

“paddling western iowa”



**WEST
NISHNABOTNA
WATER TRAIL PLAN**
POTTAWATTAMIE COUNTY • IOWA 2016

“paddling western iowa”

WEST NISHNABOTNA WATER TRAIL PLAN

DECEMBER 2016

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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.

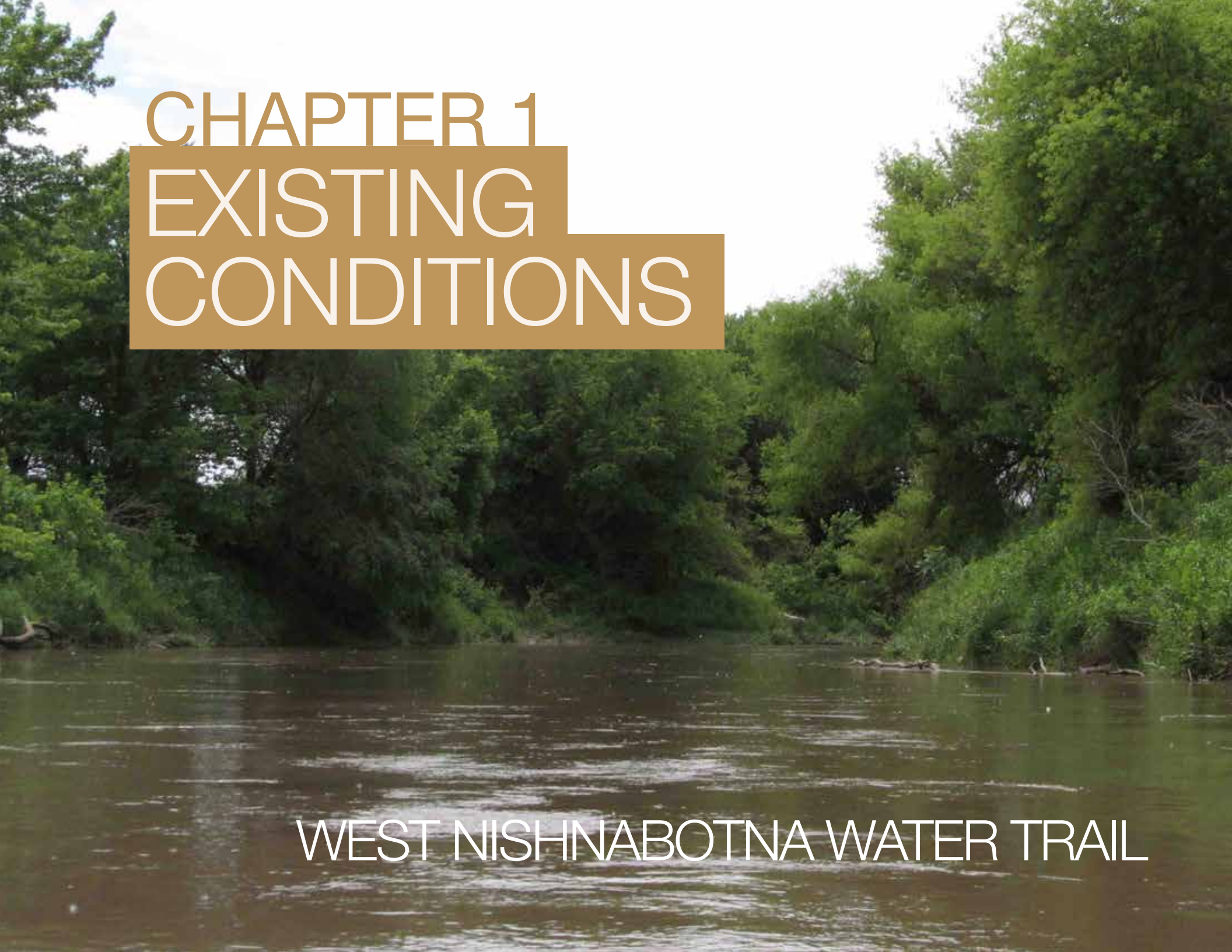
Once forgotten in years past, Iowa's navigable waters are beginning to take center stage. As they do, there is need to bridge the divides among multiple user groups, offer opportunities for listening, brainstorming, and strategizing that result in sensible decisions for the waters that connect local 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,

A handwritten signature in black ink that reads "Chuck Gipp". The signature is written in a cursive, slightly slanted style.

Chuck Gipp
Director
Iowa Department of Natural Resources

A wide river flows through a dense forest of green trees. The water is a brownish-green color, and the banks are lined with thick vegetation. The sky is visible through the canopy of trees.

CHAPTER 1 EXISTING CONDITIONS

WEST NISHNABOTNA WATER TRAIL

ACKNOWLEDGMENTS

Chapters 1 and 2 of this Water Trail Plan written by Mimi Wagner of Mimi Wagner Landscape Architecture LLC (MWLA), John Wenck of Iowa Department of Natural Resources and Emily Haase of Golden Hills RC&D. Emily Haase also provided local information, oversaw communication between Iowa Department of Natural Resources and the local project entities, and drafted the first version of Chapter 1. Pottawattamie County Conservation Board staff provided leadership and local support of the project throughout the process.

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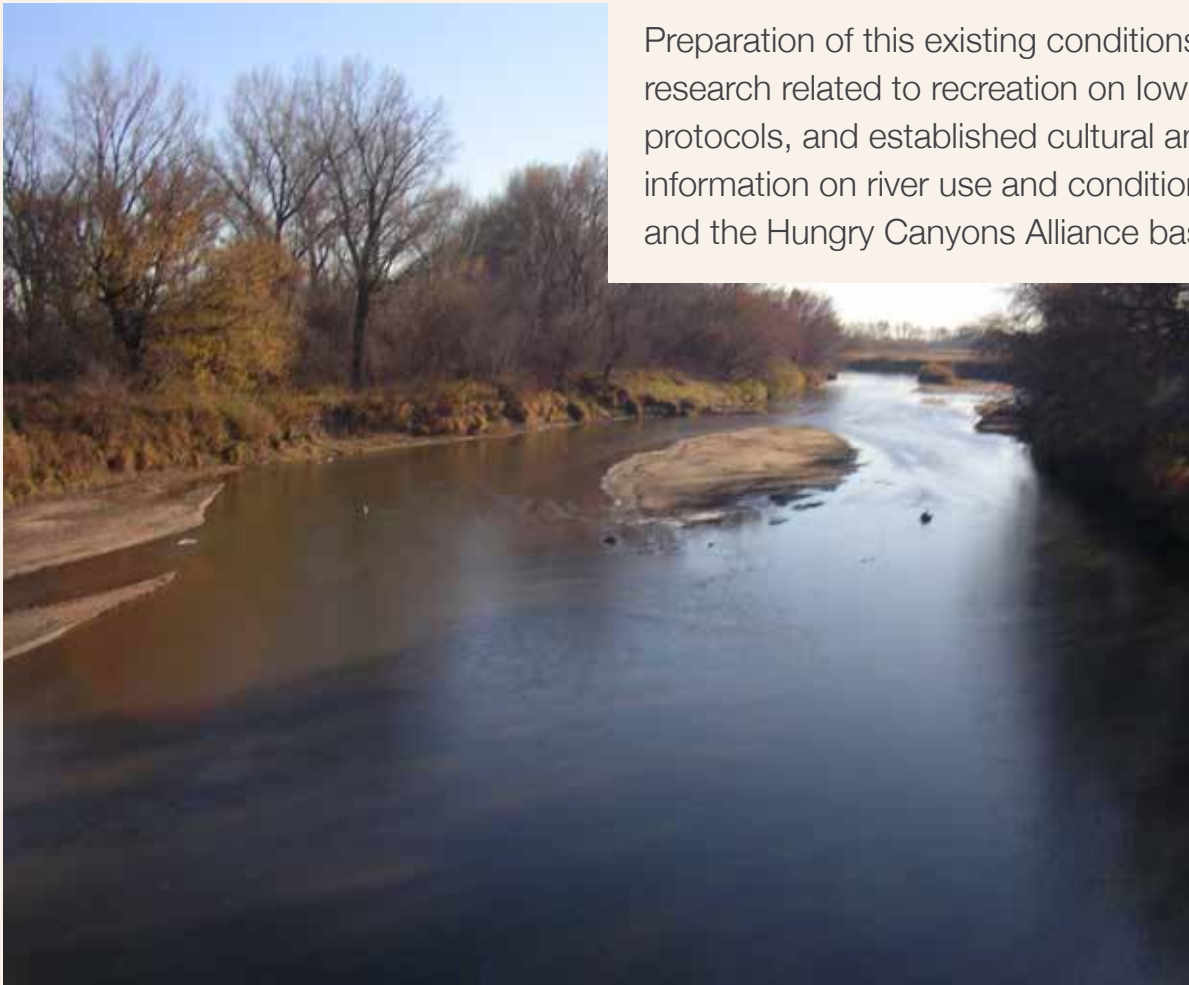
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The West Nishnabotna River in Pottawattamie County was designated a State Water Trail by the Iowa Department of Natural Resources (DNR) River Programs in 2010 at the outset of the state program for water trails.

This reach of the river had been enjoyed by local paddlers long before state designation. As currently the only state designated water trail in southwest Iowa, experiencing the West Nish (as it is called locally) has great potential for paddlers as well as the surrounding communities. A great deal of culture and history exist alongside the West Nishnabotna. No other state designated water trail in Iowa offers such a clear and strong opportunity to interpret historic migrations, social movements and river modification efforts in tandem with water trail use.

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 county staff, paddlers and the Hungry Canyons Alliance based in Oakland at Golden Hills RC&D.

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 West Nishnabotna River in Pottawattamie County has already been assigned state designated status. Pottawattamie County Conservation Board is the water trail sponsor and a steering committee 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 West Nishnabotna is a non-meandered stream beginning in Carroll, Crawford and Audubon counties and extending into Missouri before eventually draining into the Missouri River. The state designated water trail portion of river is limited to Pottawattamie County. The route is 27 river miles in length beginning at Edgington Memorial Park in Avoca and ending at Old Town Park near Macedonia (*Figure 1*). The watershed area draining into the West Nishnabotna River in Pottawattamie County is 713 square miles.

The river is used for canoeing, kayaking, small fishing boats and tubers. Water levels do not generally allow the use of larger motor boats. One livery exists on the West Nishnabotna in Botna Bend Park near Hancock. The existing livery rents large plastic tanks for use by groups of 5-7 people. Air boats also occasionally access the river at this access.



Figure 1
Each river access in Pottawattamie County is located in an established City and County Park.

According to the 2009 Iowa Rivers and River Corridors Recreation Study (Iowa State University 2009) the West Nishnabotna River is the most heavily used river in the immediate area with the exception of the Missouri River. Nearly 30% of the trips reported to the river in 2009 included use of some form of boat (*Table 1*).

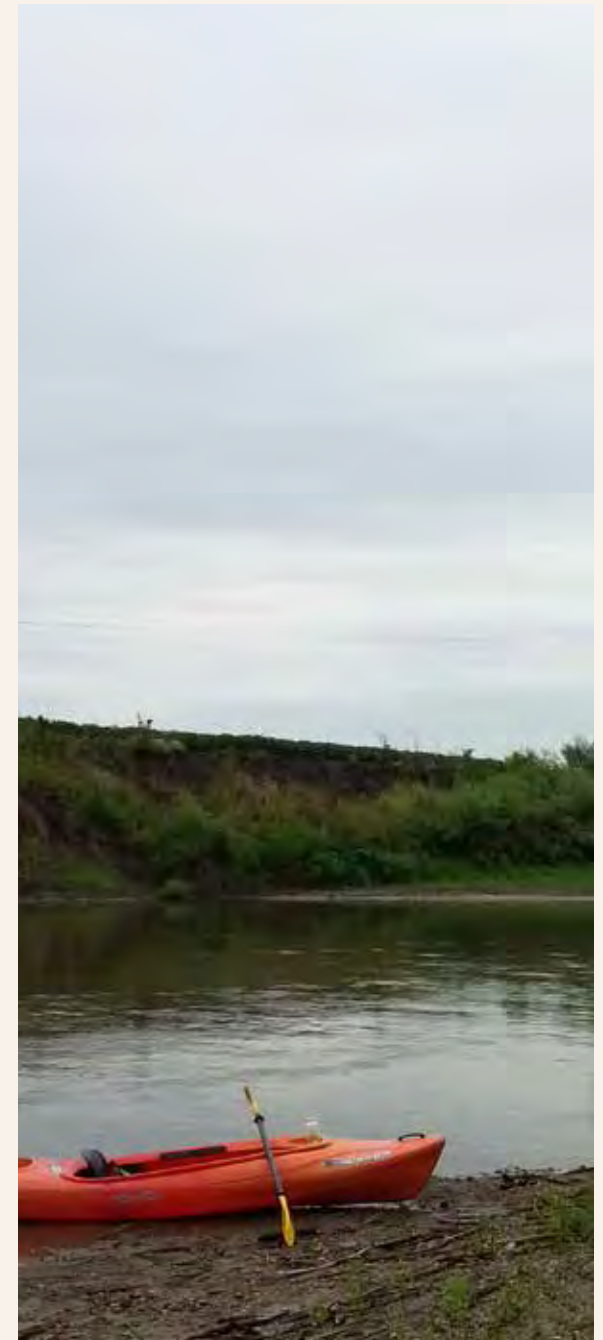
While the river is an important recreation destination in the region, there are no local organizations or entities advocating the West Nishnabotna River. Also there is no organized local paddling enthusiasts group.

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
West Nishnabotna	117	63.2%	37.6%	5.1%	23.1%	22.2%	35.0%	35.0%	36.8%	49.6%
Keg Creek	36	0.0%	58.3%	0.0%	0.0%	0.0%	11.1%	30.6%	38.9%	30.6%
East Nishnabotna (north of Red Oak)	71	59.2%	36.6%	1.4%	15.5%	19.7%	25.4%	2.8%	8.5%	53.5%
East Nishnabotna (south of Red Oak)	116	50.9%	57.8%	2.6%	6.9%	7.8%	1.7%	16.4%	37.9%	33.6%
West Nodaway	125	53.6%	29.6%	1.6%	4.8%	29.6%	7.2%	4.8%	25.6%	44.8%

Table 1

*Recreational Use Reported on Southwest Iowa Rivers**

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





Water Trail Existing Conditions

The name of the water trail is a bit deceiving as the most-northern section is actually located on the East Branch of the West Nishnabotna. The two rivers join south of Avoca. The drainage area and channel size of the East Branch are both considerably smaller compared to the main channel watershed at the same location (*Figure 2*). Very different water level conditions and paddling experiences are reported between the main channel and the east branch.

No dams are located on this reach of the river. Reported hazards include large woody debris, strainers and snags throughout most of the reaches and junk cars, other dumped large debris items and tires at select locations.

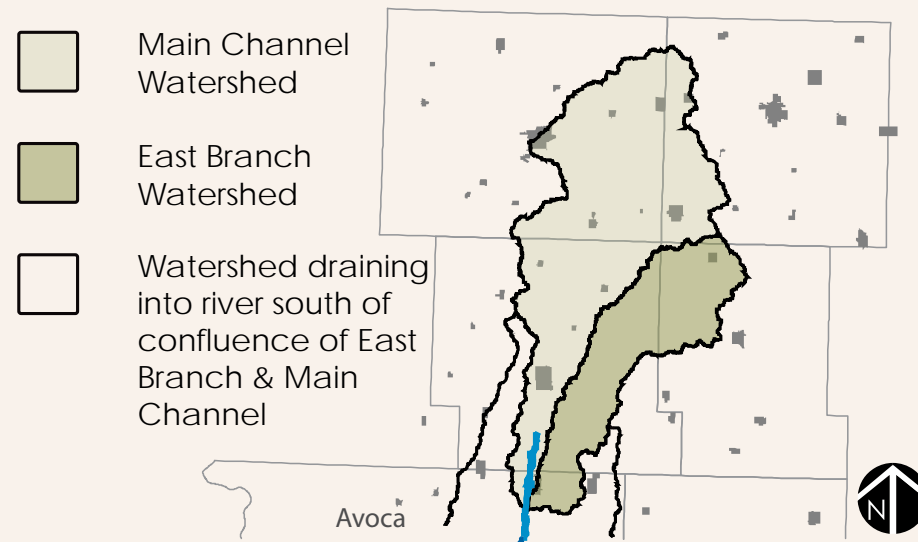


Figure 2

Differences in the watershed size between the East Branch and the main channel of the West Nishnabotna account for the disparate water levels reported by paddlers on the two segments.

The twenty-seven miles of water trail is divided by river access points into four segments (*Table 2*). The water trail passes through five rural communities. The two largest communities, Avoca and Oakland, each have a population near 1500 residents (2010 U.S. Census).

Water Trail Access Points

Each of the five access points in Pottawattamie County exist within or adjacent to a community and inside a city or county park (*Table 3*). Beyond these communities, no other landmarks, public land or facilities exist adjacent to the river within the county.

A range of public facilities and use opportunities are available at water trail access points (*see Table 4*). Restrooms, drinking water and some form of camping are available at nearly every access. Several launches have had recent upgrades and repairs.

Recreational Conditions Related to the Water Trail

The West Nish channel is deeply incised into the adjacent floodplain with average vertical streambank heights of 15' in Pottawattamie County (*Table 3*). The fairly low gradient channel also transports an enormous

Segment	Stream Speed	Segment Distance	Paddling Use Volume *	Debris, Trees, Blockage notes
Edgington Memorial Park to Botna Bend Park	slow	8	High	Rubble, Woody Debris
Botna Bend Park to Chautauqua Park	slow	8	High	Furniture, Woody Debris, Tires
Chautauqua Park to Mill Stone Park	slow	7	Low	Woody Debris
Mill Stone City Park to Old Town Park	slow	4	Medium	

Table 2

West Nishnabotna River Water Trail Segments, Pottawattamie County

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

Facility Where Access is Located	Access Number	Access Owner & Manager	Launch Type	Streambank Height
Edgington Memorial Park	3	City of Avoca	Carry Down	18
Botna Bend Park	66	PCCB ¹	Motorized boat ramp	18
Chautauqua City Park	58	City Oakland	Carry Down	15
Carson City Park	51	City of Carson	Carry Down	15
Old Town Park	47	PCCB ¹	Motorized boat ramp	10

Table 3

Water Trail Access Ownership and Basic Characteristics

¹PCCB: Pottawattamie County Conservation Board

amount of sediment. These two factors provide two challenges to recreational use of the river, particularly at access points. The steep and deep streambanks make developing low gradient river access points difficult without large amounts of earthwork. Launch surfaces on streams of this nature often become clogged with silt and other debris following high flows, requiring clearing.

Facility Where Access is Located	Water Trail Access Number	Restrooms	Amenities at Launch	Distance from river to drinking water (ft.)	Camping	Other Points of Interest at Access
Edgington Memorial Park, Avoca	3	Yes, Vault	benches, shelters, water	250	No	Developed City Park: schoolhouse museum, trail, ball diamonds, swimming pool, soccer field, paved city trails
Botna Bend Park, Hancock	66	Yes, Flush	picnic table, shelter, water, shower, tower	10	Yes, 150' from river	County Park: lodge, park office, boat livery/outfitter, picnic tables, elk, bison, traditional playground equipment, new nature playscape, city park adjacent with ball fields
Chautauqua City Park, Oakland	58	Yes, Vault	picnic table, shelter, water, shower	240	Yes	Developed City Park: wetland or stormwater area with native plants, soccer fields, ball diamonds, paved city trail, playground equipment, shelter with 6 picnic tables, benches around park, 2 covered/shelter- type tables
Mill Stone Park, Carson	51	City of Carson	picnic table, shelter, water, shower	210	Yes, 15, 90' from river	City Park: rodeo grounds, new playground equipment, ball diamond, soccer fields, natural dirt trail along river, covered shelter building
Old Town Park, Macedonia	47	PCCB ¹	picnic table	No water	Yes, 300' from river	Undeveloped County Park: tent camping

Table 4
Water Trail Access Amenities

Many of the existing river accesses in the county pose challenges for use (Table 5). Launches that are too steep (generally those exceeding 15% with the exception of the push-in section) pose use limitations for the elderly and others, including small children and those with disabilities. Walking or carrying a paddle craft down a launch 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).

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 built on the outside bend of rivers are also very vulnerable to damage and destruction when lateral channel migration occurs.

Facility Where Access is Located	Access Number	Parking Stall Count	Distance between Parking & River (ft.)	Path Slope Max. %	Vehicle Access to River is Possible	Launch Slope Max. %	Launch Angle to River (degrees)	Existing Experience Classification Of Access
Edgington Memorial Park	3	8	120	20	No	26	25	Recreational
Botna Bend Park	66	15 (planned)	N/A	11	Yes	16	80	Recreational
Chautauqua City Park	58	20	200	16	No	19	30	Recreational
Carson Mill Stone Park	51	3	150	15.5	No	15.5	20	Recreational
Old Town Park	47	10	120	27	Yes	27	60	Recreational

Table 5
Water Trail Access & Launch Relating to Use and Maintenance

River Management Conditions on the West Nishnabotna

A majority of law enforcement adjacent to the water trail, with the exception of the natural resources enforcement, is conducted by the Pottawattamie County Sheriff's office. Avoca maintains a two-officer police force. The remainder of the water trail area is served by two to three officers patrolling the eastern half of the county at all times. The Sheriff's Office utilizes a county 800 MHz digital communication system. The digital system is used county wide by all public safety responders with the exception of natural resources enforcement. The digital system also provides the ability to communicate with other jurisdictions such as Omaha; Douglas, Sarpy and Washington Counties in Nebraska. Natural resources law enforcement is provided by Iowa DNR District 3. One Conservation Officer is assigned to Pottawattamie County. Iowa DNR communicates with an analog radio system. Each of the five communities on the water trail (Avoca, Hancock, Oakland, Carson, Macedonia) have their own volunteer fire and rescue departments.

A limited number of boating accidents and/or rescues, vandalism or other disturbances have been reported on this segment of the river. Law enforcement has rarely been involved in responses on the river and does

	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 plan for accesses cleaned within a month of siltation, or rapidly repaired after flood damage.	
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.			

Table 6
Water Trail Access & River Management Elements Relating to Water Trail Classification

not regularly patrol the accesses. There are no specially-trained water rescue teams or equipment located near the water trail. A majority of the river is fairly disconnected from infrastructure. Many sections of the river are at least 0.3 miles from the nearest road. Removal operations for debris dams and strainers are not currently conducted.

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 removal of large woody debris snags and the maintenance of launches; *Table 6* 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; *Table 7* aligns people management elements suggested for experience classifications.

Current river and people management of this water trail most closely aligns with the Recreational experience classification. Several issues relating to river use, safety and law enforcement have been identified through the water trail planning process. These issues included the need for on-water rescue equipment, the need to coordinate with land owners to develop emergency access routes to the river channel from adjacent roads, and the need to inform county 911 and all rescue responders of river access locations (both formal

and emergency). An informal phone communication strategy is also needed between the county sheriff's office and Iowa DNR Conservation Officers for use until digital communication systems between organizations are compatible.

	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

Table 7
Water Trail User Elements Relating to Water Trail Classification



Social Considerations

The water trail sponsor, Pottawattamie County Conservation Board, is very supportive of state designation and planning for enhanced conditions on the water trail and for the river generally. Two of the five accesses are also owned by Pottawattamie County Conservation Board.

The three remaining accesses in community parks are owned by communities supportive of the water trail in concept (Avoca, Oakland, Carson). Each committed to maintain their access points (at least with volunteer efforts) and have accepted grant money to make improvements. Beyond this, official city engagement in planning and coordinating for the water trail has been minimal.

All public comments concerning development of the water trail have been positive and supportive. There was no landowner or other opposition voiced.

Existing Water Trail Experience Classification

All segments of the West Nishnabotna River Water Trail in Pottawattamie County exist today as Recreational experience classifications. This 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. *Table 8, Water Trail Experience Classification Summary*, summarizes key elements from the classification criteria (Wagner and Hoogeveen 2010).

Botna Bend is the one current full-service access on the water trail including the sole livery operation, ranger headquarters, and fully developed park services. As such, a heavy paddling volume exists on both segments associated with this access. Each of the five access areas includes basic amenities needed to access the river but none of the launches are constructed for use by special needs population (including the elderly and those with small children). Additionally, some access areas include very severe erosion into the river because of the way the launch and/or parking is constructed.

	Gateway	Recreational	Challenge	Wilderness
User Expectations	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • 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) 	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • 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,	<ul style="list-style-type: none"> • Often available at accesses • Liveries, shuttle often operating • Wayfinding signage on roadways is more extensive to clearly identify driving route, turns, etc. 	<ul style="list-style-type: none"> • May be available but usually not as developed • Liveries, shuttle desirable 	<ul style="list-style-type: none"> • May be available but usually not • Guided experiences may be encouraged 	<ul style="list-style-type: none"> • Any facilities present, such as remote campsites, are minimal, primitive, and without signage • Guided experiences may be encouraged over rental

Table 8
Water Trail Experience Classification Summary



Physical Conditions on the West Nishnabotna

The West Nishnabotna River is the most physically altered stream that is designated a state water trail in Iowa. Prior to 1900, streams in the Nishnabotna River watershed were “naturally sluggish and meandering” (Eash and Heinitz 1991). Streamflow characteristics in the watershed were significantly altered by channel straightening beginning in the early 1900’s and continuing through the 1970’s. Approximately 90% of the lower 100 miles of the West Nishnabotna River channel in Iowa were straightened (Eash and Heinitz 1991). The Pottawattamie County section of the river was straightened between 1910 and 1915 (*Figure 3*).

River straightening and channelization produces a predictable, natural response in both the river and surrounding riparian area.

The shifting channel alignment and the tall and vertical nature of the streambanks we observe today on the West Nishnabotna are signatures of the previous channel modifications. The water table elevation on the floodplain is drastically lowered, also a result of straightening, allowing row crop



Figure 3

A postcard from the early 1900’s depicts the steam-powered dredging machinery used to carve the new channel alignment for the straightened channel.

agriculture to replace the wet prairies mapped in the early 1850's by the General Land Office survey next to the river channel. Flooding continues to substantially impact near-river areas with the first major floods being recorded by USGS beginning in 1918 (Eash and Heinritz 1991).

River management today has moved away from channelization or straightening because of the long term, negative impacts to both the waterbody and the surrounding landscape. Federal and state permits are now required prior to most river modifications. Prior to the Clean Water Act, however, rivers were commonly straightened by dredging a new, straighter and much shorter channel to replace the original meandering planform of the river. The modified shorter,

straighter alignment produces much higher water velocities which quickly result in the erosion or downcutting of the channel bottom. As channel bottom elevations deepen, streambanks necessarily become steeper and taller (Figure 4). Mass wasting of streambanks and the channel is one obvious impact of this type of channel modification.

As the stream system naturally adjusts to major changes in alignment or land use, the channel often begins to reverse its previous downcutting action and begins to accumulate excess sediment in the bottom. This shift upward in channel elevation results in less storage space for high water flows and thereby puts additional, new pressure on streambanks. The channel planform also attempts to re-establish a stable condition by trying to develop a more curving alignment. Figure 5 illustrates an example of this return to a more curving planform on the West Nishnabotna.



Figure 4

Stream banks average between 12' and 18' high in Pottawattamie County. Approximately 28% of total stream bank length on the river is eroding bends such as this example.

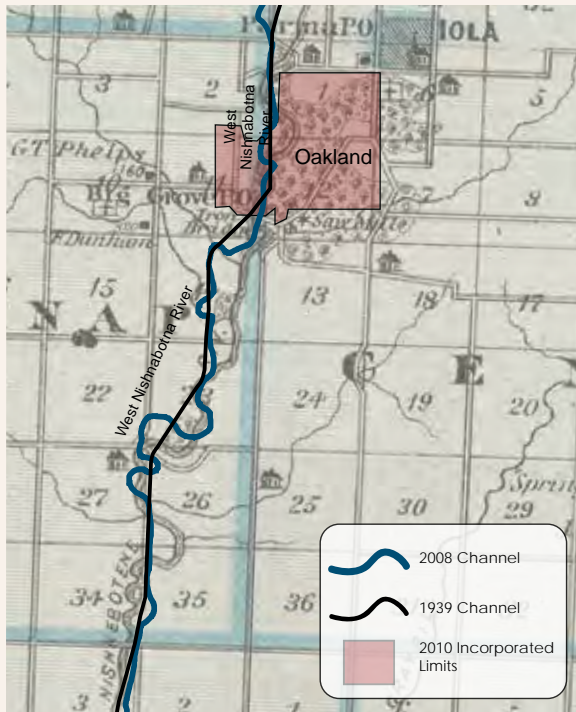


Figure 5

Note the river's re-meandering behavior as it continues to adjust to straightening in the early 1900's. The straightened 1939 West Nish channel south of Oakland is shown in black as well as the current alignment. Both are illustrated over the 1875 Andreas Atlas map background depicting the pre-straightened river.

Channel Conditions

In this section we reference Andrew Simon's Stream Channel Evolution Model (Simon & Hupp 1986) to illustrate the current conditions of the river channel and illustrate future conditions. Simon has conducted research with Hungry Canyons Alliance that included work on the West Nishnabotna River. The speed at which a river cycles through the six stages he illustrates is based on many factors including climate and watershed changes. In Simon's model (Figure 6), the river prior to channelization (circa 1910) is represented in Stage I. The channelized state is represented in Stage II. The channel bottom degradation (lowering) and associated streambank collapse that produced the conditions we see today are represented in Stage IV.

Hungry Canyons Alliance staff estimates that the channel bottom of the West Nishnabotna River in Pottawattamie County is stable in the sense that it is not actively downcutting any longer; this condition is illustrated as at the completion of Stage IV. The river condition in southern Pottawattamie County and throughout Mills and Fremont Counties is progressing into Stage V by beginning to collect extra sediment. More sand and silt is delivered to this section of the stream than can be carried away. The excess material drops out of the water column and deposits on the bottom of the channel between

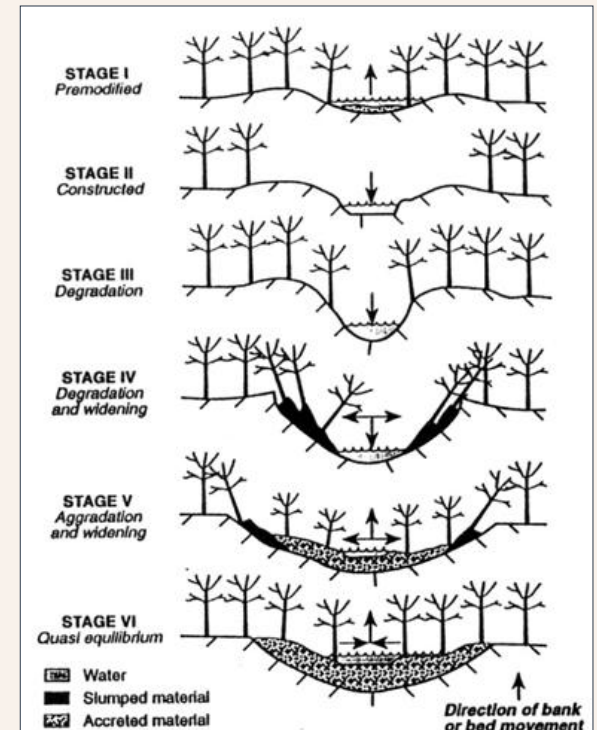


Figure 6

The widening and collapsing stream banks on the West Nish in Pottawattamie County are representative of Stage IV. The river is beginning to aggrade and widen in the southern end of the county, Stage V.

precipitation events, slowly filling in the channel and raising the streambed elevation (*Figure 7*). This build-up of material in the channel bottom places new pressure on the streambanks during flood events. According to Hungry Canyons Alliance staff, most tributaries to the West Nishnabotna River in Pottawattamie County are either in Stages IV, V, or VI determined largely on whether or not they were channelized in the 1950's. Straightened or channelized tributaries are today in Stages IV and V as the straightening activities contributed to channel downcutting and bank erosion. Tributaries not channelized are more stable in comparison and are in Stages V and VI.



Figure 7

The deposit of excess sand and sediment in the center of the channel and at the edges is known as aggradation. This is the opposite of channel downcutting. This example is downstream of the H12 bridge in southern Mills County and slightly upstream of Pottawattamie County.

Streambank Conditions

The tall and vertical nature of the West Nishnabotna streambanks easily lends itself to instability at areas where the channel is attempting to move laterally (from left to right). Mass wasting of soil occurs in these instances. We measured more than ten locations in Pottawattamie County where the river channel shifted laterally an exceptional amount within the last 30 years. *Figure 8* illustrates an example of this lateral migration.

