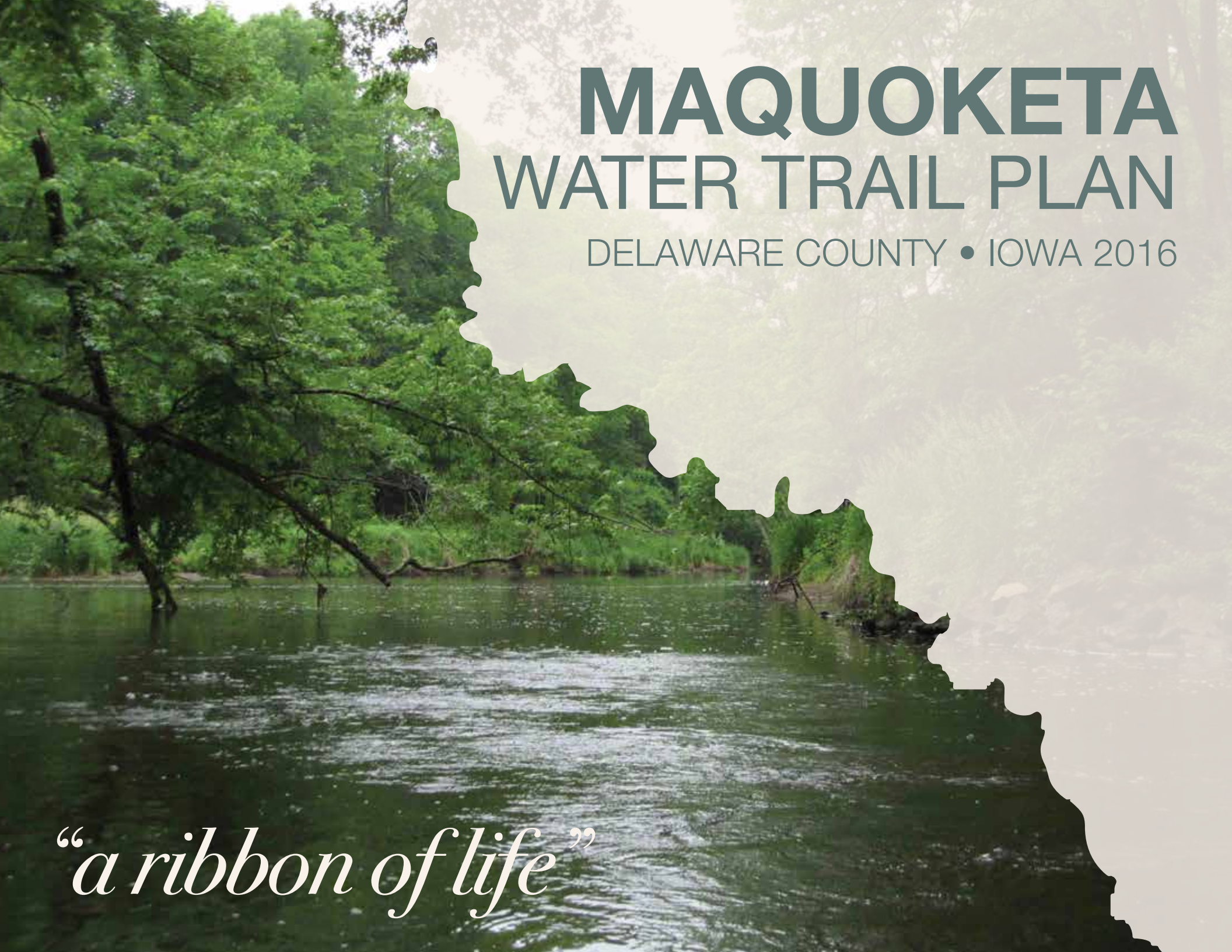

MAQUOKETA
WATER TRAIL PLAN

DELAWARE COUNTY • IOWA 2016

"a ribbon of life"

"a ribbon of life"

MAQUOKETA WATER TRAIL PLAN

DECEMBER 2016

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Iowa
Fields of Opportunities

STATE OF IOWA

TERRY E. BRANSTAD, GOVERNOR
KIM REYNOLDS, LT. GOVERNOR

DEPARTMENT OF NATURAL RESOURCES
CHUCK GIPP, DIRECTOR

January 9, 2017

It's hard to think of time when people were more interested in Iowa's rivers, whether for abundant chances to catch a fish, floating down a stream, or having an active innertubing adventure in one of Iowa's three whitewater facilities.

The DNR's work through water trail planning and development provides exciting opportunities that are ushering in a new legacy of enjoyment, respect, and care for the navigable waters of our state. It's rekindling the connection between people's interactions with the landscape and their respect and understanding of the water resource. Through improved access and information, we are connecting Iowans to the streams in their backyards and enhancing the appearances of downtown riverside communities.

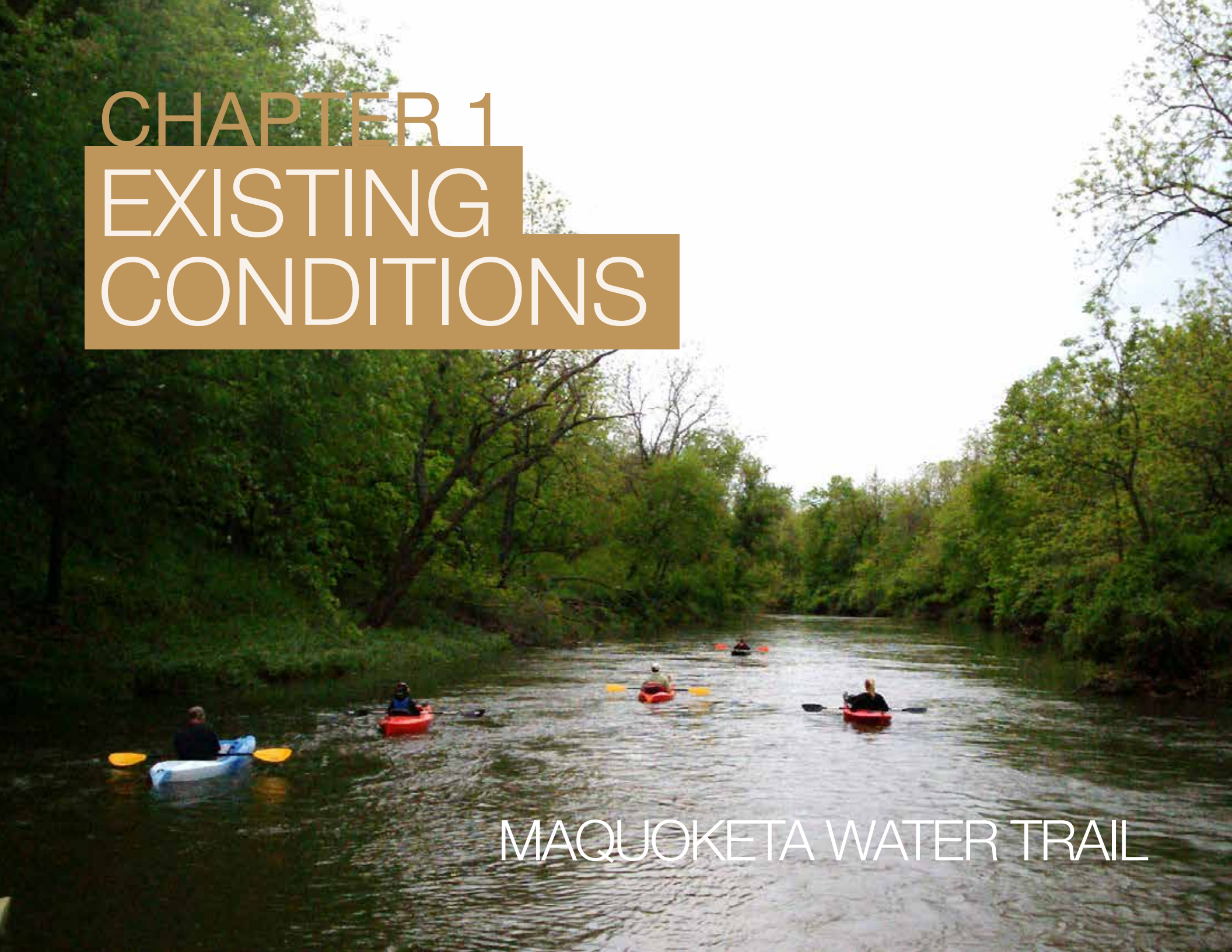
Once forgotten in years past, Iowa's navigable waters are beginning to take center stage. As they do, there is need to bridge the divides among multiple user groups, offer opportunities for listening, brainstorming, and strategizing that result in sensible decisions for the waters that connect local communities. What works for one water trail might not work for another, and what works in one community might not work in another.

Good planning tailors solutions to what citizens want and need while considering the strengths of the natural resources. Our strong commit to local listening and our increased technical understanding of project feasibility will lead to plans that will serve to improve the quality of life of individuals and positively impact the local economies of Iowa communities for generations to come.

Sincerely,

Chuck Gipp

Chuck Gipp
Director
Iowa Department of Natural Resources



CHAPTER 1
EXISTING CONDITIONS

MAQUOKETA WATER TRAIL

ACKNOWLEDGMENTS

This Water Trail Plan Chapter prepared by Mimi Wagner, Lucas Buscher and Jacob Wilson of Mimi Wagner, Landscape Architecture LLC (MWLA) and Iowa State University. Dr. James Pease and EarthView Environmental Inc contributed technical data used in development of Chapter 1. Jacob Wilson of MWLA conducted mapping and geospatial analysis. Elbongürk LLC and Lucas Buscher of MWLA completed the graphic design. The following individuals provided technical expertise, review and/or and data interpretation:

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REVISION DATE: DECEMBER 2016

DNR

MIMI WAGNER
Landscape Architecture

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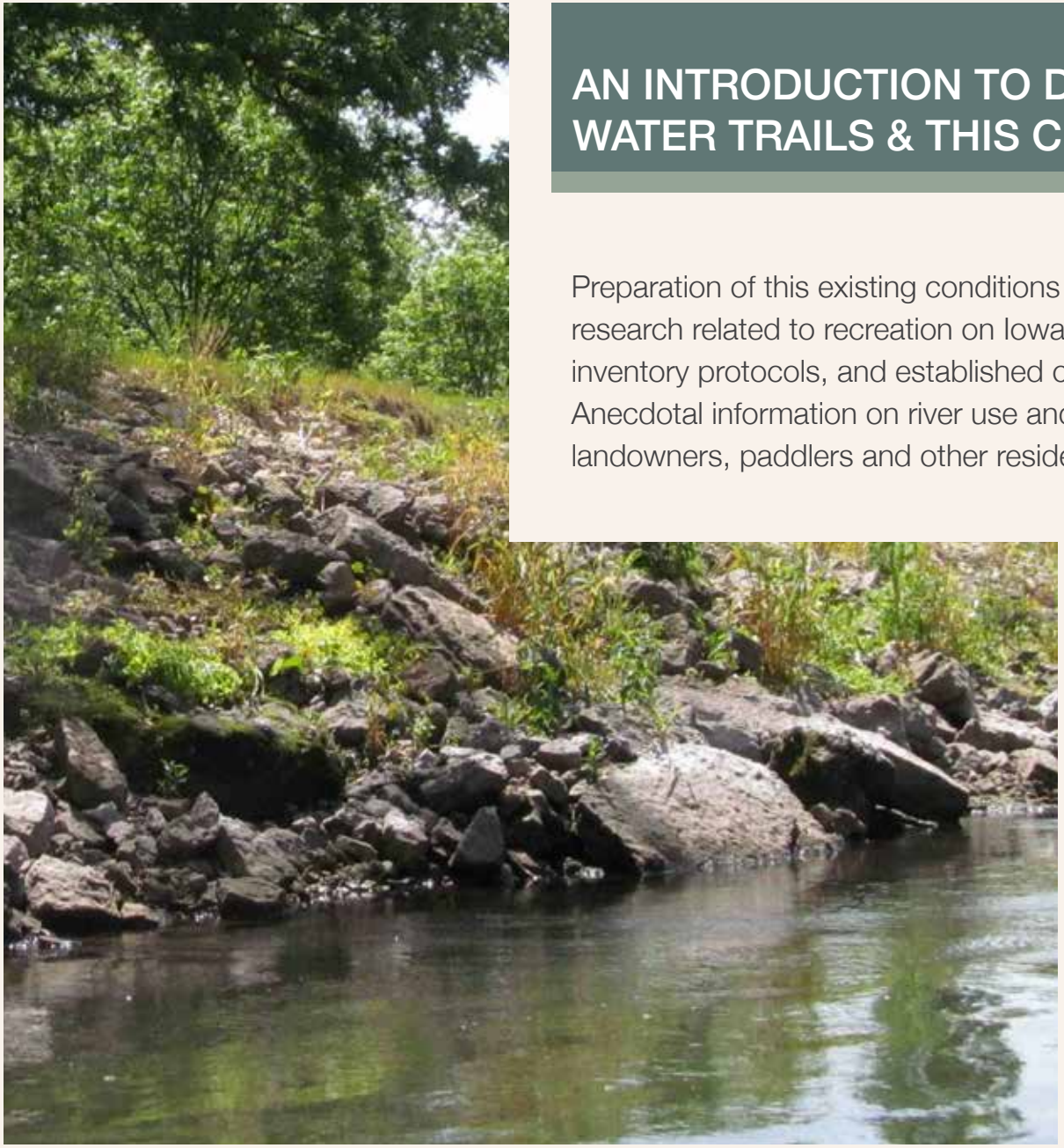
CHAPTER 1
EXISTING CONDITIONS

Paddling or hiking along rivers can bring to light the landscape features that influence them such as geology and vegetation. And people from pre-history to the present have often left their mark on rivers and the land. Sections of some rivers, however, continue to appear very similar to the early 1900's thanks to public ownership and protection from development and change.

The Maquoketa River in Delaware County, upstream of Lake Delhi, is one such river. This segment of the river, including the Manchester Whitewater Park, is popular with paddlers, anglers, campers and trail users. It is not currently designated a State Water Trail by the Iowa Department of Natural Resources (DNR) River Programs. Few places in Iowa, however, bring river conditions as diverse and spectacularly beautiful. Its scenery is matched with the outstanding recreational opportunities on and near it. This segment of the Maquoketa and its people offers a clear and strong opportunity to demonstrate the intention of the state water trail program: to conserve and restore valuable cultural and natural resources for future generations while providing recreation and education opportunities today.



AN INTRODUCTION TO DESIGNATED STATE WATER TRAILS & THIS CHAPTER

Preparation of this existing conditions chapter included all of the most recent research related to recreation on Iowa rivers, current access and launch inventory protocols, and established cultural and historic resource data sets. Anecdotal information on river use and conditions were provided by local landowners, paddlers and other residents of Delaware County.

Rivers become known as water trails when people paddle on them and begin to organize amenities to support paddling such as parking areas and launches. Water trails, in turn, also support uses beyond paddling. River edge amenities also engage anglers, those relaxing near the river, hunters and students studying the ecosystem. We know that river recreation also has a substantial impact on the Iowa economy. A 2009 study by the Center for Agricultural and Rural Development (CARD) at Iowa State University estimated overall economic impact from recreation on the fifty largest rivers in the state for the year. Results concluded that recreational river use by Iowans supported over 6,350 jobs, $824 million in retail sales and $130 million of personal income.

The status of “state-designated” is reserved for water trails that represent the best paddling experiences in each region of the state. Not every county in Iowa will have a state-designated water trail. A set of Iowa criteria established in 2010 is applied to guide classification of state designated segments. This experience classification system allows paddlers to match water trail routes with their ability level. These criteria also help water trail managers, sponsors and trail volunteers select a classification assignment for each segment based on their management resources and abilities.

The careful assignment of experience classification is one of the most important steps in water trail development. In addition to meeting paddler expectations, a segment’s experience classification is also a driver for development and infrastructure funding. One of the most important outcomes of this Existing Conditions chapter is to establish the experience classification of the water trail as it exists today and recommend alternative strategies for the future of the water trail.

As stated earlier, the Maquoketa River in Delaware County is currently not a state-designated route. A short, 7.7 mile segment of the Maquoketa in Jones County has already been assigned designated status. Delaware County Conservation Board has agreed to serve as the water trail sponsor and a steering group of local residents is also in place to guide development and management. Using the information included in this chapter, they will develop a vision for the future development and management and work together to implement this vision.

THE RIVER ITSELF

The Maquoketa River is a non-meandered stream beginning in Fayette County and continuing through Delaware, Jones, and Jackson counties, eventually draining into the Mississippi River. The geographic limits of this study include the river segment 4 miles upstream from Backbone Lake Dam and continuing downstream to Bailey's Ford Park access in Delaware County *(Figure 1)*. This segment is 23.4 river miles in length and ends at the upstream limits of the Lake Delhi impoundment. The watershed area draining into this segment of the Maquoketa River in Delaware County is approximately 327 square miles.

The anchoring river access locations of this study segment are Backbone State Park, located at the northern edge of Delaware County, and Bailey's Ford Park. The river is used for canoeing, kayaking, fishing, boating and tubing. Water levels don't generally allow the use of larger motor boats outside of the Lake Delhi area. One livery exists on the Maquoketa in Manchester. "The Water Shed" offers rentals for kayaks, canoes and tubes while also coordinating paddling events. The concessionaire at Backbone State Park Lake also rents canoes, kayaks, and paddle boards. The kayaks are 12 – 16 feet. To date they have only allowed their boats to be used on the lake.

According to the 2009 Iowa Rivers and River Corridors Recreation Survey (Iowa State University 2009), the Maquoketa River is one of the most heavily used rivers in the region. Users reported more trips to only one other local river, the Wapsipinicon. Maquoketa River users also reported the highest proportion of visits with some form of boat, as well as swimming and tubing when compared to adjacent rivers (Table 1).

An organization based in Manchester, but representing the entire Delaware County, advocates for positive change and stewardship on the Maquoketa River as well the county as a whole. The Manchester Good to Great Committee was the lead organization supporting development of the Manchester Whitewater Park. The whitewater park included the removal of 6' of the original 9' high dam on the Maquoketa in downtown Manchester; the remaining 3' was incorporated into one of the six drop structures. No organized local paddling enthusiasts group exists on the Maquoketa in Delaware County although a newly organized trash cleanup group does exist.

Figure I

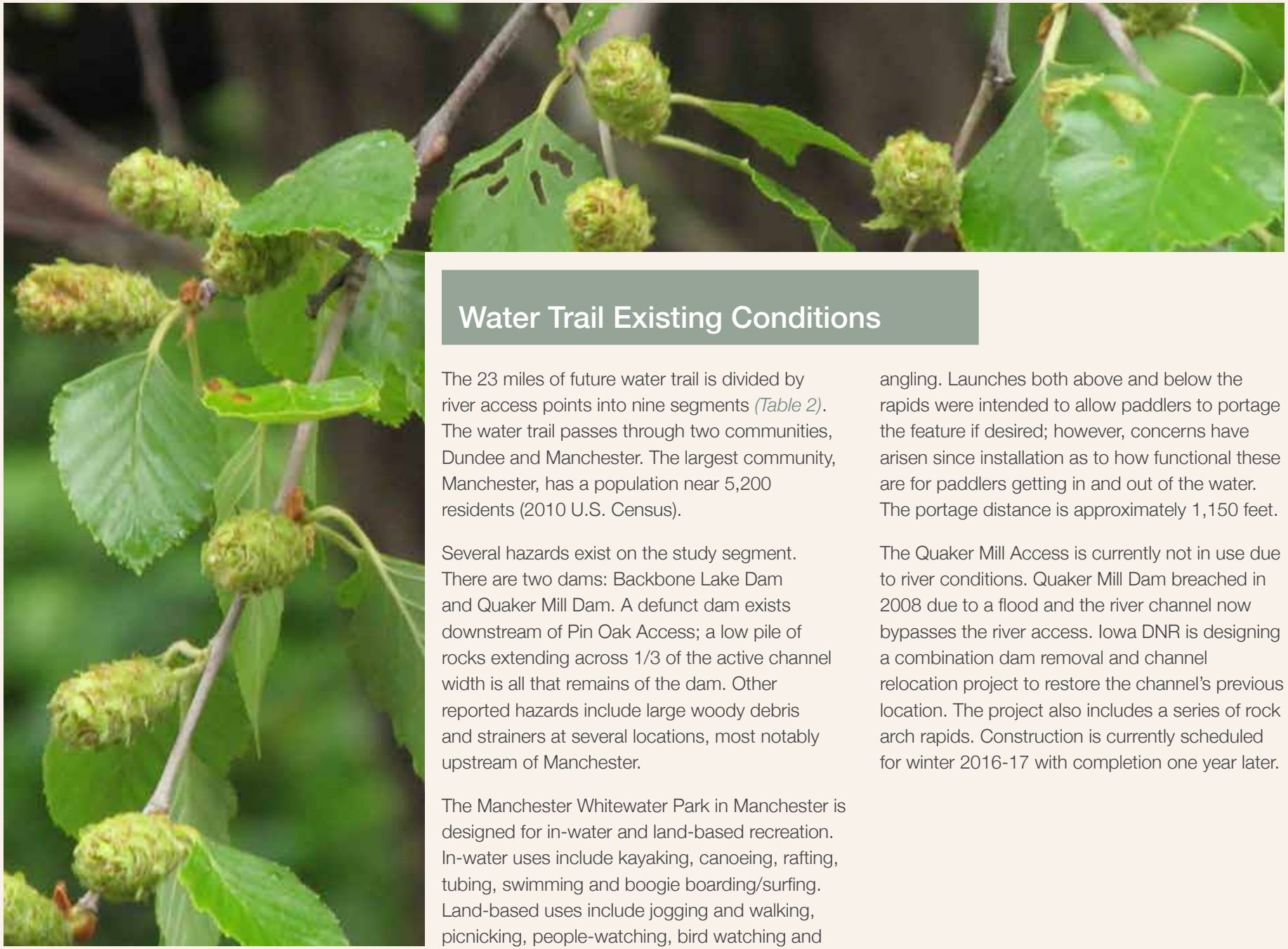
There are 8 existing river access locations on the study segment. Some locations also include a portage.

River Segment	Trips Reported to River in 2009	Fishing	Hunting	Boat with Motor	Kayak or Canoe	Swim, Tubing, Play in Water	Trails	Camping	Relaxing, Picnicking	Wildlife Watching
Maquoketa (58): Entire Length	613	67.0%	25.3%	31.2%	26.4%	33.6%	30.3%	23.5%	49.8%	36.9%
Volga R. (62): Entire Length	258	78.3%	31.4%	8.5%	6.2%	2.7%	31.4%	48.8%	73.6%	36.0%
Turkey R. (61): Below Decorah to Mississippi River	249	73.5%	22.5%	5.2%	14.5%	1.6%	30.1%	22.1%	40.2%	42.6%
North Fork Maquoketa R. (59): Entire Length	167	71.9%	25.1%	0.6%	13.8%	2.4%	50.9%	18.6%	34.7%	19.2%
Wapsipinicon R. (56): Below Independence to Mississippi River	697	58.4%	9.9%	16.8%	18.1%	11.8%	32.9%	26.3%	56.2%	30.6%
Buffalo Creek (57): Entire Length	90	37.8%	22.2%	0.0%	10.0%	24.4%	17.8%	15.6%	25.6%	26.7%

Table I

*Recreational Use Reported on Rivers in the Immediate Vicinity of Delaware County**

**Source: Iowa Rivers and River Corridors Recreation Survey 2009 (Iowa State University)*



Water Trail Existing Conditions

The 23 miles of future water trail is divided by river access points into nine segments *(Table 2)*. The water trail passes through two communities, Dundee and Manchester. The largest community, Manchester, has a population near 5,200 residents (2010 U.S. Census).

Several hazards exist on the study segment. There are two dams: Backbone Lake Dam and Quaker Mill Dam. A defunct dam exists downstream of Pin Oak Access; a low pile of rocks extending across 1/3 of the active channel width is all that remains of the dam. Other reported hazards include large woody debris and strainers at several locations, most notably upstream of Manchester.

The Manchester Whitewater Park in Manchester is designed for in-water and land-based recreation. In-water uses include kayaking, canoeing, rafting, tubing, swimming and boogie boarding/surfing. Land-based uses include jogging and walking, picnicking, people-watching, bird watching and angling. Launches both above and below the rapids were intended to allow paddlers to portage the feature if desired; however, concerns have arisen since installation as to how functional these are for paddlers getting in and out of the water. The portage distance is approximately 1,150 feet.

The Quaker Mill Access is currently not in use due to river conditions. Quaker Mill Dam breached in 2008 due to a flood and the river channel now bypasses the river access. Iowa DNR is designing a combination dam removal and channel relocation project to restore the channel's previous location. The project also includes a series of rock arch rapids. Construction is currently scheduled for winter 2016-17 with completion one year later.

Segment	Segment Distance	Hazards Identified in 2015				Paddling Use Volume*	Beginner-Friendly	Notes
		Dams on segment	Logjams covering >30% of channel	Rapids	Stream-wide Livestock Fences			
Cricket Camp to Backbone Lake Dam	4		No data			Low		
Backbone Lake Dam to Dundee Access	2.1		No data			Low		
Dundee Access to Lindsey Bridge Access	4.8		4		2	Low		
Lindsey Bridge Access to Quaker Mill Dam	4.7		No data			Medium		River channel changed course and now bypasses the dam
Quaker Mill Dam to Tirrill Park	2.2		No data			Low		Bypass channel connects to Honey Creek and the Maquoketa
Tirrill Park to Whitewater Park	.6		0			Heavy		
Whitewater Park to Schram Park	.8		0	6		Heavy		White water course functions as a series of rapids
Schram Park to Pin Oak Access	2.5		1			Heavy		
Pin Oak Access to Bailey's Ford Park	1.7		0	2		Heavy		

Table 2

Maquoketa River Water Trail Segments, Delaware County

**Use volume estimates are relative only to other segments in the study area and were generated by anecdotal observations*

Water Trail Access Points

River accesses in Delaware County are owned and managed by several entities. Four accesses are owned and managed by Delaware County Conservation, two by Iowa DNR, and four by the City of Manchester *(Table 3)*. The only access not on public land, Quaker Mill Dam, is privately owned and managed. Five of the eleven accesses are located in or near a community and two are located inside a state park. Interestingly, all accesses except for two at the downstream end are carry-down style. The current Bailey's Ford access has been abandoned and a new access for paddle craft only is planned adjacent to the new motorized boat launch slightly downriver. The new motorized launch is associated with re-establishment of Lake Delhi.

A range of public facilities and use opportunities are available at water trail access points *(see Table 4)*. Bailey's Ford is the only access on the study segment with restrooms and camping nearby. Other accesses are more primitive and generally have only tables and/or benches.

Facility Where Access is Located	Access ID	Access Owner & Manager	Launch Type	Streambank Height
Cricket Camp Access, Backbone State Park	#134	Iowa DNR	Carry down	4
Below Backbone Lake Dam, Backbone State Park	#130	Iowa DNR	Carry down	3
Dundee Access	#128	Delaware CCB	Carry down	2
Lindsey Bridge Access	#123	Delaware CCB	Carry down	8
Quaker Mill Dam	#118	Doug Hawker	Carry down	2
Tirrill Park	#117	City of Manchester	Carry down	3
Whitewater Park (Upstream Access)	#116A	City of Manchester	Carry down	3
Whitewater Park (Downstream Access)	#116B	City of Manchester	Carry down	3
Schram Park Access	#115	City of Manchester	Motorized boat ramp	7
Pin Oak Access	#112	Delaware CCB	Motorized boat ramp	6
Bailey's Ford Park	#110	Delaware CCB	Carry down	5

Table 3
River Access Ownership and Basic Characteristics

Facility Where Access is Located	Access ID	Restrooms	Amenities At Launch	Distance from river to drinking water (ft.)	Camping	Other Points of Interest at Access
Cricket Camp, Backbone State Park	#134	Yes	Shelters, tables, grills, playground, trout stream	N/A	No	Located inside Iowa's first State Park
Below Dam, Backbone State Park	#130	No	None	N/A	No	Backbone Lake, Beach
Dundee	#128 WA-287	No	None	N/A	No	-
Lindsey Bridge	#123 WA-583	No	None	N/A	No	Heavily Used Access
Quaker Mill Dam	#118 WA-783	No	Tables, benches	N/A	No	Privately owned access & dam Portage around dam
Tirrill Park	#117 WA-1004	No	Tables, benches, shelter, water	350	No	Playground, shelters, bandshell, tennis courts
Whitewater Park (Upstream Access)	#116A	No	Tables, benches, shelter, water		No	Downtown Manchester, Whitewater Park
Whitewater Park (Downstream Access)	#116B WA-299	No	Tables, benches, shelter, water	150	No	Downtown Manchester, Whitewater Park
Schram Park Access	#115	Yes	Tables, shelter	N/A	No	Playground, shelter, future campground planned
Pin Oak Access	#112 WA-752	No	Tables	N/A	Yes	Primitive Kayak-Paddle in camping allowed
Bailey's Ford Park	#110 WA-56	Yes, Vault	Tables, water	160	Yes	Nature center, wildlife exhibit, primitive/modern camping

Table 4
Water Trail Access Amenities

Recreational Conditions Related to the Water Trail

The Maquoketa channel is sinuous throughout a majority of this portion of Delaware County. Average vertical streambank heights range between 2 and 7 feet at access points *(Table 3)*. Multiple launches have limitations for use based on their location and river conditions *(Table 5)*. Common limitations in Iowa include slopes and angle of launches. Launches and the paths leading to launches that are too steep (generally those exceeding 15%) pose use limitations for the elderly and others, including small children and those with disabilities. Walking or carrying a paddle craft down a launch or path grade that is overly

steep can also be compounded by a surface that is either too smooth or loose (leading to slipping) or rough (leading to tripping). Sharp drop offs at the streambank edge where people are launching boats also complicate moving into or out of the river.

In addition, the angle of the launch as it relates to the river alignment often becomes a determining factor for the amount of sediment deposition resulting on it. Those built perpendicular (90 degrees) to the channel also generally collect the most sediment and debris. Launches located on the outside bend of rivers are also very vulnerable to damage and destruction when lateral channel migration occurs.

River Access	Access Number	Parking Stall Count	Distance Between Parking and River (ft.)	Path Slope Max. %	Vehicle Access to River is Possible	Launch Slope Max. %	Launch Angle to River (degrees)	Existing Experience Classification of Access
Cricket Camp, Backbone St. Park	#134	21	190	2	No	N/A	N/A	Recreational; this is an undeveloped access
Below Dam, Backbone St. Park	#130	0	N/A	N/A	No	N/A	N/A	Challenge; this is an undeveloped access
Dundee	#128	14	175	20	No	23	90	Recreational
Lindsey Bridge	#123	1	89	40	No	39	80	Recreational
Quaker Mill Dam	#118	11	180	30	No	35	-	Not a functional access
Tirrill Park	#117	6	86	8	No	22	90	Recreational; severe bank erosion at access & collapsing launch
East River Park (Upstream of Whitewater Park)	#116A	35	100	5	No	5	N/A	Recreational; very uneven rock surface near water's edge
Downstream of Whitewater Park	#116B	21	90	39	No	5	N/A	Not a functional access
Schram Park	#115	9	110	2	Yes	10	30	Recreational
Pin Oak	#112	10	72	7	Yes	30	100	Recreational
Bailey's Ford Park	#110	23	50	0	No	15	90	Recreational; on upstream end of Lake Delhi

Table 5

River Access & Launch Relating to Use and Maintenance. A minimum of 5 parking stalls, four regular and one accessible, are required at all river accesses signed for public use.*

**Yellow-shaded cells suggest enhancement is required for optimal use of the access. Red-shaded cells indicate elements do not meet minimum Iowa DOT standards for a signed recreational use.*

River Management Conditions on the Maquoketa

Delaware County Sheriff's department is responsible for law enforcement in the study area with the exception of the City of Manchester. Emergency response for the study area is shared between Manchester Fire and Rescue and Delaware County Sheriff's Department, the Dundee Fire Department and EMS service from the Regional Medical Center. Emergency responders utilize cell phones to contact Conservation Officer Jared Landt or through Cedar Falls Mutual Aid frequency utilized by law enforcement if required.

All emergency responders utilize landowner maps of the area to expedite rescue and recovery in emergency events. The Manchester Fire Department is the only emergency responder that owns a boat for rescue purposes. Manchester Fire borrows the Sheriff's ATV as needed. Dundee Fire Department utilizes personal boats and ATV's as needed. Manchester Fire Department conducts extensive training for the following types of rescue: ice rescue, open water recovery and rescuing anglers and tubers at the Whitewater Park with various injuries or wedged in the rock structures. It is unclear if any emergency responders for the area have been certified in swift water rescue.

Very few incidents have been reported on the river study segment. In the past 25 years, no deaths or rescues have been reported. Canoeists and kayakers who don't allot enough time to float their route is a quite common problem, however. Law enforcement suggested on-water mile-markers would alleviate problems with paddlers navigating the river. The only major safety issues in the area have been associated with Lake Delhi. Several drownings and water rescues have occurred there.

Minor safety and law enforcement issues are limited to concerns about parking at two launches. The Lindsey Bridge access has space for only one car to park or load/unload and conditions at the site don't permit expansion of the parking area. The access is heavily used and vehicles are parking on both sides of the county gravel road. While the traffic volume is not heavy on this road, the county engineer is concerned with emergency vehicle access to the residence on this road during these situations. Parking associated with the Bailey's Ford Park access was also a challenge prior to Summer 2015. Prior to this summer, parking for the access was located adjacent to the campground. When parking spaces were unavailable, paddler vehicles were parked in camp site drives in some cases. Drivers didn't return until the end of their float trip. Delaware CCB observed this struggle for parking space and also the extra volume of driving that was occurring through the campground due to day use of the river. A separate drive entrance and additional parking were constructed in summer 2015 to accommodate all boat users; this road access and parking is separate from, and not accessible from the campground.

As stated earlier, aligning how a river is managed with the type and volume of water trail users is a key goal of the state water trails program. Generally, Iowa DNR finds that the greater the volume of use and the shorter the segment length, the greater need exists for management of people and river conditions. Both types of management are important and needed. River condition management includes the level of ongoing maintenance of flood debris in the channel and the maintenance of launches; Appendix A aligns the level of river management expected for the four types of experience classification on state-designated water trails. People management can include littering and disruptive behavior, as well as illegal activities such as vandalism, alcohol consumption while paddling, and trespassing; Appendix B aligns people management elements suggested for experience classifications.

Existing Water Trail Experience Classification

Current river and people management of this water trail most closely aligns with the Recreational experience classification, with the exception of the short Whitewater Park segment. The Whitewater park segment most closely aligns with the Challenge experience classification due to its 6 rapids.

The Recreational Classification is the most common in Iowa. The water trail is neither overly difficult nor set up to match the criteria developed for beginning paddler experience, confidence, and/or those not physically strong and agile. Appendix C, Water Trail Experience Classification Summary, summarizes key elements from the classification criteria (Wagner and Hoogeveen 2010).

Bailey's Ford is the one current full-service access on the water trail including park ranger headquarters and fully developed park services. Beyond Bailey's Ford, most of the remaining 7 accesses are primitive. With the exception of the Whitewater Park launches, none are constructed for use by special needs population (including the elderly and those with small children).

Social Considerations

The water trail sponsor, Delaware County Conservation Board, is very supportive of state designation and planning for enhanced conditions on the water trail and for the river generally. The CCB owns four of the eleven river accesses.

The remaining accesses are owned by either Iowa DNR, the City of Manchester or a private party and all are supportive of water trail designation. Each is committed to maintain their access points and have been actively engaged in this planning.

Several types of public outreach events occurred in 2011 to discuss the potential of seeking state water trail designation. The Dundee City Council was introduced to the concept of state designation at their regular April 2011meeting. Their feedback was positive and they encouraged the concept. Three public meetings were held in the watershed for landowners during 2011. Meetings were facilitated by members of Manchester Good to Great's River and Recreation Committee. The length of the river was divided into three segments and stakeholder groups, landowners and the general public was invited to the meetings. Stakeholder groups included Dundee City Council, Delaware County officials, City of Manchester, Delaware County Conservation Board and Friends of Backbone State Park. Approximately 60 people participated in these meetings which were held at the Dundee Fire Station, Siebert Hall in Manchester and Manchester City Hall.

The overall tone of each of the three public meetings was positive. The majority of attendees voiced full support for water trail development, felt strongly that a trail development would encourage users who would be respectful to private property and promote environmental stewardship, and also believed that local parties, rather than paddlers, were responsible for of a majority of the trash problem near the river. A vocal minority at the first meeting expressed concerns that designation would increase police and trash issues, increase damage to fences across the river and cause a decrease in the local economy (Matteson, 2015 personal communication).

Physical Conditions on the Maquoketa

How a river moves over the landscape across time is of interest to landowners, historians, researchers and often the general public. The majority of human alterations on this river include dams constructed for infrastructure such as grain milling or power generation. A majority of these dams no longer exist or have been modified. Very little, if any, channelization or straightening has occurred. Three types of data were included in this analysis including aerial photograph reconnaissance, 2004 and 2015 stream assessment data and a planform comparison of channel alignment changes in the past thirty years.

One of the most obvious channel changes in the study area is the Quaker Mill Dam breach. Quaker Mill Dam was originally constructed in late 1800's as a grist mill. It was later converted to hydroelectric power generation although it no longer served in that capacity when it was breached. A dike on the impoundment was breached in 2004 during heavy rains. A temporary rock patch restored the dike and the normal pool elevation. More serious flooding in 2008 and 2010 again breached the dam, and drained the pond *(Figure 2)*. The river channel also rerouted itself in 2010 from its former position. The original course of the river was abandoned and the new channel flows into Honey Creek approximately 0.5 miles downstream. The breach will be repaired and the obsolete dam will be modified to return the Maquoketa to a free flowing river (Jacobson 2015). The base of the hydro electric plant will be preserved.

Figure 2

Quaker Mill Dam was one of the oldest remaining dams in Delaware County. Restoration of river channel and removal of the dam will greatly enhance biological connectivity for aquatic species.

Another significant channel change obvious to paddlers is a gravel mining operation in the river channel located between Pin Oak and Bailey's Ford accesses *(Figure 3)*.

Figure 3

Dredge mining in the Maquoketa River channel has created a long term and irreversible impact on the streambanks as well as the river hydraulics. Gravel mining in Waters of the United States, particularly those altering the stream condition, require a Federal permit and 401 certification under the Clean Water Act.

Channel Conditions

Several quantitative methods for estimating channel change are available even with limited data. Historic maps provide the earliest suggestions of river alignment in Iowa. However, river alignment on early maps can't be quantitatively compared with later aerial photography because the maps were drawn with much different accuracy standards. For example, Government Land Office (GLO) surveyors of the mid-1800's as well as the 1875 Andreas Atlas preparers were required to verify the river crossing locations only at section lines (Anderson 1974). However, important generalizations can be made about historic channel shifts and the extent of modifications using this comparison limitation.

The GLO mapping survey for Delaware County was completed in 1837. River alignment on section lines from this survey was compared with those on the 1875 Andreas Atlas to provide context for changes during the first fifty years following Euro-American settlement. Aerial photography of the complete channel length was compared with channel alignment between 1939 and 2010. Lastly, the 1837 and 1875 alignments were also compared with the more recent aerial photography.

This segment of the Maquoketa River has one of the least amounts of measured planform change from the mid-1800's to present of any river studied for potential water trail designation in 2014-15, likely due to underlying bedrock conditions. The average lateral channel movement on section lines for the Maquoketa study area during this time is only 0.05 miles of shift per river segment—the fourth lowest average of any of the 12 rivers studied.

The average lateral channel movement distance between 1980 and 2010 was 50-100 feet through the entire study segment. Deposition and scour of alluvium and streambank instability are more common in some segments compared to others *(Figure 4)*. A maximum channel migration of 0.12 miles in lateral movement can be seen at the location where the river crosses 190th Street. *Table 9* summarizes the planform changes measured for the study segment. The Dundee Bridge to Quaker Mill segment has had the most amount of change due to streambank instability.

Figure 4

Lateral movement of stream channels is a result of the river balancing energy and the volume of water delivered to it. Stream banks most susceptible to shift and erosion are usually those with row crops or grass on the bank edge.

Segment	Straight Line Length (mi.)	1980 Length (mi.)	2010 Length (mi.)	% change in length between 1980 – 2010	1980 Sinuosity	2010 Sinuosity
County Line to Backbone	6.15	7.06	7.08	0%	1.2	1.2
Backbone to Dundee	1.66	2.03	2.09	+3%	1.3	1.3
Dundee to Lindsey Bridge	3.25	4.53	4.80	+6%	1.5	1.5
Lindsey Bridge to Quaker Mill	3.76	4.43	4.66	+5%	1.2	1.2
Quaker Mill to White Water Park	2.06	2.82	2.81	0%	1.4	1.4
White Water Park to Schram Park	0.66	0.68	0.80	+18%*	1.2	1.2
Schram Park to Pin Oak	2.31	2.45	2.52	+3%	1.1	1.1
Pin Oak to Bailey's Ford	1.57	1.76	1.82	+3%	1.2	1.2

Table 6

Two segments of the river are currently experiencing significant lateral migration of the river with >1% increase in channel length in the past thirty years.

Streambank Conditions

Streambank erosion and channel widening is apparent when floating this segment of the Maquoketa River. A thorough RASCAL (Rapid Assessment of Conditions Along Length) stream assessment was completed for 18 miles of the study segment in 2004 as a part of the Maquoketa Watershed Assessment (Delaware SWCD 2004). The RASCAL protocol is a tool developed and utilized in Iowa by the DNR Watershed Planning program to assemble benchmark conditions on Iowa rivers. Assessment was completed by Northeast Iowa RC&D.

RASCAL assessment identified unstable streambank conditions on 13.6% of the channel length (2.45 miles) *(Table 7A & 7B)*. The most common type of streambank identified was a vegetated cut bank. Streambank erosion is largely limited to several reaches: Dundee to Lindsey Bridge Access and Schram Park to Pin Oak Access.

Bank Stability	Miles	% of Total
Stable	2.73	15.10%
Moderately Stable	6.89	38.11%
Moderately Unstable	5.32	29.42%
Unstable	2.45	13.55%
Artificially Stable	0.69	3.82%

Table 7 A

RASCAL Stream Assessment Results, Maquoketa River in Delaware County

Bank Type	Miles	% of Total
Sloping Bank	3.68	20.35%
Cut Bank Vegetated	9.05	50.06%
Cut Bank Eroding	4.64	25.66%
Sand/Gravel Bar	0.33	1.83%
RipRap	0.38	2.10%

Table 7 B

RASCAL Stream Assessment Results, Maquoketa River in Delaware County

Reconnaissance by Iowa State University research personnel occurred on segments with high concentrations of streambank erosion in 2015: Dundee to Lindsey Bridge and Schram Park to Bailey's Ford Park. Excess deposition in the form of frequent mid-channel bars, some diagonal, was identified in both segments suggesting aggradation *(Figure 5)*. Multiple large woody debris blockages exist at two primary areas within these reaches. The two miles immediately upstream of Lindsey Bridge Access includes numerous, extensive blockages occupying >30% of the active channel cross section. An additional cluster of channel blockages also exists immediately downstream of the Highway 20 bridge.

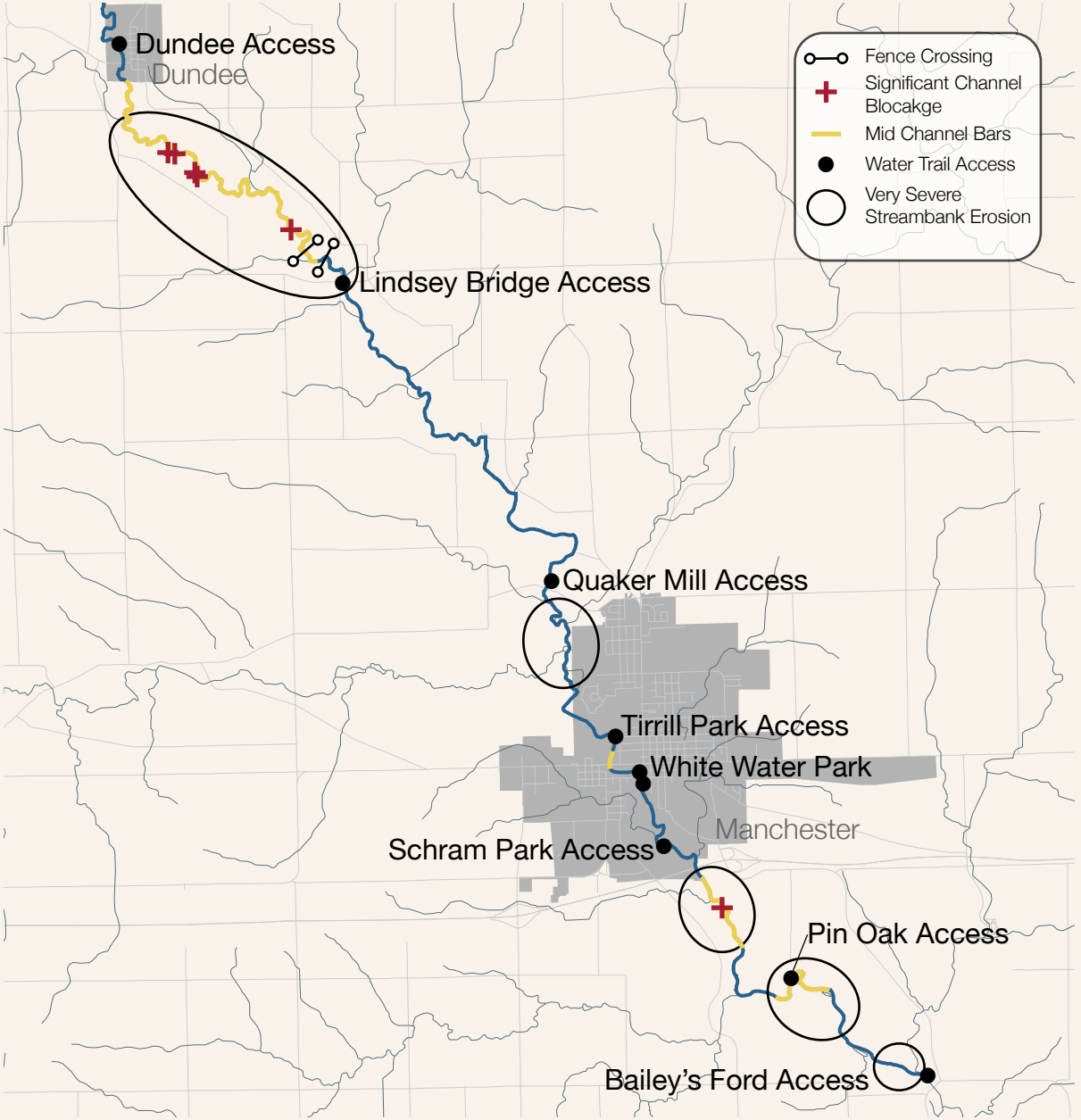


Figure 5

Segments with moderate or severe streambank instability also contain numerous partial-channel blockages and mid-channel deposition.

Flooding

Many Iowa cities and parks are located on rivers. Floods on the Maquoketa River as well as the smaller tributaries have been an ongoing destructive occurrence with the first flood in local records to be in 1851 with a drowning and damage reported to agricultural areas, housing and mill dams (Bailey 1935). Many parts of Manchester are situated in the current day FEMA floodplain *(Figure 6)*. In this study area, flood records are the most complete for the Manchester area due to a USGS river gage located near the Highway 20 bridge on the south side of Manchester. Continuous streamflow (discharge) records have been collected at this site since 2000. An earlier USGS gage located slightly downstream from Pin Oak Access (05417000) was used to collect data intermittently between 1925 and 1983 (Eash 2011). Remnants of this gage can be seen from the river.

The National Weather Service (NWS) flood stage at this gage is 14 feet. Water levels reaching or exceeding this height were recorded at the gage at least once during each five year interval since 2000 (USGS). A gage height of 24.48 (26,600 cubic feet per second) was recorded at this gage during the flood of record in July 2010 (U.S. Geological Survey 2016). This flood established a new maximum peak discharge and produced extensive urban and rural flood damage. The annual flood-probability for the 2010 flood was estimated as 0.2 to 1 percent (Eash, 2011). Prior to this event, the 2004 flood had been the largest flood on record in Manchester.

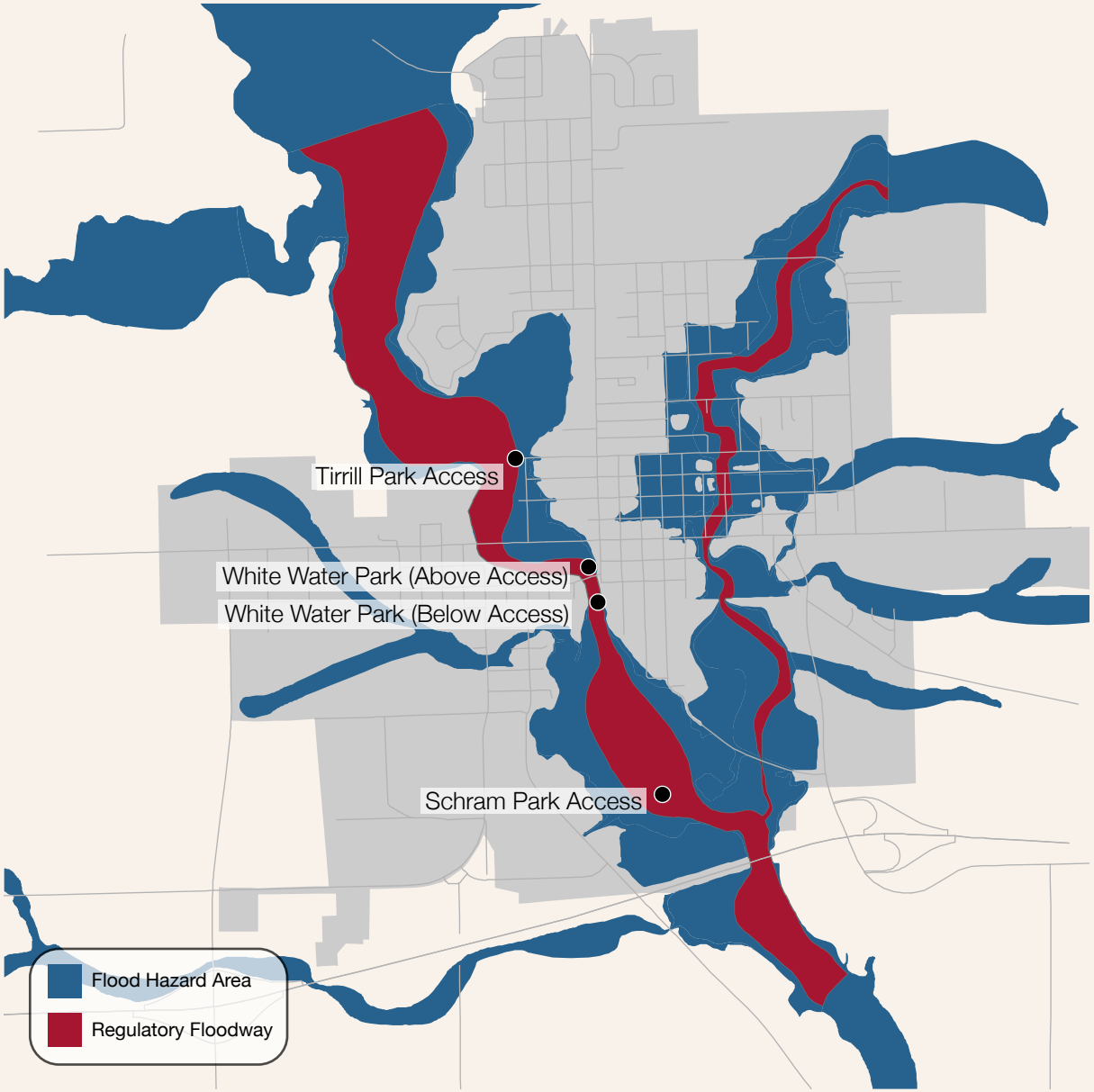


Figure 6

FEMA Floodway and floodplain areas are impacted by both the Maquoketa River as well as several smaller tributaries. The parking areas for Tirrill Park and Schram Park accesses are located within the Floodway, making them especially susceptible to damage.

Riparian Landcover Conditions

The edge or transition between an aquatic ecosystem and its upland area is known as the riparian zone. Riparian areas are linear in shape and occur along the margins of all water bodies including wetlands, lakes and rivers. The vegetation or other cover on the land surface in the riparian zone is considered the riparian landcover. Landcover in a riparian area has a strong influence on water quality, streambank condition, the rate of lateral channel migration and habitat both on the land and in the adjacent aquatic area. Research consistently shows that perennial riparian landcover such as trees, shrubs and native grasses are more beneficial for all ecosystem services compared to development or annual row crop landcover. Row crop activity at the top of tall and steep streambanks can cause further instability in streambank soils and often exacerbate eroding streambank conditions.

A riparian area is often referred to as a "buffer" when perennial landcover is present. Landowners often intentionally establish perennial vegetation buffers near stream edges for conservation purposes. In other cases, vegetation buffers establish naturally because the area is not cropped. The optimal width of riparian buffer vegetation is dependent upon its intended goals. Common buffer designs range from a minimum of 100' to greater than 500' depending on the purpose of the buffer and watershed conditions (Bentrup 2008). Existing riparian buffer conditions on the Maquoketa are very good.

