SOUTH SKUNK
WATER TRAIL PLAN

STORY COUNTY • IOWA 2016

"for the love of a river"

SOUTH SKUNK WATER TRAIL PLAN

DECEMBER 2016

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Iowa
Fields of Opportunities

STATE OF IOWA

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

DEPARTMENT OF NATURAL RESOURCES
CHUCK GIPP, DIRECTOR

January 9, 2017

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

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

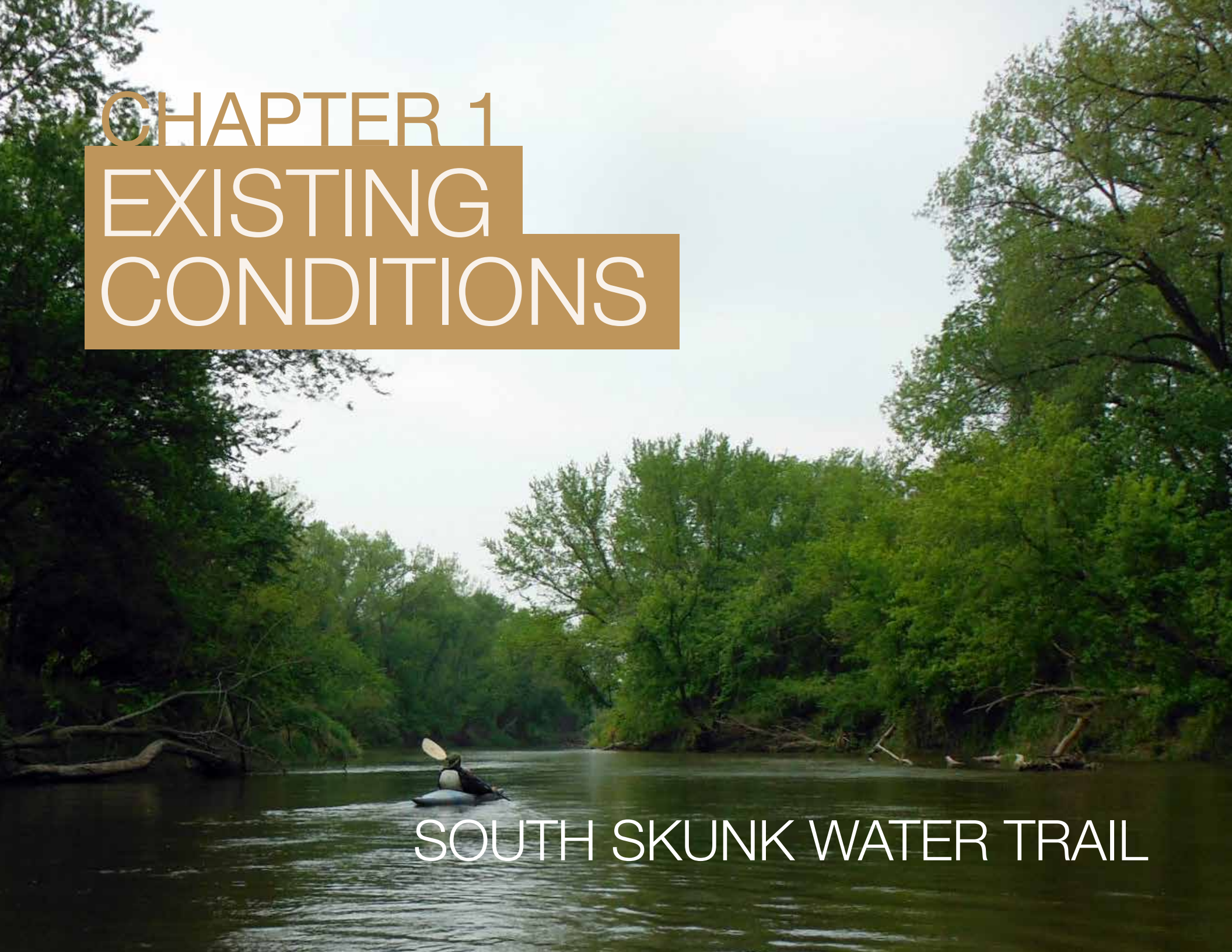
Once forgotten in years past, Iowa's navigable waters are beginning to take center stage. As they do, there is need to bridge the divides among multiple user groups, offer opportunities for listening, brainstorming, and strategizing that result in sensible decisions for the waters that connect local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

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

Sincerely,

Chuck Gipp

Chuck Gipp
Director
Iowa Department of Natural Resources



CHAPTER 1
EXISTING CONDITIONS

SOUTH SKUNK WATER TRAIL

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- John Wenck, Iowa DNR Water Trails Coordinator
- Carol Williams, Ryan Wiemold, Amy Yoakum and Mike Cox of Story County Conservation
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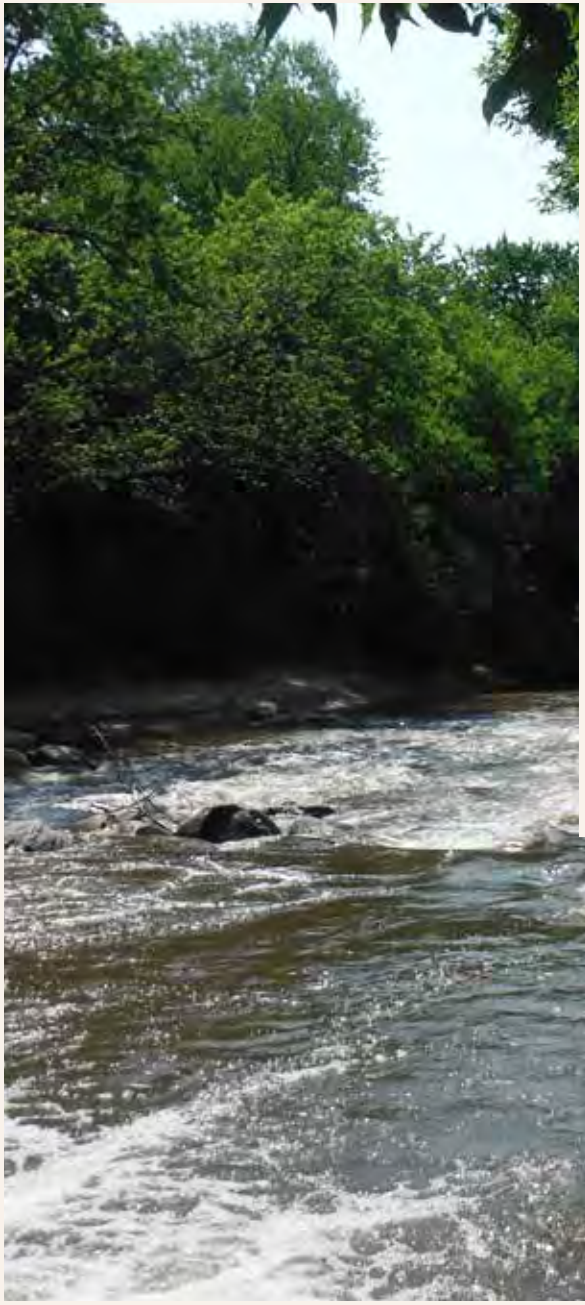
CHAPTER 1
EXISTING CONDITIONS

Rivers define a region and its possibilities. They are also influenced by their region. Some rivers and their resources are substantially impacted by the actions and passions of the people and institutions near them over time.

The South Skunk River in Story County, particularly the upstream segment, is one such river. This segment of the river is popular with paddlers, anglers and mixed use trail users. It is not currently designated a State Water Trail by the Iowa Department of Natural Resources (DNR) River Programs. However, a great deal of culture, history and natural beauty exist alongside the South Skunk. If it were to become designated, no other state designated water trail in Iowa would offer such a clear and strong opportunity to interpret the value of intentional land protection in conserving valuable cultural and natural resources for future generations.



AN INTRODUCTION TO DESIGNATED STATE WATER TRAILS & THIS CHAPTER

This existing conditions chapter compiles and considers all documented resources, histories, stories and conditions related to the South Skunk River. The purpose of this chapter was to assist local conservation and recreation leaders in constructing a regional identity for the river and the future water trail that both honors the legacy of those who've gone before as well as helps new users celebrate and embrace its potential. The chapter includes the most recent research related to recreation on Iowa rivers, current access and launch inventory protocols, and established natural, cultural and historic resource data sets. Anecdotal information on river use and conditions were provided by county staff, paddlers and the Skunk River Paddlers.

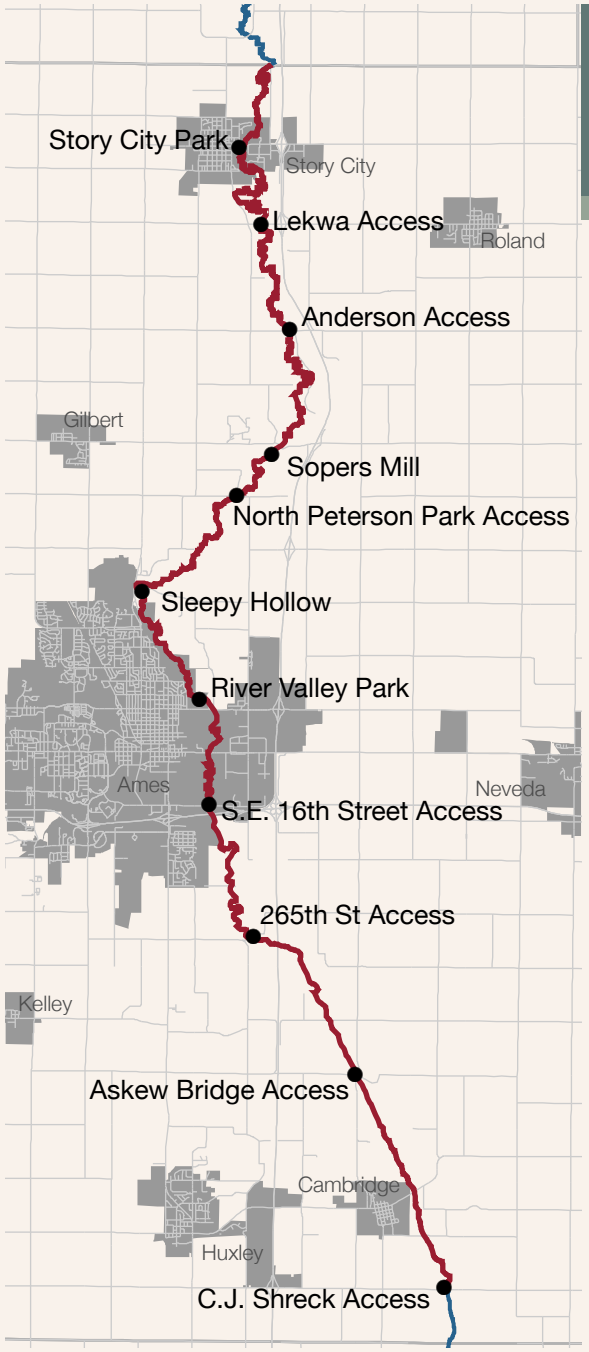
Rivers become known as water trails when people paddle on them and begin to organize amenities to support paddling such as parking areas and launches. Water trails, in turn, also support uses beyond paddling. River edge amenities also engage anglers, those relaxing near the river, hunters and students 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.

Story County Conservation Board is the water trail sponsor and a steering group of residents and stakeholders 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 South Skunk River is a non-meandered stream beginning in Iowa's Hamilton County. The South and North Skunk rivers join in Keokuk County, becoming the Skunk River. The Skunk enters into the Mississippi River in the far southeast part of the state. The Story County portion of the South Skunk River is 38 miles in length. The watershed area draining into the Story County portion of the river is approximately 651 square miles.

The South Skunk River, between the north Story County line and the confluence with Squaw Creek near the S.E. 16th Street access, is designated a Protected Stream in Iowa Administrative Code 567 – 72.2(455B). This means that no channel changes are allowed by code, because of actual or potential significant adverse effects on fisheries, water quality, flood control, flood plain management, wildlife habitat, soil erosion, and public recreation.

The river is used for canoeing, kayaking and tubing. Locally, residents perceive that more paddling occurs between Story City and Ames compared to the study segment downstream of Ames. A high number of college students recreate on the river due to the close proximity to Iowa State University. Iowa State University and one business rent canoes and kayaks in the Ames area, but neither provides shuttle services.

A 2009 study of recreational use of Iowa rivers reported that the South Skunk River receives moderate use by paddlers compared to other rivers in the area *(Table 1)*. The Center for Agricultural and Rural Development's (CARD) work, the Iowa Rivers and River Corridors Recreation Survey (Iowa State University 2009), included portions of 49 rivers in the state. The Story County portion of the river included in this water trail planning study lies partially within two CARD study segments. The upstream CARD study segment portion of the South Skunk River Water Trail extends from Ames upstream to the headwaters in Hardin and Hamilton counties. The reported hiking trail use near the river on this segment was the highest of nearly any river in the state. The Skunk River Greenbelt, which extends from Story City to Ames, is likely responsible for the high trail use in this segment.

Figure I
With the exception of two accesses, all in Story County are either stand-alone facilities or in unimproved natural areas.

The downstream CARD study segment includes the 131.4 miles of river between Ames and the confluence of the North and South Skunk rivers. This water trail planning study area includes only the upstream-most 16.1 miles of this CARD segment. While CARD results suggest a greater level of paddling on this segment when compared with the upstream CARD segment *(Table 1)*, these data are misleading since the segment in Story County is lumped in with such a large overall segment. Locally, river users confirm that paddling volume downstream of Ames within Story County is quite limited.

The South Skunk River is an important recreation resource for the area. The primary advocates for the river are the Skunk River Paddlers. This organized local paddling enthusiasts group paddles year round and helps to maintain the general health of the river by removing log jams, trash, etc. Additionally, the Skunk River Navy is an ISU-based volunteer effort working to clean up trash in waterbodies surrounding the Ames area. The Outdoor Alliance of Story County is a relatively new non-profit organization supporting the enhancement of outdoor recreation, education and conservation in Story County. The Alliance partners with Story County Conservation Board as well as the cities, towns and other groups in the county.

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
South Skunk R. (40): Hardin/ Hamilton County Line to Sleepy Hollow Access	313	17.9%	8.6%	0.0%	25.6%	24.0%	80.5%	3.5%	67.1%	48.6%
South Skunk R. (41): Sleepy Hollow Access to mouth of North Skunk River	305	44.9%	22.0%	36.0%	49.0%	10.5%	31.1%	13.8%	43.0%	42.3%
Iowa R. (45): Above Marshalltown	409	59.4%	32.0%	22.5%	35.0%	35.5%	38.6%	8.1%	50.9%	42.8%
North Skunk R. (42): Entire river length	147	69.4%	72.8%	10.2%	21.8%	17.0%	4.8%	0.7%	44.2%	65.3%
Des Moines R. (23): Humboldt to Saylorville Dam	963	37.0%	10.4%	15.8%	16.3%	22.4%	53.8%	16.6%	50.8%	37.3%

Table I

Reported use of Central Iowa rivers was compiled by ISU's Center for Agricultural and Rural Development (CARD) economists for the 2009 summer season.
The South Skunk River had less reported paddling use compared to other rivers in the region with the exception of the North Skunk. Cells highlighted in yellow denotes the study area.*
**Source: Iowa Rivers and River Corridors Recreation Survey 2009 (Iowa State University)*

Water Trail Existing Conditions

The thirty-eight miles of river is divided into eleven segments by river access points *(Table 1)*. The water trail passes through two communities. The largest community, Ames, has a population near 59,000 residents (2010 U.S. Census).

Two low head and one sheet pile dams are located on the South Skunk River in Story County. Story City Park has a sheet pile dam that is impassable to paddlers during most water conditions. Several attempts to modify the structure for fish and paddler passage have been unsuccessful. The General Filter/Hannum's Mill Dam is located slightly upstream of Sleepy Hollow Access and is owned by USGS. The 13th Street dam is located in North River Valley Park and owned by the City of Ames. Paddler hazard warning signs exist for all three obstructions. A portage route was constructed around the General Filter/Hannum's Mill and the 13th Street dam in 2013 by Conservation Corps volunteers and Iowa DNR staff.

Log jams, large woody debris, strainers and snags are located on many of the reaches. One particularly large debris dam is located 0.3 miles downstream of Anderson Access. This bend of the river has historically collected large wood debris. Debris resulting from the record flood in 2010 exacerbated conditions, creating a debris dam approximately one city-block wide and one-half block long with no clear channel for water or

Figure 1
A view of the log jam downstream of Anderson Access in early spring 2014. This bend of the river has been a long term snag and jam location for woody debris. Periodic clearing is required throughout each year to keep a route open for paddle craft.

paddlers to move through. A warning sign located at Anderson Access alerts paddlers that a portage may be required to pass through the bend.

The log jam downstream of Anderson Access requires frequent clearing to remain passable by boats. Iowa DNR and the Skunk River Paddlers have been working for the past three years to clear debris, creating a bankfull floodplain bench and restoring stable streambanks at this location. The Skunk River Paddlers continue to use hand tools to saw and remove new debris blocking the main channel after rainfall events. A second large debris dam is located slightly downstream of the Southeast 16th Street Access at the Ken Maril Road bridge. Removal and clean up attempts funded by Iowa DNR at this location also continue.

It is common for the South Skunk River channel to dry entirely during some parts of the summer. Paddling and other water-based uses are obviously impacted by these conditions. Many other times during summer months when flow does exist, it can be too low for paddling.

Segment	Segment Distance	Hazards Identified in 2015				Paddling Use Volume*	Beginner-Friendly	Notes
		Dams on segment	Logjams covering >30% of channel	Rapids	Stream-wide Livestock Fences			
100th Street (County Line) to Story City Park	2.6		N/A	N/A	N/A	Low		Sheet Pile Structure at Story City Park requires portage
Story City Park to Lekwa Access	3.7		1	0	0	Moderate		
Lekwa Access to Anderson Access Bridge Access	3.3		3	0	0	Moderate		
Anderson Access to Soper's Mill Access	4.0		3	0	0	Moderate		Large Debris Dam
Soper's Mill to North Peterson Park Access	2.2		0	1	0	High		
North Peterson Park Access to Sleepy Hollow Access	3.5	Yes	5	0	0	High		
Sleepy Hollow Access to North River Valley Park	2.9		1	0	0	Moderate	Yes	
North River Valley Park to S.E. 16th Access	3.0	Yes	2	0	0	Low		
S.E. 16th Access to 265th Street Access	3.7		3	0	0	Low		Large Debris Dam
265th Street Access to Askew Bridge/ Cambridge Pond	3.6		0	0	0	Low		
Askew Bridge/ Cambridge Pond to C.J. Shreck Access	4.5		0	0	0	Low		

Table 1

South Skunk River Water Trail Segments, Story County

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

Water Trail Access Points

A variety of entities own and manage the river accesses in Story County. Five are owned and managed by either the county or a city, while the remaining six are privately owned with either an easement or leasing arrangement *(Table 2)*. A special circumstance with the Southeast 16th Street access was discovered during planning for this project. The City of Ames has an easement agreement for a multi-use land trail head with the landowner adjacent to the river, Bradshaw Farms Ltd. Prior to now it was assumed that the existing river access and launch were included in this use agreement. On closer review, City and planning staff realized the property where the river access is located is actually owned by a different landowner, Hickory Park Inc. So, although this river access is signed and paddlers use the well-developed parking lot, it is located on private property without formal permission from that landowner.

Most accesses are undeveloped *(Table 3)*. The two city parks include the most amenities, but neither is considered highly developed.

Facility Where Access is Located	Access Number	Access Owner	Access Manager	Launch Type	Streambank Height
Story City Park	246A	City of Story City	City of Story City	Motorized boat ramp (portage take out)	4
Story City Park	246B	City of Story City	City of Story City	Carry down	4
Lekwa Access	242	Easement w/ Owner Don Lekwa	Story County Conservation	Carry down	7
Anderson Access	239	5 yr. lease, Larson	Story County Conservation	Carry down with stairs	6
Soper's Mill Access Area	235	Story County Conservation	Story County Conservation	Carry down	4
North Peterson Park Access	234	Easement w/ Owners Templeton, Kayser	Story County Conservation	Carry down	12
Sleepy Hollow Access	230	Story County Conservation	Story County Conservation	Motorized boat ramp	6
North River Valley Park	227	City of Ames	City of Ames	Non-motor ramp	3
S.E. 16th Access*	224	Private, Hickory Park Inc. and Bradshaw Farms Ltd.	City of Ames	Carry down	7
265th Street Access	220	Easement w/ Owner Junkins	Story County Conservation	Carry down	8
Askew Bridge/ Cambridge Pond	217	Easement w/ Cambridge Farms	Story County Conservation	Carry down	8
C.J. Shreck Access	212	Story County Conservation	Story County Conservation	Motorized boat ramp	8

Table 2

Water Trail Access Ownership and Basic Characteristics. Cells highlighted in yellow indicate conditions where enhancement is desirable.