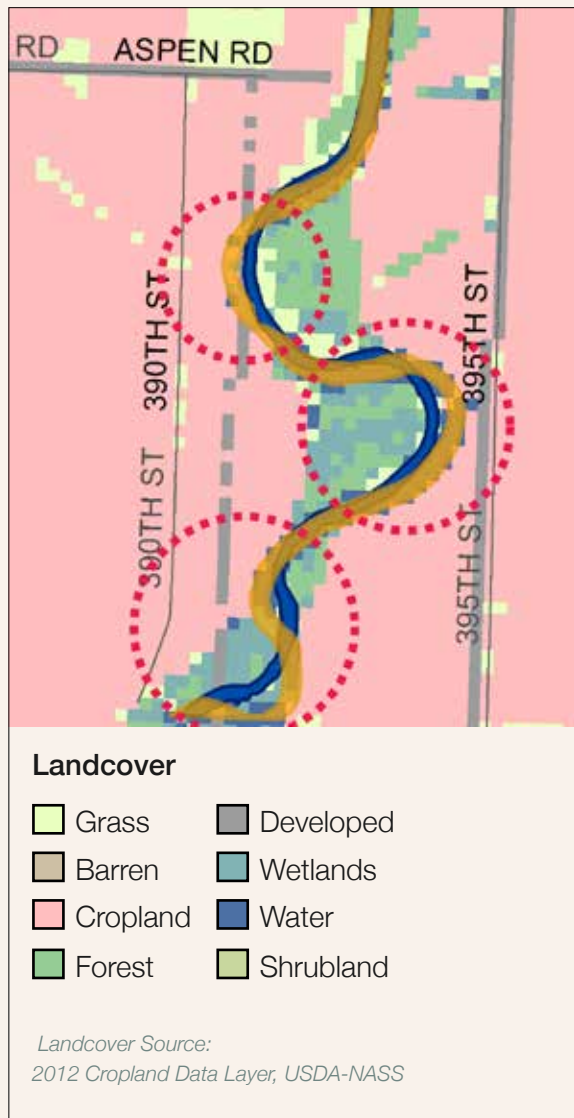


Figure 8

The West Nishnabotna channel alignment is highly active compared to other rivers of a similar size in Iowa. The largest changes are visible on outside bends of the channel. The brown line above represents a more recent alignment while the blue line show an older alignment.

Often the most vulnerable locations are bends in the river where top of bank vegetation is annual row crops or grasses. In some instances straight segments are affected, particularly when the top of bank is not vegetated with trees. Many areas on the West Nishnabotna, however, are currently not wasting large amounts of soil despite the vertical nature of the streambanks.

The extent and impact of lateral channel movement is not to be taken lightly. The West Nishnabotna River in Pottawattamie County is 2.3 miles longer today than it was in 1980 (Table 9). Likewise, the overall sinuosity of the river has also increased on each segment in Pottawattamie County.

Segment	Straight Line Length (mi.)	1980 Length (mi.)	2009 Length (mi.)	% change in length between 1980 – 2009	1980 Sinuosity	2009 Sinuosity
Avoca to Botna Bend	6.5	8.3	8.8	+ 6%	1.3	1.4
Botna Bend to Oakland	6.6	6.7	7.3	+ 8%	1.0	1.1
Oakland to Carson	4.8	6.3	6.7	+ 7%	1.3	1.4
Carson to Macedonia	3.2	4.0	4.2	+ 8%	1.2	1.3

Table 9

River Channel Calculations for West Nishnabotna River, Pottawattamie County

Riparian Landcover Conditions

The edge or transition between an aquatic ecosystems 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, such as those on the West Nishnabotna, 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 West Nishnabotna River are variable. More of the riparian area is perennial vegetation, appropriate for buffering, rather than annually cultivated crops.

Riparian areas within 100’ of the top of streambanks on both sides of the West Nishnabotna River were evaluated using landcover data from the 2015 cropping year to better understand the presence or absence of beneficial riparian buffer vegetation (Figure 9). The water trail

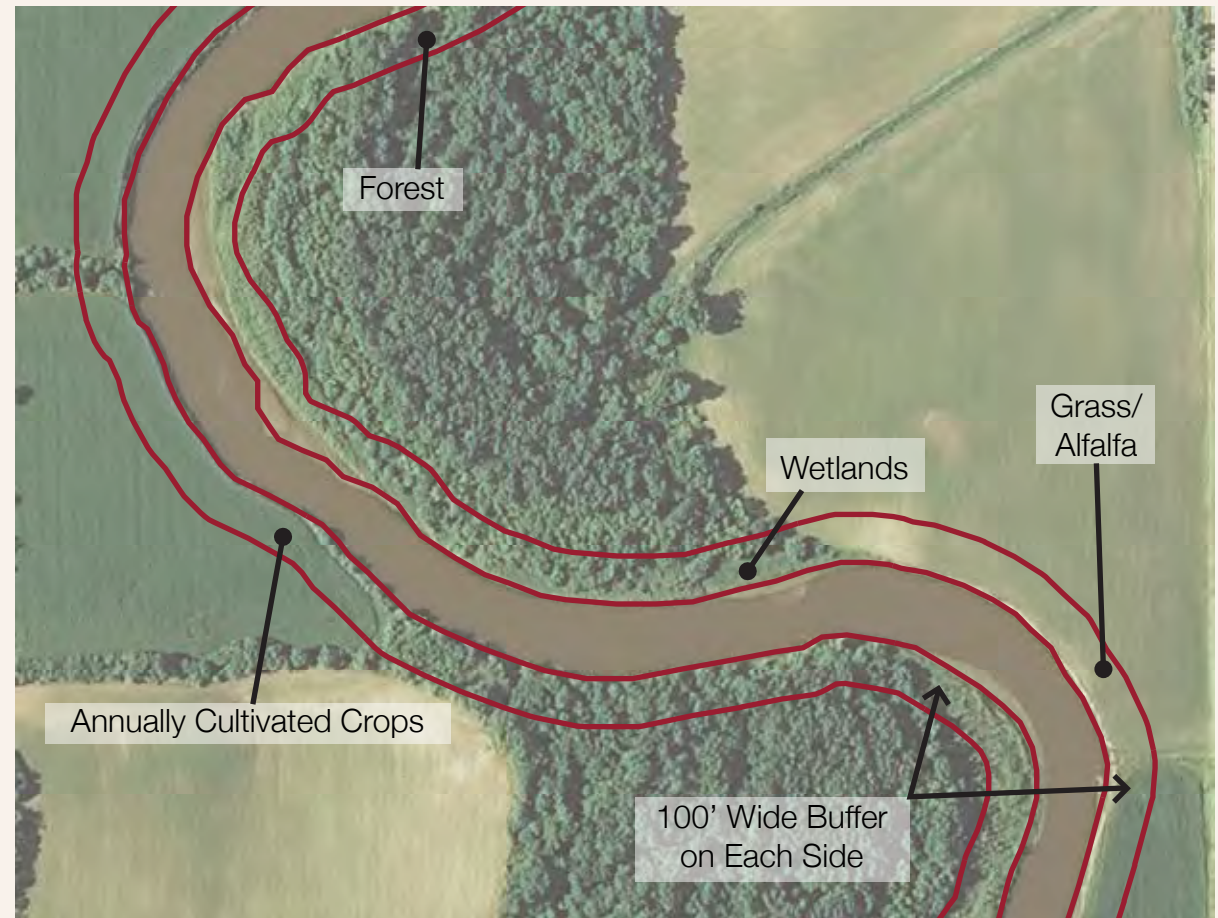


Figure 9

Red lines either side of the river channel approximate a 100’ distance from the top of the streambank. Landcover inside this line was identified for the length of the water trail. A perennial buffer is present on 75% of the acres included in this 100’ buffer on all water trail segments.

corridor was divided into segments based on river access points. Landcover in each of the four 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 10*.

Each of the four segments contain a minimum of 74% perennial landcover and one, Carson to Macedonia, has 88% perennial cover. Of all the water trail segments, the Botna Bend to Oakland segment includes the highest percentage of annually cultivated crops up to the top of the streambank, with 26%.

Looking at the water trail corridor as an entire unit, 75% of the total vegetated acres are perennial landcover while 17% are annually-cultivated crops (*Figure 10*).

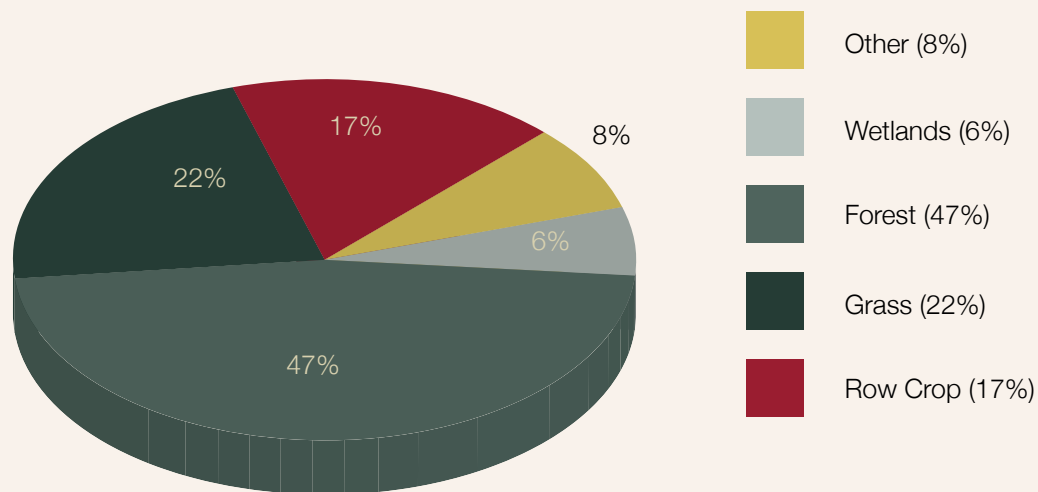


Figure 10

Only 17% of the stream-edge acres of this water trail are vegetated with annually-cultivated cropland. These cropped tracts are usually located on outside bends of the river where the channel is laterally migrating.

	County Line to Botna Bend	Botna Bend to Oakland	Oakland to Carson	Carson to Macedonia
Annually Cultivated Crops	27.0 (20%)	46.8 (26%)	34.5 (15%)	11.4 (12%)
Perennial Grass & Alfalfa	21.3 (16%)	17.9 (10%)	13.7 (6%)	19.0 (18%)
Forest	40.7 (30%)	97.3 (54%)	99.6 (44%)	68.1 (65%)
Wetland	46.8 (34%)	18.2 (10%)	11.1 (33%)	4.3 (4%)
Other	1.4 (1%)	0 (0%)	4.7 (2%)	0.5 (0%)
Totals	137.2 (100%)	180.2 (100%)	163.6 (100%)	103.3 (100%)

Table 10

The Carson-Macedonia water trail segment had the least amount of annually cultivated landcover in the 100' buffer either side of the channel. 2015 crop year acres for each landcover type are shown above as well the total percent of each type within a water trail segment.



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 we generally can see, smell or taste such as the temperature or the turbidity (cloudiness) of the 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 with 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 the 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.

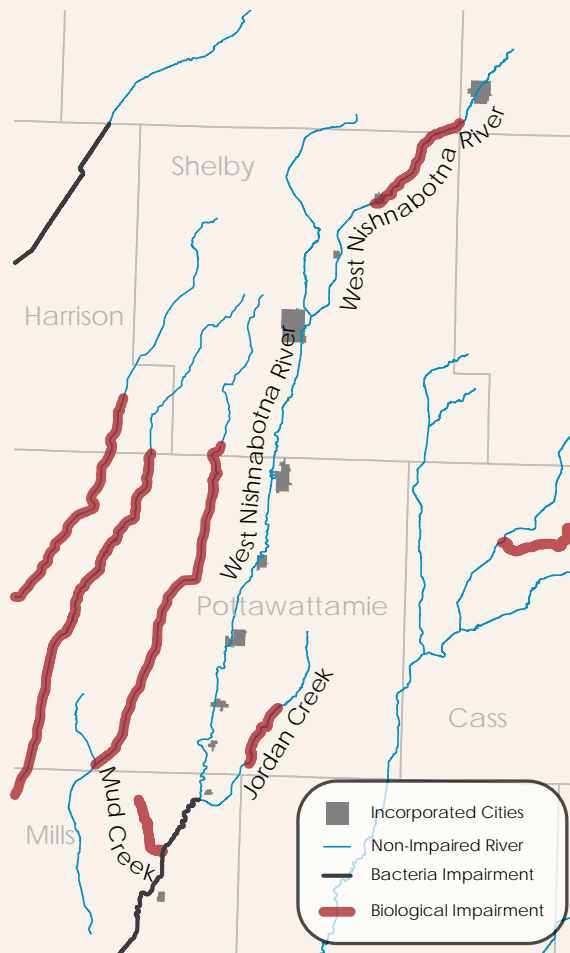


Figure 11
 While the water trail itself is not included on Iowa's 303d List, several tributaries are included as well as up and downstream segments.

No segment of the West Nishnabotna water trail is included on Iowa's 2012 List of Impaired Waters although segments up and downstream are included. *Figure 11* illustrates the 2012 List of Impaired Waters in the vicinity of the water trail.

A section of the West Nishnabotna River upstream of the water trail between Manning and Irwin is impaired for aquatic life uses due to biological stressors. A section of the river in Mills and Fremont counties, downstream of the water trail, is impaired for primary contact recreation due to high levels of e. coli bacteria. In addition, three Pottawattamie County segments of tributaries entering the West Nishnabotna downstream of the water trail are impaired for aquatic life uses due to biological stressors.

Contaminant Sources

Iowa DNR lists a total of 20 contaminant sources within 0.3 miles of the West Nishnabotna River in Pottawattamie County (*Table 11*). Contaminant sources include potentials for contamination of water resources based on the type of operation.

Contaminant Source Type	Total Within 0.3 miles of River*
Wastewater Outfall	4
Tier II Chemical Storage	5
Leaking Underground Storage Tank	7
Contaminated Sites	3
Open Feedlots	0
Solid Waste Facility	1

Table 11
 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.

The entire West Nishnabotna watershed is designated as a Prioritized Nutrient Strategy Watershed by the Water Resources Coordinating Council, meaning it is a high priority area for demonstrating conservation practices and technologies to reduce nutrient (nitrogen and phosphorus) loading to surface waters. Although the West Nishnabotna is qualified as a high priority, the watershed was not selected for funding from the Iowa Nutrient Reduction Strategy in 2013 to support these activities.

The Jordan Creek sub-watershed received Iowa 319 funding to develop a watershed management plan in 2000–2011. There are currently no active 319 projects in the West Nishnabotna watershed. Two active WIRB projects are located on Walnut Creek in the upper West Nishnabotna watershed in Pottawattamie and Montgomery Counties. Both focus on reducing soil erosion with field terraces and drop structures.

CONTEXT OF THE RIVER



Watershed Characteristics and Condition

This water trail is located within the Steeply Rolling Loess Prairies ecoregion in Iowa (Figure 12). It is the only designated water trail in this ecoregion.

The concept of “ecoregions” is used to characterize and group 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 Steeply Rolling Loess Prairies ecoregion is distinguished by rolling hills of thick loess deposits with underlying glacial till. Most of the ecoregion is prime farmland and cropland is extensive. Massive land clearing of the

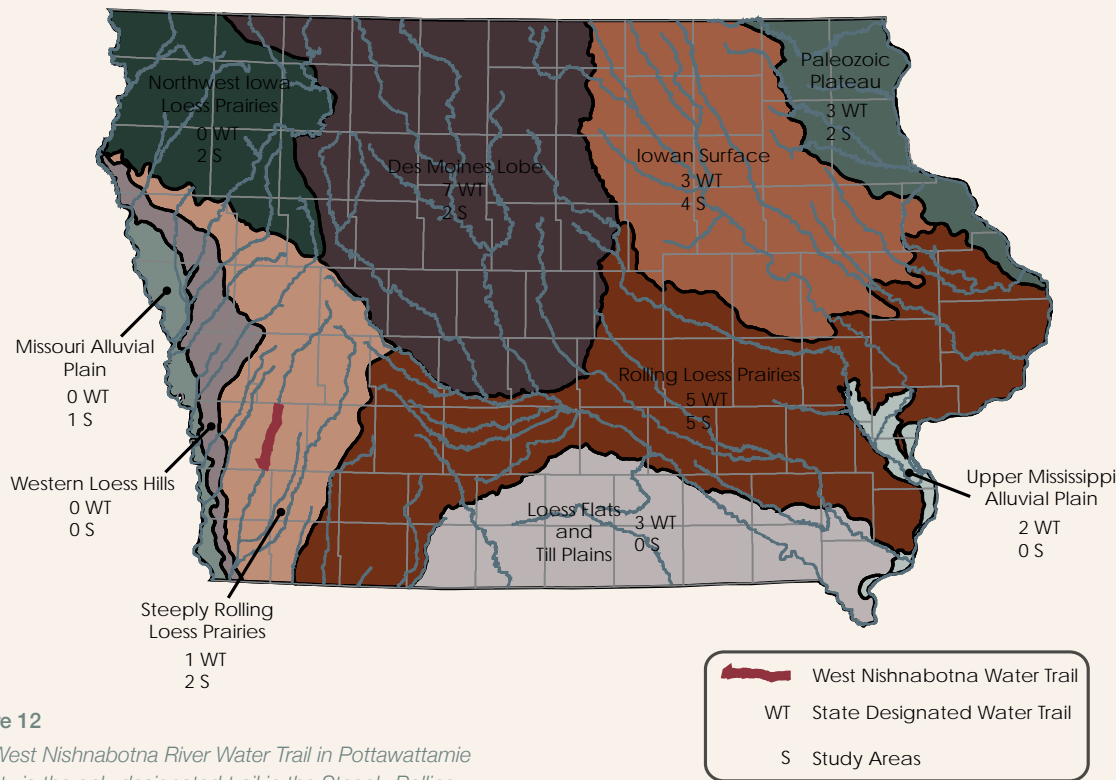
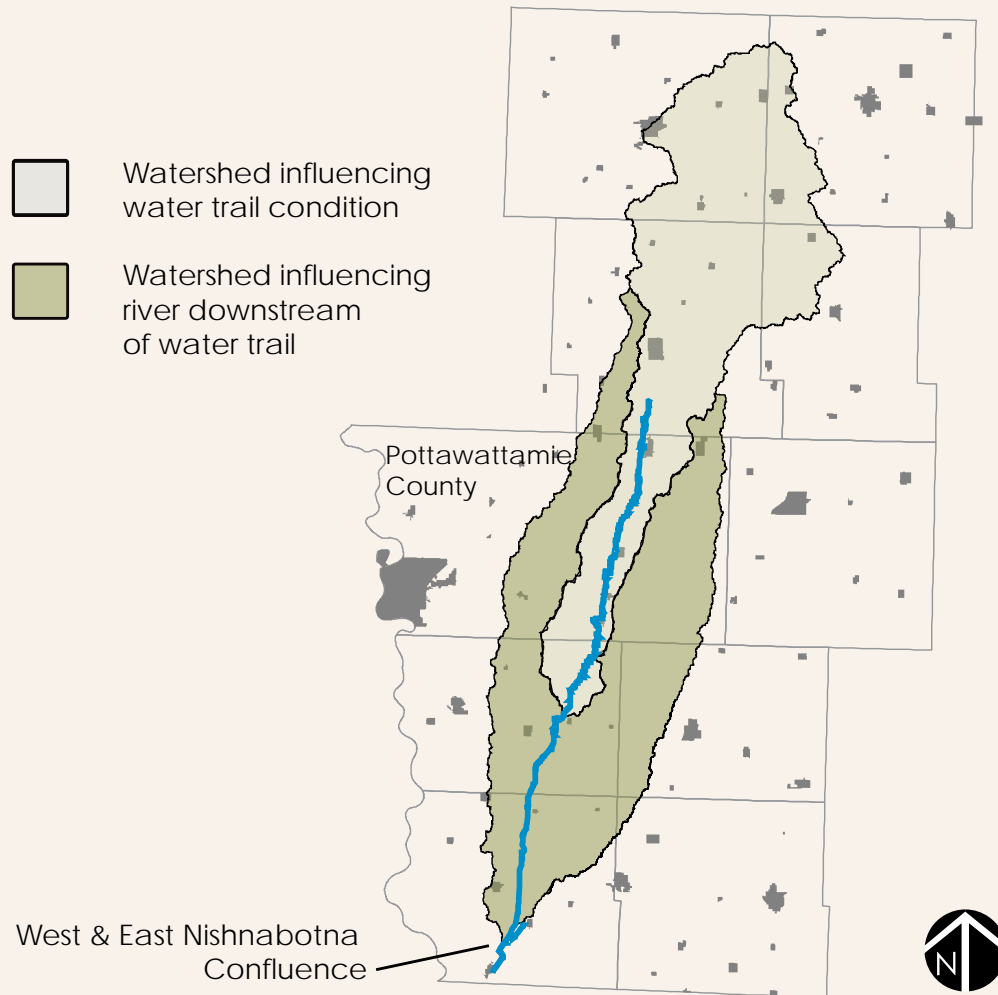


Figure 12
 The West Nishnabotna River Water Trail in Pottawattamie County is the only designated trail in the Steeply Rolling Loess Prairies ecoregion.

rolling hills post-settlement has promoted vast sheet erosion and gulying (Chapman et al. 2002). Subsequently, much of the loess soil deposit has been re-deposited in the valley bottoms.

The drainage basin or watershed area draining in the West Nishnabotna Water Trail route includes 489,509 acres (Figure 13). A majority of the watershed acres (80%) in 2012 was annually cultivated cropland (Table 12). Developed areas, including roads, neighborhoods and buildings, totaled 7% of the watershed. Twenty-one percent (101,480 acres) of the watershed is located in Pottawattamie County.



Land Cover Type	2012 Acres*
Annually Cultivated Crops	394,043
Grassland, Pasture, Alfalfa	53,532
Forest, Woodland, Shrubland	6,249
Wetlands	2,202
Open Water	1,600
Developed Land	31,883
TOTAL ACRES IN WATERSHED	489,509

Table 12
Land cover from the 2012 crop year was used to characterize the Pottawattamie County portion of the watershed. While only 13% of the watershed in Pottawattamie County is forested, it comprises 55% of the riparian buffer (Figure 10).
 *Land Cover Source: USDA National Agricultural Statistics Service, Cropland Data Layer 2013

Figure 13
 Slightly more than half of the total West Nishnabotna watershed influences conditions on the water trail. The remaining drainage area, shown in the darker green above, enters the river below the water trail.



Population and Development

High populations both reside and travel near this water trail. The U.S. Census 2010 indicated approximately 316,835 people lived within 25 miles of the West Nishnabotna River water trail. Additionally, Interstate 80 crosses the West Nishnabotna River several miles north of the beginning of the state-designated water trail. Iowa Department of Transportation indicates the annual average traffic on this section of road is 21,800 vehicles daily.

Once on the river, though, paddlers can expect a much different experience. A total of only four homes are located within 450 feet (equivalent to the length of 1½ football fields) of either side of the river in the entire county (*Table 13*). Road crossings, which act as a public interface for river users and an access point for rescue teams, are also limited. A total of 4 road crossings exist on the 27 miles of water trail with the exception of roads within 1000 feet of a water trail access point.

Land Cover Type	Within Municipal Limits	Rural	Total Houses
Within 450' of either side of river	1	3	4
Within 0.3 miles of either side of river	272	24	296

Table 13

Few homes are located close to the West Nishnabotna River with the exception of those within municipalities.

**Residential location data source: Structure Points of Pottawattamie County, Iowa DNR, 2010*

Resource Experiences Near the West Nishnabotna River

Recreation & Tourism in the Region

Although paddling is obviously the primary focus of people using a water trail, state-designated routes often offer a variety of other activities for paddling families and groups. From a paddling standpoint, the West Nishnabotna River Water Trail is one of the few designated routes in the region (Figure 14). The closest designated water trail in Iowa is 60 miles to the east, the Middle River Water Trail.

Several unique recreation and tourism opportunities exist near this water trail to complement its use. Trails and other linear experiences are one of these (Table 14). Bicycle routes in the Loess Hills and on the Wabash Trace Nature Trail are nearby. The planned but not yet constructed Lewis and Clark National Historic Trail will offer multi-use experiences through the landscape traveled by the famous explorers when it is completed. And last, but not least, the Loess Hills National Scenic Byway and the Western Skies Scenic Byway offer striking scenery and interpretative opportunities.

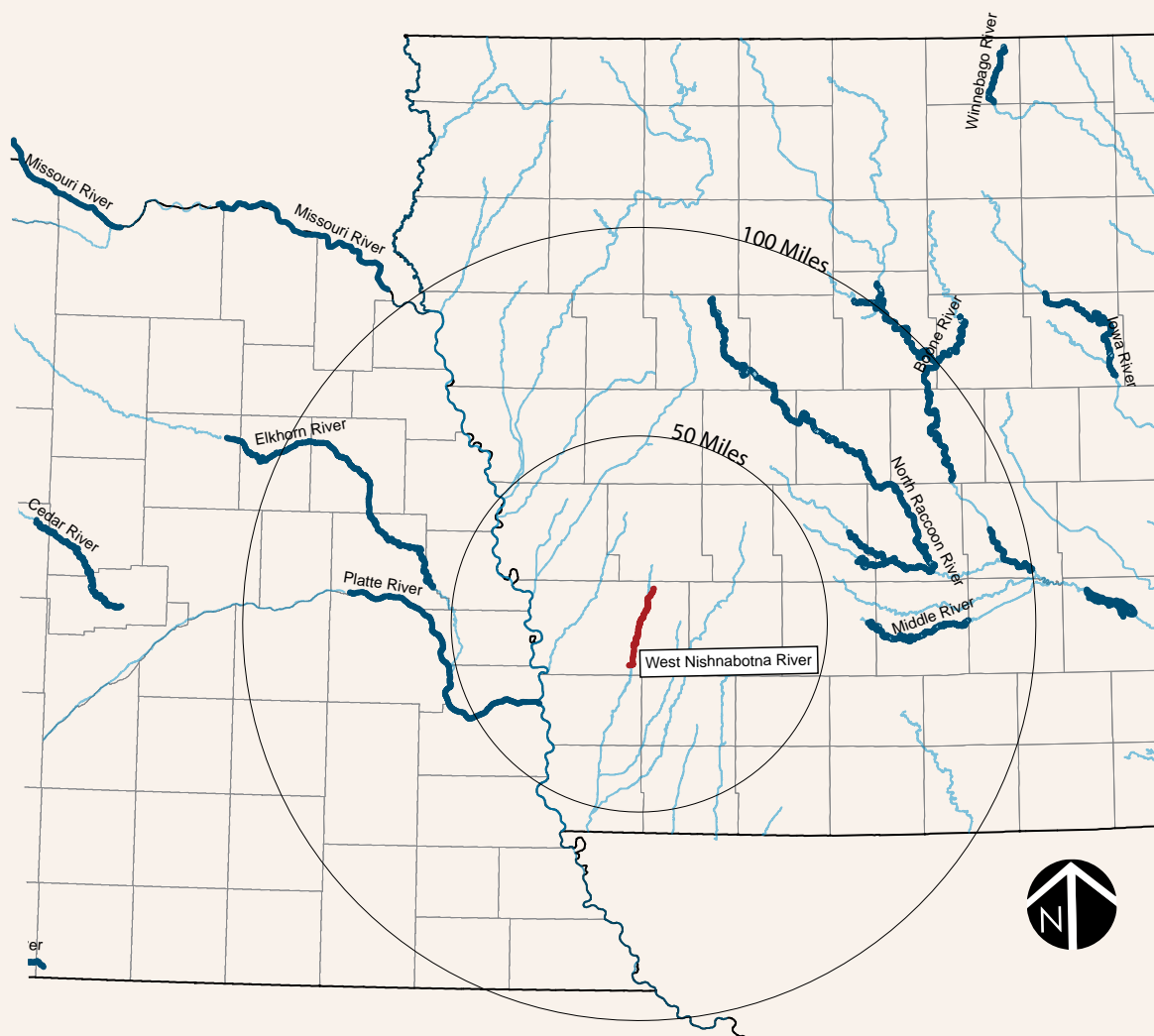


Figure 14

The West Nishnabotna River Water Trail is the only other state designated water trail in western Iowa and Iowa portion of the Missouri River drainage basin. The only other designated water trail within 50 miles is located in Nebraska.

State and national documentation certify the importance of the historic and cultural resources of eastern Pottawattamie County, particularly of the towns and features directly on the water trail route. And although it's not surprising that these resources are showcased locally, the degree to which they are is striking and valuable. More than 60 local museums or historic sites are available within 60 miles of the water trail; more than 50% of these are within a 30 minute drive of the water trail (Table 14).

Attraction	Miles Between Attraction and Water Trail	
Loess Hills National Scenic Byway	17 miles	
Western Hills Scenic Byway	11 miles	
Wabash Trace Nature Trail	20 miles	
Lewis & Clark National Historic Trail (planned)	30 miles	
	Quantity within 30 minutes of Water Trail	Quantity from 31 minutes to an hour of Water Trail
Iowa Museums, Historical Sites	34	29
Iowa State Parks, Forests, Recreation Areas	3	7

Table 14
Distance between West Nishnabotna Water Trail and Other Tourism Points of Interest

Cultural & Historic Resources

The West Nishnabotna provided a formidable barrier to westward advancement prior to and during settlement of the Western U.S. According to the General Land Office Survey from 1851-1853, vast wet prairie complexes occupied what is now drained farmland on much of the river in Pottawattamie County. Seasonal flooding and unstable channel bottom conditions limited the areas appropriate for river crossing. A location near Macedonia, at the site of the present Old Town Access is the location where settlers, including those using the Mormon Trail, did make passage.

The five communities on the river (Avoca, Hancock, Oakland, Carson and Macedonia) were all strongly related to the West Nishnabotna River and the railroad at the time of settlement. Multiple historic sites in each community are linked to early life in these communities.

The Office of the State Archaeologist (OSA) completed a Phase IA archeological reconnaissance survey along the route of the water trail in 2013 (Peterson 2013). 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. A total of forty-two ¼ sections of land within the OSA study area were mapped as containing one or more Iowa Site File-recorded archaeological sites. These ¼ sections are included in a water trail corridor map later in this chapter. The report suggests eight strong possibilities for interpretation in the water trail corridor:

There are several areas along the West Nishnabotna River Water Trail that have the potential to engage the public at large through the development of interpretive materials. Information on these properties could be presented in brochures, on interpretive signage, websites, podcasts, or through other media or outlets. Topics that may serve to engage the public include geological, paleontological, prehistoric, and historic-related themes or properties:

1. Very early quarry slightly upriver from the Old Town Access. Site would allow interpretation of local geology; it was first mapped by the 1851 surveyor. This quarry was actively used until at least the 1960s. The quarry is only 400 m (1,300 ft) from the river, and may be visible from it.
2. Oakland Mammoth Site is west of the river near the Chautauqua Park Access. The mammoth remains were discovered in 1970. Organic materials from soils just below the mammoth bones were dated to about 22750±600 years before present (B.P.), meaning the animal could be no older than that date.
3. Paleo-Indians were Iowa's earliest settlers and known sites are quite rare. A bluff top site in Pottawattamie County could be used to interpret this culture from a general interest standpoint.
4. There are six recorded Archaic sites in the river corridor in Pottawattamie and Mills counties, comprising 18 percent of all the recorded prehistoric-era sites in Iowa. The number of these hunting-and-gathering sites and the quantity of three-quarter grooved axes found along this stretch of river could be interesting to paddlers.
5. Several settlement clusters were established by the Mormons (LDS), extending from just north of the Chautauqua Park Access to south of the Old Town Park Access (covering about 17 overland km or 10 miles). River fords were mapped in the area in 1851, representing migratory routes used by LDS and other pioneers. The history of the LDS migration to Utah is a compelling story. The West Nishnabotna settlements do not appear to simply be overwintering camps, but rather cabins and fields built and used by the Mormon pioneers for several years prior to their westward trek.
6. Mills: Ruins of some former mill sites may remain. A total of six mill sites have been documented. Given their importance during Iowa's early written history—to farmers and city dwellers alike—these mainly river-related resources hold great interpretive potential.
7. National Register-listed buildings in the City of Avoca are the only NRHP-listed buildings in the corridor. These include the sub-courthouse, a cemetery chapel, and two houses.
8. Chautauqua Park history is an underreported element of our nation's history. Oakland's first Chautauqua was held in 1907, with William Jennings Bryant as the speaker. The park land was purchased in 1912, and the last Chautauqua held here in 1931. It appears that all celebrations here took place under large tents.



Geologic Resources

The unique geology found near the southernmost reach of the West Nishnabotna River in Pottawattamie County is noteworthy especially relative to the early history of the region. Records by early geologists further explain the early quarry and river crossing locations near Macedonia. Both the topographic nature as well as the exposed or near-surface stratigraphy could be important in interpretation to visitors. These areas are included in a later water trail corridor map later in this chapter. The excerpt on the right is taken from a 1900 publication on the geology of Pottawattamie County (Udden 1900).

The presence of the very early quarry near Macedonia, referenced earlier, is attributable to these near-surface deposits.

“The flood plain of the West Nishnabotna is next in importance. South of the junction of its two branches the width of its valley is one and two-thirds miles, but it is nearly two miles in width from here to Carson, where it suddenly narrows down to less than half a mile. Between Carson and Macedonia it again opens out to about one mile, but just northwest of the latter place its width... is scarcely more than one-eighth of a mile, and at the same time it makes a sharp and short turn to the west. This turn, as well as the abrupt narrowing of the valley, is due to the stream encountering the bed rock, which has more effectively withstood the effects of erosion than the loose drift. On the south line of the county the valley is again a mile and a half wide.

“The average elevation of the Nishnabotna valley in this area is one hundred feet above the Missouri river. From Avoca to the south line of the county this flood plain descends about eighty feet, or nearly three and four-tenths feet to the mile.