Riparian areas within 100' of the top of streambanks on both sides of the Maquoketa River were evaluated using landcover data from the 2015 cropping year to better understand the presence or absence of beneficial riparian buffer vegetation *(Figure 7)*. The water trail corridor was divided into

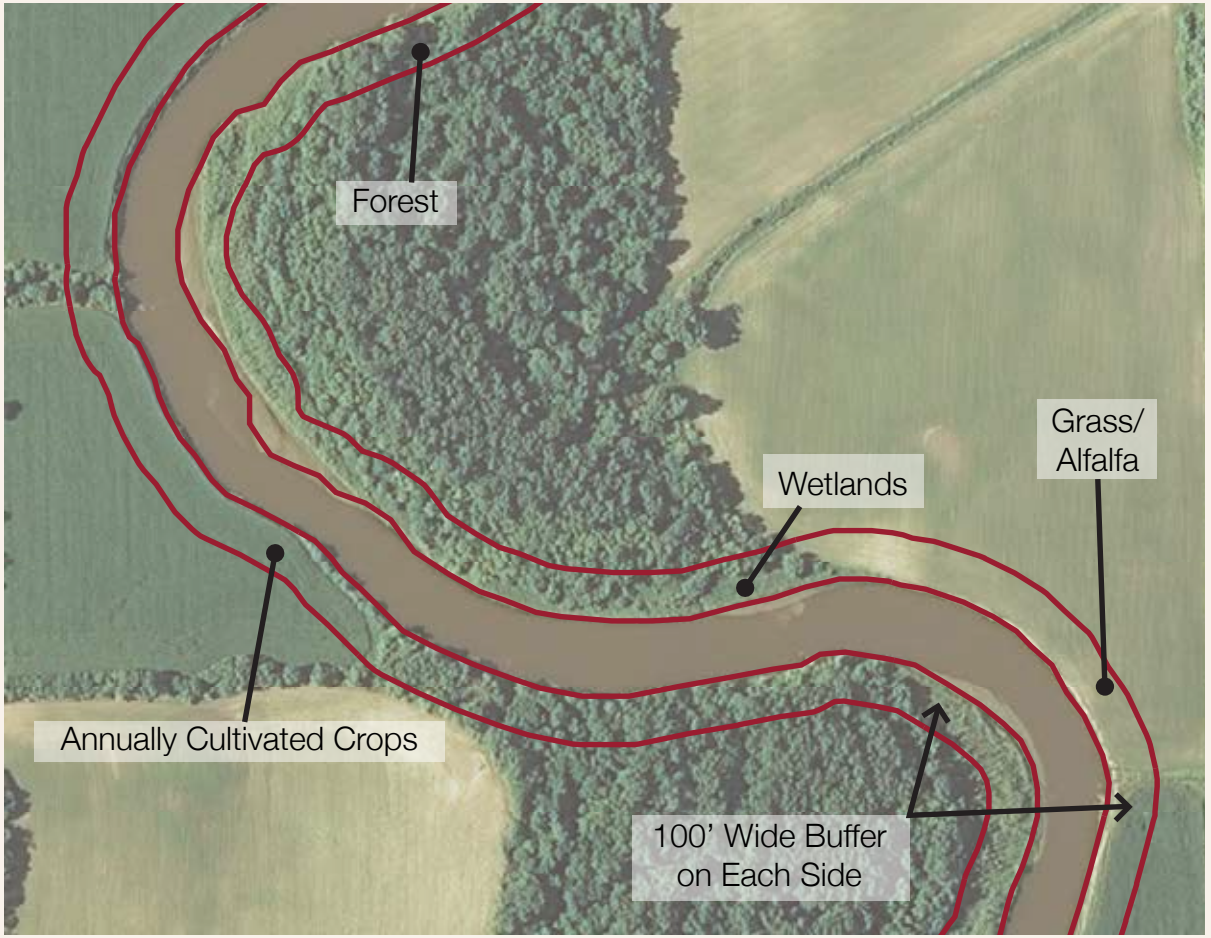


Figure 7

Red lines illustrate the top of the streambank and a distance approximately 100' away from the edge. Landcover inside these lines was identified for the length of the river in Delaware County. A perennial buffer is present on 97% of the acres included in this 100'buffer.

	Backbone State Park to Dundee Access	Dundee Access to Lindsey Bridge Access	Lindsey Bridge Access to Quaker Mill Dam	Quaker Mill Dam to Tirrill Park	Tirrill Park to Whitewater Park	Whitewater Park to Pin Oak Access	Pin Oak Access to Bailey's Ford Park
Annually Cultivated Crops	0 (0%)	0.86 (1%)	4.67 (4%)	0.06 (0%)	0 (0%)	0 (0%)	0 (0%)
Perennial Grass & Alfalfa	0 (0%)	3.72 (3%)	0 (0%)	0 (0%)	3.31 (3%)	4.69 (6%)	0 (0%)
Forest	50.01 (98%)	108.34 (95%)	86.58 (71%)	41.01 (78%)	7.67 (54%)	69.36 (86%)	45.84 (99%)
Wetland	1.14 (2%)	0.88 (1%)	28.02 (23%)	11.17 (21%)	0 (0%)	3.58 (4%)	0.11 (0%)
Other	0 (0%)	0.10 (0%)	2.79 (2%)	0.41 (1%)	3.11 (22%)	2.55 (3%)	0.42 (1%)
Totals	51.15 (100%)	113.91 (100%)	122.06 (100%)	52.65 (100%)	14.09 (100%)	80.18 (100%)	46.37 (100%)

Table 8

The Lindsey Bridge to Quaker Mill Dam water trail segment had the largest amount of annually cultivated landcover in the 100' buffer either side of the channel. 2015 crop year acres for each landcover type are shown below as well the total percent of each type within a water trail segment.

segments based on river access points. Landcover in each of the seven segments was divided into five types: annually-cultivated crops, perennial grass and alfalfa, forest or predominantly tree cover, wetlands, and other (pavement, buildings, barren and gravel). Acres of each landcover type were calculated for each segment and the total acres of each are shown in *Table 8*.

Looking at the river corridor as an entire unit, 97% of the total acres are perennial landcover while 1.6% is in urban development ("Other" category) and 1% in annually cultivated cropland *(Figure 8)*. The only segment with an appreciable amount of land in annually cultivated crops within the buffer zone is the Lindsey Bridge – Quaker Mill segment.

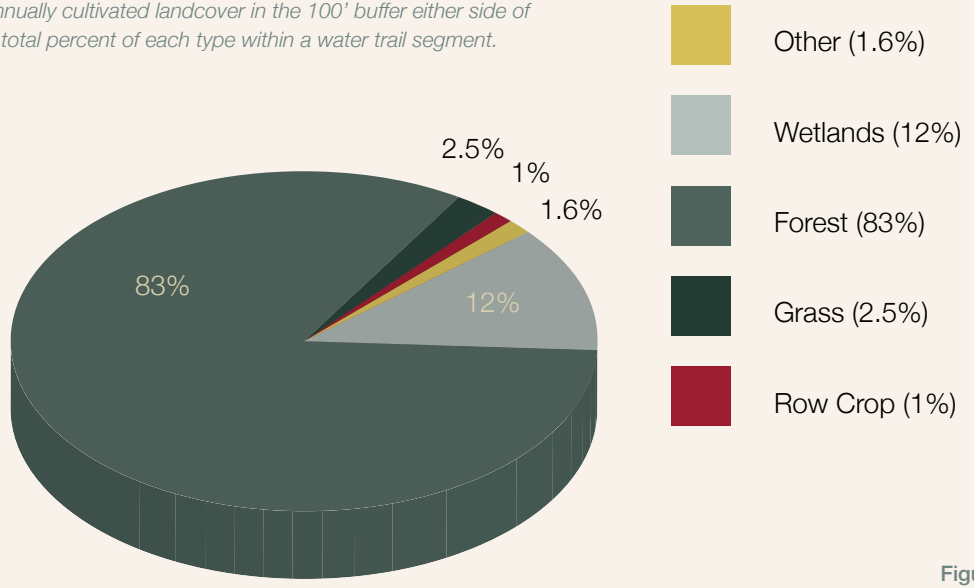


Figure 8

Ninety-seven percent of the stream edge acres along the water trail include perennial landcover which is helpful for soil stabilization, wildlife habitat and views from the water. This is the second highest amount of stream edge in perennial cover of the 12 rivers studied in 2014.

Land Use and Zoning

Rural Delaware County—where the majority of the Maquoketa River is located—does not have zoning regulations. Due to this, there is no mechanism to provide protection from the removal of the existing mature forests lining the river on both sides. Several areas of mature forest cover are protected by public ownership, such as the forests in Backbone State Park and several other small public parcels. These public lands are fragmented and largely isolated *(Figure 9)*.

The only place with zoning in the study area is the City of Manchester. Manchester features 7 different zoning classifications along the Maquoketa River and an overlay zone for the Floodplain. With the exception of the overlay zone for floodplains, these zoning classifications don't require setbacks to protect the river edge from new development or impervious cover *(Figure 10)*. Restrictions in the Floodplain Zone primarily deal with restrictions on building standards, including dimension standards and the rebuilding of structures that are damaged during flooding events.

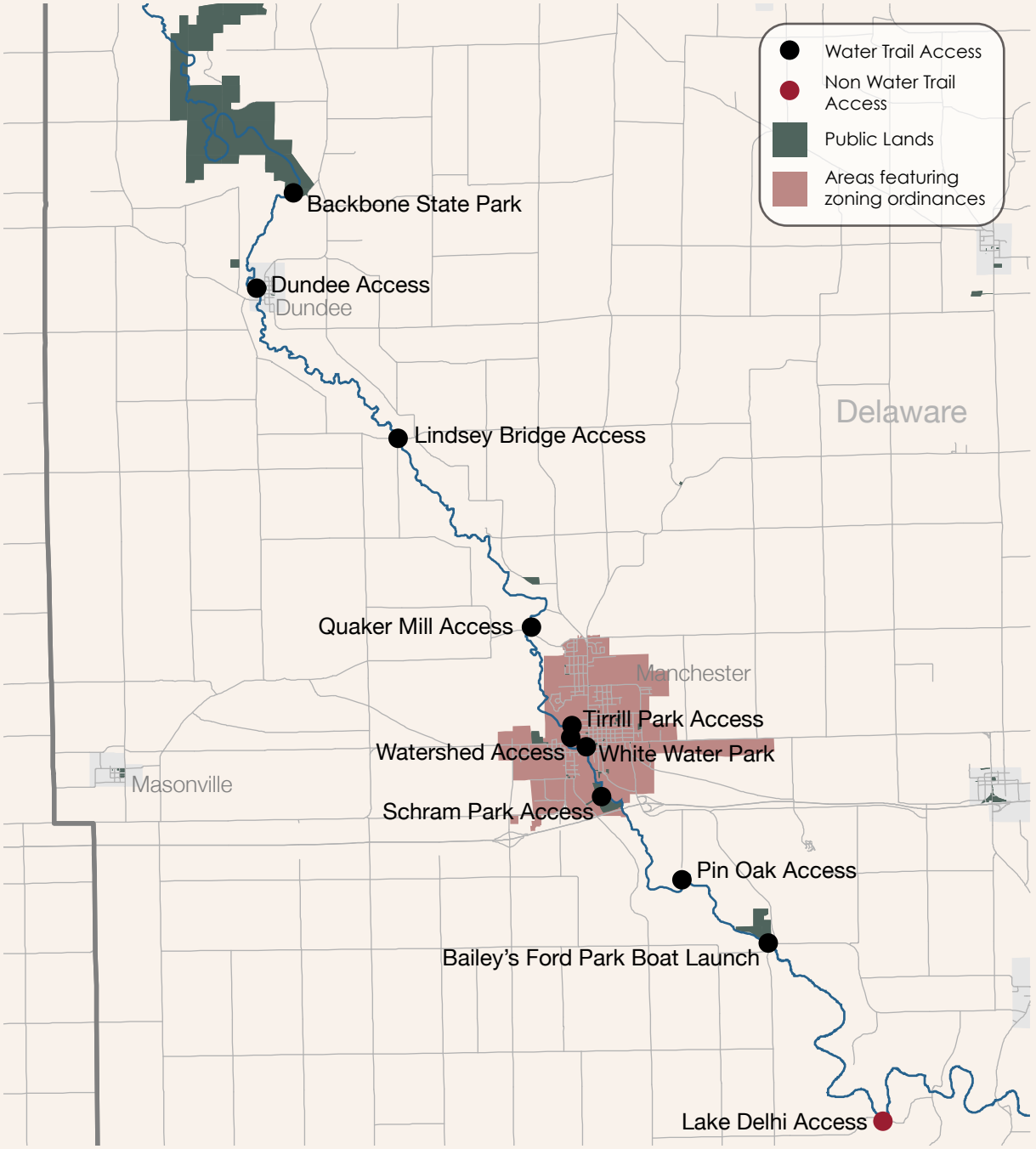


Figure 9

Public ownership and conservation easements are the only mechanism available to protect the high value forested lands near the Maquoketa River as the county has no zoning.

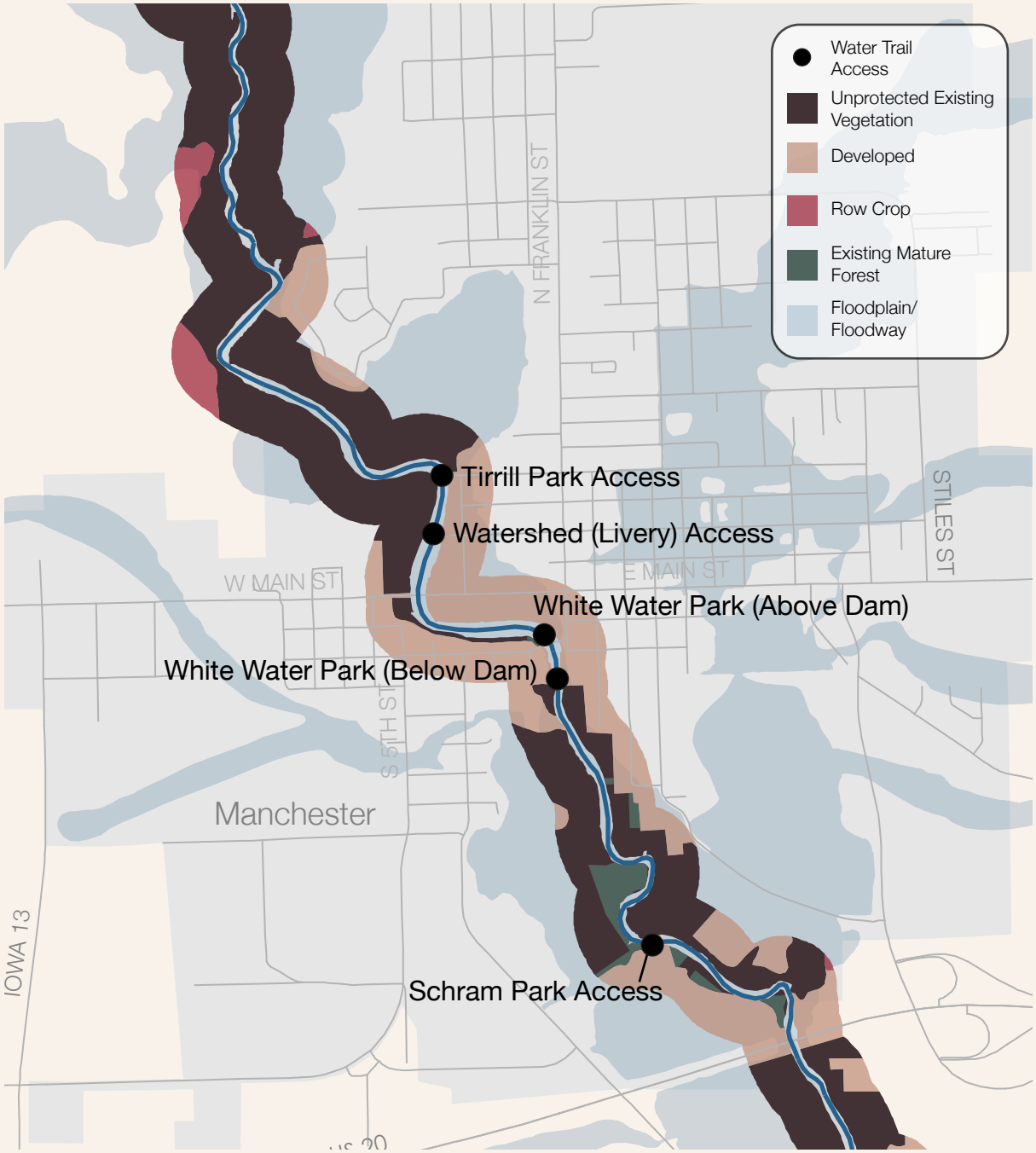
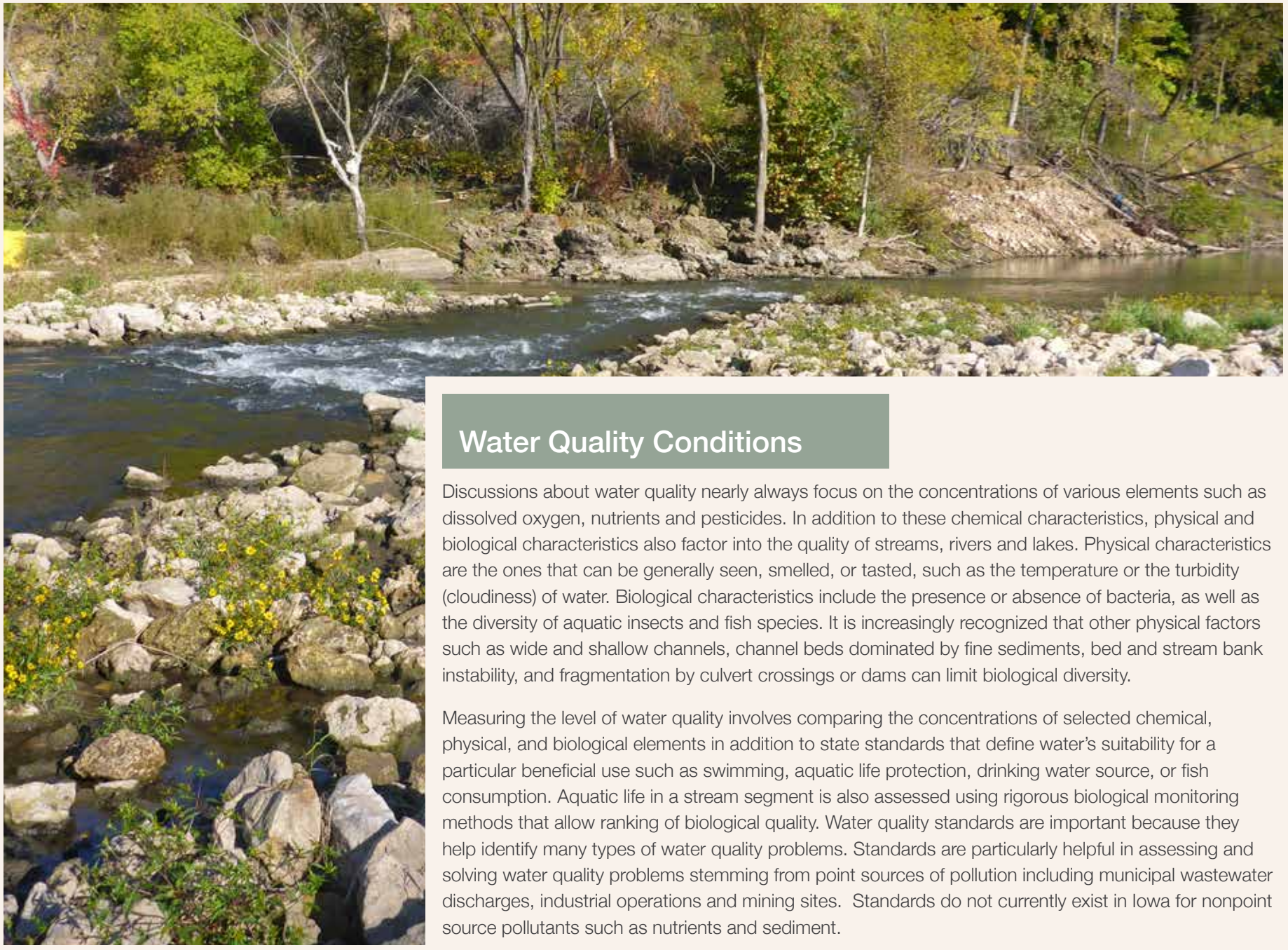


Figure 10

A majority of land near the river in Manchester is either developed or in mature forest land cover.



Water Quality Conditions

Discussions about water quality nearly always focus on the concentrations of various elements such as dissolved oxygen, nutrients and pesticides. In addition to these chemical characteristics, physical and biological characteristics also factor into the quality of streams, rivers and lakes. Physical characteristics are the ones that can be generally seen, smelled, or tasted, such as the temperature or the turbidity (cloudiness) of water. Biological characteristics include the presence or absence of bacteria, as well as the diversity of aquatic insects and fish species. It is increasingly recognized that other physical factors such as wide and shallow channels, channel beds dominated by fine sediments, bed and stream bank instability, and fragmentation by culvert crossings or dams can limit biological diversity.

Measuring the level of water quality involves comparing the concentrations of selected chemical, physical, and biological elements in addition to state standards that define water's suitability for a particular beneficial use such as swimming, aquatic life protection, drinking water source, or fish consumption. Aquatic life in a stream segment is also assessed using rigorous biological monitoring methods that allow ranking of biological quality. Water quality standards are important because they help identify many types of water quality problems. Standards are particularly helpful in assessing and solving water quality problems stemming from point sources of pollution including municipal wastewater discharges, industrial operations and mining sites. Standards do not currently exist in Iowa for nonpoint source pollutants such as nutrients and sediment.

Impaired Waters

According to Section 303(d) of the federal Clean Water Act, a beneficial use of a water body is considered “impaired” when the water in the river segment or lake is sampled and fails to meet any one of the standards set to protect that beneficial use. Federal regulations require that all states compile and submit to EPA a list of waters considered “impaired”; this list is updated with new data every two years. States must prepare a water quality improvement plan for all Section 303(d)-impaired waters to show how the impaired beneficial use can again be fully supported. Only when additional monitoring shows that all standards are met and the beneficial use is again fully supported can the impairment be removed. In practice, Iowans are swimming, fishing, and boating waters whether or not they meet the water quality standards.

Backbone State Park Lake near Forestville and nearly all portions of the Maquoketa River downstream are included on Iowa’s 2012 List of Impaired Waters (also known as the 303D List) *(Figure 11)*. Four tributaries in Delaware County draining into the water trail portion of the Maquoketa are also included on the list (Honey, Coffins, Buck and Plum creeks).

All impaired segments of the Maquoketa included in this study area, including Backbone Lake, are due to high levels of indicator bacteria (E. coli). A majority of the study area is also listed as biologically impaired due to results of biological monitoring showing that fish and/or macroinvertebrate communities do not meet regional expectations for biological integrity. The tributaries known as Coffins Creek and Honey Creek are also impaired due to indicator bacteria.

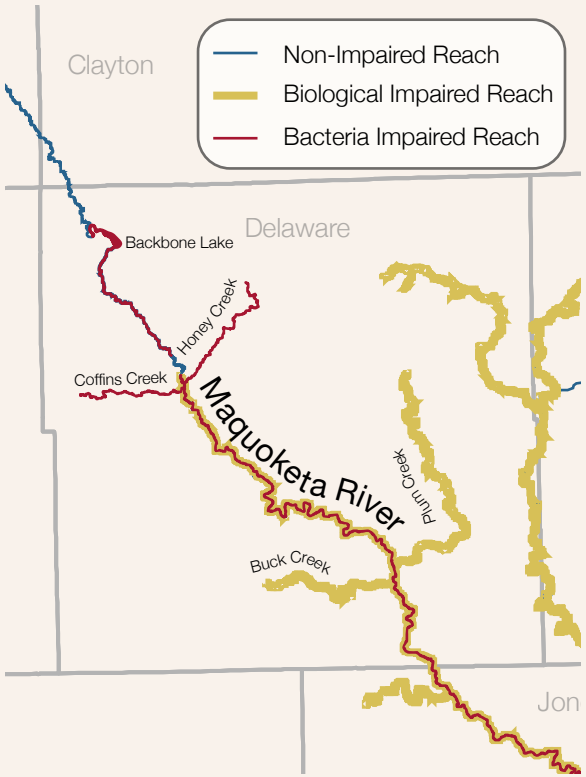


Figure 11

A majority of the Maquoketa River in Delaware County is included on Iowa’s 303d List. Several tributaries are also included.

Contaminant Sources

Iowa DNR lists a total of 58 contaminant sources within 0.3 miles of the Maquoketa River in Delaware County *(Table 9)*. Contaminant sources include potentials for contamination of water resources based on the type of operation.

Prior to the dam failure, Lake Delhi was a high priority on the Department's unsewered communities list. As of 2010, nearly half of the 400 homes or cabins surrounding the lake are currently considered to be unsewered meaning that homes are discharging untreated or partially treated wastewater to groundwater and/or surface waters (Iowa DNR, 2010).

Contaminant Source Type	Total Within 0.3 miles of River*
Hazardous Materials Spill	7
Leaking Underground Storage Tanks	8
Tier II Chemical Storage	6
Toxic Release Inventory	1
Underground Storage Tank	28
Unsewered Community	1
Wastewater Outfall	5
Wastewater Treatment Facility	2

Table 9

Contaminant sources includes locations from which contaminants are known to exist. The list does not imply contamination of surface water has occurred.

**Source: Iowa Department of Natural Resources, 2011*

Water Quality Initiatives

Local, coordinated efforts to initiate water quality enhancement are an important indicator of local and / or regional commitment to water resources. Multiple types of organizations often participate in these efforts in Iowa including federal and state agencies, county government, soil and water conservation districts (SWCD's), conservation non-profit organizations and commodity groups.

Several types of funding mechanisms exist to direct resources toward initiatives on agricultural land in critical watersheds. Examples of these include the USDA-NRCS Mississippi River Basin Healthy Watersheds Initiative (MRBI), the Iowa Water Quality Initiative (WQI) and the Iowa DNR Lake Restoration Program. Prioritized Nutrient Management Strategy Watersheds are an example of critical geographic areas identified for water quality enhancement in the state. Assessments and planning efforts are used to develop strategies for enhancing water quality conditions. Total Maximum Daily Load (TMDL's) and their linked 9-element watershed management plans are examples of these strategies. These strategies are then implemented as funding becomes available. Watershed Management Authorities (WMA) is a mechanism for cities, counties, SWCD's and stakeholders to cooperatively engage in watershed planning and management including water quality enhancement.

Funding sources include state, federal and local entities as well as private sources. Federal examples include USDA programs such as the Environmental Quality Incentives Program (EQIP) and Conservation Reserve Program (CRP)and EPA Section 319 administered through Iowa DNR. At a state level In Iowa, important sources include Watershed Protection Funds and Watershed Improvement Review Board (WIRB), both administered through the Iowa Department of Agriculture and Land Stewardship.

Two statewide community-based participation efforts focus on water quality. Project AWARE (A Watershed Awareness River Expedition) engages volunteers in water quality and aquatic habitat enhancement through an annual 7-day trash removal expedition. IOWATER is a volunteer water quality monitoring program that collects and publishes preliminary monitoring data.

Delaware Soil and Water Conservation District (SWCD) has been successful in obtaining funding for local water quality initiatives. A total of $883,058 has been awarded to water quality enhancement projects in study area watersheds since 2001. EPA Section 319 was the source of this funding. The majority of these funds were awarded to reduce sediment and nutrient loading into Sand Creek, Upper Maquoketa, and South Fork of the Maquoketa. Funding was also directed to the Upper Maquoketa and South Fork Maquoketa for bacteria reduction from manure. Nitrate reduction was the primary goal of a $60,000 MRBI grant received in 2013 for Honey, Lindsey, Allison and Dry Run creeks as they directly influence City of Manchester drinking water supplies.

Several watershed projects downstream of the study reach in Delaware County have also been active. The Bear Creek Watershed Project received $1.3 M between 2006-2009 for sediment, bacteria and nutrient reductions as well as manure management. Similar projects were also funded in the Farmers, Mineral and Prairie Creeks watersheds between 2003 and 2007 with an additional $1.6M in funding.

CONTEXT OF THE RIVER

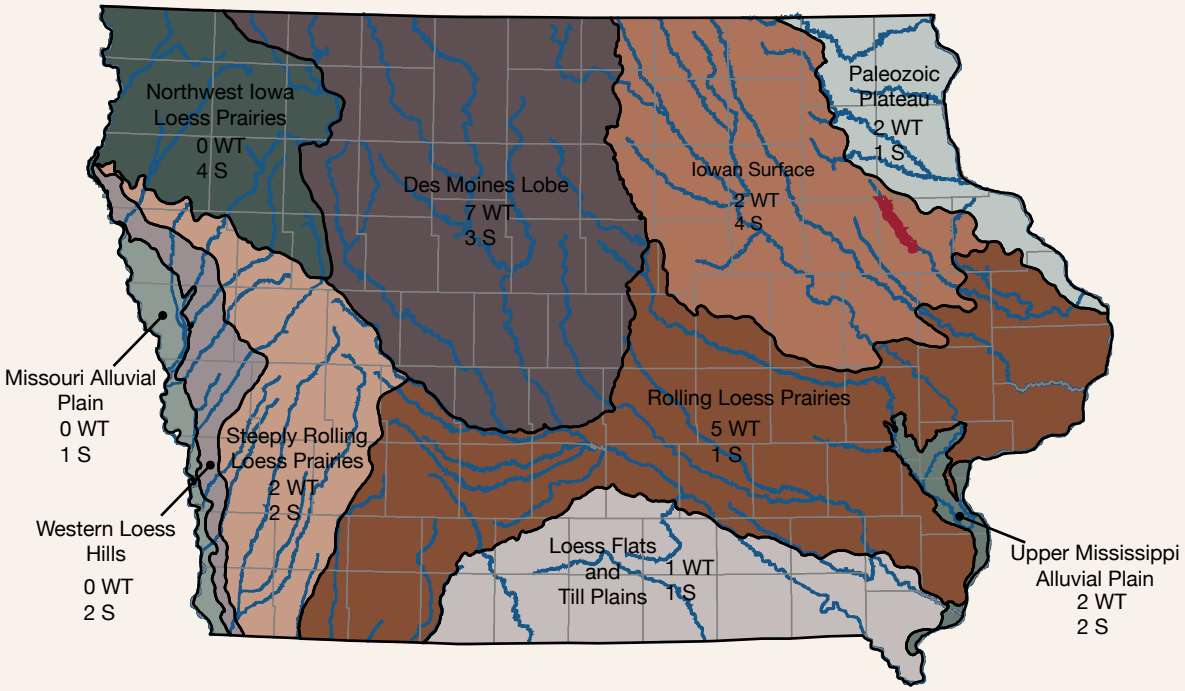


Figure 12

The Maquoketa River study segment in Delaware County located close to the limits of the Iowan Surface.

Watershed Characteristics and Condition

This river corridor is located within the Iowan Surface ecoregion *(Figure 12)*. As stated previously, this study segment is not a designated water trail. However, there are three water trails already designated within the Iowan Surface ecoregion.

The concept of "ecoregions" is used to characterize and groups geographic areas with similar climate, soils, and topography. Together, these three elements result in specific plant and animal patterns and form distinct ecological patterns unique to each ecoregion.

The Iowan Surface ecoregion is distinguished by recent glacial drift landforms of the Des Moines Lobe. There are no natural lakes of glacial origin in this area. The southern and southeastern border of this region is irregular and crossed by major stream valleys; glacial deposits in the

northern portion of the region are thin with shallow limestone bedrock creating karst features (Chapman et al. 2002).

The drainage basin or watershed area draining in the Maquoketa River study site includes 209,311 acres *(Figure 13)*. Fifty-eight percent (120,532 acres) of the watershed draining into this segment of the Maquoketa River is located in Delaware County. A majority of the watershed acres (70%) in 2013 was annually cultivated cropland *(Table 10)*. Developed areas, including roads, neighborhoods and buildings, totaled 7% of the watershed.

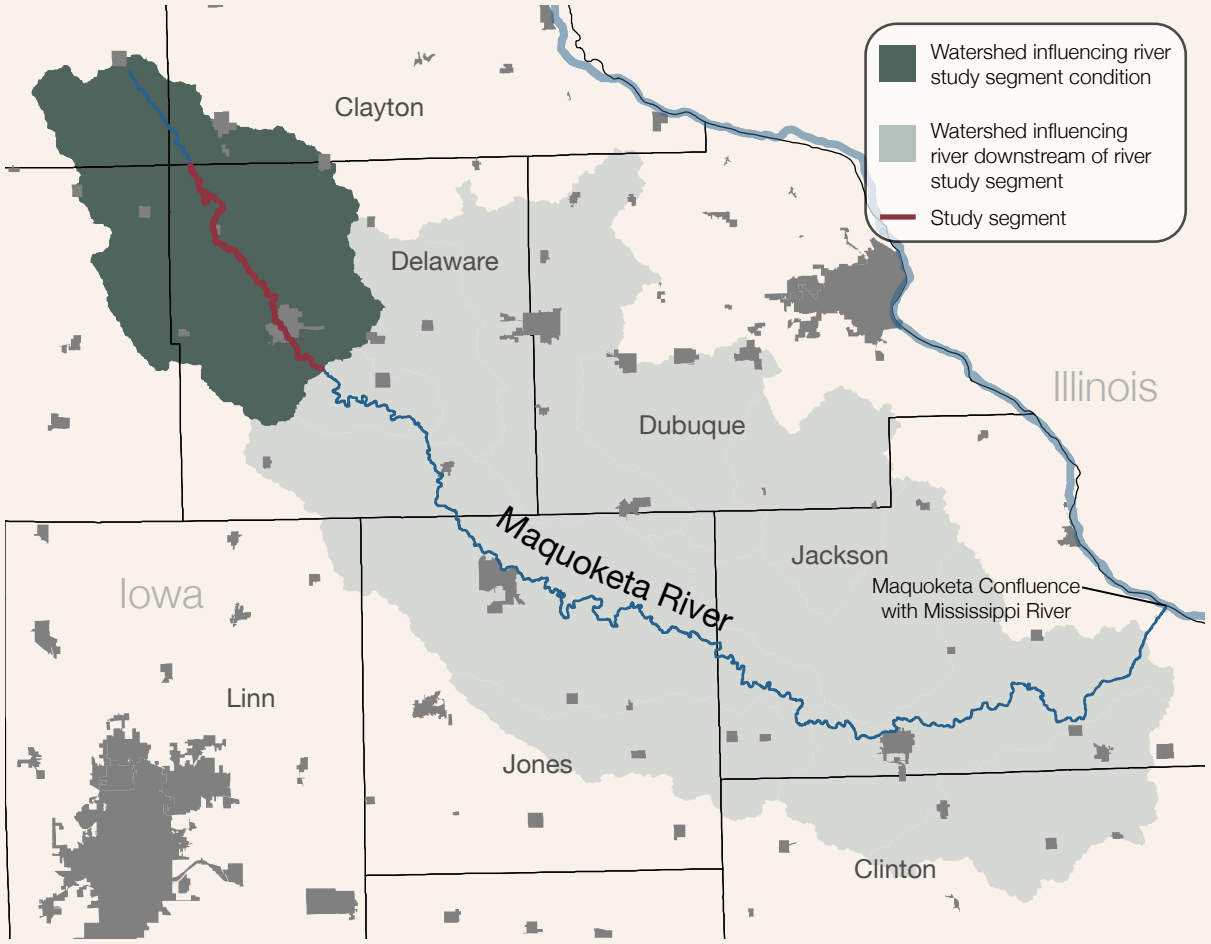


Figure 13

The watershed area for this segment of the Maquoketa River is the smallest of any studied in 2014 by Iowa DNR for potential designation. The next smallest watershed, Black Hawk Creek in Black Hawk County, is twice the size.

Land Cover Type	2013 Acres*
Annually Cultivated Crops	79,974
Grassland, Pasture, Alfalfa	22,088
Forest, Woodland, Shrubland	9,074
Wetlands	406
Developed Land	8,990
TOTAL ACRES IN WATERSHED	120,532

Table 10

*Land cover from the 2013 crop year was used to characterize the Delaware County portion of the watershed. Annually cultivated cropland comprises the largest land cover type (66%) in the watershed. Perennial landcover totaled 26%. *Land Cover Source: USDA National Agricultural Statistics Service, Cropland Data Layer 2013*

Geologic Resources

Delaware County was one of the first regions west of the Mississippi to be studied by professional geologists. The earliest investigations occurred in the fall of 1839 and were conducted by a party organized to explore the mineral lands of the United States (Calvin 1897). Another historically important investigation is reported when a team of scientists visited northern Delaware County in 1919 in order to document conditions and later recommend public ownership of what is now the Backbone State Park area (Iowa State Board of Conservation 1920). All early geological reports documented the striking contrast between the landscape in and surrounding what was referred to the "Backbone" or the "Devil's Backbone".

The "Backbone" name is derived from the high, rocky ridge formation of bedrock that curves parallel to the Maquoketa River *(Figure 14)*. At this location near its headwaters, the river is spring fed and occupies a narrow alluvial valley inside the park. Already somewhat well-known locally by the 1880's (Bailey 1935), the region was described in 1919 as "a rugged island of "oldland" rising out of the gently swelling sea of the Iowa prairie" (1920, p 45).

The elevation of the Backbone area rises higher than the surrounding landscape and thus wasn't covered by deposits from the Iowan glaciation. A layer of windblown soil, known as loess, covered the top of the formation, without impacting the vertical cliffs and walls, allowing many parts to be

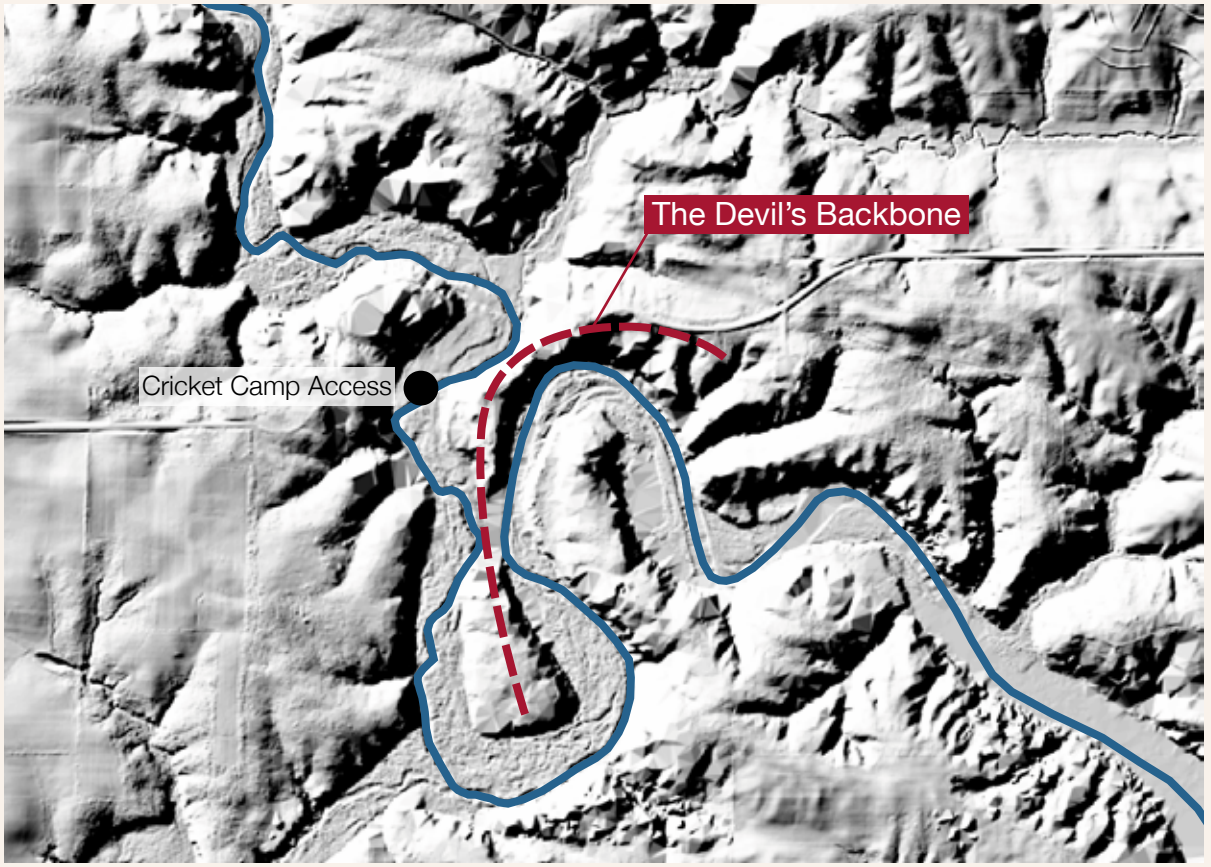


Figure 14

A popular hiking trail exists on top of the "Devil's Backbone," the feature for which the park is known and named. The geologic formation is also prominent from on the river.

covered with vegetation as we see it today. The abundance of fossils, springs, vegetation and caves, in addition to the bedrock formation, set this area apart from its surroundings and fueled early interest in its permanent protection.

The bedrock that can be observed in the study area is composed of dolomites—a brittle crystalline rock of various colors that can form massive formations. Study area dolomite bedrock formations resulted from chemical alteration of the sediments laid down between 431 and 422 million years ago (MYA) when Iowa and much of North America was covered with a shallow sub-tropical sea. The sediments that created the dolomites seen today began as limestone which formed from deposits of lime shells and other hard parts secreted by sea animals that lived in the sea. As the seas withdrew, the limestone was chemically altered by fresh rain water carrying magnesium which leached from the emergent lands. This shallow sea teamed with prehistoric life. Many fossils can be seen today preserved in the formation and as particles in the river within Backbone State Park including corals, brachiopods, crinoids (sea lilies), sponges (stromatoporoids), bryozoans, snails (gastropods), clams (bivalves), nautiloids, and trilobites. (Artz et al. 2015).

The study area is underlain by two separate dolomite formations—the Silurian Scotch Grove Formation overlies the Hopkinton Formation *(Figure 15)*. The dolomites of the Scotch Grove contain the most diverse variety of marine fossils found anywhere in the Silurian of Iowa (Artz et al. 2015). Appearing similar to the Silurian Hopkinton

Figure 15

The Maquoketa River traverses two different bedrock formations in the study area including the Hopkinton formation, shown in green, and the Scotch Grove formation shown in blue. All instances of severe streambank erosion (illustrated by the red river segments) occur in the Hopkinton formation where many layers of soil overlay very deep bedrock. Two ancient, deep bedrock valley locations (Artz et al. 2015) are shown with thin yellow lines on this diagram.

Formation, the Silurian Scotch Grove Formation includes fossils of crinoids, corals, brachiopods, and bryozoans. Additionally caves and other features of karst terrains, such as sinkholes, can be seen in the Scotch Grove Formation. These caves in the southern end of the study area were widely employed by early settlers and the Indians before them (Bailey 1935). Further downstream, outside of the study area, Maquoketa Caves State Park in Jackson County features numerous caves that developed in the Scotch Grove Formation. Bedrock was buried by deposits resulting from glaciation between 2.3 and 0.5 MYA; however, the depth of the glacial sediments is fairly thin in the Iowan Surface ecoregion.

Two segments of the Maquoketa River Water Trail study segment cross ancient buried bedrock valleys filled with older glacial deposits. One of these extends from Dundee Access to just above the Lindsey Bridge Access and a second extends from the Quaker Mill Dam Access to the Pin Oak Access *(Figure 15)*. As you paddle these reaches, the river channel is crossing erodible glacial sediment that filled the ancient buried valley of bedrock. Along both of these segments the Maquoketa Valley widens and bedrock outcrops disappear. Between these segments the valley passes through terrain where bedrock is at or near the surface, standing as bluffs on one or both sides of the valley (Merry 1914, Artz et al., 2015).

The sand and gravel deposits that now stand as terraces above the modern floodplain resulted from extremely cold temperatures that occurred at the height of the last glacial period, the Wisconsinan. As the Upper Midwest went into a deep freeze, the area that is now southwestern Minnesota and northeast Iowa became very cold and dry. Eventually the ground froze to depths of several hundred feet. Only portions of the top layer would unfreeze during the warmer months. The thawed material was picked up and moved over several thousand years during periods of strong winds and intense rains. These runoff events, with their heavy bedload, resulted in large floods that mimicked floods produced by melting glaciers (Artz et al., 2015).

The deposits underlying the lower alluvial terraces visible to paddlers today were deposited after 10,000 years ago during the Holocene age. Repeated episodes of river deposition, one from about 10,000 to 4,000 years ago, and the other from about 4,000 to 150 years ago formed two terrace levels visible in the study area. The present floodplain comprises a low terrace that is underlain by Historic-period sediment resulting from the onset of Euro-American agriculture (Artz et al. 2015).

Cultural & Historic Resources

The land of Delaware County was some of the earliest opened to settlement in Iowa. Prior to the Black Hawk War and Treaty of 1832 the land belonged to the Indians. The study area opened to settlement immediately after the treaty in 1833. In 1830 the U.S. government purchased a strip of land twenty miles wide spanning between the Mississippi River and the Des Moines River *(Figure 16)*. The purpose of this "neutral ground" was to serve as a physical separation between the two primary Indian tribes, the Sioux and the Sacs and Foxes, who were bitter enemies. The settlers of Delaware County, situated one county south of this border, felt protected from the Sioux to the north by this zone (Bailey 1935). Anecdotal settler records from the mid-1800's as well as current records with the Iowa Office of Archeology confirm that numerous prehistoric Indian mounds are scattered around the region. Mounds were built by the Woodland people sometimes as burial places but also as territorial markers, ritual meeting places, and symbols of ancestral and ongoing human connections with the land (Anderson 1995).

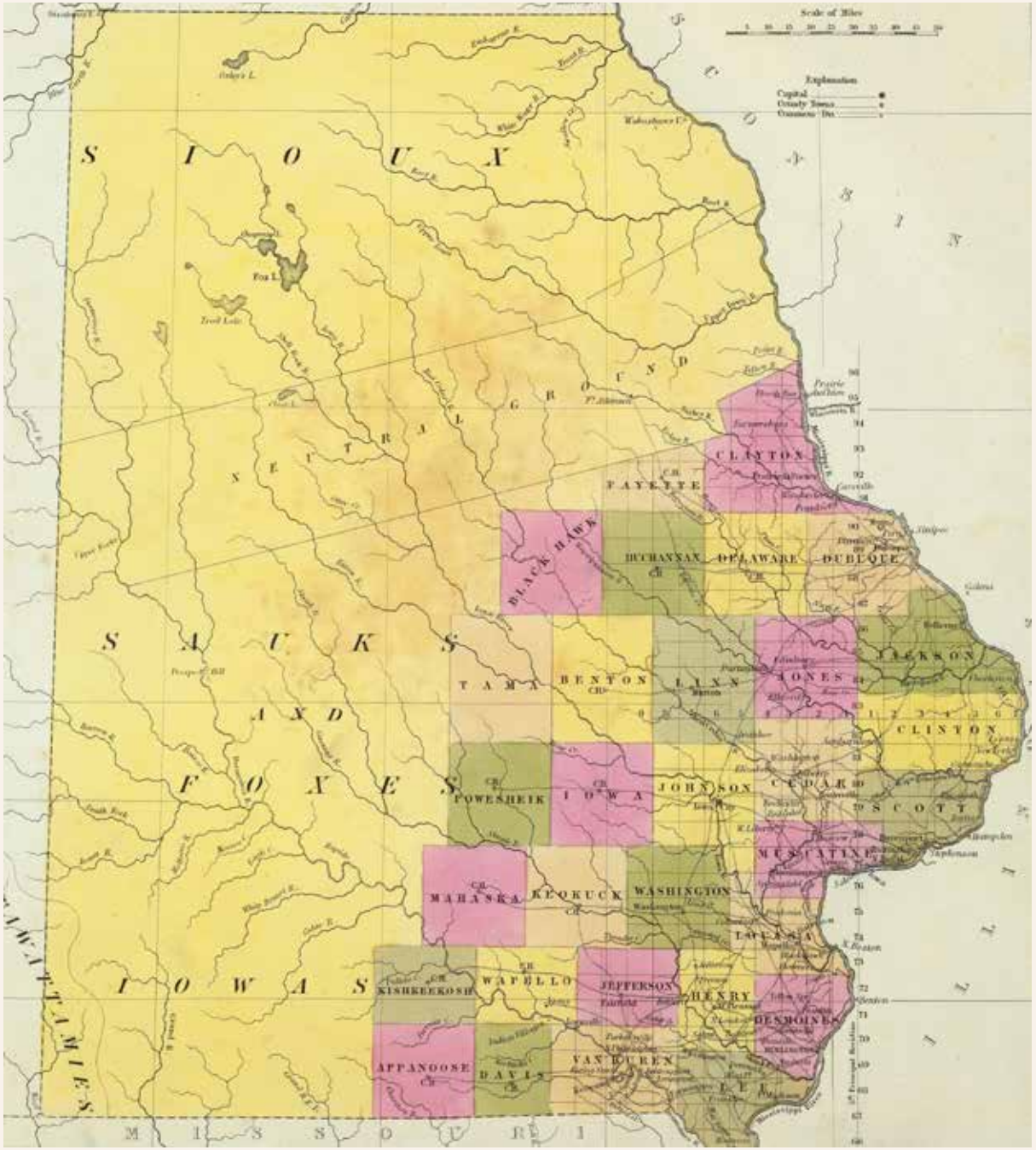


Figure 16

The "neutral ground" was located fairly close to Delaware County. Anecdotal settler communication describes the importance of this buffer area to their sense of security.

Archeologic Evidence of Prehistoric Habitation

The Office of the State Archaeologist (OSA) completed a Phase IA archeological reconnaissance survey along the route of the water trail in 2014 (Hedden 2014). Their investigation compiled and summarized prior archaeological investigations, previously recorded archaeological sites and architectural resources, National Register of Historic Places, known cemeteries, and unrecorded historical properties of possible interest. The purpose of this investigation was to develop priority areas for further study due to possible future development and to provide information to assist with development of interpretive materials in the water trail corridor.

The OSA study corridor included the total river valley from blufftop to blufftop, an area ranging from 3.4 to 5.5 miles wide. Only four ¼ sections of land within the OSA study area were mapped as containing one or more Iowa Site File-recorded archaeological sites; a total of 3 prehistoric sites have been identified on these ¼ sections (Hedden 2014). However, an additional 55 Prehistoric sites lie just outside the original OSA boundary, largely clustered around today's Backbone State, Bailey's Ford parks and Pin Oak Access (Hedden, 2014). Findings at these sites document occupation from the Archaic through the Middle Woodland periods or from 8000 BC to 300 AD. The open habitation sites, rock shelters, lithic scatters, camp sites, quarry sites, fish weir and mounds suggest heavy use by multiple periods.

Early Euro-American Settlement

While the late 1830's General Land Office maps fail to identify any improvements near the river corridor, county histories indicate settlement began shortly thereafter and initially concentrated along the water bodies of the county (Hedden 2014).. The first settlers arrived in 1834 or 1835 (Bailey 1935). Water figured in to the early history of the county in a number of ways. The frequent streams and springs were important water sources for families and villages while timber that was found along rivers was both useful for construction and fuel (Hedden 2014). The permanence of many of Delaware County's streams—even during times of drought—is due to these numerous springs and the volume of water they supply. Early settlers as well as the Indians before them found that the spring water created high quality cold water fish habitat.

Prior to the establishment of the railroad in the county in 1859, the main crossing on the Maquoketa in this area for stage coaches, freight wagons and travelers on foot was Bailey's Ford. The ford was named after the first settler, Joel Bailey, who lived nearby in 1837. The ford is a large riffle near the location of today's Bailey's Ford Park. In early history, a post office, stone school house and homes were located near the ford.

Settler reports from 1854 indicated that Indians were still more numerous than “white men” (Bailey 1935). By 1860, nearly all Indians had been removed from the Delaware County region (Foster 2009). Writings from a lifelong resident of the region acknowledged the drastic nature of the forced removal of Indians from the state: “Probably none of us could honestly wish for their return yet it is sad to think of a race of human beings so completely driven from their homes that the only trace of them here is an occasional arrowhead and a few mounds of earth which may have been erected by a more ancient people, the mound-builders. However, their memory is perpetuated for ‘the everlasting rivers speak their dialect of you.’ In our state they have given us the names Iowa, Maquoketa, Wapsipinicon. These are the enduring monuments of an almost forgotten people who used to enjoy the land we now occupy” (Bailey 1935 V. 1, p. 92).

Settler accounts of vegetation at the time included largely prairie with high grasses and numerous wildflowers. Trees occurred near the streams and other areas that had been protected from fires. Much of the land near the streams was covered with a thick growth of “hazel brush” which impeded travel and cultivation. Plum, cherry and crabapple thickets were common and prized for their sweet fruit. Raspberries, blackberries, strawberries, gooseberries and grapes were also plentiful. At the time of white settlement: deer, rabbits, raccoon, bear, panther, wolves, mink and muskrat; bird species included Passenger Pigeon, prairie chickens, ducks, geese, sand hill cranes, blue heron, and the Carolina parakeet (Bailey 1935).

Early settlers began harnessing local resources to improve their quality of life by the late 1800’s. One of the first features put on the river was a flour mill near Manchester; after a flood destroyed the original structure it was rebuilt and name ‘Quaker Mill’. This would later get washed out again and a dam would be built that was 120 feet long and fourteen feet high (Swisher 1940). Six dams had been constructed the Maquoketa River by 1897 to generate power and to mill grain in Delaware County (Calvin 1897). Of these, only the Lake Delhi location continues to have a full-height functional dam. Also by 1897, early settlers were also using Loess and drift clays for brick making as these deposits were are widely distributed throughout the county. Primary brickyards were located in Manchester and near Hopkinton while a stone quarry was operating in Delhi township (Calvin 1897). A large woolen manufacturer and a creamery were also located in Manchester (Bailey 1935).

Manchester was developed in the early 1850’s with the original town name of Burrington. A dam with a bridge on it was built around 1855 and was used to generate electricity for Manchester shortly thereafter. Based on newspaper accounts, the area of today’s Manchester Whitewater Park has been used by spectators to recreate and to watch boats race since at least the 1860’s.

The area adjacent to the south end of the project corridor was the epicenter of Iowa’s early dairy industry (Hedden, 2014). The first butter creamery in Iowa was in the 1872 Spring Branch Creamery, one mile east of the study area or two miles northeast of the Pin Oak Access (Hedden, 2014). Spring Branch is also the location of the historic Manchester Fish Hatchery. Developed in 1893 by the US Fish and Wildlife Service, this hatchery was one of two in operation at that time and the first federally owned hatchery in the U.S. It has been operated by Iowa DNR since 1976 (Iowa DNR 2015).

Arrival of the Railroad

The railroad arrived in Earlville in eastern Delaware County in1857 but halted there due to the financial crash of 1857. It finally arrived in Manchester in 1859. Manchester residents and business leaders participated in the completion of the line to their city because of the enormous economic and social prosperity they believe it would bring. An enormous celebration was held as the first train crossed the bridge in Manchester and stopped at the Depot.

An educational institution, later known as Lenox College, began organizing in Hopkinton in 1855 (Ferguson, 1949). The first building was constructed using 100,000 local bricks in 1857. The first classes were held in 1859. The site is now operated by the Delaware Historical Society and the buildings lack heating and air-conditioning, just as they did when occupied by the college. When the call in 1864 came for volunteers to serve in the Civil War, President McKean and every male student except for two volunteered. The college closed while they were gone. President McKean died a few weeks later and a monument to honor him and the 43 other residents who died related to the war activities was erected in 1865. Later, President McKean's sword was donated to the school and it remains on display. However due to large amounts of uncollected tuitions and a failure to gain local interest from high school graduates in the surrounding area, Lenox College was forced to close—only two years before the introduction of the GI Bill (Ferguson, 1949).

