chance flood (the so-called “100-year” flood), as well as for flood events with an annual chance of 50% (2-

year), 20% (5-year), 10% (10-year), 4% (25-year), 2% (50-year), 0.5% (200-year), and 0.2% (500-year) for the state of Iowa (Figure 4).

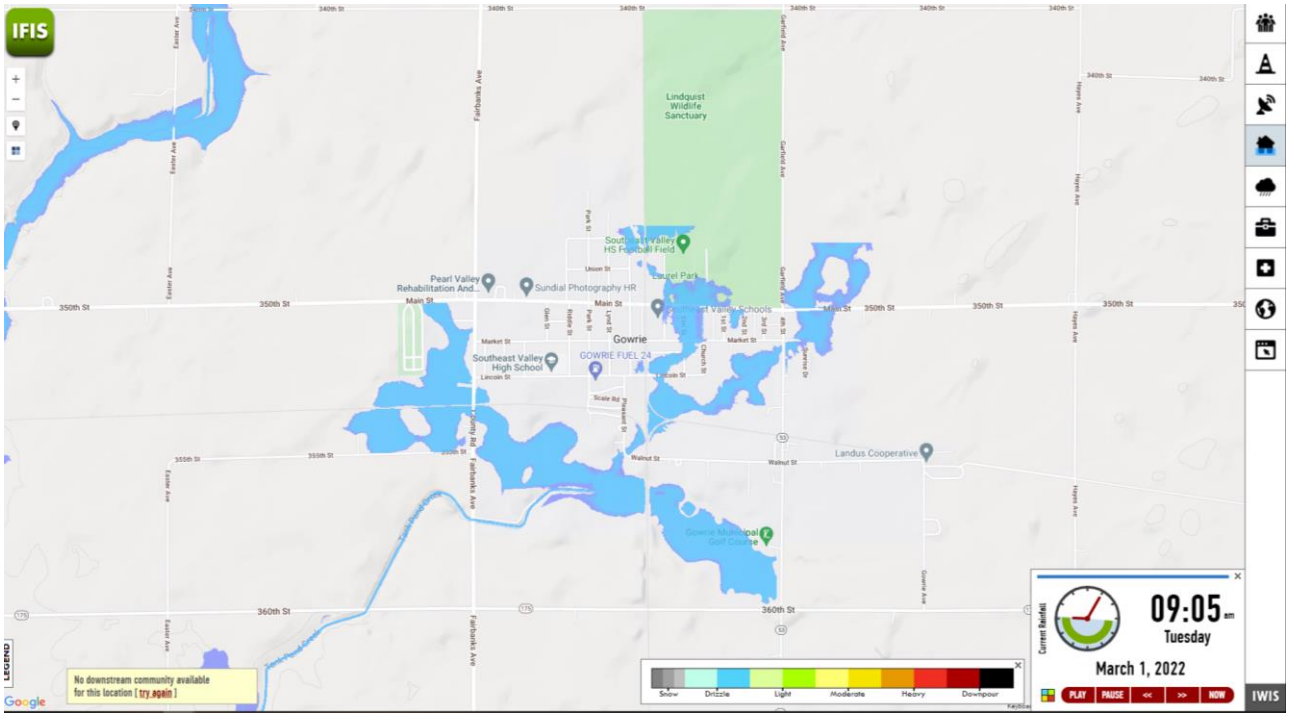

Figure 4: City of Gowrie - map view of 1% flood risk from statewide inundation maps in IFIS.

Existing BMPs

The Iowa Best Management Practices (BMP) Mapping Project is a collaborative effort led by the Iowa State University Geographic Information Systems (GIS) Facility, in association with the Iowa DNR, Iowa Flood Center, Iowa Department of Agriculture and Land Stewardship, Iowa Nutrient Research Center, National Laboratory for Agriculture and the Environment, and the Iowa Nutrient Research and Education Council. The goal of the project is to provide a complete baseline set of BMPs during the 2007–10 timeframe for use in watershed modeling, historic documentation, and future practice tracking. These practices include terraces, water and sediment control basins (WASCOBs), grassed waterways, pond dams, contour strip cropping, and contour buffer strips. The data has been manually digitized for each HUC 12 using LiDAR products, color-infrared (CIR) imagery, National Agriculture Imagery Program imagery, and historic aerial photography. This data is visualized in the Iowa Watershed Information System (IWAIS). Unfortunately, no known ponds, water and sediment control basins and grassed waterways were identified upstream or downstream of the Gowrie (Figure 4).