THE MISSOURIAN STRATIGRAPHY.

“There are only a few places in the county where strata of the Missourian stage are exposed. These are in the south part of the valley of the West Nishnabotna and in the bluffs of the Missouri south of Crescent.” (Udden 1900)

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. 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 lowland Surface ecoregion. The lowest values were found in the Steeply Rolling Loess Prairies ecoregion, where the West Nishnabotna Water Trail is located.

General fish species maps generated by Iowa DNR in 2010 as a part of the Iowa Dams Plan included 15 species known to occur on the West Nishnabotna Water Trail corridor (Figure 15). More detailed inventory assessments

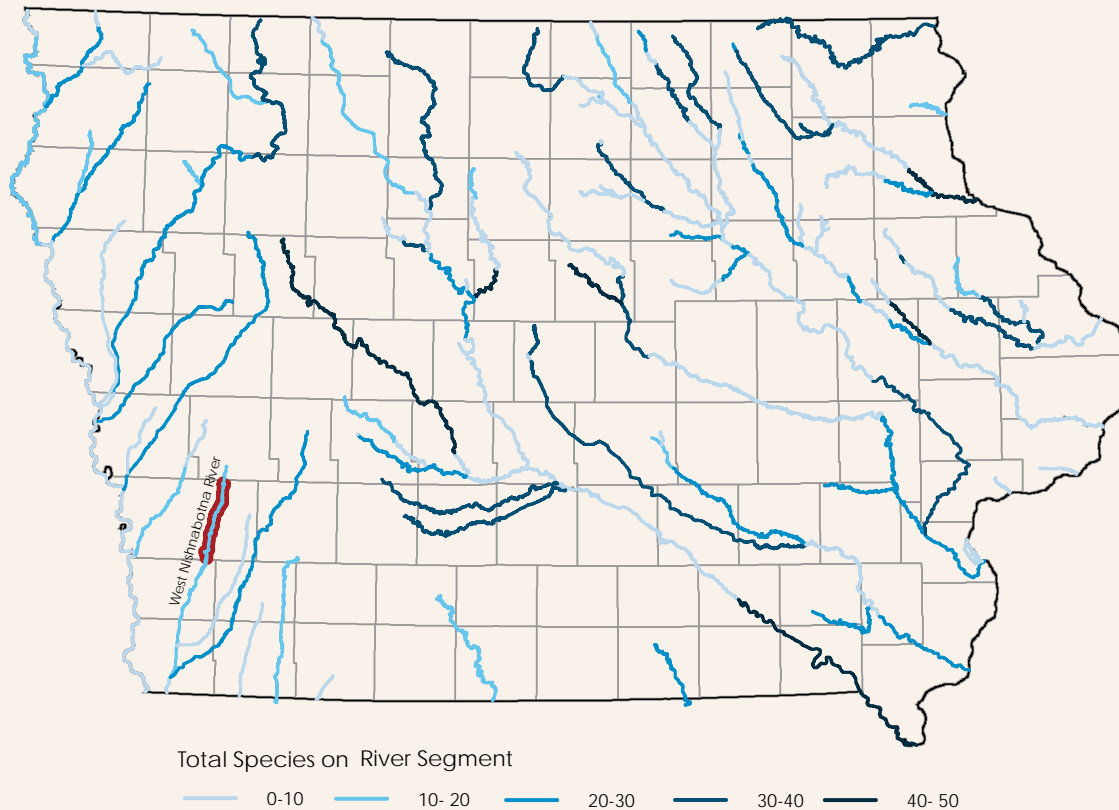


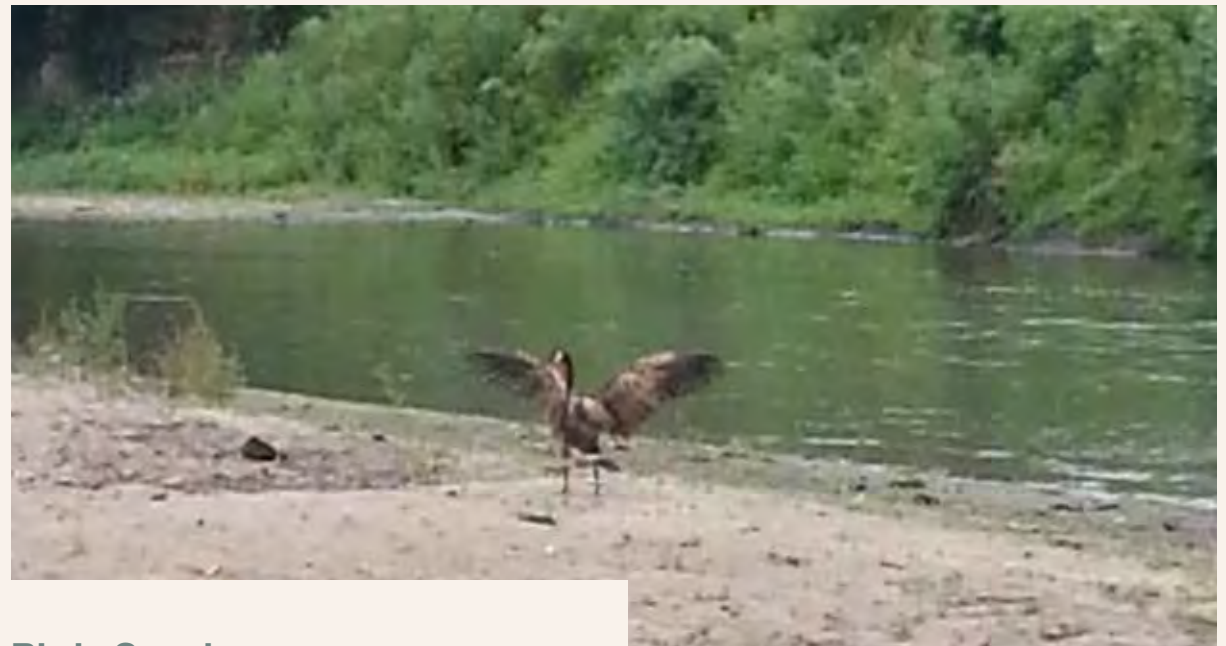
Figure 15

2010 DNR fish species inventory from the West Nishnabotna River identified 15 species on the water trail segment which is average for all streams in its ecoregion. A full list of fish species included in this inventory is included in Appendix B.

of both benthic macroinvertebrates and fish on the West Nishnabotna Water Trail in Pottawattamie County identified “fair” conditions (Table 15). Additionally, Iowa DNR mussel survey data from 2013 identified a range of between 5 and 14 living species on the study segment of the river.

Monitoring Location	1994	2000	2004	2007	2011
Avoca, East Branch of the West Nishnabotna					
Fish	39 (fair)	35 (fair)		N/A	27 (fair)
Benthic Macroinvertebrate	N/A	46 (fair)		43 (fair)	37 (fair)
Oakland					
Fish			28 (fair)		3 7

Table 15
Results from investigations show a decline in the diversity and populations of fish and aquatic organisms between 1994 and the present time on the West Nishnabotna Water Trail.
Source: Iowa Department of Natural Resources BIONET



Birds Species

Breeding birds are of great interest to many Iowans. 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. Three study blocks were located on the West Nishnabotna Water Trail. Both atlas projects used these same blocks. Two of the study

blocks are near Hancock and one is near Macedonia. These data reported a total of 84 species, 16% (13) of these are included on Iowa’s Species of Greatest Conservation Need (SGCN) List. Table 16 details SGCN species identified in both Breeding Bird Atlas projects. A full list of species reported is represented in Appendix Item A.

Monitoring Location	1985-1990 BBA	2008-2012 BBA
Black-billed Cuckoo		Y
Bobolink	Y	Y
Chimney Swift	Y	Y
Dickcissel	Y	Y
Eastern Meadowlark	Y	Y
Field Sparrow	Y	Y
Grasshopper Sparrow	Y	Y
Loggerhead Shrike	Y	
Northern Bobwhite	Y	Y
Red-headed Woodpecker	Y	Y
Sedge Wren	Y	Y
Wood Thrush		Y
Yellow-billed Cuckoo	Y	Y

Table 16
Of the 85 birds on Iowa's Species of Greatest Conservation List, 13 have been identified as breeding on or near the West Nishnabotna Water Trail by the Breeding Bird Atlas Project.

Visual Resources

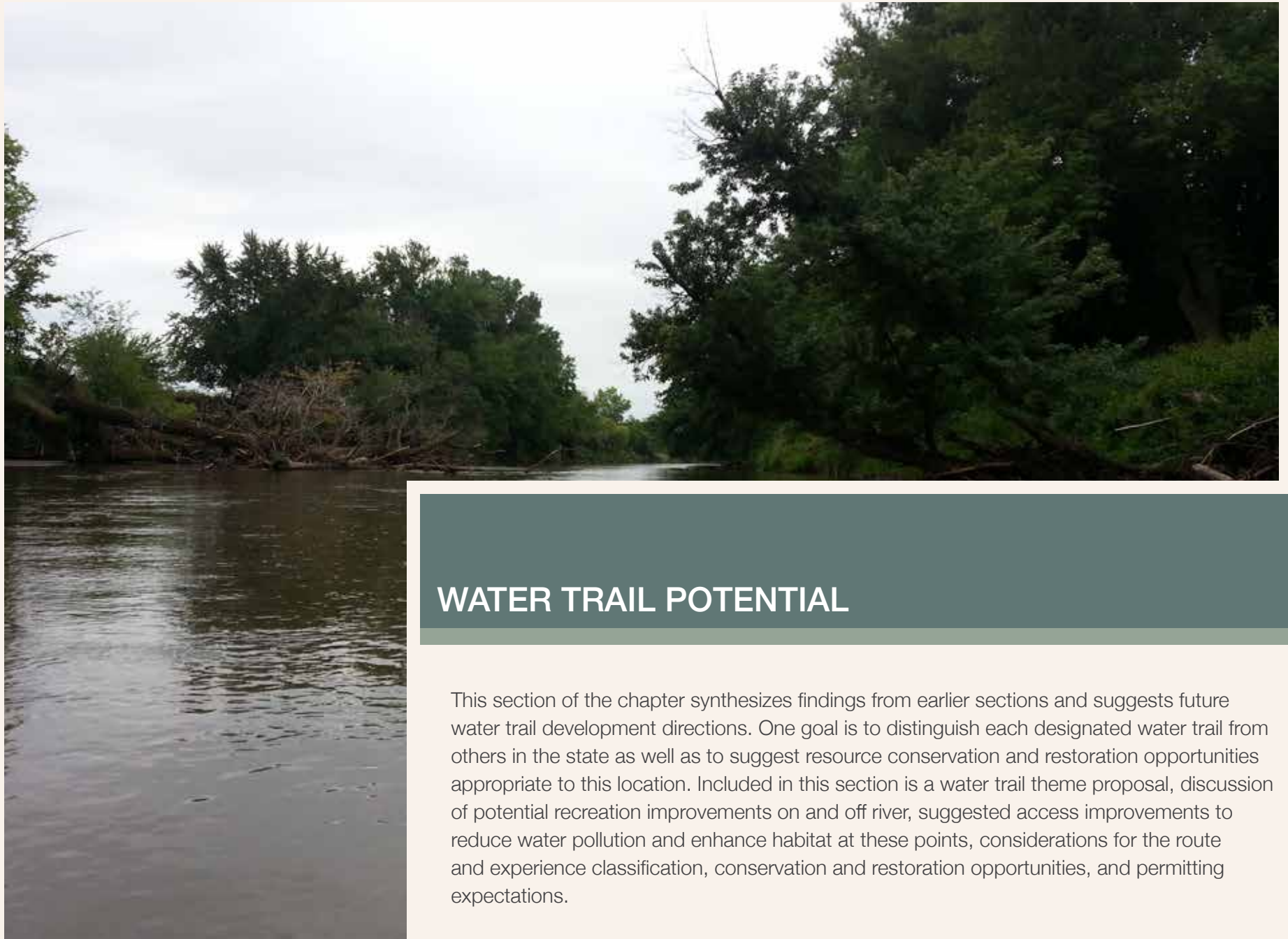
The quality of what paddlers look at while on the river is an important element in designating a state water trail. Views of the surrounding landscape near the river and the top of the streambank are the most widely seen elements beyond the water surface. The width of the floodplain viewshed changes spectacularly in several locations while on the river. The most notable location are the bedrock outcroppings on the river between Carson and Macedonia as noted in the above excerpt and illustrated in *Figure 16*. An additional expansive and spectacular view was noted approximately 0.5 miles north of Oakland.

As noted earlier in this chapter, 17% of the river edge acres lack a perennial buffer at the top of the streambank. Alternatives to perennial cover are annual row crops planted up to the edge of the streambank. High and vertical streambanks with annual vegetation or grasses are more vulnerable to massive failures.

Interpretation Programs and Efforts

Several public interpretive activities on or near the West Nishnabotna River in Pottawattamie County were coordinated in 2013 by Golden Hills RC&D staff. Seven participants attended a freshwater mussel and other macro invertebrates were observed in a June public event based out of Botna Bend Park in June. Thirty-seven participants attended a River Critters and Wildlife tour led by Jim Pease in August.

Pottawattamie County Conservation Board celebrated its 50th anniversary in 2014. Naturalists planned a series of events focusing on the West Nishnabotna River as a part of the celebration.



WATER TRAIL POTENTIAL

This section of the chapter synthesizes findings from earlier sections and suggests future water trail development directions. One goal is to distinguish each designated water trail from others in the state 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.



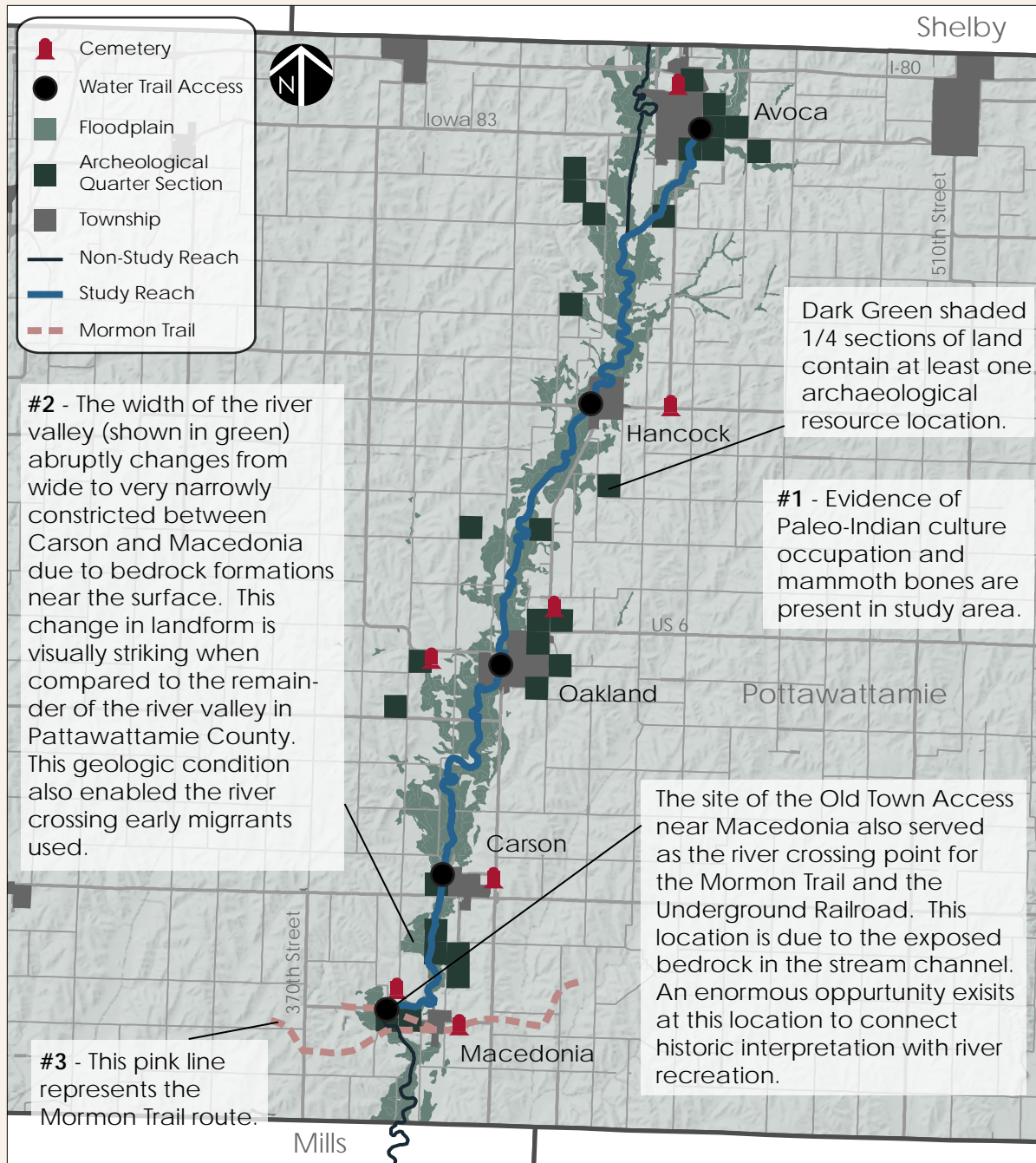
Water Trail Theme

A water trail theme describes the unique experiences a river and its surrounding area offers the public. Themes are used to distinguish one water trail from another for marketing as well as in conservation priorities. Themes also identify and focus future development efforts on and near the river.

The West Nishnabotna Water Trail area includes a unique set of natural, cultural and recreation resources: a high diversity of fish species, surficial geology unusual for this ecoregion, nationally significant cultural and historic features and sites, and a rich river modification story. As the only state designated water trail in the Steeply Rolling Loess Prairies ecoregion, it brings people in contact with the ecosystems and wildlife resources expected in this ecoregion. Socially, the water trail includes a water trail sponsor dedicated to enhancing river use and interpretation, a functioning boat livery, and five river communities with a vested interest in expanded visitorship.

More than 400,000 people are estimated to either live within 25 miles of the water trail or pass near its northern limits everyday on Interstate 80. Despite this high number, the water trail setting offers a relatively remote, quiet and peaceful experience. Only 4 residences and 4 bridge/road crossings outside of communities and river access areas exist on this water trail. Planning identified specific elements related to water trail theme. Some of these elements are illustrated in *Figure 16*:

- Early 1900's straightening of the river in Pottawattamie County and a channel that continues to try to resume its sinuous, pre-straightened alignment
- Documented occupation by Paleo-Indian culture – the earliest documented residents of the Iowa region (approximately 13,000 years before present)—as well as bones of a mammoth (aged 22,000 years before present), one of the “big-game” species hunted by Paleo-Indians (example cultural resource sites shown as #1 on *Figure 16*)



- Abrupt changes in floodplain width with exposed bedrock outcrops on the river and a related quarry first mapped in 1851 (#2 on Figure 16)
- Early Mormon settlement sites (mapped in 1851) as well as Mormon Trail crossing of the West Nishnabotna at bedrock outcropping riffle of the West Nishnabotna (#3 on Figure 16)
- More than 60 local museums and historic sites within an hour's drive of the water trail
- Camping at 4 city or county parks on the banks of the water trail and at 10 additional state parks, forests and recreation areas within an hour's drive

Figure 16
Numerous cultural and historic sites are located on or near the West Nishnabotna River.

Recreation Potential On-River

The West Nishnabotna is already the most heavily used interior river in southwest Iowa. Currently the water trail functions as a Recreational classification, meaning it is a typical Iowa river experience and suitable for people with some paddling experience. The water trail functions well in this classification.

However, opportunities exist to enhance use of the river by current users as well as to expand use to new populations. *Tables 17, 18 and 19* organize enhancement opportunities for river use aspects of the water trail. These enhancements are discussed in more detail later in this chapter.

Recreational Enhancement	Issue Addressed
Enhance Everyday Management Conditions	
Increase capacity for on-water rescue	A lack of put-in locations on rural sections of the water trail and on-water rescue equipment delays rescue time in the case of emergencies
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
Develop a livery management policy	Livery management policies adopted at the county level in Iowa enable liveries to improve paddler understanding of appropriate behavior as well as safer use of the river
Standardize ordinary maintenance at launches	Better communication and agreement by the 4 access owners/managers could result in more efficient and timely removal of sediment and debris from launches and other ordinary maintenance tasks

Table 17
Opportunities to enhance everyday management conditions

Recreational Enhancement	Issue Addressed
Enhance Water Trail Experience for Current Users	
Locate a new water trail access upstream of Botna Bend on the main channel	Significantly different water level experiences can occur on the Avoca to Botna Bend segment due to the differing size of the watershed areas of the two rivers. In times of low water, paddling the upper half of this segment can be difficult due to low water. No option currently exists to enter the main channel upstream of Botna Bend in Pottawattamie County
Upgrade parking availability geared for river users	Parking areas near the access point are a necessity for loading boats and gear. While all accesses have open grass areas where cars are allowed to park, not all have parking areas developed near the launches
Upgrade accesses with overly steep launch and path slopes	High, vertical streambanks often result in steeply sloped access routes to the water's edge; alternative launch designs and materials could be utilized which would allow people with a greater range of physical abilities to reach the water
Demonstrate low impact streambank restoration	Stream restoration practices for bank and floodplain restoration could be incorporated near accesses to demonstrate them and interpret the appearance and functionality of these approaches

Table 18
Opportunities to enhance water trail experiences for current users

Recreational Enhancement	Issue Addressed
Attract New Paddler & Angler User Populations	
Upgrade launch types to allow vehicles & people to reach the water's edge	Three of the five accesses are carry down launches on 15'-18' high streambanks. 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 capacity	Large, downed trees can cause hazards to paddlers, especially with high water. Wood in the channel is also an important habitat element. Selective removal of large woody debris can balance safety needs with habitat quality
Alter paddling segment distances and/or upgrade facilities at existing accesses to promote Gateway classifications	Gateway segments are possible on this water trail with interventions in either paddling distance or access services. Only one segment of the river is < 6 miles in length; accesses on this segment lack a livery, restrooms, drinking water and river management facilities are secondary in terms of services. The one full-service access, Botna Bend, straddles two 8-mile paddling segments.
Upgrade some access facilities	Restrooms and drinking water are not available at all accesses. More widely available toilet and water services are an important part of enhancing the user experience and enhancing water quality of the river



Table 19

Opportunities to attract new river user populations

The most recent planning documents for each park where water trail accesses are located were reviewed in July 2013. The following improvements were included in these plans:

Edgington Memorial Park, Avoca

Planned non water trail-related recreation improvements at park: Disc golf course, upgraded electrical distribution system, additional parking for soccer and other team sport fields, expansion of trail system within the park including impervious surfacing, resurfaced basketball court, dog park construction, play equipment replacements, convert water hydrants to drinking fountains

Planned water trail-related improvements:

Botna Bend Park, Hancock

Planned non water trail-related recreation improvements at park: new camping, parking, disc golf course, road construction, streambank restoration, interpretive panels, river overlook, basketball court & playground area, park road improvements

Planned water trail-related improvements: new impervious surface parking, water hydrant, paved extension of existing launch, restrooms—all near water trail access portion of the park

Chautauqua City Park, Oakland

Planned non water trail-related recreation improvements at park: new RV park near water trail access

Planned water trail-related improvements: water hydrant

Millstone Park, Carson

Planned non water trail-related recreation improvements at park: realigned roadways, new basketball, baseball, disc golf, soccer complex, impervious parking for 100 cars +/-, spray play area, memorial tree plantings, heritage park, upgraded primitive campsites, pedestrian bridge across West Nishnabotna River

Planned water trail-related improvements:

Old Town Park, Macedonia

Planned non water trail-related recreation improvements at park: new water hydrant, toilets, electric campsites

Planned water trail-related improvements:

Several already planned improvements connect with water trail access needs identified in this planning process, such as the need for parking at Botna Bend. Most planned improvements, however, extend recreational value in traditional city or county park activities. None of the planned changes impact the existing Recreational classification of the water trail.

Recreation Potential Off-River

A potential on-land recreation development adjacent to the river was suggested during this planning process. The idea included an equestrian trail using a former railroad grade connecting the Carson Rodeo Grounds and city of Macedonia. Stakeholders believed this trail could be an interesting new way to provide experiences of the river for visitors and residents.

The four communities owning and managing water trail accesses will become more actively involved in the future of the water trail in future phases of planning. However, their commitment to their river-edge park facilities demonstrates a continuing level of support for providing recreation amenities at these locations. There are no known objections for any future developments or changes related to the water trail.

The Route

Two water trail route change considerations were identified in this planning, one each on the East Branch and the main channel. Both considerations relate to the top two water trail segments. Variable water levels on the East Branch suggest development of a new access on the main channel upstream from Botna Bend, possibly owned and managed by PCCB. If this occurred, the Edgington Park access could remain as is, allowing continued river access to the East Branch when water levels permit. A new access on the west side of Avoca is suggested if a Recreational experience classification is the long-term goal for these segments of the water trail. A new access developed within 4 – 6 miles upstream of Botna Bend Park is suggested if a Gateway experience classification is a long term goal.

Additionally, the existing access numbering for the water trail portion on the East Branch isn't functioning as intended for paddlers. Re-numbering of this access is suggested if the East Branch portion is retained on the water trail route. While the river mile numbering system was applied accurately, it doesn't function as intended for paddlers in terms of helping them understand the distance between the Avoca and Botna Bend accesses.

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
Edgington Memorial Park	40	Very severe, all areas	Moderate erosion	Yes
Botna Bend Park	0	Yes, roadway	Severe erosion	Yes
Chautauqua City Park	120	No	Severe erosion	Yes
Carson City Park	0	Yes, all locations	Severe erosion	Yes
Old Town Recreation Area	0	No	Moderate erosion	No

Table 20

Enhancements that reduce soil erosion and slow overland flow into the river channel at a river access also reduce pollutant loading into the river.

General Water Trail Improvements 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 the access
- Streambank conditions near the access should also demonstrate the latest techniques for stabilization
- Lastly, newly constructed parking areas should be at least 50 feet back from the top of streambank; this setback area should be vegetated with natural (unmown) perennial vegetation. Alternatively existing parking areas should have a similar vegetated buffer of at least 40 feet in width.

Table 20 summarizes these general conditions for this water trail. Yellow cells indicate an enhancement is recommended.



Water Trail Experience Classification

The entire length of the water trail in Pottawattamie County can remain in its current classification as a Recreational use classification. With improvements or changes in facilities, however, one or two segments could be converted to a Gateway classification. These alternatives are presented in *Figure 17*. The first Gateway opportunity is focused on the Botna Bend Park access as previously discussed.

The segment between Carson and Macedonia is an ideal length for a Gateway classification but requires upgrades. The four mile length of the segment makes it an ideal shorter distance for beginners and novices. Upgrades would be necessary to both accesses as well as a livery operation. Other aspects of this segment of the river add value to its classification as a Gateway segment including cultural and historic interpretation and equestrian opportunities.

Accesses at Carson and Macedonia would require several upgrades to best meet the standards of a Gateway segment. In addition to the above suggestions that may relate to these two accesses, the following upgrades are also suggested:

- Consider all future changes to these accesses in ways that relate the most strongly to the historic nature of these places
- 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 at each access in locations convenient to river users.
- Add interpretive signage, information and other displays concerning geology, history and culture of the region.

- Expand the parking available near the access at Carson; a minimum of six cars is required and a larger parking area would be appropriate for a Gateway segment
- Remove old cars and other dumped debris from this segment
- Maintain a minimum of large woody debris snags in this segment
- Establish a local livery and a river management presence to serve this segment of the river

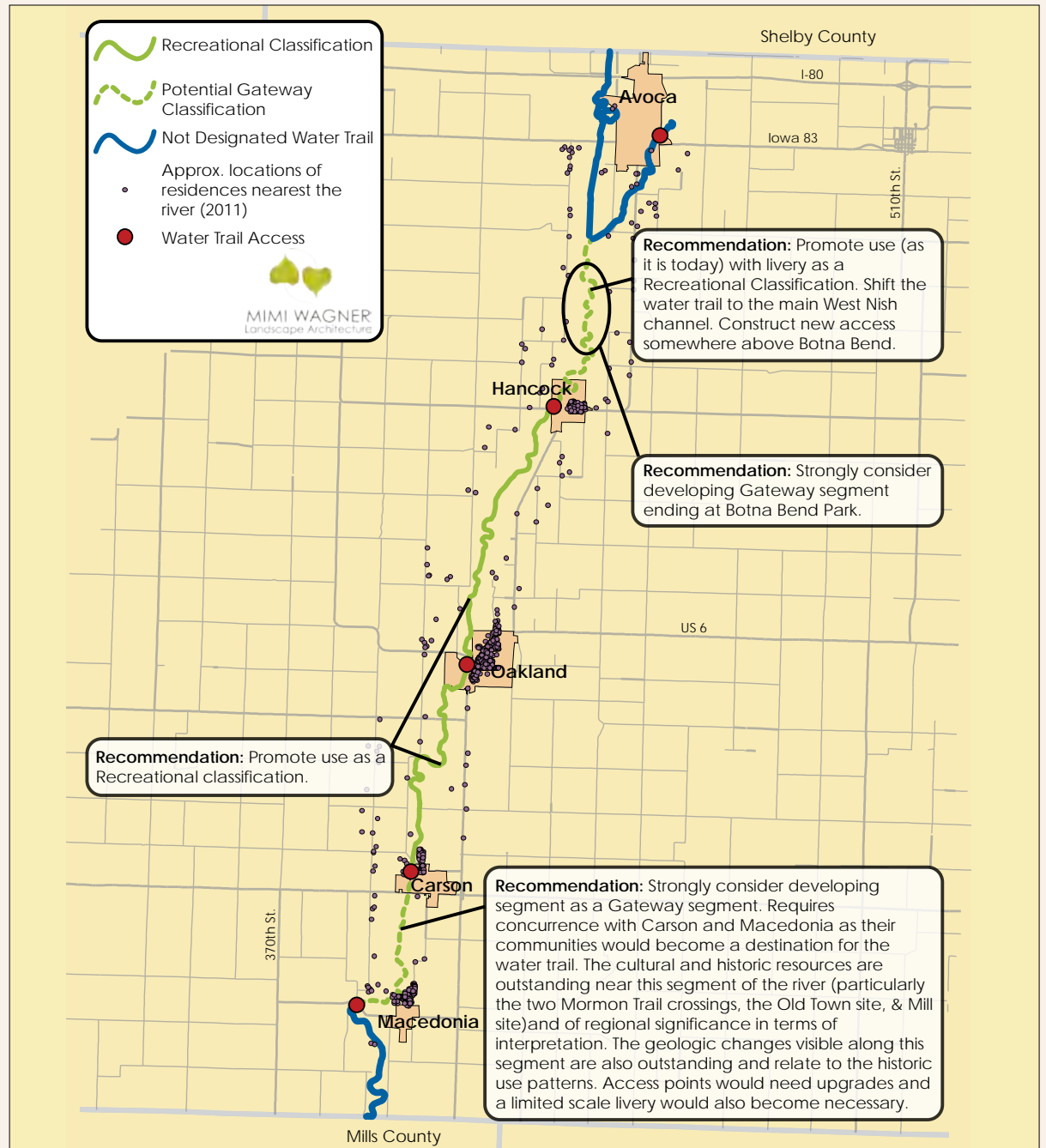


Figure 17

Several options exist for upgrades from Recreational to Gateway experience classification. Also, the East Branch of the West Nishnabotna may more accurately relate to a Challenge experience classification due to concrete debris in the channel and varying water levels.

Resource Protection & Restoration Potential

The West Nishnabotna Water Trail has the potential to be a model for integrated resource protection in Iowa. This planning documented significant cultural, historic, biologic and geomorphic resources in the river corridor that are both worthy of and would benefit from conservation, protection and interpretation. Future recreation development actions will have the most public benefit when they protect and enhance the full range of these resources. 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 and plant communities 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 degrade conditions
- Soil is recognized as a living resource capable of facilitating both economic stability and degraded water conditions when erodes in excessive amounts
- Cultural and historic resources are prioritization for conservation, preservation and interpretation.