** Access is located on private property. The launch and approach is located outside the City of Ames easement at this site.*

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
Story City Park	246	Yes, Porta Potty	Tables, Shelters	No Water	No	Ball fields, tennis courts, basketball courts, gazebo, playground, disc golf course
Lekwa Access	242	No		No Water	No	
Anderson Access	239	No		No Water	No	
Soper's Mill Access Area	235	No		No Water	No	
North Peterson Park Access	234	No		No Water	No	
Sleepy Hollow Access	230	No		No Water	No	
North River Valley Park	227	Yes, 2000' from launch	Tables, Benches, Shelter, Water	300	No	Ball fields, soccer fields, trail, playground
S.E. 16th Access	224	No		No Water	No	Bike Trail Access
265th Street Access	220	No		No Water	No	
Askew Bridge/Cambridge Pond	217	No		No Water	No	
C.J. Shreck Access	212	No		No Water	No	

Table 3
Water Trail Access Amenities

Recreational Conditions Related to the Water Trail

The South Skunk channel is incised into the adjacent floodplain throughout a majority of the county with average vertical streambank heights of 8' (Table 2). In addition to high volumes of large woody debris, the fairly low-gradient channel also transports a large amount of sand and sediment. These two factors provide 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. This debris requires clearing.

Many of the existing river accesses in the county pose challenges for use *(Table 4)*. 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 thalweg (or centerline) 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
Story City Park	246	8	150	0	Yes	7	80	Recreational
Lekwa Access	242	6	58	0	No	28	95	Challenge
Anderson Access	239	4*	23	0	No	31	170	Recreational
Soper's Mill Access Area	235	6*	40	0	No	33	90	Recreational
North Peterson Park Access	234	15	20	0	Yes	26	90	Challenge
Sleepy Hollow Access	230	6	100	0	Yes	17	80	Recreational
River Valley Park	227	8	0	2	No	14	110	Recreational
S.E. 16th Access	224	4	120	0	No	19	90	Challenge
265th Street Access	220	6	92	40	No	52	90	Challenge
Askew Bridge/ Cambridge Pond	217	4*	40	18	No	20	90	Recreational
C.J. Shreck Access	212	6	52	0	Yes	26	80	Recreational

Table 4

Water Trail Access & Launch Relating to Use and Maintenance. These Experience Classification ratings apply only to the access and launch. They do not apply to river conditions between accesses. Cells highlighted in yellow indicate conditions where enhancement is desirable. Red highlighted cells indicate conditions do not meet minimum standards required for signage as a water access by Iowa DOT.

River Management Conditions on the South Skunk

The majority of law enforcement of the water trail, with the exception of the natural resources enforcement, is conducted by the Story County Sheriff's office. Story City, Ames and Huxley/Cambridge maintain their own police forces. Ames employs a professional fire and rescue staff while Story City and Cambridge use volunteer fire departments. Story County Conservation rangers also provide law enforcement on land they own or manage. Natural resources law enforcement is provided by Iowa DNR District 5. There is very limited capability locally for swift water rescue, including both trained people and equipment. Ames has a boat and dive team which is trained and available for cold water rescues and is mostly used in lake situations. Radio communication and coordination between law enforcement organizations working in the county is made difficult because of differences in radio frequencies. All organizations except Iowa DNR utilize the same digital radio frequency system. Iowa DNR communicates with an analog radio system; other organizations and the public can reach them by cell phone. DNR requires an upgrade in service and equipment in order to be compatible with other organizations. An informal phone communication strategy currently exists between the county sheriff's office and Iowa DNR Conservation Officers.

Six or seven rescues or recoveries have been reported. These include two drownings at the General Filter/Hannum's Mill Dam and a 2014 drowning near the former Carr Pool site in North River Valley Park. The 2014 drowning occurred during high flow conditions; an ISU student tuber not wearing a personal floatation device (PFD) was caught in a strainer. Several of the rescues also involved poor judgment by boaters, including paddling during flooding and cold weather conditions.

Several other river management issues were identified:

- Alcohol consumption on the river is a concern by multiple parties, particularly by underage users. Concerns surrounding drinking on the water include littering, behavior and safety both on the water and driving after leaving the river.
- Recreational ATV use up and down in the river channel in the southern part of the county at low flow is evident from tracks. This activity is illegal. Dry or wet, the bed of non-meandered streams is off limits for ATV use. Exceptions to this law allow crossing, only, of a river channel at fords (at-grade constructed crossings) and other locations as a part of their farming operations.
- There are also frequent complaints to either the DNR or Story CCB about large wood in the channel throughout the county. Large wood and log jams are often perceived as a sign of a lack of maintenance and as a barrier to paddling. The public is often surprised to learn that neither agency has responsibility for woody debris removal.
- Existing informational kiosks signs at accesses do not alert users about dangerous conditions due to high flows or explain that much of the land is privately owned.

Numerous trespassing, sign damage, intoxication, littering, and urination incidents have also been reported. One poaching incident from a canoe was also ticketed. Law enforcement reported that many of the trespassing complaints were from landowners unwilling to allow law enforcement personnel on their land. One theme that was repeated centered on boats identified as belonging to Iowa State University. Numerous organizations reported incidents of problem paddlers, often intoxicated, in boats with an ISU rental sticker. No official outreach had occurred between the organizations and the University, however.

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 the 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. Appendix A aligns the level of river management expected for the four types of experience classification on state-designated water trails. People management can include littering and disruptive behavior, as well as illegal activities such as vandalism, public intoxication and trespassing. Appendix B 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 more effective communication with river users regarding safe water levels, coordination with ISU equipment rental services, 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).

Existing Water Trail Experience Classification

All segments of the South Skunk River in Story County exist today as a Recreational experience classification. The Recreational classification is the most common in Iowa. It suggests the water trail is neither overly difficult nor set up to match the criteria developed for beginning paddler experience, confidence, and/or those not physically strong and agile. Appendix C, Water Trail Experience Classification Summary, summarizes key elements from the classification criteria (Developing Water Trails in Iowa 2010).

There are currently no full-service accesses on the river or plans to develop any. Because the majority of accesses are either stand-alone sites or undeveloped recreational areas, there are few amenities present at them to support paddlers. There is a large opportunity for enhancing the accesses themselves aside from amenities. The angle and slope of the launches themselves, even the most recently constructed, don't take advantage of current design standards for universal access or minimal maintenance. Additionally, some access areas contribute large amounts of erosion into the river because of the way the launch and/or parking is constructed.

Social Considerations

The water trail sponsor, Story County Conservation Board, owns and/or manages eight of the eleven accesses. They are very supportive of state designation for at least a portion of the river and for planning for enhanced conditions for all recreationists and for the river corridor generally. The three remaining accesses in community parks are owned by communities supportive of a state-designated water trail in concept (Ames and Story City). Each has committed to maintain their accesses. Beyond this, official city engagement in planning and coordinating for the water trail has been minimal up to this point.

Fifty people participated in public meetings held in April 2012 as a part of this planning. This participation generated a variety of comments from river landowners and the public. The majority of comments were supportive of this project process. The most notable comments related to users and land regulations. Some participants were sensitive to any potential increase in disruptive users on the river; participants had the perception that these users are largely ISU students. Requests were made for additional surveillance to reduce trespassing (both on land and on sandbars), littering and underage drinking. Sensitivity was also expressed that new or changed regulations related to the Greenbelt zoning classification might result from this project.

Physical Conditions on the South Skunk

How a river moves over the landscape or changes across time is of interest to landowners, historians, researchers as well as the general public. Human alterations on much of the South Skunk River channel since Euro-American settlement, south of Lincoln Way in Ames, have been substantial. The river and landscape in this section of the county was known by early settlers as the "Skunk flats" (Allen 1887) due to the nature of the floodplain especially in contrast to the section of the river north of Ames *(Figure 2)*.

Beyond simply a marshy bottomland, the area was described as an entirely different landscape than exists today. "When the white settlers arrived in the area they found a sluggish stream with low, muddy banks that snaked its way through marshy bottomlands that were two miles wide in places. Each spring the raging floodwaters would cut new channels through the muddy soil, overflowing their banks and filling the bottoms with water, creating one massive lake" (p. 13, Cambridge Historical Society 2006). Early settlers envisioned transforming the river and the land. "I am inclined to believe when the drift-wood is taken from the channel of the river, and when the flat lands along it are well tiled, where it will admit of it, that the Skunk valley will be among the most beautiful and productive lands we have. I believe the improvements will be such in the next twenty years that this opinion will prove correct" (p. 266, Allen 1887).

Indeed, channelization of the lower fourteen miles of the river in Story County began in 1893 and was completed later that same decade (Brown and Brown 2003). Channelization in many places simply drew a straight line through bends in the channel. In other places however, the entire channel was relocated. One such area is located between the 265th Street and C.J. Shreck accesses *(Figure 3)*. This segment was noticeably straightened into an uninterrupted diagonal route beginning at the crossing of Interstate 35 and running 8.2 miles downstream. This segment of the channel was represented in both the 1850s GLO mapping survey and 1875 Andreas Atlas in approximately the same location and with a length of 9.1 miles. Aerial photography from 1939 shows a channel length of 7.8 miles for this same segment. In some cases this channel shift was nearly a mile of lateral relocation.

River straightening and channelization produces a predictable, natural response in both the river and surrounding riparian area. The water table elevation on the floodplain was drastically lowered, also a result of straightening, and accompanying drainage ditches, allowing row crop agriculture to replace the wet prairies mapped in the early

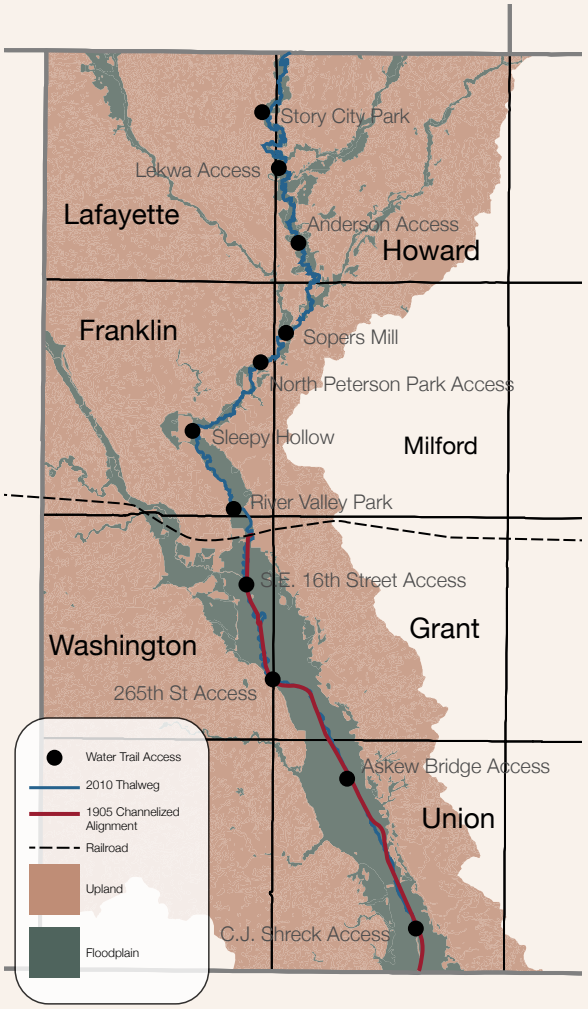


Figure 2

The nature of the South Skunk floodplain changes dramatically within Story County, beginning at a specific location near Ames. The earliest professional record of this abrupt and interesting landscape feature occurred in 1898. Samuel Beyer, a geologist documenting conditions in the county, described these and other physical landscape features of note.

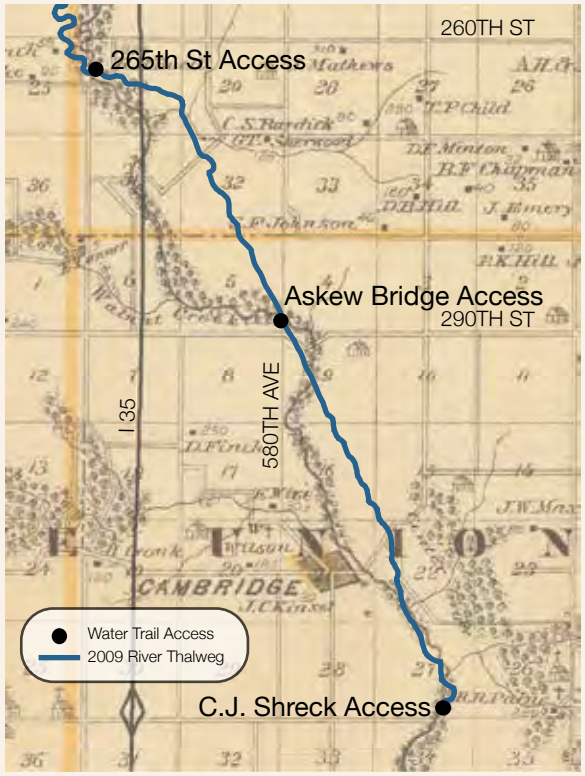


Figure 3

The river segment between 265th Street Access and C.J. Shreck Access shows the largest change in channel alignment following river straightening.

1850's by the General Land Office survey next to the river channel. Post channelization, the river attempts to create a stable condition by trying to develop a more sinuous alignment. This natural adjustment in planform is obvious at multiple locations near Ames.

An example of a very actively eroding and migrating segment today is located between Lincoln Way and Southeast 16th Street *(Figure 4)*. At this location the former straightened and channelized segment is clearly visible in 1939 aerial photography. Using 1939 aerial photography, this segment of the river measured 1.0 mile in length. By 2009, it was .7 miles longer (a 70% increase in length). When paddling this segment today, it is easy to see the ongoing active lateral migration process, including mass soil wasting and fallen trees. *(Figure 5)*.

From historical accounts we know that the channelization process shifted the channel laterally as much as 0.8 miles at one location. The initial dredged channel was constructed with a 30-foot width at top and sloping to a 4 foot width at the bottom *(Figure 6)*. Today the channel is, on average, 150-feet wide at the top with a 110-feet wide channel bottom.

River management today has moved away from channelization or straightening because of the long term, negative impacts to both the water body 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

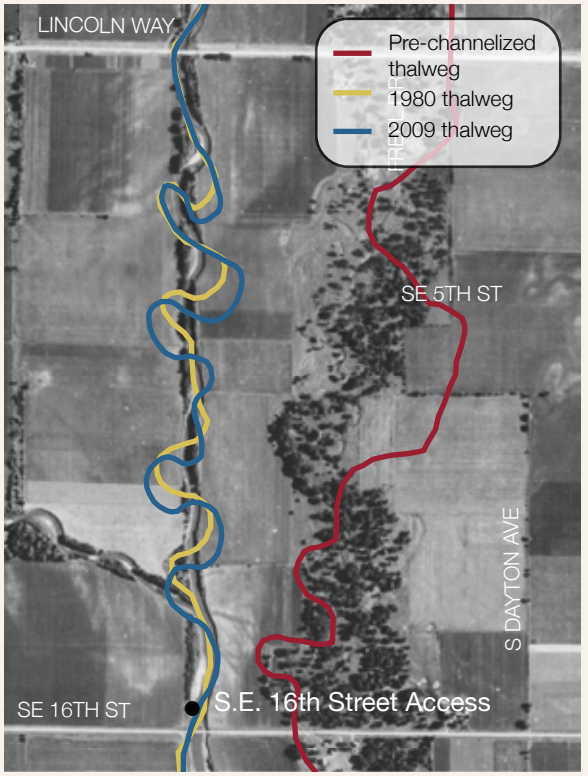


Figure 4

Following river straightening, several sections of the South Skunk are rapidly unraveling as the river attempts to convey the volume of water and sediment delivered to it.

Figure 5

The rapidly unraveling streambanks south of River Valley Park in Ames (illustrated in Figure 5) are tall and composed primarily of sand and other alluvial materials. River users often remark about the chunks of corn and soybeans observed falling into the river as they float through the area.

much shorter channel to replace the original meandering planform of the river. The modified, shorter, and straighter alignment produces much higher water velocities which quickly result in the erosion or down cutting of the channel bottom. As channel bottom elevation deepens, streambanks necessarily become steeper and taller. 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 6

Prior to and immediately following channelization, the banks of the South Skunk were much shallower than today. This postcard image from 1910 illustrates the channel cross section near Cambridge at that time.

Channel Conditions

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

Historically, the South Skunk study area has the largest amount of measured planform change from the mid-1800's to present of any river being studied. Large changes occurred throughout the study time frame from mid-1800's to present predominantly as a result of channelization beginning in the late 1890's. The average lateral channel movement on section lines is 0.24 miles of shift per river segment.

A comparison of aerial photography identified changes in channel planform between 1980 and 2010. Numerous examples of lateral channel migration were noted between the northern boundary of Story County and the 265th Street access. The typical channel migration on the South Skunk measured between 70 and 80 lateral feet during these thirty years. The river segment between North River Valley Park and S.E. 16th Access had a 10% increase in channel length from 1980 to today *(Table 5)* due to lateral migration. Often the most vulnerable locations are outside bends in the river where the top of bank vegetation is also annual row crops or grasses *(Figure 7)*. In some instances straight segments are also affected, particularly when the top of bank is not vegetated with trees.

Several instances of meander cutoff, formally known as an avulsion, were also identified. An avulsion occurs when a portion of the channel, usually a bend, is rapidly abandoned during high flows in favor of a shorter, higher gradient channel route. These new channel segments appear as straight segments cutting off a bend in the river. Lateral migration is less common downstream of 265th Street access due to the maintenance of channelized conditions.

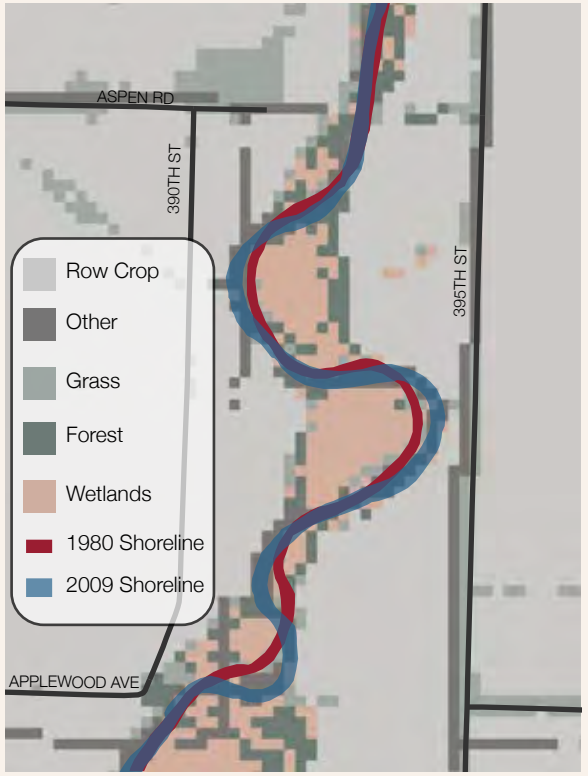


Figure 7

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

Segment	Straight Line Length (mi.)	1980 Length (mi.)	2009 Length (mi.)	% change in length between 1980 – 2009	1980 Sinuosity	2009 Sinuosity
100th Street (County Line) to Story City Park	1.84	2.73	2.62	-4%	1.5	1.4
Story City Park to Lekwa Access	2.17	4.09	4.13	+1%	1.9	1.9
Lekwa Access to Anderson Access	2.15	3.57	3.56	0%	1.7	1.7
Anderson Access to Soper's Mill Access	2.70	4.26	4.24	0%	1.6	1.6
Soper's Mill to North Peterson Park Access	1.05	1.48	1.48	0%	1.4	1.4
North Peterson Park Access to Sleepy Hollow Access	2.93	3.76	3.60	-4%	1.3	1.2
Sleepy Hollow Access to North River Valley Park	2.45	3.06	3.06	0%	1.2	1.2
North River Valley Park to S.E. 16th Access	1.95	2.86	3.16	+10%	1.5	1.6
S.E. 16th Access to 265th Street Access	2.44	3.83	3.92	+2%	1.6	1.6
265th Street Access to Askew Bridge/ Cambridge Pond	3.32	3.60	3.61	0%	1.1	1.1
Askew Bridge/ Cambridge Pond to C.J. Shreck Access	4.29	4.61	4.60	0%	1.1	1.1

Table 5

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

Streambank Conditions

The nature of streambanks on the South Skunk falls into two categories: the non-channelized river segment north of the Lincoln Way in Ames and the channelized segment south of Lincoln Way *(Figure 2)*. Eroding streambanks are fairly common on the South Skunk River. Streambanks on the channelized section are generally higher compared to those on non-channelized section of the river.

Estimates of streambank erosion were derived using the USDA-NRCS Streambank Erosion and Sediment Delivery Estimate criteria (USDA-NRCS 1998). Data from several data sources were analyzed to derive estimates of eroding bank length by water trail segment. These estimates are intended for conceptual planning purposes only and do not reflect a thorough field assessment of field conditions by a river professional.

Estimates indicate extreme instances of bank erosion on both channelized and unchannelized reaches of the river *(Table 6)*. Erosion was noted to be threatening either existing transportation or recreational infrastructure in at least three instances *(Figure 8)*.