A number of patterns and features were established in the study area by the 1880's: these were the horse and buggy days; all roads were dirt; diphtheria, small pox and measles were prevalent and deadly; women were allowed to vote only in school elections; local grain, woolen mills were common; a robust butter, cheese and broom making industries were located here; the Maquoketa River was used for pleasure boating and the Devils Backbone was already a tourist attraction. Of these, only the last two remain.

Development of Backbone State Park

A public record of interest in the "Devil's Backbone" came around 1889 when a private resort was established there that included a merry go round, a hotel and stables on top of the Backbone (Bailey 1935). Little more is formally recorded about the site until 1919 when a team of Iowa scientists scoured the state looking for candidate landscape areas suitable for public purchase as a state park.

On the need for rural public recreation areas in Iowa, Edgar Harlan, Secretary of the Iowa State Board of Conservation wrote "But in 1919 there were not ten acres of public woods, waterlandings or open prairies, in the state, unless in cities. Not a game could be played, a shot fired, a race run, a fly cast or a lunch spread, unless in cities or on dusty highways unless the enjoyment was a trespass or was through the consent of private owners. In 1919 the acre which the Indian sold for ten cents and a pioneer bought for $1.25, and the tax-sale purchaser, secured for delinquent taxes has become the $300.00 range… In their righteous ire farmers have destroyed groves of hickory, sold their walnut trees and cleared plum thickets to rid themselves of trespassers …And so the lands that now possess agricultural value mingled with historical, scientific, scenic or recreational character are under consideration for re-acquisition by the state, and return, where possible, to their pristine condition and public use" (Iowa State Board of Conservation 1920).

A state collection of parks, balanced by congressional districts, followed. Backbone was named Iowa's first state park and dedicated in October 1920 *(Figure 17)*. Several prominent Iowa scientists are credited with beginning the state park conservation movement in Iowa including Thomas H. MacBride, University of Iowa and Louis H. Pammel, Iowa State University—both professors of botany (Bergman, Horton and Hudson, 2008). Ironically, MacBride attended Lenox College in Hopkinton as a student while in his teens where he met Samuel Calvin who was an instructor at the school (McCartney 2009). Calvin later became a faculty member at University of Iowa where he hired MacBride. MacBride went on to become a professor of botany. Calvin was charged with preparing the 1897 Geology of Delaware County publication and later, all three men would collaborate to recommend the land known locally as the "Devil's Backbone" be the first state park (Iowa State Board of Conservation, 1920). Pammel was subsequently appointed as Chairman to the Board of Conservation, the precursor of today's Iowa Department of Natural Resources.

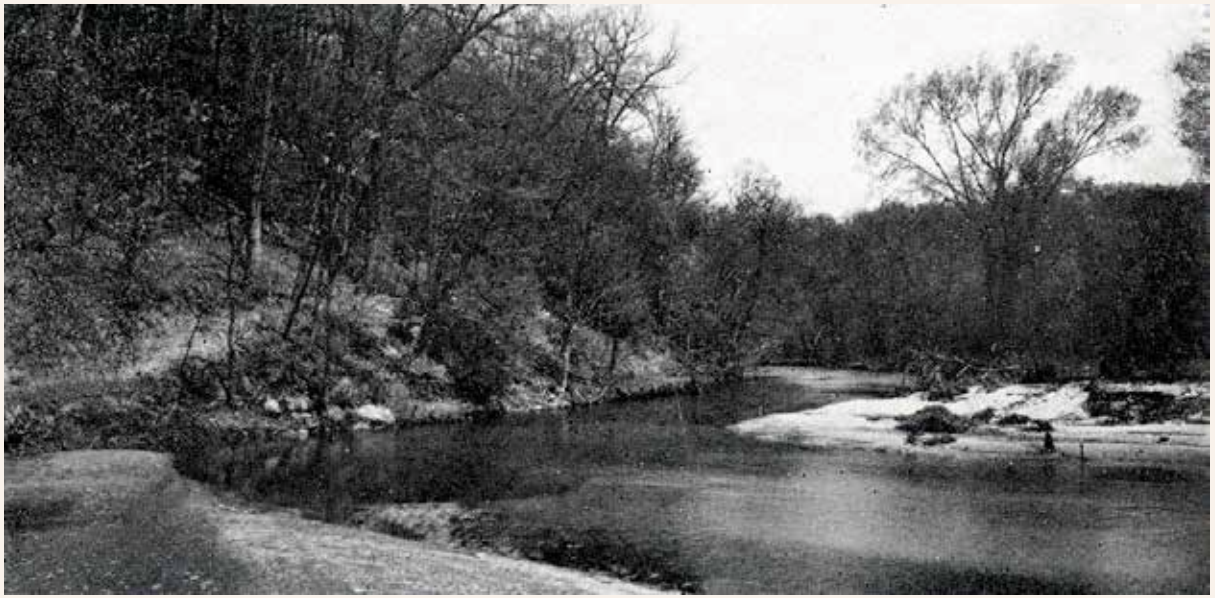
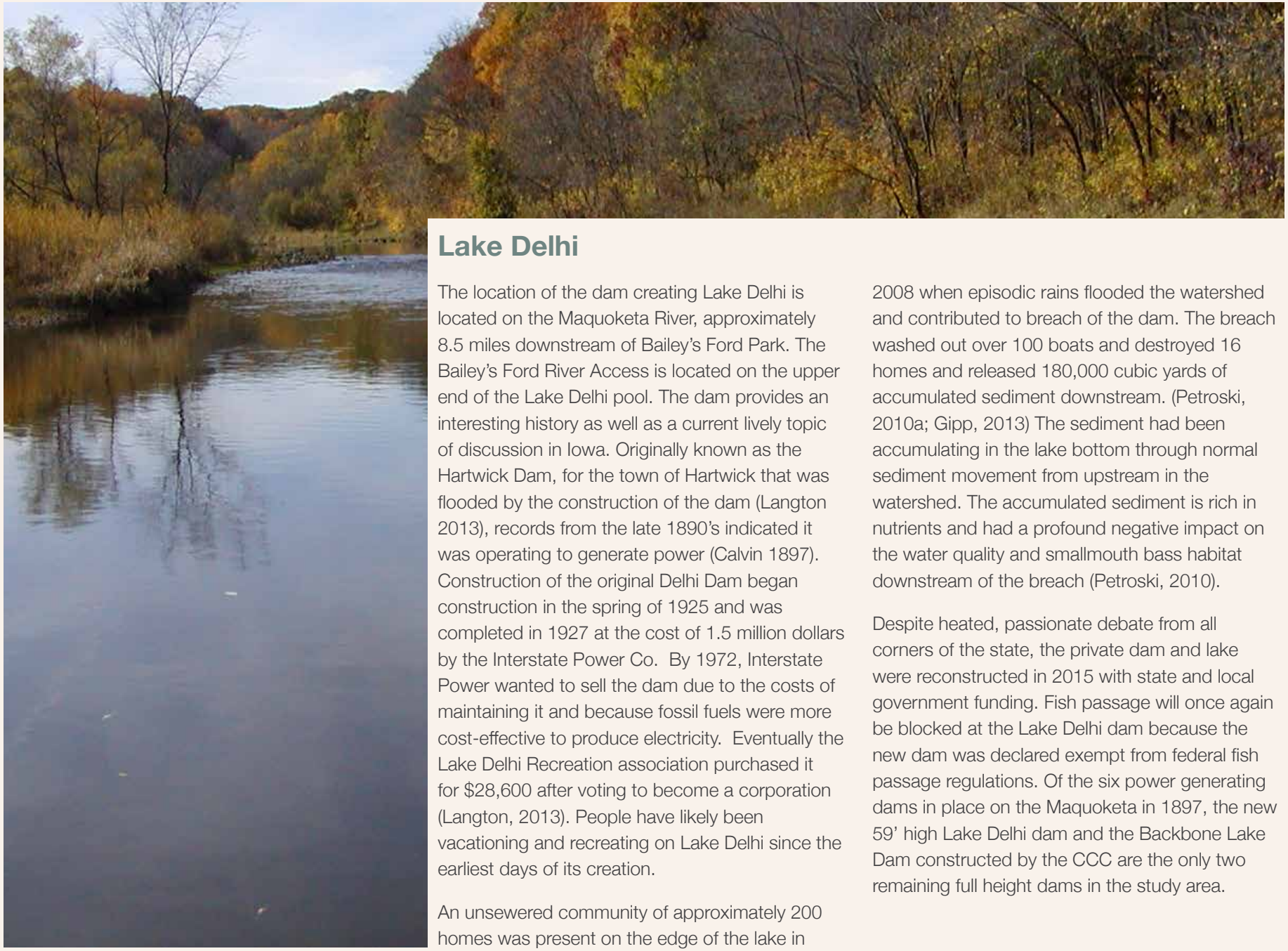


Figure 17

This view of the Maquoketa River from inside Backbone State Park was featured in the 1919 program printed for the park's Opening Celebration.

Development at Backbone was at a frenzied pace with most buildings being completed before the mid 1930's by the Civilian Conservation Corps (CCC)(Anderson, 1995). Structures built by the CCC included overnight cabins, boating and swimming facilities, picnic shelters, drinking fountains, overlooks, trails, a small concession area, parking areas, and the CCC museum. Additionally the CCC developed Richmond Springs, an artificially enhanced spring, the former state fish hatchery within the park and an outdoor auditorium. Twenty-one original structures remain in the park today and are included within a National Historic District (National Register of Historic Places). A thorough documentation of the CCC efforts is included in the CCC museum within the park.



Lake Delhi

The location of the dam creating Lake Delhi is located on the Maquoketa River, approximately 8.5 miles downstream of Bailey's Ford Park. The Bailey's Ford River Access is located on the upper end of the Lake Delhi pool. The dam provides an interesting history as well as a current lively topic of discussion in Iowa. Originally known as the Hartwick Dam, for the town of Hartwick that was flooded by the construction of the dam (Langton 2013), records from the late 1890's indicated it was operating to generate power (Calvin 1897). Construction of the original Delhi Dam began construction in the spring of 1925 and was completed in 1927 at the cost of 1.5 million dollars by the Interstate Power Co. By 1972, Interstate Power wanted to sell the dam due to the costs of maintaining it and because fossil fuels were more cost-effective to produce electricity. Eventually the Lake Delhi Recreation association purchased it for $28,600 after voting to become a corporation (Langton, 2013). People have likely been vacationing and recreating on Lake Delhi since the earliest days of its creation.

An unsewered community of approximately 200 homes was present on the edge of the lake in 2008 when episodic rains flooded the watershed and contributed to breach of the dam. The breach washed out over 100 boats and destroyed 16 homes and released 180,000 cubic yards of accumulated sediment downstream. (Petroski, 2010a; Gipp, 2013) The sediment had been accumulating in the lake bottom through normal sediment movement from upstream in the watershed. The accumulated sediment is rich in nutrients and had a profound negative impact on the water quality and smallmouth bass habitat downstream of the breach (Petroski, 2010).

Despite heated, passionate debate from all corners of the state, the private dam and lake were reconstructed in 2015 with state and local government funding. Fish passage will once again be blocked at the Lake Delhi dam because the new dam was declared exempt from federal fish passage regulations. Of the six power generating dams in place on the Maquoketa in 1897, the new 59' high Lake Delhi dam and the Backbone Lake Dam constructed by the CCC are the only two remaining full height dams in the study area.

Other Natural Resources

Aquatic Species

Organisms living in the river ecosystem are one of the most obvious wildlife-related resources associated with a water trail. Fish and other organisms such as mussels require long lengths of rivers to successfully reproduce and complete their life cycle. Many fish species make annual movements between spawning, feeding and overwintering habitats. Riverine fish also use different habitats throughout their life cycle, and move upstream and downstream in the system to avoid unfavorable conditions (flood, drought, harsh winter conditions). Therefore, connections between reaches of the Maquoketa River and its tributaries are important to the overall health of Maquoketa River ecosystem. This Maquoketa River study area has several major obstacles to organism movement. The dam at Backbone State Park as well as the reconstructed Lake Delhi dam are physical barriers to species movement.

The 2015 conversion of the dam in Manchester to a series of six rapids provides a clear example of the changed conditions that dam modification brings. There is firsthand knowledge that the whitewater rapids are passing fish and providing connectivity for organisms to complete their life cycles. Prior to the modification of the dam, the Iowa DNR Fisheries Stream Research Team marked over 4,200 fish representing 18 species downstream of the dam. Following the completion of the whitewater project in spring 2015, the team sampled fish in the Maquoketa River and Coffins Creek on several occasions as much as eight miles upstream of the project. During this monitoring they observed 98 marked fish representing nine species (Smallmouth and Largemouth Bass, Walleye, Black, Golden, and Shorthead Redhorse, White Sucker, Northern Hog Sucker, and Quillback Carpsucker) that had moved upstream over the rapids structures. Long term there is a need for assessment and monitoring. Some benefits will only be realized with additional time including building populations of organisms upstream of the dam.

Various types of standard assessments quantify fish as well as benthic macroinvertebrates. Benthic macroinvertebrates are organisms without backbones we can see without magnification living on, in or near a river or lake. As described earlier, the aquatic species found living in a water body are directly related to its water quality and riparian condition.

Statewide analysis of the presence/absence of aquatic species was conducted in 2000. This analysis used Iowa's Ambient Water Monitoring data which includes the highest quality species monitoring and water quality sampling data available. Fifteen years of monitoring data from reference sites were used to generally characterize conditions statewide based on ecoregion areas. From this analysis, the greatest diversity of native fish species and the highest number of macroinvertebrate species on average were found in the Iowan Surface ecoregion in which the Maquoketa River is located.

Recent fish sampling (2010-2015) at five sites on the Maquoketa River collected 52 species in the water trail study area in Delaware County. The species found included: American Brook Lamprey, Banded Darter, Bigmouth Shiner, Black Bullhead, Black Crappie, Black Redhorse, Blacknose Dace, Blackside Darter, Bluegill, Bluntnose Minnow, Brassy Minnow, Brook Silverside, Brown Trout, Bullhead Minnow, Carmine Shiner, Central Stoneroller, Channel Catfish, Common Carp, Common Shiner, Creek Chub, Emerald Shiner, Fantail Darter, Fathead Minnow, Golden Redhorse, Golden Shiner, Green sunfish, Highfin Carpsucker,

Hornyhead Chub, Johnny Darter, Largemouth Bass, Longnose Dace, Northern Brook Lamprey, Northern Hog Sucker, Northern Pike, Ozark Minnow, Quillback Carpsucker, Rainbow Darter, Rainbow Trout, River Carpsucker, Rock Bass, Sand Shiner, Shorthead Redhorse, Smallmouth Bass, Southern Redbelly Dace, Spotfin Shiner, Stonecat, Suckermouth Minnow, Walleye, White Crappie, White Sucker, Yellow Bass, and Yellow Bullhead (Iowa DNR Fisheries Stream Research unpublished data).

The most recent detailed assessments of fish upstream and downstream of Manchester and benthic macroinvertebrates downstream of Manchester found fish communities that rated "good-excellent" and benthic macroinvertebrate communities that rated "fair to good" compared to other streams in the Iowa Surface ecoregion *(Table 11)*. There is no mussel survey data available from the Iowa DNR.

The Iowa DNR Fisheries Stream Research Team is currently conducting an angler use survey in the Maquoketa River in and around the Manchester area. When completed, the survey will compare angler use before and after the conversion of the dam to whitewater rapids. Surveys have been conducted from April-October, 2012-2015. Annual fishing effort in the area has ranged from 4,121-6,650 angler/hours. Major game fish species caught and harvested in the survey include Smallmouth Bass, Walleye, Channel Catfish, Rock Bass, and Bluegill.

Location/Year	FIBI	BMIBI
Upstream of Manchester		
Site 1		
2011	66 (good)	
2013	61 (good)	
2014	64 (good)	
Site 2		
2011	67 (good)	
2013	65 (good)	
2014	71 (excellent)	
Downstream of Manchester		
2012	62 (good)	57 (good)
2013	82 (excellent)	48 (fair)

Table 11

Index of biotic integrity scores for fish (FIBI) and benthic macroinvertebrate (BMIBI) samples on the Maquoketa River upstream and downstream of Manchester, 2011-2014. These scores illustrate pre-dam modification conditions.

Sources: Iowa Department of Natural Resources (IDNR) BIONET, IDNR Stream Research unpublished data.

Bird Species

Breeding birds are of great interest to many Iowans. Backbone State Park, at the northern edge of the study area, constitutes a 2000-acre complex of protected habitat, and is an Audubon Society Important Bird Area. “Named for its 400-million-year-old dolomite limestone ridge, which abruptly rises out of the Maquoketa River valley, this rugged 1780 acre older-growth woodland contains some of the best bird diversity in the state. Approximately 100 bird species nest in and around this park. During the Northeast Iowa Neotropical Migrant Songbird Project (1994-1996), PHD candidate, Bill Norris, noted that more bird species were recorded at Backbone State Park than any other northeastern Iowa site. Notable nesters include Iowa species of special concern, the Bald Eagle, and the Iowa Threatened Species the Red-shouldered Hawk. Other important species include Veery, Louisiana Waterthrush, Acadian Flycatcher, Cerulean and Kentucky Warblers, Northern Parula, Wood Thrush, Black-billed and Yellow-billed Cuckoos, and Pileated Woodpecker.” (Iowa Audobon 2015). Iowa Audubon Society considers this area important because it contains endangered or threatened species habitat, rare or unique habitat and is considered a high conservation priority. The study area has numerous areas that have been identified as having a high potential for forest restoration including property owned by Delaware County Conservation Board south of Manchester.

The Breeding Bird Atlas is a source of breeding bird data used throughout the United States and Canada. Each atlas project within a state or province uses approximately 20 hours per study block of observation time to record breeding activity over a course of five years. Study blocks include 3-mile by 3-mile blocks systematically selected across the state. These atlas project survey areas record evidence of breeding. The Breeding Bird Atlas has been compiled twice in Iowa with the most recent compilation from 2008 to 2012. Two study blocks were located in the study area: in Backbone Park and in the Dundee area. These blocks reported a total of 102 unique species, 23% (23) of these are included on Iowa’s Species of Greatest Conservation Need (SGCN) List. *Table 12* lists all 23 species identified in these study blocks. Some are state-listed as either endangered, threatened or of special concern. A full list of species reported is represented in Appendix Item D.

	Endangered	Threatened	Special Concern	Species of Greatest Conservation Need
Red-shouldered Hawk	X			X
Henslow's Sparrow		X		X
Long-eared Owl		X		X
Bald Eagle			X	X
Acadian Flycatcher				X
American Woodcock				X
Bell's Vireo				X
Bobolink				X
Broad-winged Hawk				X
Brown Creeper				X
Chimney Swift				X
Dickcissel				X
Eastern Meadowlark				X
Field Sparrow				X
Grasshopper Sparrow				X
Least Flycatcher				X
Louisiana Waterthrush				X
Red-headed Woodpecker				X
Ruffed Grouse				X
Sedge Wren				X
Veery				X
Wood Thrush				X
Yellow-billed Cuckoo				X

Table 12

Breeding Bird Atlas II documented 23 species of birds present and either likely or possibly breeding in the riparian areas surrounding this segment of the Maquoketa River. This is higher than average number of SGCN compared to other Iowa DNR study areas.

Visual Resources

The quality of what paddlers look at while on the river is an important element in designating a state water trail. Views of the surrounding landscape near the river and the top of the streambank are the most widely seen elements beyond the water surface. The character of the river changes drastically from the narrow, bedrock confined upper reaches near Dundee compared to the wider lower reach downstream of Manchester. The volume of water in the lower reach is considerably more compared with the upper reach. While the upper reach is a curving, somewhat steep channel with many riffles and a narrow floodplain, the lower reach is not as sinuous with slow moving water, significantly fewer riffles and often with a broad floodplain.

As mentioned earlier in this chapter, a majority of the rural buffer area in the rural portions of the county are forested, making for beautiful views and frequent wildlife sightings. The segment between Lindsey Bridge and Quaker Mill contains the highest percentage of annually-cultivated land in the buffer area in the study area. Much of the channel through the northern part of Manchester, however, is developed and lacks a minimal 100' buffer. A fair amount of streambank erosion is present throughout the county, but not in an overly-distracting way.

Population and Development

This river segment is located in a relatively typical rural Iowa area midway between Dubuque and Cedar Falls / Waterloo. A relatively high population resides near this study segment of the Maquoketa compared with other study areas. The 2010 U.S. Census indicated approximately 94,738 people lived within 25 miles of this segment of the Maquoketa River.

U.S. Highway 20 and Iowa Highway 13 are the highest volume roadways in the vicinity of the study area. They intersect slightly south and west of Manchester. Iowa Department of Transportation reports the 2013 annual average traffic on Highway 20 at this location as 7,600 vehicles per day and Highway 13 between Manchester and Backbone State park as 3,240 vehicles per day.

The experience for people near and on the river is likewise quite remote with the exception of the Manchester section. Only 62 houses are located within 450 feet (equivalent to the length of 1½ football fields) of either side of the river with the exception of the Manchester municipal boundaries *(Table13)*. Road crossings, which act as a public interface for river users and an access point for rescue teams, are also limited. A total of 2 road crossings exist on the 19.5 miles of water trail with the exception of roads within 1,000 feet of a water trail access point.

Table 13
Many homes are located close to the Maquoketa River including those found in municipalities.
**Residential location data source: Structure Points of Delaware County, Iowa DNR, 2010*

Houses* Near the Water Trail	Within Municipal Limits	Rural	Total Houses
Within 450' of either side of river	106	62	168
Within 0.3 miles of either side of river	600	268	868

Resource Experiences Near the Maquoketa River

Recreation & Tourism in the Region

This study area is incredibly diverse in terms of visitor experiences beyond use of the river. Traditional rural Iowa opportunities, such as museums and historic buildings, as well as a well-developed trail network are nestled between two major public recreation areas: Backbone State Park and Bailey's Ford Park.

Trails

Although paddling may be the primary focus of people using a water trail, state-designated routes offer a variety of other activities for paddling families and groups. The Upper Maquoketa River in Delaware County is surrounded by diverse land-based trails, including hiking, biking, snowmobile and multi-use options.

Water trails. Paddling options on this study segment are very diverse: flat water, both fast and sinuous as well as slow and wide stream sections and whitewater. From a paddling standpoint, the Maquoketa River study area is located near multiple designated state water trails *(Figure 18)*. The Maquoketa is a nice complement to the similar designated smaller rivers in the area including the Turkey and the upper reach of the Iowa river. The study reach of the Maquoketa, especially upstream of Manchester, is a narrower and more intimate channel width compared to the designated portions of the Cedar, the lower reach of the Iowa and the Mississippi rivers. A new boat access on Lake Delhi has the potential to provide additional access capacity to the Maquoketa River *(Figure 19)*. However, paddlers are usually not comfortable on

Figure 18

The Maquoketa Water Trail is 50 miles of six designated water trails in eastern Iowa. Several other designated water trails are within 50 miles in Illinois and Wisconsin.

the lake due to its narrow width, because nearly all watercraft on the lake are motorized and the speed limit is difficult to enforce. Weekends and holidays are particularly busy times with motorized craft.

Corridors and Land trails. The Maquoketa River functions as the spine of the study area with Backbone State Park bookending the upstream limits and Bailey's Ford Park bookending the bottom of the reach. The nearest regional system, Heritage Trail, is located approximately 20 miles east in Dubuque County. Three state or national scenic byways are located within 25 miles of the Maquoketa River *(Table 14)*. One byway, Delaware Crossing, crosses and follows the Maquoketa River south of Manchester.

Figure 20 illustrates the existing 125 miles of bike trails in the study area. These include bicycle-friendly roads, paved shoulders and off-road trails. Routes connecting Backbone State Park and Manchester were developed by bicycle users in Delaware County and reflect routes that bicyclists are currently using. Delaware County and the City of Manchester are in the process of signing these routes. The City of Manchester currently has 3.7 miles of bike trails, the majority of which are off-road. An additional 21.3 miles of dedicated hiking or multi-use trails exist on state and county recreational lands adjacent to the river. Trail routes connecting Manchester and Bailey's Ford Park are included in these plans including parallel equestrian routes.

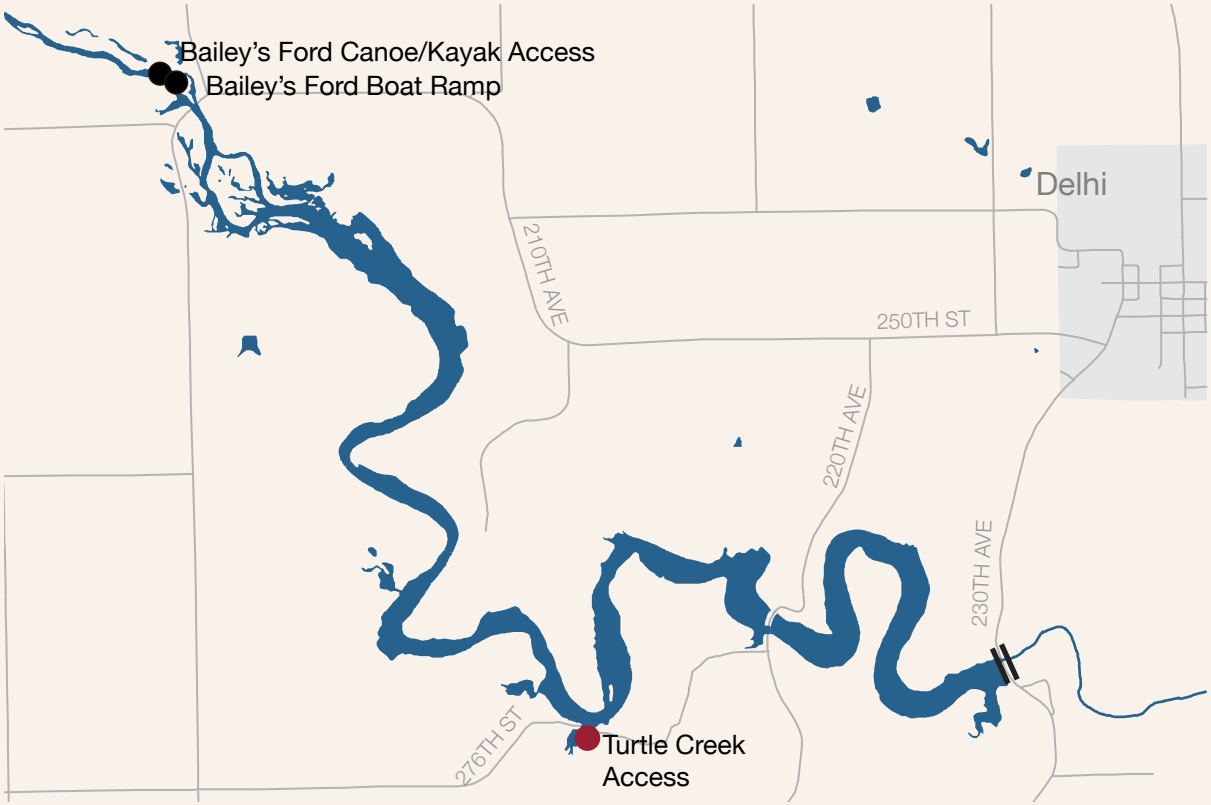


Figure 19

Turtle Creek Access, owned and managed by Delaware County Conservation Board, was newly constructed in 2015 to provide public access to Lake Delhi.

Table 14

Numerous scenic vistas and roadways are located near the study segment of the Maquoketa River, including these 3 state or national scenic byways.

Scenic Byway	Distance from River (miles)	Description
Delaware Crossing	0	The landscape along this 44-mile Iowa Scenic Byway rolls and slopes in uneven steps to the Maquoketa River Valley in the southern half of Delaware County.
River Bluffs	11	This byway plays hide and seek with three rivers, crossing them at times, providing distant views of the river valleys at others and culminating with a mesmerizing three-state view of the Mississippi River from Pikes Peak State Park near McGregor.
Iowa Great River Road	24	This national scenic byway follows the Mississippi River between Iowa's southern and northern borders on the Iowa portion of the Great River Road National Scenic Byway.

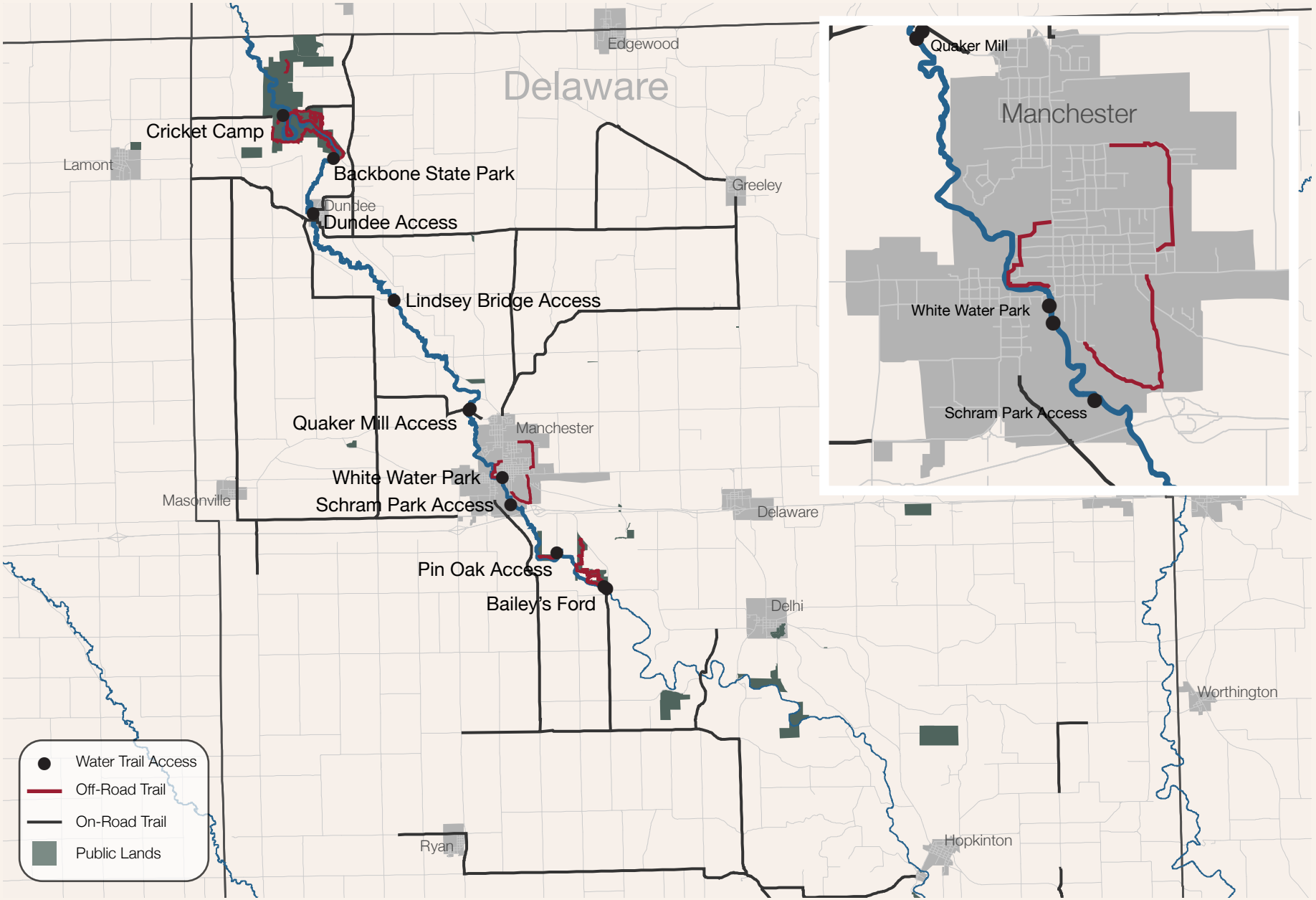


Figure 20

Existing on-road and off road trails in the study area.

Overnight Accommodations

A broad selection of accommodation types is available within 10 miles of the Maquoketa River and often much closer *(Table 15)*. Hotel/motel/bed and breakfast lodging is available in Strawberry Point and Manchester. Four facilities offer camping usually less than 5 miles from the river. One facility, Bailey's Ford, offers camping at/near the river's edge. Backbone State Park also offers rental cabins in addition to primitive and modern camping.

River Access	Nearest Modern Lodging	Distance From Access	Nearest Camping	Distance From Access
Camp Creek & Backbone Lake Dam	Backbone State Park (16 Cabins)	0.5 mi	Backbone State Park (109 Modern, 14 Primitive, & 4 Youth Group)	0.2 mi
	Strawberry Point (20 Rooms)	7.2 mi	D & D Campground (24 Modern & 12 Primitive)	16 mi
Dundee	Strawberry Point (20 Rooms)	7.2 mi	Backbone State Park (109 Modern, 14 Primitive, & 4 Youth Group)	1.6 mi
Lindsey Bridge	Manchester (90 Rooms)	4.9 mi	Backbone State Park (109 Modern, 14 Primitive, & 4 Youth Group)	4.1 mi
			Coffins Grove Park (20 Modern)	5.1 mi
Tirril Park	Manchester (90 Rooms)	0.5 mi	Coffins Grove Park (20 Modern)	3.6 mi
			Bailey's Ford Campground (57 Modern & Primitive)	8.8 mi
Whitewater Park	Manchester (90 Rooms)	0.7 mi	Bailey's Ford Campground (57 Modern & Primitive)	3.6 mi
			Coffins Grove Park (20 Modern)	3.8 mi
Schram Park	Manchester (90 Rooms)	1.1 mi	Bailey's Ford Campground (57 Modern & Primitive)	3 mi
			Coffins Grove Park (20 Modern)	4.3 mi
Pin Oak	Manchester (90 Rooms)	2.8 mi	Lazy T Campground (20 Modern)	5.0 mi
			Bailey's Ford Campground (57 Modern & Primitive)	1.3 mi

Table 15

Nearly every type of overnight accommodation is available within 5 miles of any river access on the study segment including hotel/motel, bed and breakfast, rental cabins and both modern and primitive camping.

Historic Sites

Water trail users will find numerous high quality developed historic sites both on and off the river *(Table 16)*. A unique variety of cultural attractions exist including 13 sites of national and regional significance. The Backbone State Park Historical District and the Iowa Civilian Conservation Corps Museum provide a particularly strong connection with the Roosevelt's New Deal Civilian Conservation Corps program.

Beyond sites of national significance, numerous attractions featuring local history are open to the public. These include museums featuring a college campus, one-room schoolhouses, early homes and businesses, and government buildings. The Delaware Historical Society Museum on the former Lenox College campus in Hopkinton is unique among local history museums. The society manages the four buildings and land included in the college.

Attraction	NRHP	Information	Nearest Town				Miles to River
			Strawberry Point	Dundee	Manchester	Delhi	
Natural Resource Related Sites							
Backbone State Park	X	Historic District. Backbone State Park is one of Iowa's most historically important state park, as it was the first state park. It was extensively developed by the Civilian Conservation Corps (CCC) during the New Deal era. It contains outstanding examples of Park Rustic architecture by State Landscape Architect John R. Fitzsimmons. Land was purchased in 1918 and park development began in 1925.	X	X			0
	X	Cabin/Bathing Area. Includes cabins, a pump house, bathhouse, boathouse, a dam, stone steps, drinking fountains, a sun dial and bench, and walls. This area also includes the CCC camp SP17.		X			0
	X	Central Picnic, Hiking and Camping Area. Contains shelters, a small concession, latrines, entrance portals, overlooks, drinking fountain, stone benches, parking areas, a stone bridge, stone steps, trail, sign, and Watercress Springs.		X			0
	X	Richmond Springs. Contains stone work around natural springs. Intrusions include a limited amount of primarily post CCC building construction, or modified and deteriorated CCC Structures.		X			0
		Iowa Civilian Conservation Corps Museum. Museum provides an interesting and informative look at the work of the CCC in Iowa state Parks. It is located just within the park's west gate.		X			0

Table 16

A rich variety of opportunities are available for public interpretation within 10 miles of the river in this study area. Themes of these sites include literature and education, European settlement and natural resources.

Attraction	NRHP	Information	Nearest Town				Miles to River
			Strawberry Point	Dundee	Manchester	Delhi	
Manchester Fish Hatchery		Starting in the 1890s, trout have been hatched at this location. The U.S. Fish and Wildlife Service operated this station, until it was traded to the state DNR. The station annually produces over 600,000 fish.			X		0.5
European Settlement and Early History							
Bay Settlement Church and Monument	X	This site included the first Free Baptist Church to be organized in Iowa. The present building was erected in 1873. The cemetery area contains one of the earliest monuments ever erected, in August of 1865, by citizens in Iowa to honor their Civil War dead.				X	3.9
Henry Baker House (Coffin's Grove Stagecoach House)	X	Constructed in 1855, this house was built to accommodate the overflow visitors stopping over on their way west. The house served as a hotel, post office, dance hall, and gathering space. The house is built in post-revolutionary style or those found in the east. The house remains almost unchanged from the original floor plan.			X		1
Delaware County Courthouse	X	Constructed in 1894, the courthouse combines Victorian Romanesque with elements of Chateauesque. Built after Manchester was named county seat in 1880. Built at a cost of $38,000, it was financed by the use of a bridge fund, dog tax, and the sale of swampland.			X		0.2
Richardson Jakway House	X	Built in 1851, the house is a preserved in the early vernacular style. The house was originally a part of the town of Buchanan, but the town physically moved north to the railroad in Aurora. The house and surrounding property is in a preserved park. The house served as a post office in the early period, as well as a hostelry.			X		9.0
Franklin Hotel	X	Built in 1903, this hotel is located where there previously was a store and trading post.	X				5.8
"Love" Cabin		Built in 1850, and now located in Denton Park, this cabin is the first home in Delaware County, built by Allan Love. He was involved with the surveying and platting of Manchester. The cabin was restored In 1996.			X		0.2
Manchester Public Library		Built in 1903, the library was possible from a $10,000 donation from Andrew Carnegie. At the time, the library had 4736 books.			X		0.2
Traver Toys and Farm Machinery Museum and Store		Restored machinery, all with original parts and in working condition.			X		1

Table 16 *continued*

Attraction	NRHP	Information	Nearest Town				Miles to River
			Strawberry Point	Dundee	Manchester	Delhi	
Hobb's Chimney		Stone chimney, the last remaining remnants of the county's earliest settlers, Charles W. Hobbs. Built in 1841.				X	4
Wilder Memorial Museum		With an extensive collection and fascinating exhibits, this museum includes an heirloom collection of over 800 dolls from the 1700s, as well as military artifacts and Victorian era furniture, art, and glass.	X				5.9
J.J. Hoag House (The Wheat House)	X	Constructed in 1864, the house was built with part of the profits from J.J. Hoag's fortune from selling wheat to the Union army during the Civil War. He owned a grist mill on the Maquoketa River and supplied electric power generated at the mill to the city of Manchester, making Manchester one of the early towns in Iowa to be supplied with electricity. The house is built in the Italianate style with a hipped roof crowned with a central belvedere.			X		0.3
Literature and Education							
Lincoln Elementary School	X	This Prairie Style building was designed and constructed in 1916. Each classroom contained two grades, with a total of three classrooms. Kindergarten was taught in the halls.			X		0.3
McGee School		This Late Victorian style school was built in 1868 on land donated by Isaac McGee. It is the only remaining one-room brick school in Delaware County. The building is associated with the rural school advocate and educator, Sarah Gillespie Huftalen.			X		2.1
Old Lenox College (Bowen Collegiate Institute)	X	The college itself was significant because of its contribution of student man-power to the Union Army in the Civil War and its diverse architectural resources. The school closed for a while during the Civil War because all but two of the student body agreed to serve in the war, known as the "School Boy Company." The school closed in 1944. The college consists of four acres of land and four major school buildings. Buildings and monuments were erected between 1865 and 1916. Clarke Hall is now home to the Delaware County Historical Museum.				X	0.8
Ruth Suckow House	X	Constructed in 1925. The house is associated with Iowa author Ruth Suckow. Although she only spent two summers at the cottage, she wrote her second novel there and numerous short stories.				X	7.7
McCreery Monument & Memorial Gardens		Memorial dedicated May 30, 1929. Memorial to John McCreery, famous local poet.				X	3.9

Table 16 *continued*

Outdoor Recreation on Public Land

More than 4,000 acres of public recreation land is located within 10 miles of the study segment of the Maquoketa River *(Table 17)*. Multiple highly developed traditional city parks are located in Manchester. Some rural facilities are also highly developed, such as Backbone State Park and Bailey's Ford. Opportunities for wildlife viewing and hiking are plentiful in all parts of the study area.

Features within outdoor recreational facilities in the study area meeting the Americans with Disabilities Act (ADA) requirements are considered readily accessible to and usable by individuals with disabilities. Features not meeting these standards include barriers to participation. The following elements meeting ADA standards were reported by their owners or managers:

- Restrooms at Tirrill, Central and Denton Parks in Manchester
- Picnic tables at Seibert, Schram, Tirrill, Central, Baum and Denton Parks in Manchester
- Open shelters at Tirrill, Baum and Denton Parks in Manchester
- Walkways near the river at the Manchester Whitewater Park
- An accessible fishing area, public restrooms and a suspension bridge at Manchester Fish Hatchery
- An accessible trout fishing area, the playground above the beach and the auditorium at Backbone State Park meet ADA standards; 8 of 16 cabins as well as the beach and its lodge at the park are close to meeting ADA standards. All of the open shelters would meet standards but there are no sidewalks connecting them to the parking. A new shower house planned for the park will be accessible
- Conservation Center, restrooms, picnic shelters at Bailey's Ford

	Miles From River Study Segment	®Fishing (Trout Stream (T), River, Pond, Lake (L))	Paddling (River, Lake)	Hiking Trails	Restrooms (Modern, Primitive)	Camping (Modern, Primitive)	
STATE RECREATION LAND							
Backbone State Park	0	TS,R, L	R, L	X	M	M, P	Snowmobiling, picnic shelters, stone lodge, cabins, swimming, climbing, Museum, kayak rentals
Backbone State Forest*	0.8						Equestrian trails, cross country skiing
Bixby State Preserve	9.3	TS		X			Ice Cave, picnic tables
Brayton Memorial Forest WMA*	0.3						Undeveloped natural area, ISU Forestry Extension property
Ensign Hollow WMA*	7.9	TS				P	
Joy Springs WMA & Park*	2.0	TS				P	Picnic shelter
Jakway Park	8.7	R, P		X	M	M, P	Playground, shelter house, ski trails, picnicking, historic buildings
Dundee Preserve	0	R	R				Picnicking
Coffins Grove Park	2.8	R, L			P	M, P	Dump station, picnicking, play equipment
Plum Creek Park*	8.1	R			P		Picnic shelter, play equipment
Silver Lake County Park	4.4	L	L		P		Shelter rentals, play equipment
Spring Branch Creek @ Manchester Fish Hatchery	0	TS			?		Picnicking
Bailey's Ford Park*	0	TS, R	R	X	M	M, P	Picnic shelters, swimming, trout fishing, nature center, wildlife exhibit
Morris Wildlife Area*	0.6			X			Undeveloped natural area
M&O Railroad Preserves	3.3						Undeveloped natural area
Indian Hills Wildlife Area*	7.7			X			Undeveloped natural area
Shearer Wildlife Area*	4.2	R	R	X			Undeveloped natural area

Table 17

A wide variety of state, county and municipal recreation areas offer a large variety of outdoor recreation opportunities within 10 miles of the river.

** denotes that public hunting is allowed at this facility*

	Miles From River Study Segment	®Fishing (Trout Stream (T), River, Pond, Lake (L))	Paddling (River, Lake)	Hiking Trails	Restrooms (Modern, Primitive)	Camping (Modern, Primitive)	
Turtle Creek Park WMA*	2.9	R, L	R, L	X	M	M, P	Dump station, picnic shelters, shelter rental, play equipment
Retz Wildlife Area*	5.5	R	R	X			Undeveloped natural area
Wehner Woods*	3.5	R		X			Undeveloped natural area
Milo Forest*	0			X			Undeveloped natural area
Pin Oak Wildlife Area*	0	R	R	X			Undeveloped natural area
City Recreational Facilities, Manchester							
Baum Park	0.9				M		Playground, shelter, grills, picnicking, basketball court
Central Park	0.5				M		Playground, shelter, picnic area, basketball/tennis courts
Denton Park	0.2				M		Playground, shelter, gazebo, “Love” Cabin
Howard & Helen Shelly Memorial Park	0	R	R		P		Whitewater park, gazebo
Schram Park	0	R	R		M		Shelter, water sports show
Seibert Park	0.6						Playground, shelter, volleyball/basketball court
Tirrill Park	0	R	R		M		Picnicking, playground, shelters, band shell, tennis courts, aquatic center

Table 17 *continued*

** denotes that public hunting is allowed at this facility*

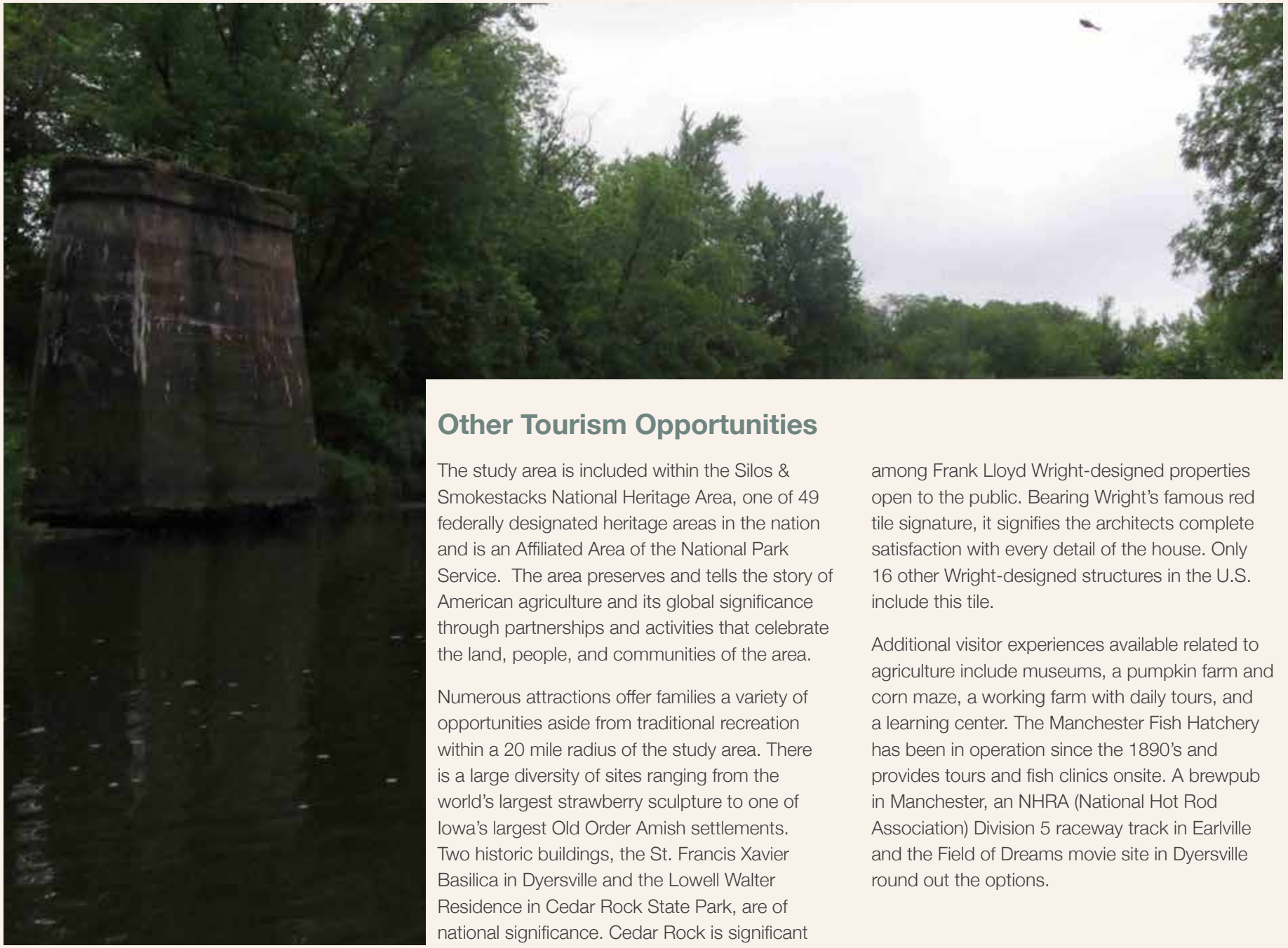
Permanently Protected Land

Land that is either publicly owned or held with a permanent conservation easement is considered to be permanently protected. While it's possible that these lands could be developed or cropped, it's unlikely. Lands in permanent protection provide critical habitat and water quality functions as well as open space enjoyment for people, particularly in a state like Iowa where 71% of land is either developed or used for agriculture (USDA National Agricultural Statistics Service 2013). More than 4,700 acres of land are permanently protected within 10 miles of the Maquoketa River study area *(Table 18)*.

Table 18

State-owned Wildlife Management Areas (WMA), forest and park land, as well as County Conservation Board properties are two of the largest types of permanent protection near the Maquoketa River. Wetland Reserve Program (WRP) easements also make a significant contribution. Municipal-owned properties are not included on this list.

	Land Within 10 miles of Maquoketa River	Land Adjoining Maquoketa River
Public Areas for River Access	11	
County Parks	556	139
Easement	34	11
State Fish Hatchery (Manchester)	32	
State Forest (Backbone)	190	190
State Park (Backbone)	1,757	1,757
State Preserves	263	
WMA (Brayton Memorial Forest, Indian Hills, Shearer, Turtle Creek Park, Retz Memorial, Milo Forest, Pin Oak)	1,437	170
Private Conservation Easement	139	71
WRP Easement	304	63
Acres in Permanent Protection	4,723	2,401
Total Land in Permanent Protection within 10 miles of Maquoketa River Water Trail	4,723 acres	
Total Recreational Land within 10 miles of the Maquoketa River Water Trail	4,280 acres	



Other Tourism Opportunities

The study area is included within the Silos & Smokestacks National Heritage Area, one of 49 federally designated heritage areas in the nation and is an Affiliated Area of the National Park Service. The area preserves and tells the story of American agriculture and its global significance through partnerships and activities that celebrate the land, people, and communities of the area.

Numerous attractions offer families a variety of opportunities aside from traditional recreation within a 20 mile radius of the study area. There is a large diversity of sites ranging from the world's largest strawberry sculpture to one of Iowa's largest Old Order Amish settlements. Two historic buildings, the St. Francis Xavier Basilica in Dyersville and the Lowell Walter Residence in Cedar Rock State Park, are of national significance. Cedar Rock is significant among Frank Lloyd Wright-designed properties open to the public. Bearing Wright's famous red tile signature, it signifies the architects complete satisfaction with every detail of the house. Only 16 other Wright-designed structures in the U.S. include this tile.

Additional visitor experiences available related to agriculture include museums, a pumpkin farm and corn maze, a working farm with daily tours, and a learning center. The Manchester Fish Hatchery has been in operation since the 1890's and provides tours and fish clinics onsite. A brewpub in Manchester, an NHRA (National Hot Rod Association) Division 5 raceway track in Earlville and the Field of Dreams movie site in Dyersville round out the options.

Interpretation Programs and Efforts

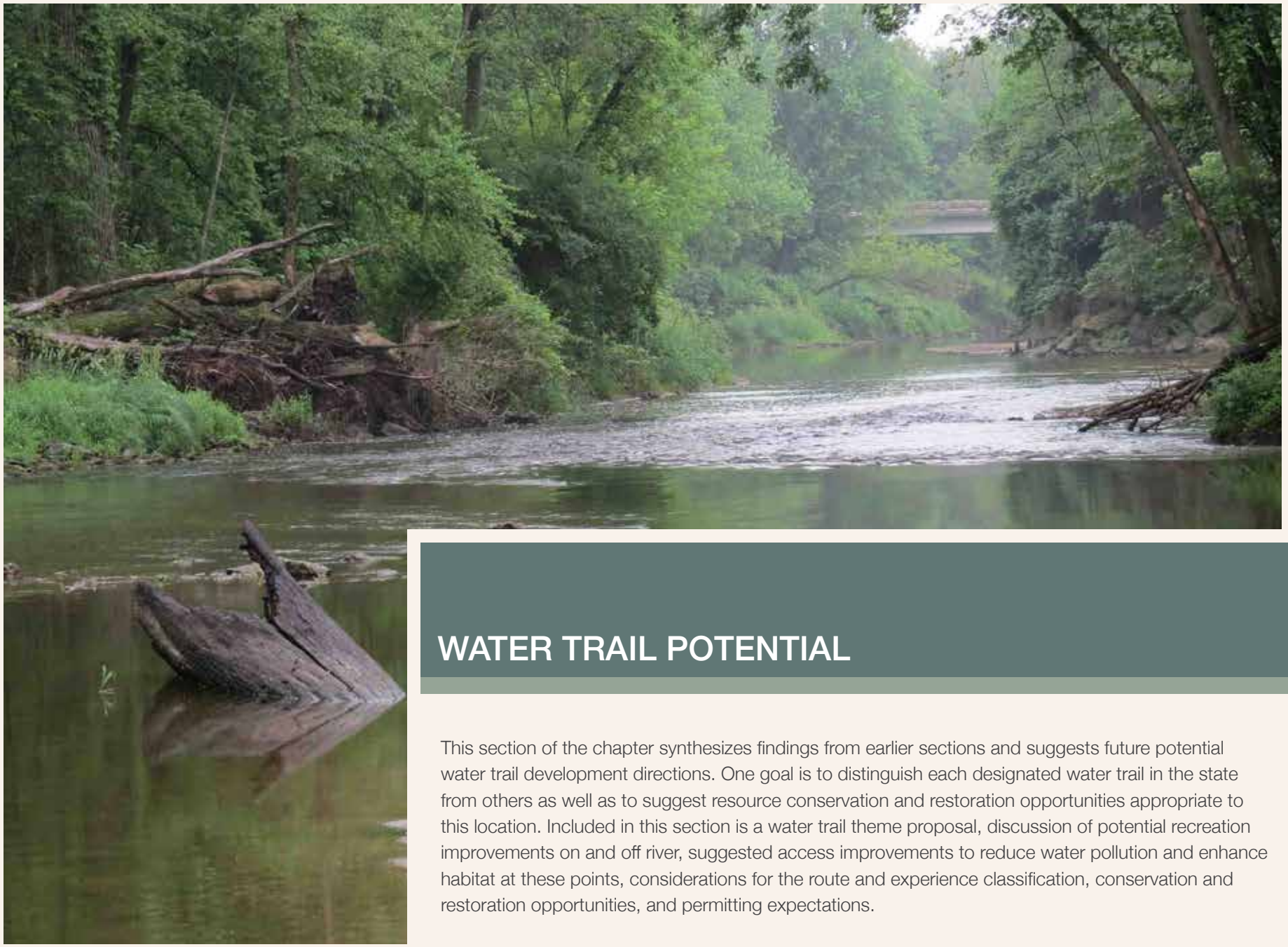
Three public interpretive activities associated with this planning project were held on or near the Maquoketa River in Delaware County in 2014. A total of 35 people participated in the events.