Conservation and Restoration Potential

Several potential opportunities were suggested by stakeholders during this planning process. These opportunities and potential local partners are described below; general locations of potential efforts are illustrated in *Figure 18*:

- (1) Increase in the use of cover crops and other conservation practices to reduce soil erosion from cropland as well as bacteria and nutrient loading in surface water especially in reaches included on the 303d List of Impaired Waters (East Pottawattamie County Soil & Water Conservation District)
- (2) A continuous perennial stream buffer for the length of the water trail (Pottawattamie County Conservation, local agriculture organizations)
- (3) Demonstration of stream bank and floodplain restoration practices that rely on vegetation rather than riprap and broken concrete (IOWA DNR)
- (4) Further investigation of early settler home and other sites noted on the original Public Land Survey to document any cultural or historic remnants near and in the corridor (local historical societies)

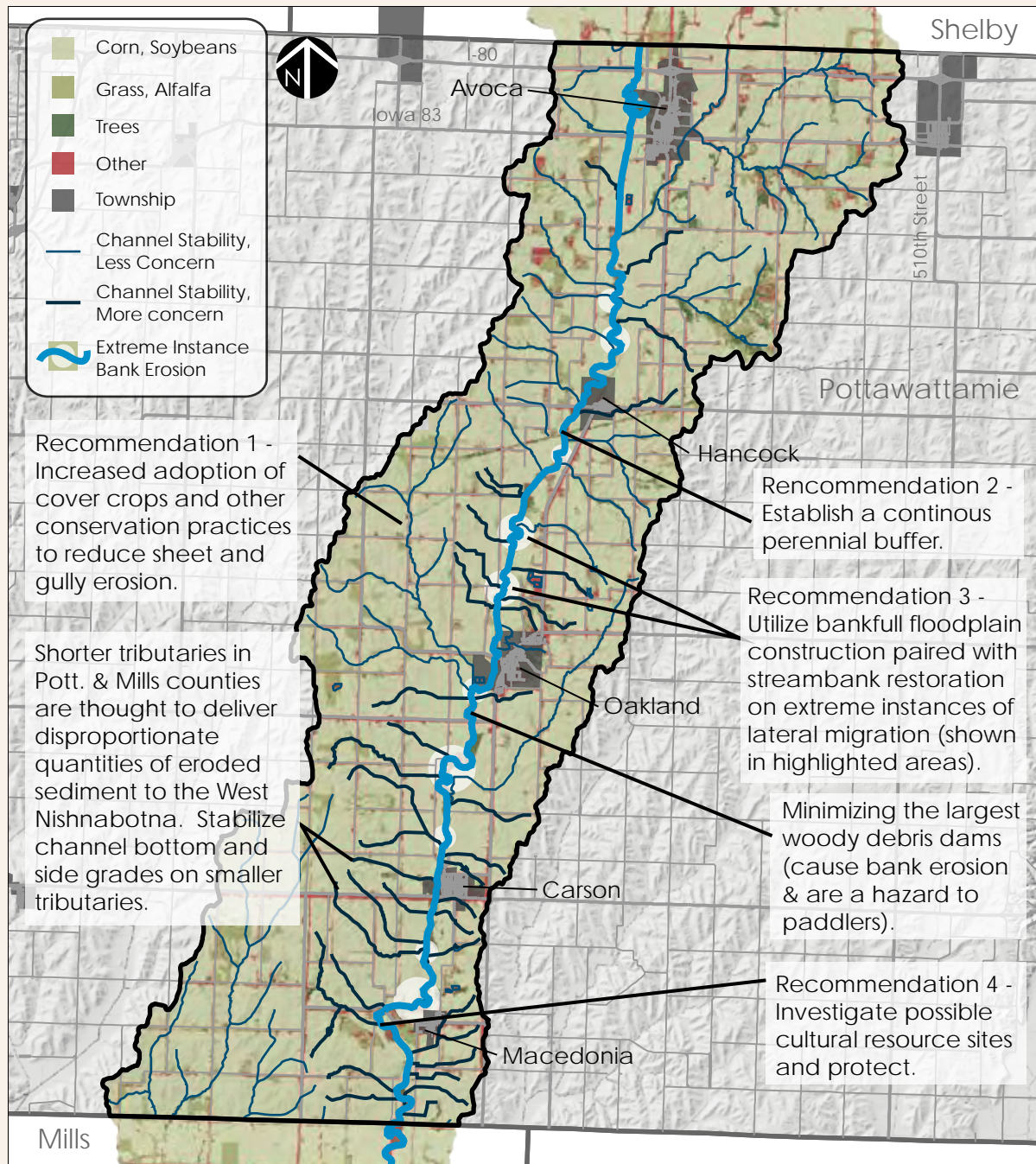


Figure 18

Conservation and Protection planning relates to both river and non-river issues. The cultural and historic resources thought to exist near the river are a great example of how the local communities and statewide enthusiasts could become involved with conservation and protection efforts.



Expected Permitting Considerations

Development projects disturbing streambank, 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 Cultural Review : archaeological resources
- Joint Application: floodplain permit, threatened and endangered species, wetlands, Waters of the U.S.

Water Trail Recommendations/Summary

State-designated water trails are as much about other resources 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 bring 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 West Nishnabotna Water Trail 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, local stakeholders, and water trail program 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 West Nishnabotna Water Trail manager, PCCB, has several decisions ahead. Initially they will commit to pursuing whichever or combination of experience classifications they believe is most appropriate and how they prefer to move forward with the route of the first segment. These decisions will quickly lead to infrastructure development projects.

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 PCCB, 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. West Nishnabotna River, Breeding Bird Atlas Species Presence List

SPECIES	BBA I	BBA II	SGCN	SPECIES	BBA I	BBA II	SGCN	SPECIES	BBA I	BBA II	SGCN
American Crow	Yes	Yes		Brown-headed Cowbird	Yes	Yes		Eastern Wood-Pewee	Yes	Yes	
American Goldfinch	Yes	Yes		Canada Goose		Yes		Eurasian Collared-Dove		Yes	
American Kestrel	Yes	Yes		Cedar Waxwing		Yes		European Starling	Yes	Yes	
American Robin	Yes	Yes		Chimney Swift	Yes	Yes	Yes	Field Sparrow	Yes	Yes	Yes
Baltimore Oriole		Yes		Chipping Sparrow	Yes	Yes		Grasshopper Sparrow	Yes	Yes	Yes
Bank Swallow	Yes	Yes		Cliff Swallow	Yes	Yes		Gray Catbird	Yes	Yes	
Barn Swallow	Yes	Yes		Common Grackle	Yes	Yes		Great Horned Owl	Yew		
Barred Owl		Yes		Common Yellowthroat	Yes	Yes		Great Blue Heron		Yes	
Belted Kingfisher		Yes		Dickcissel	Yes	Yes		Great Crested Flycatcher		Yes	
Black-billed Cuckoo		Yes	Yes	Downy Woodpecker	Yes	Yes		Hairy Woodpecker	Yes	Yes	
Black-capped Chickadee	Yes	Yes		Eastern Bluebird	Yes	Yes		Horned Lark	Yes	Yes	
Blue Grosbeak	Yes	Yes		Eastern Kingbird	Yes	Yes		House Finch		Yes	
Blue Jay	Yes	Yes		Eastern Meadowlark	Yes	Yes	Yes	House Sparrow	Yes	Yes	
Blue-Gray Gnatcatcher	Yes			Eastern Phoebe	Yes	Yes		House Wren	Yes	Yes	
Bobolink	Yes	Yes		Eastern Towhee		Yes		Indigo Bunting	Yes	Yes	
Brown Thrasher	Yes	Yes		Eastern Screech Owl	Yes			Killdeer	Yes	Yes	

SPECIES	BBA I	BBA II	SGCN	SPECIES	BBA I	BBA II	SGCN	SPECIES	BBA I	BBA II	SGCN
Lark Sparrow	Yes	Yes		Red-winged Blackbird	Yes	Yes		Wood Thrush		Yes	Yes
Mallard		Yes		Ring-necked Pheasant	Yes	Yes		Yellow Warbler	Yes	Yes	
Loggerhead Shrike	Yes		Yes	Rock Pigeon	Yes	Yes		Yellow-billed Cuckoo	Yes	Yes	Yes
Mourning Dove	Yes	Yes		Rose-breasted Grosbeak	Yes	Yes					
N. Rough Winged Swallow	Yes			Ruby-throated Hummingbird		Yes					
Northern Bobwhite	Yes	Yes	Yes	Sedge Wren	Yes	Yes	Yes				
Northern Cardinal	Yes	Yes		Song Sparrow	Yes	Yes					
Northern Flicker	Yes	Yes		Spotted Sandpiper		Yes					
Northern Rough-winged Swallow		Yes		Summer Tanager		Yes					
Northern Oriole	Yes			Tree Swallow		Yes					
Orchard Oriole	Yes	Yes		Turkey Vulture	Yes	Yes					
Purple Martin	Yes	Yes		Vesper Sparrow	Yes	Yes					
Red-bellied Woodpecker	Yes	Yes		Warbling Vireo	Yes	Yes					
Red-eyed Vireo		Yes		Western Meadowlark	Yes	Yes					
Red-headed Woodpecker	Yes	Yes	Yes	White-breasted Nuthatch	Yes	Yes					
Red-tailed Hawk	Yes	Yes		Wood Duck	Yes	Yes					

Appendix B. Iowa DNR Fisheries River Segment Fish Species Presence List for West Nishnabotna River

SPECIES PRESENT

Bigmouth Buffalo

Black Crappie

Bluegill

Channel Catfish

Common Carp

Flathead Chub

Green Sunfish

Plains Minnow

Quillback Carpsucker

Red Shiner

River Carpsucker

Sand Shiner

Shoal Chub

Shorthead Redhorse

Stonecat



CHAPTER 2

WATER TRAIL VISION

WEST NISHNABOTNA WATER TRAIL

ACKNOWLEDGMENTS

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Jon Fenner, Pottawattamie County Conservation Board
Lance Brisbois, Golden Hills RC&D
Eileen Adickes, Mayor of Macedonia
Ruby Bentley, Mormon Trail, City of Macedonia Walking Tour
Troy Graves, Mayor of Carson
Ron Stillinger, City of Carson
Tim Todd, Carson City Council
Mike Baragary, Public Works Director
Jeff Gress, Mayor of Hancock
Clint Fitcher, Avoca City Manager
Brian Leaders, National Park Service
Dennis Miller, Archaeology
Gene Olsen, Angler
Mark Bentley, Landowner
Bernie Bolton, Pottawattamie East SWCD
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The reach of the West Nishnabotna River between Avoca and Macedonia has long been enjoyed by local anglers, paddlers, and bird watchers.

This reach was designated a State Water Trail by the Iowa Department of Natural Resources (DNR) River Programs in 2010 at the outset of the state program for water trails. Being a part of the state's water trail family of water trail routes has much to offer both this river and its users. Pottawattamie County Conservation Board (PCCB) emerged as the water trail sponsor as a result of planning in 2013 – 2014.

The theme of the West Nishnabotna Water Trail synthesizes pre-history, migration and settlement patterns, and the ongoing story of river channel modification. The riparian area includes a unique set of natural, cultural and recreation resources: a high diversity of fish species, surficial geology unusual for this ecoregion, nationally significant cultural and historic features and sites, and a rich river modification story. These resources are presently only minimally interpreted at the local level. As the only state designated water trail in the Steeply Rolling Loess Prairies ecoregion, the water trail brings people in contact with the ecosystems and wildlife resources expected in this ecoregion. Socially, the water trail includes a water trail sponsor dedicated to enhancing river use and interpretation, a functioning boat livery, and five river communities with a vested interest in an expanded visitorship.

As much as further developing recreation potential, the water trail sponsor shares the values of resource protection held by the state program. They see one of the primary purposes of the water trail as a means to further conservation on and near the river. Conditions for the already high diversity of fish, bird and mussel species will be protected and as well as further enhanced with greater attention on natural

channel restoration to reduce mass channel wasting and the expansion of a diverse riparian plantings to create a continuous perennial buffer on the water trail route.

Existing conditions for water trail users include accesses in highly developed city or county parks. The vision for these facilities includes reconstruction of launches and near launch areas to reduce sediment deposition from high flows and enable a greater range of users. Currently the water trail represents a classic Iowa version of a Recreational Experience Classification. This classification will be maintained for the near future while resources are organized to enhance river management and safety, coordinate on-the-ground access management among the communities and entities and complete access upgrades.

Long term, the sponsor is interested in pursuing one or two Gateway Experience Classification segments with remaining segments remaining Recreational. River conditions, resource opportunities and size of the adjacent population support this possibility. One segment would utilize Botna Bend Park as either the take-out or put-in point and would require construction of a new access point within 5 miles of the park. The second option is the Carson to Macedonia segment. While access conditions are primitive in both locations, stakeholders in the communities are interested in strengthening their physical connection. And the most readily accessible cultural resource sites occur on this segment. Its relatively short river distance of 4 miles is ideal for Gateway Classification.

An additional goal is to resolve water level differences for users of the state-designated route. The long term vision is for the state-designated portion of the route to be entirely located on the main channel of the West Nishnabotna. This will become possible with the addition of one or more accesses on the main channel. The East Branch segment and the Edgington Park access will remain important especially during higher flow periods, with experienced paddlers and during peak use.



CHAPTER 3

RECREATIONAL DEVELOPMENT PLAN



WEST NISHNABOTNA WATER TRAIL

ACKNOWLEDGMENTS

This Water Trail Plan was prepared by Mimi Wagner, Lucas Buscher and Jacob Wilson of Iowa State University. Pottawattamie County Conservation Board staff provided leadership and local support of the project throughout the process. Mark Shoemaker and Jon Fenner of Pottawattamie County Conservation provided review and interpretation. Nate Hooegeveen, 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:

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CHAPTER 3 RECREATIONAL DEVELOPMENT PLAN

The West Nishnabotna River in Pottawattamie County is the only state-designated water trail in Southwest Iowa.

The existing route was state-designated in 2010 but has been enjoyed by local anglers and paddlers long before designation. The current designated route actually includes one segment on the East Branch of the West Nishnabotna and the remainder on the main channel of the West Nishnabotna. A great deal of culture and history exists alongside the “Nish,” as it is known locally. No other state designated water trail in Iowa offers such a clear and strong opportunity to interpret historic pioneer migration, social movements and river modification efforts in tandem with water trail use.

Today the West Nishnabotna is a winding, predominantly green corridor in the midst of a vast and wide annually-cultivated floodplain on the eastern side of this double-wide county. The winding character of today’s West Nishnabotna is in deference to the straightened channel conditions that were created when the river was straightened and dredged between 1910 and 1915. A high number of historic sites and museums are located near the water trail as well as several state, county and city parks. A future land trail is envisioned locally for the length of the water trail that interconnects with the river accesses.

The five communities and one county organization owning land and river accesses played an active role in preparation of this plan to varying degrees. Their commitment to their river-edge park facilities demonstrates 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, the 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, 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 East Branch of the West Nishnabotna River beginning in Avoca on the upstream end and merging with the main branch of the West Nishnabotna River and continuing downstream to Macedonia (*Figure 1*). The municipal boundaries of Avoca, Oakland, Carson and Hancock are located on the water trail. The City of Macedonia lies adjacent to but not contiguous with the river. This recreational plan serves three purposes:

- To provide a contemporary summary of all recreational plans near the West Nishnabotna River and integrate them with existing and proposed water trail infrastructure
- To develop conceptual plans for infrastructure development and river management that enhance river use conditions; these plans are intended 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 West Nishnabotna 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 river's edge

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

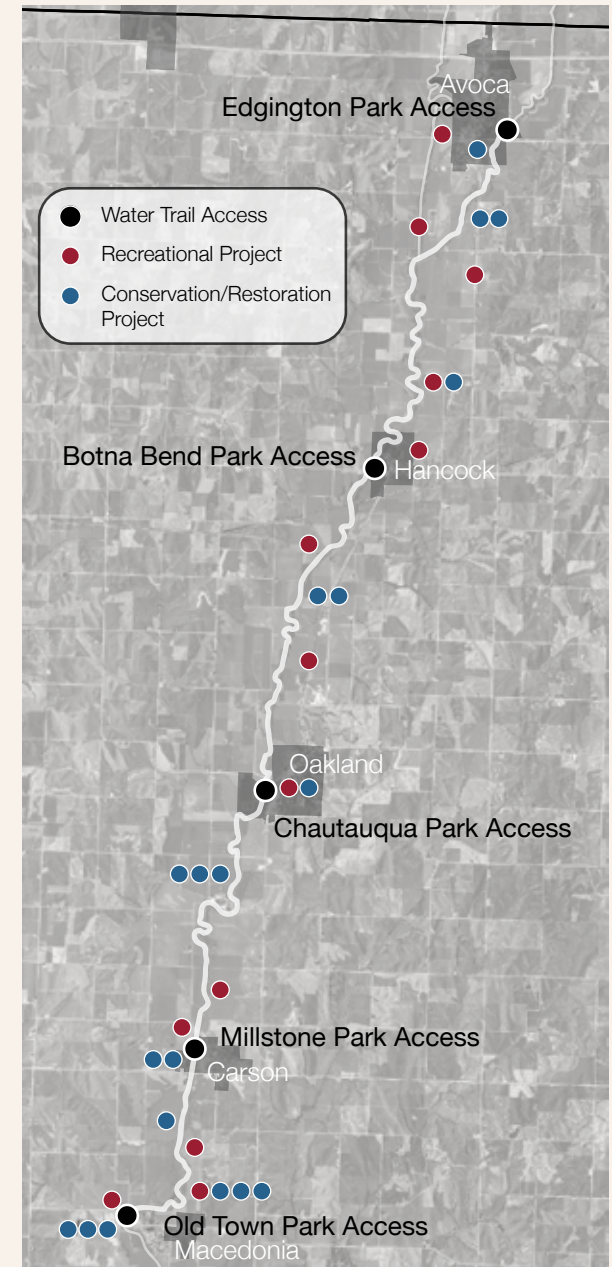


Figure 1

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 Pottawattamie 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,

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.



such as the West Nishnabotna River in Pottawattamie 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 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 321.14.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 Streams:** 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 NUISANCES and Iowa Attorney General Opinion: Smith to Kremer, 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.*

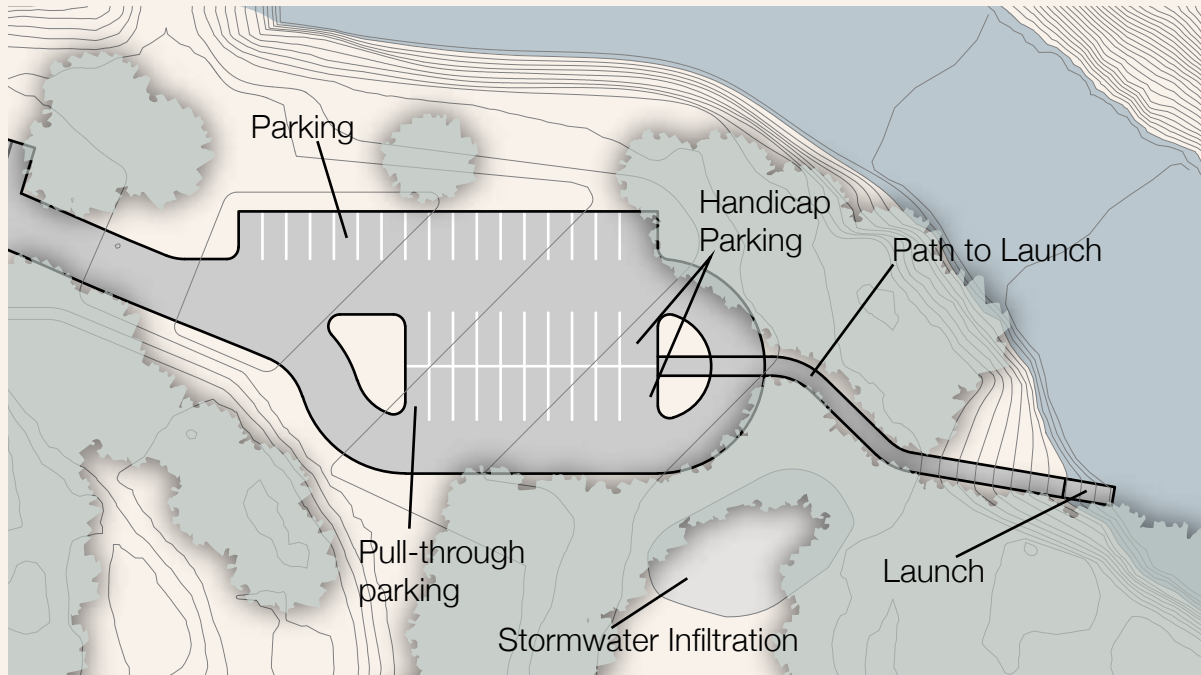
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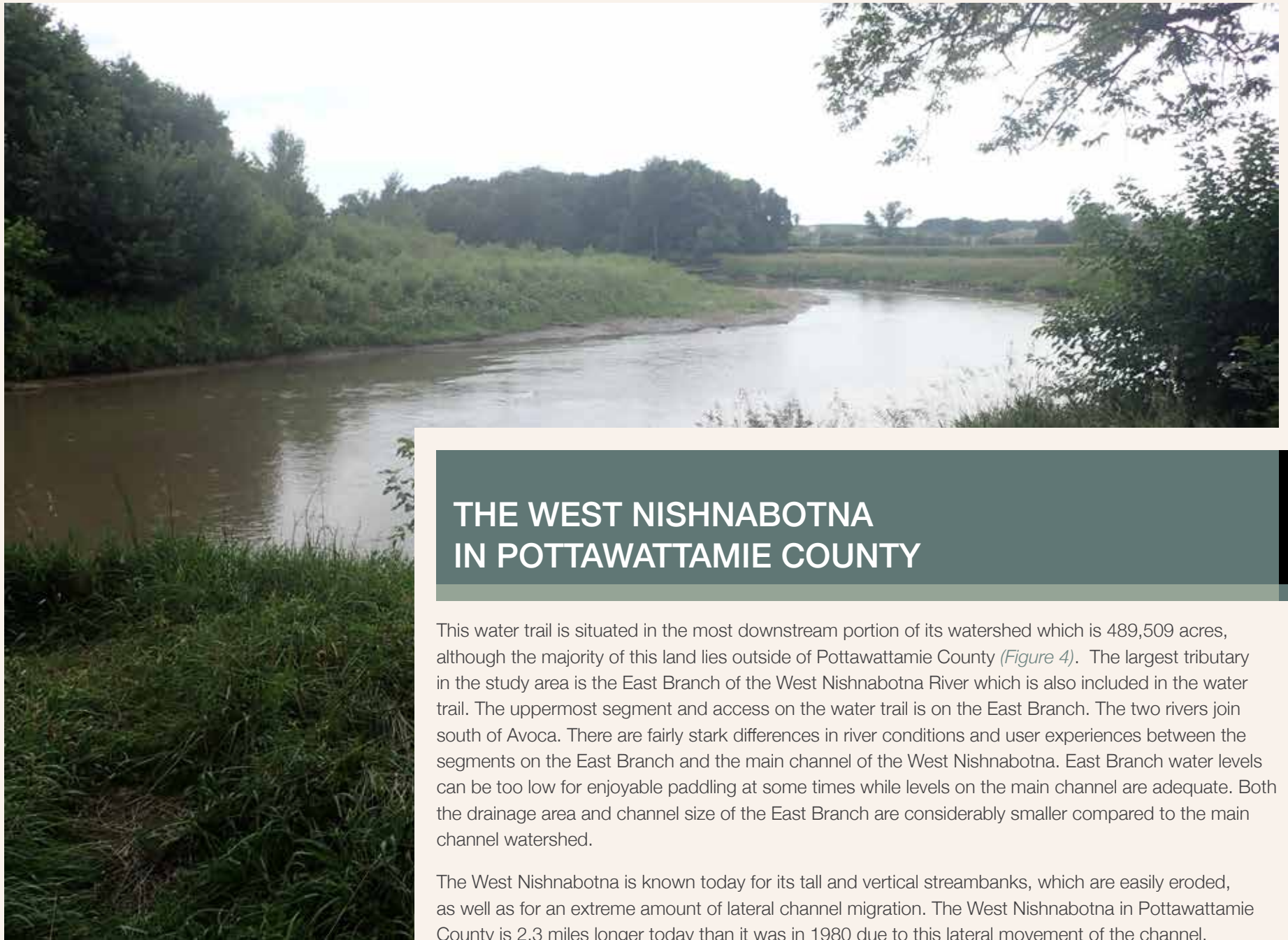
Assumptions and Concepts

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 and a pathway connecting the parking surface, the 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 at river access sites.

Figure 3
Components of a typical river access area





THE WEST NISHNABOTNA IN POTTAWATTAMIE COUNTY

This water trail is situated in the most downstream portion of its watershed which is 489,509 acres, although the majority of this land lies outside of Pottawattamie County (*Figure 4*). The largest tributary in the study area is the East Branch of the West Nishnabotna River which is also included in the water trail. The uppermost segment and access on the water trail is on the East Branch. The two rivers join south of Avoca. There are fairly stark differences in river conditions and user experiences between the segments on the East Branch and the main channel of the West Nishnabotna. East Branch water levels can be too low for enjoyable paddling at some times while levels on the main channel are adequate. Both the drainage area and channel size of the East Branch are considerably smaller compared to the main channel watershed.

The West Nishnabotna is known today for its tall and vertical streambanks, which are easily eroded, as well as for an extreme amount of lateral channel migration. The West Nishnabotna in Pottawattamie County is 2.3 miles longer today than it was in 1980 due to this lateral movement of the channel.

Much of this channel migration is a response to the straightening and dredging of the channel which occurred between 1910 and 1915 in Pottawattamie County. While a majority of the water trail is surrounded by forested land, some segments contain cropland up to the top of the streambank. The most-downstream segment, from Carson to Macedonia, has 88% perennial cover while the Botna Bend to Oakland segment includes 26 % annually cultivated crops, the highest percentage found on any segment of the water trail.

Typical channel width of the West Nishnabotna in Pottawattamie County ranges between 150 and 200 feet, with the bedrock constricted portions of the channel on the lower end of that range. Typical channel width on the East Branch is 120 feet wide. Paddling volume is highest between Edgington Access in Avoca and Botna Bend Park. The local outfitter is based in Botna Bend Park.

No dams are located on this river. Reported hazards include large woody debris, strainers and snags throughout most of the reaches and junk cars, other dumped large debris items and tires at select locations. Multiple instances of large concrete debris with exposed steel reinforcing are reported on the East Branch near its confluence with the West Nishnabotna. A total of 1,733 acres of Iowa land are known to be in permanent protection within 10 miles of the Pottawattamie County portion of the West Nishnabotna. A total of 34 museums, 3 state parks, forests or recreation areas are located within 30 miles of the water trail.

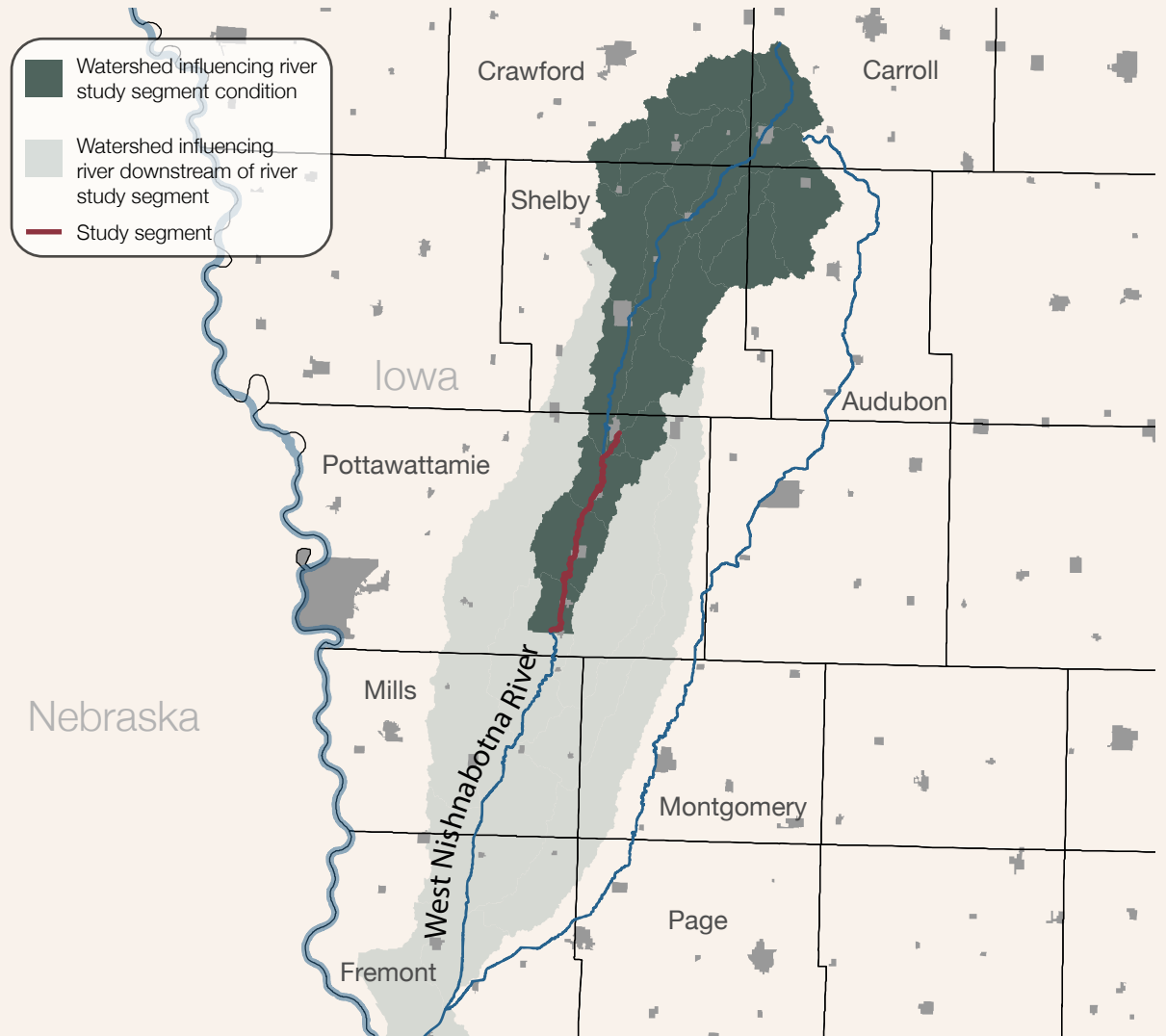
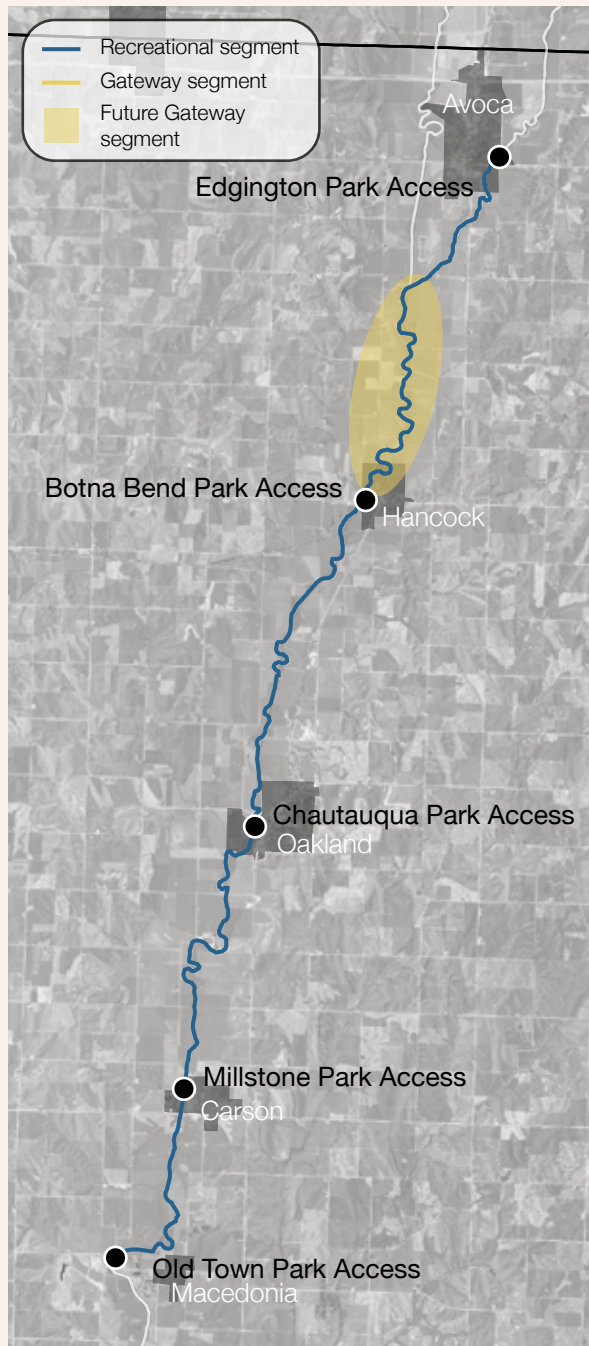


Figure 4
The water trail portion of the West Nishnabotna is located in the mid-portion of the West Nishnabotna River watershed.



Implementation of the West Nishnabotna Vision

The vision for the West Nishnabotna Water Trail in Pottawattamie County includes upgrade of most existing accesses, construction of two new accesses on the main channel and protecting conditions for the already high diversity of fish, bird and mussel species present. The route will be designated as a Recreational use classification with the possibility of two future Gateway segments (Figure 5). The Water Trail Sponsor is interested in establishing a Gateway segment in the Botna Bend Park area. This requires a new access approximately 5 miles either upstream or downstream of Botna Bend. The existing segment between Carson and Macedonia meets the criteria for a Gateway segment but this development is not a current high priority for the City of Carson. Also, the uppermost segment of the water trail will eventually be relocated from the East Branch to the main channel, requiring a new access near Avoca.

A large part of the vision for this state-designated water trail focuses on establishment of a stable, natural meandering river system where lateral channel migration, mid-channel deposition and excessive streambank scour are minimized. This type of channel also supports the conditions that make this river the biologically rich area it is today. Natural channel design is understood as the framework that can provide both types of benefits as well as provide conditions desirable for users of a state water trail. The Water Trail Sponsor also supports development of a continuous perennial vegetation buffer on both sides of the river. Lastly, and most critical for river users, the vision includes reconstruction of launches and near-launch amenities to accommodate use by people with a broad range of physical abilities. Other goals include minimizing maintenance by reducing erosion and deposition on boat launches from high flows.