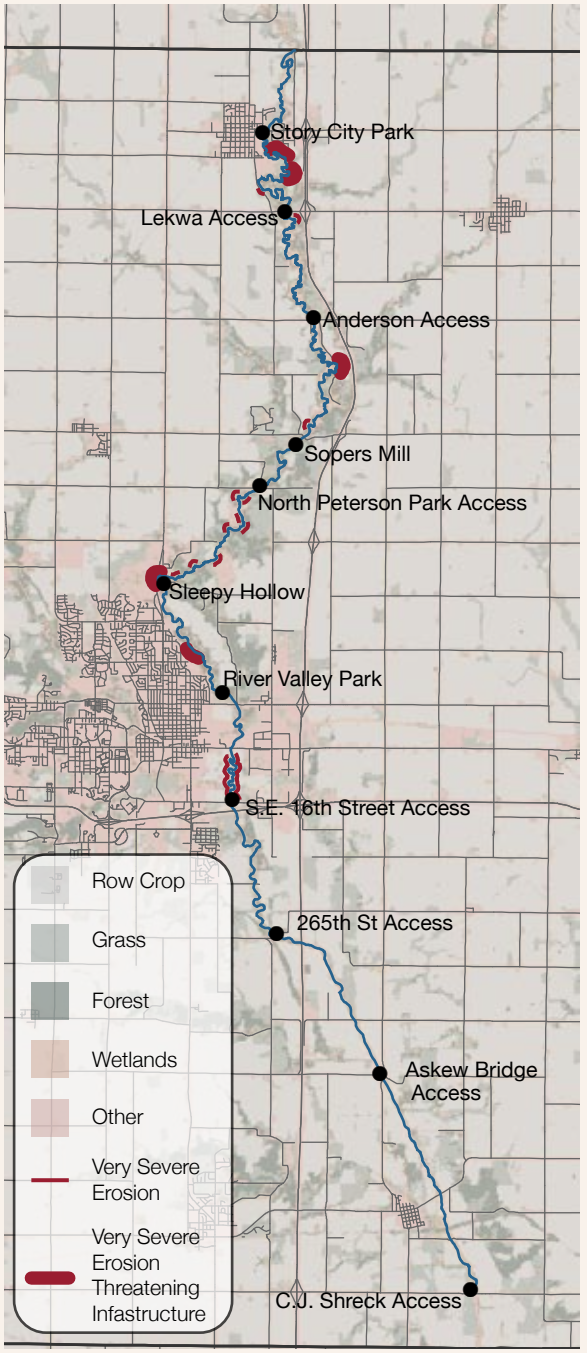
Segment	Miles, channel length	Severe Erosion Rating (ft)	Very Severe Erosion Rating (ft)	% channel length impacted	Jurisdiction
County Line to Story City Park	2.6	654	0	2	County, City
Story City Park to Lekwa	4.1	3706	1789	13	City, County
Lekwa Access to Anderson	3.6	0	217	1	County
Anderson to Sopers Mill	4.2	390	530	2	County
Sopers Mill to North Peterson Park	1.5	125	166	2	County
North Peterson Park to Sleepy Hollow	3.6	0	3741	10	County
Sleepy Hollow to River Valley Park	3.1	258	342	2	City
River Valley Park to S.E. 16th Street	3.2	2904	353	10	City
S.E. 16th Street to 265th Street	3.9	1245	431	4	City, County
265th Street to Askew Bridge	3.6	473	398	2	County
Askew Bridge to C.J. Shreck	4.6	382	508	2	County
Erosion Totals		10137	8475		

Table 6

Bank erosion estimates indicate three segments of the river are experiencing large amounts of bank erosion due to lateral migration. The locations of two of these segments are under joint jurisdiction while the other is primarily within the incorporated limits.

Figure 8

Eroding streambanks are common on the Upper South Skunk. The most common infrastructure threatened by bank erosion are roads and bridges. The southern edge of Peterson Pits Lake is also becoming impacted by lateral movement of the river.



Riparian Landcover Conditions

The edge or transition between an aquatic ecosystem and its upland area is known as the riparian area. 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 area 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 South Skunk, 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, G. 2008). Existing riparian buffer

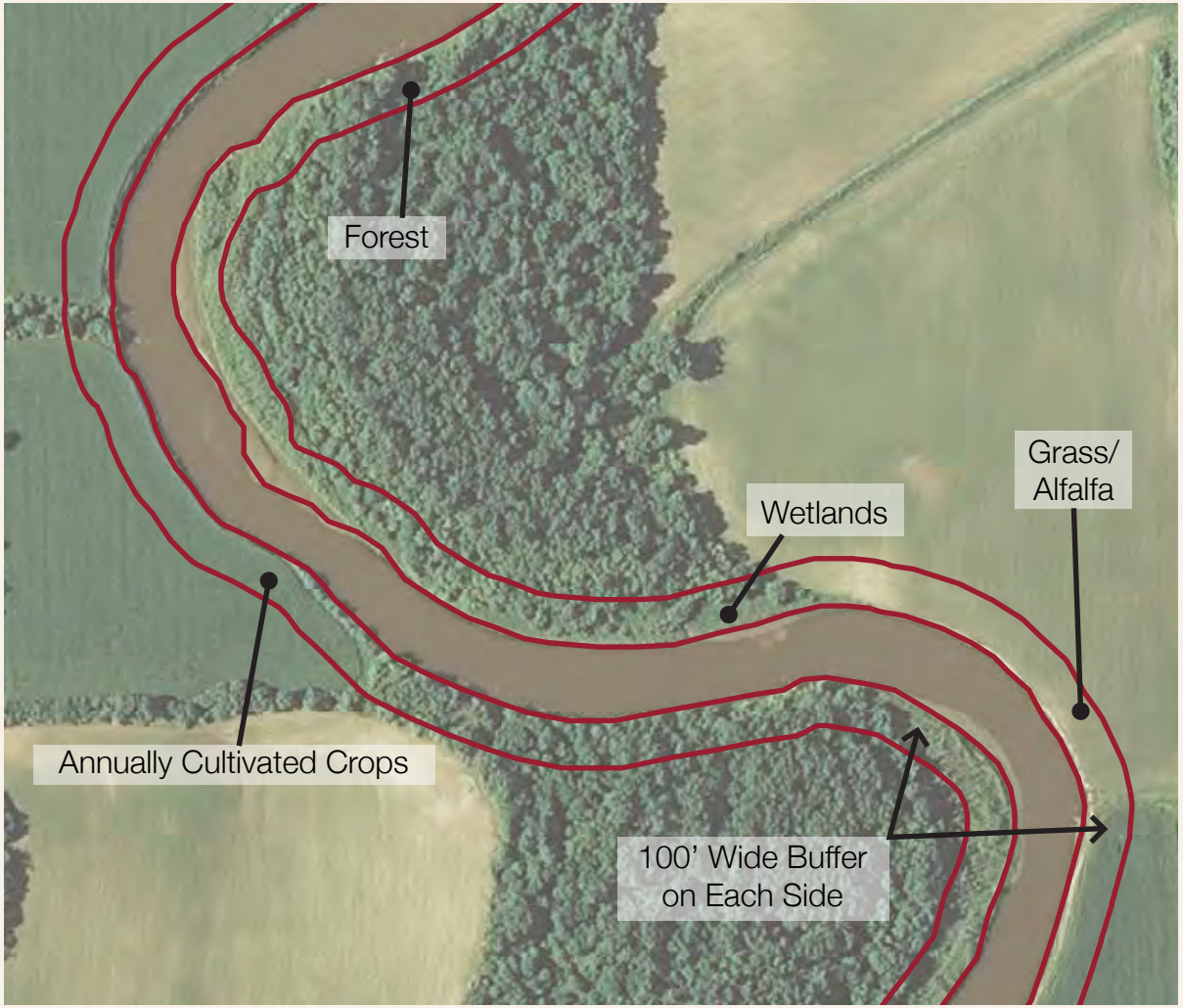


Figure 9

Red lines illustrate the top of the streambank and a distance approximately 100' away from the edge. Landcover inside these lines was identified for the length of the river in Story County. A perennial buffer is present on 92% of the acres included in this 100' buffer.

conditions on the South Skunk River vary widely in different sections of Story County. While 92% of the total buffer acres are perennial vegetation landcover, the northern, or non-channelized, portion of the county has a disproportionately higher percentage compared to the southern, channelized portion.

Riparian areas within 100' of the top of streambanks on both sides of the South Skunk 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 river 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 7*.

Looking at the river corridor in Story County as one unit, 92% of the total riparian buffer acres are perennial vegetation landcover *(Figure 10)*. The South Skunk contains among the lowest percentages of urban impervious surface (1%) of the 12 rivers studied in 2014 for potential state designated water trail status. Perennial vegetation landcover in the riparian buffer area ranges between 95 and 100% in each segment between the Story – Hamilton county line and North River Valley Park Access. This very high percentage of primarily forest landcover promotes river and habitat stability. The percentage of perennial landcover decreased significantly downstream of North River Valley Park Access. Perennial cover in the buffer area drops to between 81 and 89% between North River Valley Park and the C.J. Shrek Access near the Story – Polk county line. The Askew Bridge to C.J. Shrek segment of the river had the highest percentage of annually cultivated cropland with 19%.

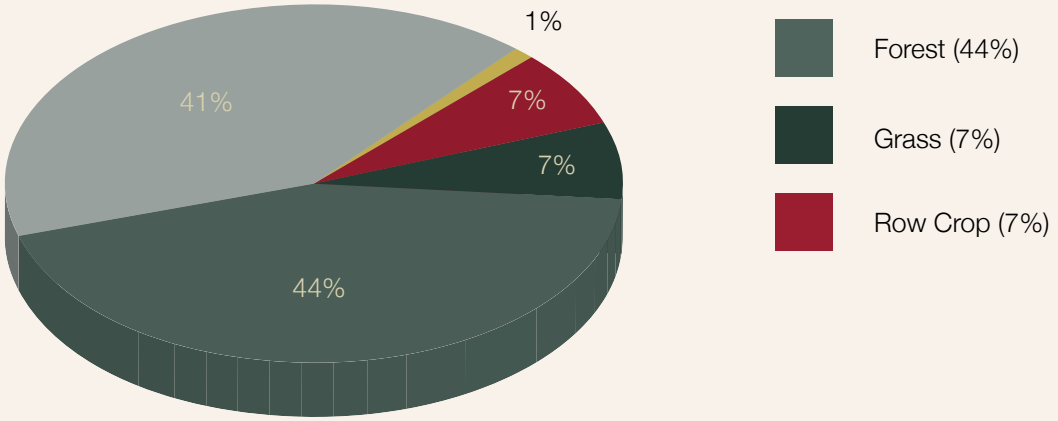


Figure 10

Ninety two-percent of the stream edge acres along the water trail include perennial landcover, which is helpful for soil stabilization, wildlife habitat and views from the water.

	County Line to Story City Park	Story City Park to Lekwa Access	Lekwa Access to Anderson Access	Anderson Access to Soper's Mill Access	Soper's Mill to North Peterson Park Access	North Peterson Park Access to Sleepy Hollow Access	Sleepy Hollow Access to North River Valley Park	North River Valley Park to S.E. 16th Access	S.E. 16th Access to 265th Street Access	265th Street Access to Askew Bridge/ Cambridge Pond	Askew Bridge/ Cambridge Pond to C.J. Shreck Access
Annually Cultivated Crops	2.18 (3%)	0.97 (1%)	1.25 (2%)	0.31 (0%)	0.32 (1%)	2.18 (3%)	0.67 (1%)	13.17 (18%)	10.05 (11%)	9.07 (11%)	21.29 (19%)
Perennial Grass & Alfalfa	14.18 (23%)	1.35 (1%)	0 (0%)	0.96 (1%)	0.16 (0%)	1.39 (2%)	2.10 (3%)	1.02 (1%)	12.28 (13%)	12.29 (14%)	15.99 (15%)
Forest	38.78 (62%)	20.88 (22%)	11.48 (14%)	77.60 (80%)	16.96 (48%)	45.80 (54%)	60.90 (85%)	39.20 (54%)	49.37 (54%)	23.05 (27%)	11.80 (11%)
Wetland	6.40 (10%)	72.20 (76%)	69.51 (85%)	17.92 (19%)	18.04 (51%)	34.12 (40%)	8.24 (11%)	19.16 (26%)	16.61 (18%)	41.83 (49%)	60.64 (55%)
Other	0.98 (2%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0.84 (1%)	0 (0%)	0 (0%)	3.48 (4%)	0 (0%)	0 (0%)
Totals	62.52 (100%)	95.40 (100%)	82.23 (100%)	96.79 (100%)	35.48 (100%)	84.33 (100%)	71.92 (100%)	72.56 (100%)	91.80 (100%)	86.24 (100%)	109.71 (100%)

Table 7

The Anderson Access to Soper's Mill Access water trail segment had the lowest percentage of annually cultivated landcover in the 100' buffer either side of the channel. 2013 Crop year acres for each landcover type are shown below as well the total percent of each type within a water trail segment.

Land Use and Zoning

The South Skunk River Greenbelt Conservation District begins directly south of the Story City municipal boundary and continues downstream along the river until it ends at the northern boundary of the City of Ames *(Figure 11)*. Originally created as an alternative to a reservoir construction proposal for the City of Ames, the Greenbelt features unique zoning regulations that prevent agriculture practices that would require removal of naturally occurring tree cover. Additionally, the Greenbelt ordinance contains language that promotes natural resource protection including soil and water conservation, drainage and water retention, and cultural/historic restoration as permitted uses.

Zoning classes located outside of the South Skunk River Greenbelt Conservation District do not have these same protections for the clear cutting of naturally occurring tree cover. *Figure 12* illustrates land with mature forest cover in riparian areas that are privately-owned and located outside of the

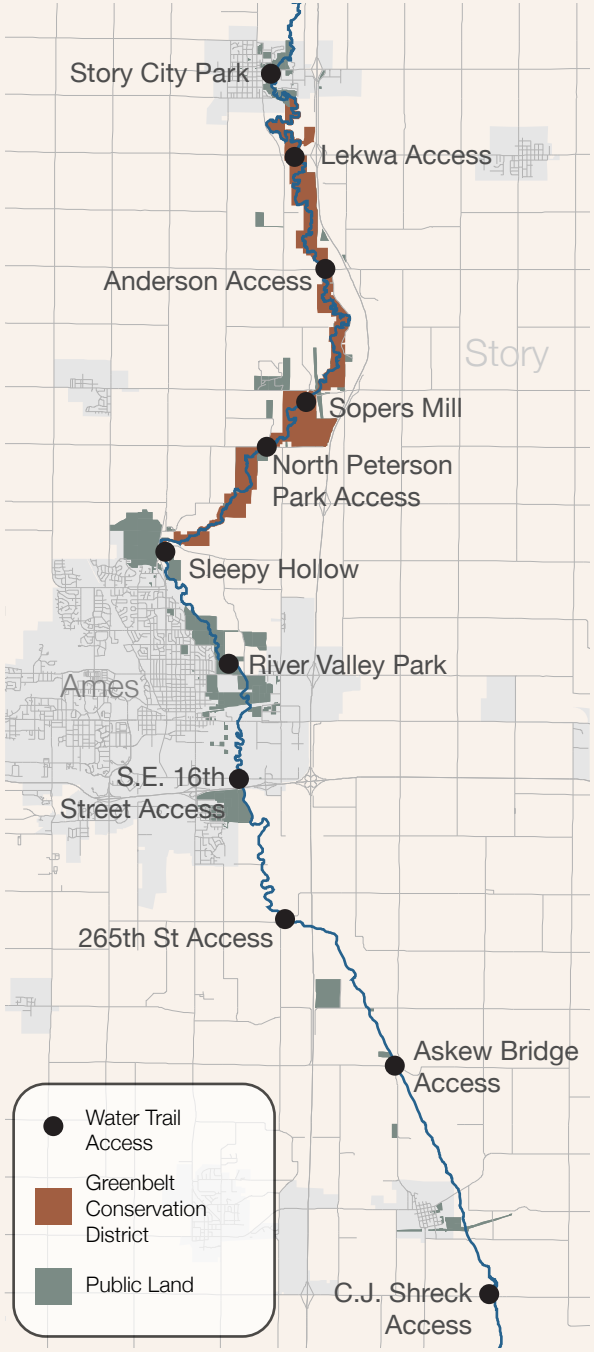


Figure 11

The South Skunk River in northern Story County may be the only river in Iowa with zoning protection on the riparian buffer. This ordinance protects the buffers' natural functions such as water quality enhancement, flood reductions downstream and wildlife habitat.

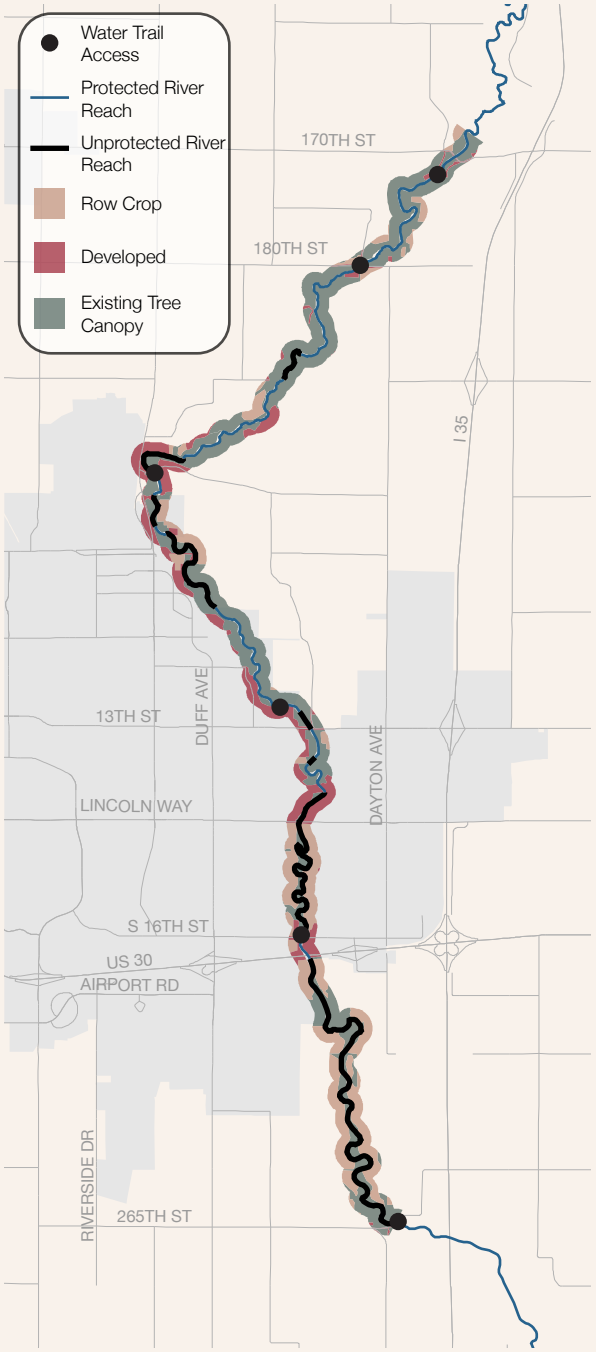


Figure 12

A majority of floodplain forests in and near Ames are in public ownership and assumed protected from mass clearing and significant change in land use. South of Ames, however, a majority of river-edge property is privately owned. Existing floodplain forests in these areas are not protected from significant change.

greenbelt zoning district. These land areas are valuable portions of the South Skunk River's buffer zone and are vulnerable to land clearing and other forms of disruption such as grazing.

The river corridor study area, based on the protection status of the existing forest canopy, naturally divides itself into five segments. These segments are descriptive and help to organize the planning approach to the study area.

Segment 1: Story City to Sleepy Hollow Access/Dawes Avenue.

The South Skunk River Greenbelt Conservation District exists in this segment. Zoning restrictions prohibit the clear cutting of existing mature trees.

Segment 2: Sleepy Hollow Access/Dawes Avenue – Northwood Drive.

This segment lies outside the greenbelt zoning district and includes several large privately owned parcels with mature forest. Parcels on the east, with County jurisdiction, are primarily row crop while those on the west side, with City jurisdiction, are developed. Forest cover on these parcels is vulnerable to change in land cover based on the owner's preferences.

Segment 3: Northwood Drive to E 16th Street.

Land on both sides of the river is largely in public ownership.

Segment 4: E 16th Street to E 5th Street/Pullman Street.

A majority of land on both sides of the river is in public ownership. A majority of the parcels along the river are in public ownership and feature existing vegetation. However, two parcels with mature forest vegetation are privately owned.

Segment 5: E 5th Street/Pullman Street to 265th Street.

The width of forest vegetation on this segment is much narrower compared to upstream segments. Many parcels abutting the river do not have tree cover due to row crop agriculture or development, and exhibit mass wasting and erosion of stream banks.

Figure 13 represents a compilation of landcover and ownership patterns. The river channel color is coded to represent either segments with near-river land that is publicly owned or protected zoning ordinance or as privately owned and not protected from change in vegetation or development.