- "River Critters" program in July with Jim Pease, retired ISU wildlife professor
- "Archeology" program" in August with Cheri Haury-Artz of Iowa's Office of State Archeologist
- "Fish Assemblage" program in September with Megan Thul and Mark Winn of Iowa DNR

The Fish Assemblage program was held at the Manchester Fish Hatchery, and all others were held at the Bailey's Ford Conservation Center building. The Fish Assemblage event was the most exciting as the majority of participants were children.

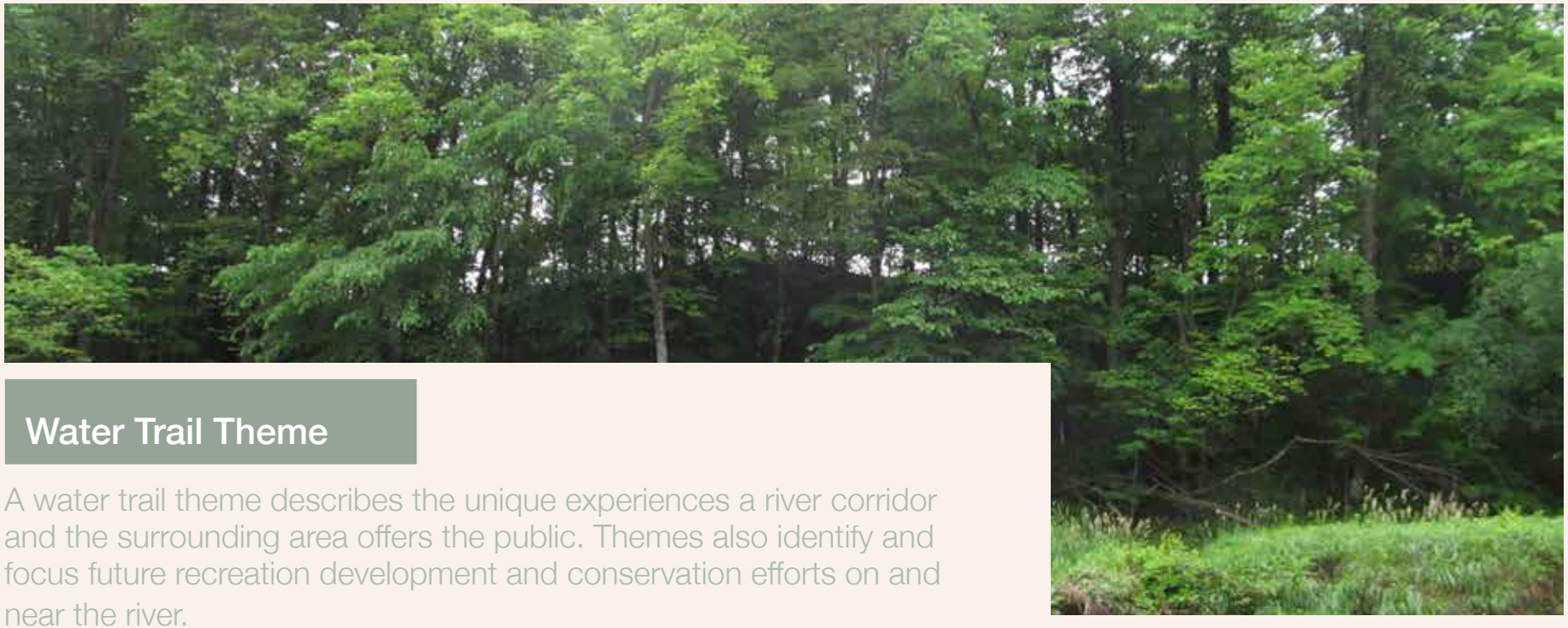
Trash-pick up floats have been held periodically on the Manchester section of the river for more than 20 years. The group is informally led by local residents Doug Hawker, Ryan Wicks, Sean McEnany, rod Schreck, and Mark Winn. The 2015 half-day event was reported as the most successful event to date and included clean-up in the channel as well as the riparian areas. This event worked on the 0.34 mile segment between the Main Street Bridge and the Railroad Bridge—this is the area of the new Whitewater Park. They removed a variety of metal items, glass, plastic sheeting, a couple bicycles, an old sleeping bag, and 14 tires. The total amount of garbage removed was less than in past years, suggesting the group is likely making progress.

A group of young local residents formed a new river clean up group, Operation Maquoketa River Clean-up (OMRC), in 2015. They held 8 cleanup events on the Maquoketa River during this first year. Trash disposal was facilitated by Delaware County Conservation and the City of Manchester.



WATER TRAIL POTENTIAL

This section of the chapter synthesizes findings from earlier sections and suggests future potential water trail development directions. One goal is to distinguish each designated water trail in the state from others as well as to suggest resource conservation and restoration opportunities appropriate to this location. Included in this section is a water trail theme proposal, discussion of potential recreation improvements on and off river, suggested access improvements to reduce water pollution and enhance habitat at these points, considerations for the route and experience classification, conservation and restoration opportunities, and permitting expectations.



Water Trail Theme

A water trail theme describes the unique experiences a river corridor and the surrounding area offers the public. Themes also identify and focus future recreation development and conservation efforts on and near the river.

The Maquoketa River is a fundamental feature of Delaware County. The geology, vegetation, climate, prehistory and geology are intertwined together to create the resource present today. The unique geology, best visible from the water in Backbone State Park and downstream south of Manchester, delights and attracts paddlers and hikers today much as it did the early Euro-American settlers and prehistoric people. People's struggle to modify this river to suit their needs and desires dates back to a prehistoric fish weir downstream of Bailey's Ford Park as well as numerous historic and contemporary dams. Although the integrity of these structures continues to be challenged by climate, this water trail celebrates the recent application of contemporary technology to modify two of the four dams in the county. The two modified dams on this water trail demonstrate that positive economic, biological and recreational outcomes are attainable.

The river landscape continues to inspire people to be active and engaged in the outdoors. Opportunities for enjoying the river corridor are as diverse as landscape changes along this river segment. A rich system of recreation options, on and off-river, is available. Trails for hiking and biking connect major landscape features such as communities and parks. Coldwater and warm water fisheries are present on and near the Maquoketa as well as lake fishing. Finally, varied lodging options exist on or near the river including cabin rental, modern and primitive camping and hotel/motel. Some of these elements are illustrated in *Figure 21*. A strong, diverse community has come together to engage around the river through planning for this project. They realize the value of the resources present and the enormous opportunities present for the public. Manchester Good to Great is a critically important and valuable organization for the future of the Maquoketa River in Delaware County. Their leadership supporting conservation, civic, social and economic enhancements sets this potential state-designated water trail apart from others in the region.

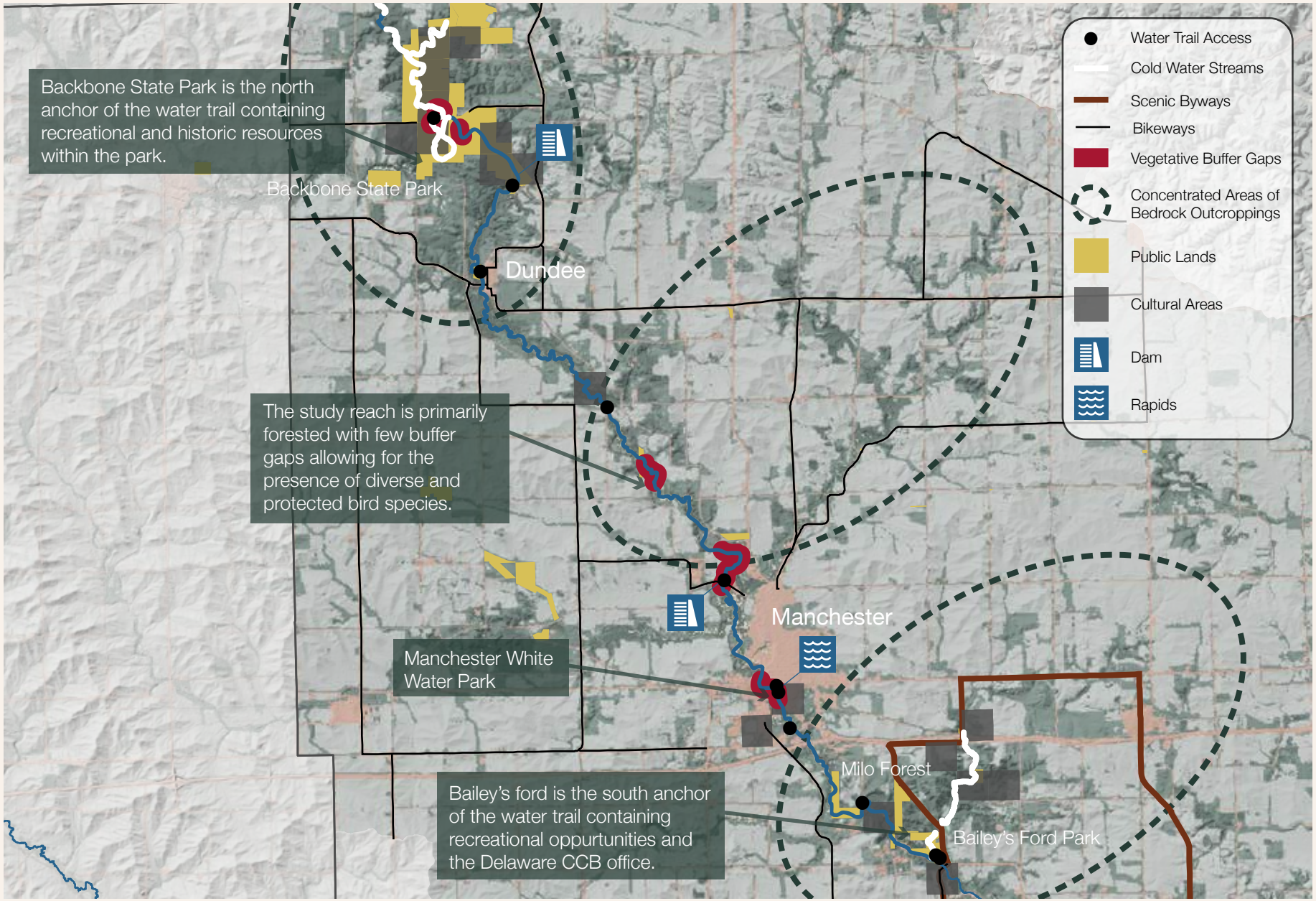


Figure 21

This study area is an excellent candidate for State Water Trail designation. Visitors will experience rich biological, geological and cultural resources in addition to well-developed tourism opportunities.

Background

The Maquoketa River corridor cuts a nearly diagonal swath through Delaware County and is one of the most heavily used and loved rivers in the region. Located between two large population centers, Cedar Rapids and Dubuque, slightly less than 95,000 people live within 30 miles of the study segment. The corridor is home to outstanding natural, cultural and recreational resources. The region is best known historically as home of the first Iowa state park, Backbone, on the upstream end of the segment. Bailey's Ford, Delaware County's flagship park, is located at the downstream end of the water trail on the site of the first settlement on the river in this county. The Manchester Whitewater Park, a destination in its own right, is situated in the middle of the segment. Use of the river has increased dramatically since the Whitewater Park opened in 2015 putting additional stress on river access facilities that were largely undeveloped.

River modification has played a large role in subsistence activities as well as building communities in Delaware County. The earliest evidence of modification and utilization is a prehistoric fish weir on Spring Branch. Euro-American settlement brought the first formal dams to this river segment, nine by 1849, and dams have played a large role ever since. Climate change, with a pattern of extreme precipitation events corresponding to increasing peak flows, and evolving technology continue to re-shape the condition and function of the Maquoketa River. Prior to the 2008 and 2010 floods, four large dams existed on this river: Backbone, Quaker Mill, Manchester and Delhi. Only the Backbone dam remains in situ. Two dams, Quaker Mill and Manchester are replaced with rock arch rapids while the Delhi dam is under re-construction.

The landform and vegetation of the northern extent of this water trail, the Backbone State Park region, offers paddlers and other visitors a rich opportunity to experience a beautiful stretch of the Maquoketa River as well as the site of prehistoric cultural significance as well as the federal work programs of the Great Depression era that make this park famous. This reach of the Maquoketa River has one of the most intact riparian buffers in the state water trail system. Only 1% of the buffer is annually cultivated cropland. Largely due to this condition, as well as the large habitat areas near Backbone and Bailey's Ford parks, 23 species of birds on the Iowa Species of Greatest Concern list are known to breed in areas near the river. Fish passage has been documented to have increased post-modification of the Manchester dam which will positively influence the biological diversity of the upstream segments. However, historic bacterial contamination due to livestock waste in Backbone Lake and downstream in the Maquoketa River and multiple tributaries continue to exist despite modeling, landowner outreach and federal and state-funded remediation in the watersheds.

Backbone State Park is a designated Important Bird Area and Wildlife Watching Area. Among its signature bird species are nesting bald eagles and pileated woodpeckers. The park also is an important migration stop for many species of warblers and other migrating songbirds, waterfowl, and deep forest birds. The diversity of forest and woodland communities in Backbone State Park itself, including the old oaks and white pines overlooking the river that the park is famous for, contributes to its designation as an Important Bird Area and Wildlife Watching Area. Wildlife watching and fall color displays are spectacular downstream of the State Park as well. Sugar maple, basswood, old red and white oaks and sugar maple in the Dundee area transition to a silver maple and cottonwood community near Lindsey Bridge. River Birch and occasional Catalpa enter the corridor near Quaker Mill while Silver Maple and Box Elder become more common near Manchester. A few remaining American Elms and willow exist between Pin Oak and Bailey's Ford accesses.

The Water Trail Route

The Steering Group recommended designating the Maquoketa River between Cricket Camp, which is above Backbone Lake and inside the state park, to Bailey's Ford Park access. The Maquoketa segment inside Backbone State Park was recommended for designation despite having significantly different water levels compared to downstream reaches of the river. ISU Researcher Dr. Jim Pease, who researched the river for this planning, reported "It is—when water levels are sufficient—an excellent paddle and should be included in any water trail put in this area. [It] is entirely within the park and contains some spectacular river level views of the limestone cliffs that make the park famous. In particular, from the flats to Backbone Lake, the paddler goes through two horseshoe turns of the river, around the famous Backbone dolomite outcrop and back around a matching (and largely unused by the public) area before entering the lake. Sightings of eagles, herons, and deer are practically guaranteed. The woodlands that surround the river are spectacular, having some of the finest examples of mature oak forest in the state, and the limestone and dolomite cliffs are some of the finest in Iowa."

Areas of large woody debris that block more than 30% of the channel width occur on Maquoketa River in Delaware County as they do on almost all Iowa rivers. This condition is due to several factors. Much of the river edge is forested and is in a current phase of channel widening. The Dundee to Lindsey Bridge segment has more blockages compared to other segments. This is related to the severely eroded streambank conditions in this reach due to underlying geologic conditions. Woody debris poses obstacles for paddlers when it blocks a significant portion of the channel and when piles accumulate and act as strainers on outside bends. However, woody channel debris is also an important and valued habitat element in river channels. Currently Iowa DNR does not have a management policy for management of large woody debris on rivers.

The urban segment of the river through Manchester, with the new addition of the Whitewater Park, now has three existing accesses in this 1.4 mile reach. As mentioned previously, the Tirrill Park Access is damaged and requires significant upgrades to remain usable. The Schram Park Access, while new and constructed to meet current design standards, is remote and difficult to find when unfamiliar with Manchester.

Water Trail Experience Classification

The entire length of the Maquoketa River between Backbone State Park and Bailey's Ford Park can remain in its current classification as a Recreational use classification with the exception of the Whitewater Park segment which is a Challenge classification. With enhancement, one segment has the potential to be converted to a Gateway classification *(Figure 22)*.

The Whitewater Park to Pin Oak segment is an ideal length for a Gateway classification but requires enhancement. The 3.3 mile length of the segment makes it an ideal shorter distance for beginners and novices. The juxtaposition of the upstream end of the segment in Manchester relates well to the urban context, interpretation and service expectations of this experience classification. Upgrades would be necessary at Pin Oak Access and a new access would be required immediately downstream of the Whitewater Park. Occasional large wood blockages also can occur on this segment and may require management. Other aspects of this river segment add value to its classification as a Gateway segment including cultural and historic interpretation and land trail opportunities.

In addition to a Universal designed launch at both ends of the segment, the following upgrades in the spirit of Gateway classifications are also suggested:

- Consider all future changes to these accesses in ways that relate the most strongly to the historic and cultural nature of these places as well as the rich recreational amenities located nearby
- Reconfigure the access experience with as low a slope % as possible; this includes the parking areas, paths to the launch and the launch itself
- Provide drinking water, toilets and basic amenities near each access as possible in locations convenient to river users
- Add interpretive signage, information and other displays concerning geology, history and culture of the region
- Strike a balance between the amount of large woody debris present that could impact paddlers in this segment and communication of these conditions to river users
- Establish or strengthen a river management presence on this segment of the river as well as a communication strategy between river users and land managers

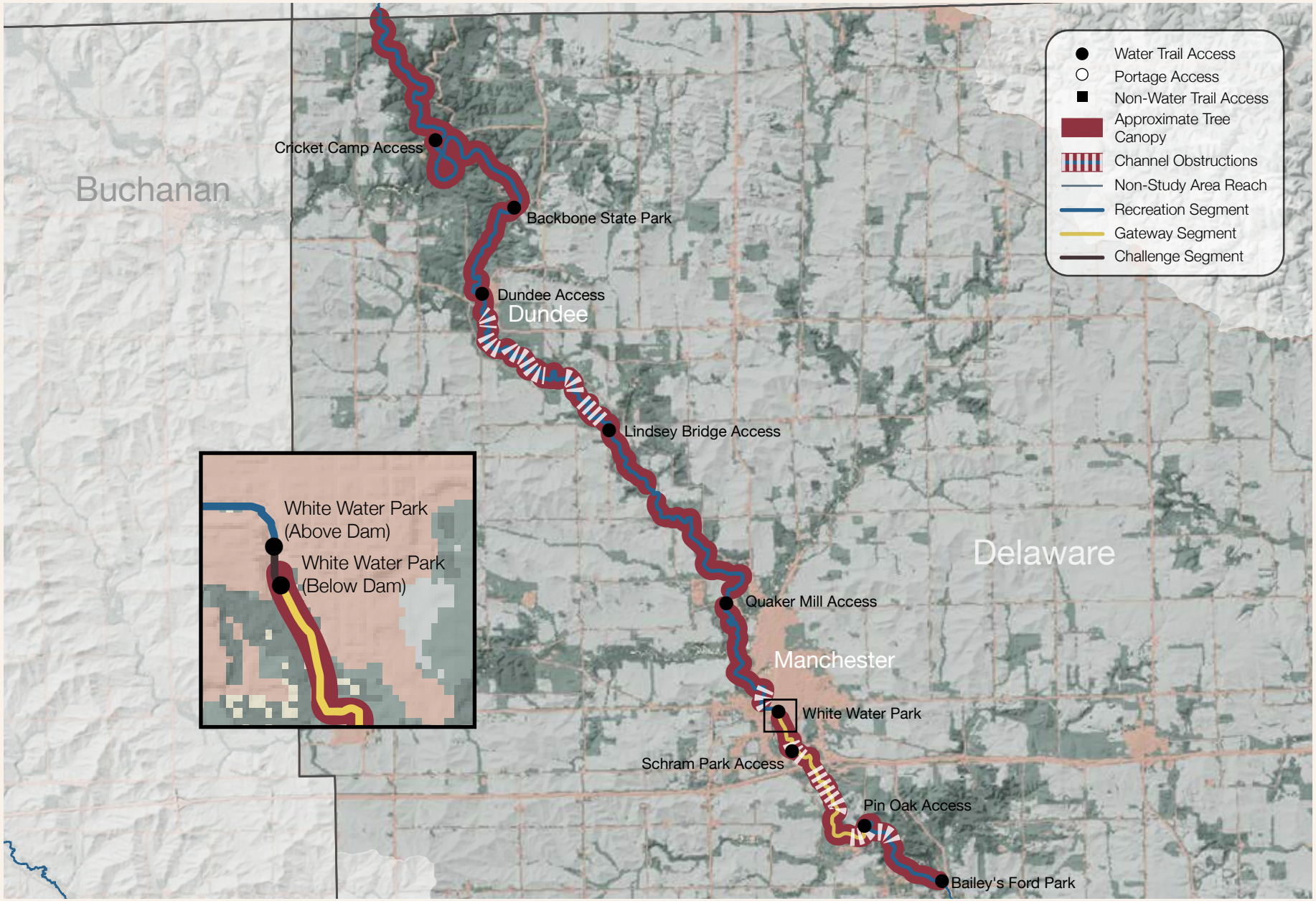
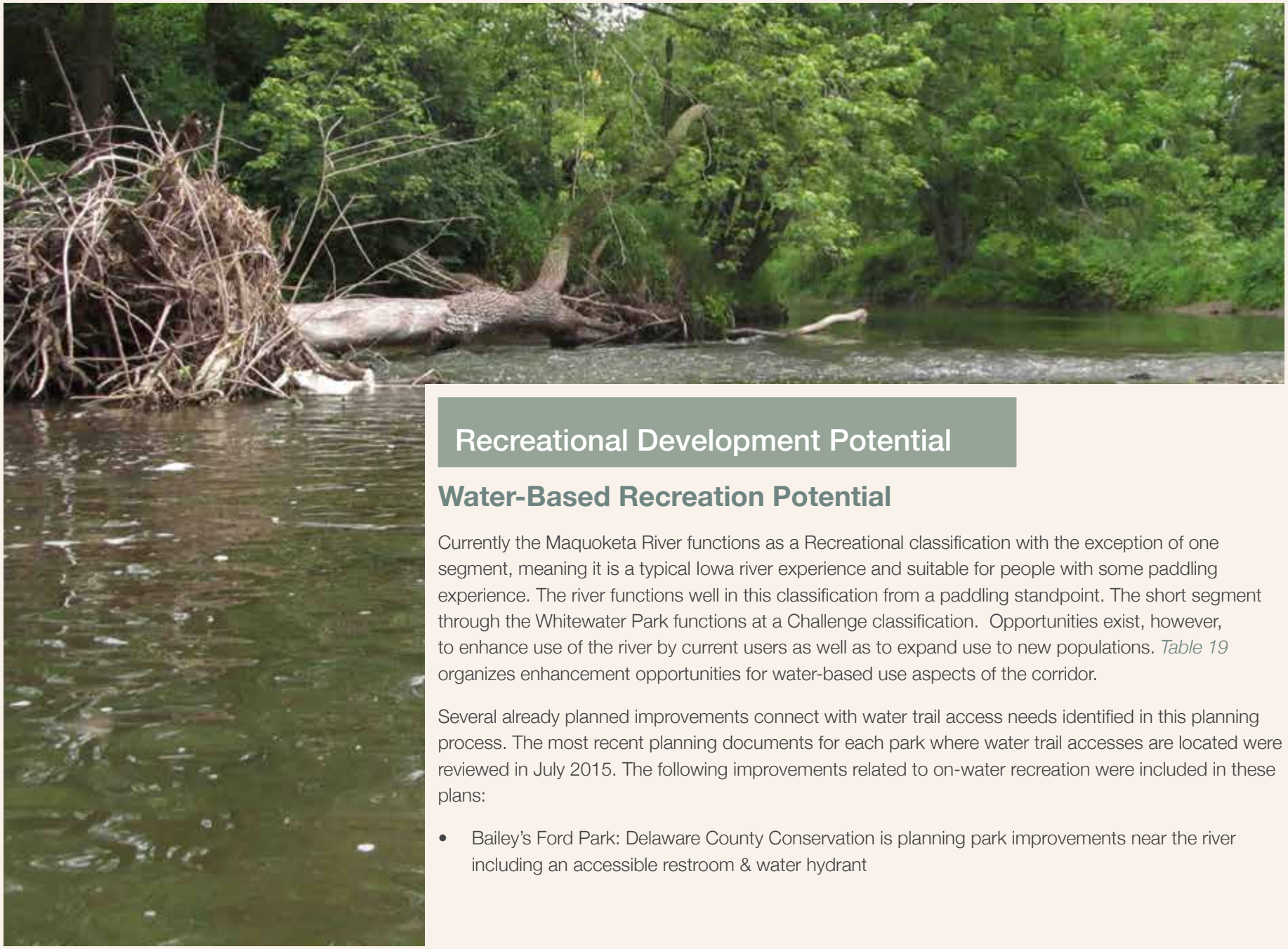


Figure 22

The proposed future Gateway segment would begin immediately downstream of the Whitewater Park and extend to Pin Oak Access. A new full access near the bottom of the Whitewater Park will alleviate parking needs downtown as well as provide an access for put-in on a stable reach of the river.



Recreational Development Potential

Water-Based Recreation Potential

Currently the Maquoketa River functions as a Recreational classification with the exception of one segment, meaning it is a typical Iowa river experience and suitable for people with some paddling experience. The river functions well in this classification from a paddling standpoint. The short segment through the Whitewater Park functions at a Challenge classification. Opportunities exist, however, to enhance use of the river by current users as well as to expand use to new populations. *Table 19* organizes enhancement opportunities for water-based use aspects of the corridor.

Several already planned improvements connect with water trail access needs identified in this planning process. The most recent planning documents for each park where water trail accesses are located were reviewed in July 2015. The following improvements related to on-water recreation were included in these plans:

- Bailey's Ford Park: Delaware County Conservation is planning park improvements near the river including an accessible restroom & water hydrant

Recreational Enhancement	Issue Addressed
Enhance Everyday Management Conditions	
Reinforce capacity for on-water rescue	Emergency staff turn-over is common in Iowa. Reinforcing the network of personnel serving the river corridor in Delaware County is a good way to learn of new management challenges and share information between agencies.
Enhance communication between water trail access managers	Future coordination of water trail activities and issues would be enhanced with a defined organizational structure and regular communication among access owners/managers
Standardize ordinary maintenance at launches	Better communication and agreement by the 3 access owners/managers could result in more efficient and timely removal of sediment and debris from launches and other ordinary maintenance tasks
Enhance Water Trail Corridor Experience for Current Users	
Upgrade accesses with overly steep launch and path slopes as well as perpendicular alignment to the thalweg	Nearly all accesses in Delaware County require reconstruction to address high volume use and existing conditions. Alternative launch designs and materials could be utilized which would allow people with a greater range of physical abilities to reach the water and launch angles can also be modified at many launches to minimize deposition on the launch surface
Upgrade parking availability geared for all users	Parking areas associated with some access points do not meet Iowa DOT minimum requirements for capacity. Some also lack the space for loading boats and gear.
Enhance communication for users before they get to the river	River users will feel better prepared for their experience with updated maps of the river corridor; maps can be printed as well as available to download online.
Update public interpretation	Utilize the resources included in this chapter to produce compelling, varied interpretation of critical issues and resources based on the conditions on this river segment
Attract New Recreational User Populations	
Enhance angler experiences	Additional bank fishing opportunities are possible on existing public land. The investment of in-stream habitat structure would also provide necessary cover for fish
Upgrade launch types to allow vehicles & people to reach the water's edge	Five of eleven launches exceed 18% slope. Four of these launches require river users to hand-carry boats from the staging area to the water's edge. This limits users to those able to carry boat gear and negotiate steep and uneven surfaces
Increase river management communication and capacity	Large, downed trees can cause hazards to paddlers, especially with high water events. Wood in the channel is also an important habitat element. Careful management of large wood is required to minimize streambank erosion. Communication to paddlers on Gateway segments is necessary if large channel blockages occur
Upgrade some access facilities	Restrooms and drinking water are available only at one access facility but not within close range of the river access. More available toilet and water services are an important part of enhancing the user experience and enhancing water quality of the river

Table 19

Three types of water-based recreational enhancements were identified during planning. Each type and the specific issues included in each are detailed in this table.

Land-Based Recreation Potential

Land-based recreation development adjacent to the river suggested during the development of this chapter largely coincides with expansion plans for the land trail network already proposed by Manchester Good to Great. Enhancements to aid in management and increased use of off-river amenities are also included. These elements are documented in *Table 20*.

Recreational Enhancement	Issue Addressed
Enhance Water Trail Corridor Experience for Current Users	
Secure proper easement or ownership of land for accesses	The land on which Lindsey Bridge Access is located is inadequate in size to accommodate a river launch and associated amenities.
Upgrade parking availability geared for all users	Parking areas associated with some access points do not meet Iowa DOT minimum requirements for capacity.
Enhance on-road signage & conditions for shared use roadways	Delaware County is in the process of installing signs on designated rural roads north of Manchester. Some additional roads currently used by cyclists require upgrades to road surface and width to accommodate shared use.
Attract New Recreational User Populations	
Provide additional land trail miles between Bailey's Ford Park and Backbone State Park	Additional trail miles connecting Backbone State Park and Bailey's Ford Park, including the additional of equestrian trails, may result in new hikers, bikers and equestrians visiting the area
Enhance communication for users before they get to the river	Corridor users will feel better prepared for their experience with updated maps of the river corridor illustrating all recreation amenities; maps can be printed as well as available to download online

Table 20

Two types of land-based recreational enhancements were identified during planning. Each type and the specific enhancements included in each are detailed in this table.

Basic Riparian Land Impacting Habitat and Water Quality

Three elements related to water quality are recommended of all river access points in Iowa.

- Low impact stabilization methods should be used to repair sheet and gully erosion occurring at any location on land so additional sediment loading is not occurring as a result of erosion on public land
- Streambank conditions near river access points and other prominent locations should also demonstrate the latest techniques for streambank restoration
- The first 50 feet back from the top of the streambank edge is reserved for a natural (unmown) native perennial buffer. All constructed parking and other features, with the exception of launches and trails, should be located outside of this buffer area; this setback area should be vegetated with natural (unmown) perennial vegetation. Existing parking areas at launches should have a similarly vegetated buffer of at least 40 feet in width

Table 21 summarizes these general conditions for this study area. Yellow cells indicate an enhancement is recommended.

Facility Where Access is Located	Width of Vegetative Buffer Between Parking and River	Erosion Present at Access	Streambank Conditions Adjacent to Launch	Rip Rap Present at Launch	Elements of Concern
Backbone State Park	-	-	-	-	-
Dundee Access	35’	No	Minor or no erosion	No	
Lindsey Bridge Access	30’	Yes	Moderate erosion	Yes	
Quaker Mill Dam	20’	No	Minor or no erosion	Yes	
Tirrill Park	20’	No	Moderate erosion	Yes	Launch is damaged
East River Park	30’	No	Minor or no erosion	No	
Pin Oak Access	25’	Yes	Minor or no erosion	Yes	
Bailey’s Ford Park	0’	No	Minor or no erosion	Yes	

Table 21

Enhancements reducing soil erosion and slowing overland flow into the Maquoketa channel at a river access also reduce pollutant loading into the river.

Resource Protection & Restoration Potential

The Maquoketa River in Delaware County has the potential to be a model for integrated resource protection in Iowa. This planning documented significant cultural, historic, biologic and geologic resources in the river corridor that are both worthy of and would benefit from conservation and protection. Corridor users would benefit from enhanced conservation and protection as well as from a focused interpretation that builds knowledge about the unique resources present. Substantial existing public lands adjacent to the river at both ends of this water trail lay a foundation to reach long term conservation goals, especially those actions which will have the most public benefit, such as flood resilience and water quality enhancement. The following standards relate to all future development efforts intended to bring people to the river corridor:

- Development actions occur in ways that protect long-term conditions for existing aquatic and terrestrial wildlife, cultural resources, plant communities and river channel function in the area
- Conservation planning and communication is utilized to identify land management actions that are helpful in protecting habitat conditions in the river corridor as well as those that may degrade conditions
- Soil is recognized as a living resource capable of facilitating both economic stability and degraded water conditions when erosion in excessive amounts occurs
- Cultural and historic resources are prioritized for conservation, preservation and interpretation

Conservation and Restoration Elements

Multiple conservation and restoration opportunities became apparent from stakeholder input and through research for this chapter. These opportunities and potential partners are described below in *Table 22*; these elements are illustrated in *Figure 23*.

Conservation and Restoration Enhancement	Supporting Organizations and Individuals
Enhance River Structure and Function	
Demonstration of low impact stream bank and floodplain restoration practices on public land that minimize use of riprap and broken concrete	*Iowa DNR, Delaware CCB. City of Manchester*
Conduct professional assessment on the river channel upstream of Bailey's Ford park access to establish basic geomorphic parameters appropriate for this river	*Iowa DNR, outside consultant*
Enhance Aquatic Resource Conditions	
Utilize state of the art fish habitat enhancement practices to expand fish habitat options based on a changing climate	*Iowa DNR, Iowa Cooperative Fish & Wildlife Research Unit (ISU)*
Continue supporting Delaware Soil & Water Conservation District in their work with landowners to reduce bacteria loading into the Maquoketa from livestock	*Manchester Good to Great*
Encourage additional IOWATER volunteer monitoring on the Maquoketa and its tributaries	*Manchester Good to Great, Delaware SWCD, IOWATER volunteers, Iowa DNR,*
Minimize sheet and gully erosion on public lands adjacent to the river	*Iowa DNR, City of Manchester, Delaware CCB*
Enhance Terrestrial Resource Conditions	
Develop a forest management plan on county conservation-owned land	*Iowa DNR, Delaware CCB, local interested residents*
Encourage landowners on the Maquoketa River with annually-cultivated and urban development along river banks to convert these areas to perennial vegetation buffer	*Delaware SWCD, City of Manchester, Manchester Good to Great*
Reach out to river-edge landowners with existing forested buffers to encourage voluntary permanent protection through conservation easements	*Delaware SWCD, Iowa Natural Heritage Foundation, local habitat organizations*
Enhance Cultural and Historic Resource Conditions	
Pedestrian survey for remnants of early settler church, cemeteries and a number of schools, houses or farmsteads depicted on the 1875 Andreas Atlas; pursue permanent protection for priority cultural, historic sites. Doing so allows for their interpretation, future research, and educational opportunities	*Local interested residents, OSA*

Table 22

Three types of conservation and restoration enhancements were identified during planning. Each type and the specific elements included in each are detailed in this table.

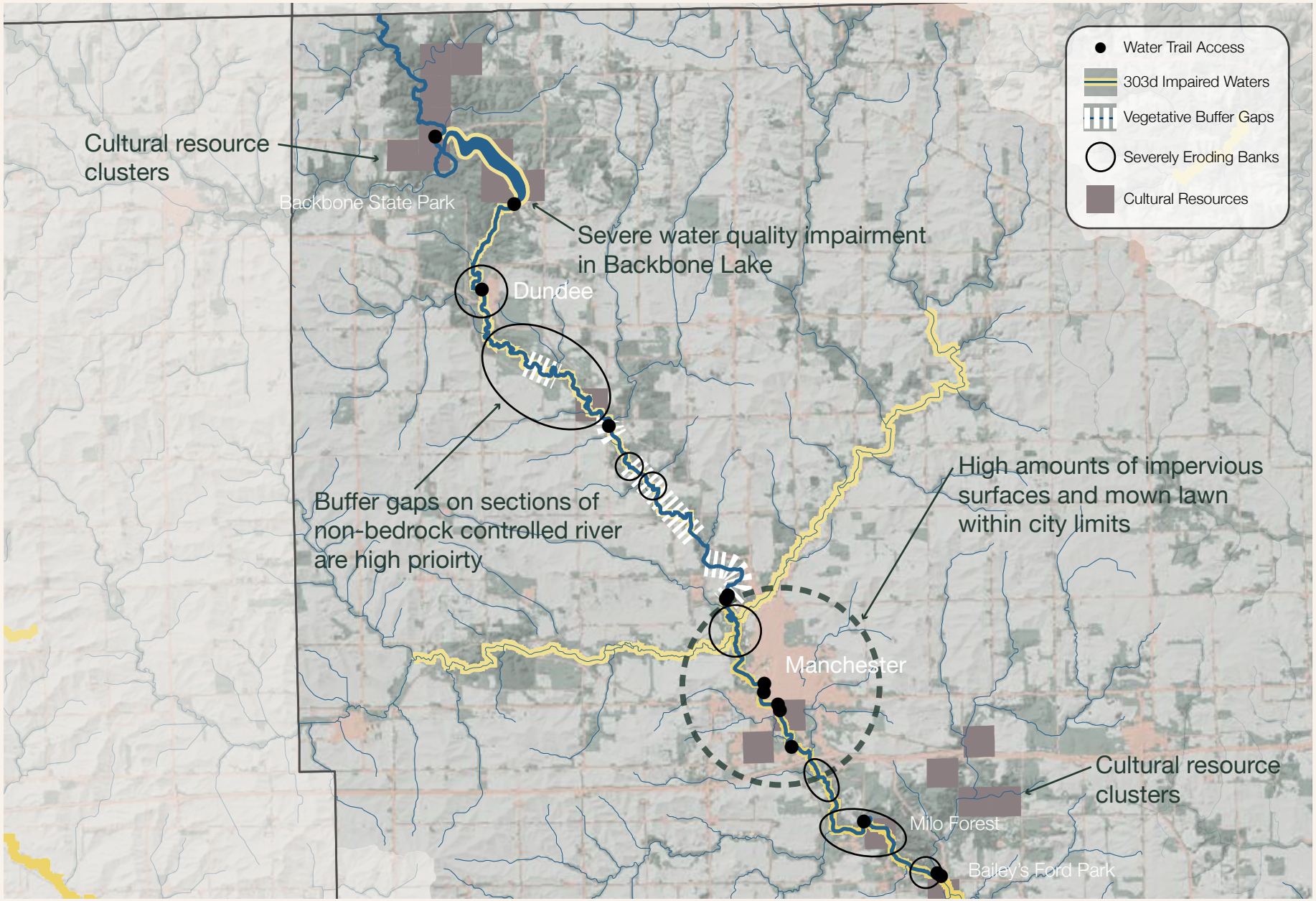


Figure 23

Further archaeological investigations will identify remaining resources, enabling their permanent protection and interpretation. Water quality enhancements are needed to manage animal waste more effectively and minimize bacterial contamination. Lastly, natural riparian buffers near the river in Manchester will enhance visitor experiences and minimize future flood damage.

Expected Permitting Considerations

Development projects disturbing streambank, riparian areas, channel bottoms, and/or near-river areas will require review to determine if critical resources will be impacted. The following permitting activities should be expected:

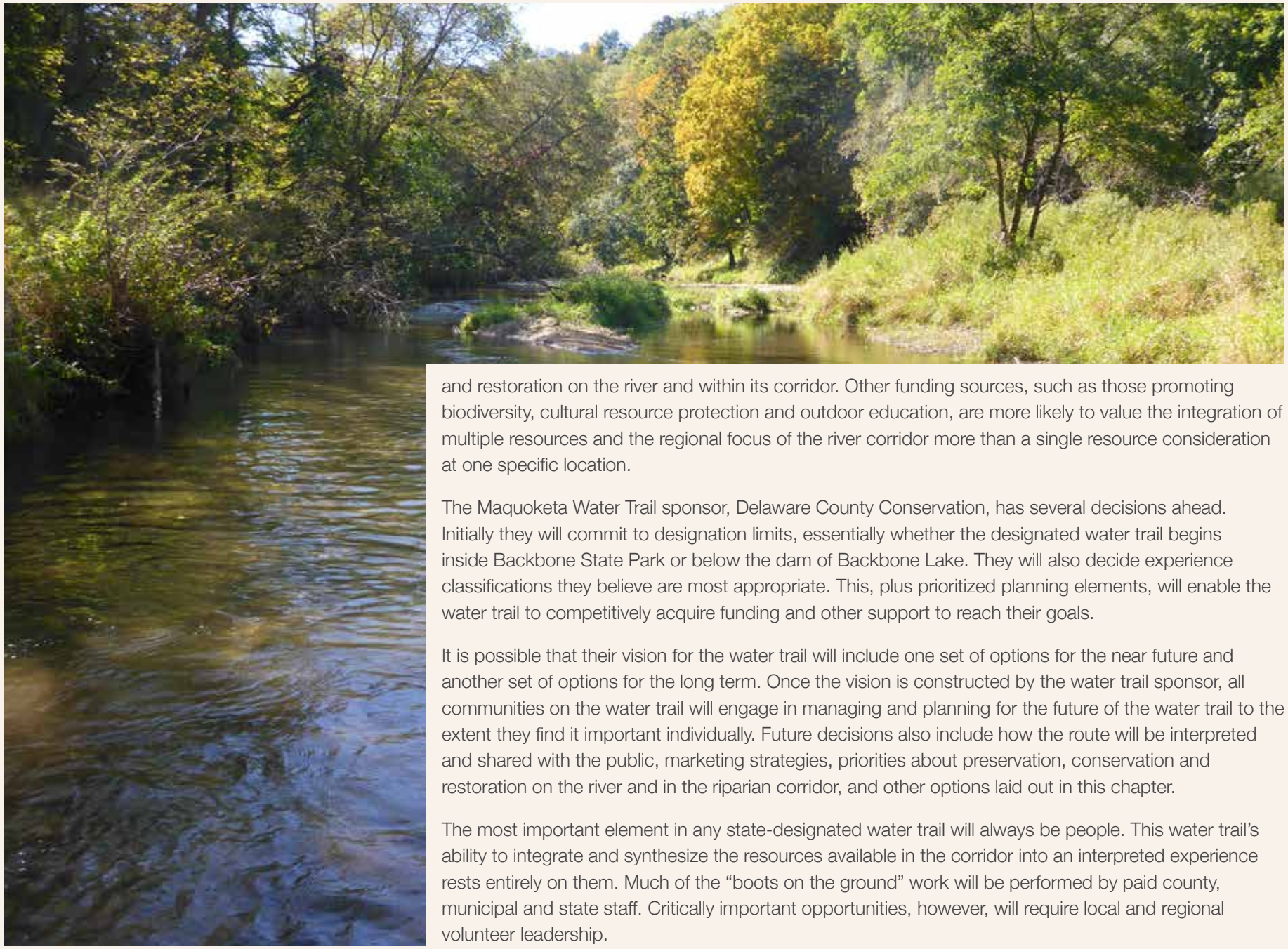
- Phase I: Intensive Archaeological Survey
- Joint Application: A joint permit application is shared between the DNR flood plain development program, the DNR sovereign lands program, and the U.S. Army Corps of Engineers
- Municipal and County Floodplain permitting

Water Trail Recommendations/Summary

State-designated water trails are as much about other resources and experiences as they are about paddling. The most successful trails integrate and synthesize multiple opportunities at once: working to minimize damage to sensitive aquatic species, such as native mussels, while working to create new habitat; thoughtfully designing restoration practices such as streambank bioengineering to reduce nutrient pollution and increase biodiversity in ways that respect the needs of anglers and boaters; and partnering with local organizations with shared goals for conservation in the watershed and region of the water trail. People are the most important component in taking advantage of these opportunities.

Planning for state-designated trails brings all parties to the table because it is realized that all parties are necessary to protect, conserve, restore and promote resources on the ground.

The Maquoketa River Water Trail in Delaware County, including Backbone State Park, is seen as a leader because it is one of the first Iowa water trails to plan comprehensively for their future. Movement forward from this planning activity is informed by the work of many informed technical specialists, researchers, local stakeholders, water trail program sponsors, and land managers. And the future is very optimistic. State water trail staff and funding resources are poised to promote development, conservation



and restoration on the river and within its corridor. Other funding sources, such as those promoting biodiversity, cultural resource protection and outdoor education, are more likely to value the integration of multiple resources and the regional focus of the river corridor more than a single resource consideration at one specific location.

The Maquoketa Water Trail sponsor, Delaware County Conservation, has several decisions ahead. Initially they will commit to designation limits, essentially whether the designated water trail begins inside Backbone State Park or below the dam of Backbone Lake. They will also decide experience classifications they believe are most appropriate. This, plus prioritized planning elements, will enable the water trail to competitively acquire funding and other support to reach their goals.

It is possible that their vision for the water trail will include one set of options for the near future and another set of options for the long term. Once the vision is constructed by the water trail sponsor, all communities on the water trail will engage in managing and planning for the future of the water trail to the extent they find it important individually. Future decisions also include how the route will be interpreted and shared with the public, marketing strategies, priorities about preservation, conservation and restoration on the river and in the riparian corridor, and other options laid out in this chapter.

The most important element in any state-designated water trail will always be people. This water trail's ability to integrate and synthesize the resources available in the corridor into an interpreted experience rests entirely on them. Much of the "boots on the ground" work will be performed by paid county, municipal and state staff. Critically important opportunities, however, will require local and regional volunteer leadership.

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APPENDICES

Appendix A.
Water Trail Access & River Management Elements Relating to Water Trail Classification

	Gateway	Recreational	Challenge	Wilderness
Accesses	Maintenance plan for at least a pair of accesses cleaned within 1-2 weeks of siltation, or rapidly repaired after flood damage.	Maintenance plan for accesses cleaned within a month of siltation, or rapidly repaired after flood damage.	Maintenance can be sporadic, and may be at a scale volunteers or small work parties can conduct.	
On-Land	Weekly mowing along edges of roadways and pedestrian areas, scheduled resurfacing plans are employed	Edges of roadways and pedestrian areas mowed approximately monthly.	Any amenities are intentionally kept light and remote -- paddle in campsites may be considered appropriate.	
On-River	Response plan for river-wide tree/debris blockage may be developed	Only major, river-wide obstructions that become chronic, cannot be easily portaged, and result in temporary "challenge" condition should be addressed.	Woody debris never maintained in a channel.	
Resources	Public launch fees may be considered to support maintenance. Pooled resources among various local and DNR water trail partners to create management / maintenance entities or jointly fund staff is encouraged.	Pooled resources among various local and DNR water trail partners to create management / maintenance entities or jointly fund staff is encouraged.	Cooperative funding can be explored if need arises.	Pooled resources among various local and DNR water trail partners to create management / maintenance entities or jointly fund staff is encouraged. Public launch fees or back-country-type camping permits may be considered.
Water Trail Signage	Sign maintenance: Inspected three times per warm season and replacements made immediately	Sign maintenance: Inspected two times per warm season and replacements made within a month	Fewer signs placed; inspected once per year and replacements made within a month	
	May be eligible for annual maintenance inspection / sign replacement funding.			

Appendix B.
Water Trail User Elements Relating to Water Trail Classification

	Gateway	Recreational	Challenge	Wilderness
River User Safety	Public communication describes river and access conditions as better for novices	Public communication describes river conditions, and on rivers warns strainers are high potential for hazard.	Public communication describes why river conditions are not appropriate for novices, and on rivers warns strainers are high potential for hazard.	Public communication describes river conditions, length and distance commitments, and on rivers warns strainers are high potential for hazard.
	Emergency action plan is required, and includes egresses including private lane accesses. Plan is communicated among landowners and responders; E911 communication framework for locating distraught users established	Emergency action plan identified and communicated among landowners and responders; E911 communication framework for locations established	Communication to public implies they should have skills and equipment in order to commit to segment, some planning for landmark-based communication for locations and rescue methods among emergency responders discussed	
River User Behavior	Water trail manager locally leads in litter control, etiquette, and safety education and enforcement programs and campaigns. Trash receptacles available at controlled settings.	Water trail manager participates in litter control, etiquette, and safety education and enforcement programs and campaigns	Leave No Trace ethic is encouraged through materials and literature.	
	Law enforcement presence is moderately visible and law enforcement is briefed in dealing with problem users	Law enforcement presence is occasionally visible and law enforcement is briefed in dealing with problem users	Law enforcement presence rarely needed.	
Services	Management of liveries through requiring concessionaire agreements, fees, and conditions placed on operation is strongly encouraged.	Management of liveries through low-cost concessionaire agreements with some conditions placed on operation is encouraged.	Skilled guide services may be more appropriate than standard rental businesses. System to vet guides for use of public access may be considered for public safety.	Guide services may be more appropriate than standard rental businesses

Appendix C.
Water Trail Experience Classification Summary

	Gateway	Recreational	Challenge	Wilderness
User Expectations	• Most predictable, particularly for those with less experience • A paired launch and landing with ramped, hard-surface or well-maintained compacted aggregate • Slopes generally 12% and accommodating widths of 4' or greater • A readily enjoyable setting that will be attractive to new users • Exposure to few hazards relative to other segment types	• Requires some boat control • Intended for users with some experience • Low-head dam hazard signage present, as needed • Varied settings • Basic level of navigational aid available (maps, signage)	• User expects to manage risk in hands-on ways • Good boat control necessary • Launch and/or parking may be slightly to very difficult to use • Low-head dam hazard signage present, as needed	• Some degree of solitude and wildlife viewing • Paddling endurance and skill required • Launch and parking areas can be very undeveloped in context with the setting • Wayfinding signage not always present at accesses and on-river • Low-head dam hazard signage present, as needed
Typical Development Goals	• Exposing the greatest number of new users to water trails • Appropriate for extended families and groups of friends • Part-day to full-day trip opportunity • Strong emphasis on building user confidence through signage and ultra-easy launch and parking • Launches, parking, trails designed with Universal Design standards • High degree of environmental educational / interpretive opportunity	• Offers a typical Iowa water trail experience • Day-trip opportunity • Family and group experiences • Access points may be less developed compared with Gateway experience • Access surfaces may not be stable	• Day- and multi-day-trip opportunity • Low-impact access development may result in more difficult movement from parking to launch: steep slopes, tight turn on trails, or long distances from parking to launch	• Day- and multi-day-trip opportunity • Less development, more restoration and protection of habitats • May include parking in already impacted areas, rustic launches, and rustic remote campsites • Low-impact practices required in all water trails-related construction
Accesses	≤ 6 miles apart	≤ 9 miles on average	Varies	> 9 miles
Amenities such as restrooms, running water, picnic areas, camping	• Often available at accesses • Liveries, shuttle often operating • Wayfinding signage on roadways is more extensive to clearly identify driving route, turns, etc.	• May be available but usually not as developed • Liveries, shuttle desirable	• May be available but usually not • Guided experiences may be encouraged	• Any facilities present, such as remote campsites, are minimal, primitive, and without signage • Guided experiences may be encouraged over rental

Appendix D.
Seventy-nine species were identified in the riparian study blocks that are not listed as a Species of Greatest Conservation Need (SGCN).

**Denotes breeding birds were identified in the Skunk River Greenbelt*

SPECIES

American Crow
American Goldfinch
American Kestrel
American Redstart
American Robin
Baltimore Oriole
Bank Swallow
Barn Swallow
Barred Owl
Belted Kingfisher
Black-capped Chickadee
Blue Jay
Blue-gray Gnatcatcher
Blue-winged Teal
Brown Thrasher
Brown-headed Cowbird
Canada Goose
Carolina Wren
Cedar Waxwing
Chipping Sparrow
Cliff Swallow
Common Grackle
Common Yellowthroat
Cooper's Hawk
Downy Woodpecker
Eastern Bluebird
Eastern Kingbird
Eastern Phoebe
Eastern Screech-Owl
Eastern Towhee
Eastern Wood-Pewee
European Starling
Gray Catbird
Great Blue Heron
Great Crested Flycatcher
Great Horned Owl
Hairy Woodpecker
Horned Lark
House Finch
House Sparrow
House Wren
Indigo Bunting
Killdeer
Lark Sparrow
Mallard
Mourning Dove
Northern Cardinal
Northern Flicker
Northern Parula
Northern Rough-winged Swallow
Orchard Oriole
Ovenbird
Pileated Woodpecker
Purple Martin
Red-bellied Woodpecker
Red-eyed Vireo
Red-tailed Hawk
Red-winged Blackbird
Ring-necked Pheasant
Rock Pigeon
Rose-breasted Grosbeak
Ruby-throated Hummingbird
Savannah Sparrow
Scarlet Tanager
Song Sparrow
Spotted Sandpiper

Tree Swallow

Tufted Titmouse

Turkey Vulture

Vesper Sparrow

Warbling Vireo

Western Meadowlark

White-breasted Nuthatch

Wild Turkey

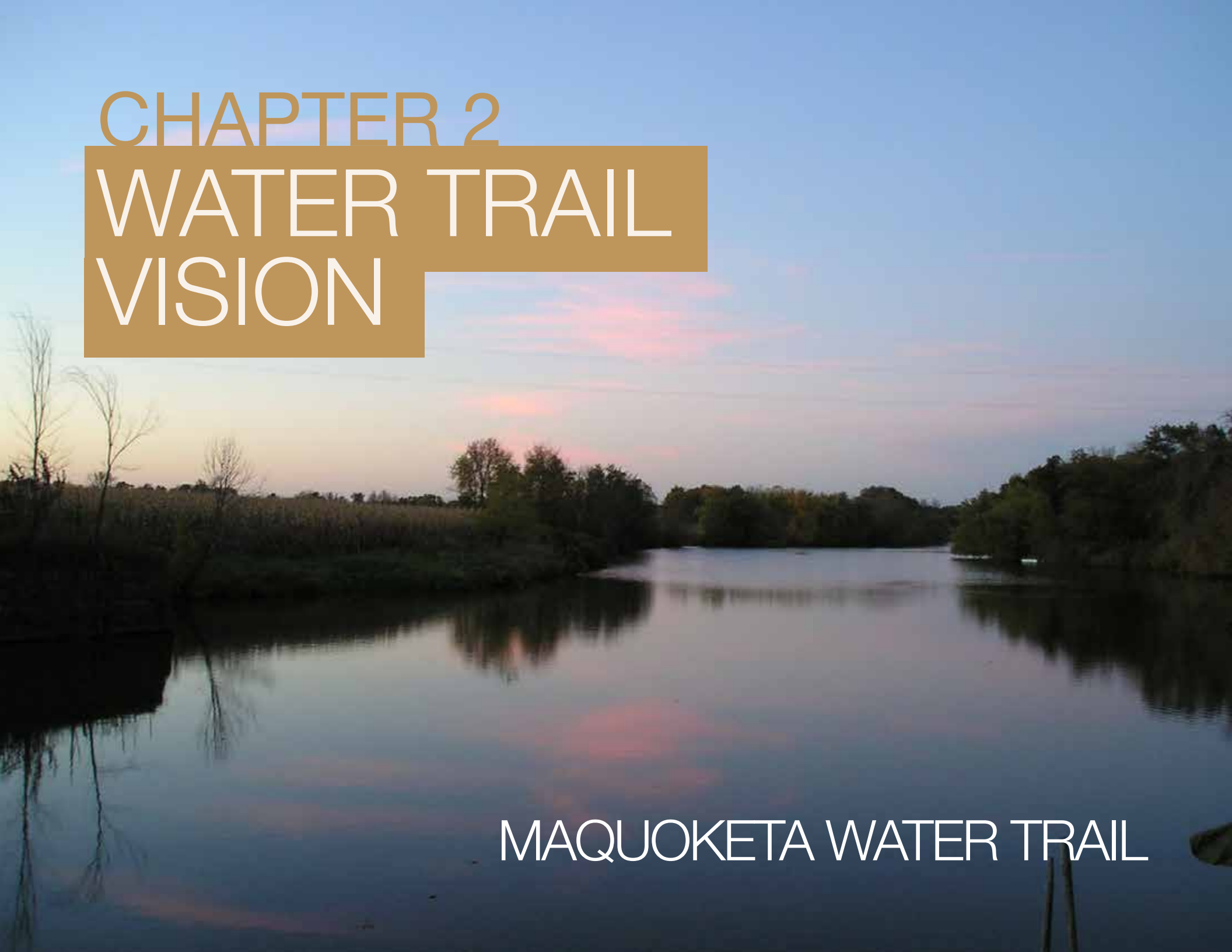
Wood Duck

Yellow Warbler

Yellow-bellied Sapsucker

Yellow-throated Vireo

Yellow-throated Warbler



CHAPTER 2
WATER TRAIL VISION

MAQUOKETA WATER TRAIL

ACKNOWLEDGMENTS

This Water Trail Plan Chapter prepared by Mimi Wagner of Mimi Wagner, Landscape Architecture LLC (MWLA) and Iowa State University. John Wenck, State Water Trail Coordinator of Iowa DNR River Programs provided guidance.