Figure 5

Initially the water trail will be designated with the Recreational Use Classification. This is the most common classification in Iowa. Potential changes in classification may occur in the future as conditions change.



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 and attention on water trail planning. A steering group composed of 21 local individuals representing special interests such as water quality, equestrians, botany, archaeology 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, Pottawattamie County Conservation Board.

The existing conditions surrounding this section of the West Nishnabotna River were assessed and researched concurrently with the 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, Pottawattamie County Conservation staff, Pottawattamie County Conservation board members and Iowa DNR.

Scope of the Plan

Recreation development elements are recommended for both aquatic-based recreation and on-land recreation. Aquatic recreation recommendations include structural upgrades for all launches, the development of Universal Design launches and improved angler access. Land-based recommendations in the riparian area include enlarged and improved parking areas, a new equestrian trail and an off-road trail connecting Avoca and Macedonia.

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 West Nishnabotna River is a non-meandered stream beginning in Iowa's Crawford and Carroll counties. The West Nishnabotna joins with the East Nishnabotna River near Riverton in Fremont County, entering the Missouri River approximately 5 miles south of the Iowa – Missouri border. The Pottawattamie County portion of the West Nishnabotna River is 27 miles in length. River access points divide the 27 miles into four segments. Fishing and wildlife watching are the two most popular river uses. Nearly 30% of the trips reported to the river in 2009 included use of some form of boat (Iowa State University 2010).

A majority of land adjacent to the West Nishnabotna River Water Trail in Pottawattamie County is privately owned (Figure 6). Highly-developed city or county parks exist in Avoca, Hancock, Oakland and Carson. No additional public lands are located on the river in Pottawattamie County.

The largely forested edge and the laterally migrating planform of the river contribute to a large number of large woody debris accumulations in the river. Woody debris piles in the channel generally exacerbate streambank erosion and become obstacles for paddlers when they block a significant portion of the channel and when piles accumulate and act as strainers on outside bends.

Adjacent parks provide a wide variety of visitor opportunities to compliment river use including camping, playgrounds, ballfields, rodeo grounds, trails, swimming pools, and historic sites. Some regional, urban and rural trails exist near the river and additional trails are planned.

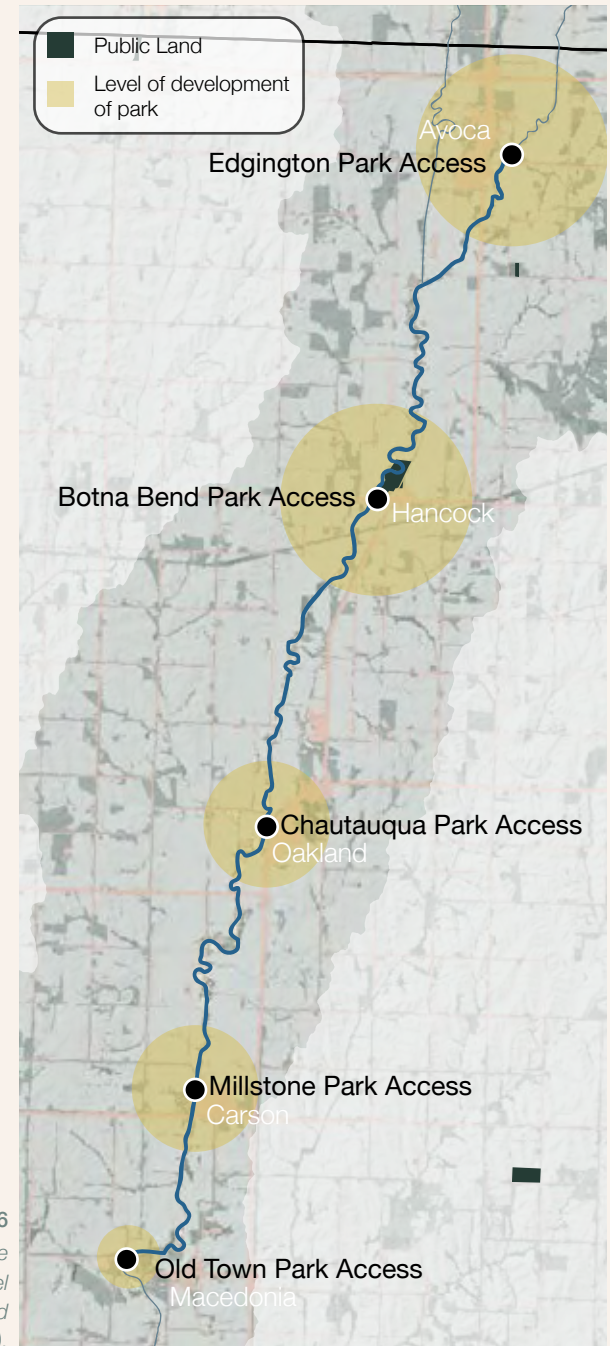


Figure 6
Existing recreational resources along the water trail route are limited to city and county parks located on the river. The level of development of each park varies from highly developed (Edgington and Botna Bend) to minimally developed (Old Town).

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 with coordination. River access maintenance is an example. This river 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 minimal 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
- 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 user experiences on the river (*Table 1*).

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

Table 1

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



River-Edge Infrastructure Needs

The existing spacing and availability of river accesses in this corridor are adequate for the Recreational use classification. The existing condition of the accesses, in general, could be improved (*Table 2*). Launch steepness, and in some cases angle, exceeds state recommendations. Stormwater runoff from parking areas is frequently directed toward the river over the launch surface and some riparian buffers are inadequate. Also, the capacity of off-road parking is not always adequate to meet Iowa DOT minimum, required standards.

River Access	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
Edgington Memorial Park	3		√	√			√	
Botna Bend Park	66		√	√	√	√	√	
Chautauqua City Park	58		√	√		√		
Carson Millstone Park	51	√	√	√		√	√	
Old Town Park	47		√	√	√		√	√

Table 2

Access conditions were assessed during the planning process and the results are summarized here. Spacing and availability of river accesses in this corridor are adequate for Recreational use classification; however, accesses require upgrades to protect the river, to be functional for a greater segment of the population and to minimize maintenance.



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

On-Water Desired Outcomes:

- Upgrade access facilities
 - Upgrade launch types to allow vehicles & people to reach the water's edge
 - Upgrade parking to meet ADA regulations
 - Upgrade accesses with overly steep launch slopes as well as those with perpendicular alignment to the thalweg
- Enhance angler opportunities

On-water infrastructure recommendations relate strongly to the water trail vision developed locally, Iowa DNR water trail development standards, the Water Trail Sponsor's priorities and natural resource issues in Iowa.

Land-Based Recreational Outcomes:

Provide equestrian trail opportunity and parking facilities

Provide additional land trail miles between Avoca and Macedonia

Communication-Based Recreational Outcomes:

- Enhance communication for users before they get to the river
- Update educational interpretation

Table 3 organizes all desired recreational outcomes and recommended plan elements to illustrate their overlap.



Recommended Recreation Elements	Increase Flood Resilience of recreational amenities at rivers edge	Reduce routine maintenance needs	Support public access to land & 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 slopes		✓	✓	✓		✓
Upgrade angle of launch & construct new launches on stable river sections	✓	✓	✓		✓	
Upgrade parking availability geared for all users at launches		✓	✓	✓		✓
Create “Gateway” style & Universal Design Accesses			✓	✓		✓
Enhance angler experiences			✓	✓	✓	✓
Provide additional trail miles			✓	✓		
Enhance communication with the public						
Update educational interpretation			✓		✓	✓
Increase river management ability		✓	✓		✓	✓

Table 3

Desired recreational outcomes and proposed infrastructure improvements 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 off-river. 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 and 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. Bankfull elevation on this study segment of the West Nishnabotna is approximately 4.0'. 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: resource interpretation, water trail map
- On-water recreation infrastructure: Launch upgrades and replacements, parking improvements, new Gateway-style launch near Botna Bend with angler access
- Land-based recreation enhancements: soft and hard trail expansion and an equestrian trail with parking facilities

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 resource sites is also critical, including those not yet identified or understood. Lastly, local stakeholders desire to develop this water trail in ways that maintain and protect the prehistoric and historic cultural integrity of the corridor.

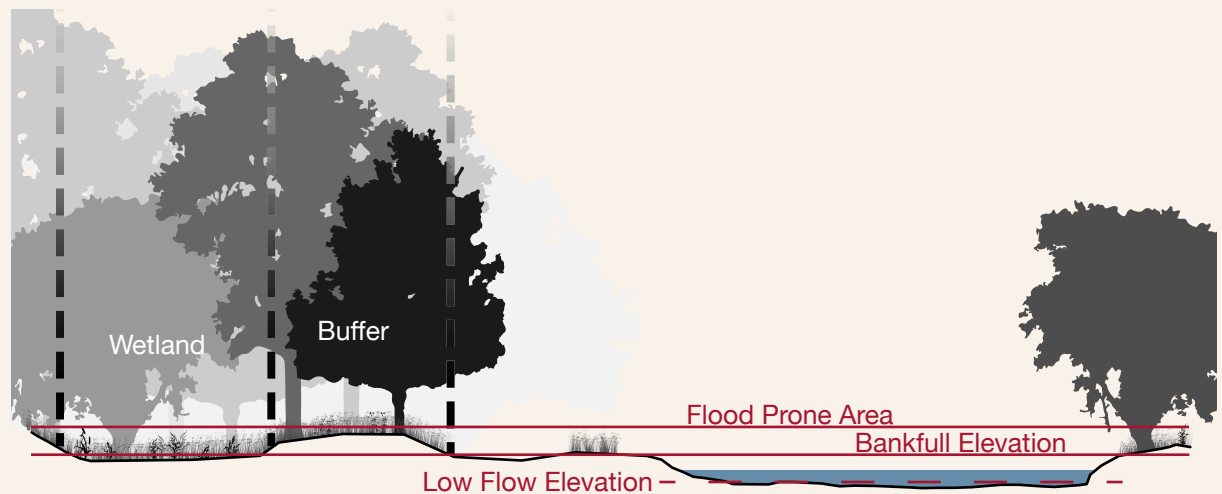
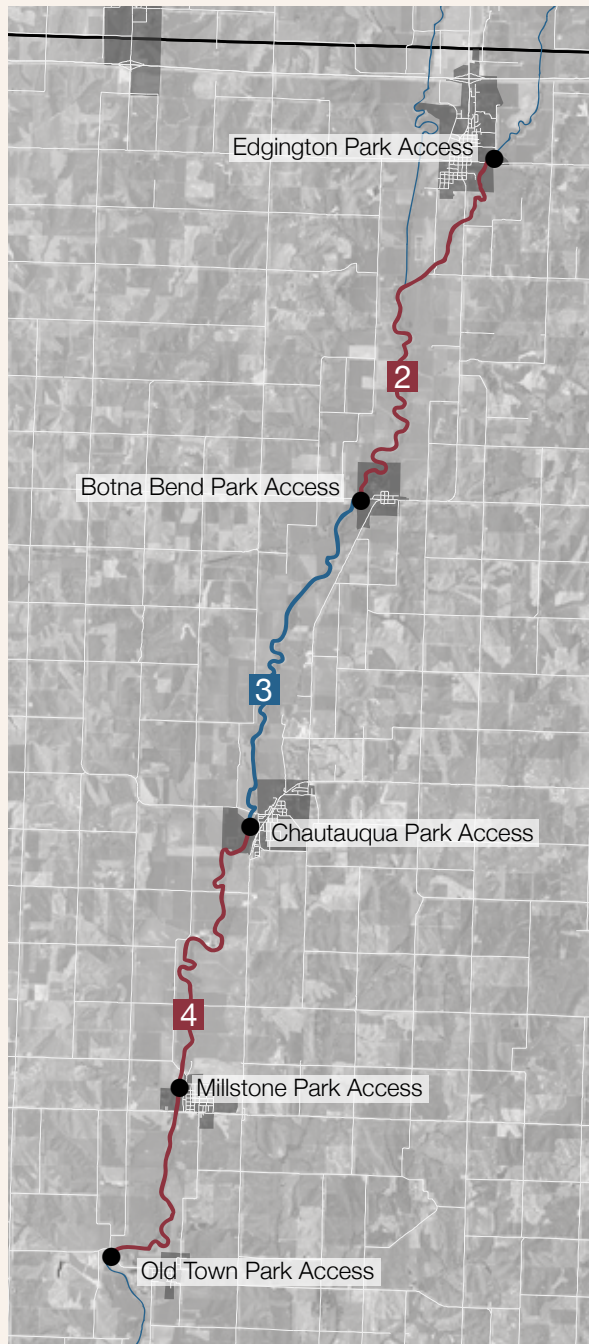


Figure 7

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 West Nishnabotna River in Pottawattamie County, particularly for expanding use of the river corridor to more diverse users. Proposed recreation plans will connect land trail users, including equestrians, with the river and adjacent communities. Recommended infrastructure enhancements include traditional elements such as entry points for people entering the river channel and top of bank opportunities such as fishing. 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 four segments (*Figure 8*). Recommendations are organized by segment and include maps, drawings and text descriptions. Some recommendations span multiple segments or the entire 27 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, local communities and Pottawattamie County. The design of infrastructure utilized technical experts from Iowa DNR and Iowa State University.

Figure 8
The planning study area is divided into 4 segments.



SEGMENT R1: Corridor-Wide and Multiple Segment Projects

R 1.A On-Water Rescue Capacity

Support and reinforcement of the already existing network of emergency personnel serving the river corridor in Pottawattamie 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.

R 1.B Communication to Users

Enhanced communication with users before they get to the river is recommended. River users will feel better prepared for their experience with updated water trail maps; printed maps as well as downloadable pdf online versions are recommended.

R 1.C Public Interpretation, Wayfinding Signage, New Water Trail Map & Communication Among Water Trail Access Managers

An interpretive plan and enhanced signage for wayfinding is recommended. The resources included in this water trail plan and future studies will be used to produce a compelling, varied interpretation of critical elements, issues and resources based on this river. Review of the existing wayfinding signage is recommended to ensure all signage is present. Both of these will add to the quality of the experience for users.

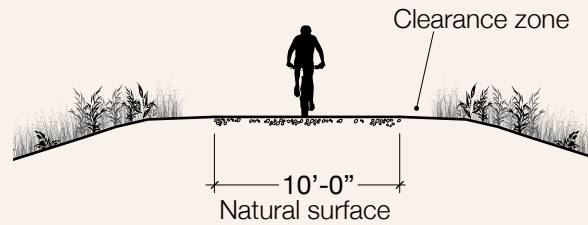
A formalized system of communication is recommended between the Water Trail Sponsor and access owners and managers. Regular communication can enhance coordination of water trail activities and issues and can result in more consistent, efficient and timely removal of sediment and debris from launches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



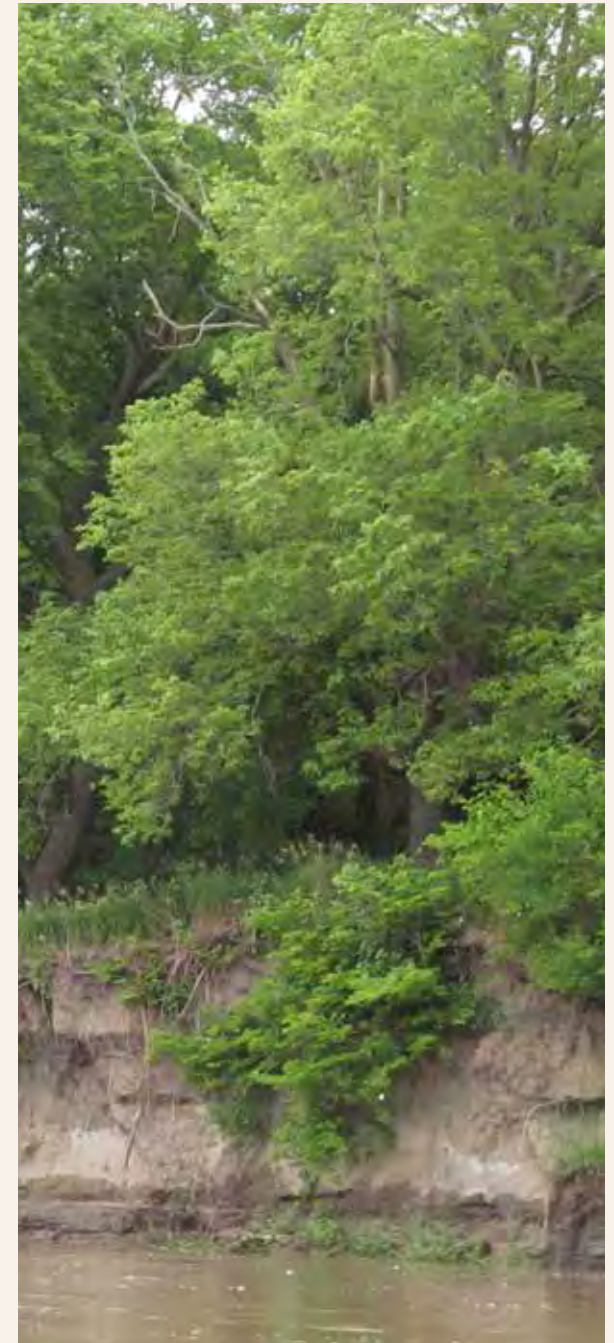
SEGMENT R1: Corridor-Wide and Multiple Segment Projects

R 1.D Off-Road Trail between Avoca and Macedonia

A new soft trail is recommended adjacent to the river between Edgington Memorial Park in Avoca and Old Town Park near Macedonia. This will connect with existing and proposed trails in each community. It will also enable pedal-paddle opportunities along the future Gateway trail segment. It is also recommended that the trail connect with the new recommended access on G18/Tamarack Road.



R1.D The long term goal of a trail connection between Avoca and Macedonia will add enormous recreational value to the region because it will interconnect all communities on the water trail.



R1 Permitting Considerations

Disturbance for construction of the new off-road soft trail will likely require a Phase I archaeological investigation for portions of the site previously undisturbed unless previous disturbance can be verified.

SEGMENT 1 COST ESTIMATES		
RECOMMENDATIONS	MAP CODE	COST ESTIMATE
On-Water Rescue Capacity Building	R1.A	\$0
Communication to Users	R1.B	Reimbursable from IDNR
Public Interpretative Program, Wayfinding Signage, New Water Trail Map, Communication Among Access Managers	R1.C	\$0
Off-Road Trail between Avoca and Macedonia	R1.D	

SEGMENT R2: Avoca to Botna Bend Park Access

Existing Conditions

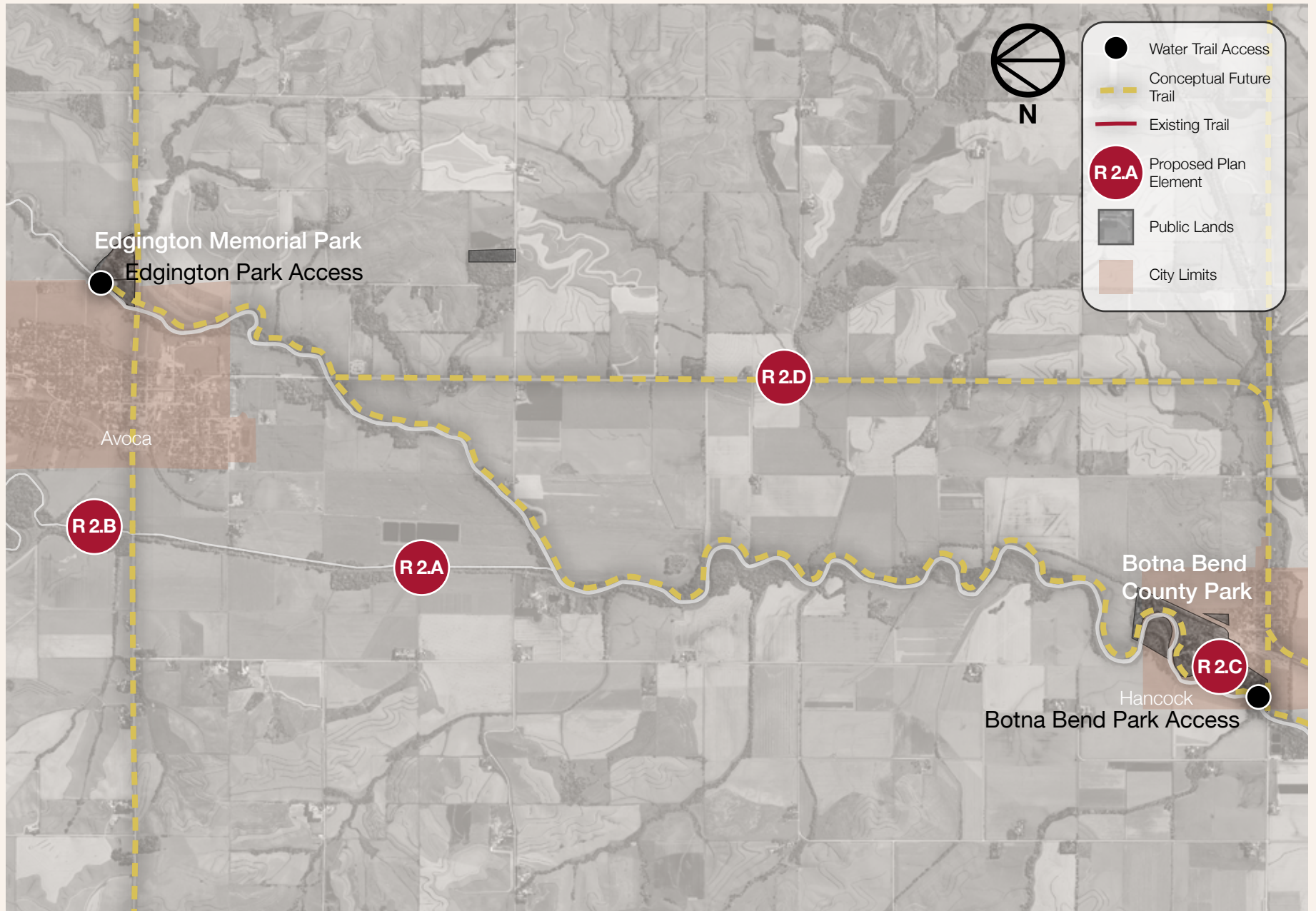
This segment of the water trail is 8 miles in length with the upper half located on the East Branch of the West Nishnabotna rather than the main channel. The East Branch is a straightened and channelized river with several geometric bends. The confluence of the two rivers is located approximately 4 miles downstream, approximately half of the distance to the next access at Botna Bend. Water levels on the East Branch portion of the water trail, prior to the confluence, often differ substantially. This becomes a problem for paddlers during low water conditions on the East Branch. This segment has a high level of use by paddlers, particularly because it ends in Botna Bend Park. The local outfitter business is located in the park making Botna Bend a convenient take out location for rented boats. A moderate amount of large woody debris and large concrete rubble with exposed rebar are present in the river channel. The concrete rubble appears to be remnants of former bridge crossings. The Edgington Memorial Park Access in Avoca has a history of instability due to damage from high water. The access is located in a full-service park and the amount of land needed to reconfigure the access and provide dedicated water trail parking isn't available. The access was reconstructed by Iowa DNR in 2016 and sustained damage and erosion almost immediately. The Botna Bend Park Access is favorably located but the launch is limited by steep slope and a perpendicular angle.

Issues and Opportunities

Avoca is an important anchor on the West Nishnabotna Water Trail. It is the largest city on the trail and the only one with motel lodging and multiple dining options. Avoca is also a great location for the most-upstream access on this water trail because of its close proximity to I-80. The existing access at Edgington Park, however, is limited in effectiveness as the most-upstream access on the water trail. Differing water levels between the East Branch and the main channel of the river are problematic for paddlers during some seasons of the year. There is also a lack of space in Edgington Park to construct an access with dedicated parking for water trail use. An alternative river access in Avoca on the main channel of the West Nishnabotna is recommended.

The five miles upstream (+/-) of Botna Bend Park has been identified as a future Gateway segment by the Water Trail Sponsor. A new access will be required upstream of the park to meet water trail recommendations for Gateway conditions. Access improvements in Botna Bend Park are recommended to prepare for higher volumes of use on this segment, expand the population able to use to the launch and to reduce maintenance of the access.





SEGMENT R2: Avoca to Botna Bend Park Access

R 2.A Shift Trail Route to the West Nishnabotna River with New Avoca Access

An alternative river access near Avoca is recommended. Establishment of this access would shift the water trail off the East Branch entirely and onto the main channel of the West Nishnabotna, relieving water level complications between the two rivers. The northeast corner of the bridge crossing the river at G18/Tamarack Road, slightly west of the City of Avoca, is recommended as the new access location. Ample space exists for dedicated parking as well as a launch. The land is currently not cropped and some locals reportedly already use the site for launching. The Edgington Memorial Park Access will remain and can serve in an overflow capacity during peak use time.

R 2.B New Gateway Access Upstream of Botna Bend

A new Universal Design access is recommended approximately 5 miles upstream of Botna Bend Park to facilitate development of a Gateway segment. This recommendation requires a willing owner with land on the river as well as land for accessing the launch from a public road. No proposed site is recommended at the time of this plan.

Edgington Memorial Park

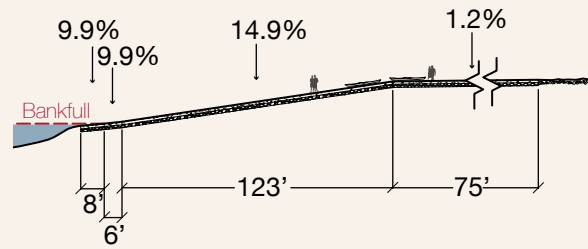
- Walking Trail
- Picnic Shelters
- Soccer Field
- Ball Diamonds
- Outdoor Pool
- Sand Volleyball Court
- Newtown School
- Bathrooms



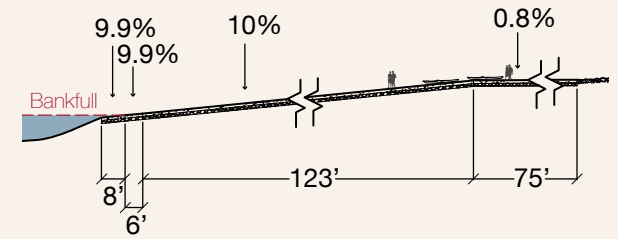
R 2.C

New Gateway Access at Botna Bend

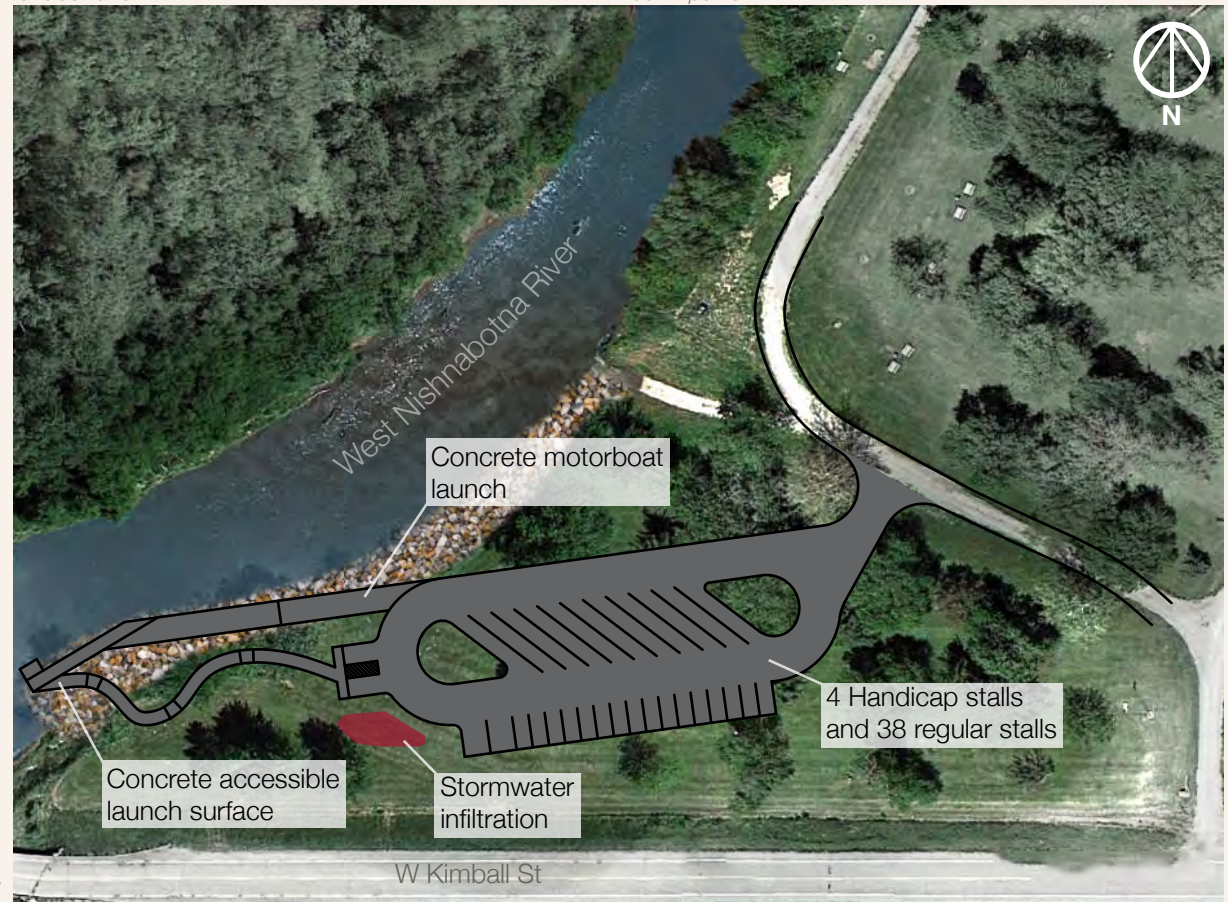
A new Universal Design access is recommended near the existing access at Botna Bend Park. This will enable a Gateway segment on the water trail. Botna Bend is the appropriate location for this use classification because it is the CCB's flagship park and because the existing livery is based at this location. This segment of the river is the most highly used of any on the water trail. Access design includes parking for 20 cars and 11 additional pull-through lanes for vehicles with trailers and streambank restoration demonstration to minimize future erosion at the new launch.



R2.C The proposed carry down launch portion of the new Gateway style access is designed to meet the ADA specification for sidewalks.



R2.C The proposed vehicle ramp portion of the new Gateway style access is wider and more steep than the adjacent carry down portion.



New Universal Design Access at Botna Bend

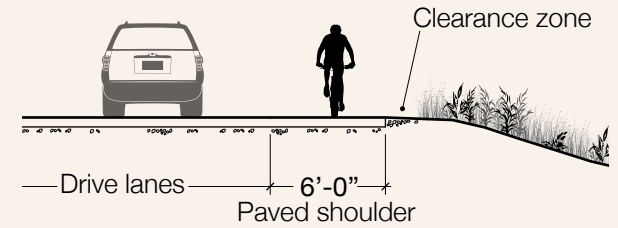
Botna Bend

- Archery Range
- Bird Viewing Blind
- Covered Shelters
- Bathrooms
- Playground
- Basketball Court
- Sand Volleyball Court
- Primitive Camping
- RV Camping
- Modern Cabins
- Bison & Elk Enclosures
- Seasonal Programming
- Trails
- Olsen Lodge with Kitchen



R 2.D New On-Road Bike Trail

A new on-road bike trail / lane is recommended on Highway 59 between Avoca and Hancock. This will facilitate commuting between cities as well as recreational riding.



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

R2 Permitting Considerations

Disturbance for launch and parking construction for the Avoca and the new access upstream of Botna Bend will likely require a Phase I archaeological investigation for portions of the site previously undisturbed unless previous disturbance can be verified. LiDAR imagery provides evidence to support a recommendation that no Phase I archaeological investigation is warranted for reconstruction of the Botna Bend Access.

SEGMENT 2 COST ESTIMATES

RECOMMENDATIONS	MAP CODE	COST ESTIMATE
Shift Water Trail to West Nishnabotna, New Access at Avoca	R2.A	
New Gateway Access	R2.B	\$155,169
New Gateway Access	R2.C	\$178,223
On-Road Bike Trail/Lane	R2.D	



SEGMENT R3: Below Botna Bend Park Access to Chautauqua Park Access

Existing Conditions

This segment of the river is 8 miles in length and has a relatively high level of use by paddlers including the local outfitter. Once past Hancock, this is a rural paddling experience with few homes or farm operations visible. One industry, Oakland Foods, LLC is located on the segment and has a large, highly visible wastewater treatment outfall on the water trail. Paddlers report foamy, strong-smelling effluent from this pipe. The riparian area on this segment includes the highest percentage of annually cultivated cropland, 26%, on the water trail within 100' of the top of the streambank. A variety of large trash and woody debris exists on this segment including furniture, fallen trees and tires. The existing access at Chautauqua Park in Oakland is difficult to clear of sand and silt after high water due to its alignment. The switchback design precludes the use of the city's tractor. The launch is also more steep than desired contributing to reports of small children tripping on its surface.