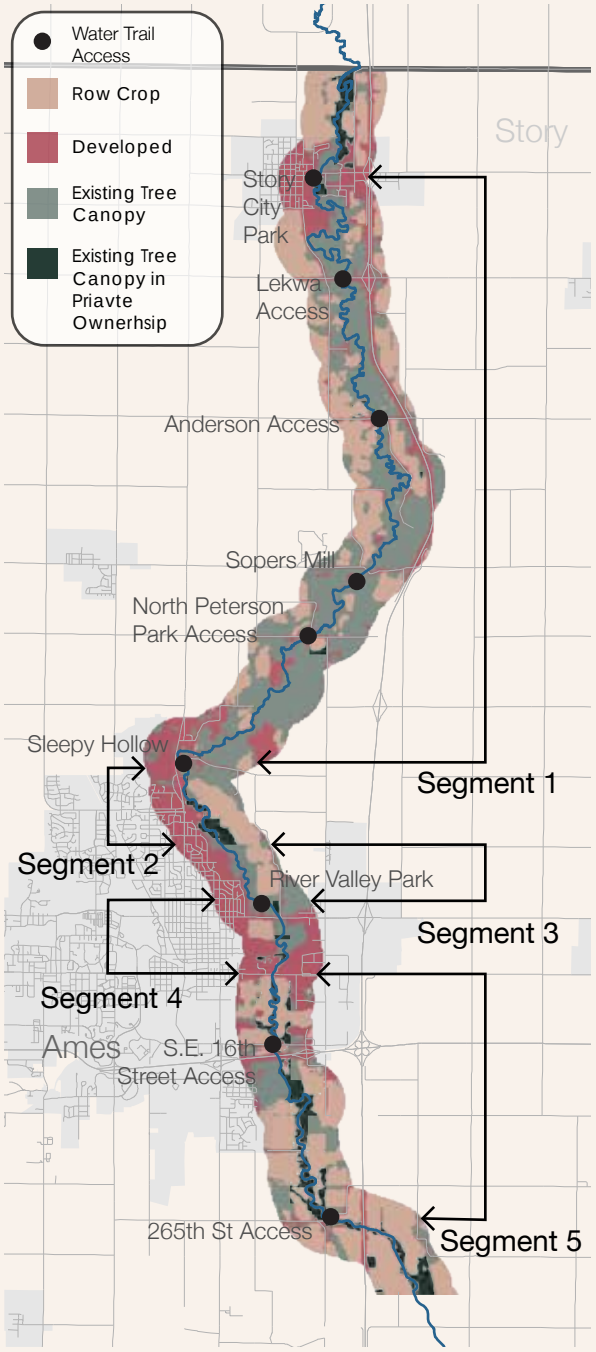
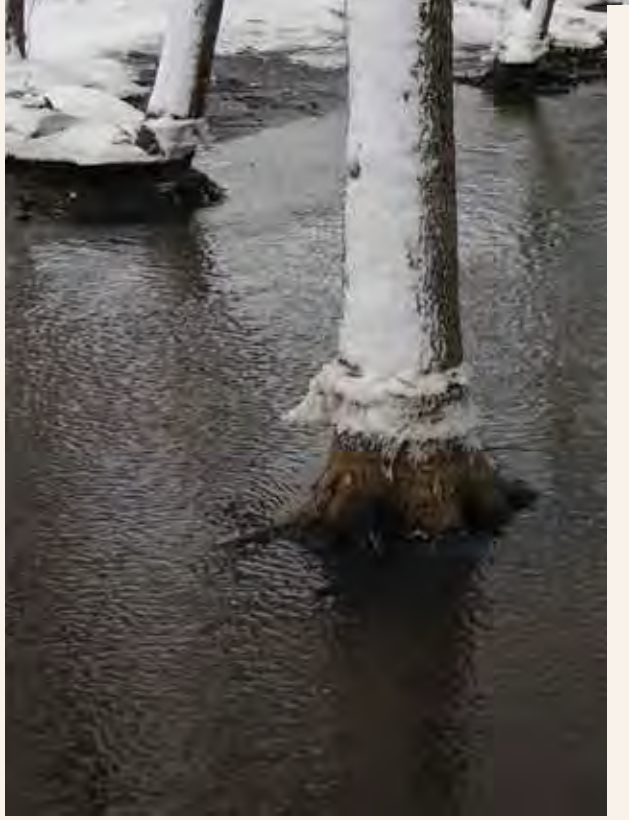


Figure 13

Just as the floodplain width varies widely from north to south Story County, highly variable protection and management strategies also exist. Public resources protect and manage a majority of the more narrow floodplain areas within and near the City of Ames while the broader floodplains south of Ames are managed as farmland and unprotected from change.



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.

Multiple segments of the South Skunk River in Story County are included on Iowa’s 2012 List of Impaired Waters (also known as the 303(d) List) *(Figure 14)*. Three tributaries in Story County draining into the study area portion of the South Skunk are also listed as impaired including Long Dick, Ballard and Walnut creeks.

All impaired segments of the South Skunk included in Story County are due to high levels of indicator bacteria (E. Coli). The impaired tributaries for this portion of the water trail are listed as biologically impaired due to results of biological monitoring showing that fish and/or macroinvertebrate communities do not meet regional expectations for biological integrity.

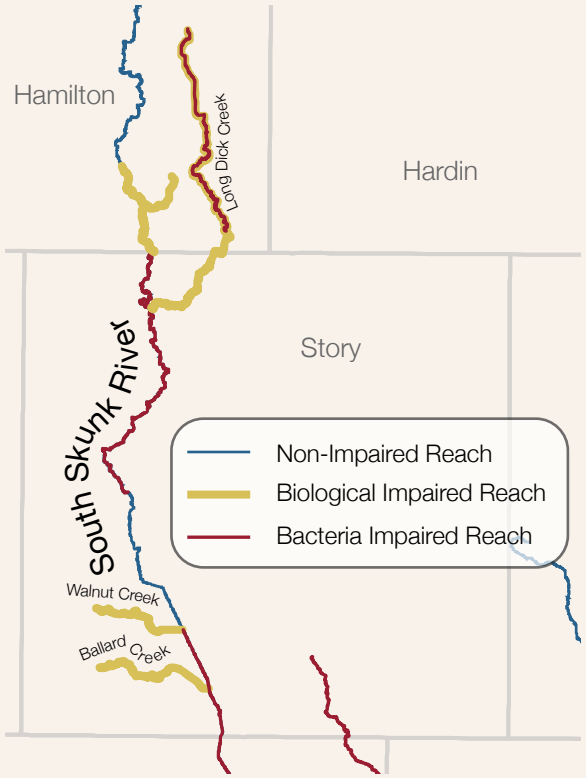


Figure 14

Greater than 50% of the river in Story County is impaired for bacteria, including the northern section where large numbers of people tube, paddle and fish.

Contaminant Sources

Iowa DNR lists a total of 44 contaminant sources within 0.3 miles of the South Skunk River in Story County *(Table 8)*. 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*
Hazardous Materials Spill	10
Leaking Underground Storage Tanks	8
Open Feedlot	1
Solid Waste Facility	2
Tier II Chemical Storage	2
Underground Storage Tank	9
Wastewater Outfall	5
Wastewater Treatment Facility	7

Table 8

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 most substantial water quality efforts in the South Skunk River included in this study area are those included in the Squaw Creek watershed. A total of $616,072 in funding has been awarded since 2007. Squaw Creek is a tributary of the South Skunk; the confluence of the Squaw and Skunk rivers is slightly upstream of the SE 16th Street Access. A watershed management authority exists and a number of WIRB grants have been awarded in this watershed. The Squaw Creek Watershed Management Authority includes Story, Boone and Webster counties. The purpose of the authority is to improve water quality in Squaw Creek and to explore methods to infiltrate more runoff in the watershed during large rain events to reduce flooding downstream. The Authority received $138,000 in state funding to develop a 20 year plan to reduce erosion, sedimentation, flooding, nutrient loss and biodiversity loss in the watershed.

Additional water quality enhancement funding in the Squaw Creek watershed includes College Creek Restoration within the City of Ames and the Lake LaVerne Watershed Project on the Iowa State University Campus. WIRB funded both between 2007 and 2015 for a total of $349,545. The Onion Creek Watershed Protection Project received an additional $128,527 to implement practices to reduce erosion and perform stream bank erosion monitoring.

An additional $746,224 in water quality funding has been awarded within the South Skunk watershed for drainage areas downstream of the study area. These include the Hickory Grove Lake watershed, grazing management in Marshall County and non-point source pollution.

CONTEXT OF THE RIVER

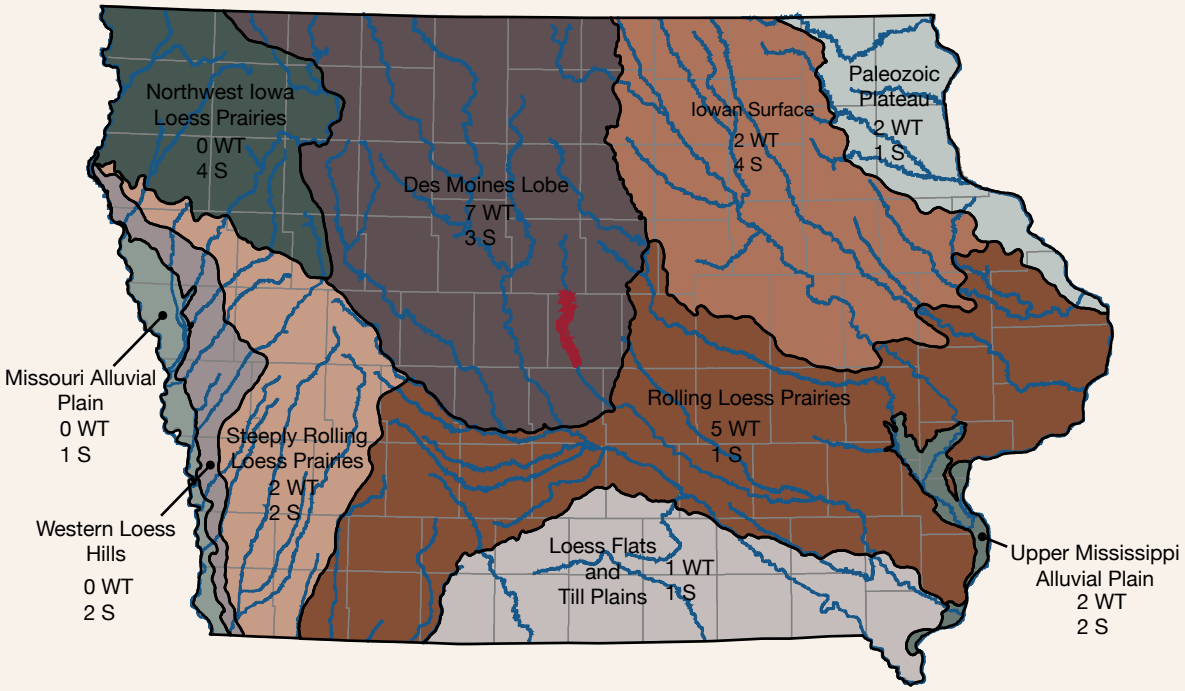


Figure 15

The South Skunk River in Story County is located within the Des Moines Lobe ecoregion--the most recently glaciated region of the state.

Watershed Characteristics and Condition

This study area is located within the Des Moines Lobe ecoregion in Iowa *(Figure 15)*. The South Skunk River is not a state designated water trail, however there are seven state designated water trails located within the Des Moines Lobe ecoregion.

The concept of "ecoregions" is used to characterize and groups geographic areas with similar climate, soils, and topography. Together, these three elements result in specific plant and animal patterns and form distinct ecological patterns unique to each ecoregion. The Des Moines Lobe ecoregion is distinguished by Wisconsin glacial stage landforms currently under extensive agriculture. The landscape includes level to gently rolling hills with some areas containing morainal ridges as well as hummocky knob and kettle topography. Lack of loess over the glacial

drift, the stream network is poorly developed and is widely spread. Almost all of the natural lakes of Iowa are found in the north portion of this ecoregion (Chapman et al. 2002).

The drainage basin or watershed area draining in the segment of South Skunk River included in this study is 413,970 acres in size *(Figure 16)*, representing only 35% of the total South Skunk watershed. A majority of the watershed acres (approximately 77%) was annually cultivated cropland in 2013 *(Table 9)*. Developed areas, including roads, neighborhoods and buildings, totaled approximately 10% of the watershed.

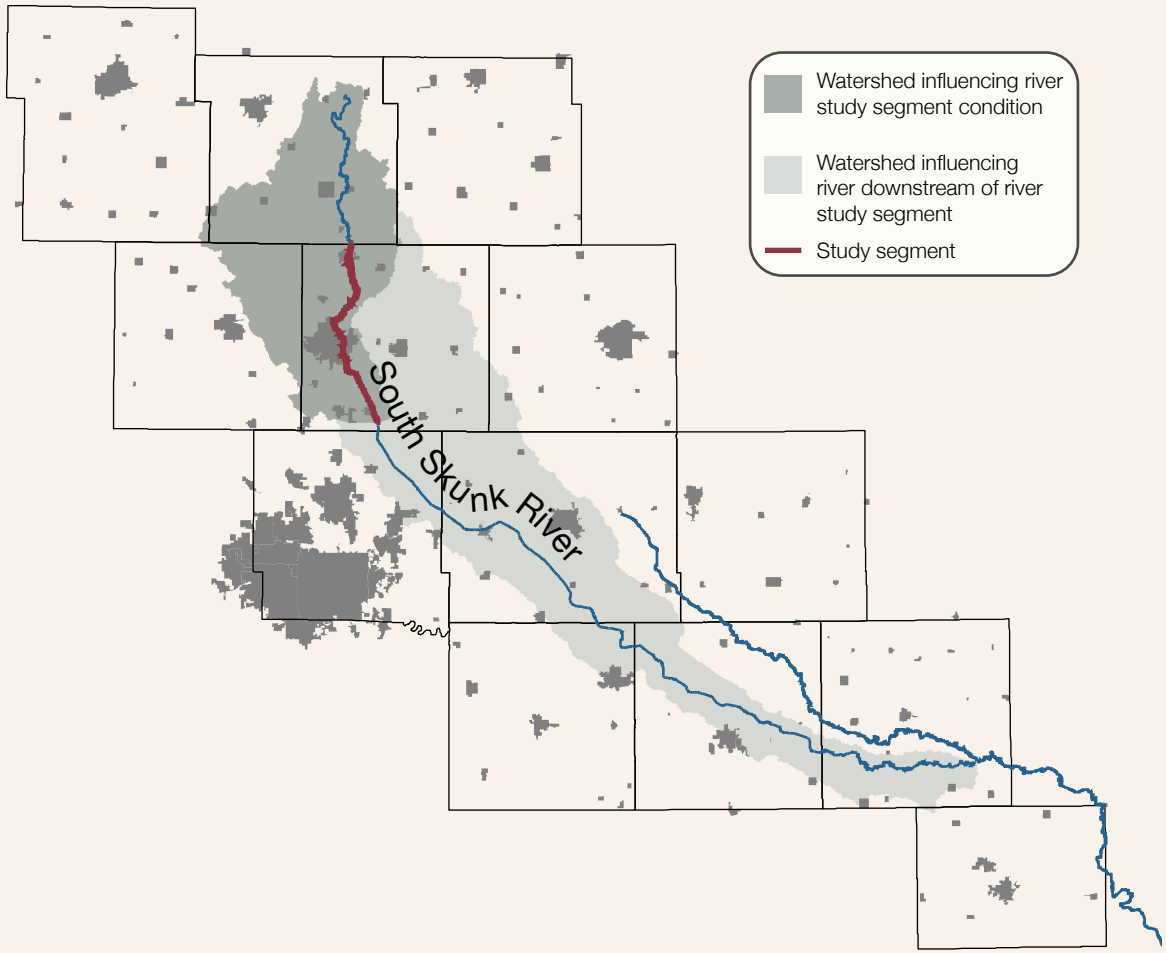


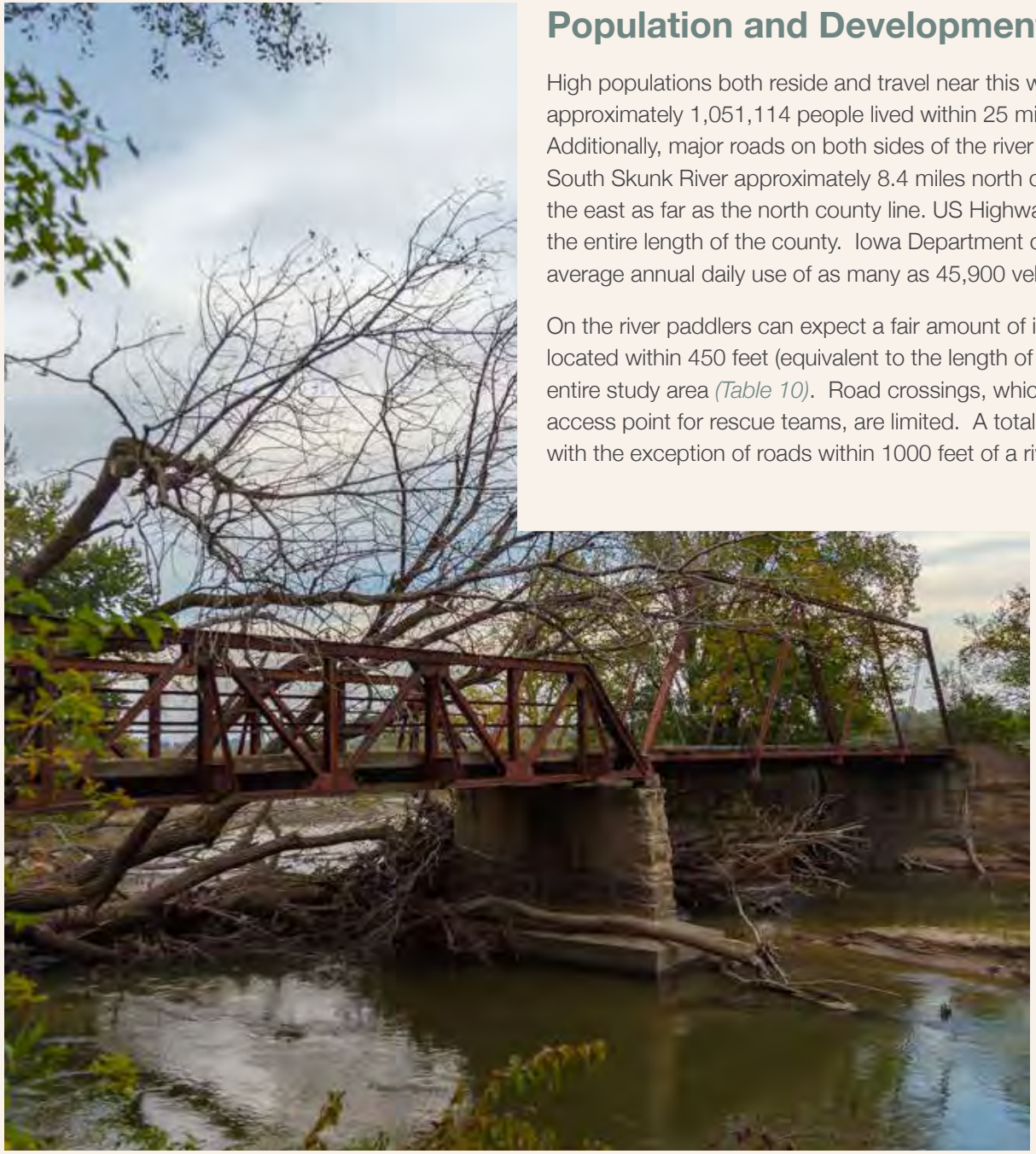
Figure 16

The Story County section of the river lies near the very top of the watershed or drainage basin.

Land Cover Type	2013 Acres*
Annually Cultivated Crops	317,373
Grassland, Pasture, Alfalfa	39,169
Forest, Woodland, Shrubland	10,531
Wetlands	3,490
Developed Land	43,407
TOTAL ACRES IN WATERSHED	413,970

Table 9

*Land cover from the 2013 crop year was used to characterize the watershed that supplies the South Skunk River in Story County. *Land Cover Source: USDA National Agricultural Statistics Service, Cropland Data Layer 2012*



Population and Development

High populations both reside and travel near this water trail. The U.S. Census 2010 indicated approximately 1,051,114 people lived within 25 miles of the South Skunk River water trail study area. Additionally, major roads on both sides of the river provide easy access. Interstate 35 crosses the South Skunk River approximately 8.4 miles north of the county line and roughly parallels the river on the east as far as the north county line. US Highway 69 runs parallel to the river on the west side for the entire length of the county. Iowa Department of Transportation's 2011 traffic counts suggest an average annual daily use of as many as 45,900 vehicles on these two routes in Story County.

On the river paddlers can expect a fair amount of interface with the public. A total of 251 homes are located within 450 feet (equivalent to the length of 1½ football fields) of either side of the river in the entire study area *(Table 10)*. Road crossings, which act as a public interface for river users and an access point for rescue teams, are limited. A total of 8 road crossings exist on the 38 miles of river with the exception of roads within 1000 feet of a river access point.

Houses* Near the Water Trail	Within Municipal Limits	Rural	Total Houses
Within 450' of either side of river	136	115	251
Within 0.3 miles of either side of river	1,340	493	1,833

Table 10

*More than 250 houses exist near the river, predominantly in and north of Ames. The land near the river downstream of Ames is most often annually cultivated cropland with few houses. *Residential location data source: Structure Points of Pottawattamie County, Iowa DNR, 2010*

Recreation & Tourism in the Region

This study area is highly developed in terms of visitor experiences. A complete set of outdoor recreation activities exist as well as world class museums and art collections. Opportunities for off-river activities are enormous within 10 miles of the South Skunk River.

Corridors and trails.

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. The South Skunk River in Story County is a premier location for land-based trails including hiking, biking and multi-use options that include equestrian near a potential state-designated water trail.