Delaware County Conservation Board and staff provided leadership, local support and adoption of this Vision.

The project Steering Group provided valuable insight and direction throughout development of this vision:

Garlyn Glanz, Delaware County Conservation Director
Mike Schmitz, Delaware County Conservation Board, Pheasants Forever
Dave Sunne, Backbone State Park
Dennis Meggers, Friends of Backbone State Park
Tim Vick, City of Manchester
Barb Robinson, City of Dundee
Dave Gibbs and Joan Salow, Manchester Good to Great Committee
Rick Martens, Iowa DNR
Chuck Ungs, Wickiup Outdoor Learning Center
Dean Sherman, Manchester City Council
Taylor Matteson, Manchester Good to Great
Ryan Wicks, Manchester Good to Great
Mark Winn, Iowa DNR
Doug Hawker, Iowa DNR
Keith Krause, Delaware Soil and Water Conservation District
Jeff Ogden, The Watershed, Landowner
Andrew Rucker, Operation Maquoketa River Clean-Up

Initiated and funded by the Iowa General Assembly and Governor Terry Branstad.

REVISION DATE: DECEMBER 2016

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CHAPTER 2
WATER TRAIL VISION

The reach of the Maquoketa River between Backbone State Park and Bailey's Ford has a long history of use by recreationists including paddlers, hikers and bird watchers.

This segment of the river is situated in the landscape of Iowa's first state park. State designation of this water trail would benefit both river users and the state system of trails. Water trail users will benefit from the upgrade of undeveloped and often undersized launch facilities as well as from more organized river management. The state system of water trails benefits with the addition of the Maquoketa because it represents a strong example of desired water trail attributes: engaged local residents, a beautiful river to experience, stellar resources to interpret and a well-developed network of visitor services and attractions, including the Manchester Whitewater Park. Delaware County Conservation Board (DCCB) has agreed to be the water trail sponsor as a result of planning between 2013 and 2015.

Water Trail Theme

The geology, vegetation, climate, prehistory and geology of Delaware County interweave to create a beautiful and rich resource best seen from the water. It continues to delight and attract paddlers and hikers today much as it did the early Euro-American settlers and prehistoric people. Situated between two large Iowa population centers, the water trail has a distinctly pastoral character. It celebrates the positive economic, biological and recreational outcomes that have come from the two recent dam modifications, leaving only one dam on its route, at Backbone Lake, still functioning. Recreational opportunities on and near this river corridor are as diverse as the landscape changes paddlers see. A rich diverse system of on and off-river outdoor recreation is available including trails, parks, cold and warm water fisheries, a whitewater park and nationally significant historic resources. This water trail is supported by an established strong and diverse community organization, Manchester Good to Great, who are as dedicated to conservation and water quality enhancement as they are to enjoying the river.

Vision

The water trail sponsor shares the values of resource protection coupled with recreation held by the state program. They see one of the primary purposes of the water trail to bring more people near the river and to interpret resources in ways that highlight the connection between healthy rivers and healthy communities. The upstream limits of the Maquoketa River Water Trail will be below the Backbone State Park dam based on a request from Iowa DNR State Park staff to exclude the river segment within the park and lake from designation. The designated portion of the water trail will end at the Bailey's Ford Access, upstream from Lake Delhi. In tandem with upgrading river access facilities and removing accesses that no longer serve a function from the water trail route, the most important locally-identified element in the long-term vision is addressing impaired water quality conditions on the Maquoketa and in Backbone Lake. The water trail community supports the Delaware County Soil & Water Conservation District's work in resolving issues created by livestock waste. They realize the interconnection between a clean and safe water supply in rivers and lakes and the economic viability of local communities. They are particularly interested in streambank restoration and in closing the 1% gap of missing perennial buffer in agricultural areas on the Maquoketa by working with landowners. The retrofit of two dams on this water trail has resulted in passage of a greater diversity of fish and safe navigation for paddlers. Further improvement of in-stream aquatic habitat for fish and other organisms is possible and important locally. Lastly, the vision includes expanding the land trail network in order to connect Backbone State Park with Bailey's Ford Park for multiple types of users. Manchester Good to Great functions as a public advocate for the Maquoketa River and the water trail generally. They have the leadership necessary to further support development amenities that complement the water trail and to assist with publicity and marketing.

Only four of the accesses are located in communities or parks with developed facilities nearby while the remaining six locations are stand-alone rural access sites. The vision includes reconstruction of nearly all launches and the addition of near-launch amenities to accommodate use by people with a broader range of physical abilities. Other goals include minimizing maintenance by reducing erosion and deposition from high flows. Currently the river represents a classic Iowa version of a Recreational Experience Classification with the exception of one Challenge classification segment in the Whitewater Park. These classifications will be maintained for the near future. The water trail sponsor and the community of Manchester are interested in future development of a Gateway Experience Classification. The 3.3 mile segment between the Whitewater Park and Pin Oak Access matches the distance and difficulty standards for a Gateway segment. The rich urban experience near the Whitewater Park exemplifies the intent and interpretive possibilities of the experience classification. Enhancements would include access upgrades and river channel improvements to provide a more stable river edge. The Whitewater to Pin Oak segment will remain Recreational Experience Classification until the access owners and Iowa DNR believe upgrades are sufficient to meet the Gateway classification. Expansion of the water trail upstream into Backbone is also a possibility for long term consideration should Iowa DNR State Parks be willing to consider this.

CHAPTER 3
RECREATIONAL DEVELOPMENT PLAN

MAQUOKETA WATER TRAIL

ACKNOWLEDGMENTS

This Water Trail Plan prepared by Mimi Wagner, Lucas Buscher and Jacob Wilson of Iowa State University. Delaware County Conservation Board staff and the Manchester Good to Great provided leadership and local support of the project throughout the process. Garlyn Glanz, Delaware County Conservation Board Director, and Tim Vick, Manchester City Manager provided review and interpretation. Nate Hoogeveen, John Wenck and Heath Delzell of Iowa Department of Natural Resources provided technical support.

The project Steering Committee provided valuable insight and direction throughout all planning phases:

Garlyn Glanz, Director of Delaware County Conservation Board
Mike Shmitz, Delaware County Conservation Board member & Pheasants Forever
Dave Sunne, Backbone State Park
Dennis Meggers, Friends of Backbone State Park
Tim Vick, City of Manchester
Barb Robinson, City of Dundee
Dave Gibbs, Backbone Maquoketa River Valley Trails
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Mark Winn, Iowa DNR Fish Hatchery
Doug Hawker, Iowa DNR Field Office
Keith Krause, NRCS Field Office
Jeff Ogden, The Watershed
Andrew Rucker, Operation Maquoketa River Clean-up

Initiated and funded by the Iowa General Assembly and Governor Terry Branstad.

REVISION DATE: DECEMBER 2016

DNR

MIMI WAGNER
Landscape Architecture

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CHAPTER 3
RECREATIONAL DEVELOPMENT PLAN

The Maquoketa River corridor cuts a nearly diagonal swath through Delaware County and is one of the most heavily used and loved rivers in the region. The corridor is home to outstanding natural, cultural and recreational resources.

The river functions as a spine in the county with Backbone State Park at the upstream limits and Bailey's Ford Park at the bottom. Backbone was Iowa's state park. Bailey's Ford, Delaware County's flagship park, is located on the site of the first settlement on the river in this county. The Manchester Whitewater Park, a destination in its own right, is situated in the middle of the study segment. This reach of the Maquoketa River has one of the most intact riparian buffers in the state water trail system. Only 1% of the buffer is annually cultivated cropland. Largely due to this condition, as well as the large habitat areas near Backbone and Bailey's Ford parks, 23 species of birds on the Iowa Species of Greatest Concern list are known to breed in areas near the river.

Dundee and Manchester, the two cities on the water trail, one county organization owning land and river accesses, Delaware County Conservation and Backbone State Park staff played an active role in preparation of this plan. Their commitment to their river-edge park facilities demonstrate a continuing level of support for providing recreation amenities at these locations.

Water Trail Existing Conditions

In 2010 the Iowa Department of Natural Resources (DNR) completed "IOWA WATER TRAILS: Connecting People with Water and Resources" (Wagner and Hoogeveen 2010). This statewide plan was the result of a 2008 mandate for the water trails program. This plan ushered in a new legacy of enjoyment, respect, and care for the navigable waters of Iowa. This recreation development plan adds to that excitement by utilizing the increasing volunteer spirit and local pride communities have for their rivers and for understanding how they function naturally. The vision for Iowa's water trail program centers both on expanding recreational experiences as well as protecting and enhancing Iowa's aquatic and riparian resources. And in addition to providing access to Iowa's rivers, the vision points to water trails as an entry point for people to become aware of and learn about the challenges facing Iowa's waterways. Similarly, state water trail plan goals focus both on user experiences as well as natural resource conservation and efficient management.

Recreation planning for state water trails responds to the individual character of each river, its local support and landscape conditions. Recommended outcomes focus on enhancing both the recreational infrastructure and the experiences of water trail users. The Iowa Water Trails Program recognizes water trail users as all people using the river as well as the adjacent land. On the river itself this includes paddlers and other boaters, anglers, swimmers and tubers. Active and passive users on land adjacent to the river are also included such as land trail users, equestrians, hunters, picnickers and bird watchers as well as those enjoy watching the river from their parked car.

State Water Trails Program Goals

- Goal One: Provide positive water trail experiences meeting user expectations
- Goal Two: Use water trail development to strengthen natural resources conservation
- Goal Three: Adapt water trail development techniques to the waterway's individual character
- Goal Four: Support public access to water for recreational purposes
- Goal Five: Create a robust, resilient system for developing and experiencing water trails
- Goal Six: Encourage education in outdoor settings
- Goal Seven: Support positive water trail experiences by initiating strategies to manage intensively used areas

Project Planning Area

The project area of this plan includes the Maquoketa River beginning in Backbone State Park on the upstream end to the upstream limits of Lake Delhi *(Figure 1)*. The municipal area of Manchester is a critically important segment of this water trail. This recreational plan serves three purposes:

- To provide a contemporary summary of all recreational plans near the Maquoketa River and integrate them with existing and proposed water trail infrastructure
- To develop conceptual plans for infrastructure development and river management to be used by local agencies and organizations for funding and construction
- Ensure that all proposed recreational development elements are consistent with the conceptual framework of the Water Trail Sponsor, DNR River Programs standards and the goals of the local steering group.

The goals of this recreation development plan center on enhancing conditions on the Maquoketa River in ways that support successful, broad-based public access to the river for recreational purposes with infrastructure designs that work with the river system. Because natural resource conservation is a critical element of Iowa's Water Trails program, it's important that recreational development opportunities enhance the physical condition of the river and cause no further degradation. The following framework elements are used to guide the choice of recreational enhancements as well their design:

- Enhance and support public access to water for recreational purposes
- Minimize limitations to recreational access based on age and physical abilities
- Provide positive water trail experiences meeting user expectations
- Use water trail development to strengthen natural resources conservation
- Reduce routine maintenance needs
- Increase flood resilience of recreational amenities at rivers edge

These elements are integrated into later sections of the plan to illustrate how specific elements contribute to the success of the planning.

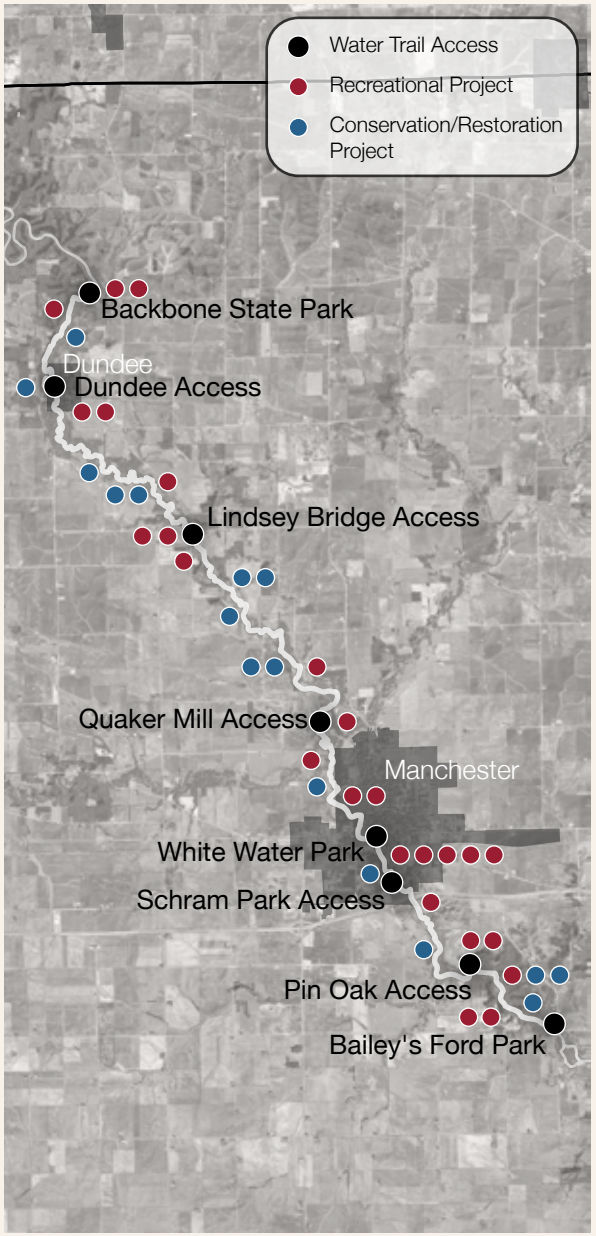


Figure 1
This plan included both recommended recreational and conservation projects

Administrative Rules and Definitions

A number of federal, state and local statutes, rules and ordinances apply to recreational river use in Iowa. These rules govern public use of rivers and behavior while on-water. Current interpretation of statutes, rules and codes related to recreation are summarized in *Figure 2*.

- **Meandered vs Non-Meandered Stream:** Rivers with Meandered status generally allows river users on-foot access rights to the channel bottoms and stream banks up to the ordinary high water mark. Note that overnight camping may not be allowed on the sandbars of meandered rivers within state parks due to park use regulations. Alternatively, the stream bed and banks of rivers classified as "non-meandered" are considered part of the adjacent property. River users on these "non-meandered" rivers may have the right to recreate only on the water surface, with additional incidental rights associated with navigation (see Navigation and Trespass, below) where the bed and banks of the stream are in private ownership. All streams in Delaware County are non-meandered. *Iowa Code 462A.2, 462.69 IOWA WATER NAVIGATION REGULATIONS; Iowa Attorney General Opinion: Smith to Kremer, State Representative, 2-6-96 (#96-2-3)*.

- **Navigation and Trespassing:** Paddlers on Iowa rivers are allowed to portage their boat to safely circumvent a channel blockage or hazard. Users also have the right to portage their boat on dry sandbars and channel bottoms. Iowa Code 462A.2, 462.69 IOWA WATER NAVIGATION REGULATIONS; Iowa Attorney General Opinion: Smith to Kremer, State Representative, 2-6-96 (#96-2-3). Entering privately owned land next to the river without the express permission of the owner or remaining there after being notified or requested to leave by the owner is considered trespass. *Iowa Code 716.7 IOWA DAMAGE AND TRESPASS TO PROPERTY REGULATIONS; Iowa Attorney General Opinion: Smith to Kremer, State Representative, 2-6-96 (#96-2-3)*.

- **Tort Liability of Governmental Subdivisions:** Municipal tort law provides a protection from claims of liability for local units of government when recreational infrastructure on rivers is built to current standards. *Iowa Code 670 TORT LIABILITY OF GOVERNMENTAL SUBDIVISIONS*.

- **Iowa's Recreational Use Statute:** Under the Iowa recreational use statute, a landowner is encouraged to open their land and water to others for recreational uses, including swimming and boating, by receiving immunity from liability except for injuries resulting from the landowner's willful or malicious acts, or when a landowner charges a fee for recreational use. *Iowa Code 461C PUBLIC USE OF PRIVATE LANDS AND WATERS*.

- **Littering:** Discarding litter onto water or land is prohibited. Additional fines or penalties may exist based on the jurisdiction of the littering incident such as county or municipal-owned property. *Iowa Code 455B.363 LITTER*.

- **Motorized Vehicle Use in River:** The use of motorized vehicles, including ATVs, in all parts of certain navigable streams, such as the Maquoketa River in Delaware County, is prohibited at all times and conditions. Iowa Administrative Code 461, Chapter 49 provides a list of those navigable streams in which off-highway vehicle use is prohibited. Specific exceptions exist and relate to agricultural access. In meandered streams, motor vehicles shall not be operated on any

Figure 2

Iowa regulations providing the framework for use and behavior of public waters are constantly evolving. These interpretations were developed in late 2016 with assistance from the Iowa Attorney General's Office and Iowa DNR staff.

part of the stream at any time, including on dry sand bars. *Iowa Administrative Code 571, Chapter 49 OPERATION OF MOTOR VEHICLES IN MEANDERED STREAMS, NAVIGABLE STREAMS AND TROUT STREAMS; Iowa Code 321I.14.g ALL TERRAIN VEHICLES*.

- **Bicycle Use in Streams:** There is no restriction of bicycle use on the bed or banks of meandered streams (fat bikes, mountain bikes, etc.). Their use on the dry beds of non-meandered streams without permission of the landowner could result in trespass. *Iowa Code 716.7 IOWA DAMAGE AND TRESPASS TO PROPERTY REGULATIONS*.
- **Livestock Fences Across Stream:** The owner of the bed of a non-meandered, navigable stream has a right to erect fences and electric fences across the stream as necessary to confine livestock on his or her land in a manner that affords boaters safe passage. Methods of affording safe passage typically include setting the wire high over deep water cattle avoid, or the use of a non-conductive rubber hose over the electric wire to allow river users to raise the wire. It is recommended that fences be flagged as a warning for river users. *Iowa Code 657.2(3) WHAT DEEMED NUSIANCES and Iowa Attorney General Opinion: Smith to K¬remer, State Representative, 2-6-96 (#96-2-3*).
- **Consuming Alcohol and Intoxication:** Operating a motorboat or sailboat while under the influence of alcohol (.08 alcohol blood level or higher), controlled substances, or illegal chemicals is unlawful. In addition, public intoxication may be enforced in public places. Local ordinances may vary in terms of allowing alcohol consumption in public places such as city or county parks. *Iowa Code 123.46 CONSUMPTION OR INTOXICATION IN PUBLIC PLACES*.
- **Personal Floatation Devices (PFDs):** All vessels are required to have at least one personal floatation device (PFD) or life vest for each person onboard. PFDs must be readily accessible in an emergency. All children under the age of 13 on a vessel are required to wear a PFD. *Iowa Code 462.A WATER NAVIGATION REGULATIONS*.
- **Boat Registration:** Registration is not required for inflatable vessels seven feet or less in length, and canoes and kayaks 13 feet or less in length that have no motor or sail. It is also not required for vessels properly registered in another state and using Iowa waters for 60 days or less. *Iowa Code 462A WATER NAVIGATION REGULATIONS*.

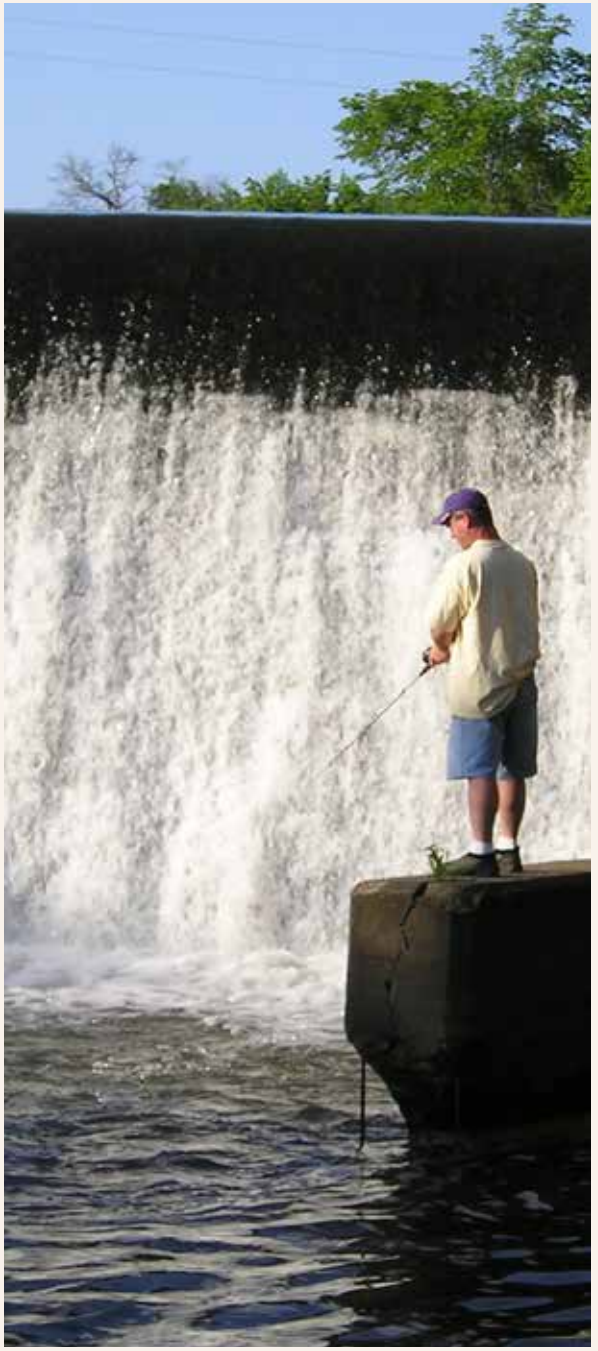


Figure 2 *(continued)*

Assumptions and Concepts

This recreational plan includes concept design for all near-water infrastructure construction. One of the most important recreational development elements in this plan is the upgrade of existing river accesses. River accesses include five functional components: entrance drive, parking surface, launch surface, a pathway connecting the parking and launch and stormwater infiltration areas *(Figure 3)*. Several assumptions exist in this planning related to natural resource conservation and the goal of working with the river system.

Construction and vegetation clearing on the floodplain, in the floodway and on the river's edge is regulated at the federal, state and local levels. All recreational infrastructure development included in the water trail plan should conform to the minimum standards established by regulation. This is critical because all river access locations are located in either the floodplain or floodway. In addition to federal protection of wetlands and Waters of the U.S., state and local floodplain and Sovereign Lands regulations also exist. The Iowa DNR Water Trail development standards also recommend a minimum 50-foot wide unmown riparian buffer between the top of the streambank and all parking areas.

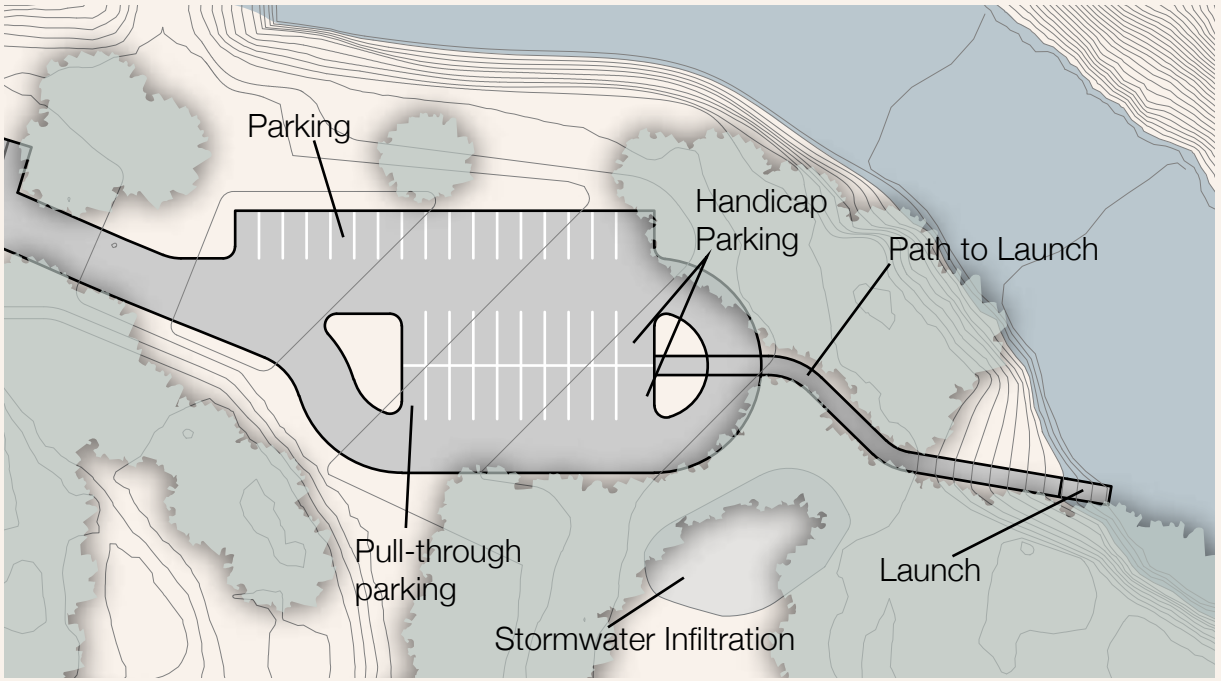


Figure 3
Components of a typical river access area

THE MAQUOKETA IN DELAWARE COUNTY

This segment of the Maquoketa River is situated in the most upstream portion of the river's watershed. The drainage basin or watershed area draining into this segment of Maquoketa River is 209,311 acres in size *(Figure 4)*. With only a few exceptions, this river's location on the landscape has changed very little since the mid-1840s. Repeated, exceptionally large rain storm events beginning in 2004 have contributed to several large channel changes in Delaware County. Within this study area, the river changed course during the 2010 breach of the Quaker Mill Dam when it cut a new channel connecting to a tributary, Honey Creek. The Lake Delhi dam, immediately downstream of this study area, breached in 2008, causing the entire lake area to drain.

Channel conditions and patterns of very severe streambank erosion relate strongly to the underlying bedrock geology. Two different bedrock formations underlie the river. The upstream and mid-reach portions of this study segment are underlain by the Scotch Grove Formation. The Scotch Grove Formation is generally quite shallow and overlies the deeper Hopkinton Formation. All of the very severe streambank erosion identified on the study segment is located on land overlying the Hopkinton Formation. These eroded portions of the river, between Dundee and Lindsey Bridge

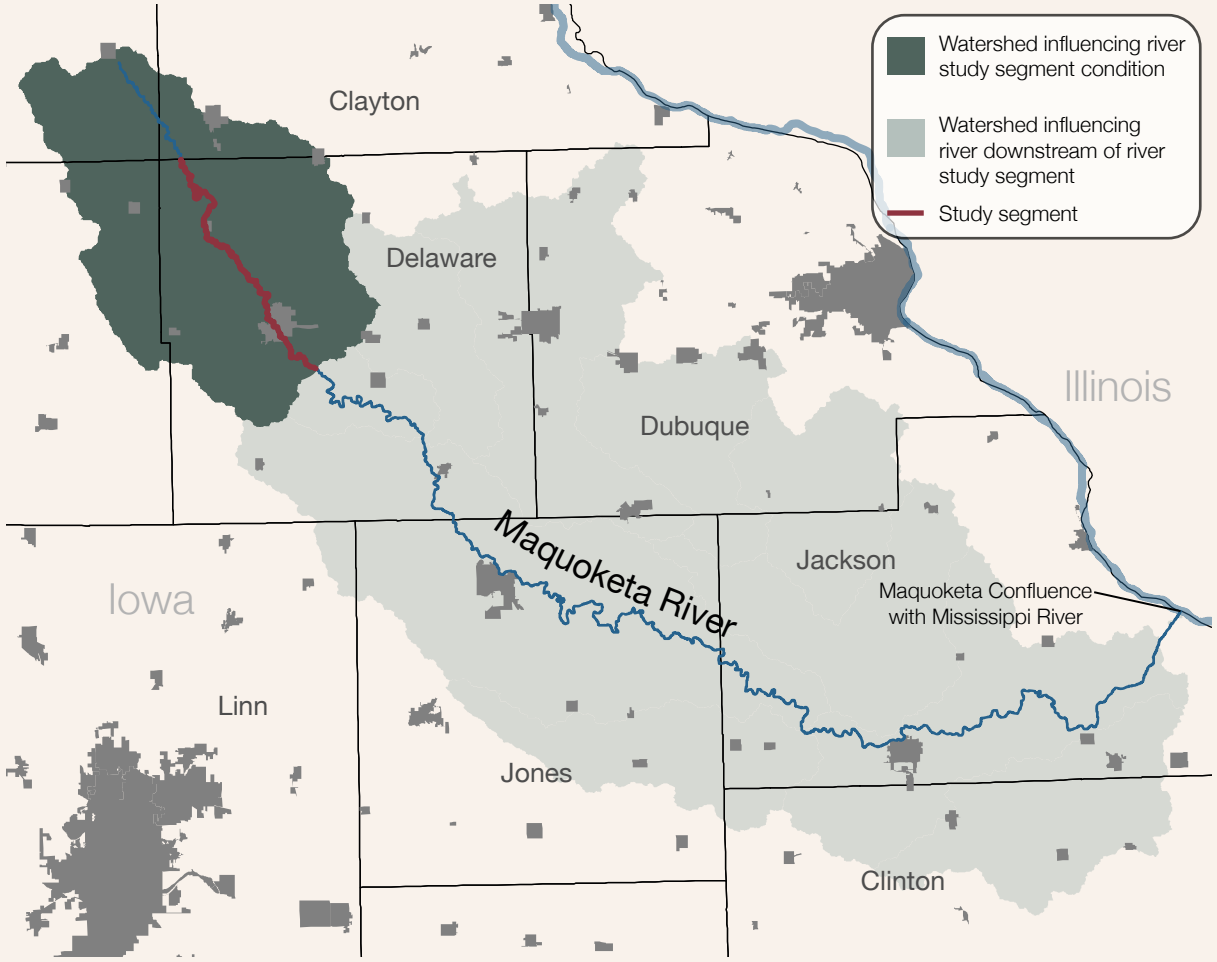


Figure 4

The water trail portion of the Maquoketa is located near the top of the Maquoketa River watershed

accesses and between Schram Park and Bailey's Ford, also present the majority of large woody debris channel obstructions.

Typical channel width of the Maquoketa upstream of Manchester ranges between 40 and 65 feet; the channel gradient is steeper in this upstream area compared with downstream segments. The upstream segment has many riffles and sharp channel turns. The typical channel width downstream of Manchester is approximately 165 feet wide; this segment is less steep with visibly calmer water. Paddling volume is particularly high between the Manchester Whitewater Park and Bailey's Ford Park.

A total of 4,723 acres of land are known to be in permanent protection within 10 miles of the study segment of the Maquoketa; 91% of these acres (4,280) are available for public recreation.

Implementation of the Maquoketa Vision

The Maquoketa River in Delaware County will be designated as a Recreational use classification with the exception of one segment *(Figure 5)*. The ¼ mile segment encompassing the Whitewater Park will be designated a Challenge use classification. Also, the 2.3 mile segment between the Manchester Whitewater Park and Pin Oak Access is envisioned at some point in the future as a Gateway segment; this will require a new full-service access immediately downstream of the Whitewater Park as well as upgrades at Pin Oak Access. A large part of the vision for this proposed state-designated water trail includes protecting and enhancing the conditions that make this river such a high quality recreational experience today. This includes promoting protection as well as adding to the already high percentage of forest and grassland in the riparian buffer area. Other parts of the vision address resource concerns described earlier in the Existing Conditions chapter. The most important locally-identified element in the long-term vision is addressing impaired water quality conditions on the Maquoketa and in Backbone Lake. Streambank restoration where needed is also a high priority.

Recreational development included in the vision includes upgrading river access facilities and removing accesses that no longer serve a function from the water trail route. Reconstruction of launches and near-launch amenities will allow people with a broader range of physical abilities to access the river. Other goals include minimizing maintenance by reducing erosion at and deposition on boat launches from high flows.

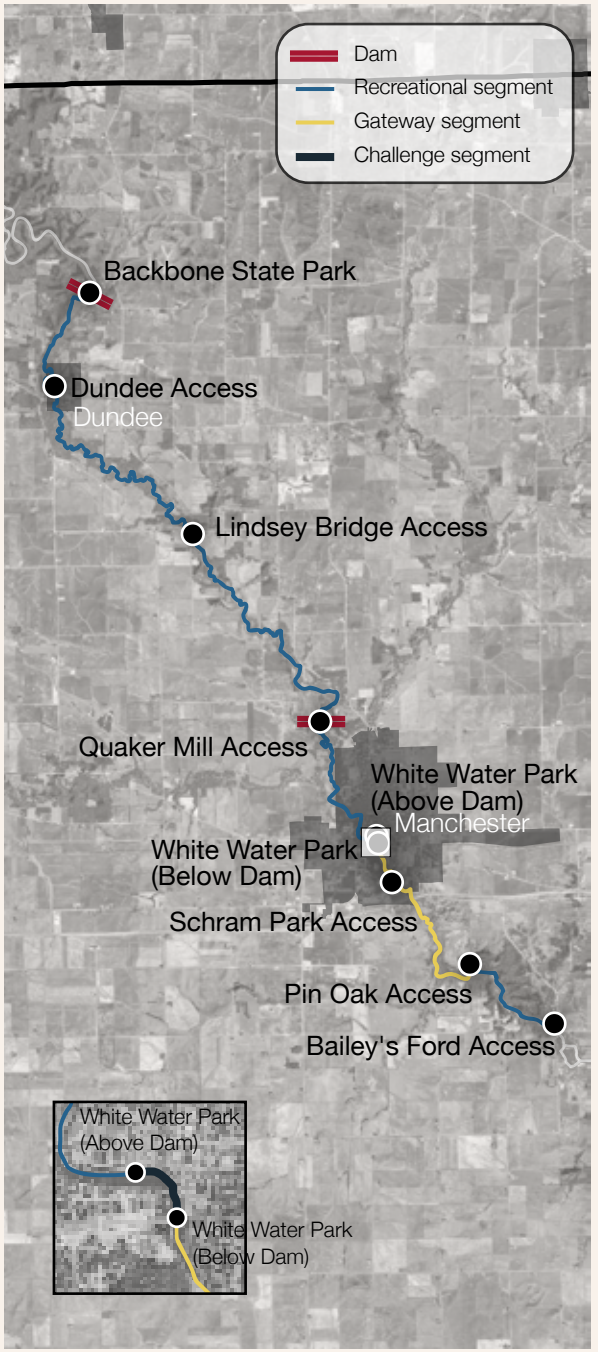


Figure 5

Initially the water trail will be designated with the Recreational Use Classification with the exception of the Whitewater Park segment. This is the most common classification in Iowa. Potential changes in classification are likely.

Planning Process

This vision was developed through a two-year planning process integrating stakeholders, agencies, university researchers, non-profit organizations and landowners. Three public events were held to generate interest for and attention to water trail planning. A steering group composed of 17 local individuals representing special interests such as water quality, angling, botany, history and landowners guided development of both the vision and this plan. The recreational development priorities included in this plan were developed by the Steering Group and the Water Trail Sponsor, Delaware County Conservation Board.

The existing conditions surrounding this section of the Maquoketa were assessed and researched concurrently with this recreational planning. Planning for resource conservation and protection occurred during the same two-year time period. An extensive review period occurred with the Steering Group, Delaware County Conservation staff and board members and Iowa DNR.

Scope of the Plan

Recreation development elements are recommended for both on-water recreation and on-land recreation. On-water recreation recommendations include structural upgrades for most launches, the development of Universal Design launches and improved angler access. Land-based recommendations in the riparian area include enlarged and improved parking areas, the completion of the on and off-road trails between Strawberry Point and Bailey's Ford Park.

A number of issues related to recreation development emerged that do not include infrastructure but are no less important. Typically these issues are not site-specific but rather apply to part or the entire study segment. These issues relate to river and user management on the water trail, maintenance of infrastructure and communicating with the public.

RECREATIONAL RESOURCES AND NEEDS IN THE CORRIDOR

Existing Conditions

The Maquoketa River is a non-meandered stream beginning in Iowa's Fayette County. The Maquoketa and North Fork of the Maquoketa rivers join near the community of Maquoketa in Keokuk County. The Maquoketa enters into the Mississippi River in Jackson County. The Delaware County study segment of the Maquoketa River is 23 miles in length. River access points divide the 23 miles into nine segments.

Four low head dams existed on this study segment prior to 2010. Only one, Backbone Lake Dam, remains as of this writing. As discussed earlier, the Quaker Mill Dam breached in 2010 and is being replaced with a set of rock arch rapids. The Manchester Dam was modified with a set of rock arch rapids in 2015 to create the Manchester Whitewater Park. The remaining dam near Pin Oak Access, a rock dam associated with an historic USGS gage, also washed out in a recent flood. The river is used for canoeing, kayaking, tubing, swimming, fishing and hunting. Locally, residents and county officials perceive use of the river has drastically increased since the Manchester Whitewater Park was established.

Two groups of residents volunteer to remove trash and debris from the river, however, no organized paddling group is associated with the river. The Manchester Good to Great Committee is a local non-profit dedicated to improving the quality of life in Manchester and Delaware County. They spearheaded development of the Whitewater Park and provided strong representation in the water trail planning process.

A fair amount of municipal, county and state-owned public recreational land exists adjacent to the Maquoketa River Water Trail in Delaware County *(Figure 6)*. Backbone State Park and Bailey's Ford Park provide highly developed recreational experiences. Public land and parks in Manchester are common on one or both banks of the river. Additional county and state wildlife areas allow a great variety of recreation, particularly fishing-related opportunities.

Portions of the study segment, particularly between Dundee and Lindsey Bridge accesses, are recognized for above-average amount of large woody debris accumulations and outside bend streambank erosion. These conditions are due to deep alluvial soils overlaying bedrock, the often-forested edge of the river, the channels' current phase of widening and the pattern of intense rain events of the past ten years. Woody debris piles blocking the entire channel width are common throughout the calendar year and generally exacerbate streambank erosion. Woody debris poses obstacles for paddlers when it blocks a significant portion of the channel and when piles accumulate and act as strainers on outside bends.

Beyond on-river experiences on the Maquoketa is a premier location for all types of fishing including cold water trout streams, ponds and lakes. A high number of historic sites are also open to the public including 13 sites of national or regional significance. All types of lodging options exist within 10 miles of the study segment including more than 200 camping sites and 125 hotel rooms.

A total of 125 miles of bike trails are located in the study area including bicycle-friendly roads, paved shoulders and off-road trails. Over 21 miles are dedicated hiking or multi-use trails exist on state and county recreational lands adjacent to the Maquoketa River. Trails are not directly connected to water trail accesses on the Maquoketa so pedal-paddle options are limited.

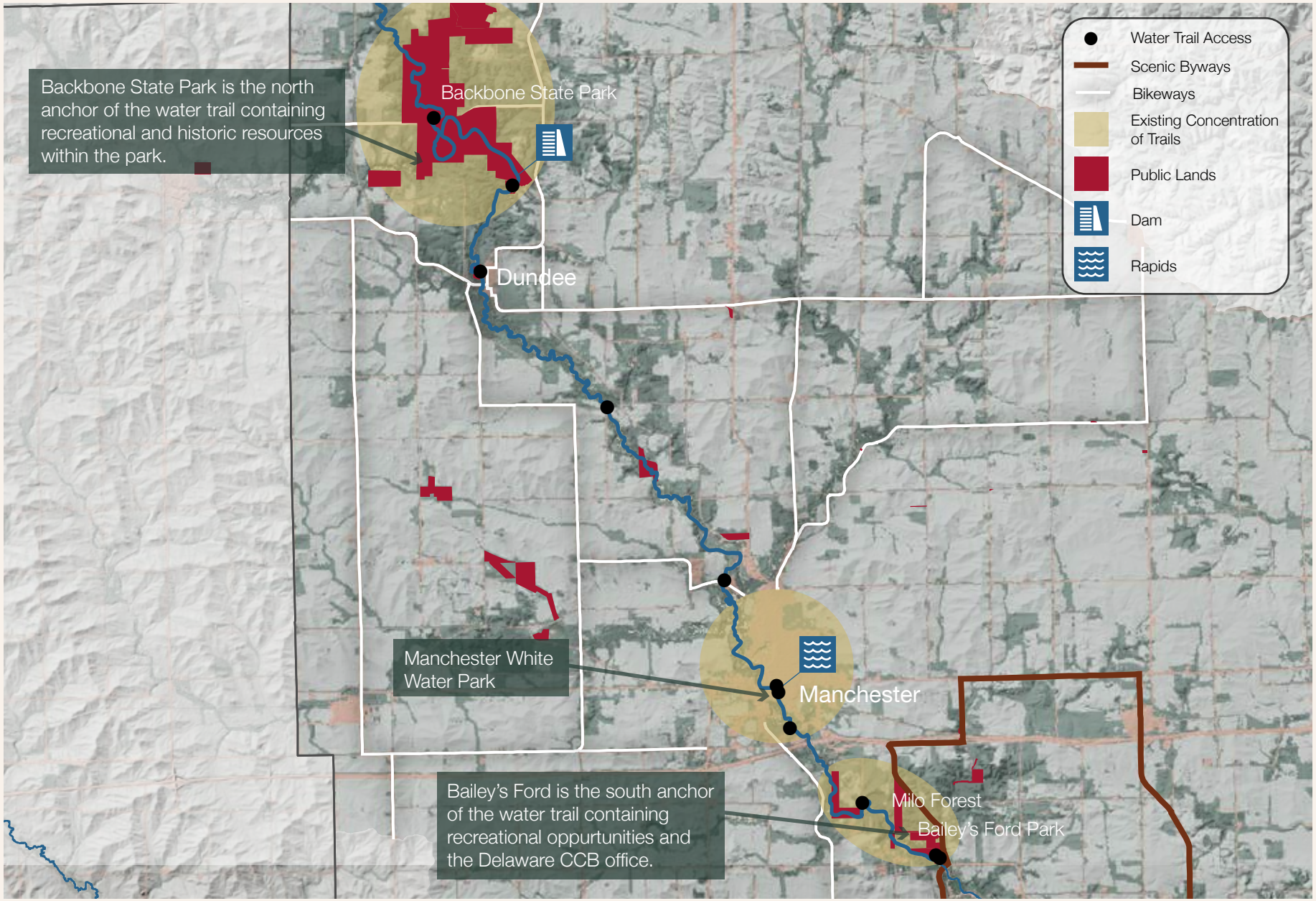


Figure 6

Existing recreational resources are concentrated near Backbone State Park, Manchester and Bailey's Ford Park.

Water Trail Management Needs

A number of management issues were identified during this planning. And while none of them are emergency situations, enhancement is possible on each one with coordination. River access maintenance is an example. This river segment has been used by paddlers and anglers locally for generations. There had been minimal coordination between access owners / managers in the county prior to the time this plan was developed. Every day and seasonal maintenance practices vary between access owners, providing variable conditions for river users from no maintenance to frequent attention. The following desired water trail management outcomes were identified during planning:

- Increase river management communication and capacity
- Enhance communication between water trail access managers
- Establish a river management presence on the water trail
- Standardize ordinary maintenance at launches
- Reinforce capacity for on-water rescue

The capacity-building necessary to achieve these outcomes are also expected to result in stronger relationships with river landowners, an increased efficiency of resources and enhanced users experiences on the river *(Table 1)*.

Table 1
The recommended capacity-building outcomes are expected to address the water trail management needs identified during this planning.

Elements Included in this plan	Enhance Everyday Management Conditions	Strengthen Relationship between Land Owners and River Users	Increased Efficiency of Resources and Time	Enhance River Use Experience	Leadership Responsibility For Element
Increase capacity for on-water rescue	√	√		√	Delaware County/ WT Sponsor
Enhance communication between water trail access managers	√	√		√	WT Sponsor / Access Managers
Establish a river management presence on the water trail	√	√	√	√	WT Sponsor
Develop management agreements between access managers and DNR	√			√	WT Sponsor / River Programs Staff
Standardize ordinary maintenance at launches	√			√	WT Sponsor & Access Managers

River-Edge Infrastructure

The majority of existing river accesses in this corridor have been in place for generations. The existing condition of the accesses, in general, is primitive and in need of upgrading *(Table 2)*. Several, Tirrill and Schram Park, are spaced so closely to other amenities that they are duplicative. Tirrill Park and Pin Oak have been severely damaged by floods and are unusable. Other areas including the downstream end of the Whitewater Park and Backbone State Park lack a developed access entirely and one, Lindsey Bridge, is sited at a location where safe and legal standards for parking and boat maneuvering cannot be met. A majority of launch surfaces themselves are natural-surface and have been damaged from high water events. Stormwater runoff from the parking areas is frequently directed toward the river over the launch surface causing gully erosion in the center of the launch.

	Access Number	Inadequate Parking	Lacking Storm Water Management	Over-Steepened Launch Slope	Launch Angle Pointing Upstream or Perpendicular	Stream Bank Restoration	Missing Riparian Buffer	Restroom Access Needed
Below Dam, Backbone St. Park	#130	√	√					
Dundee	#128		√	√	√		√	
Lindsey Bridge	#123	√	√	√	√	√	√	
Quaker Mill Dam	#118		√	√			√	
Tirrill Park	#117		√	√	√	√	√	
East River Park (Upstream of Whitewater Park)	#116A		√	√			√	√
Downstream of Whitewater Park	#116B		√	√			√	
Schram Park	#115		√				√	
Pin Oak	#112		√	√	√		√	
Bailey's Ford Park	#110		√					

Table 2

The existing spacing and availability of river accesses in this corridor are adequate and in some cases, there are more closely spaced launches than required. With a few exceptions, the condition of existing accesses are primitive in terms of development. Access needs identified during the existing conditions assessment are detailed later in this chapter.

The following desired river-edge infrastructure outcomes were developed as a result of this planning:

On-Water Desired Outcomes:

- Ensure spacing of accesses is sufficient and remove non-essential accesses from the water trail to reduce maintenance
- Ensure all accesses are located on adequately sized land parcels to accommodate parking and launch needs for river users
- Upgrade some access facilities
    - Upgrade launch types and designs to allow vehicles & people to reach water's edge experiences
    - Upgrade parking availability geared for all users
    - Upgrade accesses with overly steep launch and path slopes as well as perpendicular launch alignment to the thalweg
- Enhance angler opportunities

On-water infrastructure recommendations relate strongly to the water trail vision developed locally, Iowa DNR development standards, the Water Trail Sponsor's priorities and natural resource issues in Iowa. *Table 3* organizes desired recreational outcomes and recommended plan elements to illustrate their overlap.

Land-Based Recreational Outcomes:

- Provide additional land trail miles and trail connectivity between Strawberry Point and Bailey's Ford Park.
- Communication-based recreational outcomes:
    - Enhance communication for users before they get to the river
    - Update public interpretation

Recommended Recreation Elements	Increase Flood Resilience of recreational amenities at rivers edge	Reduce routine maintenance needs	Support public access to water for recreational purposes	Minimize limitations to recreational access based on age and physical abilities	Use water trail development to strengthen natural resources conservation	Provide positive water trail experiences meeting user expectations
Upgrade overly steep launch and path slopes		√	√	√		√
Upgrade angle of launch & construct new launches on stable river sections	√	√	√		√	
Upgrade parking availability geared for all users at launches		√	√	√		√
Create “Gateway” Water Trail Segment & Universal Design Accesses			√	√		√
Enhance angler experiences			√	√	√	√
Enhance communication with the public						
Update educational interpretation			√		√	√
Increase river management ability		√	√		√	√

Table 3

Desired recreational outcomes are organized to reflect their relationship to local and statewide issues.

Recreational Development Overview

Several site development protocols exist that may differ from traditional construction. Consistent with resource conservation goals and federal, state and local regulations, any existing wetland areas in river access areas are to remain undisturbed. Upgraded launch designs minimized the number of mature trees required to be removed and the amount of earthwork. Only the minimum amount of earth fill is utilized as necessary to construct proper parking surfaces with proper slopes and drainage. Lastly, the water quality volume of stormwater runoff from all parking areas is infiltrated onsite rather than being directing toward the river over the launch surface.

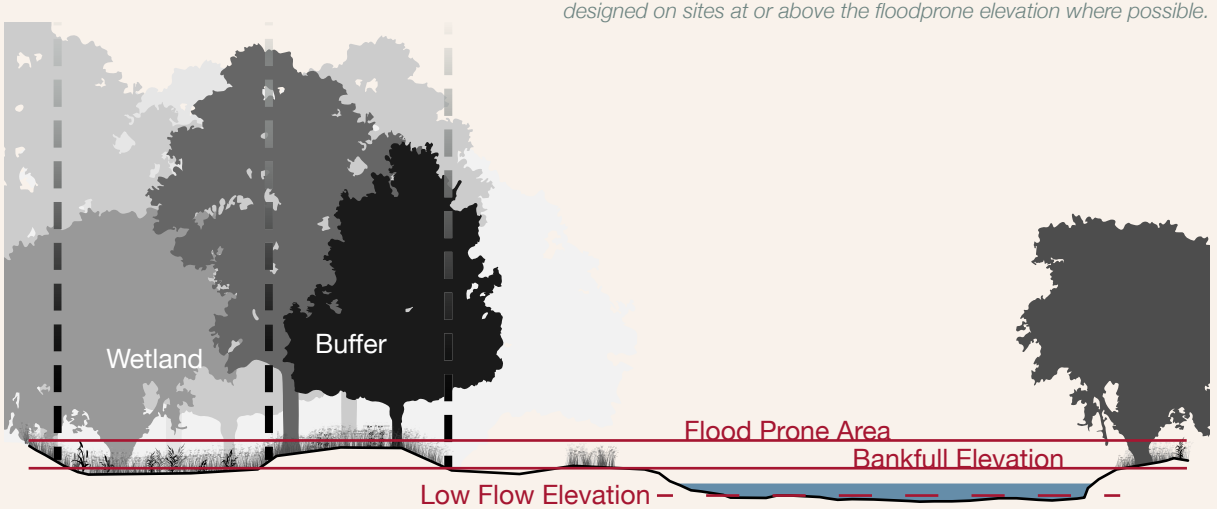
Launches are designed in conformance with Iowa DNR Water Trail standards (Wagner & Hoogeveen 2010), including the technical delineation of channel bankfull and floodprone elevations *(Figure 7)*. These elevations were established morphologically by field surveying and verified with quantitative gauge analysis. Bankfull elevation is understood as the river stage with discharge for a 1.5 year (on average) recurrence interval. This elevation varies with each river and can change with watershed conditions. Mean bankfull depth at a riffle in this study segment of the Maquoketa is approximately 4.3'. Floodprone elevation represents the area adjacent to the stream that is inundated or saturated during a 50 year recurrence interval. Wetlands are often located in riparian areas and are federally protected.

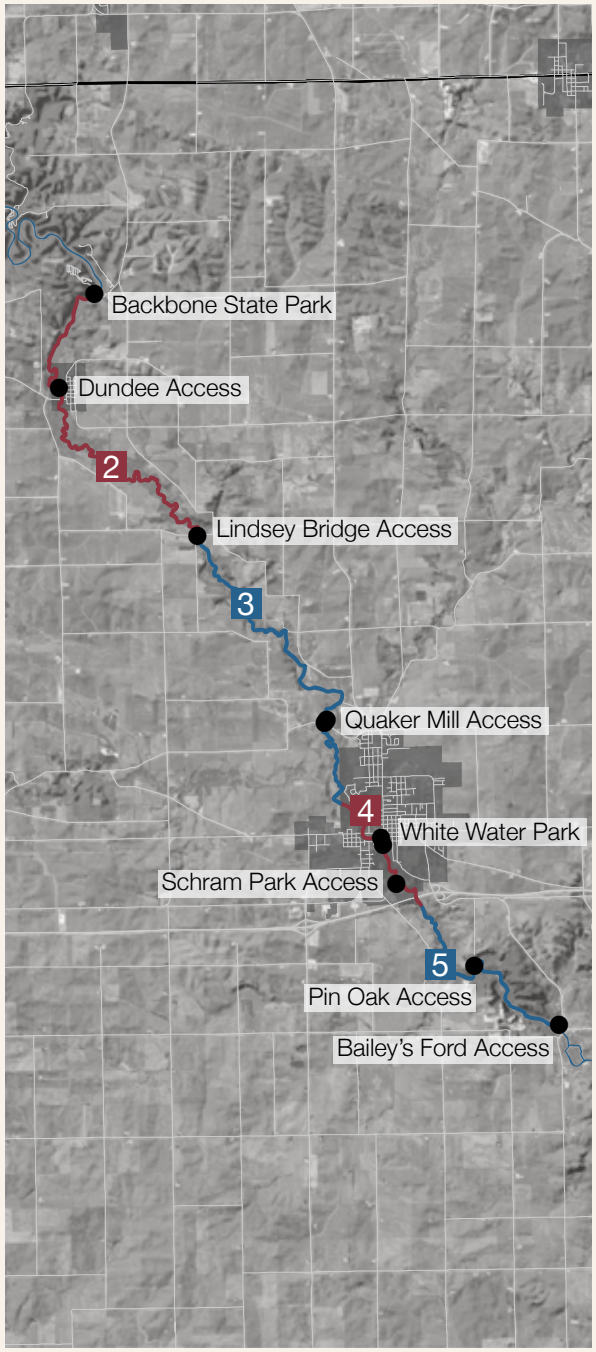
Recommended recreational elements included in this plan consist of the following types:

- Communication with users: wayfinding signage, resource interpretation and trail maps
- On-water recreation infrastructure: Launch upgrades and replacements, parking improvements and angler access
- Land-based recreation enhancements: soft and hard land trail expansion (Minnesota, Trails and Waterways Unit 2006) and equestrian trails (Hancock 2007)
- Several overarching resource conservation and protection considerations also exist. These considerations impact the placement, design and construction of recreational infrastructure. These considerations include enhancement and restoration of a biologically-rich riparian corridor to benefit fish, mussels and birds and to minimize flood damage. The protection of cultural and historic resource sites is also critical, including those not yet identified or understood (Hedden 2014).