Issues and Opportunities

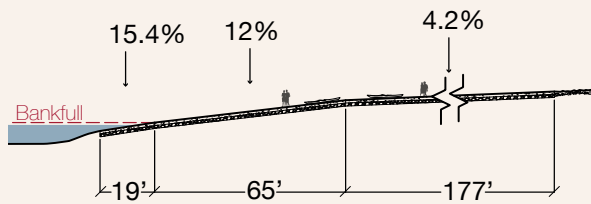
Oakland is an important city on the water trail. It provides basic retail including such as fuel and groceries. Chautauqua Park, the location of the water trail access in Oakland, is a full service park with future plans for RV camping. Access improvements in Chautauqua Park are recommended to expand the range of positive experiences on this segment and allow timely maintenance of the launch. Improvements include formalizing designated parking for the water trail include a handicapped parking stall and the alignment, slope and angle of the launch. The new launch is proposed very close to the existing launch and will require removal of several mature cottonwood trees. Organized removal of furniture tires and other trash by volunteers is recommended.



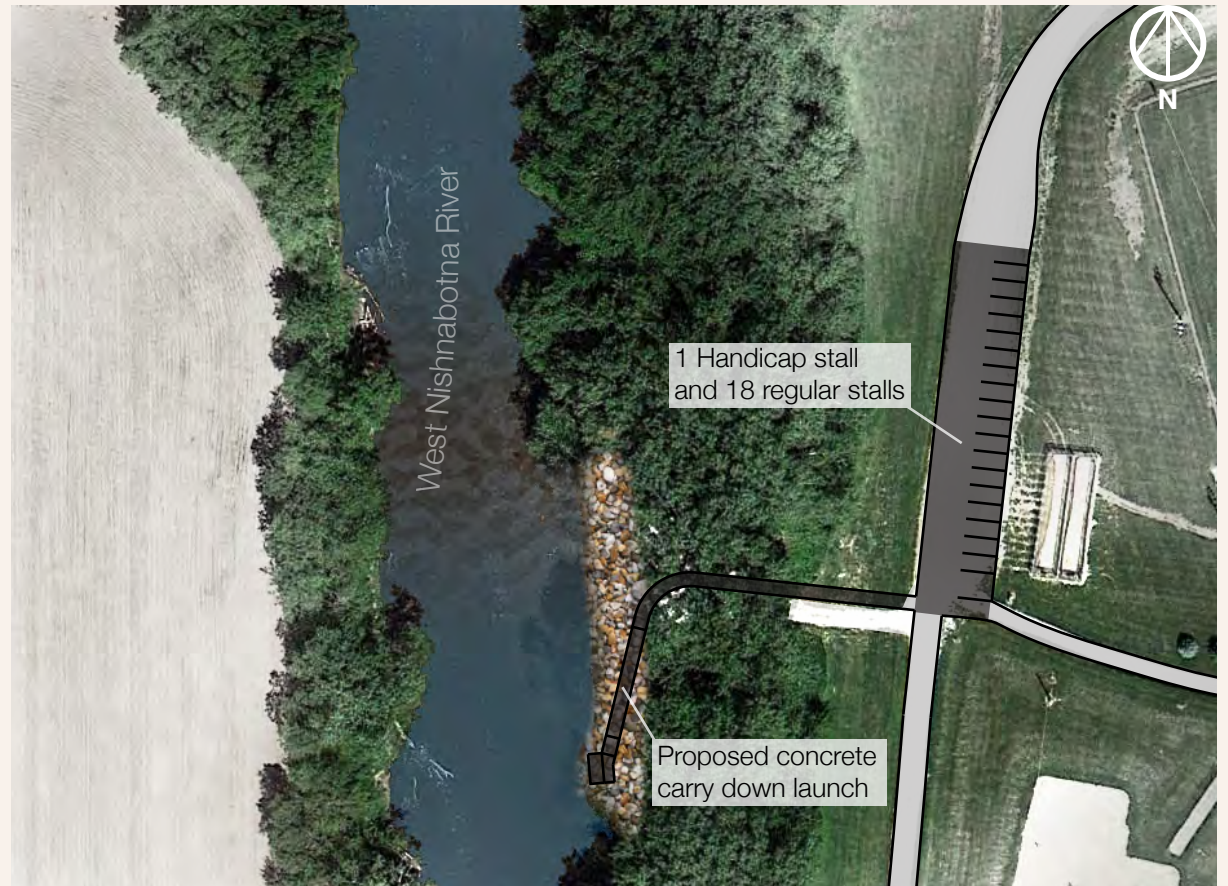
SEGMENT R3: Below Botna Bend Park Access to Chautauqua Park Access

R 3.A Chautauqua Park Access Upgrades

Recommendations for this launch include a complete reconstruction at the same location. Parking upgrades include parking for 5 cars as well as one handicapped parking stall. Recommended parking is adjacent to the existing park drive and across the park drive from the launch.



R3.A The existing river access at Oakland is constructed with a zigzag layout. City maintenance equipment is not able to clear the launch of sediment because of the sharp bends in the launch alignment. The new design reduces the slope of the existing access and angles the launch appropriately.



Chautauqua Park Access Upgrades

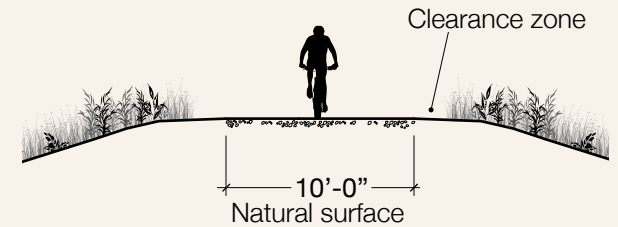
Chautauqua Park

- Concession stand & restroom
- Ball Diamonds
- Sand Volleyball Court
- Basketball Court
- Covered Shelter



R 3.B New Off-Road Bike Trail

A new off-road bike trail / lane is recommended near Highway 59 between Hancock and Oakland.



R3.B An off-road location in a former railroad corridor right of way could potentially become available.

R3 Permitting Considerations

Improvements to the access and parking area in Chautauqua Park are not expected to require a Phase I investigation. The Phase Ia assessment and field reconnaissance included this area. The park was found to have a low potential to contain significant cultural materials.

SEGMENT 3 COST ESTIMATES		
FEATURE	MAP CODE	COST ESTIMATE
Chautauqua Park Access Upgrades	R3.A	\$88,558
Off-Road Bike Trail	R3.B	

SEGMENT R4: Below Chautauqua Park Access to Old Town Park Access

Existing Conditions

This segment of the river is 11 total miles in length. The 11 miles is divided by Millstone Park Access in Carson resulting in one 7-mile segment (between Chautauqua Park and Millstone Park) followed by a 4-mile segment between Millstone Park and Old Town Park near Macedonia. The upper 7-mile segment has a low level of use by paddlers while the lower 4-mile paddle into Old Town has a moderate level of use. The corridor is heavily vegetated with forests and newer low-lying wetland areas created on the inside river bends by lateral migration of the channel. Annually cultivated crops occupy from between 10-20% of the riparian area on this segment. The only bedrock outcrops on the West Nishnabotna River in Pottawattamie County occur on this reach, most obviously just above the Pioneer Trail bridge and Old Town Park Access.

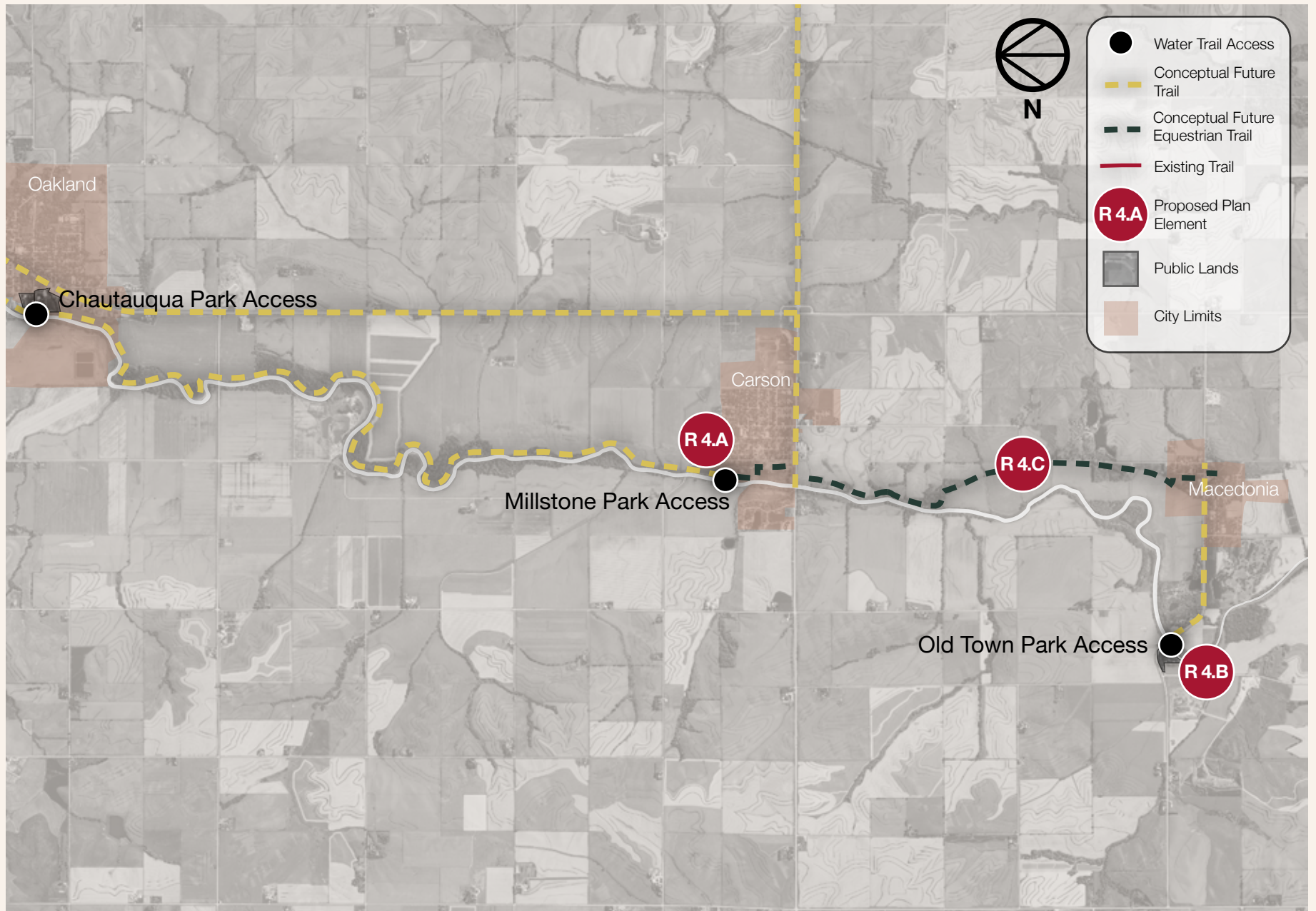
Issues and Opportunities

The Millstone Access to Old Town Park Access is the most visually attractive segment on the water trail. There are also strong prehistoric and historic interests on this segment. Each of the three accesses on the segment is located in a public park and all but Old Town Park are highly developed recreational areas. Old Town Park is minimally developed but upgrade plans include enhanced camping, a restroom and a shelter house. River access improvements in both Millstone Park and Old Town Park include complete launch reconstruction and development of more formalized parking facilities. Recommended launches at both locations are Universal Design with lower slopes compared to existing conditions. Angle of the launches will also be corrected to result in less sediment and sand deposition during high flows. The Water Trail Sponsor is interested in the possibility of a future Gateway Trail on the Millstone Park – Old Town Park Access segment. The existing segment distance of 4 miles is within DNR guidelines for a Gateway segment and the interpretation of local history is compelling to support Gateway use. This is currently not a high priority for the City of Carson so plans remain for the long term future. There are no existing equestrian trails adjacent to the West Nishnabotna in Pottawattamie County.

Millstone Park

- Playground
- Basketball Court
- Baseball Diamond
- Carson Community Rodeo
- Mown Trail





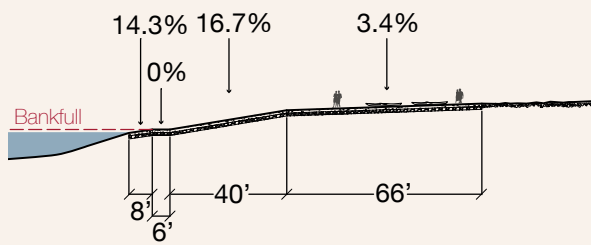
SEGMENT R4: Below Chautauqua Park Access to Old Town Park Access

R 4.A Millstone Park Access Upgrades

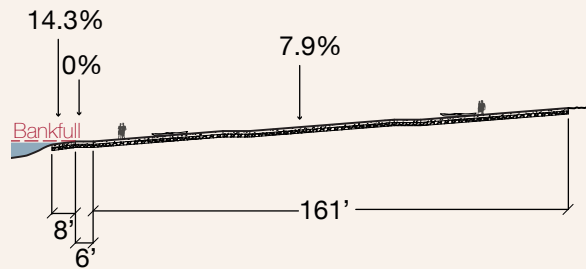
The existing launch surface at this access is functional but underdeveloped. Alignment and slope improvements are recommended. Establishment of a formalized parking area for the water trail is also recommended adjacent to the launch; this will require the relocation of several electric campsites. Initially a 11 vehicle parking area is recommended but design plans allow for future expansion, if needed, up to 21 vehicles, including 5 pull-through stalls for vehicles with trailers.



Millstone Park Access Upgrades



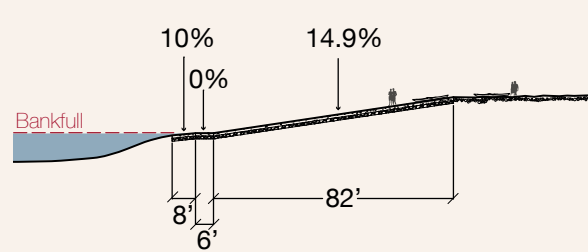
R4.A The proposed carry down launch portion of the new Universal Design style access is designed to meet the ADA specification for sidewalks.



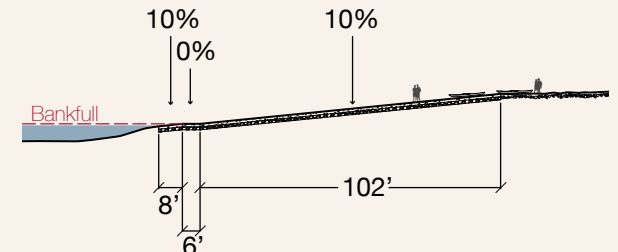
R4.A The proposed vehicle ramp portion of the new Universal Design style access is wider and more steep than the adjacent carry down portion.

R 4.B Old Town Park Access Upgrades

The existing river access at Old Town Park is located immediately below the Pioneer Trail bridge. As such a great deal of sediment deposition routinely occurs. A new access is recommended at the downstream park limits near the new park shelter constructed in 2016. Parking capacity for 11 pull-through stalls for vehicles with trailers (equating to 22 regular vehicle stalls) is recommended. This location is the least likely location in the park for sedimentation on the launch surface to occur. This location is also immediately upstream of a set of recently constructed concrete rubble weirs on the river. The weirs redirect the river current to the center of the channel to reduce streambank erosion.



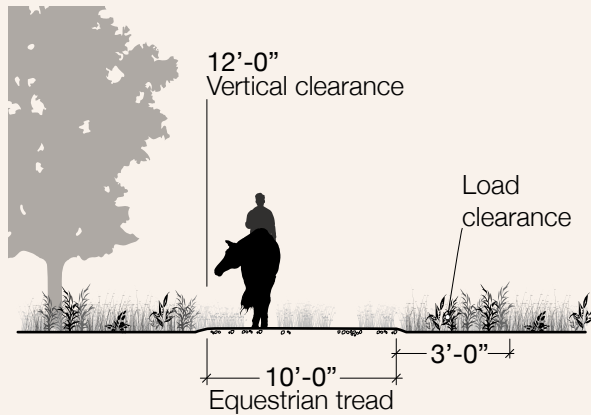
R4.B The proposed vehicle ramp portion of the new Universal Design style access is wider and more steep than the adjacent carry down portion.



R4.B The proposed vehicle ramp portion of the new Universal Design style access is wider and more steep than the adjacent carry down portion.



Old Town Park Access Upgrades



R4.C A majority of the proposed equestrian trail alignment will occupy the former railroad right-of-way.

R 4.C Equestrian Trail and Parking

A new equestrian trail is recommended between the City of Macedonia and Millstone Park in Carson (Figure 9). Local equestrians and residents of Macedonia developed this recommendation. A series of abandoned railroad corridor parcels between Macedonia and Carson were the inspiration for this amenity. The majority of parcels have not been integrated into adjacent farmland and remain either as railroad property (near Macedonia) or have reverted to private, adjacent landownership. Alternate routes are recommended for those parcels that have already been converted to cropland.



Figure 9

The proposed equestrian trail is approximately 3.94 miles in length (one-way.)

Old Town County Park

- Primitive Camping
- Picnic Tables
- Covered Shelter





R4.C This equestrian parking area has pull-through parking for 12 truck + trailer units. Each parking area also has an adjacent grass area for set up.

R4 Permitting Considerations

Disturbance for construction of the new equestrian trail will likely require a Phase I archaeological investigation for portions of the site previously undisturbed by the railroad unless previous disturbance can be verified. Construction of the equestrian parking area will also likely require a Phase I archaeological investigation unless the area has already been included in an earlier investigation.

SEGMENT R4 COST ESTIMATES		
FEATURE	MAP CODE	COST ESTIMATE
Millstone Park Access Upgrade	R4.A	\$104,680
Old Town Access Upgrade	R4.B	\$102,433
Equestrian Trail Between Carson Rodeo Grounds and Macedonia; Equestrian Trail Head & Parking in Macedonia	R4.C	

RECREATIONAL DEVELOPMENT CONCLUSIONS

All recommended elements are summarized and organized in Appendix A including the lead entity, partners, location and local prioritization. Cost estimates for water trail infrastructure are also included. 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:

- Pottawattamie County has 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 Sponsor. 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, Golden Hills RC&D, Iowa Prairie Network, Iowa Ornithologists' Union and Iowa Archeological Society
- Local and State Agencies including Pottawattamie County 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 (Metropolitan Area Planning Agency), statewide Transportation Enhancements Program funding, the Land and Water Conservation Fund, and Wildlife Conservation and Appreciation funds from U.S. Fish and Wildlife Service.

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- Minnesota, Trails and Waterways Unit. (2006). : Trail planning, design, and development guidelines. St. Paul, MN: Minnesota Dept. of Natural Resources, Trails and Waterways.
- Wagner, Mimi & Hoogeveen, Nate. (2010). Developing Water Trails in Iowa. Des Moines, IA: Iowa DNR.

APPENDIX

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	3	\$0	Pottawattamie CCB, Local Volunteer Fire Departments	Iowa DNR
R1.B	River Corridor	Iowa DNR	Communication to Users	1	Reimbursable from IDNR		
R1.C	River Corridor	Iowa DNR	Public Interpretative Program, Wayfinding Signage, New Water Trail Map, Communication Among Access Managers	1	\$0	Pottawattamie CCB	
R1.D	River Corridor	Pottawattamie County Trails Committee	Off-Road Trail between Avoca and Macedonia	3			
C1.A	River Corridor	Pottawattamie CCB	Enhance Aquatic Habitat for Fish and Mussels	2		Iowa DNR Fish Biologists	
C1.B	Various Locations	Pottawattamie CCB	Restore Habitat at Gravel Pits	2		Willing Landowners, Ducks Unlimited	
C1.C	River Corridor	Pottawattamie CCB	Vegetative Buffer Establishment (entire length: 212 ac.)	1	\$159,000	Willing Landowners, Pottawattamie Soil & Water Conservation District	
C1.D	River Corridor	TBD	Explore Voluntary Riparian Forest Protection	1		Iowa Natural Heritage Foundation	
C1.E	River Corridor	Pottawattamie CCB	Coordinate Public River Clean Up Events and Environmental Education Events	2		Pottawattamie Soil and Water Conservation, Golden Hills RC&D	
C1.F	West Nishnabotna Watershed	Pottawattamie CCB & Soil and Water Conservation	Increase Voluntary Water Quality Monitoring	2		IOWATER	
C1.G	River Corridor	River Access Owner	Streambank and Floodplain Restoration Demonstration Projects	1	costs included in individual site plans below	Iowa DNR	
C1.H	River Corridor	Property Owner	Streambank Restoration	1	costs included in individual site plans below	Iowa DNR	
R2.A	West of Avoca, Outside City Limits	Pottawattamie CCB	Shift Water Trail to W. Nishnabotna, New Access at Avoca	1		Willing Landowner	
R2.B	Upstream of Botna Bend Park	Pottawattamie CCB	New Gateway Access	3	\$155,169	Willing Landowner	
R2.C	Botna Bend Park	Pottawattamie CCB	New Gateway Access	2	\$178,223		
R2.D	Avoca to Hancock	Pottawattamie County Trails Committee	On-Road Bike Trail / Lane	2		Water Trail Sponsor	Iowa DOT
C2.A	Avoca	City of Avoca	Legacy Dumpsite Cleanup	1			
C2.B	Botna Bend Park	Pottawattamie CCB	Floodplain Restoration Demonstration (Water Quality Enhancement)	2		Iowa DNR	

Map Code	Location	Lead Jurisdiction	Recommendation	Local Prioritization	Budget Estimate for River-Related Recommendations	Other Collaborators	Notes
R3.A	Chautauqua Park	City of Oakland	Chautauqua Park Access Upgrades	1	\$88,558		
R3.B	Hancock to Oakland	Pottawattamie County Trails Committee	Off-Road Bike Trail	2			
C3.A	Chautauqua Park	City of Oakland	Streambank Restoration	2	cost included in R3.A	Iowa DNR	
C3.B	Chautauqua Park	City of Oakland	Legacy Dumpsite Cleanup	1		Volunteers	
R4.A	Millstone Park	City of Carson	Millstone Park Access Upgrade	1	\$104,680		
R4.B	near Macedonia	Pottawattamie CCB	Old Town Access Upgrade	1	\$102,433		
R4.C	Carson to Macedonia	Macedonia Hamilton Development Corporation	Equestrian Trail Between Carson Rodeo Grounds and Macedonia; Equestrian Trail Head & Parking in Macedonia	1		Saddle Club	
C4.A	Old Town Park	Pottawattamie CCB	Streambank Restoration (in conjunction with new Old Town Access)	2	cost included in R4.A	Iowa DNR	
C4.B	River Corridor Between Oakland to Carson	Iowa DNR	Explore Restoration of Impacted River Reach	2		Outside Consultant	
C4.C	River Corridor Between Oakland to Carson	Pottawattamie CCB	Restore Habitat at Gravel Pits	3		Willing Landowners	
C4.D	Millstone Park	City of Carson	Legacy Dumpsite Cleanup	1		Volunteers	
C4.E	Millstone Park	City of Carson	Gully Repair	1		Outside Consultant	
C4.F	Macedonia	Macedonia Hamilton Development Corporation	Macedonia Folk Art Center	2		City of Macedonia, Golden Hills RC&D	
C4.G	Near Macedonia	Macedonia Historical Preservation Society	Mormon Trail Driving Tour	3		City of Macedonia	
C4.H	Macedonia	Macedonia Historical Preservation Society	Macedonia Historic Walking Tour	3		City of Macedonia	
C4.I	Near Old Town Park	Pottawattamie CCB	River Overlook Site	1		City of Macedonia	

The background of the slide is a photograph of a riverbank. The foreground shows a calm, brownish river. The middle ground is filled with a thick layer of green grasses and shrubs. In the background, there are several tall, leafy trees with green foliage. The sky is not clearly visible, appearing as a bright, overcast area.

CHAPTER 4

RESOURCE CONSERVATION & PROTECTION PLAN

WEST NISHNABOTNA WATER TRAIL

ACKNOWLEDGMENTS

This Water Trail Plan was prepared by Mimi Wagner, Lucas Buscher and Jacob Wilson of Iowa State University. Pottawattamie County Conservation Board staff provided leadership and local support of the project throughout the process. Mark Shoemaker and Jon Fenner of Pottawattamie County Conservation provided review and interpretation. Nate Hooegeveen, 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:

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CHAPTER 4 RESOURCE CONSERVATION & PROTECTION PLAN

The near-level floodplain of the West Nishnabotna River intertwines with prehistory, history, wildlife, vegetation and Southern Iowa hospitality to create a high value river corridor experience for both local residents and those traveling from a distance.

This water trail is unique in Iowa because it is situated on a segment of river that was historically dredged and channelized. Once the dredging was complete in the early 20th century, however, the resulting ditch was not uniformly maintained. The river channel continues to respond and “unwind”, shifting laterally on outside bends, sometimes drastically, in response to the initial dredging as well as changes in its watershed and weather patterns. As such, many new low-lying wetlands exist on inside bends of the river. Contrasting these low-lying wetland areas are 15’ high (on average) streambanks. The subtle yet unique exposed bedrock on the river held specific significance for Indian and Euro-American transportation, including the Mormon Trail.

Planning for this project, as well as other concurrent efforts in the region, engaged an energetic, diverse community to focus on this river. They recognize the river as the heart of the region and value of the cultural and natural resources present. They also realize the enormous opportunities these resources hold for the public as well as local economies.



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 results 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 West Nishnabotna River beginning at Avoca on the upstream end to Old Town Park near Macedonia (Figure 1). The uppermost 4 miles of the water trail, beginning at Avoca, is on the East Branch of the West Nishnabotna River rather than the main channel. Five communities on the river are included in this planning: Avoca, Hancock, Oakland, Carson and Macedonia. The West Nishnabotna River watershed area draining into study segment is 489,509 acres in size (Figure 2). This resource conservation and protection plan serves three purposes:

- Promote establishment of perennial vegetation buffers in place of annually cultivated cropland on the West Nishnabotna River and its tributaries
- Identify opportunities enhance water quality
- Set long term goals for enhancing natural and cultural resource conditions

The goals of this resource conservation and protection plan center on enhancing conditions on the West Nishnabotna 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 in the watershed 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.

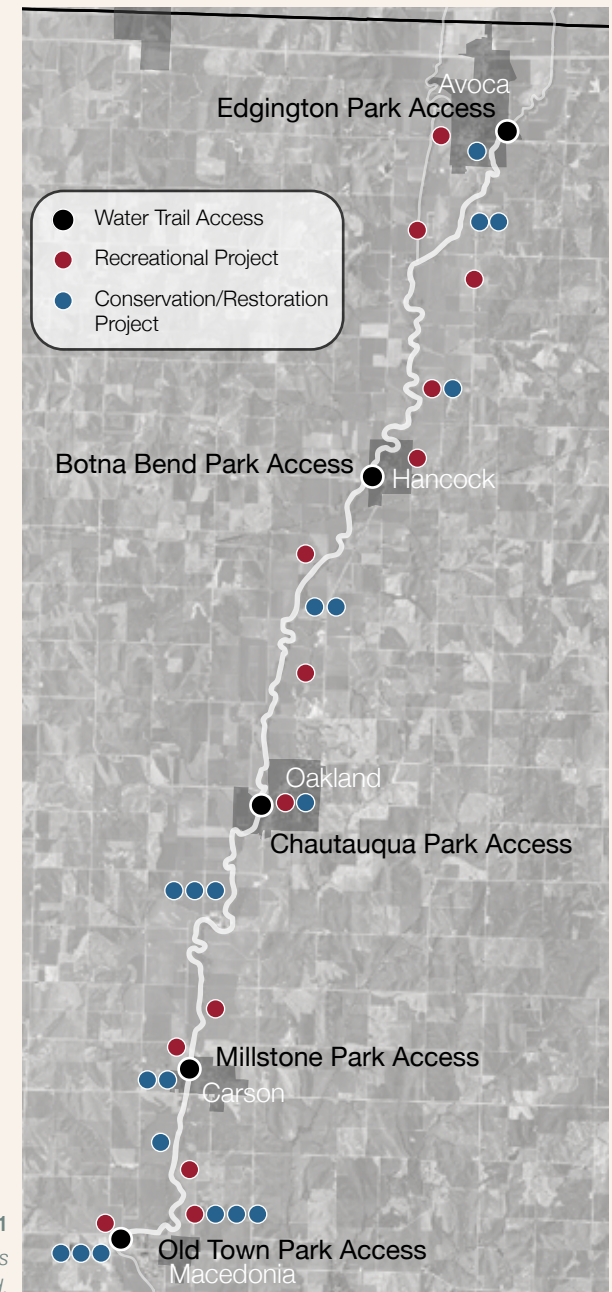
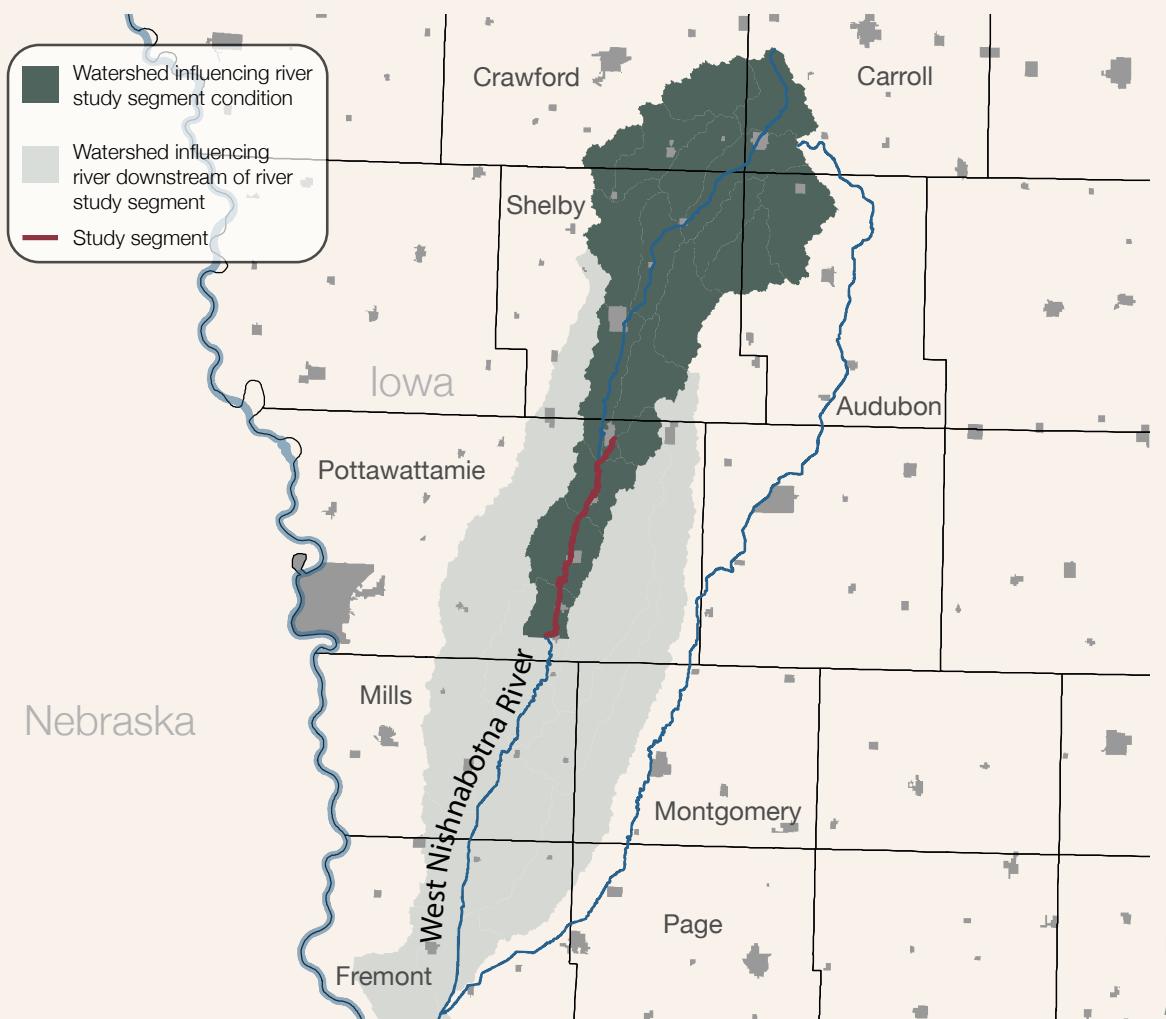


Figure 1

Both resource conservation and protection as well as recreational development plan elements are included.



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*.

Figure 2

The study segment of the West Nishnabotna is located at the mid-point of the river's watershed.

- **Cultural Resource Protection:** Additional site improvements or development at some river access points on the West Nishnabotna will likely require a Phase I archaeological investigation due to cultural resources known to exist in the area. [Phase IA Archaeological Reconnaissance of the West Nishnabotna Water Trail Corridor, Pottawattamie County Iowa, 2013; *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, 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 RULE 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 West Nishnabotna River corridor 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 as a minimum.