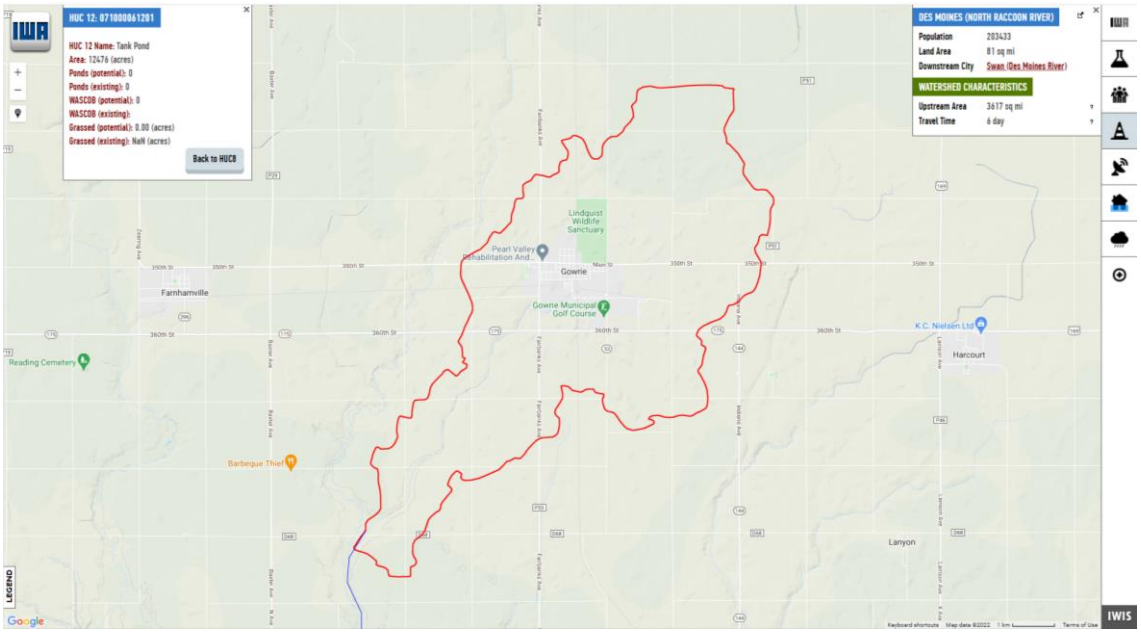

Figure 5: IWAIS showing existing best management practices near Gowrie. No practices were identified in the subwatershed of Tank Pond.

Agricultural Conservation Planning Framework (ACPF)

Development of an effective watershed planning document will require identification of potential conservation practices and viable locations to implement them. One cutting-edge tool available for practical conversation planning is the Agricultural Conservation Planning Framework watershed planning toolbox, developed by Mark Tomer and his research team at the USDA-ARS (Agricultural Research Service) in Ames, Iowa (Tomer et al., 2013). ACPF is a watershed approach to conservation planning facilitated with a set of semi-automated tools within ArcGIS software. Freely available and prepackaged GIS data can be used for terrain analyses to determine which fields within the watershed are most prone to runoff into streams. Users can apply the ACPF toolbox to identify locations where field-scale and edge-of-field practices could be installed based on general design criteria. These practices include controlled drainage, surface intake filters or restored wetlands, grassed waterways, contour buffer strips, WASCOBs, nutrient removal wetlands (NRWs), or edge-of-field bioreactors (North Central Region Water Network 2018).

Through elevation data processing we identified three areas (A, B, and C) that drain into Gowrie and where the implementation of detention structures has the potential to provide flood-reduction benefits for the city (Figure 6). Area B is the largest with approximately 2,600 acres whereas area C is the smallest with about 2,000 acres. We used the ACPF tool to locate nutrient removal wetlands upstream from Gowrie (in areas A, B, and C) but no candidate location for the implementation of this practice was identified. Furthermore, we extended our analysis to the entire HUC12 where Gowrie is located but again ACPF identified no viable nutrient removal wetlands.

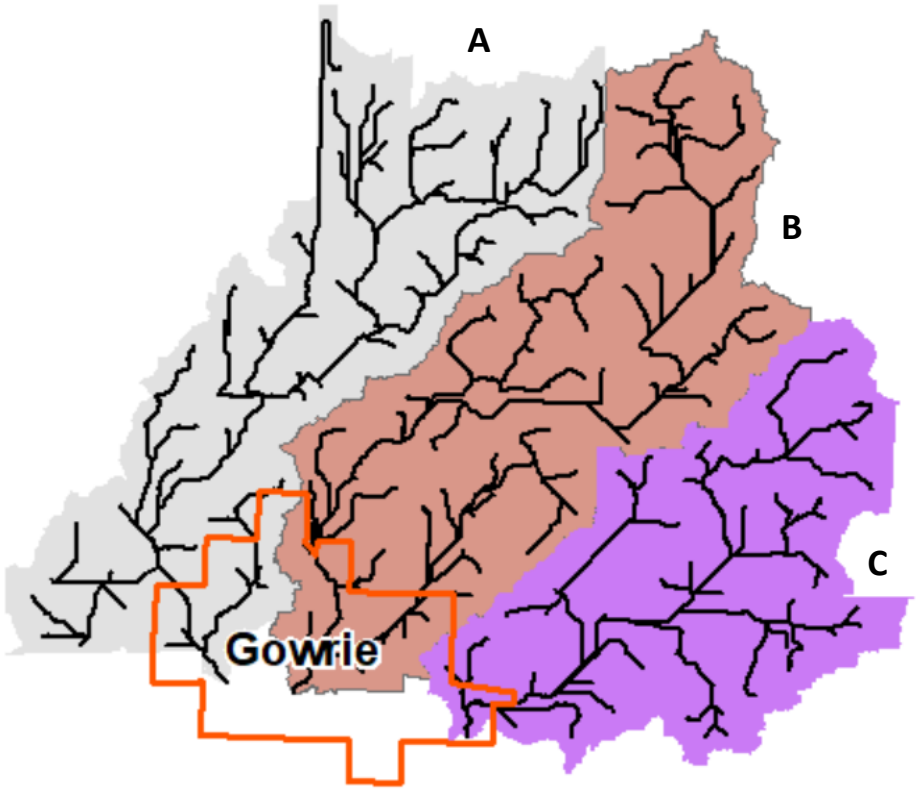

Figure 6: Gowrie and upstream areas as visualized in the ACPF tool.

Recommendations

To address flooding and stormwater infrastructure, we recommend the city conduct a stormwater infrastructure assessment. This may identify infrastructure in need of repair, maintenance, or that could be retrofitted for urban conservation practices. We suggest the city work with state partners like Iowa Homeland Security and Emergency Management, Iowa Department of Natural Resources, Iowa Department of Agriculture and Land Stewardship, and the Iowa Stormwater Education Partnership for further analysis.