Figure 7

Parking and other developed amenities, such as interpretive signage, are designed on sites at or above the floodprone elevation where possible.





RECOMMENDED RECREATION DEVELOPMENT PROJECTS

This is an exciting time for recreation development near the Maquoketa River in Delaware County, particularly for expanding use of the river corridor to more diverse users. The river corridor is already a primary focus of county conservation. Proposed recreation plans will connect users with adjacent communities and regional trails. Recommended infrastructure enhancements include traditional elements such as entry points for people entering the river channel, top of bank opportunities such as fishing and paddle-in campsites. River user management recommendations are also included and form a critical link to managing future use of the river. Recommendations enhance recreational experiences for users; they are also sensitive to Species of Greatest Conservation Need (SGCN), geologic and cultural resources.

The study area river corridor is divided into five segments *(Figure 8)*. Recommendations are organized by segment and include maps, drawings and text descriptions. Some recommendations span multiple segments or the entire 23 mile study area. Preliminary cost estimates are provided based on recent material and construction costs in Iowa.

Recommended recreation development projects included in this plan consolidate the most recent comprehensive recreational plans available as well as add recommendations for infrastructure related to use of the river. The goals of recommended recreation infrastructure proposed near the river are always grounded in resource protection and enhancement including water quality and terrestrial and aquatic habitat. These recommendations were developed locally by the project Steering Group, Manchester and Delaware County. The design of infrastructure utilized technical experts from Iowa DNR and Iowa State University.

Figure 8

The planning segment is divided into five segments.

SEGMENT R1: **Corridor-Wide Projects**

R 1.A
On-Water Rescue Capacity

Support and reinforcement of the already existing network of county and municipal emergency personnel serving the river corridor in Delaware County is recommended. Enhancing local capacity as it relates to river rescue is a good way to better prepare for unexpected circumstances, learn of new management challenges and share information between agencies. Particular emphasis on the future Gateway experience segment as well as the most heavily used segments of the water trail are recommended.

R 1.B
Enhanced Communication Among Water Trail Access Managers

A formalized system of communication is recommended between the Water Trail Sponsor and access managers. Regular communication can enhance coordination of water trail activities and issues and can result in more consistent, efficient and timely removal of sediment and debris from launches and other ordinary maintenance tasks.

R 1.C
Public Interpretation Plan

A formal interpretation plan including signage is recommended. The resources included in this water trail plan and supplemental information will be used to produce a compelling interpretation of critical issues and resources based on the conditions on this river. This will add to quality of the experience for users.

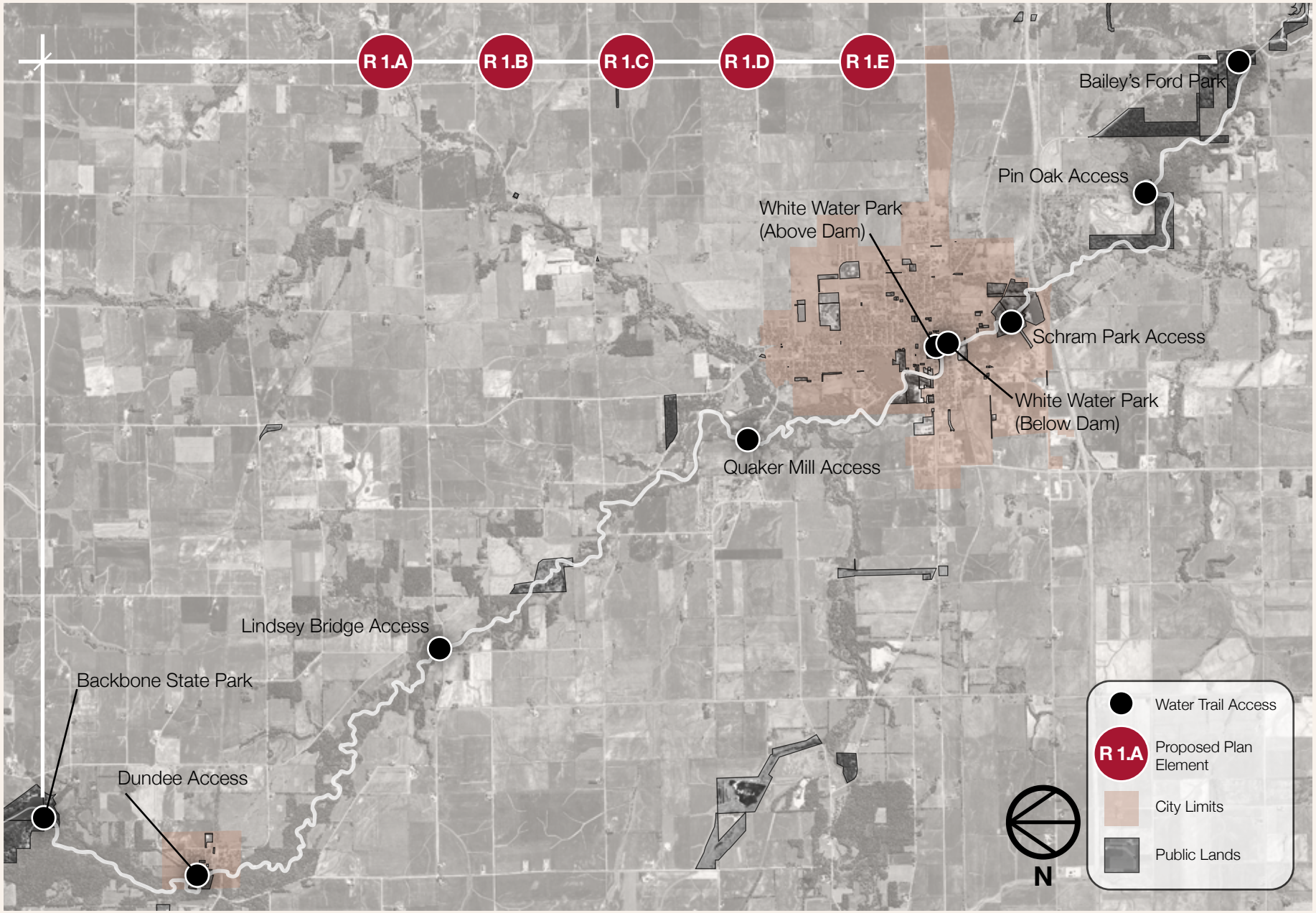
R 1.D
Water Trail Wayfinding Signage

Water trail wayfinding signage is recommended. The resources included in this water trail plan and future studies will be used to produce a compelling interpretation of critical issues and resources based on the conditions on this river. This will add to quality of the experience for users.

A formalized system of communication is recommended between the Water Trail Sponsor and access managers. Regular communication can enhance coordination of water trail activities and issues and can result in more consistent, efficient and timely removal of sediment and debris from launches and other ordinary maintenance tasks.

R1.C *Public Interpretation Plans include, but are not limited to, interpretative panels near water trail access points.*

R1.D *Wayfinding signage for water trail access points, such as this example from Story County, is required prior to State Designation. Iowa DNR prepares the signage plan, orders the signs and organizes installation with entities responsible for it.*



SEGMENT R1: **Corridor-Wide Projects**

R 1.E
Dry Hydrant Installation Study

A feasibility and location study is recommended for utilizing dry hydrants in conjunction with the Maquoketa River using water trail access facilities as well as other locations. Water trail access designs prepared for this plan do not necessarily meet the turning radius needs of emergency pumper-tanker vehicles.

SEGMENT 1 COST ESTIMATES		
RECOMMENDATIONS	MAP CODE	COST ESTIMATE
On-Water Rescue Capacity Building	R1.A	$0
Communication Among Access Managers	R1.B	Reimbursable from IDNR
Public Interpretative Plan & Education Program	R1.C	$0
Water Trail Wayfinding Signage Plan	R1.D	$0
New Water Trail Map	R1.E	$0
Dry Hydrant Installation Study (at some accesses)	R1.F	

SEGMENT R2: **Backbone State Park to Lindsey Bridge Access**

Existing Conditions

This segment of the river is 2.1 miles in length and has a low level of use by paddlers. The segment begins near the outfall of the Backbone Lake Dam *(Figure 9)*. This short reach of the river is scenic, narrow and located nearly all outside the state park boundaries but the scenery is similar to that inside the park. The river flows through deep woodlands and includes several series of riffles. Further down, past Dundee Access, the channel takes many sharp turns with eroding streambanks and a high amount of large woody debris in the channel. A high diversity of bird species is found on this segment. Several gravel and sand point bars exist and mature mussel shells are commonly seen.

Issues and Opportunities

Backbone State Park is one of the high points of this water trail. The full service park has many amenities including an extensive history collection and museum. Both this segment of the Maquoketa River and Backbone Lake are listed on Iowa's 303d List for Impaired Water due to high bacteria levels. Although there is an existing river access at Dundee, there is not a developed access at the put-in near Backbone Lake Dam. River users are currently carrying boats under the bridge and using a rip rap-covered bank to launch.

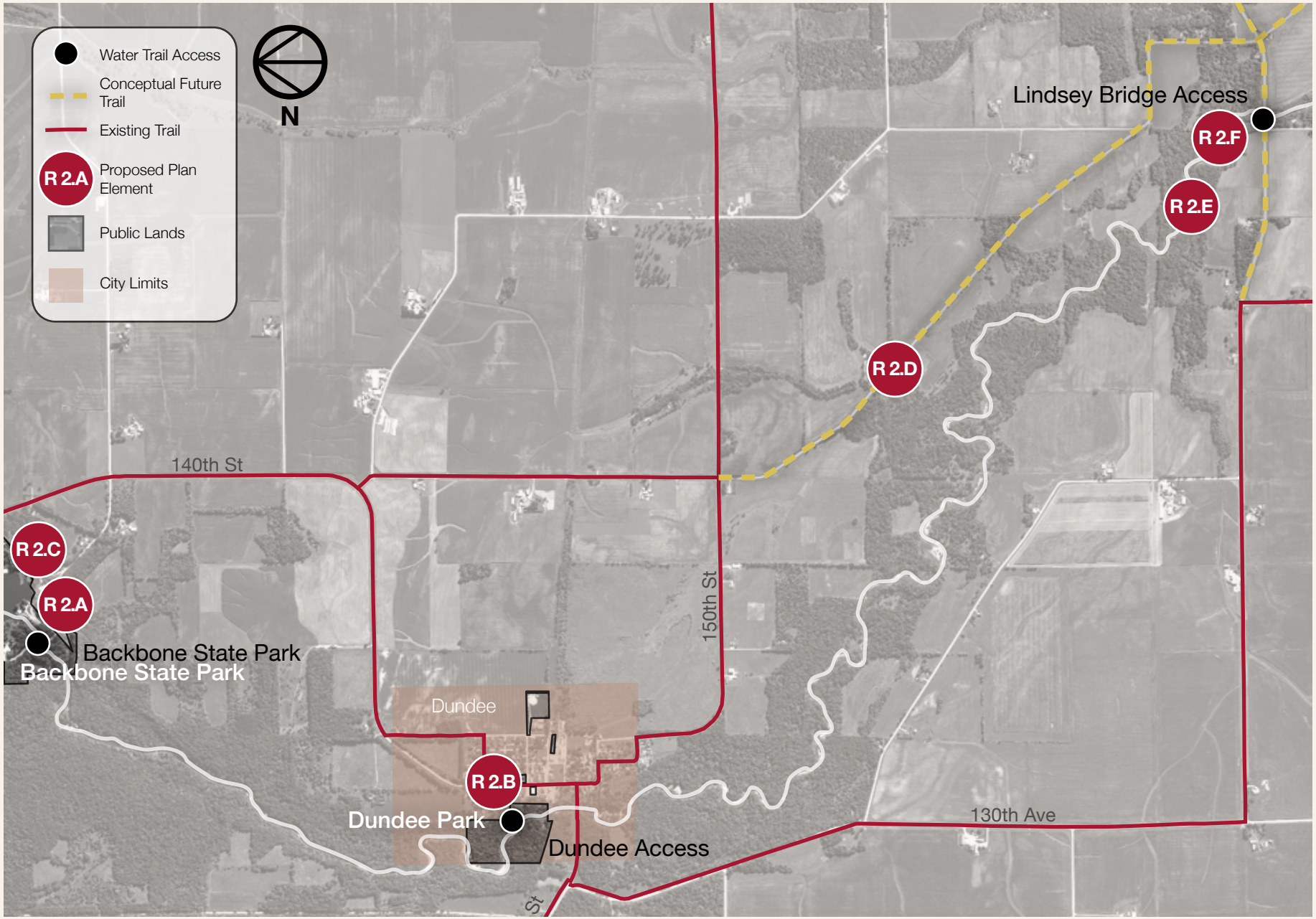
The existing access at Lindsey Bridge is signed but it does not meet Iowa DOT minimum requirements. Conditions include of a primitive, flood damaged launch located on steeply sloping county road right-of-way; there is space for only one car to park. This launch is heavily used and users park their cars on both sides of the adjacent gravel road, 145th Avenue, causing safety concerns for users as well as insufficient road width for emergency vehicles.

Figure 9
The original Backbone Lake Dam was constructed by the Civilian Conservation Corps in the 1930's. Backbone Lake is included on Iowa's 2015 Impaired Waters List.

R 2.A
New River Access at Backbone Lake Dam

Available land suitable for access development is very limited near Backbone Lake Dam. The location for this new access is set lower relative to the river channel elevation than is preferred *(Figure 10)*. The design includes a carry-down launch, parking for 12 cars and 2 vehicle-trailer stalls. Removal of existing tree cover will be required.

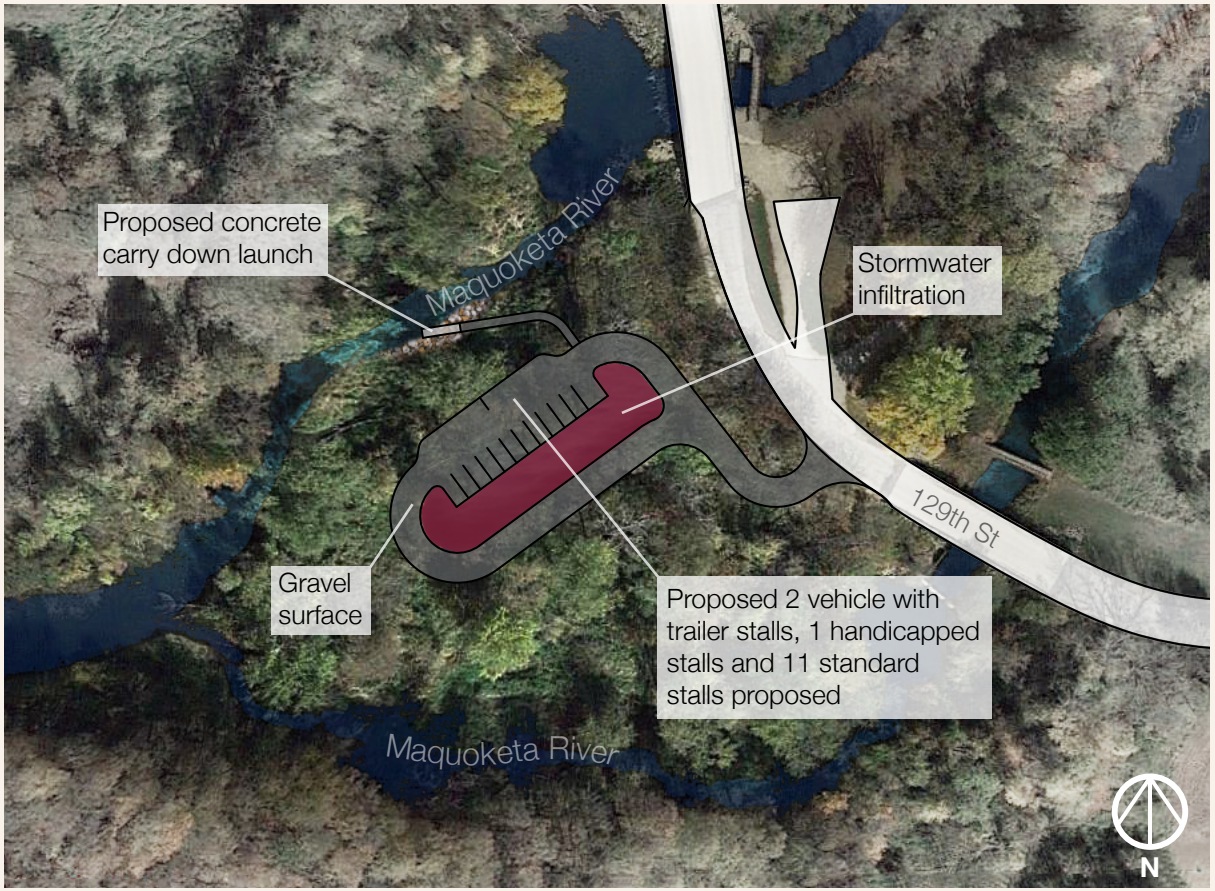
Figure 10
A lack of highly suitable access sites exist near the Backbone Dam. The most promising location is forested and located downstream of the park road crossing.



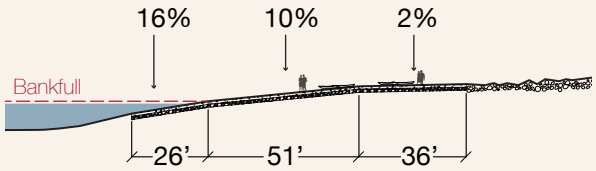
SEGMENT R2: **Backbone State Park to Lindsey Bridge Access**

Backbone State Park

- Auditorium
- Open air shelters
- 16 year-round modern cabins
- Electric and non-electric camping
- Multi-use trails
- Northeast Iowa Bike Route
- Swimming
- Boating
- Fishing
- Climbing
- Iowa Civilian Conservation Corps Museum
- Rental: paddle boat, kayak
- Playground
- Wildlife viewing



R2.A *New River Access at Backbone Lake Dam*



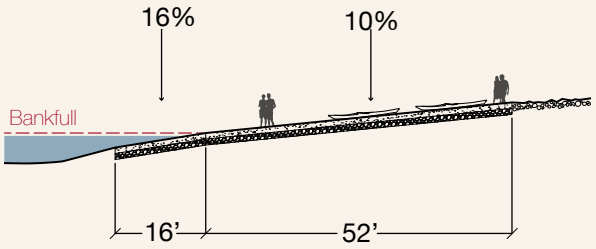
R2.A *A constructed river access will improve launching conditions for paddlers and anglers on this beautiful reach of the river.*

Dundee Wildlife Area

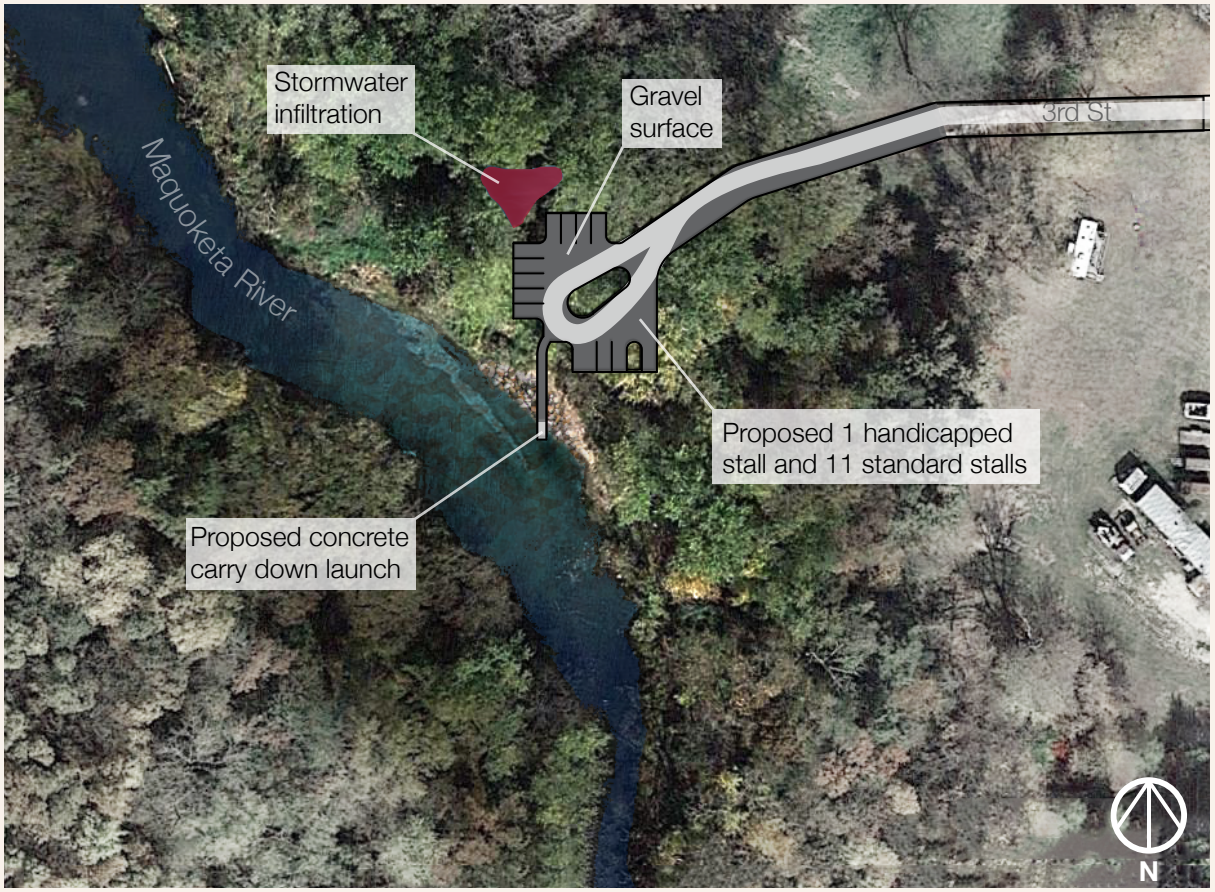
- Fishing
- Hunting with restrictions
- Undeveloped natural areas

R 2.B
Dundee Access Upgrade

The existing access at Dundee is primitive but functional. Recommended upgrades include a carry-down launch, 13 parking stalls and preservation of 3 mature oak trees. Also recommended is widening the entrance road to allow for a 2-vehicle width, although these costs are not included in the cost estimate.



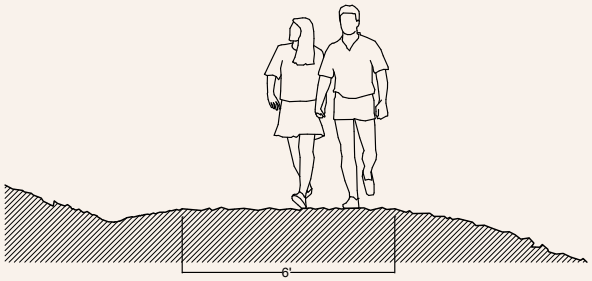
R2.B *The existing river access at Dundee is both overly steep and angled perpendicular to the channel. The new design reduces the slope by nearly 50% and angles the launch appropriately.*



R2.B *Dundee Access Upgrade*

R 2.C
Trail Extension: Strawberry Point to Backbone State Park

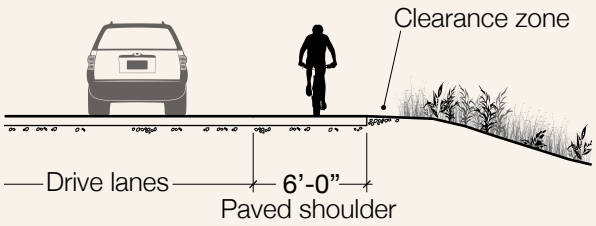
An off-road trail extension is recommended between the existing trails in Backbone State Park and the community of Strawberry Point. Strawberry Point has multiple business amenities and would provide a vital connection for trail and park users.



R2.C *A trail connection between Strawberry Point and Backbone State Park will benefit people in both locations.*

R 2.D
Bike Trail Extension

An extension of the on-road trail system is planned for Firefly road connecting Manchester to Dundee.



R2.D *Some roads currently being used by bicycles are more narrow than desired. Additional bike lanes are recommended on these routes.*

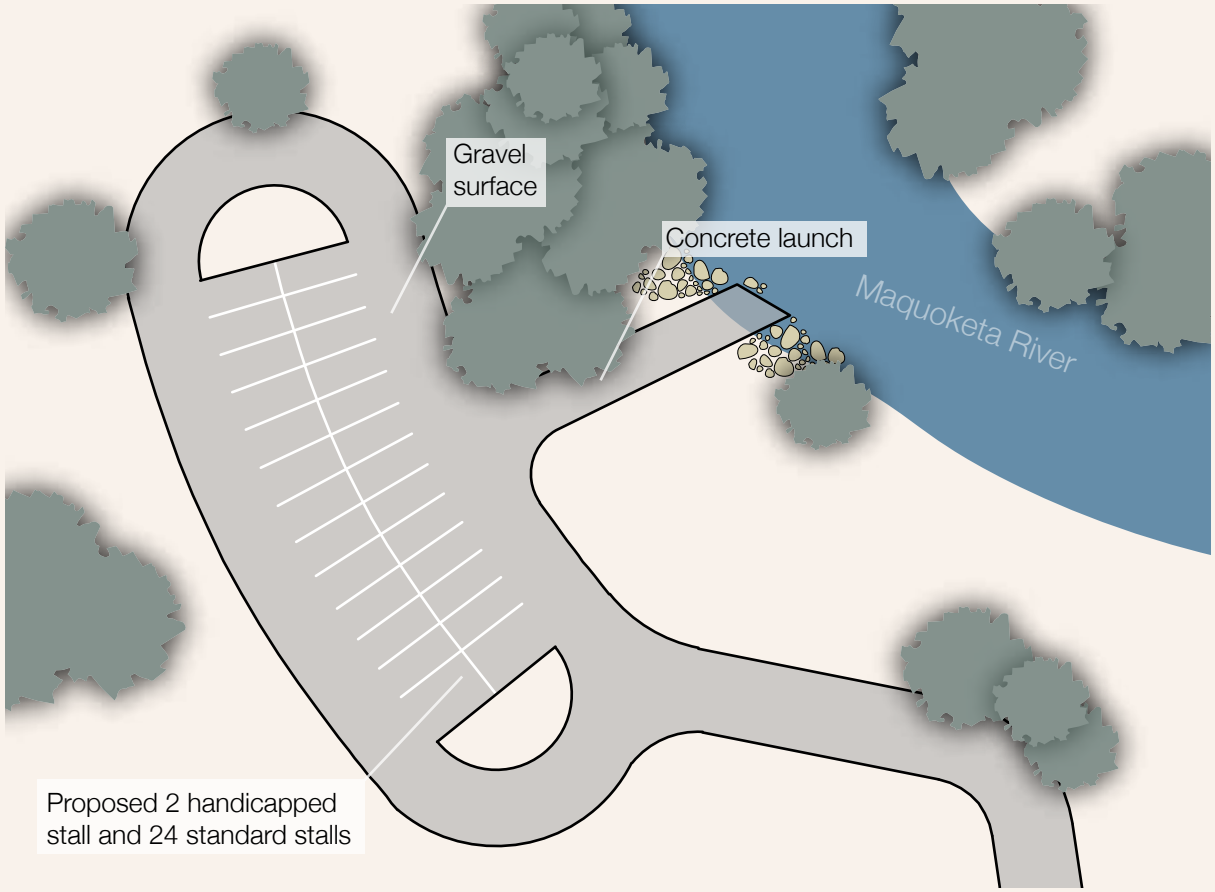
R 2.E
Flag Fence Crossings

Two barbed-wire fences across the channel were noted on this reach in 2015; neither were marked with warning flags for river users. Communication and coordination with the landowner is recommended.

R 2.F
New Lindsey Bridge Access

The recommended features at this access include a carry-down launch and parking for 25 cars. Approximately 3.2 acres of land are required with a location not on an outside bend of the river. None of the landowners adjacent to the existing access are willing to sell or lease land for a new river access. The Delaware County Engineer will become involved and resolve either by identifying a new access location and purchasing the land or by modifying 145th Avenue, adjacent to the access entry, to allow for safe vehicle parking conditions. Site designs were not developed for a specific location due to this uncertainty. A generic access design meeting the recommended sizes is included in this plan.

R2.F *Lindsey Bridge Access is one of the most heavily used and the most primative launch in Delaware County. The existing launch requires additional space to accommodate parking for up to 25 cars as well as a proper launch surface.*



R2 Permitting Considerations

Disturbance for launch and parking improvements for water trail accesses at Backbone Lake Dam, Dundee and Lindsey Bridge Accesses will likely require a Phase I archaeological investigation unless previous disturbance of these construction areas can be verified.

SEGMENT 2 COST ESTIMATES		
RECOMMENDATIONS	MAP CODE	COST ESTIMATE
New Backbone State Park River Access	R2.A	$180,452
Dundee Access Upgrade	R2.B	$44,623
Off-Road Bike Trail Extension Between Strawberry Point & Backbone State Park	R2.C	
On-Road Trail Extension on Firefly Road to 150th Street/Existing On-Road Bike Trail	R2.D	
Flag Fence Crossing	R2.E	$0
New Lindsey Bridge Access (new location)	R2.F	$82,286

SEGMENT R3: **Lindsey Bridge Access to Manchester Municipal Boundary**

Existing Conditions

The segment of the river is 4.7 miles in length and has a moderate level of use by paddlers. This is a rural paddling experience with few homes or farm operations visible; homes and cabins become more common near Quaker Mill and Manchester. Rock outcroppings are visible on this segment as are a high diversity of bird species.

Issues and Opportunities

Currently there is no functional river access at Quaker Mill dam which was breached in 2010 *(Figure 11)*. The river bypassed the dam and existing access completely as a result of the breach. This lack of access likely influences the number of river users.

Figure 11

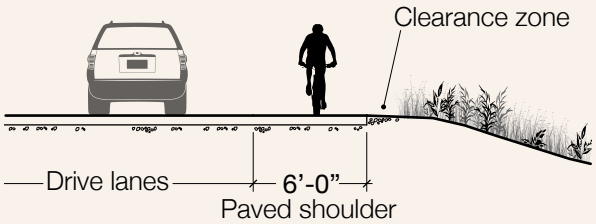
The stability of the Quaker Mill dam had been in question for several years prior to its breach, shown left, in 2010.

R 3.A
Quaker Mill Access Upgrade

Iowa DNR is designing both a modification to the dam and adjacent river channel as well as a new access and parking.

R 3.B
Bike Route Extension

An extension of the on-road trail system is planned for Firefly road connecting Manchester to Dundee.

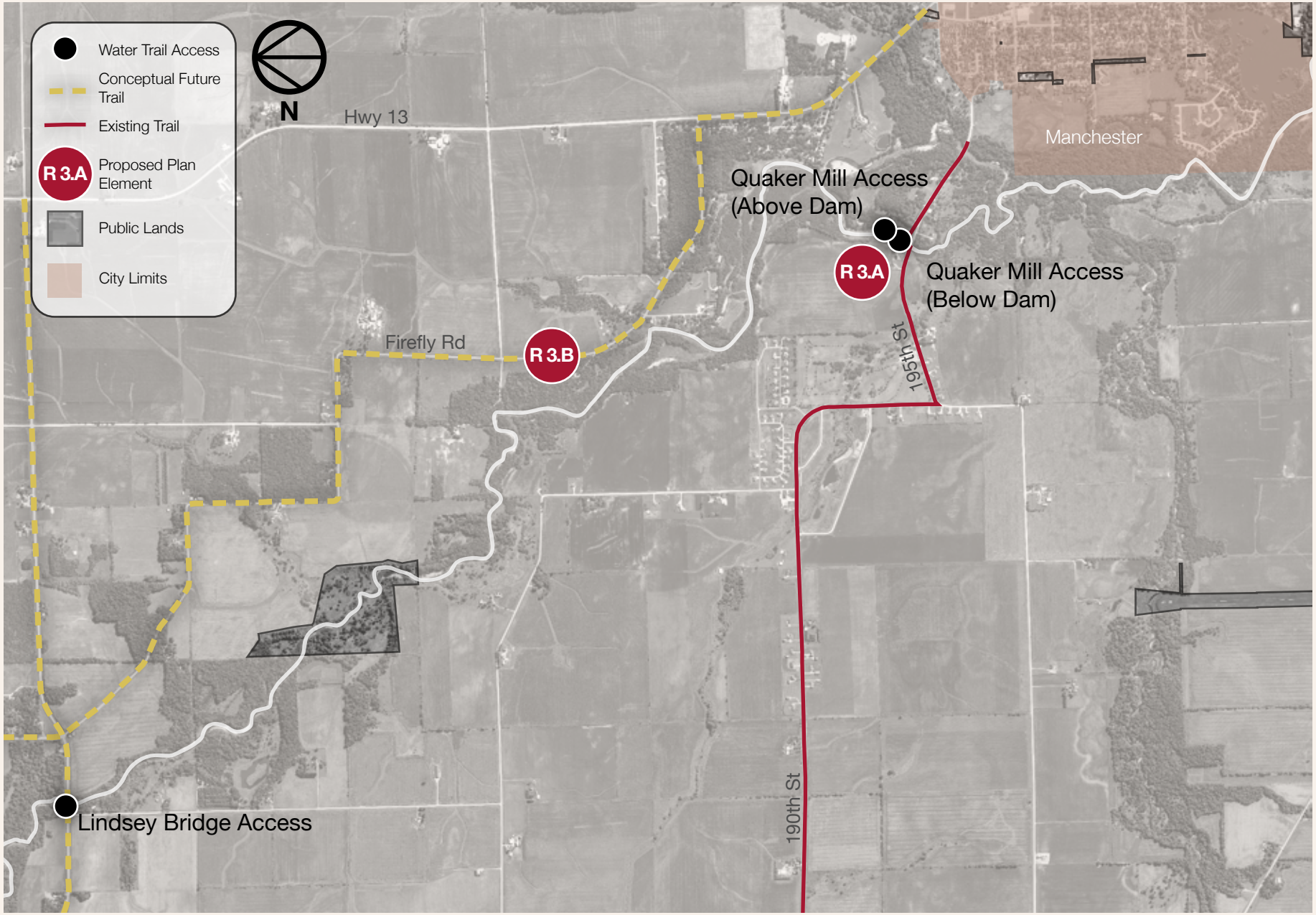


R3.B *Some roads currently being used by bicycles are more narrow than desired. Additional bike lanes are recommended on these routes.*

R3 Permitting Considerations

Disturbance for launch and parking improvements for water trail access at Quaker Mill Dam will likely require a Phase I archaeological investigation unless previous disturbance of the site can be verified or the area of the access was included in Phase I investigations conducted for the dam mitigation.

SEGMENT 3 COST ESTIMATES		
RECOMMENDATIONS	MAP CODE	COST ESTIMATE
On-Road Bike Trial Extension	R3.B	



SEGMENT R3: **Lindsey Bridge Access to Manchester Municipal Boundary**

SEGMENT R4: **Manchester Municipal Boundary to Highway 20**

Existing Conditions

The segment of the river is 3.6 miles in length and portions have a high level of use by paddlers. This segment flows through the City of Manchester and the Manchester Whitewater Park *(Figure 12)*. The river is much wider and slower, with the exception of the Whitewater Park, on this segment. Mid-channel aggradation is apparent between Tirrill Park and the Whitewater Park.

Issues and Opportunities

Manchester is the only urban area included on this water trail and provides full service amenities near the river with the exception of a public restroom. The Whitewater Park is a large attraction and will be classified as a Challenge segment. Use of the river downstream of the park has drastically increased since it opened in 2015. The Whitewater Park functions well as a stand-alone park but isn't designed to accommodate users on the river immediately upstream and downstream of it. There is need for a full service river access below the Whitewater Park, as there is no place for people to get on the river and paddle downstream. This segment, from downstream of the Whitewater Park to Pin Oak Access has been identified as a future Gateway use classification segment.

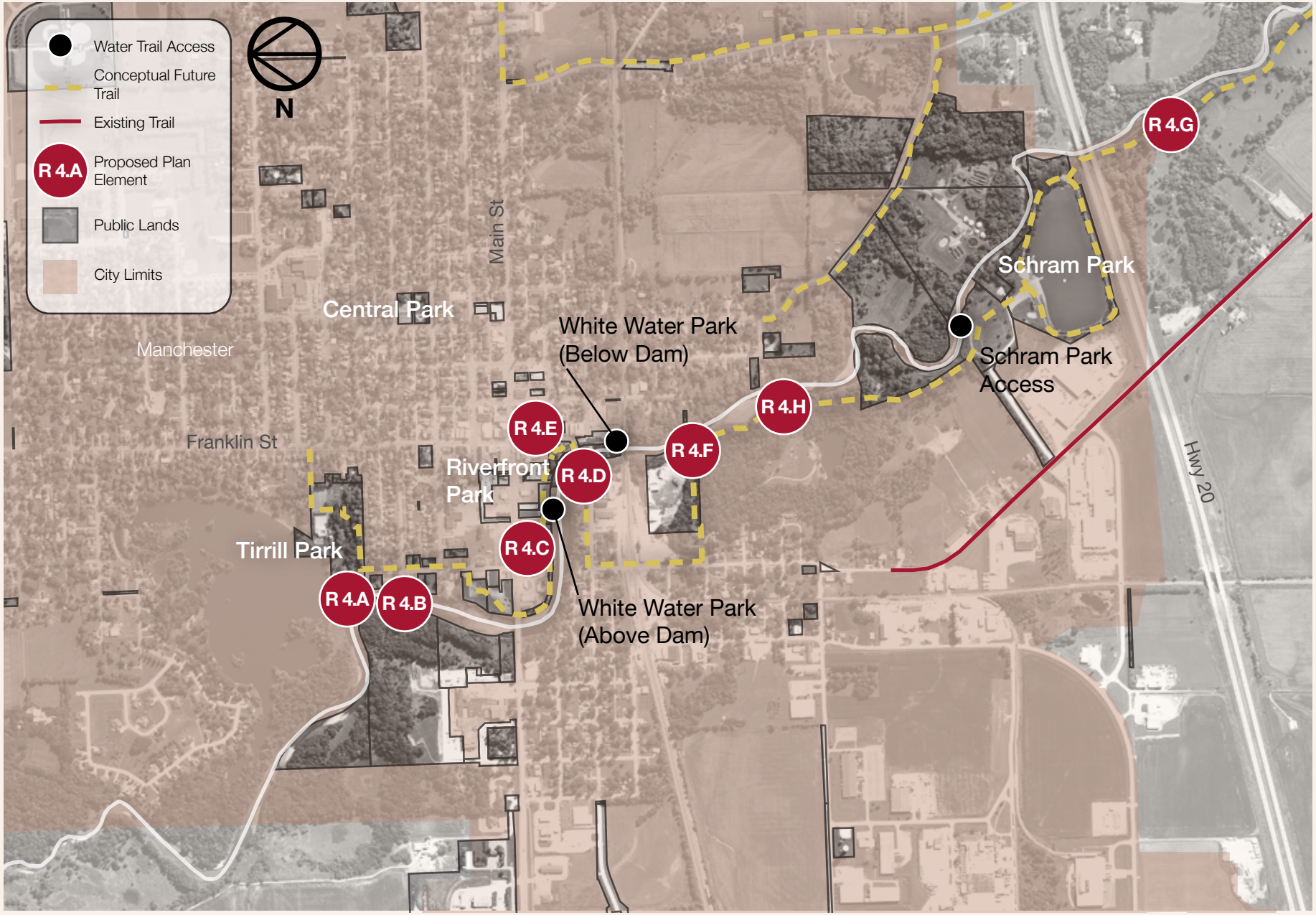
This segment also includes two existing accesses that will not be included longterm in the water trail. The Schram Park Access is a newer motor boat-style access. Schram Park is primarily a water-ski lake park and is visible from Highway 20; it is difficult to navigate to if unfamiliar with Manchester. The Schram Park Access will be included in the designated water trail until a new Gateway Launch is constructed downstream of the Whitewater Park. At that point the access will not be included in the designated water trail. Tirrill Park Access is not included in the designated water trail.

Figure 12
The Whitewater Park in Manchester has become a large draw for people recreating on and near the Maquoketa River.

R 4.A
Remove Tirrill Park Access

The access at Tirrill Park is a hog slat carry-down style launch located 0.6 miles upstream of the Manchester Whitewater Park. Due to high water and streambank erosion, the hog slats are now cantilevered out over the river above normal water elevation and pose a hazard *(Figure 13)*. The City of Manchester plans to remove and not replace the launch.

Figure 13
This hogslat-style launch at Tirrill Park has become damaged because of the way it was constructed and due to high water and streambank erosion.



SEGMENT R4: **Manchester Municipal Boundary to Highway 20**

Tirrill Park

- Playground area
- Two shelters
- Bandshell
- Restrooms
- Tennis Courts
- Grills
- Fishing
- Tirrill Rose Garden
- Aquatic Center
- Pave multi-use trail

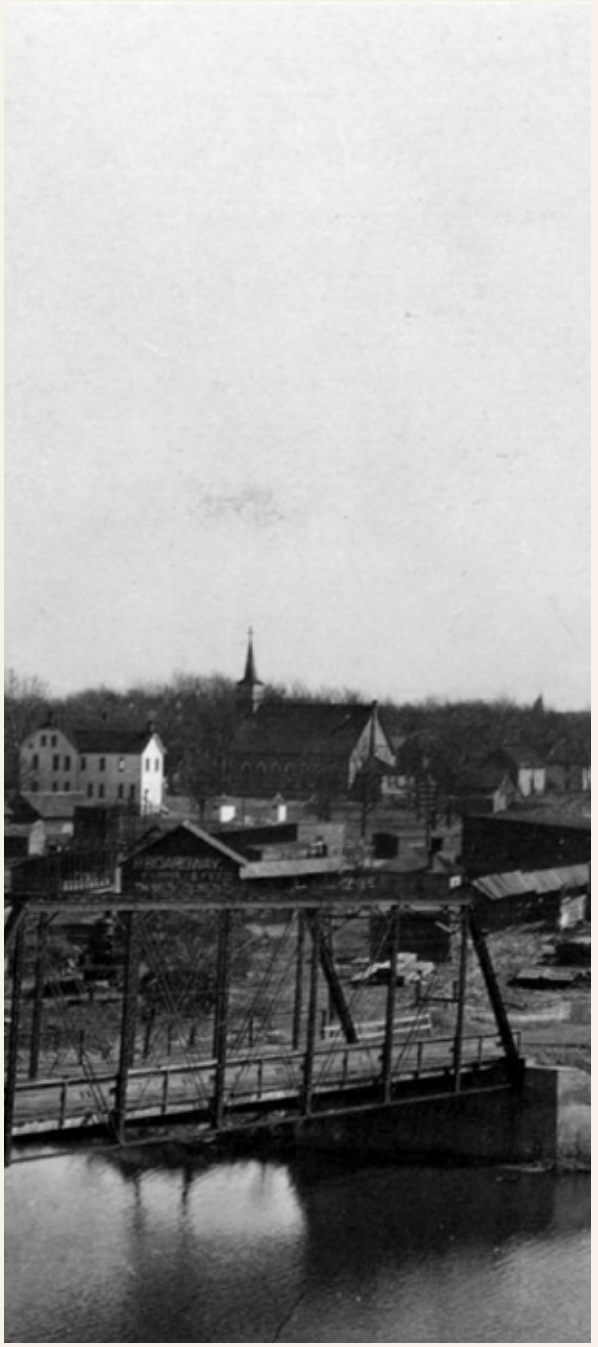
R 4.B
Butler Road Primitive Boat Launch

A primitive motor boat style launch is recommended on Butler Road where it dead-ends at the river *(Figure 14)*. This launch will serve the needs of fishing boats launching to go upstream of the Whitewater Park.

Figure 14
Butler Road right of way is already being used informally as a launch for fishing boats. A gravel surface is recommended.

Howard and Helen Shelly Memorial Park

- Paved multi-use trail
- Gazebo
- Flower garden
- White Water Park access and viewing
- Fishing



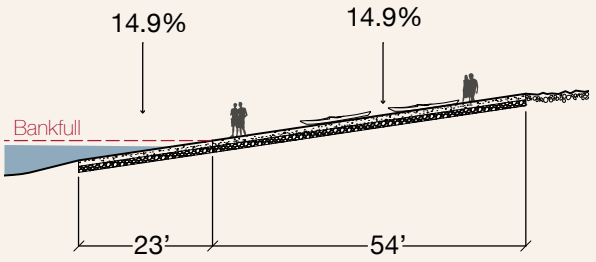
R 4.C
River Access Upstream of Whitewater Park

The access constructed at the upper limits of the Whitewater Park is designed to accommodate users entering the river to use the park; it is located very close to the first rock weir *(Figure 15)*. River users paddling from upstream and wishing to exit the river prior to the Whitewater Park feel unsafe floating this close to the first weir. Also, the surface of the existing launch is large, grouted limestone rock which has a very uneven surface. Older paddlers and those carrying heavy boats feel they have unsure footing on this surface. A new carry-down style hard-surfaced launch is recommended slightly upstream of the Whitewater Park.

R4.C *Whitewater Park Upstream Access*

Figure 15

River users find the river access designed on the upstream end of the Whitewater Park is difficult to maneuver. A simple carry down launch slightly upstream is recommended to separate the whitewater from the river users.



R4.C *The recommended launch is a concrete carry down style. While slightly steeper than the existing Whitewater access, it is designed to better meet the needs of general river users.*

R 4.D
Repair Rock Weir

At least one person has become caught in a rock weir while on the water in the Whitewater Park. This may be due to the design and/or construction of the weir. Locally it is understood that this weir was constructed differently from the others. Evaluation and repair of this condition is recommended.

R 4.E
Public Restrooms & Shower

The need for public restrooms and possibly a shower near the Whitewater Park is widely acknowledged locally. The City has several alternative locations near the Whitewater Park.

R 4.F
Gateway Access Downstream of Whitewater Park

The Whitewater Park is the hub of public activity in Manchester as well as on the river in Delaware County. It generates a high level of use and people-watchers. The facility lacks access for people with boats at the bottom of the Park due both to topography and available land *(Figure 16)*. A new Gateway use classification segment is recommended beginning at the bottom of the Whitewater Park and ending at Pin Oak Access. A new full service access located at the downstream end of the Whitewater Park will draw more people downtown, solve the problem of having no access and parking at the bottom of the Park and provide a Gateway launching experience. After considering multiple sites, the Steering Group agreed that the location adjacent to the City Maintenance Yard is the best available alternative. This option will require additional land from the adjacent landowner who has agreed to this need.

R4.F *Gateway Access Downstream of Whitewater Park*

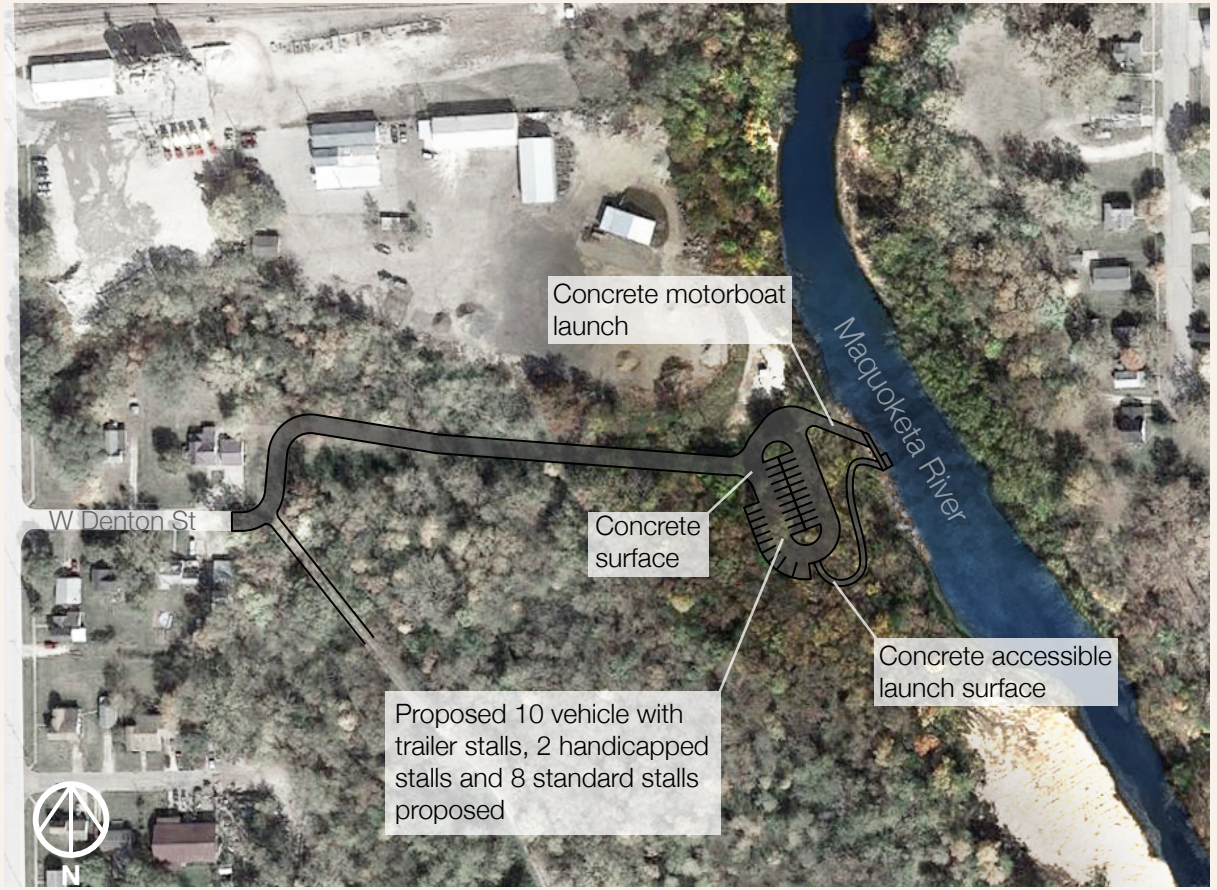
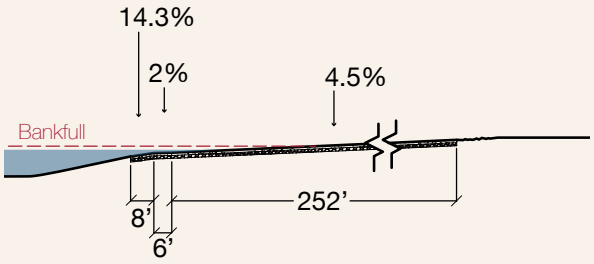
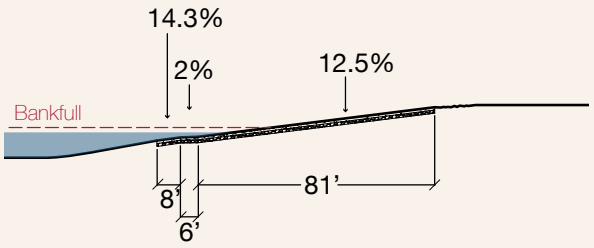


Figure 16
Whitewater Park users on the downstream end of the rapids have created this very steep and uneven path to access adjacent parking in the Fareway Grocery parking lot. This is the only existing location to move between the rapids and the parking on the downstream end of the Whitewater Park.



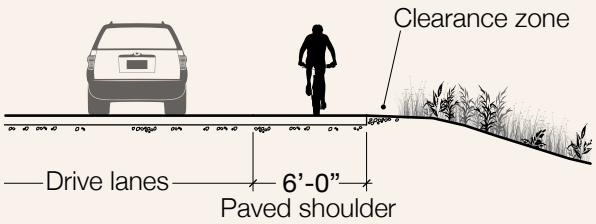
R4.F *The proposed carry down launch portion of the new Gateway style access is designed to meet the ADA specification for sidewalks.*



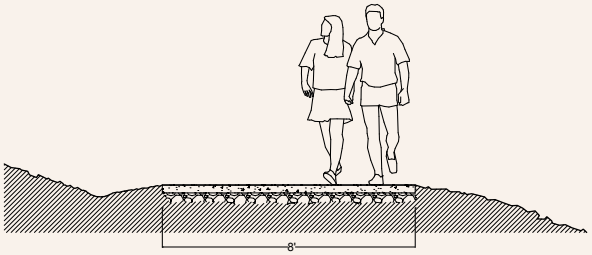
R4.F *The proposed vehicle ramp portion of the new Gateway style access is wider and more steep than the adjacent carry down portion.*

R 4.G
Bike & Pedestrian Trail Extensions

Multiple land trail segments are proposed in and surrounding Manchester. Both on- and off-road extensions are planned.



R4.G *Some roads currently being used by bicycles are more narrow than desired. Additional bike lanes are recommended on these routes.*



R4.G *Manchester’s land trail system is largely in place. A few segments are planned that have not been constructed yet.*

Schram Park

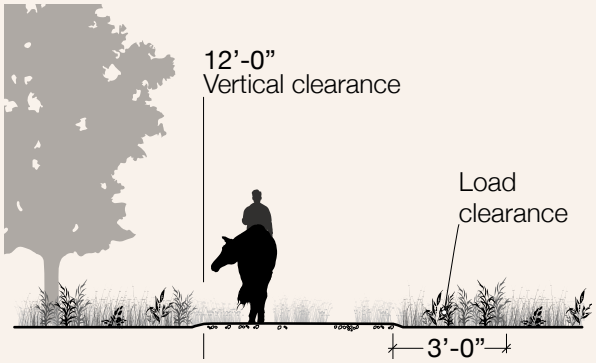
- Shelter
- Limestone walking path
- Water Ski Shows
- Playground
- Restrooms
- Pond with boat access (electric motors only)
- Fishing

R4 Permitting Considerations

Disturbance for launch and parking improvements for the Gateway water trail access downstream of the Whitewater Park will likely require a Phase I archaeological investigation for portions of the site previously undisturbed unless previous disturbance can be verified.