THE WEST NISHNABOTNA IN POTTAWATTAMIE COUNTY

This water trail is situated on a broad valley bottom that overlies Pennsylvanian-age sedimentary bedrock. This bedrock is very near the surface and visible only between Carson and Macedonia (Figure 4). The presence of bedrock provided opportunities for prehistoric and historic people to cross the river, including the Mormon Trail. The adjacent bedrock river terraces are overlain by sediment and visible only at one location, the upstream side of the Pioneer Trail bridge crossing the West Nishnabotna. The limestone is resistant to erosion, and constrains the river to a narrow valley, a phenomenon known as bedrock control. Multiple sand, gravel and limestone quarries operate on the valley bottom in Pottawattamie County including one that was in operation at the time of the General Land Office Survey of 1851. This quarry is now used as a private recreation retreat named Stone Quarry.

As you paddle the West Nishnabotna River in southwest Iowa, you are paralleling or flowing over one of the most prominent bedrock channels in Iowa, the Fremont Channel. The Fremont Channel extends from near the Minnesota border nearly due south to the Missouri border in Fremont County, from which it is named. The channel was created by outwash from melting Pre-Illinoian glaciers about 2 million years ago. The bedrock channel flowed from Minnesota through Iowa into central Missouri and ultimately east to the Mississippi River. As such it was the Ancestral Missouri River, and it was incised more deeply into the bedrock surface than is the current Missouri River.

Streambank erosion is a major concern in Pottawattamie County. The river channel is incised into the floodplain between 10 and 20 feet. In some sections of the water trail, wild meanders exist, particularly when compared to the straightened geometry created one hundred years ago by dredging and channelization. The two most substantial meander shifts are located on the west side of Avoca and south of Oakland. The streambanks on much of the water trail are vertical, eroding surfaces. Large scale streambank collapses occur when annually cultivated crops are planted at the tops of these meandering curves. Meandering river channels are most concerning to residents when they threaten infrastructure such as roads, bridges and parks. Annually cultivated cropland occupies an average of

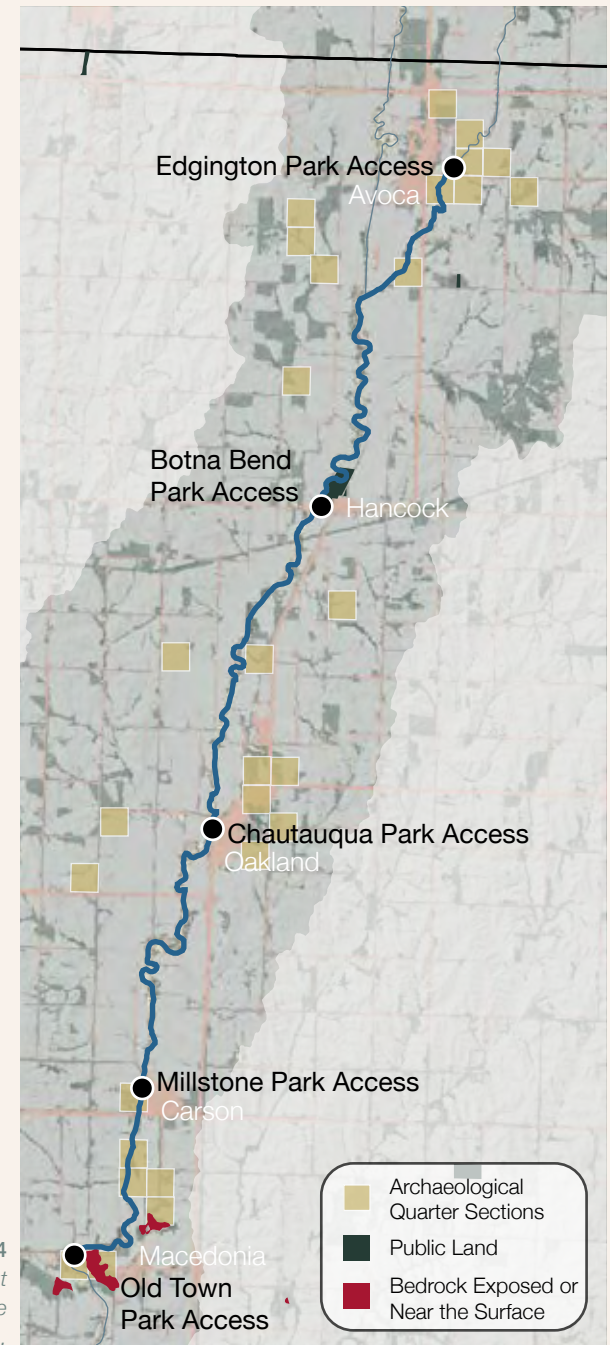


Figure 4
Known archaeological sites are located throughout the water trail corridor but bedrock outcroppings are only between Carson and Macedonia.



17% of the riparian buffer while 75% is in perennial vegetation such as pasture, forests or wetlands. Residents reported watching as neighboring landowners removed mature cottonwood forests adjacent to the river, pushing the trees into the river with bulldozers to dispose of them. Steering group members are interested in finding new ways to engage landowners so they understand how their actions can exacerbate streambank erosion.

As the river shifts locations along its outside bends, low-lying longitudinal bands of wetlands are formed on the opposite side of the channel on the inside bend. These wetlands, too low to occupy or cultivate, are the rivers' new functional floodplain. The habitat they provide on a river like the West Nishnabotna, surrounded by miles of annually cultivated cropland, is highly valuable. Very little wildlife monitoring data exists for the water trail area with the exception of freshwater mussels and birds. Between 5 and 14 species of living mussels were identified at three separate locations on the river in 2013. Iowa's Breeding Bird Atlas documented 84 bird species breeding or likely breeding near the river in Pottawattamie County. Of these, 16% (13) are included on Iowa's Species of Greatest Conservation Need list.

A majority of the river edge is privately-owned and Pottawattamie County has no existing natural resource protection regulations. An enormous potential exists to develop voluntary conservation easements with willing landowners to ensure the resources and habitat 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.

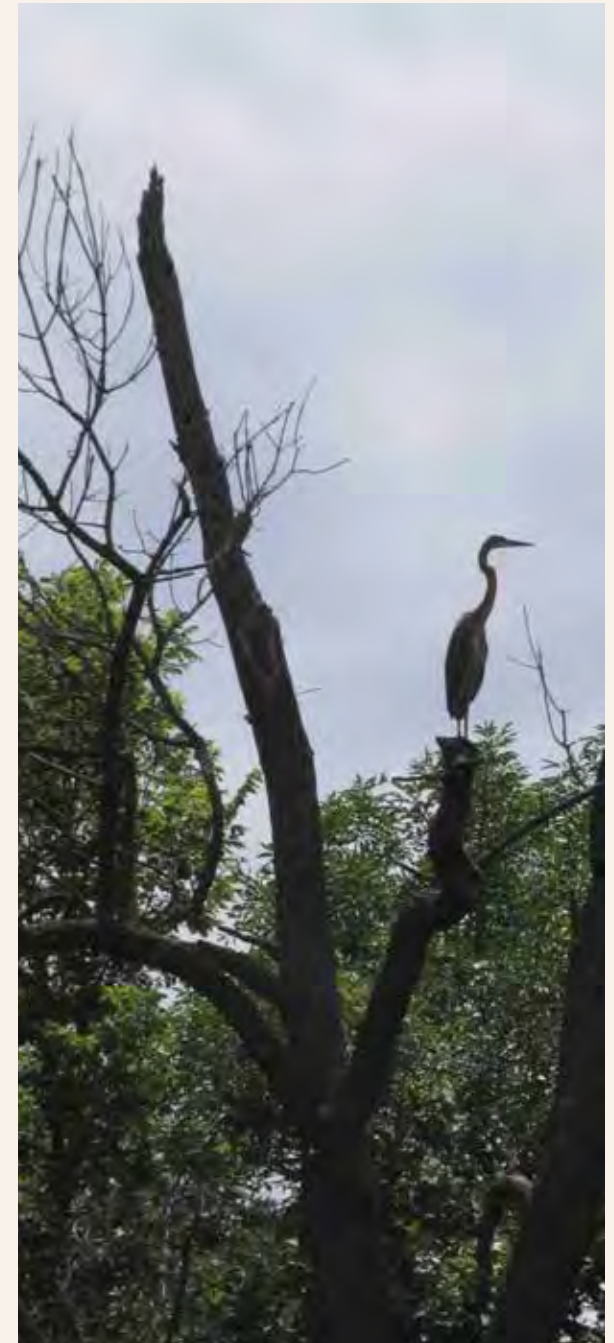
Implementation of the West Nishnabotna Vision

The West Nishnabotna River in Pottawattamie County is designated as a state water trail between the Avoca and Old Town Park near Macedonia. In addition to shifting the water trail entirely onto the West Nishnabotna River, a large part of the vision includes protecting and enhancing the conditions that make this river the valued recreational experience it is today. The foremost important element in this vision is enhancement of water quality, both the biochemical balances as well as the physical structure of the river corridor. These enhancements will protect existing fish, mussel and bird species from degradation. The further development of cultural resources from an active interpretation standpoint is also important in the region.

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 and attention on water trail planning. A steering group composed of 21 local individuals representing special interests such as water quality, equestrians, botany, archaeology 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, Pottawattamie County Conservation Board.

The existing conditions surrounding this section of the West Nishnabotna River were assessed and researched concurrently with the 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, Pottawattamie County Conservation staff, Pottawattamie County Conservation 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. On-land recommendations center on water quality enhancement and expansion of the perennial riparian vegetation buffer in agricultural areas. *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.

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
Cleanup Legacy Dumpsites		√		√		√	√
Streambank Restoration	√	√	√	√		√	√
Establish Perennial Vegetation Buffer	√	√	√	√		√	
Protect and Interpret Significant Cultural & Historic Sites					√	√	√
Develop Partnerships With Other Watershed Efforts and Organizations	√	√	√	√			

Table 1
Desired conservation and protection outcomes and proposed improvements are organized to reflect their relationship to local and statewide issues.

RESOURCE CONSERVATION AND PROTECTION NEEDS IN THE CORRIDOR

Existing Conditions

Challenges and needs are fairly consistent along the entire water trail (Figure 5). Enormous amounts of sediment erode annually particularly where the channel is migrating laterally. Mid-channel aggradation is visible particularly on the lower reaches of the water trail. These conditions are due to the channels' current phase of aggradation, the imbalance between the quantity of water, sediment and debris present and the continuing response from straightening in the early 20th century. Concerns about water quality exist on multiple rivers in Pottawattamie County. The scale of the river and the bank height prohibit traditional stabilization techniques. The water trail route is not included on Iowa's list of impaired waters, however, both upstream and downstream segments are impaired for either indicator bacteria or biological conditions. Numerous tributaries to the West Nishnabotna are also impaired.

The majority of the West Nishnabotna watershed in Pottawattamie County, excluding the river valley itself, is rated as highly erodible land from an agricultural standpoint and it is intensively managed for agriculture. The riparian buffer landcover in the first 100' on either side of the West Nishnabotna River includes a total of 17% annually cultivated cropland.

Acres of public ownership and permanent protection as well as recreation opportunities are generally limited to the area surrounding communities. The cultural resources known to exist are particularly interesting: a proportionately high quantity of sites from the hunting and gathering Archaic period (between 10,000 and 3,000 years ago), substantial Mormon pioneer settlements, a mammoth skeleton and a cluster of buildings in Avoca eligible for the National Register of Historic Places. Beyond knowledge of these specific sites, very little investigation of cultural resources has occurred in the study area. Far less than one percent (0.01 percent; 1,126 acres) of the river corridor area has been subjected to archaeological survey. Due to the annually cultivated nature of much of the river corridor, archaeological traces could remain. Additional investigations as well as volunteer pedestrian survey are possible on areas with cultural features on early maps or identified by modeling as highly suitable for the presence of cultural resources.

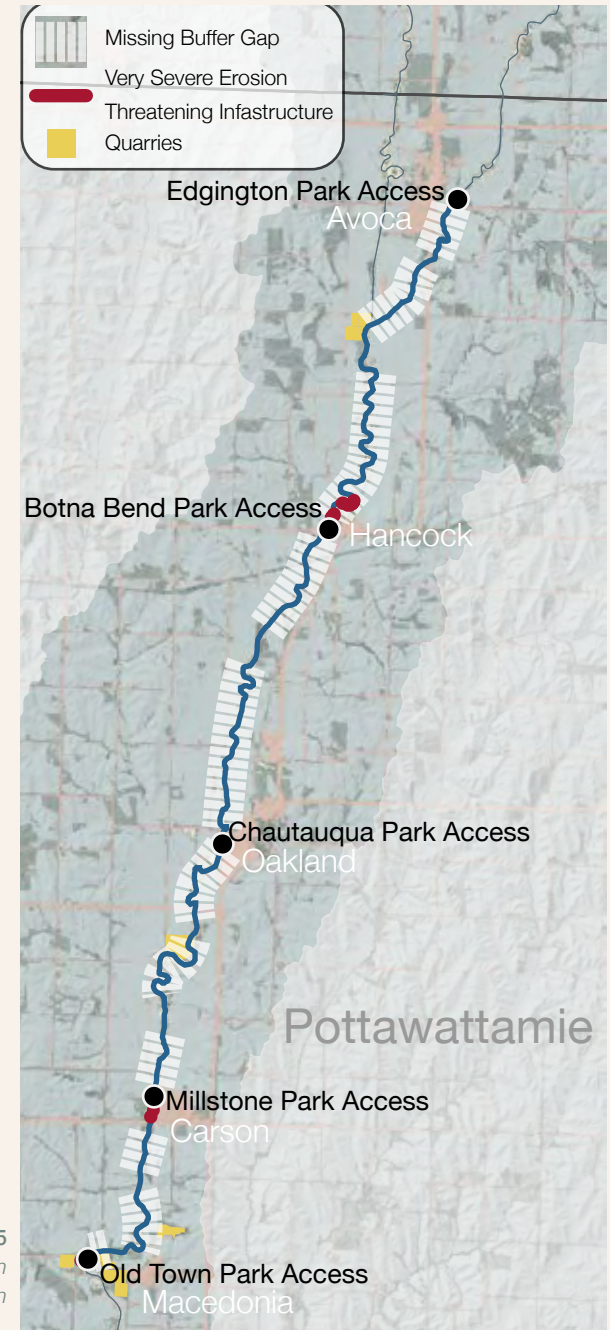


Figure 5
Office and Iowa DNR staff. Gaps in the perennial riparian buffer and instances of severely eroding streambank erosion are the most visually obvious land conservation needs.



River Channel Conservation Needs

A number of issues were identified during this planning directly related to the river itself. 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:

- Demonstration of stream bank, floodplain restoration and stormwater management practices on public land utilizing natural channel design and other low-impact practices
- Utilize state of the art fish habitat enhancement practices based on a changing climate
- Coordinate public meetings and events for river clean ups and education

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 West Nishnabotna. The following desired outcomes related to land-related issues were identified during planning:

- Support other organizations work to enhance water quality conditions on the West Nishnabotna and its tributaries, both point and non-point source pollution
- Increased participation in voluntary water quality monitoring
- Establish a continuous perennial stream buffer for the length of the West Nishnabotna River Water Trail
- Voluntary permanent protection of existing mature forested riparian land tracts in private ownership
- Conversion of former and inactive quarries and pit mine sites to native vegetation for wildlife habitat

Cultural Resource Protection and Interpretation Needs

The following desired outcomes related to cultural and historical issues were identified during planning (Peterson 2013):

- With only 0.01% of the river corridor surveyed for cultural resources, additional Phase I survey work and research may yield 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 river
- 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
- Standardized interpretation of historic architecture, Mormon Trail migration and early Euro-American settlements including the strong relationship with the river



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).

Gully Erosion

Multiple areas were identified with gully erosion. Two low impact stabilization methods are included in these recommendations. It is also recognized that some gully conditions may require more invasive, engineered stabilization. The most important aspect of gully repair is to utilize a structure to stabilize and stop the headcut from progressing uphill. Recommendations included in this plan utilize both rock and dormant vegetation for headcut stabilization. Willow wall construction is recommended for gullies with active downcutting (Wagner and Hoogeveen 2010). A series of low rock structures are recommended for gullies with a stable bottom (Sponholtz and Anderson 2010).

Streambank Restoration

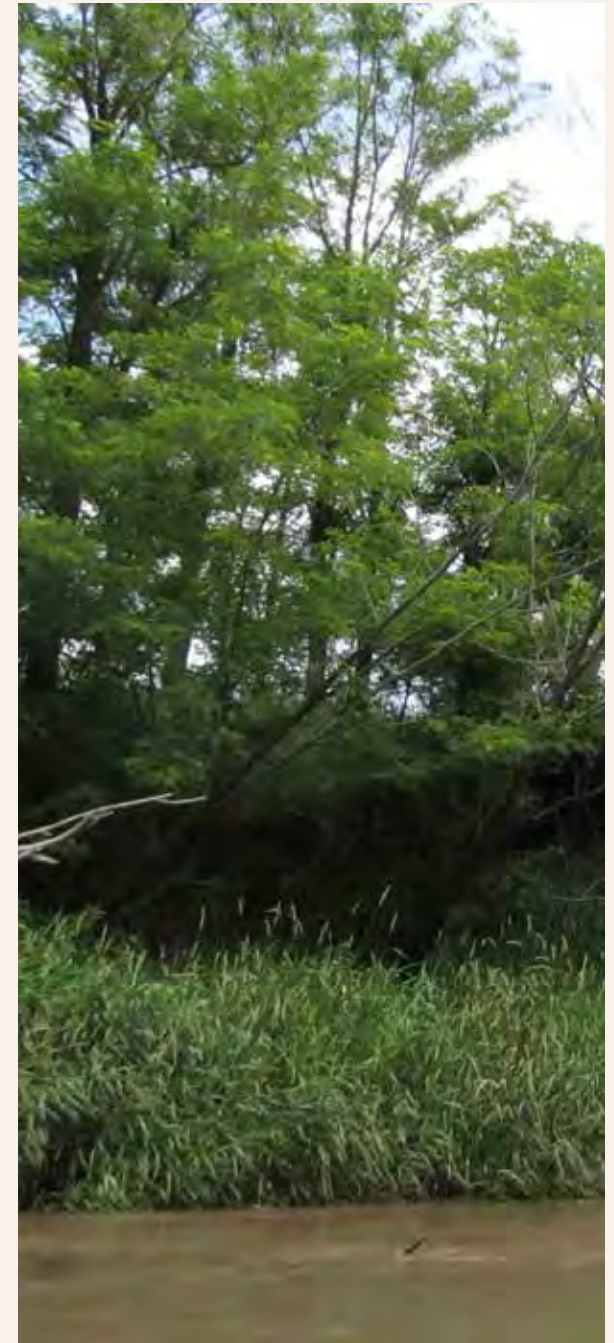
Restoring streambanks and minimizing future streambank erosion is a high priority on this river. Two methods are recommended. The Wood Toe Sod Mat is a low impact practice incorporating a toe structure constructed of large dead trees and sod. The second recommended alternative is a stone toe at 50% the bankfull height and a laid-back streambank. Both alternatives include a bankfull bench.

The Pottawattamie County reach of the West Nishnabotna River provides a unique recreation and conservation opportunity. The presence of multiple types of natural and cultural resources paired with local resident energy and commitment distinguishes this county from others in Western Iowa. 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: streambank and floodplain restoration, volunteer water quality monitoring and river cleanup events
- Land-Based Resource Conservation: implementation of bacteria-loading reduction practices, continuous perennial stream buffer establishment, legacy dumpsite cleanup, gully repair and voluntary riparian forestland protection
- Cultural Resource Protection and Interpretation: additional professional and volunteer field studies as needed, developed opportunities for public education

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 soft and hard trail systems, river access upgrades, new river accesses and additional signage.



RECOMMENDED CONSERVATION AND PROTECTION PROJECTS

A range of resource conservation and protection strategies are recommended to protect and enhance conditions on the West Nishnabotna River in Pottawattamie County. The strategies include in-channel and shoreline, streambank, and inland / upland areas. The study area river corridor is divided into three 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 the entire 27-mile study area. Preliminary cost estimates for water trail-related enhancements are included and are 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 each community and Pottawattamie County Conservation Board and staff. Finally, these recommendations address local, regional, state and national conservation priorities.

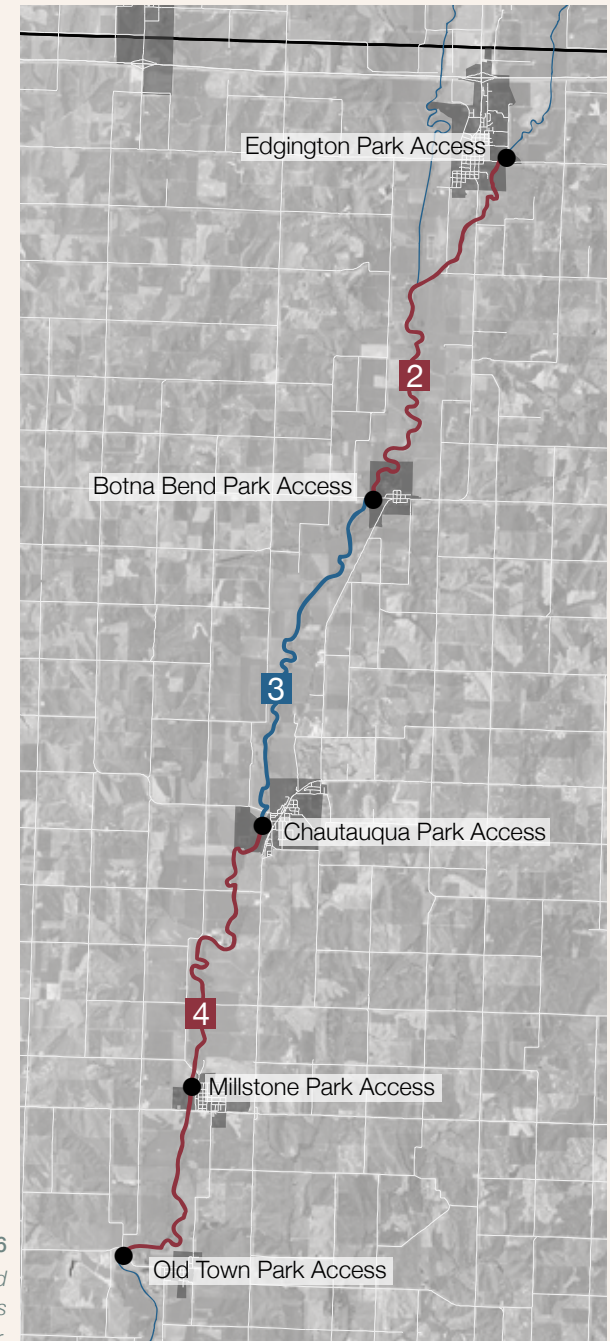


Figure 6

The 27 miles of river included in this plan are divided into 5 distinct segments for planning purposes, plus one additional segment spanning the entire corridor.

SEGMENT C1: Corridor-Wide and Multiple Segment Projects

C 1.A Enhance Aquatic Habitat for Fish and Mussels

In-stream and riparian corridor enhancements to further support populations are recommended in conjunction with local anglers, Pottawattamie County Conservation Board and Iowa DNR.

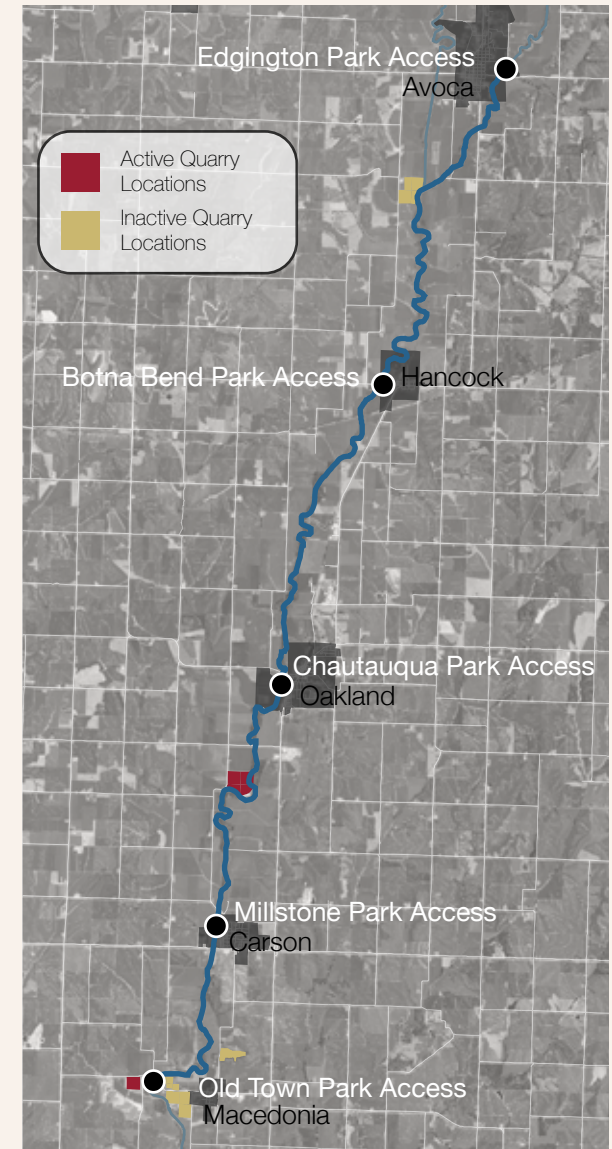
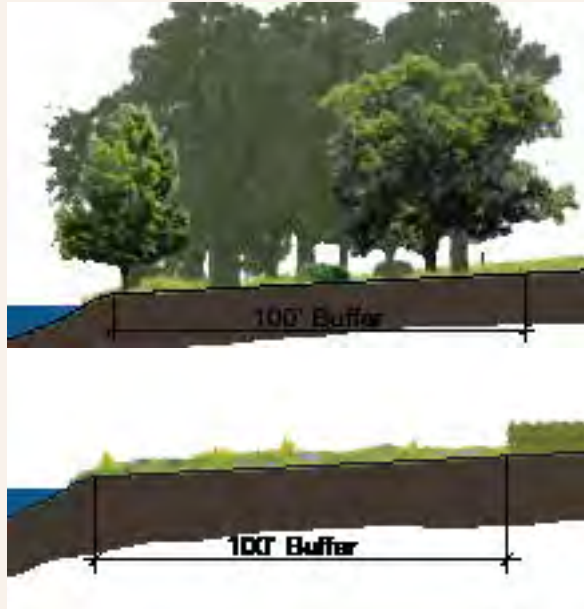


C1.B. Both active and inactive sand and gravel mining operations exist on the floodplain surrounding the water trail.

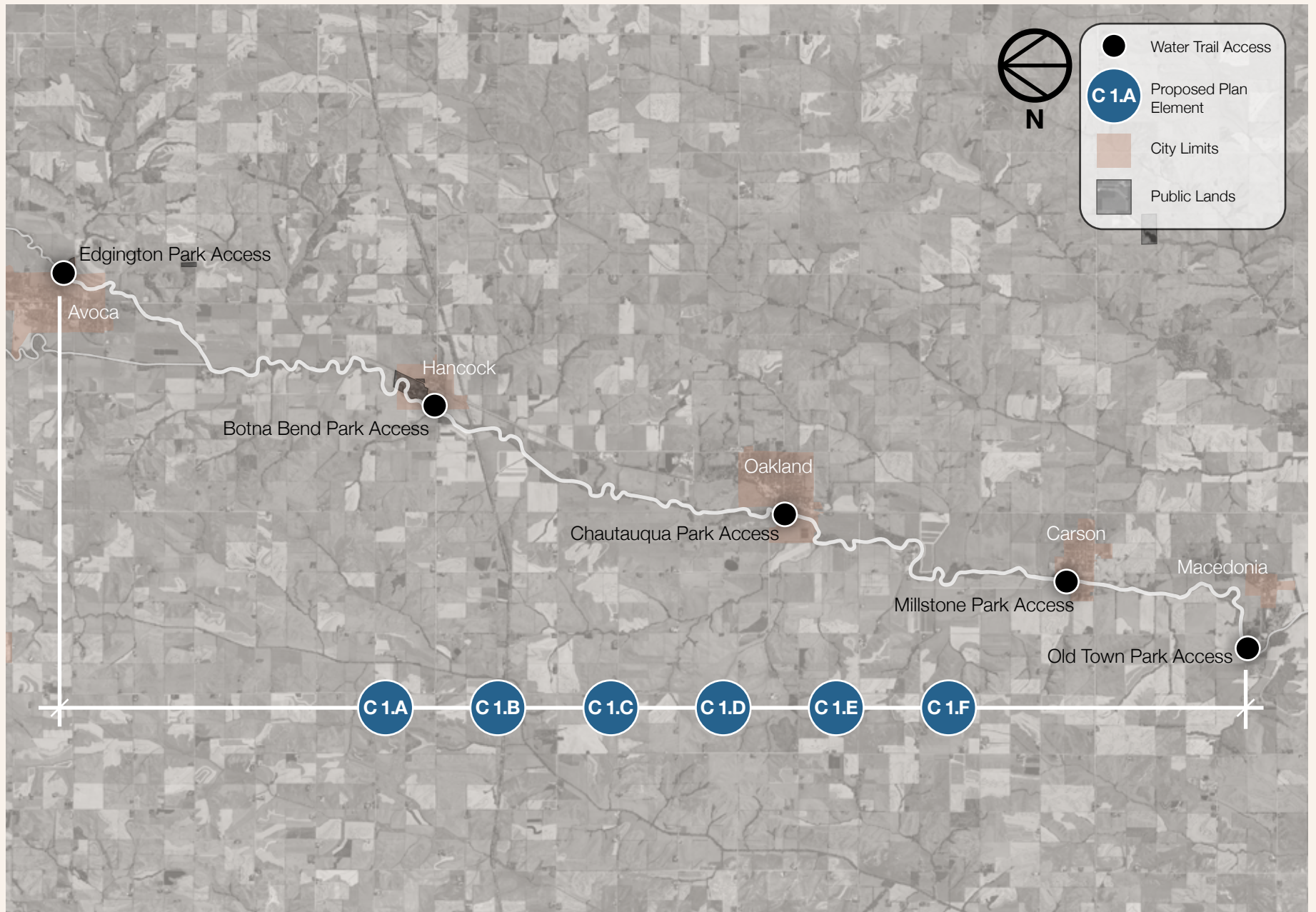
C 1.B Restore Habitat at Gravel Pits

A total of six sand and gravel mining operations exist on the water trail. Only two remain in active operation. All of these sites hold great potential for nodes of wildlife habitat, particularly water fowl, after mining operations are completed. The conversion of abandoned or inactive gravel pits near the river corridor into wildlife habitat is recommended (Figure 7).

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 (left) provides diverse habitat for multiple species as well as the most successful, natural reinforcement for streambank protection. The Herbaceous Mix (right) provides excellent filtering capability for sheet erosion from adjacent crop fields as well as important bird habitat.



C1.B. Two active quarry locations occur on the water trail route. Numerous former quarry operations have been converted to perennial landcover.



SEGMENT C1: Corridor-Wide and Multiple Segment Projects

C 1.C Establish a Continuous Riparian Buffer

Development of a 100' wide perennial stream edge buffer is recommended for the entire 27 miles of the West Nishnabotna River in Pottawattamie County. The recommendation would add valuable bird habitat as well as enhance water quality. A total of 212 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 Botna Bend Park in Hancock and Oakland (Figure 8). Establishment of either a Type A Riparian Buffer Vegetation Mix, comprised of native trees, shrubs and herbaceous plants or a Type B Mix, comprised of herbaceous plants only, is recommended.



Figure 8
Although 75% of the buffer acres on the water trail were already in perennial vegetation in 2015, 17% of the total acres were in annually-cultivated row crop landcover. The largest segments of missing perennial cover (annual cropped) exist between Hancock and Oakland.

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 West Nishnabotna River. Potential strategies include donation or purchase of permanent conservation easements from willing landowners and donation or purchase of fee title from willing landowners. An organization, such as the County Conservation Board, would need to organize, obtain funding for and receive the easements.



C1.D Mature riparian forests are an excellent tool for mitigating floods and slowing the streambank erosion that comes with lateral migration of outside bends in the channel.

C 1.E Coordinate Public River Clean Up Events and Environmental Education Events

Additional public recreation and environmental education events on and about the West Nishnabotna are recommended. Clean up paddles would be an excellent method for removing large trash from the river such as furniture and tires.

C 1.F Increase Voluntary Water Quality Monitoring

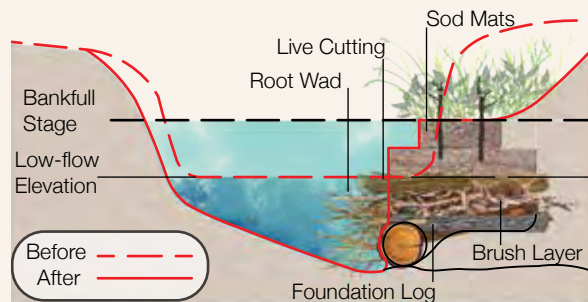
Additional IOWATER volunteer monitoring on the West Nishnabotna and its tributaries is recommended and will provide a valuable understanding of water chemistry conditions.

C 1.G Streambank and Floodplain Restoration Demonstration Projects

Streambank and floodplain restoration projects that utilize natural channel design principles are recommended on this water trail. Vegetation in combination with streambank armoring, in particular, is recommended as well as restoration of a bankfull bench. These practices have been included in access redesigns in the following segments where they are appropriate.