Water trails. From a paddling standpoint, the South Skunk River study area is located near multiple state-designated water trails *(Figure 17)*. The characteristics of the South Skunk, however, distinguish it from other designated routes near it. First, watershed scale and channel width of the South Skunk is much smaller compared to the Des Moines and Raccoon rivers, the nearest state-designated options. Likewise, the channel width of the Iowa River is approximately twice as wide as the South Skunk. Second, the amount

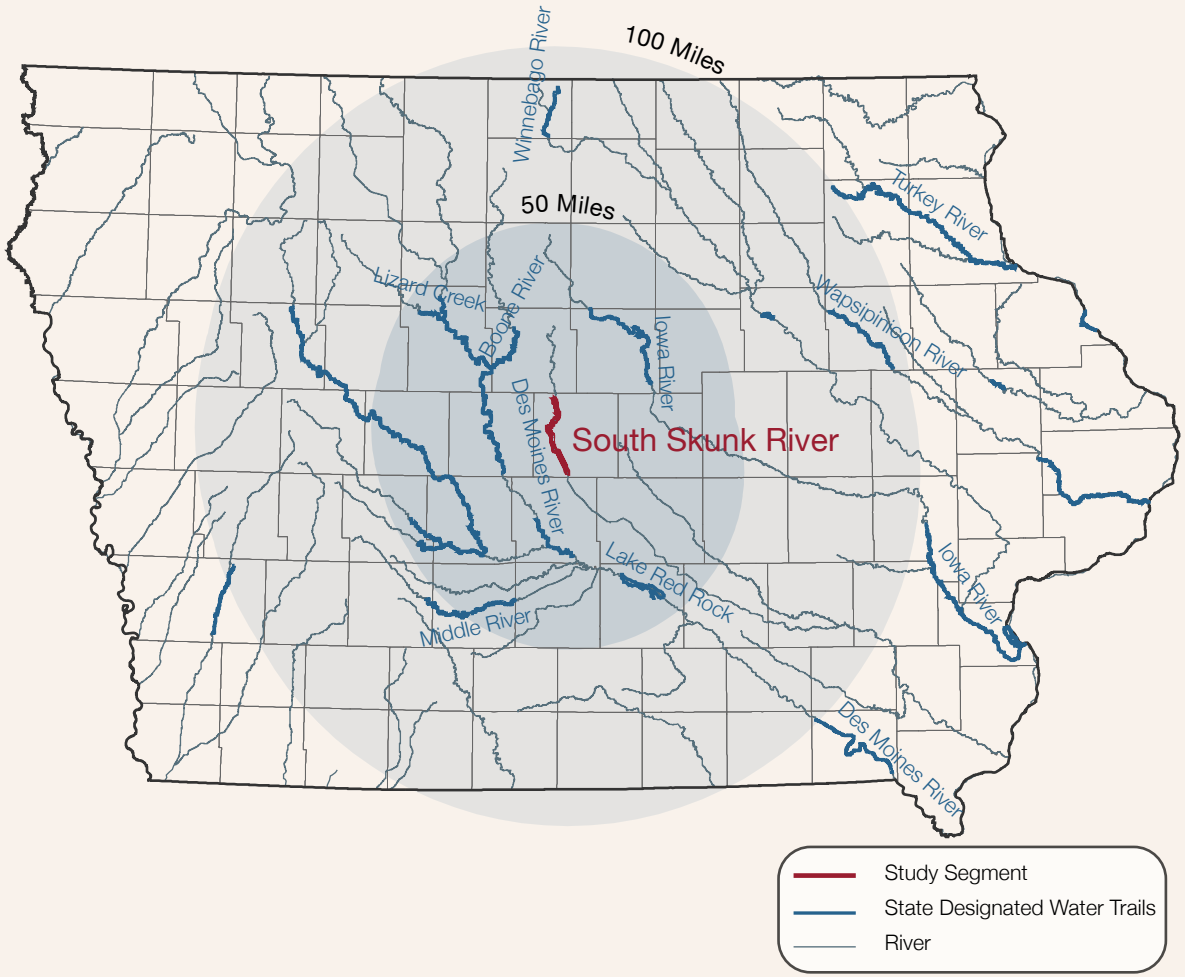


Figure 17

The South Skunk River study area is in close proximity to multiple state-designated water trails in central Iowa. No portion of the South Skunk, however, is currently state-designated.

of developed, multi-use public recreation land and facilities adjacent to the Skunk is much greater compared to designated water trails on the Boone, Des Moines, Raccoon and Iowa rivers.

Land trails. Three types of land trail experiences exist in this study area, each type intersecting with the South Skunk River: regional, urban and rural. One regional trail, the Heart of Iowa Trail, intersects the study area two miles upstream of the southern Story County boundary. The Heart of Iowa Trail connects with the High Trestle Trail approximately 8 miles west of the South Skunk River. Together the two trails span 57 miles in Central Iowa, offering views of prairie, forest and wetland remnants, the Des Moines River valley, a pioneer cemetery, historical museum, vernacular buildings and historic bridges.

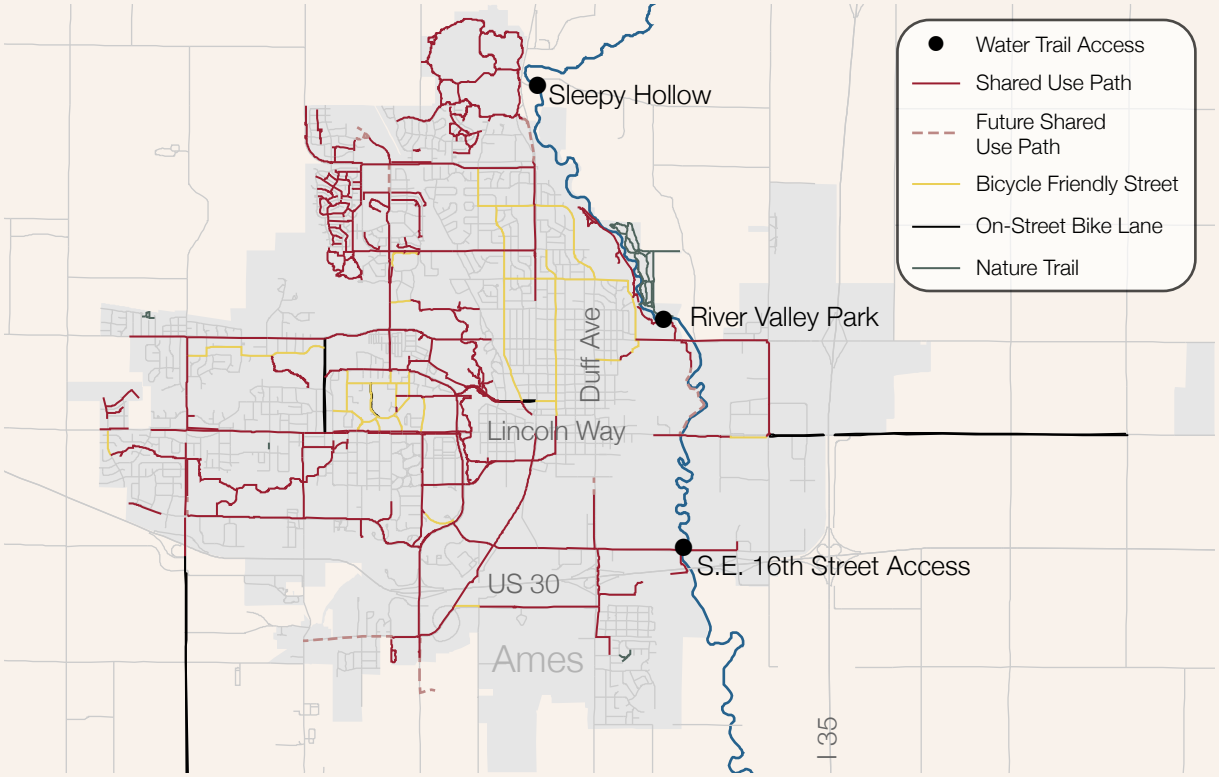


Figure 18

All three river accesses in Ames are located either on or directly adjacent to established City of Ames bike trails enabling pedal-paddle opportunities.

The second type of land trail experience, an urban trail network, exists upstream in both Ames and Story City. Ninety-seven miles of either paved bike trail or shared road trail exist today within the City of Ames, all accessible from both the North River Valley Park and S.E. 16th Street accesses on public roadways *(Figure 18)*. The S.E. 16th Street access parking also serves as a node for the bike trail. An additional 43.7 miles of on and off-road bike trails are planned for construction with the city in the near future. Story City has 2.6 miles of either paved trail or shared road trails.

The Skunk River Greenbelt north of Ames provides the third type of land trail, a rural and often remote experience. The Skunk River Greenbelt includes a highly planned and developed 20.2-mile trail network following 8.5 miles of the South Skunk River *(Figure 19)*.

Trail users can gain access to the network at four water trail access points: North Peterson, Sopers Mill, Anderson and Lekwa. The greenbelt network includes a combination of hiking only (1.5 miles), hiking and biking combination (7.5 miles), on-road (3.3 miles) and multi-use including equestrian (8 miles).

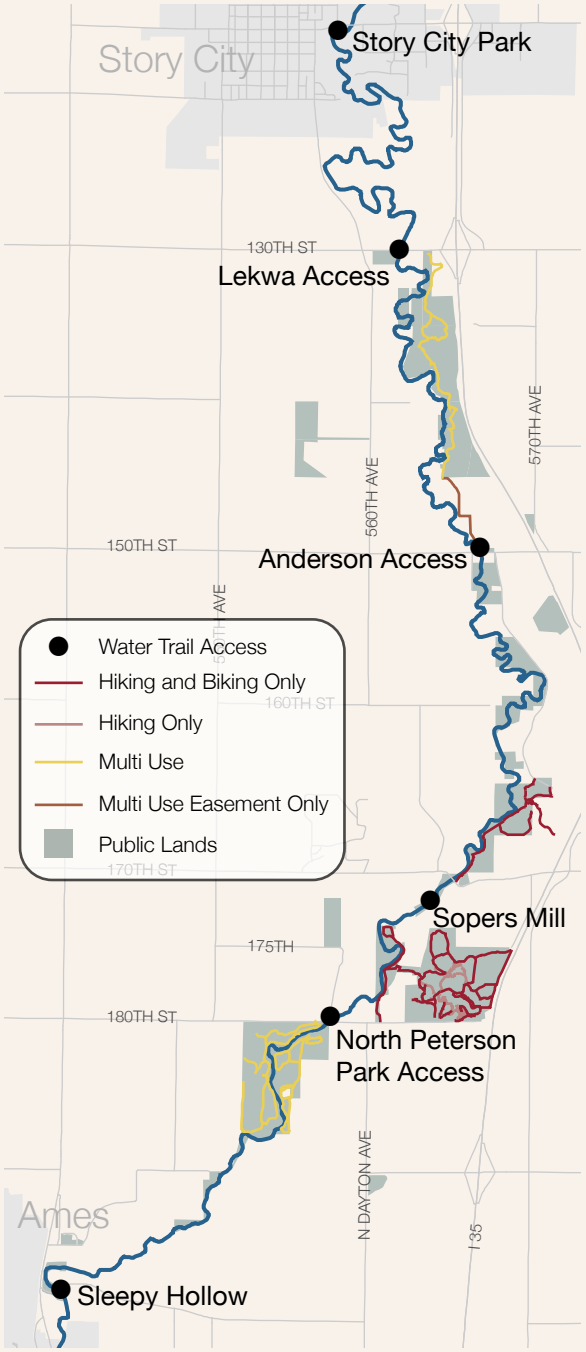


Figure 19

Lekwa and Anderson Accesses are nearly connected by a multi-use trail. Existing trails begin to connect other water trail segments between Anderson and S.E. 16th Accesses.

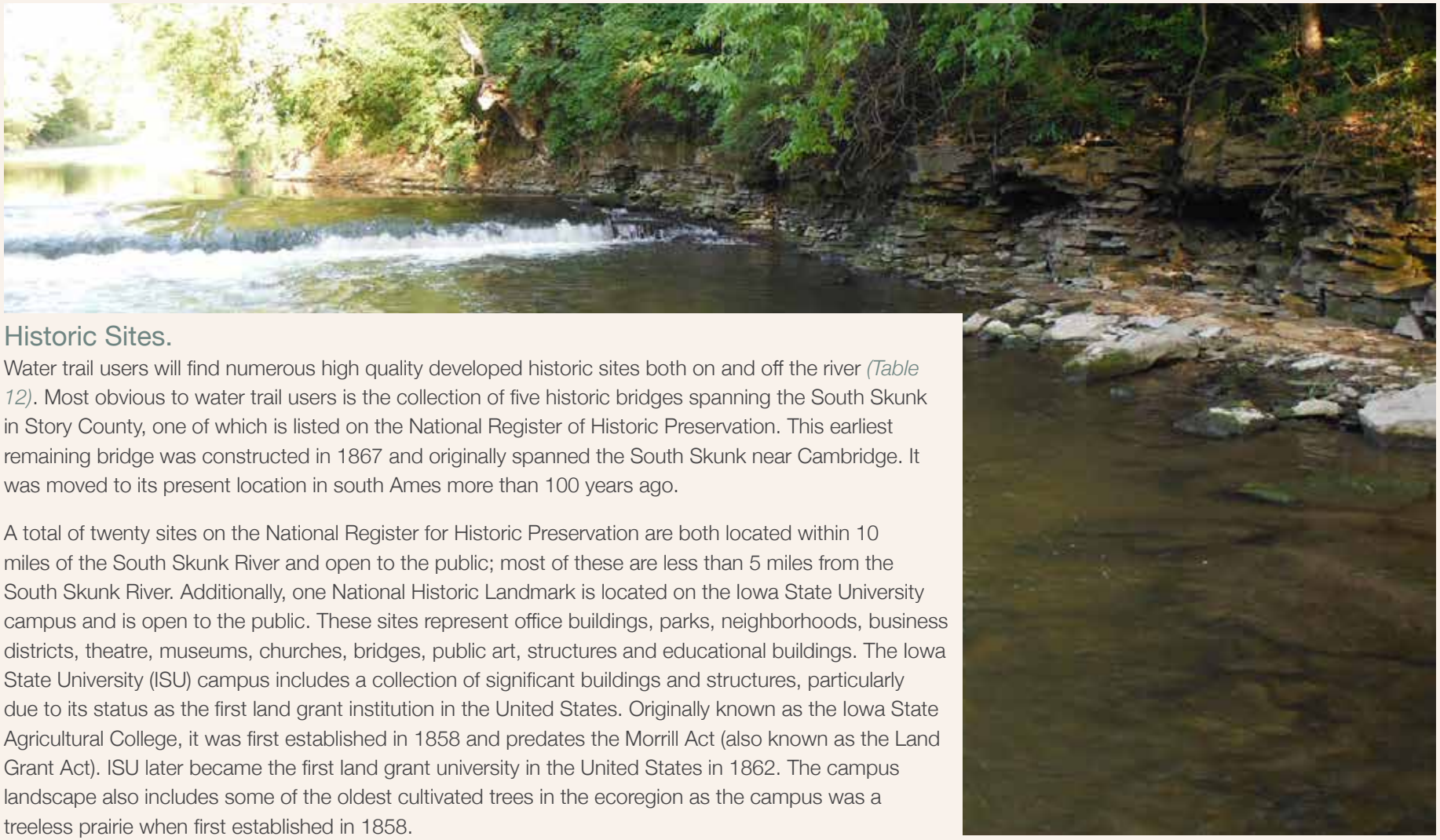
Overnight accommodations.

Hotel/motel lodging is the most readily available form of overnight accommodation near the South Skunk River. There are fewer camping locations and available campsites compared to modern lodging locations. The distance between camp sites and all the river accesses is also farther compared to modern lodging *(Table 11)*. Modern lodging is available in Story City, Ames and Nevada while the nearest campgrounds are in Story City and at Hickory Grove and Chichaqua Bottoms parks

Water Trail Access	Distance to Nearest Modern Lodging	Nearest Modern Lodging	Distance to Nearest Camping	Nearest Camping
Story City Park	< 4.8 miles	Story City (129 Rooms)	< 5.2 miles	Whispering Oaks RV Park (14 primitive & 57 modern), Story City
Lekwa Access				
Anderson Access				
Sopers Mill	< 7 miles	Ames (1450 Rooms)	11 - 20 miles	Whispering Oaks RV Park (14 primitive & 57 modern), Story City Hickory Grove Park (43 Modern & 11 Primitive)
North Peterson				
Sleepy Hollow				
North River Valley				
SE 16th Access				
265th St Access				
Askew Bridge	7.8 miles	Ames (1450 Rooms)	7 – 19 miles	Hickory Grove Park (43 Modern & 11 Primitive) Chichaqua Bottoms (8 Modern, 28 Primitive) Elkhart
	11.2	Nevada (38 Rooms)		
C.J. Shreck	13.1mi			
	13.8 mi	Ames (1450 Rooms)		

Table 11

There are more than 1600 hotel/motel rooms within 14 miles of any river access in this study area while only 150 camping sites exist within 20 miles of the accesses.



Historic Sites.

Water trail users will find numerous high quality developed historic sites both on and off the river *(Table 12)*. Most obvious to water trail users is the collection of five historic bridges spanning the South Skunk in Story County, one of which is listed on the National Register of Historic Preservation. This earliest remaining bridge was constructed in 1867 and originally spanned the South Skunk near Cambridge. It was moved to its present location in south Ames more than 100 years ago.

A total of twenty sites on the National Register for Historic Preservation are both located within 10 miles of the South Skunk River and open to the public; most of these are less than 5 miles from the South Skunk River. Additionally, one National Historic Landmark is located on the Iowa State University campus and is open to the public. These sites represent office buildings, parks, neighborhoods, business districts, theatre, museums, churches, bridges, public art, structures and educational buildings. The Iowa State University (ISU) campus includes a collection of significant buildings and structures, particularly due to its status as the first land grant institution in the United States. Originally known as the Iowa State Agricultural College, it was first established in 1858 and predates the Morrill Act (also known as the Land Grant Act). ISU later became the first land grant university in the United States in 1862. The campus landscape also includes some of the oldest cultivated trees in the ecoregion as the campus was a treeless prairie when first established in 1858.

Beyond sites of national significance, numerous attractions featuring local history are open to the public. These include museums featuring one-room schoolhouses, log cabins, main street businesses and manor houses. The Ames Historical Center is unique among local history museums. The Center is located in downtown Ames and is open to the public six days a week year round. It features archives, artifact collections, exhibits, and research assistance for visitors. The Ames Historical Society operates the Center.

Attraction	NRHP	Information	Nearest Town				Miles to River
			Story City	Ames	Cambridge	Nevada	
Ames High School	X	Built in 1939 and currently used as the Ames City Hall; designed with the Classic Revival Style		X			1.2
Bandshell Park Historic District	X	Park was created in 1884 as a gift to the City; the present day Bandshell, including the copper-clad roof, was built in 1935		X			.8
Grand Auditorium and Hotel Block	X	Built and operational in 1913, the theatre held 400 seats and initially hosted only stage plays prior. Motion pictures were shown starting in 1917. The theatre is operational today	X				.5
Herschel-Spillman Two-Row Portable Menagerie Carousel	X	Manufactured in 1913, it is the only restored example of a portable carousel in the U.S. The carousel includes all its original figures and has been restored to near original condition	X				.1
Sheldahl First Norwegian Evangelical Lutheran Ch urch	X	Constructed in 1883 and owned privately by the Sheldahl family, the building remains intact on the interior from the original construction			X		9.2
Old Town Historic District, between Clark & Duff and 7th and 9th Streets (circa 1874 – 1941)	X	Almost exclusively a residential district with building examples from four historic styles and mature landscape / street trees representing the era		X			.8
Nevada Downtown Historic District	X	Buildings date from the 1870's to mid-1900's with examples from six historic building forms or styles prevalent during this period.				X	7.1
Municipal Building @ 420 Kellogg Ave	X	Built in 1869 to house the Ames City Hall, Jail, Fire Station; current home of Youth and Shelter Services		X			.9
Pleasant Grove Community Church and Cemetery	X	Nondenominational church near the South Skunk built in 1874 by local families		X			.3
Dr. Claude G. Dickey Log Cabin		Christened as "Yekcid" this original family home was donated and moved to Cambridge City Park for use as a shelter house.			X		.4

Table 12

A well-rounded collection of developed historic sites are available for the public both indoors and outdoors, including 21 of national significance.