R 4.H
New Equestrian Trail

Interest exists for a new equestrian trail on land recently acquired by the Manchester Hospital on the west side of the Maquoketa River. Ideally this trail would follow the river downstream and connect with Pin Oak Access.



R4.H *The recommended equestrian trail route will require willing landowners to grant easements for establishment of the trail.*

SEGMENT R4 COST ESTIMATES		
RECOMMENDATIONS	MAP CODE	COST ESTIMATE
Remove Damaged Tirrill Park River Access	R4.A	$0
New Primative Motorized Boat Ramp	R4.B	$500
Upgrade Existing Access Above Whitewater Park	R4.C	$14,208
Repair Rock Weir to Avoid Injuries	R4.D	Completed
New Gateway Access Downstream of Whitewater Park	R4.E	$130,588
New Restrooms & Shower Near Whitewater Park	R4.F	
Bike and Pedestrian Trail Extension	R4.G	
New Equestrian Trail	R4.H	

SEGMENT R5: **Highway 20 to Bailey's Ford Park**

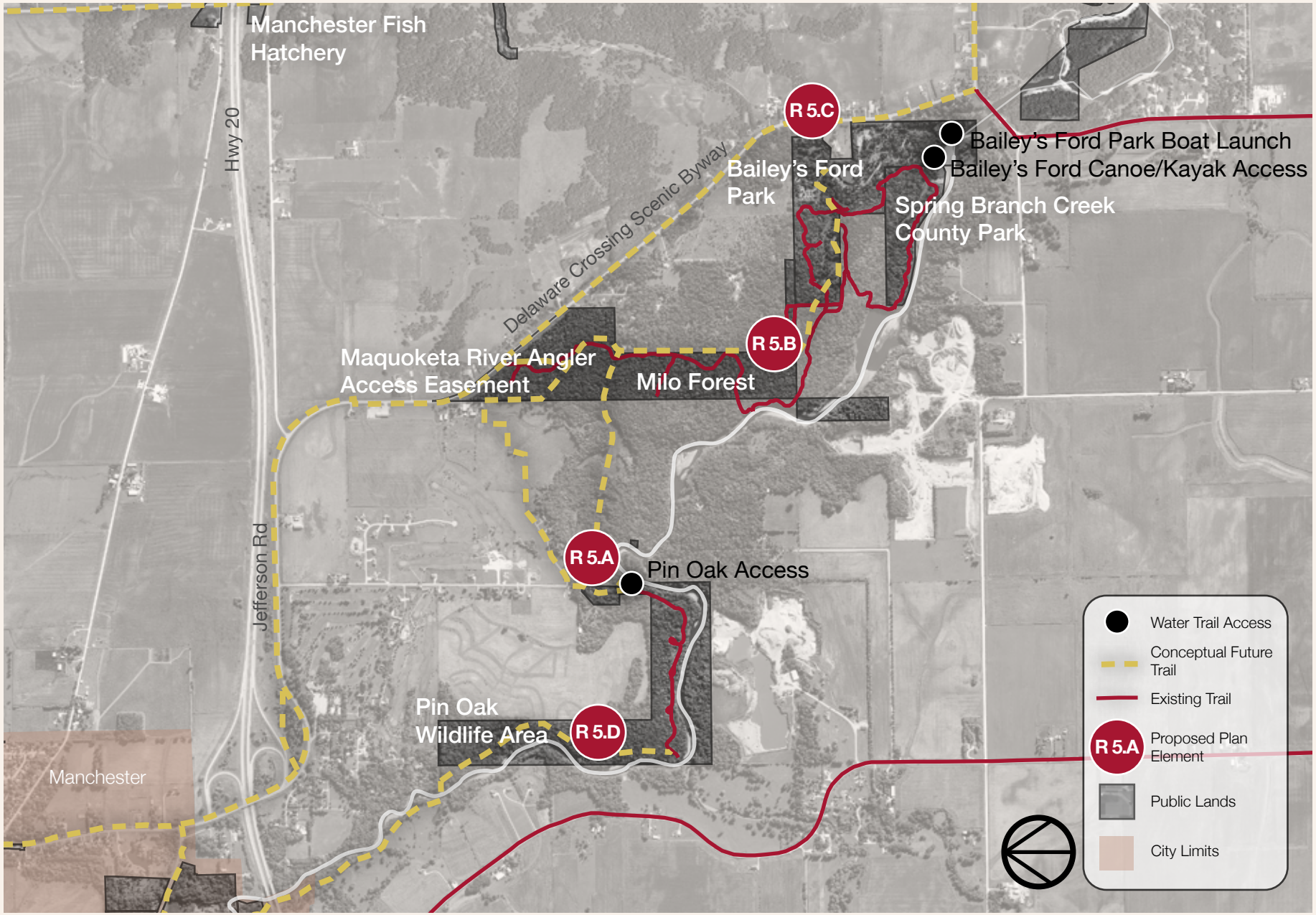
Existing Conditions

This segment of the river is 4.2 miles in length and has a high level of use by paddlers traveling from Manchester downstream to Bailey's Ford Park. Bailey's Ford Park is Delaware County's full-service park with many amenities. The Park is also located at the upper limits of Lake Delhi *(Figure 17)*. Non-motorized boats generally feel unsafe paddling beyond Bailey's Ford Park onto Lake Delhi during summer weekends due to the heavy motor boat traffic there and the difficulty of enforcing speed limits on the lake.

Issues and Opportunities

Accesses and facilities at Bailey's Ford Park were upgraded during the planning phase of this project and meet all water trail standards. Separate motor boat and paddling launches are provided as well as accessible restrooms and a large parking area near the river. The existing launch at Pin Oak Park is a damaged carry-down, hog slat design. Pin Oak will be the future downstream limits of the Gateway segment.

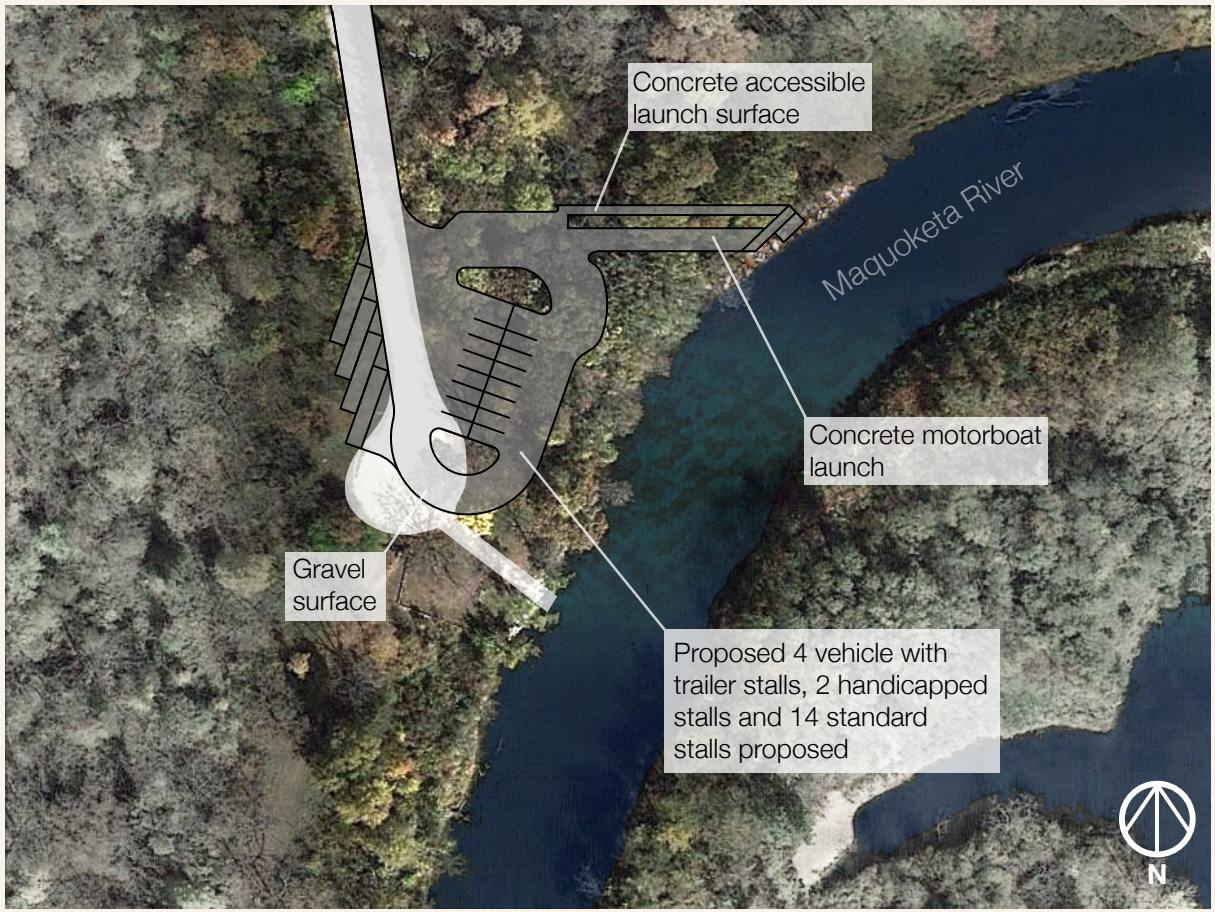
Figure 17
The newly constructed and operating Delhi Dam Delhi Dam is 55 feet high. It replaced the failed dam of the same height built between 1922 and 1929.



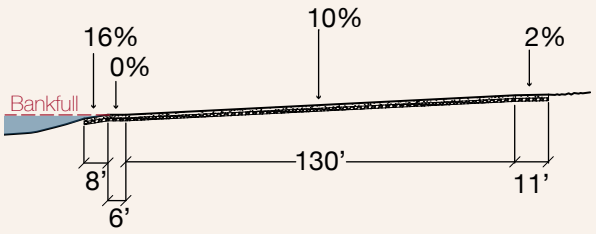
SEGMENT R5: **Highway 20 to Bailey's Ford Park**

R 5.A
Pin Oak Access Upgrades to Gateway Use Classification

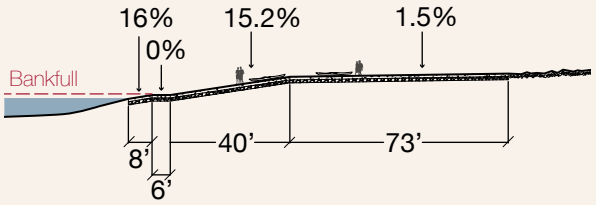
Gateway accesses typically include larger parking areas compared to non-gateway accesses. They also include Universal Design launches which allow both a vehicle and pedestrians to access the same location at the river edge at the same time. Slope on the pedestrian walk and launch meet or exceed ADA requirements; typically launches on Iowa rivers are much steeper. The recommended upgrades include these features as well as parking for 16 cars and 4 vehicles with trailers. Construction of this launch will require an easement from the adjacent landowner, who is willing.



R5.A *Pin Oak Access Upgrades to Gateway Use Classification*



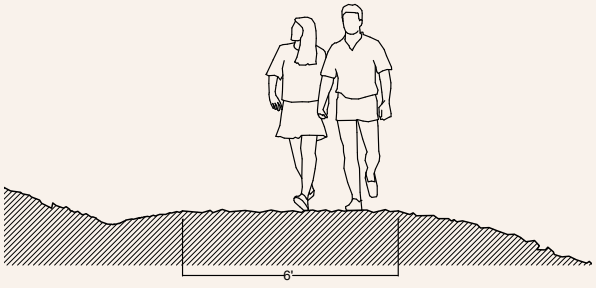
R5.A *The proposed carry down launch portion of the new Gateway style access is designed to meet the ADA specification for sidewalks.*



R5.A *The proposed vehicle ramp portion of the new Gateway style access is wider and more steep than the adjacent carry down portion.*

R 5.B
Off-Road Trail Extension

Off-road soft trails are planned connecting Bailey's Ford Park, Milo Forest and Pin Oak Access and Manchester. These will complement the existing 4.5 miles of trails already existing in this area.



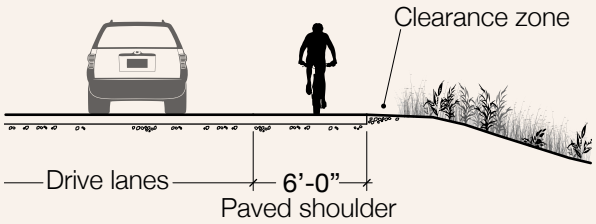
R5.B *Hiking in Bailey's Ford Park and Milo Forest is very popular. These trail extensions will add value to the overall trail system.*

Milo Forest

- Hiking trails
- Hunting
- Undeveloped natural areas

R 5.C
On-Road Trail Extension

On-road trail extensions are planned connecting Schram Park in Manchester with Bailey's Ford Park and Lake Delhi.



R5.C *Some roads currently being used by bicycles are more narrow than desired. Additional bike lanes are recommended on these routes.*

Pin Oak Wildlife Area

- Hiking trails
- Fishing
- Hunting
- Undeveloped natural areas

R 5.D
New Equestrian Trail

Interest exists for a new equestrian trail on land recently acquired by the Manchester Hospital on the west side of the Maquoketa River. This segment of this trail spans between Highway 20 and Pin Oak Access.

Kuhlman Wildlife Area

- Hiking trails
- Fishing
- Hunting

Baileys Ford Park

- Delaware County Conservation Board office
- RV camping with electric/water
- Tent camping
- Drinking fountains
- Showers
- Pit Toilets & Dump Station
- Picnic shelters with/without electric
- Play Equipment
- Nature Center & Wildlife Exhibit
- Hiking trails
- River & Trout fishing
- Hunting

SEGMENT R5 COST ESTIMATES		
RECOMMENDATIONS	MAP CODE	COST ESTIMATE
New Gateway Access at Pin Oak Access	R5.A	$62,872
Off-Road Trail Extension	R5.B	
On-Road Trail Extension	R5.C	
New Equestrian Trail	R5.D	

R5 Permitting Considerations

Disturbance for launch and parking improvements for water trail access at Pin Oak and the soft trail construction south of Highway 20 will likely require a Phase I archaeological investigation unless previous disturbance of these areas can be verified.

RECREATIONAL DEVELOPMENT CONCLUSIONS

All recommended elements are summarized and organized in Appendix A including the lead entity, partners, location, estimated costs and local prioritization. Resource conservation and protection project elements are also integrated into this appendix.

Permitting Considerations

As with all construction on and near rivers, multiple permits are required prior to any disturbance. The following are expected:

- Local City (Manchester) and Delaware County have permitting processes for developing on a floodplain
- Joint permit application shared between the DNR flood plain development program, the DNR sovereign lands program, and the U.S. Army Corps of Engineers

As noted earlier in each plan segment, additional investigations and permits are required in some locations. These requirements are related to the sensitive nature of the known and not-yet identified cultural resource sites. These restrictions can affect vegetation removal, revegetation techniques and earthwork.

Potential Partners and Funding Sources

Funding and development of each plan element is the responsibility of the lead jurisdiction with oversight from the water trail manager. A number of local and state partner organizations and agencies are organized and positioned to assist with development of individual plan elements. Examples of partners include:

- Non-Profit Organizations such as Iowa Natural Heritage Foundation, Manchester Good to Great, Foundation for the Future of Delaware County and Greater Delaware County Community Foundation
- Local and State Agencies including Delaware Soil and Water Conservation District, Iowa Department of Transportation, Iowa Office of State Archaeologist, State Historical Society of Iowa, Iowa Department of Natural Resources, Iowa Economic Development Authority

Sections of this recreational development plan are intended to stand alone for use in funding proposals. Likely funding partners to supplement local funds include federal and state agencies and grant programs such as Resource Enhancement and Protection (REAP), State Water Trail grants, state and federal recreational trails program funding, regional Transportation Enhancements Program funding, statewide Transportation Enhancements Program funding, the Land and Water Conservation Fund, Wildlife Conservation and Appreciation funds from U.S. Fish and Wildlife Service.

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APPENDICES

Map Code	Location	Lead Jurisdiction	Recommendation	Local Prioritization	Budget Estimate for River-Related Recommendations	Other Collaborators	Notes
R1.A	River Corridor	Iowa DNR	On-Water Rescue Capacity Building	2	$0		
R1.B	River Corridor	Delaware CCB	Communication Among Access Managers	1	Reimbursable from IDNR		
R1.C	River Corridor	Iowa DNR	Public Interpretative Plan & Education Program	2	$0		
R1.D	River Corridor	Iowa DNR	Water Trail Wayfinding Signage Plan	1	$0	Water Trail Sponsor	
R1.E	River Corridor	Iowa DNR	New Water Trail Map	1	$0		
R1.F	River Corridor	Delaware CCB	Dry Hydrant Installation Study (at some accesses)	3			
C1.A	River Corridor	Delaware CCB	Enhance Aquatic Habitat for Fish and Mussels	2		Iowa DNR Fisheries, local angler organizations	
C1.B	River Corridor	Delaware CCB	Additional Archaeological Study	3		Outside Consultant, Iowa Office of the State Archaeologist	
C1.C	River Corridor	Delaware CCB	Vegetative Buffer Establishment (entire length)	2	$4,500	Willing Landowners, Delaware Soil & Water Conservation District	
C1.D	River Corridor	Delaware CCB	Explore Voluntary Riparian Forest Protection	3		Iowa Natural Heritage Foundation	
C1.E	Maquoketa Watershed	Delaware CCB	Support Delaware SWCD to work with landowners to reduce bacteria loading into the Maquoketa	1		Manchester Good to Great	
C1.F	Maquoketa Watershed	Delaware CCB	Increase Voluntary Monitoring	1		IOWATER, Manchester Good to Great	
C1.G	River Corridor	Delaware CCB	Use an established 501c3 to support development and conservation on the water trail	1	$0	Manchester Good to Great	
R2.A	Backbone State Park	Iowa DNR State Parks	New Backbone State Park River Access	3	$180,452	Iowa DNR	
R2.B	Dundee	Delaware CCB	Dundee Access Upgrade	2	$44,623		
R2.C	Strawberry Point to Backbone State Park	Backbone-Maquoketa Valley Trails	Off-Road Bike Trail Extension Between Strawberry Point & Backbone State Park	3			
R2.D	Dundee to Manchester	Backbone-Maquoketa Valley Trails	On-Road Trail Extension on Firefly Road to 150th Street/Existing On-Road Bike Trail	3			

Map Code	Location	Lead Jurisdiction	Recommendation	Local Prioritization	Budget Estimate for River-Related Recommendations	Other Collaborators	Notes
R2.E	Dundee Access to Lindsey Bridge Access	Delaware CCB	Flag Fence Crossings	1	$0	Willing Landowners, Manchester Good to Great	
R2.F	Near 165th Street & 150th Avenue	Delaware CCB	New Lindsey Bridge Access (new location)	1	$82,286	Delaware County Engineer, Manchester Good to Great, Iowa DNR	
C2.A	Dundee Access to Existing Lindsey Bridge Access	Iowa DNR	River Technical Assessment in Non-Bedrock Controlled Sections	1	$50,000	Delaware County Engineer, Delaware SWCD	
C2.B	River Corridor	Delaware CCB	Streambank Restoration	1	$2,283,555	Willing Landowners, Iowa DNR	
C2.C	Dundee Access	Delaware CCB	Legacy Dumpsite Cleanup	3		Manchester Good to Great	
R3.B	Firefly Road/140th Street	Backbone-Maquoketa Valley Trails	On-Road Bike Trail Extensions	3		Manchester Good to Great, Delaware County Engineer	
C3.A	Quaker Mill Dam	Iowa DNR	Quaker Mill Dam Modification ($504,000 total cost)	1	$252,000	Willing Landowner, Delaware County Engineer	
C3.B	River Corridor	Water Trail Sponsor	Streambank Restoration	1	$436,655	Willing Landowners, Iowa DNR	
R4.A	Manchester	City of Manchester	Remove Damaged Tirrill Park River Access	3	$0	Manchester Good to Great	
R4.B	Butler Road, Manchester	City of Manchester	New Primitive Motorized Boat Ramp	3	$500	Manchester Good to Great	
R4.C	Whitewater Park	City of Manchester	Upgrade Existing Access Above Whitewater Park	1	$14,208	Manchester Good to Great	
R4.D	Whitewater Park	City of Manchester	Repair Rock Weir to Avoid Injuries	1	Completed	Manchester Good to Great	
R4.E	Manchester	City of Manchester	New Gateway Access Downstream of Whitewater Park	2	$130,588	Manchester Good to Great	
R4.F	Manchester	City of Manchester	New Restrooms & Shower Near Whitewater Park	1		Manchester Good to Great	
R4.G	Manchester	City of Manchester	Bike and Pedestrian Trail Extensions	2		Manchester Good to Great	
R4.H	Manchester - Regional Medical Center to City Limits	Manchester - Regional Medical Center, City of Manchester	New Equestrian Trail	3		Interested Residents, Willing Landowners, Manchester Good to Great	
C4.A	River Corridor	City of Manchester	Streambank Restoration	2	$165,485	Willing Landowners, Iowa DNR, Manchester Good to Great	

Map Code	Location	Lead Jurisdiction	Recommendation	Local Prioritization	Budget Estimate for River-Related Recommendations	Other Collaborators	Notes
C4.B	Manchester Wastewater Treatment Plant	City of Manchester	Legacy Dumpsite Cleanup	2		Manchester Good to Great	
C4.C	Manchester	City of Manchester	Explore Greenbelt Protection Zoning	3		Outside Consultant, Manchester Good to Great	
R5.A	Pin Oak Access	Delaware CCB	New Gateway Access at Pin Oak Access	1	$62,872	Manchester Good to Great	
R5.B	Schram Park to Bailey's Ford Park	Delaware CCB	Off-Road Trail Extension	2		Backbone - Maquoketa Valley Trails, Manchester Good to Great	
R5.C	Milo Forest to Lake Delhi	Delaware County Engineer	On-Road Trail Extension	3		Backbone - Maquoketa Valley Trails, Manchester Good to Great	
R5.D	Manchester City Limits to Pin Oak Access	Delaware CCB	New Equestrian Trail	3		Interested Residents, Willing Landowners	
C5.A	River Corridor	Water Trail Sponsor	Streambank Restoration	1	$908,040	Delaware County Engineer, Iowa DNR, Willing Landowners	
C5.B	Milo Forest to Bailey's Ford Park	Delaware CCB	Forest Management Plan	2	$0	Iowa DNR District Forester	
C5.C	Iowa DNR Fish Hatchery	Iowa DNR	Interpretive Signage at Hatchery & Historic Spring Branch Creamery Site	3		Delaware Historical Society, Manchester Good to Great	

CHAPTER 4
RESOURCE CONSERVATION & PROTECTION PLAN

MAQUOKETA WATER TRAIL

ACKNOWLEDGMENTS

This Water Trail Plan prepared by Mimi Wagner, Lucas Buscher and Jacob Wilson of Iowa State University. Delaware County Conservation Board staff and the Manchester Good to Great provided leadership and local support of the project throughout the process. Garlyn Glanz, Delaware County Conservation Board Director, and Tim Vick, Manchester City Manager provided review and interpretation. Nate Hoogeveen, John Wenck and Heath Delzell of Iowa Department of Natural Resources provided technical support.

The project Steering Committee provided valuable insight and direction throughout all planning phases:

Garlyn Glanz, Director of Delaware County Conservation Board
Mike Shmitz, Delaware County Conservation Board member & Pheasants Forever
Dave Sunne, Backbone State Park
Dennis Meggers, Friends of Backbone State Park
Tim Vick, City of Manchester
Barb Robinson, City of Dundee
Dave Gibbs, Backbone Maquoketa River Valley Trails
Joan Salow, Backbone Maquoketa River Valley Trails
Rick Martens, Iowa Department of Natural Resources
Chuck Ungs, Wickiup Outdoor Learning Center in Toddville
Dean Sherman, Manchester Good to Great Committee
Taylor Matteson, Manchester Good to Great Committee
Ryan Wicks, Manchester Good to Great Committee
Mark Winn, Iowa DNR Fish Hatchery
Doug Hawker, Iowa DNR Field Office
Keith Krause, NRCS Field Office
Jeff Ogden, The Watershed
Andrew Rucker, Operation Maquoketa River Clean-up

Initiated and funded by the Iowa General Assembly and Governor Terry Branstad.

REVISION DATE: DECEMBER 2016

DNR

MIMI WAGNER
Landscape Architecture

DELAWARE CO. CONSERVATION
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CONTENTS

CHAPTER 4

RESOURCE CONSERVATION & PROTECTION PLAN

The geology, vegetation, climate, prehistory, geology and people of the Maquoketa River are intertwined to create a river corridor experience that delights visitors and residents.

The unique geology, best visible from the water in Backbone State Park and downstream south of Manchester, attracts paddlers and hikers today much as it did for early Euro-American settlers and prehistoric people. People's struggle to modify this river to suit their needs and desires dates back to a prehistoric fish weir downstream of Bailey's Ford Park as well as numerous historic and contemporary dams. Although the integrity of these structures continues to be challenged by climate, this water trail celebrates the recent application of contemporary technology to modify two of the four dams in the county. The two modified dams on this water trail demonstrate that multiple positive outcomes are achievable including economic, conservation and recreation.

A strong, diverse community has come together to engage around this river through planning for this project. They realize the value of the resources present and the enormous opportunities present. Manchester Good to Great is a critically important and valuable organization for the future of the Maquoketa River in Delaware County. Their leadership supporting conservation, civic, social and economic enhancements has largely created the unique identity of this state-designated water trail compared to all others in the region.

State Water Trails in Iowa

In 2010 the Iowa Department of Natural Resources (DNR) completed "IOWA WATER TRAILS: Connecting People with Water and Resources" (Wagner and Hoogeveen 2010). This statewide plan was the result of a 2008 mandate for the water trails program. This plan ushered in a new legacy of enjoyment, respect, and care for the navigable waters of Iowa. This resource conservation and protection plan adds to that excitement by integrating the local passion and pride the community has for the diverse, high quality natural and cultural resource potential in the corridor. The vision for Iowa's water trails program balances resource conservation and protection with expanding recreational opportunities. And in addition to providing access to Iowa's rivers, the vision points to water trails as an entry point for people to become aware of and learn about the challenges facing Iowa's waterways. Similarly, the state water trail plan goals strongly point to developing water trails in ways that protect aquatic and terrestrial resources. They also commit to partnering with other existing conservation efforts in the water trail watershed and region.

Resource conservation and protection planning for state water trails responds to the individual character of each river, local resources and landscape conditions. Recommended outcomes focus on enhancing both the condition and function of the river and other resources as well as acting as public demonstrations for low-impact restoration and other forms of protection. The Iowa Water Trails Program recognizes water trail users as all people using the river as well as the adjacent land. On the river itself this obviously includes paddlers and other boaters, anglers, swimmers and tubers. Active and passive users on land adjacent to the river are also included such as hikers, bird watchers and equestrians as well as those enjoy watching the river from their parked car.

State Water Trails Program Goals

- Goal One: Provide positive water trail experiences meeting user expectations
- Goal Two: Use water trail development to strengthen natural resources conservation
- Goal Three: Adapt water trail development techniques to the waterway's individual character
- Goal Four: Support public access to water for recreational purposes
- Goal Five: Create a robust, resilient system for developing and experiencing water trails
- Goal Six: Encourage education in outdoor settings
- Goal Seven: Support positive water trail experiences by initiating strategies to manage intensively used areas

Project Area Planning

The project area of this plan includes the Maquoketa River beginning at Backbone State Park on the upstream end to the upper limits of Lake Delhi at Bailey's Ford Park *(Figure 1)*. The municipal area of Manchester is a critically important segment of this water trail. The unincorporated village of Dundee lies close to the water trail but is not spatially connected to the river. The Maquoketa River watershed area draining into study segment is 209,311 acres in size *(Figure 2)*. This resource conservation and protection plan serves three purposes:

- Establish the importance of implementing strategies to reduce bacteria loading enhance water quality in the Maquoketa River, its tributaries and Backbone Lake
- Set long term goals for enhancing natural resource conditions
- Define future river assessment and restoration needs and conceptual designs to demonstrate stream restoration practices

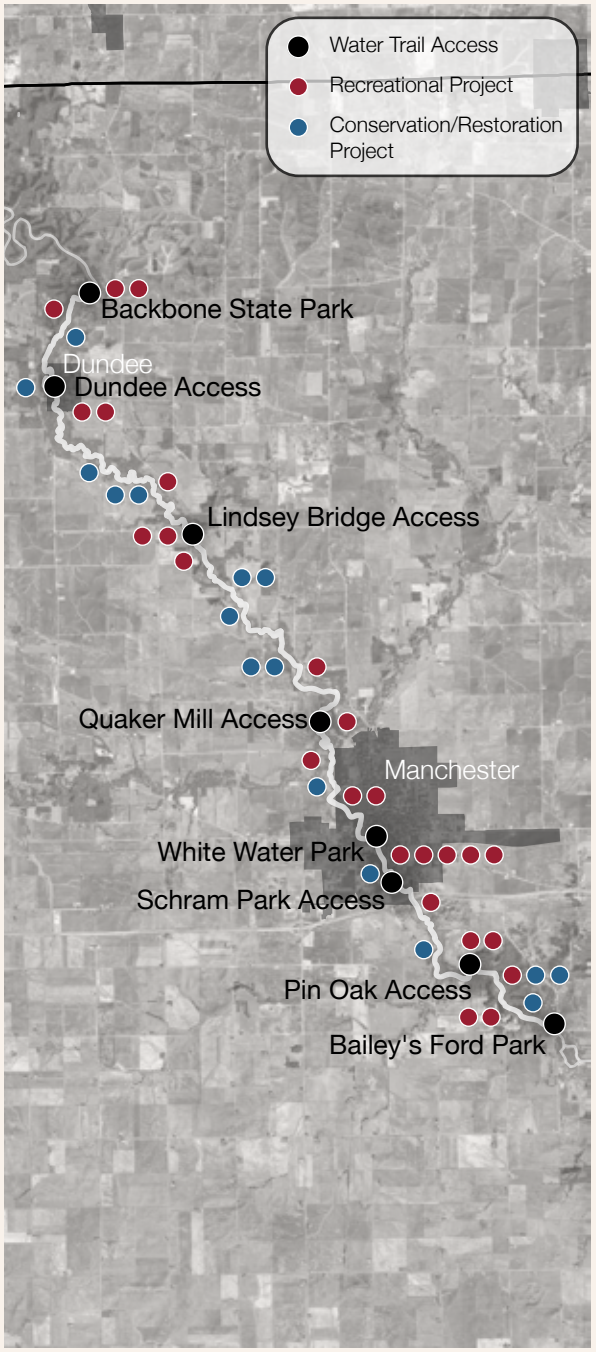


Figure 1
Project recommendations for both resource conservation and protection as well as recreational development are distributed throughout the river corridor.

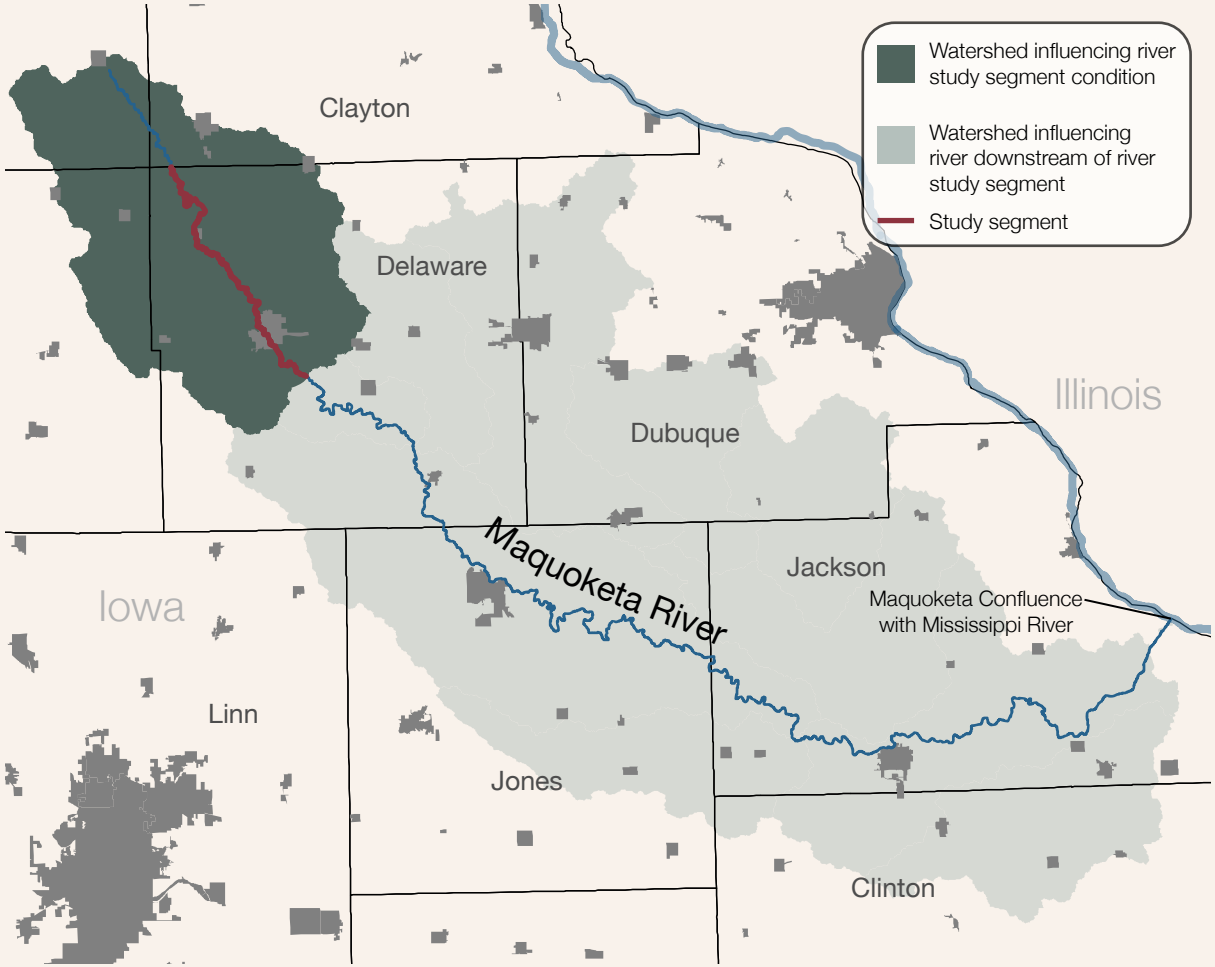


Figure 2
The study segment includes the top-most portion of the Maquoketa River watershed.

The goals of this resource conservation and protection plan center on enhancing conditions on the Maquoketa River in ways that support broad-based public education and recreation on and near the river. Because a primary purpose of state water trails is to promote recreation, it's important that resource conservation opportunities support this end outcome rather than restrict use. The following framework elements are used to guide the choice of recommended conservation and protection enhancements:

- Contribute to stable river structure and function
- Work to understand the causes of bacteria and biological water quality impairments so conditions can be enhanced
- Promote aquatic and terrestrial habitat to support diverse biological populations
- Expand what is understood about historic and prehistoric life and culture in the river valley
- Partner with other organizations and efforts to promote resource conservation goals in the watershed
- Invigorate the opportunities present for outdoor education, tourism and recreation

These elements are integrated into later sections of the plan to illustrate how specific elements contribute to the success of the planning.

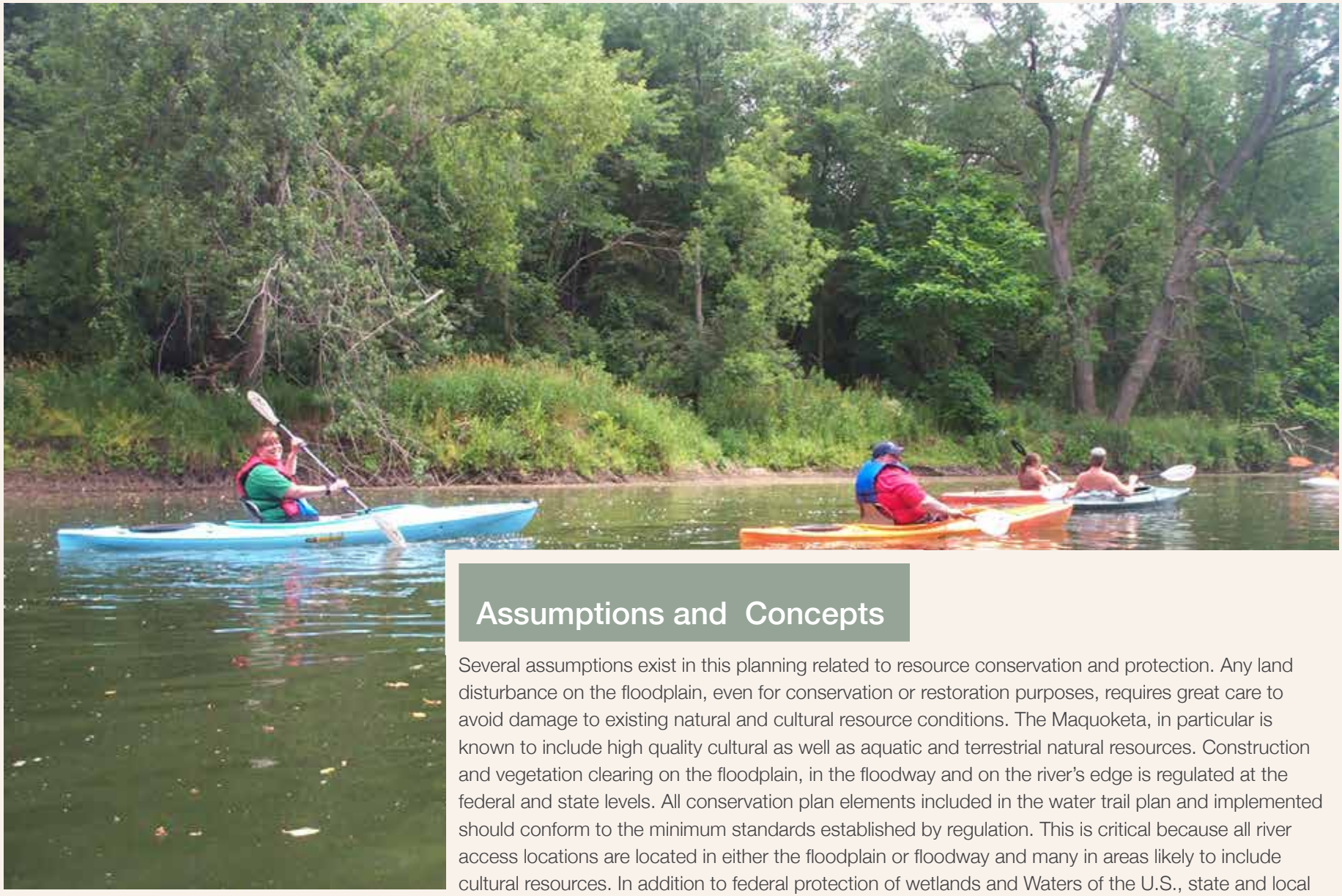
Administrative Rules and Definitions

A number of federal, state and local statutes, rules and ordinances apply to conditions of the river and changes planned for it. These rules govern changes that can be made in the floodplain, streambanks and river channel. Current interpretation of statutes, rules and codes related to recreation are summarized in *Figure 3*.

- **Cultural Resource Protection:** Additional site improvements or development at some river access points on the South Skunk River will likely require a Phase I archaeological investigation due to cultural resources known to exist in the area. See Phase IA Archaeological Reconnaissance of the Maquoketa River Water Trail Corridor, Delaware County Iowa, 2014; *Section 404 of the Clean Water Act; Section 106 of the National Historic Preservation Act of 1966. Federal transportation funded projects also have additional specific cultural review requirements in Section 4(f) of the Department of Transportation Act of 1966*.
- **Illegal Dumping:** The dumping or depositing of solid waste or debris in rivers, on streambanks, in public areas, and on others' property is illegal. This includes tires, appliances, construction and demolition waste, trash, and hazardous chemicals. *Iowa Code 455B.307 Dumping*.
- **Farm Waste:** Farm waste includes machinery, vehicles, and equipment used in conjunction with crop production or with livestock or poultry raising and feeding operations and trees, brush, and grubbed stumps from the same property. Farm waste and farm buildings cannot be dumped or deposited within 100 feet of streams, lakes, ponds, or intermittent streams. IOWA ADMINISTRATIVE CODE 567—100.4(455B).
- **Floodplain Filling, Changing a Channel, Placement of Rip Rap or Rubble on Streambanks:** A permit is required when floodplain elevation or channel alignment changes are proposed and when rip rap or rubble is proposed. A joint permit application is required that includes federal and state reviews. At the federal level, the U.S. Army Corps of Engineers issues permits under Section 404 of the Clean Water Act. In the state of Iowa, Iowa DNR grants floodplain and sovereign land permits. *Iowa Administrative Code 571, Chapter 13; Iowa Administrative Code 567, Chapters 71, 72; Section 404 of the Clean Water Act*.
- **Logjam Clearing:** Large woody debris piles often block parts or all of smaller river channels. Any trees or other large wood that comes to rest on the bottom of a channel is owned by the adjacent landowner. Therefore, modifying log jams for navigation or conservation purposes requires landowner permission. Log jams, while they can be impediments or natural hazards for navigation, also can function as habitat for aquatic species. Fisheries biologists should be involved in decisions about cutting wood in channels, and balanced solutions should be found. Most meandered rivers are sufficiently wide that logjams can be avoided while navigating them, but in the case where modifying a logjam appears desirable, permission from the Iowa DNR is required and a joint application form should be submitted.

Figure 3

Iowa regulations providing the framework for use and behavior of public waters are constantly evolving. These interpretations were developed in late 2016 with assistance from the Iowa Attorney General's Office and Iowa DNR staff.



Assumptions and Concepts

Several assumptions exist in this planning related to resource conservation and protection. Any land disturbance on the floodplain, even for conservation or restoration purposes, requires great care to avoid damage to existing natural and cultural resource conditions. The Maquoketa, in particular is known to include high quality cultural as well as aquatic and terrestrial natural resources. Construction and vegetation clearing on the floodplain, in the floodway and on the river's edge is regulated at the federal and state levels. All conservation plan elements included in the water trail plan and implemented should conform to the minimum standards established by regulation. This is critical because all river access locations are located in either the floodplain or floodway and many in areas likely to include cultural resources. In addition to federal protection of wetlands and Waters of the U.S., state and local floodplain and Sovereign Lands regulations also exist. Iowa DNR Water Trail development standards also recommend a minimum 50-foot wide unmown riparian buffer between the top of the streambank and all parking areas.

THE MAQUOKETA IN DELAWARE COUNTY

This water trail passes through two basic types of landscapes. Portions of the route consist of narrow valleys incised in the bedrock formation Backbone State Park is famous for. The river in these narrow valleys often makes abrupt turns that are controlled by fracture networks in the bedrock. Outside these bedrock valleys, the river valley tends to be shallow and wide. Bedrock in these flatter valleys is older and lies deeper underground. The thick soil deposits in these valleys contain the most severe streambank instability and erosion. The river edge is forested throughout 83% of the corridor. Only 1% of riparian corridor is annually cultivated cropland which is very low for a river in Iowa of this size. The remaining1.6% of the non-perennial landcover areas are impervious, developed surfaces inside the City of Manchester.

Outstanding natural, historic and recreational resources exist near the river between Backbone State Park and Bailey's Ford. Existing public lands at both these locations, as well as Pin Oak Access, include high densities of historic and cultural sites. Findings at these sites document occupation from the Archaic through the Middle Woodland periods or from 8000 BC to 300 AD. The open habitation sites, rock shelters, lithic scatters, camp sites, quarry sites, fish weir and mounds suggest heavy use by multiple periods. Anecdotal settler records from the mid-1800's as well as current records with the Iowa Office of Archeology confirm that numerous prehistoric Indian mounds are scattered around the region. The river is a biologically diverse resource with a nearly intact perennial riparian buffer. A majority of the buffer (83%) is forested and in private ownership. This buffer supports diverse fish and other wildlife populations. Recent fish sampling (2010-2015) at five sites on the Maquoketa River collected 52 species in the water trail study area in Delaware County. Mussel populations have been observed but have not been documented. Twenty-three bird Species of Greatest Conservation Need have been field identified as likely breeding on or near this segment of the river.

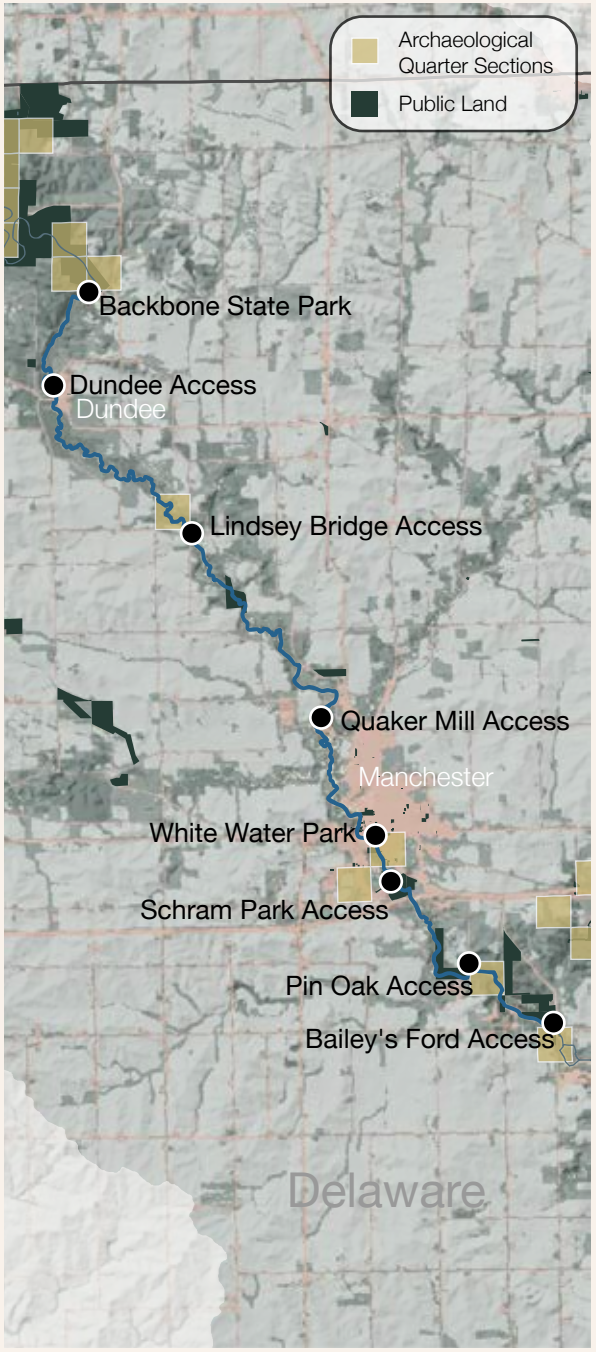


Figure 4

The majority of known archaeological sites are located in the area of Backbone State Park and Bailey's Ford Park. However, much less archaeological survey and exploration has been completed in the study area.

The Maquoketa River Water Trail is an example of a high-quality state-designated water trail in a rural county. Landowners and corridor users would benefit from enhanced conservation and protection as well as from a focused interpretation that builds knowledge about the unique resources present. A majority of the river edge is privately-owned and Delaware County has no existing natural resource protection regulations. There is enormous potential to develop voluntary conservation easements with willing landowners to ensure the resources are present for future generations. These actions would move resource conditions closer to the local vision. Conservation and protection of resources will also provide additional public benefit, such as flood resilience and water quality enhancement.

Implementation of the Maquoketa Vision

The Maquoketa River in Delaware County will be designated as a state water trail between the Backbone Lake Dam and Bailey's Ford Park. Future extension of the designated water trail above the dam into the state park is desirable by the steering committee and resource experts engaged with this planning. A large part of the vision for this proposed water trail includes protecting and enhancing the conditions that make this river a high quality recreational experience today. The foremost important element in this vision is enhancement of impaired water quality conditions, both bacterial and biological impairments. Also critical is the long term protection and enhancement of habitat utilized by the high diversity of bird and fish species from degradation. A stable, natural meandering river system is desired where lateral channel migration, mid-channel deposition and excessive streambank scour are minimized.

Planning Process

This vision was developed through a two-year planning process integrating stakeholders, agencies, university researchers, non-profit organizations and landowners. Three public events were held to generate interest for and attention to water trail planning. A steering group composed of 17 local individuals representing special interests such as water quality, angling, botany, history and landowners guided development of both the vision and this plan. The recreational development priorities included in this plan were developed by the Steering Group and the Water Trail Sponsor, Delaware County Conservation Board.

The existing conditions surrounding this section of the Maquoketa were assessed and researched concurrently with this recreational planning. Planning for resource conservation and protection occurred during the same two-year time period. An extensive review period occurred with the Steering Group, Delaware County Conservation staff and board members and Iowa DNR.

Scope of the Plan

Conservation and protection elements are recommended for both the river channel as well as the riparian corridor and within the watershed. River channel recommendations include streambank restoration demonstration projects and aquatic species habitat enhancement. On-land recommendations center on water quality enhancement and expansion of the perennial riparian vegetation buffer in agricultural areas as well as in Manchester. *Table 1* summarizes and organizes desired resource conservation and protection outcomes with examples of recommended plan elements to illustrate their relevance.

Several issues related to resource protection emerged that relate to the watershed rather than the actual river corridor. These issues relate to developing livestock wastewater treatment practices and systems in the watershed, inventory of aquatic species and studies to guide natural channel design in eroding segments.

Table 1

Resource conservation outcomes important locally and in Iowa and included in this plan are organized to reflect their relationship to recommended projects.

Elements Included in This Plan	Stable River Structure & Function	Enhanced Water Quality Conditions	Aquatic Habitat Supporting Diverse Mussel and Fish Populations	Terrestrial Habitat Supporting Diverse Bird Populations	Protected Cultural & Historic Resources	Expanded Outdoor Education & Recreation	Expanded Tourism Opportunities
Prepare Forest Management Plan				√	√	√	√
Modify or Remove Dams	√	√	√			√	√
Cleanup Legacy Dumpsites		√		√		√	√
Conduct Studies to Further River Conservation	√	√	√			√	
Streambank Restoration	√	√	√	√		√	√
Establish Perennial Vegetation Buffer	√	√	√	√		√	
Permanently Protect and Designate Significant Cultural & Historic Sites					√	√	√
Develop Partnerships With Other Watershed Efforts and Organizations	√	√	√	√			

RESOURCE CONSERVATION AND PROTECTION NEEDS IN THE CORRIDOR

Existing Conditions

Challenges and needs vary based on geographic location in the study segment *(Figure 5)*. Enormous amounts of sediment erodes annually from segments where underlying bedrock is overlain with thick soil deposits—Dundee to Lindsey Bridge and Schram Park to Bailey's Ford Park. These segments are also recognized for the above-average amount of large woody debris accumulations compared to other similarly-scaled Iowa rivers. Channel widening and mid-channel aggradation are visible on nearly all parts of the study segment. These conditions are due to the largely forested edge of the river, the channels' current phase of widening and the recent pattern of intense rain events.

Concerns about water quality exist throughout most of the county. The Maquoketa in Delaware County is impaired for indicator bacteria beginning at and including Backbone Lake and continuing throughout the entirety of Delaware County. Biological impairment begins at the confluence of the Maquoketa and Honey Creek and similarly extends throughout the downstream portion of the county. Four tributaries draining into the Maquoketa in this study segment are also impaired for either bacteria or biological conditions.

The unique geology and soil conditions of Delaware County in the Maquoketa watershed are largely responsible for the unique conditions leading to high natural and cultural resource conditions as well as high value for recreation and tourism. Both the landcover in the first 100' on either side of the Maquoketa River as well as landcover in its watershed are a stark contrast compared many rivers in Iowa. Only 1% of land in the first 100' on the Maquoketa is annually cultivated cropland compared with as much as 24% in other rivers studied for state water trail designation; the majority of this 1% is located between Lindsey Bridge and Quaker Mill accesses. And while annually cultivated cropland is the largest landcover type in the Delaware County portion of the watershed (66%), other rivers studied for state designation have included as high as 80% cropland. In contrast to these comparisons, 3% of the first 100' on either side of the river in the county, all within Manchester, is impervious surfaces, buildings or other development.

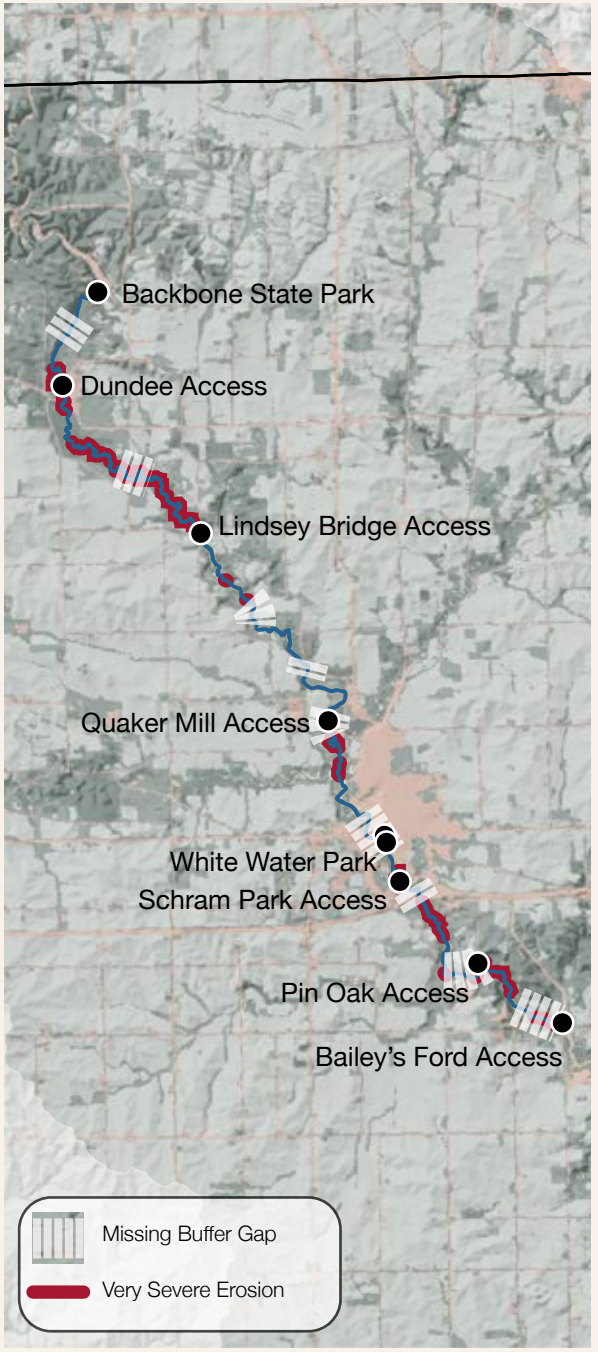


Figure 5

Gaps in the perennial riparian buffer, instances of very severe streambank erosion and mature riparian forests that are not permanently protected from disturbance are the most visually obvious land conservation needs.