C 1.H Streambank Restoration

Reducing streambank erosion is one of the highest priorities for this water trail project. This project recommendation is included in each of the individual water trail access re-designs. Either a Wood Toe Sod Mat or a Stone Toe is recommended to restore the streambank.



C1.H This structural feature, the Wood Toe Sod Mat, is used to stabilize outside bends on eroding streams. Another alternative is a Stone Toe.

C1 Permitting Considerations

Disturbance for construction of streambank and floodplain restoration will likely require a Phase I archaeological investigation for portions of the site previously undisturbed unless previous disturbance can be verified.

SEGMENT 1 COST ESTIMATES		
RECOMMENDATIONS	MAP CODE	COST ESTIMATE
Enhance Aquatic Habitat for Fish and Mussels	C1.A	
Restore Habitat at Gravel Pits	C1.B	
Vegetative Buffer Establishment (entire length: 212 ac)	C1.C	\$159,000
Explore Voluntary Riparian Forest Protection	C1.D	
Coordinate Public River Clean Up Events and Environmental Education Events	C1.E	
Increase Voluntary Water Quality Monitoring	C1.F	
Streambank and Floodplain Restoration Demonstration Projects	C1.G	costs included in individual site plans below
Streambank Restoration	C1.H	costs included in individual site plans below

SEGMENT C2: Avoca to Botna Bend Park Access

Existing Conditions

This 8-mile segment of the water trail includes a combination of forested and annually-cropped land in the buffer area. One former gravel pit operation that has been converted to wildlife habitat is visible from the river. This segment has a high level of use by paddlers, particularly because it ends in Botna Bend Park. A moderate amount of large woody debris and large concrete rubble with exposed rebar are present in the river channel. The concrete rubble appears to be remnants of former bridge crossings. One large legacy dumpsite is also located on this segment.

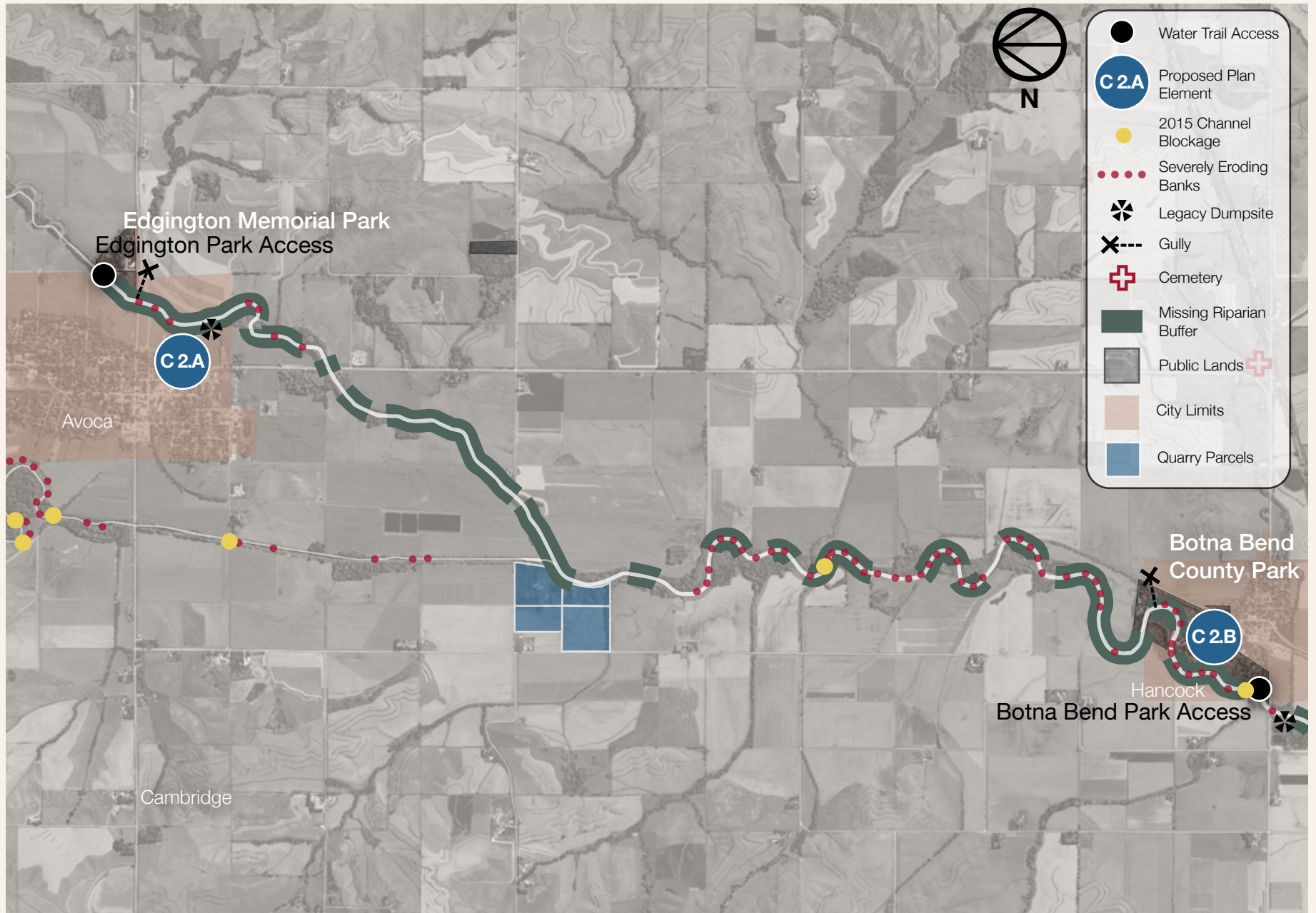
Issues and Opportunities

The upper portion of this segment, between Edgington Park and the East Branch – West Nishnabotna confluence, will not be a part of the designated trail route at some point in the future. Several opportunities exist, however, for resource conservation and protection on this segment. Concrete and rebar debris in the river channel is an underwater hazard for paddlers. A large legacy dumpsite is also located on this segment. The East Branch portion of this segment is channelized and maintained as a ditch; it has few issues with streambank erosion. Streambank erosion, usually on an alternating bank pattern, is present downstream of the confluence.

C 2.A Legacy Dumpsite Cleanup

The top of the streambank on a parcel owned by the City of Avoca on North Elm Street is lined with a tangle of large debris, trash and vegetation. This site is a storage yard for the City. Removal of the material to an off-floodplain landfill or, minimally, 100 feet from the edge of the streambank is recommended.





SEGMENT C2: Avoca to Botna Bend Park

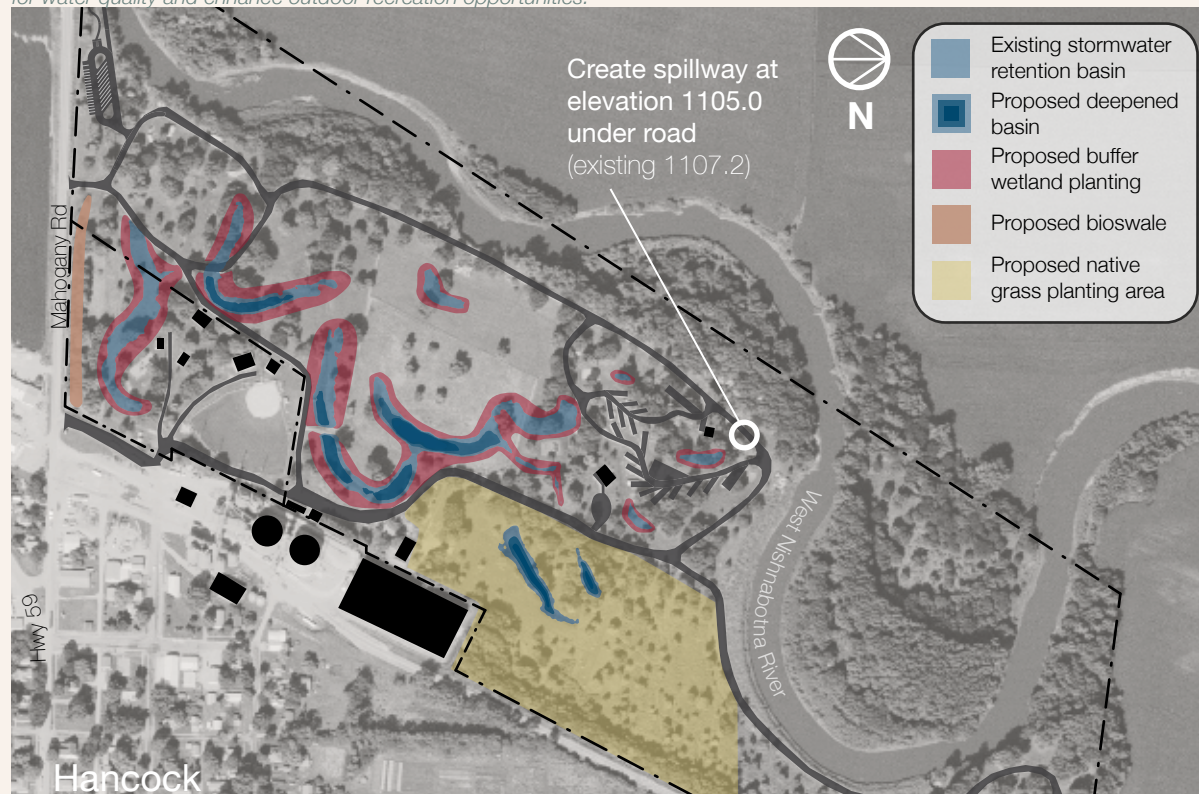
C 2.B Floodplain Restoration Demonstration

Reducing streambank erosion and the voluntary protection of existing forests on the river edge are identified by the Project Steering Group the highest conservation priority for this water trail project. Streambank restoration is recommended in conjunction with construction of the new Botna Bend Access. Floodplain restoration to manage stormwater runoff within Botna Bend Park is also recommended.

Botna Bend Park is located on a low spot adjacent to the West Nishnabotna River. The remnants of several old river oxbows are evident in the park's topography. Runoff from nearly 385 acres of land surrounding the park drains through it on its way to the river. The park becomes inundated with

Figure 8

A combination of basin enlargement, native vegetation restoration, a bioswale and regrading is recommended to recreate the conditions similar to the historic floodplain ecology, enhance conditions for water quality and enhance outdoor recreation opportunities.



stormwater after large rainstorms, impacting the type and quality of recreation that can occur. Restoration of floodplain storage for stormwater is recommended within the park. This restoration would include developing capacity for additional stormwater ponding and enhancing the infiltration capability of soils. Diversion of drainage away from the park from several of the largest contributing sub-watersheds is also recommended. (Figure 9).

Both these practices will be highly visible to the public and demonstrate the role of restoration in enhancing water quality.

C2 Permitting Considerations

Disturbance for launch and parking construction for the Avoca and the new access upstream of Botna Bend will likely require a Phase I archaeological investigation for portions of the site previously undisturbed unless previous disturbance can be verified. LiDAR imagery provides evidence to support a recommendation that no Phase I archaeological investigation is warranted for reconstruction of the Botna Bend Access.

SEGMENT 2 COST ESTIMATES		
RECOMMENDATIONS	MAP CODE	COST ESTIMATE
Legacy Dumpsite Cleanup	C2.A	
Floodplain Restoration Demonstration (Stormwater Management Design)	C2.B	

SEGMENT C3: Below Botna Bend Park Access to Chautauqua Park Access

Existing Conditions

The segment of the river is 8 miles in length and has a relatively high level of use by paddlers. This is a rural paddling experience with few homes or farm operations present. The riparian area is predominantly forested; sections of the channel with annually-cropped fields in the riparian area are located almost entirely on outside bends of the river. This river segment has the highest proportion of annually-cultivated land on the water trail in the first 100 feet beginning at the top of the streambank.

Issues and Opportunities

Very severe streambank erosion is present on much of this segment, particularly on outside bends where the river is laterally migrating. A majority of the missing perennial riparian buffer is located on this segment. A variety of large trash and woody debris exists on this segment including furniture, fallen trees and tires. The existing access at Chautauqua Park in Oakland is difficult to clear of sand and silt after high water due to its alignment.

C 3.A Streambank Restoration

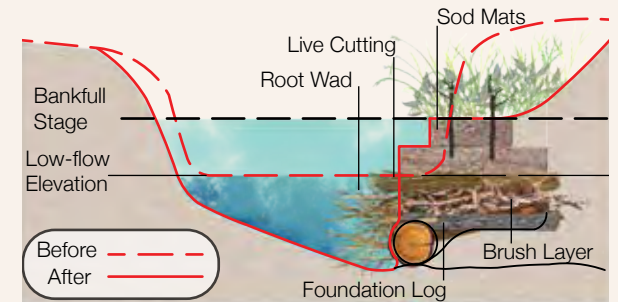
Reducing streambank erosion was identified by the Project Steering Group as the highest conservation priority for this water trail project. Streambank restoration is recommended in conjunction with construction of the new Chautauqua Park Access.

C 3.B Legacy Dumpsite Cleanup

Multiple instances of concrete debris have been dumped on the side of the river in Chautauqua Park slightly upstream of the access. Tires have also been dumped near the access. Removal of the material to an off-floodplain landfill site is recommended.

C3 Permitting Considerations

Improvements to the access and parking area in Chautauqua Park are not expected to require a Phase I investigation. The Phase IA assessment and field reconnaissance included this area. The park was found to have a low potential to contain significant cultural materials.



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

SEGMENT 3 COST ESTIMATES		
RECOMMENDATIONS	MAP CODE	COST ESTIMATE
Streambank Restoration	C3.A	cost included in R3.A
Legacy Dumpsite Cleanup	C3.B	



SEGMENT C3: Below Botna Bend Access to Chautauqua Park Access

SEGMENT C4: Below Chautauqua Park Access to Old Town Park Access

Existing Conditions

This 11-mile segment is divided by Millstone Park Access in Carson. The upper 7-mile segment has a low level of use by paddlers while the lower 4-mile paddle into Old Town has a moderate level of use. This section of the water trail has the most natural-appearing river characteristics. The corridor is heavily vegetated with forests and newer low-lying wetland areas created on the inside river bends by lateral migration of the channel. In addition to the high proportion of riparian forests and floodplain wetlands, there are multiple instances of bankfull floodplains, particularly between Chautauqua Park and Millstone Access. Annually cultivated crops on this segment occupy the least amount of the riparian area compared to the remainder of the water trail. The only bedrock outcrops on the West Nishnabotna River in Pottawattamie County occur on this reach.

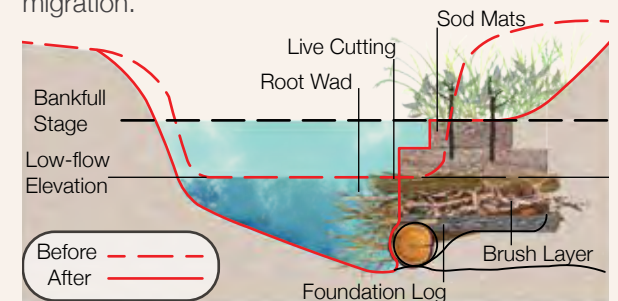
Issues and Opportunities

One section of the river downstream of Oakland has the appearance of impact from a mining operation as well as from an adjacent agricultural operation. A fairly large and old legacy dumpsite exists on municipal property and another smaller dump site on private land. The proportion of severely eroding streambanks on this segment is less compared to the remainder of the water trail. Only a few instances of lateral channel migration exist and all are in agricultural areas. Numerous eroding gullies are present on municipal land.

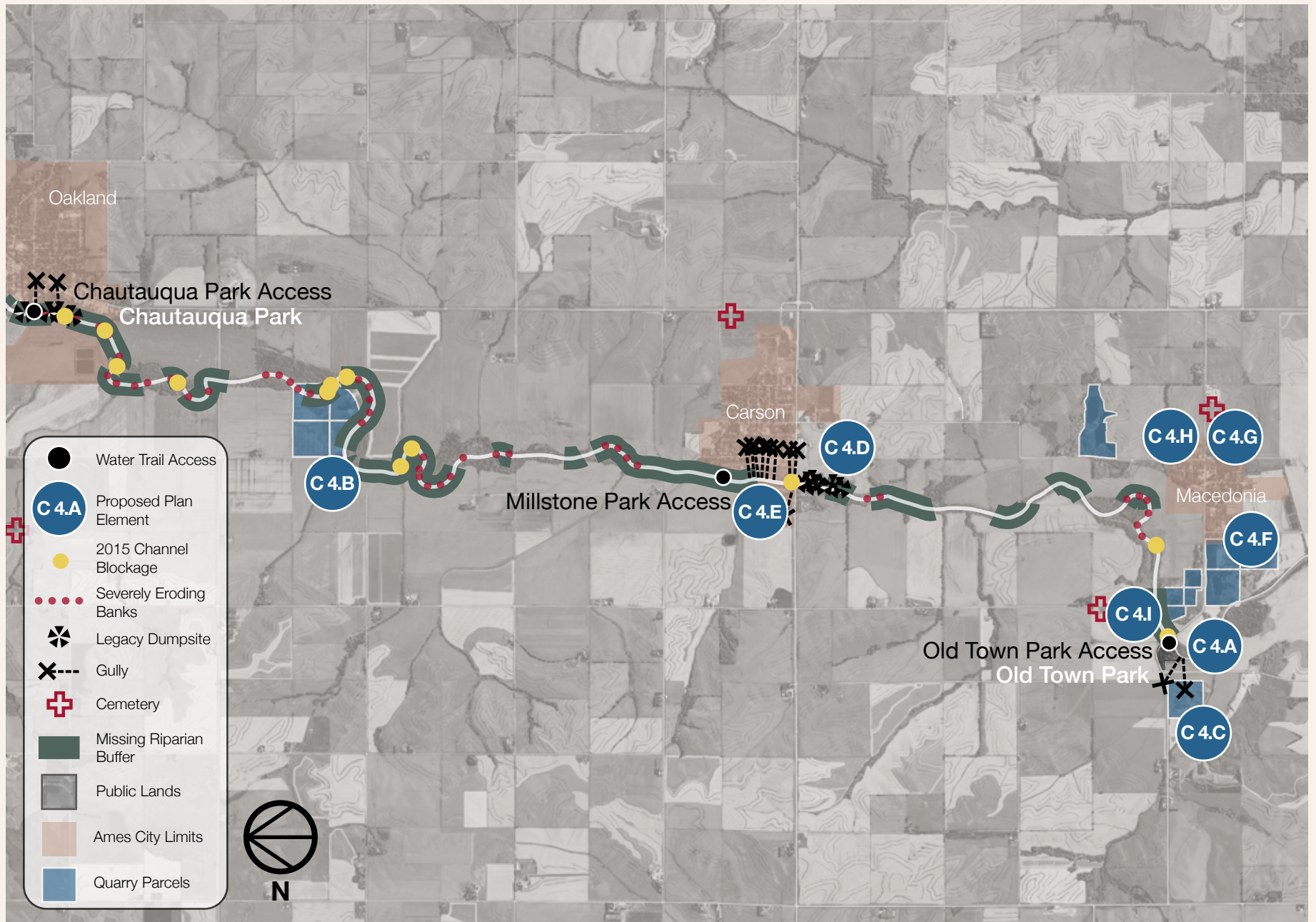
This segment of the water trail includes the land and resources associated with the Mormon Trail. These resources are minimally interpreted and the potential exists to expand interpretation to enhance visitor experience and the number of visitors in the area. A locally directed project in Macedonia focusing on the folk arts is also developing.

C 4.A Streambank Restoration

A streambank restoration demonstration is recommended at the location of the new river access at Old Town Park. The location for this proposed access is ideal because it is adjacent to a set of rock weirs installed on an outside bend in 2015 just outside the park boundary. Construction of a toe-wood-sod mat or other low impact structure such as a stone toe is recommended in conjunction with access construction. A rock vane is also recommended slightly upstream of the new access to protect it from future lateral channel migration.



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.



SEGMENT C4: Below Chautauqua Park Access to Old Town Park Access

C 4.B

Explore Restoration of Impacted River reach

A segment of the river approximately 1.5 miles south of Oakland appears impacted by land use. The river segment is 0.7 miles in length. Part of the river segment is adjacent to a sand and gravel mine operation owned by Western Engineering Inc. The remainder is located on private property used for agriculture. River edge filling and excavation near the streambank appear to have altered channel width and stability of the streambanks. River restoration studies as well as outreach with the landowners are recommended to mitigate additional impact to the river system.

C 4.C

Restore Habitat at Gravel Pits

Two active sand and gravel mining operations on or near the West Nishnabotna River are recommended for conversion when they become inactive. One operation is located between Oakland and Carson and owned by Western Engineering Company Inc. while the other is west of Old Town Park near Macedonia and owned by SMK LLC. to wildlife habitat. This land holds great potential for waterfowl and other bird habitat once mining is complete. Habitat restoration planning is recommended for these sites.



C4.B Obvious impact to the river channel, including an alternately over-wide and narrowed channel width, is visible 1.5 miles downstream of Oakland.



C4.C Sand and gravel mining operations are a common feature on the floodplain of the West Nishnabotna in Pottawattamie County.

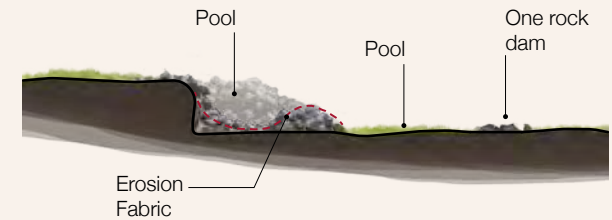
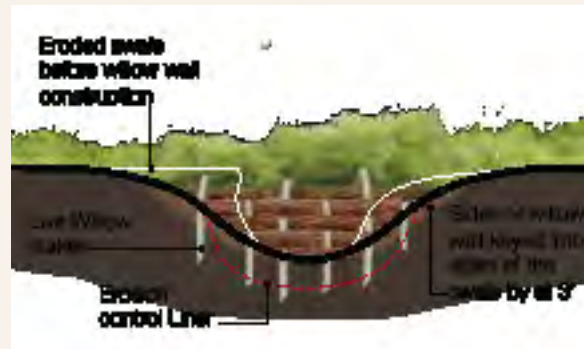
C 4.D

Legacy Dumpsite Cleanup

A linear legacy dumpsite approximately 400 feet in length is located along the top edge of the streambank and within the bank itself slightly downstream from the Millstone Access. The site appears to be a dump site for the City of Carson. Auto bodies, scrap metal, building debris and other large trash make up the majority of the dumped material. Material at the top of the streambank should be removed and disposed of in a landfill. Spot removal of the debris embedded in the streambank is recommended during low water conditions. Material that can be removed entirely without disturbing streambank stability above the bankfull elevation should be removed. The exposed portions of additional material (that which cannot be removed without destabilizing the streambank) should be trimmed and removed on a case by case basis. The use of dormant cuttings of shade tolerant native shrubs are recommended to stabilize newly opened streambank areas above the bankfull elevation.

C 4.E Gully Repair

A series of nine gullies are located in Carson draining land owned by either the City of Carson, the Carson Community Rodeo Inc. or the Carson Recreation Area Inc. This set of parcels are contiguous and are collectively known as Millstone Park. At present these gullies are in various stages of downcutting and widening. Construction debris has been dumped in several in an attempt to stabilize the erosion. Though numerous, they are relatively short with an average length of ten feet. Stabilization is recommended using two different techniques. The Type 1 Willow Wall repair method is recommended for portions in a downcutting stage. The Type 2 Rock Headcut Control Structure is recommended for gully segments with a stable channel bottom.



C4.E. Successful gully repair structures require that the headcut is stabilized to prevent up-channel migration, ensure materials are keyed into both sides of the gully wall and notched to keep flow in the center of the structure. Willow walls (Type 1, left) rely largely on dormant woody vegetation while the low rock structures (Type 2, right) rely largely on rock.

C 4.F Macedonia Folk Art Center

The Macedonia Folk Art Center is a developing effort and will provide studio, education and event space to showcase traditional folk art, artists and craftspeople. The proposed site is on the southwest side of Macedonia and will include a large gallery, class rooms, marketing, gathering place, and an administrative area. This project will bring in diverse audiences, create full time and seasonal jobs and offer a different way to experience historic and traditional art.



C4.F. The proposed location for the Macedonia Folk Art Center is a site with gently-rolling topography that is currently annually-cropped and privately owned.

C 4.G Mormon Trail Driving Tour Interpretation

Macedonia is an established Mormon Trail Site. A driving tour of significant Mormon Trail sites surrounding Macedonia is recommended (*Figure 10*) as an enhancement to the already present interpretive panel. Sites include cemeteries, churches, and former historic mills, buildings, towns, farmsteads and cabin sites. This tour would allow outside visitors and residents to embrace the heritage of the region.

- | | | | |
|---|-----------------------------------|------------------------|----------------------------|
| 1. Methodist Episcopal Church | 6. Historic Bedrock Outcropping | 11. T.J. Ring Barn | 16. Farm Creek Mill Site |
| 2. Levi Graybill Log Cabin | 7. Old Town Park | 12. Macedonia Cemetery | 17. RLDS Church Site |
| 3. Old Town Macedonia & Cemetery | 8. Early County School | 13. Graybill Creek | 18. Eminence Town Site |
| 4. Methodist Episcopal Church built in 1873 | 9. Pioneer or Old Town Cemetery | 14. Jordan Creek | 19. Wheeler Grove Cemetery |
| 5. Stutsman's Mill Site | 10. T.J. Ring Farmstead, Ringtown | 15. Mormon Cemetery | 20. Wheeler Grove Church |



C4.I. Implementation of this driving tour requires only minimal investment. In addition to printed and online driving tour maps, signage of some of these points is required. Several sites are already signed but signage may not be uniform and would not correspond to the driving tour element identification numbers.



C 4.H Macedonia Historic Walking Tour

A walking tour of 13 historic sites in Macedonia is recommended (Figure 12). The early history of the community is represented by various buildings, sites as well as by a Plat Tree. A self-guided tour brochure and small monuments are proposed to facilitate use.



C4.H Similar to the Driving Tour, establishing this walking tour will a straightforward process that can be implemented locally. Printed brochures and an online driving tour map as well as simple identification signage are needed. ,

C 4.1 River Overlook Site

The most prominent bedrock outcrop and channel bottom on the river in Pottawattamie County is located adjacent to the bridge for Pioneer Trail. This bedrock crossing was used by Native Americans prior to Euro-American settlement. Mormon pioneers founded the village of Macedonia on the Mormon Trail at this location due to this same bedrock crossing. The land is owned today by Pottawattamie County Conservation Board and overlooks Old Town Park, the water trail and the original floodplain location of the Mormon settlement. The land rises 15-18' above the edge of the river, is approximately one acre in size and affords an excellent view of the river and the surrounding landscape. A primitive overlook on this bluff with interpretation is recommended including parking for 5 cars at the base of the bluff. A natural surface or paved trail to the bluff top is recommended as well as bench seating and interpretive signage at the top. Interpretive signage will highlight the role of the river and this bedrock feature in human migration for thousands of years. Potential users include people following the Mormon Trail route, bicyclists and the general public.



C4.1. The most obvious bedrock exposure on the water trail is located adjacent to Old Town Park although the deposit is not visually obvious when driving on Pioneer Trail. An overlook and interpretation area is recommended. The site is owned by Pottawattamie County Conservation Board.

C4 Permitting Considerations

Disturbance for construction of the new equestrian trail will likely require a Phase I archaeological investigation for portions of the site previously undisturbed by the railroad unless previous disturbance can be verified. Construction of the equestrian parking area will also likely require a Phase I archaeological investigation unless the area has already been included in an earlier investigation.

SEGMENT 3 COST ESTIMATES

RECOMMENDATIONS	MAP CODE	COST ESTIMATE
Streambank Restoration	C4.A	cost included in R4.A
Explore Restoration of Impacted River Reach	C4.B	
Restore Habitat at Gravel Pits	C4.C	
Legacy Dumpsite Cleanup	C4.D	
Gully Repair	C4.E	
Macedonia Folk Art Center	C4.F	
Mormon Trail Driving Tour	C4.G	
Macedonia Historic Walking Tour	C4.H	
River Overlook Site	C4.I	

RESOURCE CONSERVATION AND PROTECTION OVERVIEW

All recommended elements are summarized and organized in the Appendix 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:

- Pottawattamie County maintains a permitting processes floodplain development
- 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 sponsor. 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:

- Local and State Agencies and Council of Governments including Pottawattamie 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, Omaha-Council Bluffs Metropolitan Area Planning Agency
- Non-Profit Organizations such as Iowa Natural Heritage Foundation, Pheasants Forever, Ducks Unlimited, Golden Hills RC&D, the Nature Conservancy

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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APPENDIX

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	3	\$0	Pottawattamie CCB, Local Volunteer Fire Departments	Iowa DNR
R1.B	River Corridor	Iowa DNR	Communication to Users	1	Reimbursable from IDNR		
R1.C	River Corridor	Iowa DNR	Public Interpretative Program, Wayfinding Signage, New Water Trail Map, Communication Among Access Managers	1	\$0	Pottawattamie CCB	
R1.D	River Corridor	Pottawattamie County Trails Committee	Off-Road Trail between Avoca and Macedonia	3			
C1.A	River Corridor	Pottawattamie CCB	Enhance Aquatic Habitat for Fish and Mussels	2		Iowa DNR Fish Biologists	
C1.B	Various Locations	Pottawattamie CCB	Restore Habitat at Gravel Pits	2		Willing Landowners, Ducks Unlimited	
C1.C	River Corridor	Pottawattamie CCB	Vegetative Buffer Establishment (entire length: 212 ac.)	1	\$159,000	Willing Landowners, Pottawattamie Soil & Water Conservation District	
C1.D	River Corridor	TBD	Explore Voluntary Riparian Forest Protection	1		Iowa Natural Heritage Foundation	
C1.E	River Corridor	Pottawattamie CCB	Coordinate Public River Clean Up Events and Environmental Education Events	2		Pottawattamie Soil and Water Conservation, Golden Hills RC&D	
C1.F	West Nishnabotna Watershed	Pottawattamie CCB & Soil and Water Conservation	Increase Voluntary Water Quality Monitoring	2		IOWATER	
C1.G	River Corridor	River Access Owner	Streambank and Floodplain Restoration Demonstration Projects	1	costs included in individual site plans below	Iowa DNR	
C1.H	River Corridor	Property Owner	Streambank Restoration	1	costs included in individual site plans below	Iowa DNR	
R2.A	West of Avoca, Outside City Limits	Pottawattamie CCB	Shift Water Trail to W. Nishnabotna, New Access at Avoca	1		Willing Landowner	
R2.B	Upstream of Botna Bend Park	Pottawattamie CCB	New Gateway Access	3	\$155,169	Willing Landowner	
R2.C	Botna Bend Park	Pottawattamie CCB	New Gateway Access	2	\$178,223		
R2.D	Avoca to Hancock	Pottawattamie County Trails Committee	On-Road Bike Trail / Lane	2		Water Trail Sponsor	Iowa DOT
C2.A	Avoca	City of Avoca	Legacy Dumpsite Cleanup	1			
C2.B	Botna Bend Park	Pottawattamie CCB	Floodplain Restoration Demonstration (Water Quality Enhancement)	2		Iowa DNR	

Map Code	Location	Lead Jurisdiction	Recommendation	Local Prioritization	Budget Estimate for River-Related Recommendations	Other Collaborators	Notes
R3.A	Chautauqua Park	City of Oakland	Chautauqua Park Access Upgrades	1	\$88,558		
R3.B	Hancock to Oakland	Pottawattamie County Trails Committee	Off-Road Bike Trail	2			
C3.A	Chautauqua Park	City of Oakland	Streambank Restoration	2	cost included in R3.A	Iowa DNR	
C3.B	Chautauqua Park	City of Oakland	Legacy Dumpsite Cleanup	1		Volunteers	
R4.A	Millstone Park	City of Carson	Millstone Park Access Upgrade	1	\$104,680		
R4.B	near Macedonia	Pottawattamie CCB	Old Town Access Upgrade	1	\$102,433		
R4.C	Carson to Macedonia	Macedonia Hamilton Development Corporation	Equestrian Trail Between Carson Rodeo Grounds and Macedonia; Equestrian Trail Head & Parking in Macedonia	1		Saddle Club	
C4.A	Old Town Park	Pottawattamie CCB	Streambank Restoration (in conjunction with new Old Town Access)	2	cost included in R4.A	Iowa DNR	
C4.B	River Corridor Between Oakland to Carson	Iowa DNR	Explore Restoration of Impacted River Reach	2		Outside Consultant	
C4.C	River Corridor Between Oakland to Carson	Pottawattamie CCB	Restore Habitat at Gravel Pits	3		Willing Landowners	
C4.D	Millstone Park	City of Carson	Legacy Dumpsite Cleanup	1		Volunteers	
C4.E	Millstone Park	City of Carson	Gully Repair	1		Outside Consultant	
C4.F	Near Macedonia	Macedonia Hamilton Development Corporation	Macedonia Folk Art Center	2		City of Macedonia, Golden Hills RC&D	
C4.G	Near Macedonia	Macedonia Historical Preservation Society	Mormon Trail Driving Tour	3		City of Macedonia	
C4.H	Macedonia	Macedonia Historical Preservation Society	Macedonia Historic Walking Tour	3		City of Macedonia	
C4.I	Near Old Town Park	Pottawattamie CCB	River Overlook Site	1		City of Macedonia	