Attraction	NRHP	Information	Nearest Town				Miles to River
			Story City	Ames	Cambridge	Nevada	
MUSEUMS							
Briggs Terrace	X	Constructed on an 8.4 acre lot in 1879, the site comprises an entire city block. The house was constructed the Italianate style while the grounds exemplify the ideas developed by Andrew Jackson Downing. The buildings and the grounds have had remarkably little alteration and are operated as a museum by the Nevada Historical Society.				X	7.5
Hoggatt School		Built in 1861-2 and moved to the grounds of Meeker Elementary School in Ames in 1983 to operate as a one-room schoolhouse museum		X			.6
Ames Historical Center		Museum hosting a vast array of historical items related to the history of Ames and the surrounding area		X			.9
Farm House Museum	XX	A National Historic Landmark, built in 1860 and known as the Knapp-Wilson House, the building was the first on the Iowa State University campus. Restored as a farm house from the era of construction.		X			2.3
Story City Museum		Showcases businesses and service once located in the Story City Main Street District	X				.1
Sheldahll School Museum		One room schoolhouse constructed in 1860 and moved to Story City in 1990 to serve as a museum	X				.2
Bartlett House Museum & Carriage House Museum	X	Built in 1903 as a family residence; restored and furnished in the 1903-1920's era. Carriage House Museum (not NRHP) is a recent construction to resemble a utility building of the same era.					.3
HISTORIC BRIDGES ON THE SOUTH SKUNK							
		Works Progress Administration (WPA) bridge built in 1936 in Story City Park. Wired cable suspension with wooden decking and lighting.	X				0
		Anderson Access (150th Street); built in 1920 on the Lincoln Highway and moved to current location in 1952; a Parker through truss design.	X				0
		Soper's Mill Access (170th Street):built in 1939; an 8 panel Parker through truss design		X			0

Table 12 (continued)

Attraction	NRHP	Information	Nearest Town				Miles to River
			Story City	Ames	Cambridge	Nevada	
	X	260th Street / Ken Maril Road: originally constructed to cross the Skunk River in Cambridge in 1876, the bridge was moved to its present location near Ames in 1916. It was one of three wrought iron bridges built in Story County over the South Skunk in 1876-7 and the only one remaining. A Warren through truss with pinned connections, only a few Warren trusses were built in Iowa and this example is the oldest remaining in the state.		X			0
		320th Street: built in 1949; a Warren pony truss design			X		
Keigley Branch Bridge	X	550th Avenue and Keigley Creek: built in 1913; a concrete filled spandrel arch bridge. It is the oldest remaining Iowa State Highway Commission-designed arch bridge.	X				.9
IOWA STATE UNIVERSITY CAMPUS							
	X	Agricultural Hall built in 1893 and now known as Catt Hall, one of two remaining well-preserved red brick 19th century buildings on Central Campus. The site where the country's first county extension program was launched.		X			2.4
	X	Alumni Hall built in 1907 and now known as Enrollment Services Center, of the Georgian Revival style		X			2.6
	X	Christian Petersen Courtyard Sculptures and Dairy Industry Building including nine bas relief sculptured panels by Petersen as a part of the first federally subsidized art programs of the Depression era.		X			2.3
	X	Engineering Hall built between 1882 – 1885 and now known as the Lab of Mechanics, it is the oldest remaining instruction building on campus		X			2.6
	X	Knapp-Wilson House; now known as Farm House Museum, a National Historic Landmark. Built in 1860 it was the first building on the Iowa State University campus.		X			2.3
	X	Marston Water Tower built in 1897 and believed to be one of the earliest, if not the first, steel water tower constructed west of the Mississippi River		X			2.8
	X	Morrill Hall built in 1890 and named in honor of Iowa Senator Justin S. Morrill of the Land Grant College Act (or the Morrill Act) of 1862 establishing land grant educational institutions.		X			2.7

Table 12 (continued)

Outdoor Recreation on Public Land.

More than 8,000 acres of public recreation land is located within 10 miles of the Story County portion of the South Skunk River *(Table 13)*. Highly developed traditional city parks are located in Story City, Ames and Cambridge. Some rural facilities are also highly developed, such as McFarland Park, but most offer native vegetation community experiences. Hunting and fishing opportunities are also plentiful.

Table 13

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

	Miles From River	Hunting	Fishing	Paddling	Wildlife Viewing	Hiking Trails	Multi-Use Trail	Modern Restrooms	Accessible Facilities	Other
STATE RECREATION FACILITIES										
Little Wall Lake WMA	5.7	X	X	X	X	X		X	Restrooms, shower facilities, dock	Modern & primitive camping, swimming, picnic area
Heise WMA	2	X			X					Access only via the South Skunk River
Bob Pyle Marsh WMA	4.5	X			X					
Doolittle Prairie State Preserve	0.8	X			X					
I-35 Prairie (Scenic View)	0.3				X	X				
Skunk River Flats WMA	0.3	X			X	X				
Paul Errington Marsh WMA	7.4	X			X					
COUNTY RECREATION FACILITIES										
Richard's Marsh	8.2	X			X					
Sheffield Wildlife Area	0.5	X								
Skunk River Greenbelt	0.1				X	X	X			Equestrian Trails, Biking Trails
Leopold Woods	0.3				X					
McFarland Park	0.4	X	X	X	X	X	X	X	Picnic area with grills, fishing dock	Stargazing Observatory, Picnic area with grills, Touch-a-Life Trail, Conservation Center
Peterson Park	0	X	X	X	X	X		X		Equestrian trails, Picnic Area, Swimming Beach, Restrooms
Wakefield Woods	0.7									Picnic area
O'Neil Prairie	0.2									

	Miles From River	Hunting	Fishing	Paddling	Wildlife Viewing	Hiking Trails	Multi-Use Trail	Modern Restrooms	Accessible Facilities	Other
Jim Ketelsen Greenwing Marsh	3.1	X			X					
Cooper's Prairie	3.2	X			X					
Larson Marsh	4.3	X			X					
Hickory Grove Lake	10	X	X	X	X	X		X	Picnic Shelters, Camping, Lodges, Office	Camping, Youth Camping, Boat Rentals, Sand Beach, Picnic Area, Lodges, Cross Country Skiing, Snowmobiling, Archery Range, Swimming
Hertz Family Woods	6.1				X	X				
Jennett Heritage Area	4.3	X	X		X	X				
Robison Wildlife Acres	5.5				X	X				Picnic areas with grills, portable bathroom (April-Oct), outdoor classroom
Christiansen Forest Preserve	2.8				X	X	X			
Gladys Leui Preserve	6.8				X					
Chichaqua Bottoms WMA	6	X	X	X	X	X		X		Modern & Primitive Camping, Paddle-In Campsites, Dog training area, geocaching, boat rental, Historic Bridge, Picnic area, Trap Range, Waterfowl Blinds for rent, Wildlife Exhibit
MUNICIPAL RECREATION FACILITIES										
Story City Park	0.2					X				Gazebo with electricity, Picnic area
Ada Hayden Heritage Park, Ames	0.1		X	X		X	X	X	Walking Path, Parking, Picnic Tables and Shelter, Restrooms	Paved Boat Access, Drinking Fountain, Water Spigot, Covered Shelters, Nature Area, Grills

Table 13 (continued)

	Miles From River	Hunting	Fishing	Paddling	Wildlife Viewing	Hiking Trails	Multi-Use Trail	Modern Restrooms	Accessible Facilities	Other
Inis Grove Park, Ames	0.2							X	Picnic Shelters	Picnic Area, Basketball courts, covered shelters, playground, restrooms, horseshoes, Tennis Courts
Moore Memorial Park, Ames	2						X	X	Picnic Shelters, Paths, Restrooms	Picnic Tables, Covered Shelters, Playground, Restrooms, Walking Paths, Paved Bike Path, Grills, Drinking Fountain
River Valley Park, Ames	0					X	X	X	Paths, Picnic Shelters, Restrooms	Picnic Tables, Covered Shelter, Playground, Restrooms, Sand Volleyball, Horseshoes,
Emma McCarthy Lee Park, Ames	2.8							X	Picnic Shelters	Covered Shelters, Playground, Restrooms, Tennis Courts, Sand Volleyball Courts, Grills
Brookside Park, Ames	1.6						X	X	Paths, picnic shelters	Picnic Shelters, Restrooms, Basketball Courts, Playground, Tennis courts, Sand Volleyball Courts, Ballfields, Wading Pool
Daley Park, Ames	4.8							X	Picnic Shelter, Restrooms, Paths	Basketball Court, Picnic Area, Covered Shelter, Playground, Restrooms, Paved Bike Path
Stewart Smith Park, Ames	1.8						X		Paths	Picnic Area, Playground, Paved Paths
4-H Park, Nevada	6.3							X	Paths	Picnic Area with Grills, Playground, Hiking, Biking
Ames Dog Park	0.5						X		Walking Path	
Cambridge Park	0.5		X			X				Picnic Area, Outdoor Classroom

Table 13 (continued)

Permanently Protected Land.

Land that is either publicly owned or held with a permanent conservation easement is considered to be permanently protected. While it's possible that these lands could be developed or cropped, it's unlikely. Lands in permanent protection provide critical habitat and water quality functions as well as open space enjoyment for people, particularly in a state like Iowa where 71% of land is either developed or used for agriculture (USDA, National Agricultural Statistics Service 2013). More than 8,700 acres of land are permanently protected within 10 miles of the South Skunk River study area *(Table 14)*.

Doolittle Prairie State Preserve is one of two State Preserves in Story County and is located less than one mile from the river near Lekwa Access. The 26-acre tallgrass prairie remnant includes fourteen pothole prairies, wetland depressions created as a result of the most recent glaciation in Story County. The north 15 acres of the preserve has never been plowed or grazed while the south portion had a history of grazing and the southwest corner was cropped until 1965. Seed harvested from the site has been used to re-establish prairie vegetation on all previously disturbed portions. A total of 220 native plant species, 45 birds, several mammals and 31 butterfly species have been documented using the site. Volunteer botanists offer guided tours of the preserve annually.

	Land Within 10 miles of South Skunk River	Land Adjoining South Skunk River
Public Areas for River Access	14	14
City Parks	267	
County Parks	1,367	409
Skunk River Greenbelt	3,392	
Recreation (High Trestle Trail, Heart of Iowa Trail)	432	
State Forest Nursery	100	
State Preserve	54	
Waterfowl Production Area	109	
WMA (McFarland Park, Chichaqua Bottoms, Jennett Heritage Area, Little Wall Lake, Paul Errington Marsh)	2,878	681
WRP Easement	113	6
Acres in Permanent Protection	8,726	1,110
Total Land in Permanent Protection within 10 miles of the South Skunk River Water Trail	8,726 acres	
Total Recreational Land within 10 miles of the South Skunk River Water Trail	8,613 acres	

Table 14

State-owned Wildlife Management Areas (WMAs) and the Skunk River Greenbelt are two of the largest types of permanent protection near the South Skunk River. Wetland Reserve Program (WRP) easements also make a significant contribution.

Other Tourism Opportunities.

Numerous attractions offer families a variety of opportunities aside from recreation *(Table 15)*. Sports fans are likely familiar with the well-established sporting venues on the ISU campus, including Jack Trice Stadium (Football) and Hilton Coliseum (Basketball, Gymnastics, Volleyball, and Wrestling). Stephen's Auditorium and Fisher Theatre, adjacent to the sports facilities, offer world class theatre, music and other cultural performances.

Attraction	Distance from River; Location
ART	
Octagon Center for the Arts: A major regional art center featuring local, regional, and national art exhibitions. Tours and art programs. Museum gift shop offers works by Iowa and Midwest artists. Year-round art education for all ages.	1.5 miles; Ames
Brunnier Art Museum: A nationally accredited decorative and fine arts museum with one of the largest glass collections tracing history of glass from antiquity to present	3.4 miles; Ames
Christian Petersen Art Museum: The museum was named for the nation's first permanent artist-in-residence, who sculpted and taught at ISU from 1934-1955. It includes two galleries showcasing work by Petersen and other contemporary artists. The museum also features special guest exhibits throughout the year.	3.3 miles; Ames
Art on Campus, Iowa State University: Self-guided, beautiful walking tours of art on Iowa State University campus. ISU has the largest public art collection of any university in the nation. Many items available for viewing 24 hours a day.	3.3 miles; Ames
Left Bank Studio: A 19th century bank converted to art studio. The bank history is depicted on a floor-to-wall mural. Sit, sip, eat, and create art at this destination.	4.1 miles; Gilbert
OUTDOOR ATTRACTIONS	
Reiman Gardens: A 17 acre public garden including a Conservatory, Butterfly Wing and gift shop. The Gardens change around a new theme annually. Reiman is also home to the world's largest concrete garden gnome.	2.3 miles; Ames
Center Grove Orchard: An orchard and family attraction in a farm setting including weekend festivals with live entertainment, apples and pumpkins, and farm animals.	1.4 miles; Cambridge
Prairie Moon Vineyard & Winery: A family owned and operated winery producing regional wines with character. Live music outdoors every Sunday in the summer.	3.5 miles; Ames
Kate Shelley High Bridge: The Kate Shelley High Bridge is the tallest double-track railroad bridge in America. On the National Register of Historic Places, this bridge is named for the Iowa Railroad heroine, Kate Shelley.	23.6 miles; Boone
High Trestle Trail Bridge: The High Trestle Trail Bridge rises 13 stories in the air above the Des Moines River valley. Beautiful lights illuminate the bridge at night.	18.9 miles; Madrid
OTHER	
Carrie Chapman Catt Center for Women and Politics: The Center is a tribute to Carrie Chapman Catt, an ISU graduate who led the women's suffrage movement to passage of the 19th amendment. The Center includes exhibits related to suffrage movement along with some of Catt's personal belongings. A "Plaza of Heroines" features nearly 3,000 bricks honoring women.	3.1 miles; Ames
Niland's Café and Colo Motel: A restored gas station, motel, and cafe from the early days of motoring, at a formerly key (but now fairly sleepy) transcontinental highway intersection.	16.1 miles; Colo

Table 15

An outstanding collection of art attractions, in particular, is located within 5 miles of the South Skunk River. Other types of attractions provide a well-rounded experience for water trail users and families.

Geologic Resources

The surficial geology of this Story County study area is a result of the last great continental glacier, the Laurentide Ice Sheet (Quade et al. 2004). Multiple lobes from this ice sheet flowed into topographic low points. The lobe impacting the north central one-fifth of Iowa, the Late Wisconsin lobate extension, created the landform region known as the Des Moines Lobe, which is also the ecoregion name where Story County is located. Restricted to north central Iowa, the glacial lobe entered the state about 15,000 years ago, reaching its southern terminus about 14,000 years ago at present day Des Moines. The ice mass then began to melt in place. Rocks and soil embedded in the glacier were left on the land surface as a layer, 50 or more feet thick, of a material known as glacial till. The till plain was pockmarked by depressions that filled with water, creating thousands of ponds and lakes, most of which have been drained and tiled for agriculture.

About 13,500 years ago, the retreat of the glacier halted at present day Ames. Early geologists remarked about the presence of a long, curving ridge of sand and gravel in the northern part of Story County. Parts of present day Ames sit on this ridge, which is known as the Altamont Moraine. The South Skunk River passes through the highest, thickest part of this moraine downstream from the Sopers Mill Access. The glacier resumed melting about 13,000 years ago. The Altamont Moraine acted as an enormous dam, trapping meltwater and creating an immense lake called Lake Wright that extended 40 miles north into present day Wright County. The rising water soon overtopped low points on the moraine, resulting in catastrophic floods that within 400 years (12,600 years ago,) drained Lake Wright. The South Skunk River and Squaw Creek valleys were widened and deepened by these floods, and an entirely new channel was gouged out. This valley, today occupied by tiny Kegley Branch, enters the South Skunk at Soper Mills Access.

The earliest professional landscape interpretation in Story County was published in 1898 as a part of a systematic county-by-county investigation and mapping effort by the Iowa Geological Survey series of county geology (Kemmis et al. 1981). As part of this publication, Samuel Beyer reported that a majority of the land was comprised of undrained chains of kettle holes and swales in a northwest – southeast trend. There was little connection between the wet areas except during the spring or during extensive wet period. His observations included, “In scores of (township) sections… the water which falls upon them, save during periods of very high water, cannot escape save through seepage, evaporation or tiling. Many of these ponds persist during the year” (p. 163). Today these circular depressions in the land are known as pothole prairie wetlands. Doolittle Prairie State Preserve is an excellent, remaining undrained remnant of this landscape type.

Bedrock outcrops near the South Skunk in northern Story County were recognized as valuable by both prehistoric people and early European settlers. Aboriginally, chert-bearing strata in the study area were used as far back as the Late Paleoindian Period (between 10,500 and 8,000 years ago) in the fabrication of implements and tools (Hoksbergen, 2004). Economic production of geological materials by 1897 included clay working (used for bricks and drainage tiles), coal mining, a small amount of building stone production, and glacial boulders shaped into building stone (Beyer 1898). *Figure 20* depicts the location of these geologic features near the Upper South Skunk.

Early geologist Beyer also identified stark differences between the upper and lower portions of the South Skunk in Story County. In addition to the discernible difference in floodplain width between upper and lower described earlier, he also distinguishes differences in bedrock features and slope of the river channel. He notes that bedrock exposures, while present in the Upper South Skunk valley, are absent downstream of Hannam’s Mill (the location of the present day General Filter Dam). Many historians, including Beyer, noted the presence of the narrow bedrock gorge on either side of the original Soper’s Mill site. Beyer estimates a channel slope of approximately 5 feet per mile (0.09%) above Hannum’s Mill (known as the General Filter Dam today) and approximately 2 feet per mile (0.03%) below the mill dam.

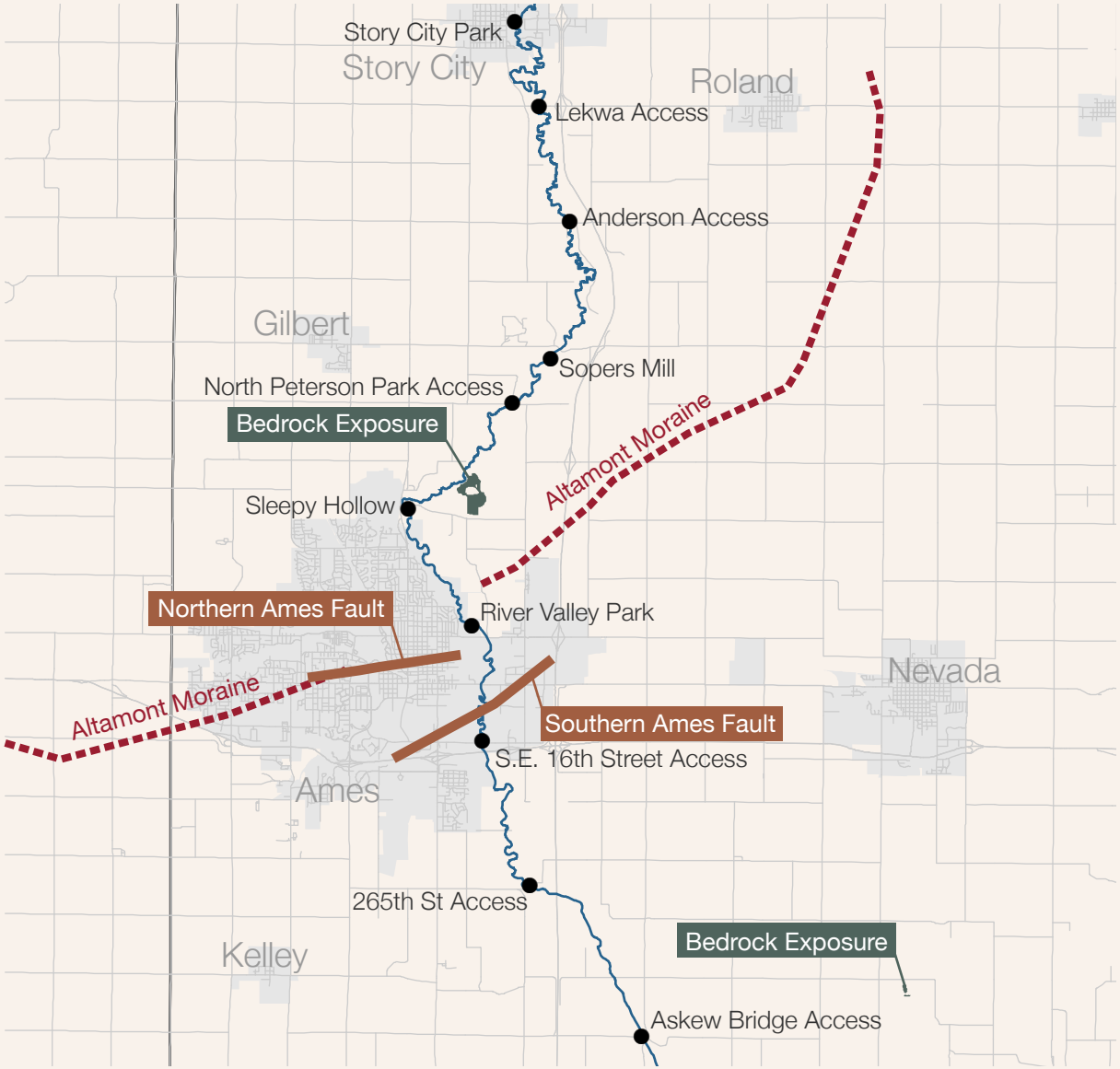


Figure 20

The end moraine of the Altamont Glacial advance can be seen just northeast of River Valley Park Access. A wall of ice several hundred feet tall would have stood here 13,500 years ago. The South Skunk also passes over two geological faults which have not been active for the last 300 million years.

Flooding.

Like many Iowa cities, proximity to a river was a primary early consideration in locating a city. The majority of the original city of Ames was located on a delta-shaped terrace separating the South Skunk and Squaw Creek. In this study area, flood records are most complete for the portion of the river near Ames, due in large part to the three river gages present in or near the city. Continuous streamflow records have been collected since 1919 by a gage on the South Skunk River near the Sleepy Hollow Access. Minimal flood information is available for Story County before this time.

The National Weather Service (NWS) flood stage at this gage is 14 feet. Water levels reaching or exceeding this height were recorded at the gage during at least seven years since 1918 (U.S. Geological Survey 2016). A gage height of 26.72 was recorded at this gage (U.S. Geological Survey 2016) during the flood of record in August 2010 (Barnes and Eash 2012). This flood established new maximum peak discharges as well as urban flood damage in the area of this gage. Prior to this event, the 1975 flood had caused the most urban flood damage in the basin (Heinitz and Wiitala, 1978).