This is an extremely high amount for the size of the city. Research on flood damage and flood attenuation consistently show that river edges with landscape buffers, compared to development, are better able to withstand damage.

Acres of public ownership and permanent protection as well as recreation opportunities are limited to the very top and bottom of the water trail as well as in Manchester. Very little investigation of cultural resources has occurred in the study area despite the high quality resources known to exist. Far less than one percent (0.01 percent; 139.4 acres) of the river corridor area has been subjected to archaeological survey (Hedden 2014). Due to the forested nature of much of the corridor, at least some archaeological evidence is likely undisturbed. Additional investigations are possible targeting publicly owned parcels and other areas identified by modeling as highly suitable for the presence of cultural resources.

River Channel Conservation Needs

A number of issues were identified during this planning directly related to the river itself. These issues are critical but not of the significance of developing river accesses that meet minimum standards for safety. Addressing these issues will alleviate further strain on aquatic habitat conditions and some water quality impairment issues. Addressing these issues may also open up opportunities for state river restoration funding as well as funding from other external sources. The following desired outcomes related to the river channel were identified during planning:

- Conduct professional assessment on the river channel to establish basic geomorphic parameters appropriate for this river, including the differing landscape conditions found in the study area
- Demonstration of stream bank restoration practices on public land utilizing natural channel design and other low-impact practices
- Assess the presence of existing mussel species and enhance habitat conditions
- Utilize state of the art fish habitat enhancement practices based on a changing climate
- Coordinate public meetings and events for river clean ups, education and channel-wide log jam mitigation

Land-Based Resource Conservation Needs

A number of land management and potential landscape change issues were identified during this planning. Addressing these issues will enhance conditions on the Maquoketa. The following desired outcomes related to land-related issues were identified during planning:

- Implementation of bacteria loading conservation practices in the watershed as identified by previous research and modeling, increased participation in voluntary monitoring
- Support other organizations to enhance water quality conditions on the Maquoketa and its tributaries
- Establish forest management plans on county-owned lands to maintain the desired historic vegetation conditions
- Establish a continuous perennial stream buffer for the length of the Maquoketa River Water Trail
- Voluntary permanent protection of existing mature forested riparian land tracts in private ownership
- Explore additional river buffer ordinances for new development in Manchester

Cultural Resource Protection Needs

An enormous opportunity exists in Delaware County to understand more completely how prehistoric cultures lived and used the land. Without knowledge of the existence of resources, their locations cannot be protected and made available for future generations. The following desired outcomes related to cultural and historical issues were identified during planning:

- With only 0.01% of the river corridor surveyed for cultural resources, additional Phase I survey work and research is necessary for a more complete understanding of early occupation
- Pedestrian walkover surveys can typically identify surface sites and would result in important new information about prehistoric habitation along this watershed
- Public outreach events calling for artifact collectors to share information will generate volunteer participation in the pedestrian surveys and may elicit landowner support for allowing walkovers of their cultivated fields
- Analyzing historic accounts of early settler life in Delaware County could provide information concerning the early settlement along the Maquoketa. An archaeological survey to identify these 1840s and 1850s sites would yield a great deal of information about early settlers in the area. Like the pedestrian survey effort, public outreach would generate appreciation for the water trail and its associated cultural resources

Resource Conservation and Protection Overview

Riparian Buffers

Recommended riparian buffers include only native plant species that are appropriate for the soil conditions present. Two buffer alternatives are recommended in this plan based on the type of vegetation desired by the landowner. Type A buffers contain woody tree and shrub species. Type A buffers are designed in conformance with USDA Natural Resources Conservation Service Conservation Practice Standard 391, Riparian Forest Buffer (USDA NRCS 2014). Specific woody vegetation species included in each buffer conform to Conservation Suitability Group (CSG) for the soil type established by Iowa DNR and NRCS (Iowa DNR 2007). Type B buffers include only herbaceous species and are designed in conformance with USDA Natural Resources Conservation Service Conservation Practice Standard 390, Riparian Herbaceous Cover (USDA NRCS 2011). Specific herbaceous species recommended for each buffer include those contained in the Iowa USDA NRCS Plant Community Query and resulting species list (USDA NRCS 2011).

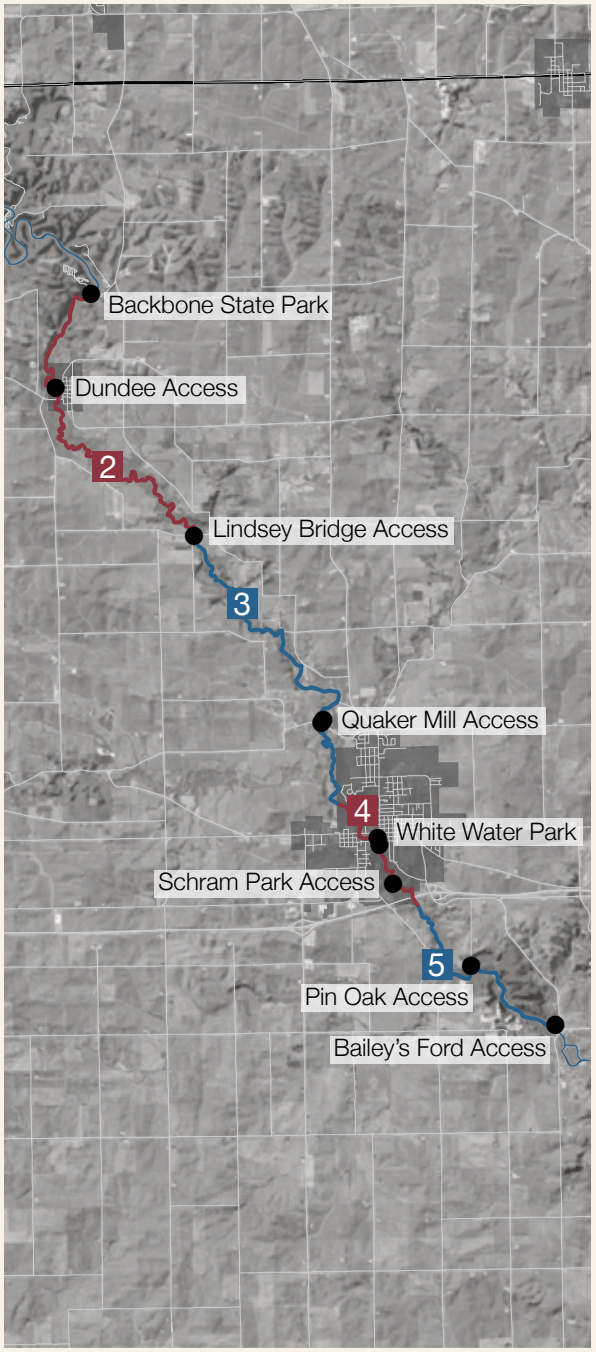
Streambank Restoration

Restoring streambanks and minimizing future streambank erosion is a high priority on this river. Two methods are recommended. The Wood Toe Sod Mat is a low impact practice incorporating a toe structure constructed of large dead trees and sod. The second recommended alternative is a stone toe at 50% the bankfull height and a laid-back streambank. Both alternatives include a bankfull bench. Multiple resource conditions distinguish this segment of the Maquoketa from other rivers in the region. The purpose of this chapter is to identify and organize the resources that are currently understood and integrate them with local and state priorities for conservation and protection.

Recommended conservation and protection elements included in this plan consist of the following types:

- River Channel Conservation: river channel assessment, dam mitigation, streambank and floodplain restoration, in-stream habitat enhancement, legacy dumpsite cleanup, volunteer water quality monitoring and river cleanup events
- Land-Based Resource Conservation: implementation of bacteria-loading reduction practices, continuous perennial stream buffer establishment, voluntary riparian forestland protection and forest management planning
- Cultural Resource Protection: additional professional and volunteer field studies

Recreational development priorities also exist for this same river segment. Planning for recommended recreational enhancements included considerations for resource protection, but the success of final construction depends on sensitivity to the potential presence of resources not already identified. These enhancements include extensions of existing soft and hard trail systems, river access upgrades and additional signage.



RECOMMENDED CONSERVATION AND PROTECTION PROJECTS

A broad range of resource conservation and protection strategies are recommended to protect and enhance conditions on the Maquoketa River in Delaware County. The strategies include in-channel and shoreline, streambank, and inland / upland areas. The study area river corridor is divided into four segments *(Figure 6)* and one additional segment that includes the entire corridor. Recommendations are organized by segment and include maps, drawings and text descriptions. Some recommendations span multiple segments or the entire 23 mile study area. Preliminary cost estimates for water trail-related enhancements based on recent restoration material and construction costs in Iowa.

These recommendations were developed jointly with technical experts at Iowa DNR, Iowa Office of the State Archaeologist and Iowa State University and have commitment from Manchester and Delaware County Conservation Board and staff. Finally, these recommendations address local, regional, state and national conservation priorities.

Figure 6

The 23 miles of river included in this plan are divided into 4 distinct segments for planning purposes, plus one additional segment spanning the entire corridor.

Resource Conservation and Protection Recommendations for the Entire Corridor:

C 1.A
Assess, Enhance Aquatic Habitat for Fish and Mussels

The modification of the Quaker Mill and Manchester dams will contribute to enhancing fish and mussel diversity. Baseline monitoring is needed to assess the species of mussels living in the study reach. Additional fish species monitoring is also recommended so post-dam removal recovery can be documented. In-stream and riparian corridor enhancements to further support populations are recommended as per Iowa DNR recommendations.

C1.A *Iowa DNR fisheries determined that at least nine species of fish were navigating the rapids created by modification of the Manchester Dam within the first few months.*

C 1.B
Conduct Additional Archaeological Investigations

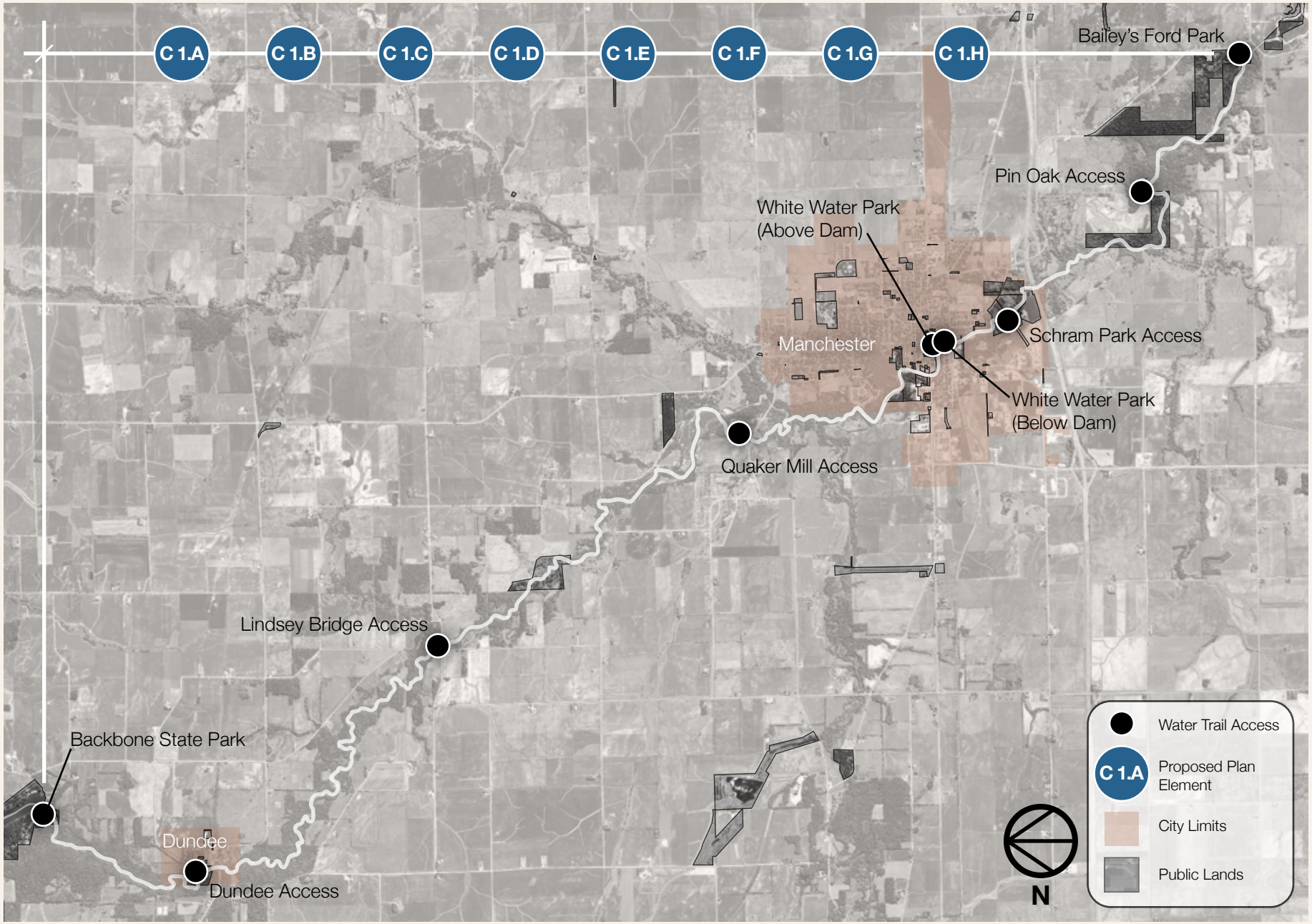
Previous archaeological surveys have covered only 0.01% of the study area and additional resources are likely present beyond those listed in state registry. A Phase I pedestrian survey is recommended for river terraces and valley margins throughout the corridor where sites are likely to occur and be exposed. Sites with known historic habitation are also recommended for trained pedestrian surveyors. Public events held in conjunction with these surveys are likely to generate attention for the water trail.

C 1.C
Establish a Continuous Riparian Buffer

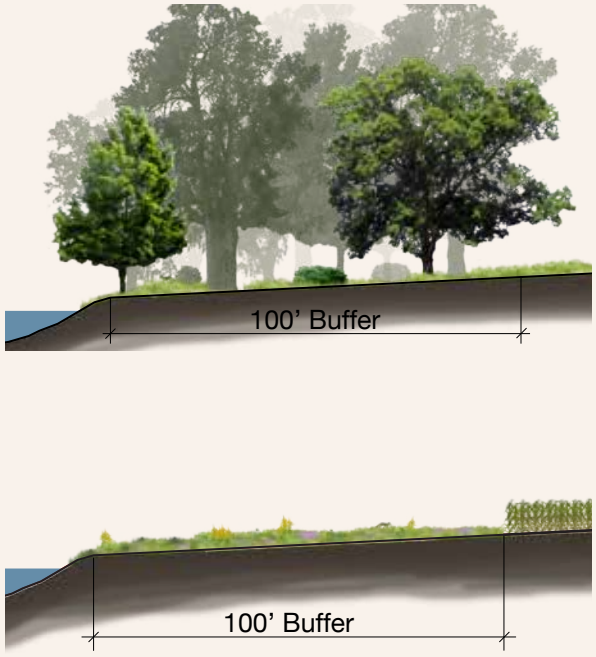
Development of a 100' wide perennial stream edge buffer is recommended for the entire 23 miles of the Maquoketa River in Delaware County. A total of only 6 acres are missing from this buffer (2015). The buffer width is measured beginning at the top of the streambank. The largest gaps in the study segment are between Lindsey Bridge and Quaker Mill accesses and inside the City of Manchester *(Figure 7)*. Establishment of either a Type [A] Woody Tree and Shrub Mix, comprised of native trees and shrubs or a Type [B] Herbaceous Mix, comprised of herbaceous plants only, is recommended.

Figure 7

The largest buffer gap in the study area is located inside the city limits of Manchester. These gaps include mown grass and buildings (shown here) as well as streets and homes.



SEGMENT C1: **Corridor-Wide Projects**



C1.C *Perennial vegetation buffers are recommended beginning at the top of the streambank for both sides of the river. The Woody Tree and Shrub Mix when mature (top) provides diverse habitat for multiple species as well as the most successful, natural reinforcement for streambank protection. The Herbaceous Mix (bottom) provides excellent filtering capability for sheet erosion from adjacent crop fields as well as important bird habitat.*

C 1.D
Explore Voluntary Land Protection Strategies for Riparian Forests

The exploration of various strategies is recommended to protect existing mature riparian forest tracts adjacent to the Maquoketa River *(Figure 8)*. Potential strategies include (1) Inside the City of Manchester limits, explore a buffer requirement for new construction (although not truly permanent protection), similar to the City of Ames; (2) Donation or purchase of permanent conservation easements from willing landowners; and (3) Donation or purchase of fee title from willing landowners.

Figure 8
The mature floodplain forests on the Maquoketa River are one its most important habitat and visual resources.

C 1.E
Support Delaware SWCD to Reduce Bacteria Loading from Livestock Waste

Research and modeling have identified the livestock sources of bacteria likely causing impaired water conditions in Backbone Lake and the Maquoketa River. Additional community support of Delaware Soil and Water Conservation District (SWCD) efforts to engage landowners to make these improvements is recommended. River clean up events are also recommended *(Figure 9)*.

Figure 9
The strong history of local river clean ups are a great way to demonstrate stewardship as well as build community.

C 1.F
Increase Voluntary Water Quality Monitoring

Additional IOWATER volunteer monitoring on the Maquoketa and its tributaries is recommended and will provide a valuable understanding of water chemistry conditions.

C 1.G
Use 501(c)(3) to Support Water Trail Development and Priorities

Fundraising support and organization will be important for continued development of the water trail. The use of an existing nonprofit organization to assist and support the Water Trail Sponsor is recommended.

SEGMENT 1 COST ESTIMATES		
RECOMMENDATIONS	MAP CODE	COST ESTIMATE
Enhance Aquatic Habitat for Fish and Mussels	C1.A	
Additional Archaeological Study	C1.B	
Vegetative Buffer Establishment (entire length)	C1.C	$4,500
Explore Voluntary Riparian Forest Protection	C1.D	
Support Delaware SWCD to Work with Landowners to Reduce Bacteria Loading into the Maquoketa	C1.E	
Increase Voluntary Monitoring	C1.F	
Use an Established 501c3 to Support Development and Conservation on the Water Trail	C1.G	$0

SEGMENT C2: **Backbone State Park to Lindsey Bridge Access**

Existing Conditions

This segment of the river is 6.9 miles in length. Once outside the state park, it is located entirely on privately owned land. The corridor is heavily wooded with multiple instances of very severe bank erosion. A moderate amount of large woody debris in the river channel also exists.

Issues and Opportunities

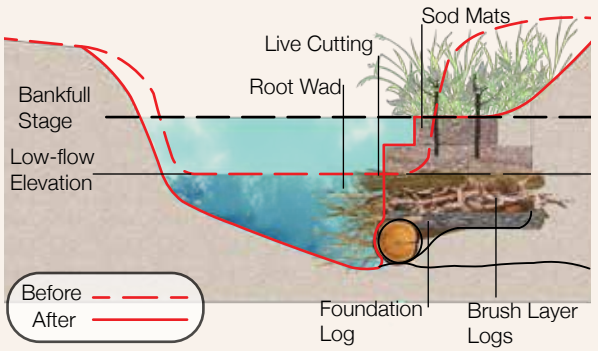
This segment crosses one of two deeply buried bedrock channels on the water trail. River corridor segments intersecting with these deeply buried channels have the most severe streambank erosion conditions found anywhere on the water trail. One legacy dumpsite on public property is located on this reach.

C 2.A
River Technical Assessment in Non-Bedrock Controlled Sections

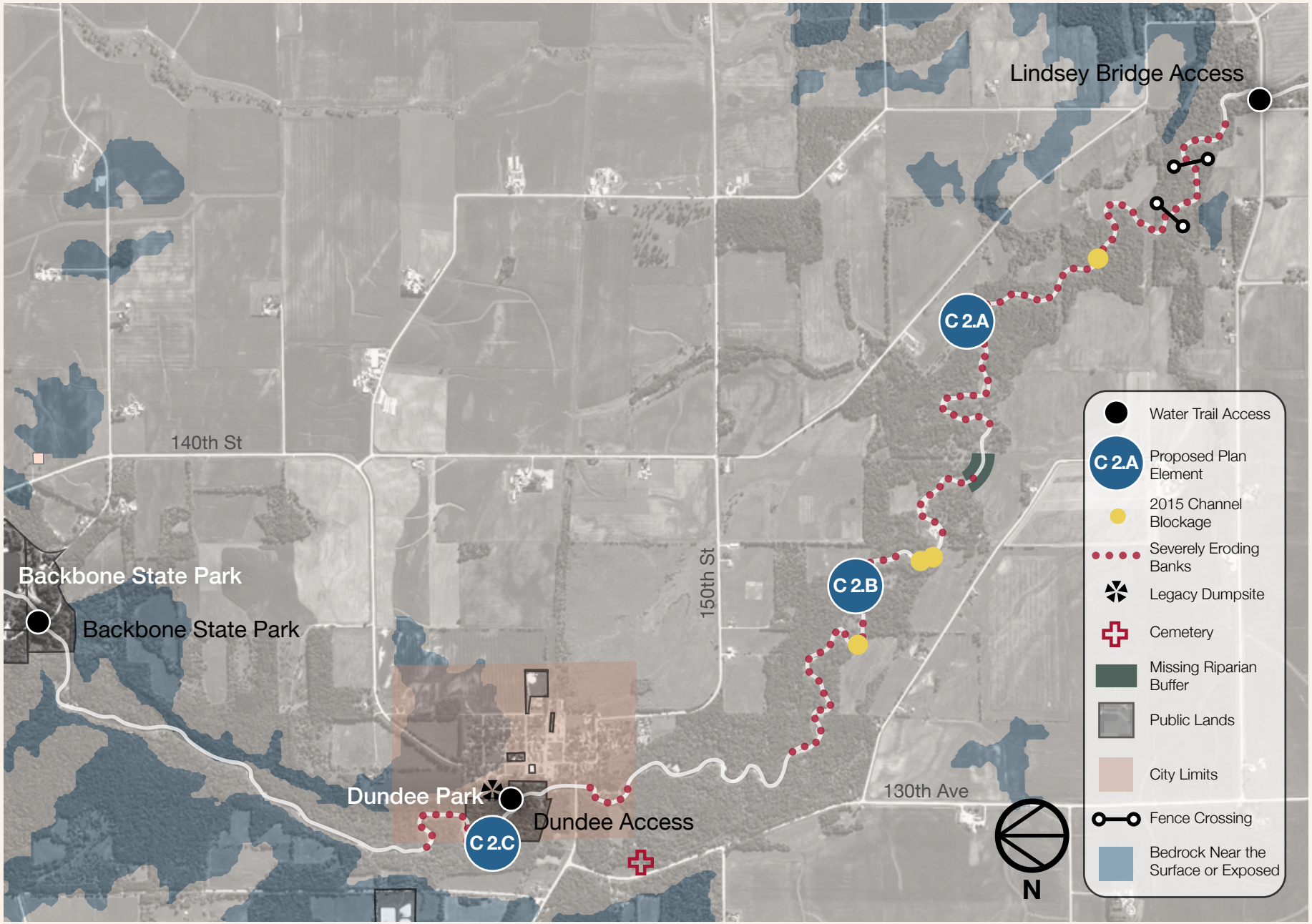
This assessment will develop alternatives for streambank restoration that are appropriate for this landform region. An assessment of the specific streambank erosion locations and needs are also recommended. This recommendation requires contracting with private sector consultants.

C 2.B
Streambank Restoration

Reducing streambank erosion is one of the highest priorities for this water trail project. This project recommendation is the implementation of C2.A Technical Assessment. Either a Wood Toe Sod Mat or a Stone Toe is recommended to restore the streambank.



C2.B *This structural feature, the Wood Toe Sod Mat, is used to stabilize outside bends on eroding streams. Another alternative is a Stone Toe.*



SEGMENT C2: **Backbone State Park to Lindsey Bridge Access**

C 2.C
Legacy Dumpsite Cleanup

The legacy dumpsite located on county property at the Dundee Access predates public ownership of this land. The debris is located on the floodplain near the existing parking area. Multiple car bodies are included and are partially covered with river sediment deposited during flooding. Excavation and removal are recommended.

C2 Permitting Considerations

Disturbance for launch and parking improvements for water trail accesses at Backbone Lake Dam, Dundee and Lindsey Bridge Accesses will likely require a Phase I archaeological investigation unless previous disturbance of these construction areas can be verified.

SEGMENT 2 COST ESTIMATES		
RECOMMENDATIONS	MAP CODE	COST ESTIMATE
River Technical Assessment in Non-Bedrock Controlled Sections	C2.A	$50,000
Streambank Restoration	C2.B	$2,283,555
Legacy Dumpsite Cleanup	C2.C	

SEGMENT C3: **Lindsey Bridge Access to Manchester Municipal Boundary**

Existing Conditions

The segment of the river is 4.7 miles in length and has a moderate level of use by paddlers. This segment ends at the currently-defunct Quaker Mill Dam. This is a rural paddling experience with few homes or farm operations visible; homes and cabins become more common near Quaker Mill and Manchester. A high diversity of bird species use this segment of the corridor. It also includes much more annually cultivated cropland near the river compared to other segments.

Issues and Opportunities

Very severe streambank erosion is present on several very short segments. A majority of the missing perennial riparian buffer is located on this segment. Lastly, the Quaker Mill Dam site acted as an impediment to migration of fish and mussel species prior to its breach. The channel damage downstream of the dam is in need of stabilization and restoration.

C3 Permitting Considerations

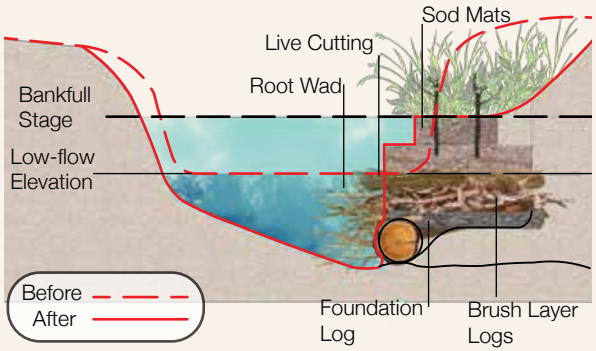
Disturbance for launch and parking improvements for water trail access at Quaker Mill Dam will likely require a Phase I archaeological investigation unless previous disturbance of the site can be verified or the area of the access was included in Phase I investigations conducted for the dam mitigation.

C 3.A
Quaker Mill Dam Modification

Iowa DNR's design for the Quaker Mill dam modification includes a series of rock arch rapids. Construction is expected in 2017.

C 3.B
Streambank Restoration

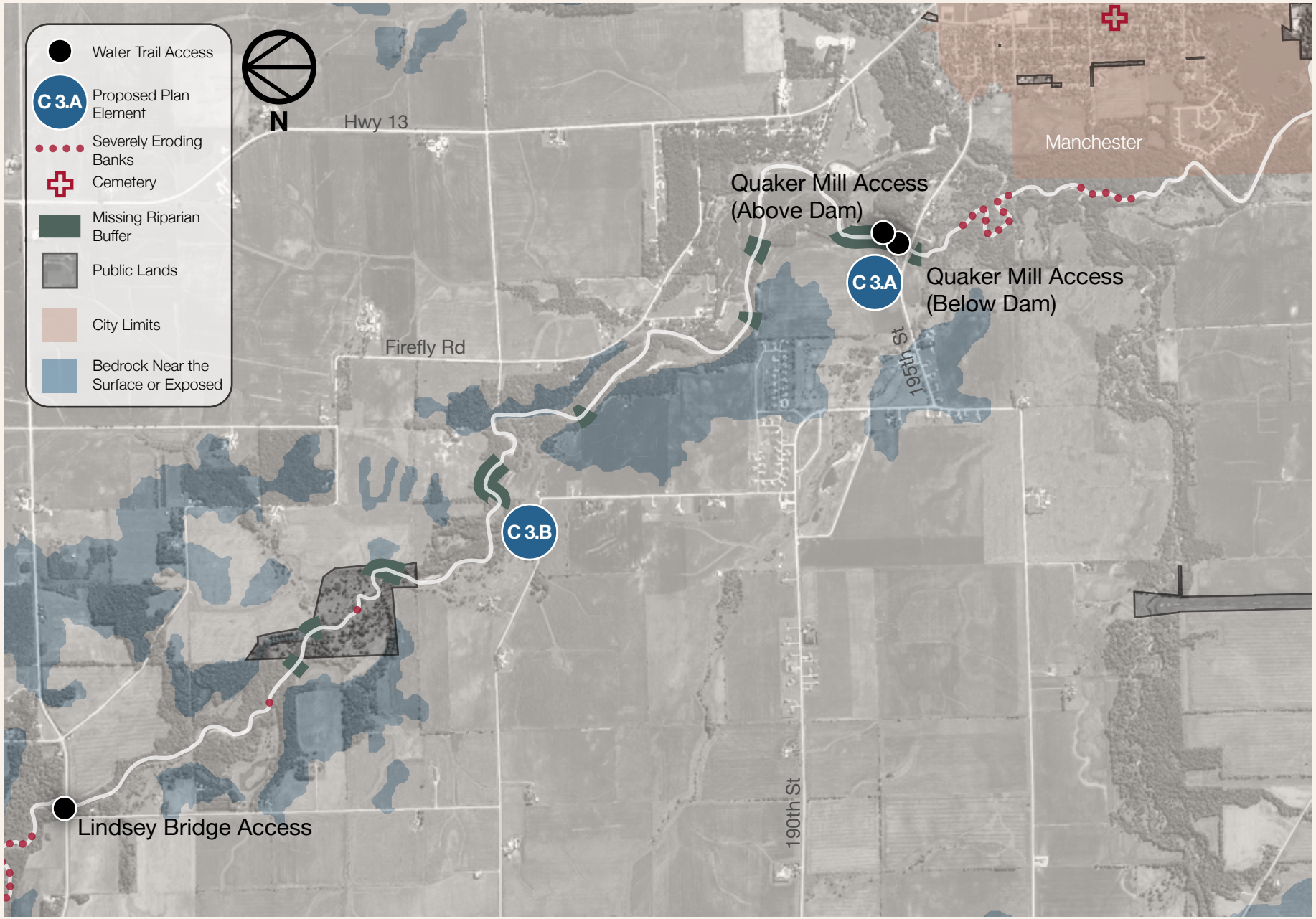
Reducing streambank erosion is one of the highest priorities for this water trail project. This project recommendation is the implementation of C2.A Technical Assessment. Either a Wood Toe Sod Mat or a Stone Toe is recommended to restore the streambank.



C3.B *This structural feature, the Wood Toe Sod Mat, is used to stabilize outside bends on eroding streams. Another alternative is a Stone Toe.*

C3.A *Quaker Mill Dam is one of the oldest remaining dams in Delaware County. Modification of the dam will preserve the base of the historic hydro electric plant.*

SEGMENT 3 COST ESTIMATES		
RECOMMENDATIONS	**MAP CODE**	**COST ESTIMATE**
Quaker Mill Dam Modification ($504,000 total cost)	**C3.A**	**$252,000**
Streambank Restoration	**C3.B**	**$436,655**



SEGMENT C3 **Lindsey Bridge to Manchester Municipal Boundary**

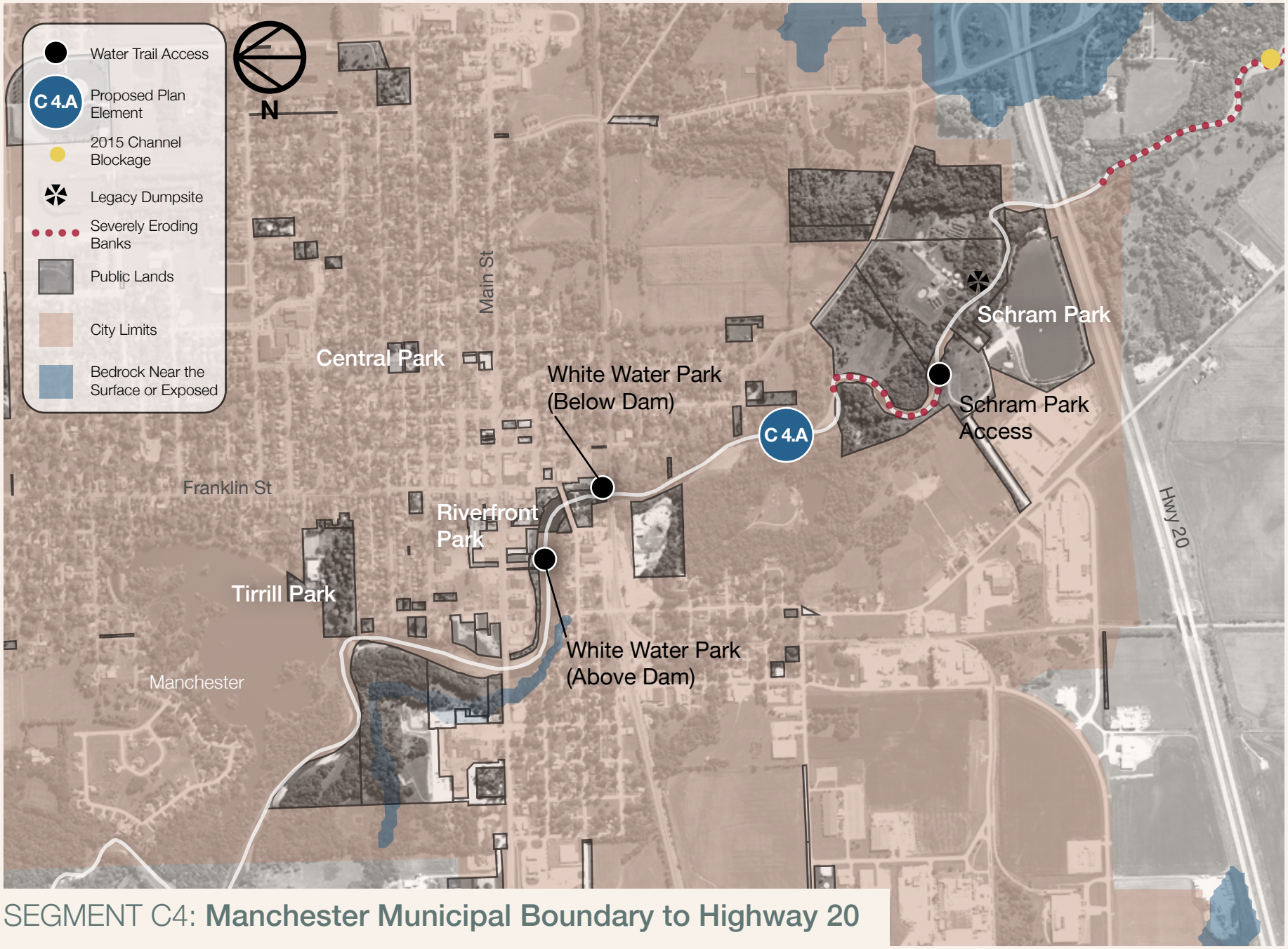
SEGMENT C4: **Manchester Municipal Boundary to Highway 20**

Existing Conditions

The segment of the river is 3.6 miles in length and portions have a high level of use by paddlers. This segment flows through the City of Manchester and the Manchester Whitewater Park. The river is much wider and slower on this segment, with the exception of the Whitewater Park. Mid-channel aggradation is apparent between Tirrill Park and the Whitewater Park.

Issues and Opportunities

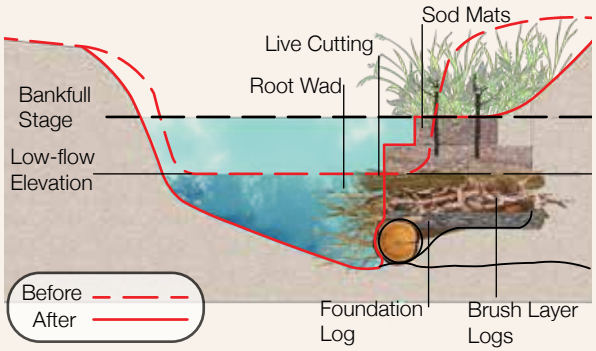
This segment is near the second of two deeply buried bedrock channels on the water trail. River corridor segments intersecting with these deeply buried channels have the most severe streambank erosion conditions found anywhere on the water trail. Several long sections of streambank downstream of Quaker Mill are severely eroding as well as some between the Whitewater Park and Highway 20. Streambanks inside Manchester are often vertical and eroding at least partially due to the high amounts of sediment deposited in the channel upstream of the Whitewater Park. Debris and trash from past floods has largely been removed from the river by volunteer paddlers. Some debris will likely continue to surface in the future and will require removal. One legacy dumpsite is located on public land on this segment. The second largest gap of perennial riparian buffer is located upstream of the Whitewater Park; this gap consists of streets, parking lots and buildings.



SEGMENT C4: **Manchester Municipal Boundary to Highway 20**

C 4.A
Streambank Restoration

Reducing streambank erosion is one of the highest priorities for this water trail project. Visual appearance of streambanks are likely more noticeable on this segment due to the high use by both paddlers and pedestrians. Pedestrian use in the riparian zones on this segment includes Tirrill, Whitewater and Schram park areas. Streambank restoration designs for this segment should be both attractive as well as functional. The technical assessment included in C2.A will explore these options. Either a Wood Toe Sod Mat or a Stone Toe is recommended to restore the streambank.



C4.A *This structural feature, the Wood Toe Sod Mat, is used to stabilize outside bends on eroding streams. Another alternative is a Stone Toe.*

C4 Permitting Considerations

Disturbance for launch and parking improvements for the Gateway water trail access downstream of the Whitewater Park will likely require a Phase I archaeological investigation for portions of the site previously undisturbed unless previous disturbance can be verified.

SEGMENT 4 COST ESTIMATES		
RECOMMENDATIONS	MAP CODE	COST ESTIMATE
Streambank Restoration	C4.A	$165,485
Legacy Dumpsite	C4.B	
Explore Greenbelt Protection Zoning	C4.C	

SEGMENT C5: **Highway 20 to Bailey's Ford Park**

Existing Conditions

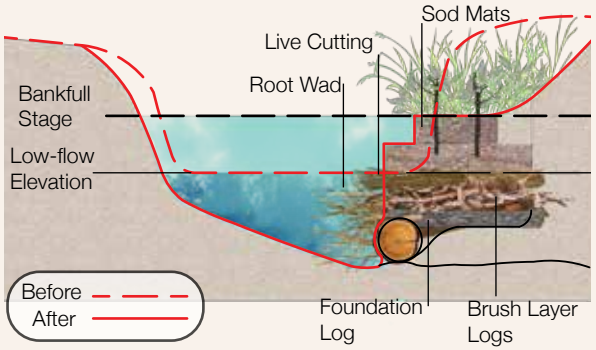
This segment of the river is 4.2 miles in length and has a high level of use by paddlers traveling from Manchester downstream to Bailey's Ford Park. This river segment once again enters the bedrock-controlled portion of the river corridor.

Issues and Opportunities

This segment crosses the second of two deeply buried bedrock channels on the water trail. River corridor segments intersecting with these deeply buried channels have the most severe streambank erosion conditions found anywhere on the water trail. A substantial distance of streambank is eroding on the water trail downstream of the Highway 20 Bridge. The second largest cluster of public land on the water trail occurs on this segment beginning midway between Highway 20 and Pin Oak Access. Additional public lands associated with Bailey's Ford Park intersect further downstream near the end of the water trail.

C 5.A
Streambank Restoration

Reducing streambank erosion is one of the highest priorities for this water trail project. This project recommendation is the implementation of C2.A Technical Assessment. Either a Wood Toe Sod Mat or a Stone Toe is recommended to restore the streambank.

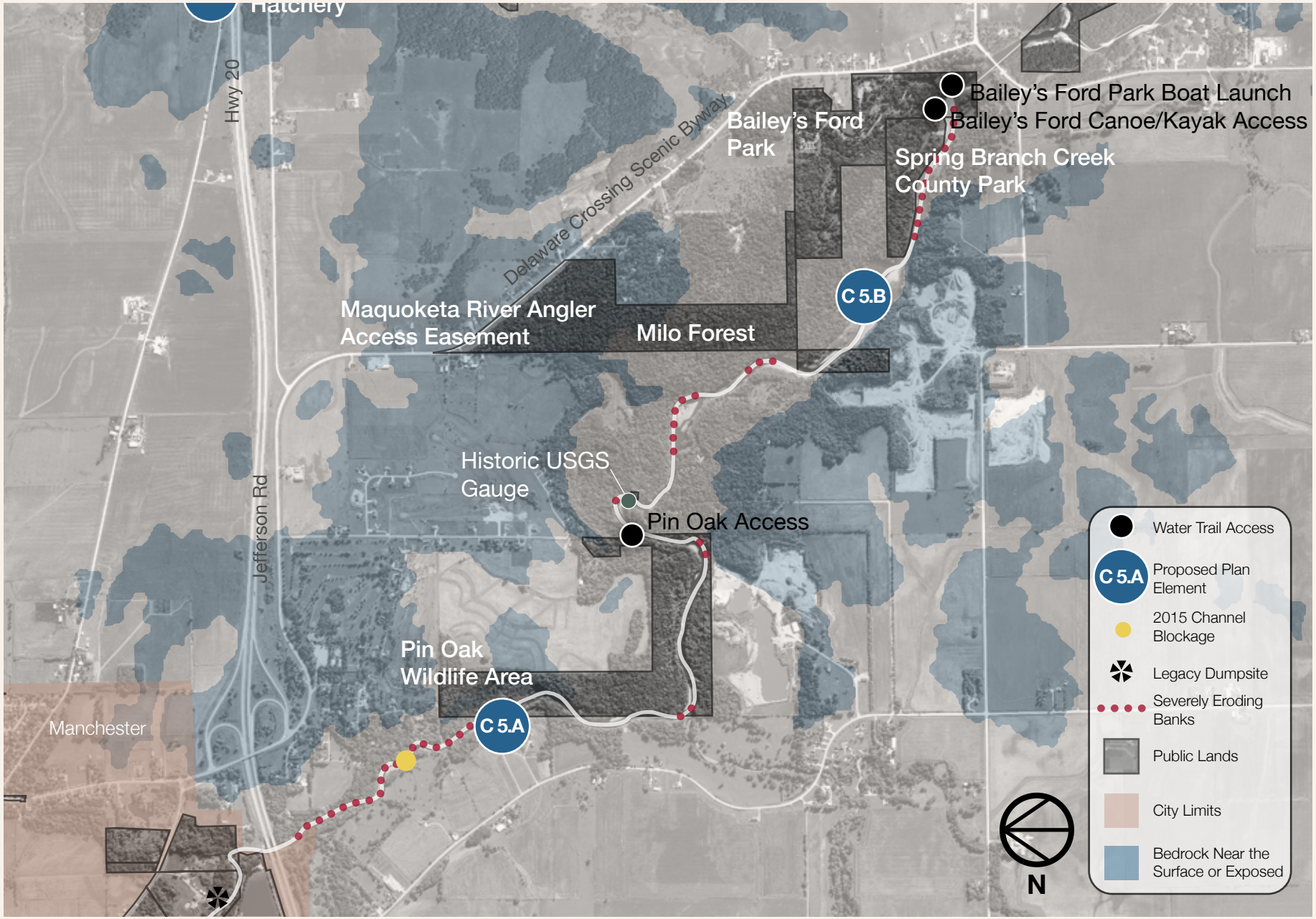


C5.A *This structural feature, the Wood Toe Sod Mat, is used to stabilize outside bends on eroding streams. Another alternative is a Stone Toe.*

C 5.B
Forest Management Plan

Iowa DNR regional foresters provide technical assistance to landowners to expand and care for Iowa's forests. A Forest Management Plan is recommended for land owned by Delaware County Conservation Board. The professionally trained foresters and natural resource technicians can help to plan for the sustainable management of these forests including development of long term goals for plant communities on public lands.

C5.B *Delaware County Conservation Board members acknowledge the importance of their forest resources and are actively planning for long term management Iowa DNR foresters.*



SEGMENT C5: **Highway 20 to Bailey's Ford Park**

C 5.C
Interpretive Signage at Hatchery & Historic Spring Branch Creamery Site

The fish hatchery is an outstanding, major attraction near the water trail. The Spring Branch creamery site holds a great deal of significance because it was the first operation in Iowa creamery to produce butter commercially. Butter from this creamery was exhibited four years after the creamery opened, in 1876, at the International Centennial Exposition in Philadelphia where it won the gold medal, outperforming butter-makers from across the world. This honor legitimized Iowa butter and created an international demand for the product. Onsite interpretation is recommended for both sites.

C5.C *Interpretative panels are one popular form of public education. This example of a river's edge panel is from another Iowa project.*

C5.C *The Manchester Fish Hatchery provides excellent recreational and educational facilities for the public.*

C5 Permitting Considerations

Disturbance for launch and parking improvements for water trail access at Pin Oak and the soft trail construction south of Highway 20 will likely require a Phase I archaeological investigation unless previous disturbance of these areas can be verified.

SEGMENT 5 COST ESTIMATES		
RECOMMENDATIONS	MAP CODE	COST ESTIMATE
Streambank Restoration	C5.A	$908,040
Forest Management Plan	C5.B	$0
Interpretive Signage at hatchery & Historic Spring Branch Creamery Site	C5.C	

RESOURCE CONSERVATION AND PROTECTION OVERVIEW

All recommended elements are summarized and organized in Appendix including the lead entity, partners, location, estimated costs and local prioritization. Resource conservation and protection project elements are also integrated into the Appendix.

Permitting Considerations

As with all construction on and near rivers, multiple permits are required prior to any disturbance. The following are expected:

- Local City (Manchester) and Delaware County have permitting processes for developing on a floodplain
- Joint permit application shared between the DNR flood plain development program, the DNR sovereign lands program, and the U.S. Army Corps of Engineers

As noted earlier in each plan segment, additional investigations and permits are required in some locations. These requirements are related to the sensitive nature of the known and not-yet identified cultural resource sites. These restrictions can affect vegetation removal, revegetation techniques and earthwork.

Potential Partners, Funding Sources and Local Resources

Funding and development of each plan element is the responsibility of the lead jurisdiction with oversight from the water trail manager. A number of local and state partner organizations and agencies are organized and positioned to assist with development of individual plan elements. Examples of partners include:

- Non-Profit Organizations such as Iowa Natural Heritage Foundation, Manchester Good to Great, Foundation for the Future of Delaware County and Greater Delaware County Community Foundation
- Local and State Agencies including Delaware Soil and Water Conservation District, Iowa Department of Transportation, Iowa Office of State Archaeologist, State Historical Society of Iowa, Iowa Department of Natural Resources, Iowa Economic Development Authority

Sections of this resource conservation and protection plan are intended to stand alone for use in funding proposals. Likely funding partners to supplement local funds include federal and state agencies and grant programs such as Resource Enhancement and Protection (REAP), State Water Trail grants, state and federal recreational trails program funding, regional Transportation Enhancements Program funding, statewide Transportation Enhancements Program funding, the Land and Water Conservation Fund, Wildlife Conservation and Appreciation funds from U.S. Fish and Wildlife Service.

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APPENDICES

Map Code	Location	Lead Jurisdiction	Recommendation	Local Prioritization	Budget Estimate for River-Related Recommendations	Other Collaborators	Notes
R1.A	River Corridor	Iowa DNR	On-Water Rescue Capacity Building	2	$0		
R1.B	River Corridor	Delaware CCB	Communication Among Access Managers	1	Reimbursable from IDNR		
R1.C	River Corridor	Iowa DNR	Public Interpretative Plan & Education Program	2	$0		
R1.D	River Corridor	Iowa DNR	Water Trail Wayfinding Signage Plan	1	$0	Water Trail Sponsor	
R1.E	River Corridor	Iowa DNR	New Water Trail Map	1	$0		
R1.F	River Corridor	Delaware CCB	Dry Hydrant Installation Study (at some accesses)	3			
C1.A	River Corridor	Delaware CCB	Enhance Aquatic Habitat for Fish and Mussels	2		Iowa DNR Fisheries, local angler organizations	
C1.B	River Corridor	Delaware CCB	Additional Archaeological Study	3		Outside Consultant, Iowa Office of the State Archaeologist	
C1.C	River Corridor	Delaware CCB	Vegetative Buffer Establishment (entire length)	2	$4,500	Willing Landowners, Delaware Soil & Water Conservation District	
C1.D	River Corridor	Delaware CCB	Explore Voluntary Riparian Forest Protection	3		Iowa Natural Heritage Foundation	
C1.E	Maquoketa Watershed	Delaware CCB	Support Delaware SWCD to work with landowners to reduce bacteria loading into the Maquoketa	1		Manchester Good to Great	
C1.F	Maquoketa Watershed	Delaware CCB	Increase Voluntary Monitoring	1		IOWATER, Manchester Good to Great	
C1.G	River Corridor	Delaware CCB	Use an established 501c3 to support development and conservation on the water trail	1	$0	Manchester Good to Great	
R2.A	Backbone State Park	Iowa DNR State Parks	New Backbone State Park River Access	3	$180,452	Iowa DNR	
R2.B	Dundee	Delaware CCB	Dundee Access Upgrade	2	$44,623		
R2.C	Strawberry Point to Backbone State Park	Backbone-Maquoketa Valley Trails	Off-Road Bike Trail Extension Between Strawberry Point & Backbone State Park	3			
R2.D	Dundee to Manchester	Backbone-Maquoketa Valley Trails	On-Road Trail Extension on Firefly Road to 150th Street/Existing On-Road Bike Trail	3			

Map Code	Location	Lead Jurisdiction	Recommendation	Local Prioritization	Budget Estimate for River-Related Recommendations	Other Collaborators	Notes
R2.E	Dundee Access to Lindsey Bridge Access	Delaware CCB	Flag Fence Crossings	1	$0	Willing Landowners, Manchester Good to Great	
R2.F	Near 165th Street & 150th Avenue	Delaware CCB	New Lindsey Bridge Access (new location)	1	$82,286	Delaware County Engineer, Manchester Good to Great, Iowa DNR	
C2.A	Dundee Access to Existing Lindsey Bridge Access	Iowa DNR	River Technical Assessment in Non-Bedrock Controlled Sections	1	$50,000	Delaware County Engineer, Delaware SWCD	
C2.B	River Corridor	Delaware CCB	Streambank Restoration	1	$2,283,555	Willing Landowners, Iowa DNR	
C2.C	Dundee Access	Delaware CCB	Legacy Dumpsite Cleanup	3		Manchester Good to Great	
R3.B	Firefly Road/140th Street	Backbone-Maquoketa Valley Trails	On-Road Bike Trail Extensions	3		Manchester Good to Great, Delaware County Engineer	
C3.A	Quaker Mill Dam	Iowa DNR	Quaker Mill Dam Modification ($504,000 total cost)	1	$252,000	Willing Landowner, Delaware County Engineer	
C3.B	River Corridor	Water Trail Sponsor	Streambank Restoration	1	$436,655	Willing Landowners, Iowa DNR	
R4.A	Manchester	City of Manchester	Remove Damaged Tirrill Park River Access	3	$0	Manchester Good to Great	
R4.B	Butler Road, Manchester	City of Manchester	New Primitive Motorized Boat Ramp	3	$500	Manchester Good to Great	
R4.C	Whitewater Park	City of Manchester	Upgrade Existing Access Above Whitewater Park	1	$14,208	Manchester Good to Great	
R4.D	Whitewater Park	City of Manchester	Repair Rock Weir to Avoid Injuries	1	Completed	Manchester Good to Great	
R4.E	Manchester	City of Manchester	New Gateway Access Downstream of Whitewater Park	2	$130,588	Manchester Good to Great	
R4.F	Manchester	City of Manchester	New Restrooms & Shower Near Whitewater Park	1		Manchester Good to Great	
R4.G	Manchester	City of Manchester	Bike and Pedestrian Trail Extensions	2		Manchester Good to Great	
R4.H	Manchester - Regional Medical Center to City Limits	Manchester - Regional Medical Center, City of Manchester	New Equestrian Trail	3		Interested Residents, Willing Landowners, Manchester Good to Great	
C4.A	River Corridor	City of Manchester	Streambank Restoration	2	$165,485	Willing Landowners, Iowa DNR, Manchester Good to Great	

Map Code	Location	Lead Jurisdiction	Recommendation	Local Prioritization	Budget Estimate for River-Related Recommendations	Other Collaborators	Notes
C4.B	Manchester Wastewater Treatment Plant	City of Manchester	Legacy Dumpsite Cleanup	2		Manchester Good to Great	
C4.C	Manchester	City of Manchester	Explore Greenbelt Protection Zoning	3		Outside Consultant, Manchester Good to Great	
R5.A	Pin Oak Access	Delaware CCB	New Gateway Access at Pin Oak Access	1	$62,872	Manchester Good to Great	
R5.B	Schram Park to Bailey's Ford Park	Delaware CCB	Off-Road Trail Extension	2		Backbone - Maquoketa Valley Trails, Manchester Good to Great	
R5.C	Milo Forest to Lake Delhi	Delaware County Engineer	On-Road Trail Extension	3		Backbone - Maquoketa Valley Trails, Manchester Good to Great	
R5.D	Manchester City Limits to Pin Oak Access	Delaware CCB	New Equestrian Trail	3		Interested Residents, Willing Landowners	
C5.A	River Corridor	Water Trail Sponsor	Streambank Restoration	1	$908,040	Delaware County Engineer, Iowa DNR, Willing Landowners	
C5.B	Milo Forest to Bailey's Ford Park	Delaware CCB	Forest Management Plan	2	$0	Iowa DNR District Forester	
C5.C	Iowa DNR Fish Hatchery	Iowa DNR	Interpretive Signage at Hatchery & Historic Spring Branch Creamery Site	3		Delaware Historical Society, Manchester Good to Great