Hydrogeology.

There is a unique history between hydrology, geology and the South Skunk River near Ames that impacts users of the river today. Ames derives its drinking water supply from groundwater through well fields located in the buried, interconnected bedrock river channels of Squaw Creek and the South Skunk River. Squaw Creek, the smaller of the two rivers today, is thought to be the older and deeper of the two channels (Simpkins and Christensen 2008). City of Ames backup water supplies were developed and first utilized during the drought of 1977. A sand and gravel operation, known locally as Hallett's Quarry, operated on the north side of Ames for 35 years beginning in the 1950's (http://www.ameshistory.org/exhibits/hallets/hallets3.htm).

Excavators noticed that the sand and gravel quarry filled quickly with water during extraction, requiring the continual use of pumps. The expense of operating the pumps eventually contributed to a cease in operations at the location. Groundwater, rather than surface flow, was the source of this water. Simpkins and Christensen (2008) summarize the local response to the 1976-7drought. They explain that Dr. Merwin Dougal and his colleagues at the Iowa State Water Resources Research Institute developed an ingenious approach utilizing water in the quarry to counteract extremely low water levels in the Ames well fields during the drought. They proposed building a dam in the South Skunk in North River Valley Park and pumping water from the Hallett Quarry across the street, Grand Avenue / Highway 69, into the South Skunk River. They believed water would travel from the river channel into and raise water levels in the aquifer containing the city wells. The quarry ponds, up to 50 feet deep, are located approximately 2.5 river miles upstream from what is now known as the 13th Street Dam.

Initially the 8-10' high dam was built at its current location utilizing sand and gravel in the river channel. The dam location was selected because the researchers believed water would travel from this location toward the well fields using the bedrock river channel. Water levels in the well fields returned to normal after four days of pumping water into the channel. More recently, researchers deduced that it was likely a pressure response from the water pumped into the channel that moved extra water into the well fields, rather than the same water that was pumped into the channel migrating to the well fields so rapidly (Todd, 1980). The sand dam washed away later in 1977 and was rebuilt in 1981-2 in response to another drought. A permanent low head dam was constructed at the location in 1983-4.

With the exception of acting as a water supply for drought relief, the quarry sat vacant and abandoned from 1996 when mining operations ceased (Christensen, 2008) until 2001 when the Ames passed a bond issue to purchase it as a permanent backup water supply and recreation park. Research on the quarry site, now known as Ada Hayden Heritage Park, determined that groundwater likely moves approximately 1 billion gallons of water into the lake annually, which overflows into the South Skunk River.

Historic Descriptions.

The Skunk River valley as well as the uplands north of Ames presented a great deal of water-related obstacles to European settlement (Allen 1887, Marean and Jones 1904, Payne 1911). One common nickname for the wet lands, above which were perched settlements and homes, was the “Slough of Despond” (Gradwohl and Osborn 1972). But not all aspects of the high water table were an obstacle.

A series of lakes were created in the Keigley Branch sub watershed near Story City beginning around 1914. Two artesian wells generated enough water to create the attraction known as Watkin’s Lake and later as Lake Comar (Brown 1993). Fishing, swimming, boating, an outdoor auditorium, an ice cream parlor, roller skating rink, a nine-hole golf course and an ice house were included at the attraction during its most popular era, the 1920’s. The lake was converted to an operation producing wholesale goldfish to markets in Kansas City, Omaha and Minneapolis until 1950. The land is now part of a farm owned by Brent and Jody Larson. The river segment in what is now North River Valley Park in Ames, near the former site of Carr Pool, was an important early fishing and swimming hole *(Figure 21)*.

Figure 21

Prior to the advent of public swimming pools in the mid-1920’s, rivers such as the South Skunk were important places to cool off and recreate. Tragically, an ISU student drowned near the location of this photo in 2014. He was tubing during flood stage without a PFD and became entangled under a brush pile on an outside bend of the river. These hazards are known as sweepers and are common on the South Skunk. Photo courtesy of Ames Historical Society.

Cultural & Historic Resources

There are multiple theories as to the how the South Skunk River received its name. One theory is that it may came from the Algonquin word “checaque,” (Petersen 1941) which means a rank or offensive odor, such as onions. Another suggests the name originated from the large population of skunks that lived on the banks of the river. The Skunk River was labeled as “Polecat R.” on a map produced in 1814, the Map of Lewis and Clark’s Track Across the Western Portion of North America *(Figure 22)*. The final map was produced by Samuel Lewis after William Clark’s original drawing following his suicide. Polecat was a common name for the striped skunk during that era. The third theory suggests that the river was named for the odorous wild “skunk onions”— also known as Skunk Cabbage (Symplocarpus foetidus). Skunk Cabbage is a wetland plant once common on the banks of the river (Skunk River Paddlers). Skunk Cabbage was described as being the first green plant to appear at the beginning of spring and was important both for Native people of the area and the settlers (Skunk River Paddlers).

Figure 22

Clark’s 1814 map was the first to chart the northwest part of North America and was derived from daily observations while in the field and Indian reports and maps copied by Lewis and Clark.

Prehistoric People.

Numerous studies conclude this area was a place of prehistoric habitation, including an investigation published in 1972 by ISU researchers linked with the failed attempt to establish the Ames Reservoir (Gradwohl and Osborn 1972). Gradwohl and Osborn reported the presence of a relatively extensive collection of stone tools which indicate prehistoric habitation and chipping areas along the South Skunk River *(Figure 23)*. This is additionally supported by the presence of Warsaw dolomitic chert, which is a variety of lithic raw material. More recent archaeologic evidence near the river indicates that all prehistoric cultural periods are represented in the upper South Skunk River valley in Story County with the possible exception of Early Paleoindian (Hoksbergen 2004). John Hoksbergen, an ISU graduate student, analyzed 55 projectile points made from this chert from 19 sites in the upper South Skunk River valley upstream of its confluence with Squaw Creek. Hoksbergen's 2004 thesis concludes that over 9000 years of occupation are represented by prehistoric materials recovered in the upper South Skunk River valley. In addition to prehistoric tools, several human remains have been found along the South Skunk River. A human calvarium was believed to be the skull of a male Indian, supporting occupation of the area during the Woodland time period (Gradwohl & Osborn 1972).

The Phase IA Study conducted by the Iowa Office of State Archeology for this project concluded there are 131 known archaeological sites recorded from bluff top to bluff top on either side of the South Skunk in Story County, 87 within 400m of the streambanks of the South Skunk (Perry 2014). Some of these sites are located on public property and others are privately owned. Of the 131 sites, 95 sites include prehistoric components, 19 with historic components and 18 contained both historical and prehistoric components. Recorded prehistoric sties included isolated finds, camps, scatters, lithic scatters, open habitations, and kill/butchering.

Figure 23

These tools are examples of those collected at archaeological sites in the South Skunk River Valley near Ames and represent most of the prehistory cultural occupational periods in the South Skunk Valley. Up to six of the artifacts are fashioned with locally available sources of chert. All were fashioned and used between 3000 BC to 500 AD. Tools include a stone ax, projectile points, drill and an end scraper. The 2 pottery shards were collected from sandbars.

Area at the Time of European Settlement.

At the time of European settlement in the mid 1800's, two Native American cultures dominated the landscape in the region that was to become the state of Iowa *(Figure 24)*. The Lakota, also known as the Sioux, were located in the north while the Meskwaki, also known as the Sauk and Fox, to the south and east. The Meskwaki originated during the Woodland Culture and inhabited the bioregion from the Missouri-Mississippi River Divide in mid/central Iowa to the east coast and north to the great lakes and south to Kentucky (Buffalo, personal communication 2014). Johnathan Buffalo, Tribal Historical Preservation Coordinator, was interviewed for this project and conveyed the following history of the Meskwaki people prior to and following settlement. Rivers played a prominent role in tribal settlement patterns as well as food sources. The tribe's home river has always been the Iowa River. However, family groups also lived in other adjacent river valleys, including the South Skunk in Story County.

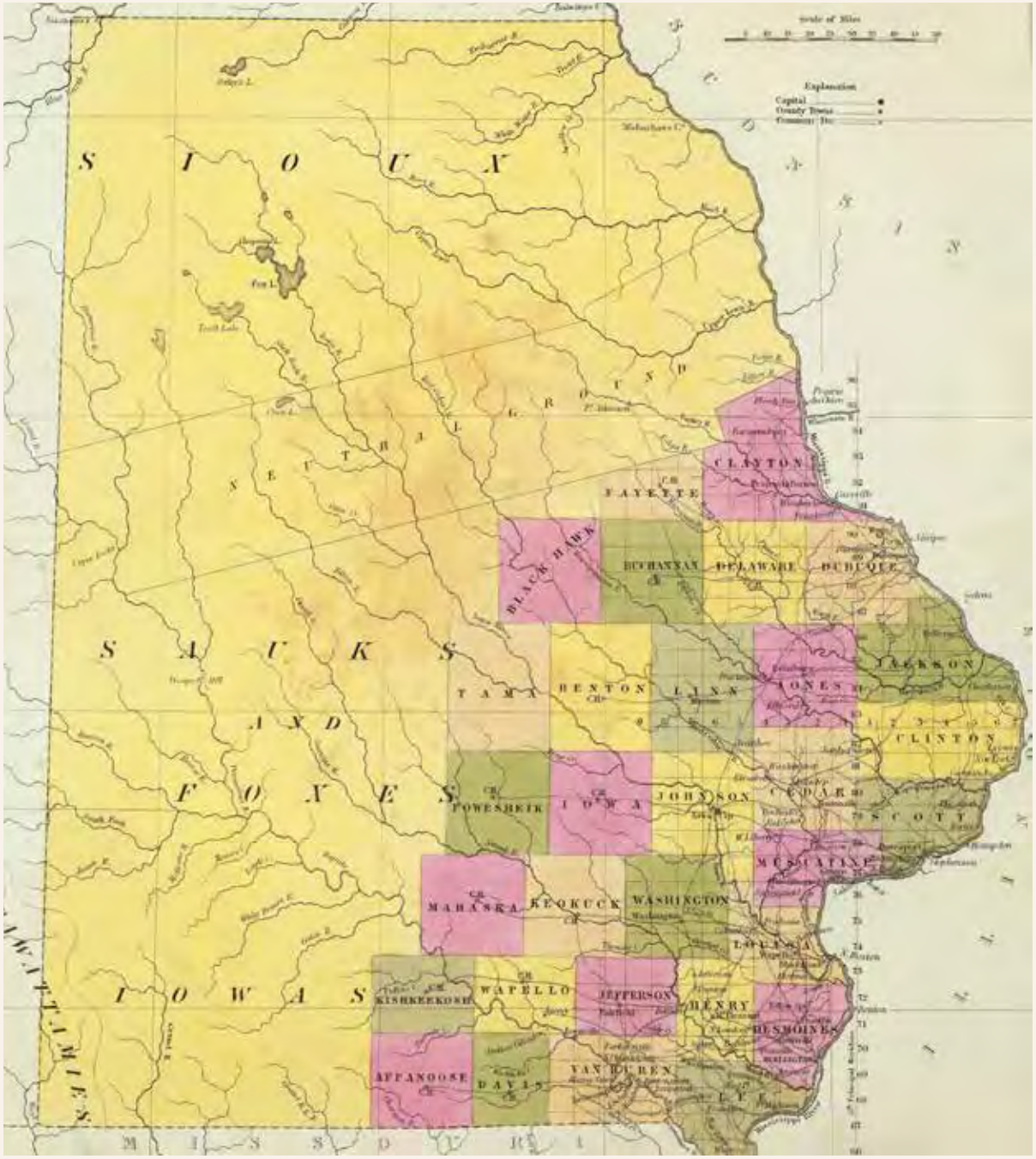


Figure 24

This map was published in 1846, the same year Iowa was granted statehood, by Samuel Augustus Mitchell. White settlement of the eastern edge of the Iowa territory was a direct result of the defeat of the Sauks in the Black Hawk War and the Black Hawk Treaty of 1832.

Meskwaki utilized separate summer camps and winter homes. Structures constructed by the Meskwaki were composed of vegetation common to the floodplain and near floodplain landscape positions. Winter homes, wooden pole structure covered with bark and cattails, are known as wickiups *(Figure 25)*. Trees found suitable for the wooden poles included willow, ironwood and maple. An outer woven layer of giant cattail and an inner layer of woven bulrush covered the wooden frame. Thread created from the inner bark of basswood (linden) trees and nettles were used to sew the woven layers. Winter home sites were organized by family and were located near the river, allowing for easy access. Walking on frozen rivers were the main transportation route between homes.

Summer camps hosted larger extended families. Summer camp structures were permanent and covered with red elm bark. Summer camp work was primarily focused on preparing for the winter. This was accomplished by gathering and preparing various food goods. A portion of the food was buried near the summer camp sites so they had food when they returned from winter. Plants collected by the Meskwaki included Arrowhead roots (also referred to as water potatoes), bulrushes, cattails, berries, various roots, and nuts.

Some species of animals were also a part of the diet. Meskwaki would eat any animal with the exception of lizards and animals that were predators. Johnathan Buffalo explained that predatory animals were intentionally not hunted because long ago their people made an ancient pact with these animals that they would not kill and eat each other. Black bears, buffalo and deer were excluded from this since they were considered to be foragers and not hunters. He also explained the Meskwaki belief that the channel bottom of the river is alive and possesses energy.

Figure 25

A variety of cattail, much taller than the 3-4 foot cattails found in Iowa today, were used to create one of the woven mat coverings on wickiup structures. Cattails and other wetland plant species used by the Meskwaki for food and structures were common along the South Skunk River prior to straightening and drainage which began in the late 1800's in Story County.

Arlen Twedt, an Iowa historian and retired educator, discovered many references to 1850's–1930s Meskwaki camps near and visits to communities in central Iowa counties. *Figure 26* illustrates potential sites of Meskwaki use during this time period in Story County near the South Skunk River based on Twedt's research. His sources included letters, oral histories, newspaper accounts, and county and other history books (OSA http://archaeology.uiowa.edu/meskwaki-sites-along-upper-south-skunk-river).

It is believed that the Meskwaki probably continued to camp along the Skunk River area until around the 1930's (Twedt 2012). Settler accounts note that Meskwaki could still be found seasonally inhabiting the Skunk River watershed during the fall and spring, as well as accounts of the Meskwaki camping on the Skunk bottom in the winters. European settlement brought changes to the land as well as to other aspects of Meskwaki life. In addition to land clearing and drainage, which eliminated vegetation required for home construction and food, other forms of European infrastructure imported by settlers were also problematic. The establishment of property lines, fence rows, railroads and roads would eventually eliminate the traditional Meskwaki summer-winter migration. Many Meskwaki families, however, had personal relationships with settler families and were often allowed to camp and hunt on settler's land because the game the Meskwaki hunted was considered to be "rodents" by the settlers.

The treaties of 1837 and 1842 with the Meskwaki granted their Iowa lands to the United States Government and required them to move to a

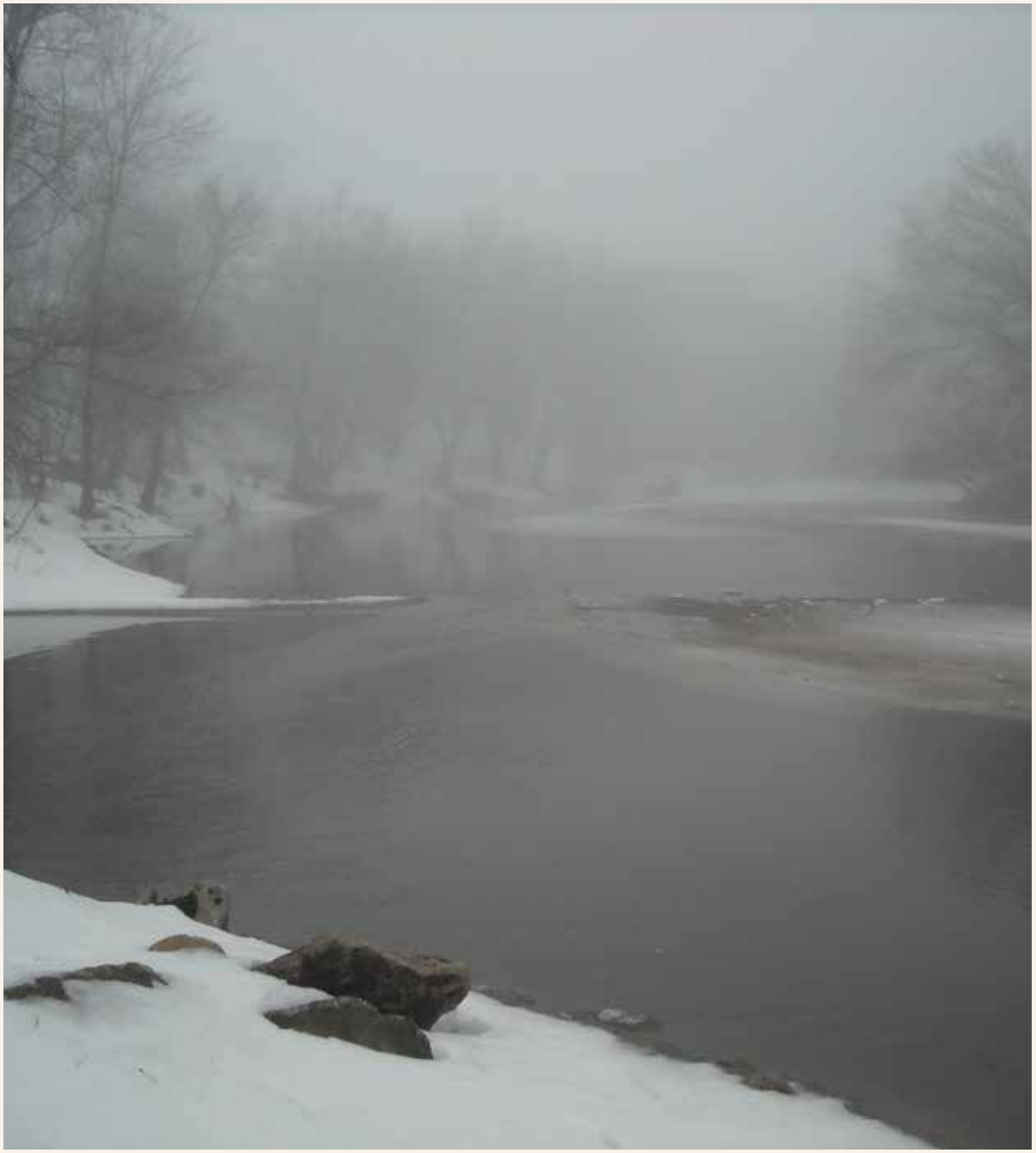
Figure 26

Meskwaki use of the South Skunk River, compiled from white settler accounts from the mid to late 1800's, was extensive and varied.

"Reservation" on the Missouri River. When the time came for the Meskwaki to move, many had scattered on hunting expeditions, making the transfer complicated. When they did arrive at their destination in Kansas they found the land to be inhospitable for hunting and agriculture. Many younger and elder Meskwaki died as a result of the hardships (Ward 1906).

Indians were not recognized citizens and therefore could not hold property by deed according to the government. However, a law permitting Indian residence had been passed in 1856 in Iowa. In the "fall of 1856 Chief Ma mi nwa ni ka of the Meskwaki raised $735.00 and brought it to Iowa with Ha pa ya sha, and others" (p. 194, Ward 1906) to secure an eighty-acre plot along the Iowa River. When this news got back to Kansas many groups of Indians made the move. According to accounts of the time the eighty-acre plot became crowded and with no regular income, basic necessities were often hard to come by.

The transition from a hunter-gatherer-farming culture to an economy based on money was a difficult transition for the Meskwaki. The government refused to pay the Meskwaki annuities in Iowa, and due to this they were often reduced to begging when money was scarce. It should also be noted that the Meskwaki were a communal culture and what European settlers may have been perceived as begging was actually a part of the cultural tradition of sharing when moving or visiting for Meskwaki (C. Haury-Artz, personal communication, 2015). It was not until 1867 that the United States Government resumed paying annuities to the Meskwaki. With regular income the Meskwaki were able to purchase "some four hundred acres" within two years (Ward 1906).



Early Settlement.

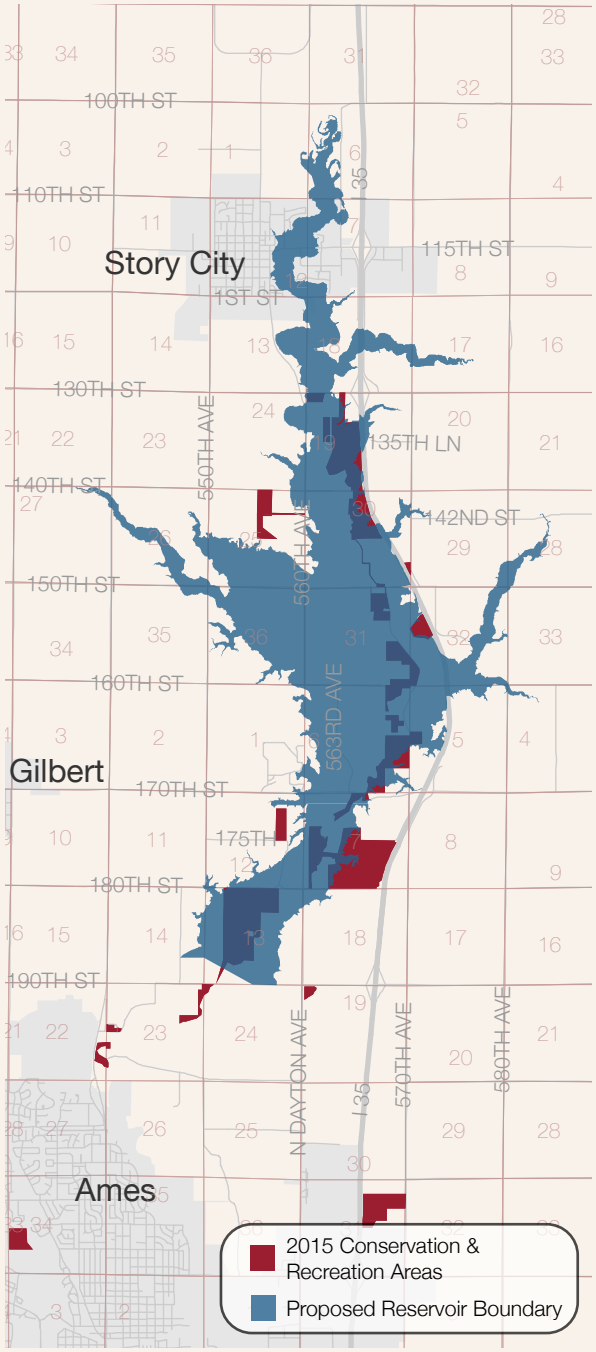
European settlers, as has been noted earlier, began significantly changing the landscape after their arrival. Similar to other parts of newly settled Iowa, saw and grist mills were soon established on the South Skunk River. Two prominent mills in Story County included Soper's and Hannum's. Both mills were situated in bedrock-exposed channel segments and both are located fairly near current river accesses. Soper's Mill operated for 30-40 years. Some of the original timber from mill dam is still visible in extremely low water though the site is located on private property. Hannum's has been reconstructed several times and is now known as the General Filter Dam. It is the site of at least two drownings in recent years.

Much of what is known about the South Skunk and its watershed during the first 100 years after settlement comes from the work of ISU researchers and graduate students. Louis H. Pammel, a professor of botany from 1889 to 1929, was an important and impressive figure in the state of Iowa. He is probably best known for his role in establishing a state park system in Iowa as a vehicle to conserve important natural resources. Thirty-eight state parks were created during his tenure as the first president of the Iowa State Board of Conservation. Pammel served on state, national and international societies including the Botanical Society of America and was twice elected President of the Iowa Academy of Science. His work is recognized through the various places in the state named after him including Pammel State Park; on the ISU campus Pammel Court (a student apartment complex), Pammel Drive and Pammel Woods are named after him. Some of Pammel's achievements included 10 books and approximately 700 papers. With Ada Hayden, he helped establish and build the Iowa State Herbarium to include around 200,000 specimens.

Figure 27

This photo of Dr. Louis H. Pammel posing with the "natural graft of American elms" was included in Raymond J. Becraft's 1923 thesis. The unique specimen served as a local landmark for residents and travelers. The tree died and was finally removed in the 1970's.

Pammel served as major professor for graduate student Raymond J. Becraft and proposed his study. Becraft's 1923 thesis, "The Distribution of Trees Along Upper Skunk River, Iowa," described the soils as well as abundance and distribution of trees along the South Skunk River between Ames and the north Story County limits. The river valley was described as being a deciduous forest to prairie transition with narrow strips of timber along the riparian corridor. One tree in this study area caught the special attention of the researchers. A natural graft of two American elm trees was located near what is today known as Anderson Access *(Figure 27)*. Anderson Access was formerly known as Anderson H-Tree Access. Ray Becraft went on as a Professor of Range Management to found what is known today as the College of Natural Sciences at Utah State University.



Flood Control Proposal.

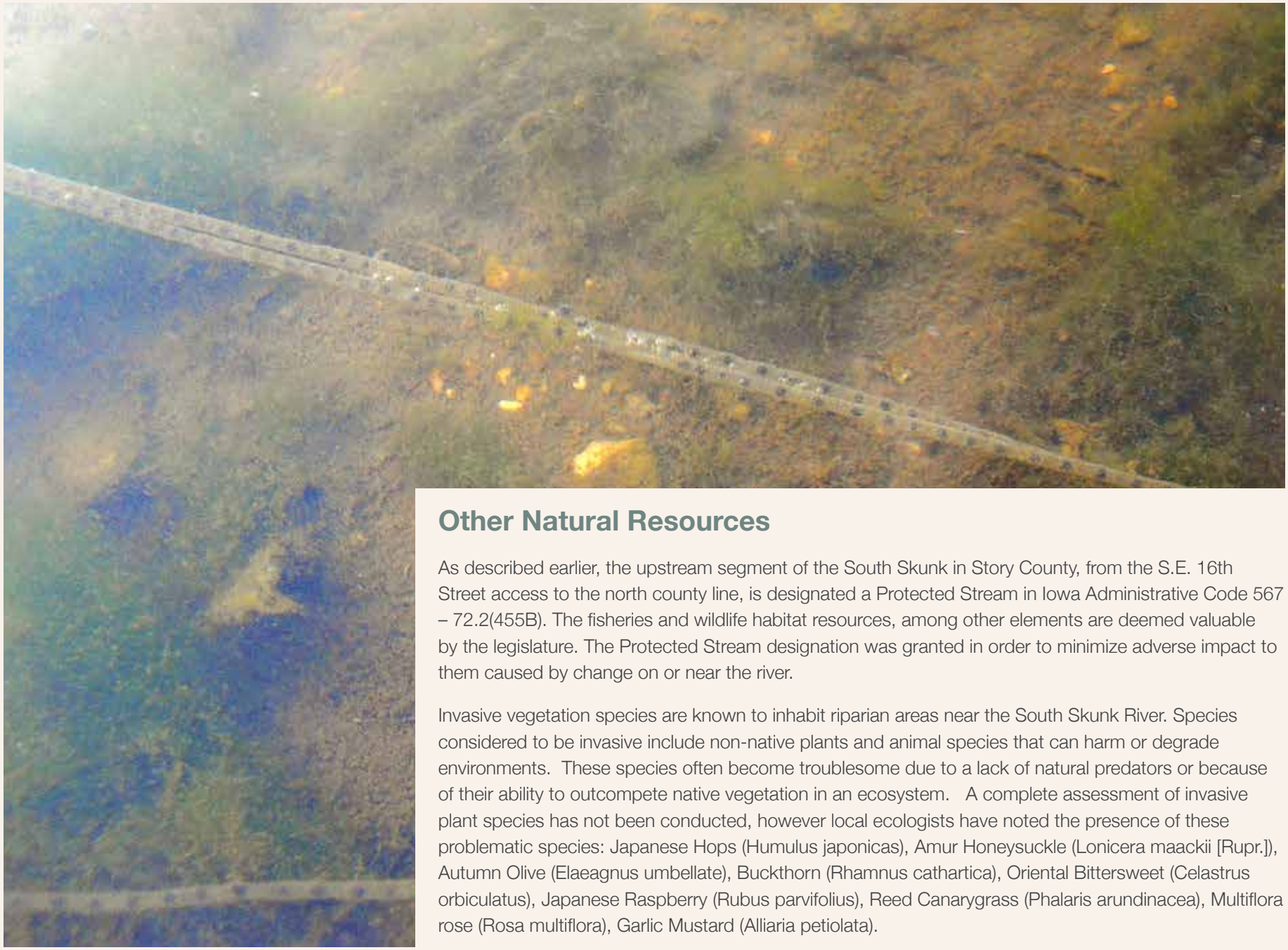
A dam and reservoir north of Ames on the South Skunk River was discussed and proposed following discussions over several decades. This proposal would have a large impact on natural resources in the South Skunk River corridor today. The primary function of this dam would have been to provide flood control along the middle and lower reaches of the Skunk River and eventually along the Mississippi River. The dam had a proposed height of 85 feet and would have permanently flooded 2100 acres along the South Skunk River, and Bear and Keigley creeks *(Figure 28)* (Gradwohl & Osborn 1972). Water would have expanded during flood events to cover 5,000 acres, reaching the Hamilton County line along the South Skunk channel alignment.

Landowners in the area of the proposed reservoir were adamantly opposed to the project. The proposal was defeated in 1973 when the Ames Reservoir Environmental Study concluded that the dam would cause a loss of all wildlife habitat under the water and an increase of acreage placed under cultivation into the surrounding area to compensate for the farm lands that were placed under water (Petersen 1973).

It was recommended that the emotional attachment stakeholders and landowners had to the area directly around the proposed reservoir be considered, as well as the corridor having multi-purpose value for the amount of timber and wildlife that would be eliminated by the construction of the dam (Petersen 1973). A land use policy protecting the mature forest surrounding this segment of the river was accepted by landowners as an alternative to construction of the reservoir. Known formally as the South Skunk River Greenbelt Conservation District, an area of 2,040 acres was established protecting existing mature trees from clearing and prohibiting the development of homes and businesses other than agriculture in the district. The purpose of this special district was to provide at least partial flood protection downstream while preserving the unique nature of this portion of the upper Skunk River and providing recreational opportunities for the public (U.S. Army Corps of Engineers, Rock Island District 1987). In addition to natural resources, without this special protection, it's unlikely the geologic, cultural and historic resources along the river would remain as intact as they are (Hoksbergen 2004).

Figure 28

Nearly all land owned today for public recreation north of Ames, as well as a large portion of Story City, would have been occupied by the flood pool of the proposed Corps of Engineers reservoir. The development of the Skunk River Greenbelt as well as protection of the existing riparian forest along the river and the preservation of numerous archaeological sites in the proposed pool area are a direct result of the failure to construct this reservoir.



Other Natural Resources

As described earlier, the upstream segment of the South Skunk in Story County, from the S.E. 16th Street access to the north county line, is designated a Protected Stream in Iowa Administrative Code 567 – 72.2(455B). The fisheries and wildlife habitat resources, among other elements are deemed valuable by the legislature. The Protected Stream designation was granted in order to minimize adverse impact to them caused by change on or near the river.

Invasive vegetation species are known to inhabit riparian areas near the South Skunk River. Species considered to be invasive include non-native plants and animal species that can harm or degrade environments. These species often become troublesome due to a lack of natural predators or because of their ability to outcompete native vegetation in an ecosystem. A complete assessment of invasive plant species has not been conducted, however local ecologists have noted the presence of these problematic species: Japanese Hops (Humulus japonicas), Amur Honeysuckle (Lonicera maackii [Rupr.]), Autumn Olive (Elaeagnus umbellate), Buckthorn (Rhamnus cathartica), Oriental Bittersweet (Celastrus orbiculatus), Japanese Raspberry (Rubus parvifolius), Reed Canarygrass (Phalaris arundinacea), Multiflora rose (Rosa multiflora), Garlic Mustard (Alliaria petiolata).

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 Iowan Surface ecoregion. A segment of the South Skunk River upstream of Ames is included as one of the reference site Iowa DNR uses for the Des Moines Lobe ecoregion. Reference reaches are defined as those with least altered of physical conditions of all rivers in the ecoregion.

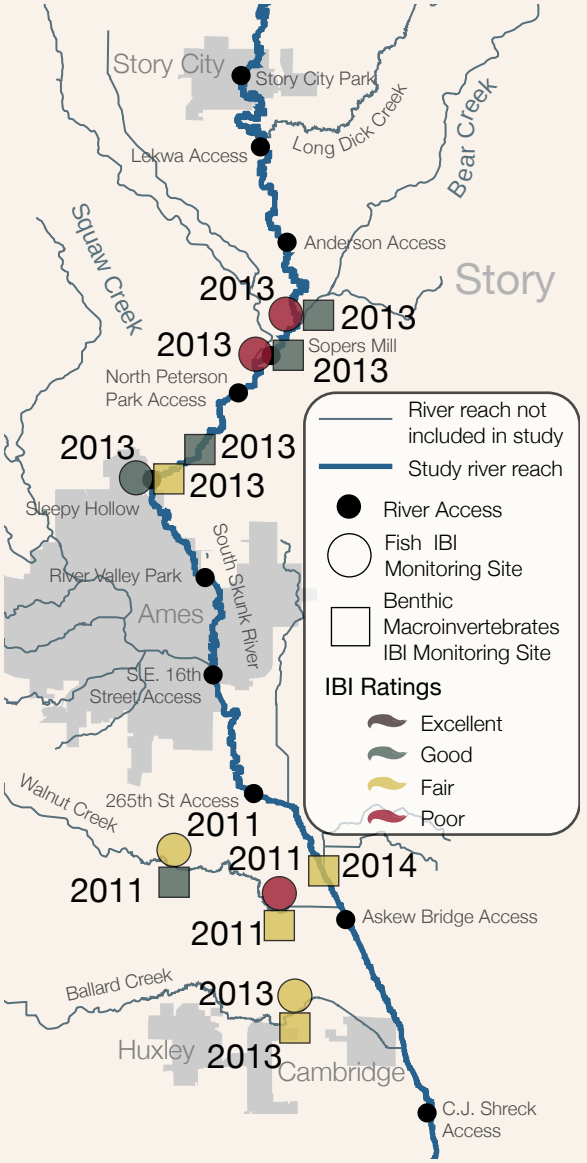
Fish species present in a particular Iowa stream reach are likely to reflect the physical habitat present in that reach as well as broad regional patterns of stream condition and fish assemblages rather than water quality (Wilton 2004). Three detailed inventories of fish assessment occurred in the past 5 years upstream of North River Valley Park, all in 2013, while no assessments occurred on downstream locations. Results included both "good" and "poor" qualitative scoring categories based on ecoregional expectations *(Figure 29)*.

A less scientifically rigorous list of fish species known to occur in the South Skunk River upstream of Ames was generated for the 2010 Iowa Dams Plan by the Iowa DNR *(Figure 30)*. This inventory reported 31 species in North River Valley Park near the 13th Street Dam. Thirty-six species were reported further upstream near the Sleepy Hollow Access near the General Filter/Hannum's Mill Dam. These species included Bigmouth Buffalo, Bigmouth Shiner, Black Bullhead, Black Crappie, Bluegill, Bluntnose Minnow, Brassy Minnow, Carpsucker Spp, Central Stoneroller, Channel Catfish, Common Carp, Common Shiner, Creek Chub, Fantail Darter, Fathead Minnow, Gizzard Shad, Golden Redhorse, Green Sunfish, Highfin Carpsucker, Moxostoma, Northern Hog Sucker, Orangespotted Sunfish, Quillback Carpsucker, Red Shiner, River Carpsucker, Sand Shiner, Shorthead Redhorse, Slender Madtom, Slenderhead Darter, Smallmouth Bass, Smallmouth Buffalo, Spotfin Shiner, Stonecat, Suckermouth Minnow, White Crappie, White Sucker, and Yellow Bullhead.

Figure 29

A diverse fish and benthic macroinvertebrate population in Iowa is typically more influenced by habitat conditions in the river and region compared to water quality. Monitoring on the South Skunk and its tributaries in Story County include mixed results in the past 5 years, ranging from good to poor.

Source: Iowa Department of Natural Resources BIONET



Benthic macroinvertebrate assessment scores in Iowa are also more likely to be associated with physical habitat factors compared to water quality. For example, stream segments with an abundance of coarse gravel channel substrates tend to support a higher diversity of benthic macroinvertebrates compared to segments with silty channel substrates (Wilton 2004). Three of the four benthic macroinvertebrate assessments conducted in the past 5 years upstream of North River Valley Park were "good" qualitative scoring category while one was in the "fair" category *(Figure 29)*. Only one assessment occurred downstream of North River Valley Park. This assessment site is located near the confluence with Walnut Creek, within the channelized portion of the river, was assessed within the "fair" scoring category. Iowa

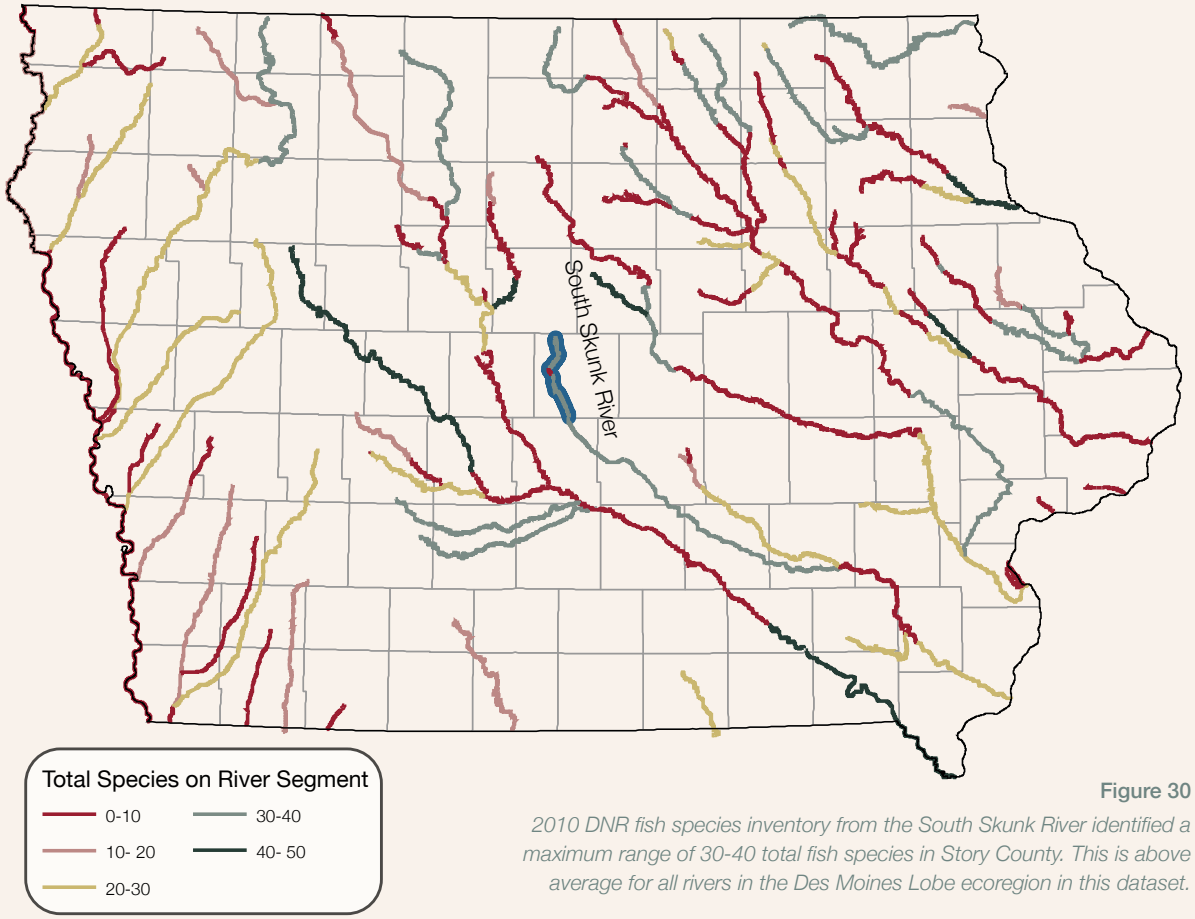


Figure 30

2010 DNR fish species inventory from the South Skunk River identified a maximum range of 30-40 total fish species in Story County. This is above average for all rivers in the Des Moines Lobe ecoregion in this dataset.

DNR mussel survey data identified 5 living mussel species in the South Skunk River in Story County in 2013 upstream of North River Valley Park *(Table 16)*. Three of the five species are Iowa Species of Greatest Conservation Need, including two Iowa Threatened Species.

Organic enrichment and physical habitat alterations are the likely culprits that have been identified for causing degradation of aquatic life in the South Skunk River corridor. Organic enrichment occurs as a result of riparian livestock grazing, row crop agriculture and municipal wastewater discharges. The application of animal waste from confined animal feeding operations (CAFOs) is also a potential source of stream nutrient and organic enrichment that needs further investigation. Physical habitat alterations include dams, bridges, channelization and the removal of riparian forest cover.

Mussel Species	Living Mussel	Recently Dead Mussel	Notes
Paper Pondshell		X	SGCN, Rare in Iowa, populations declining
Cylindrical Papershell	X		Listed as a Threatened Species in Iowa; Rare in Iowa, declining populations
Creek Heelsplitter		X	Listed as a Threatened Species in Iowa; Rare in Iowa, declining populations
White Heelsplitter	X		Uncommon in Iowa[1]
Mapleleaf		X	Uncommon in Iowa[1]
Threeridge	X		Uncommon in Iowa[1]
Fatmucket	X		Uncommon in Iowa[1]
Plain Pocketbook	X		Common in Iowa[1]

Table 16

The 2013 Iowa DNR Mussel Survey identified five mussel species living in the South Skunk River in Story County including one threatened species and an additional species on the Iowa Species of Greatest Conservation Need list. A recently dead specimen, the Creek Heelsplitter, is also listed as a threatened species in Iowa. All notations were sourced from the Iowa Wildlife Action Plan (2007) unless otherwise noted.

1 Source: Freshwater Mussel Species of Iowa, Cedar Valley RC&D, 2002

Bird Species.

Breeding birds are of great interest to many Iowans. The Breeding Bird Atlas (BBA) 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 surveys record evidence of breeding. The Breeding Bird Atlas has been compiled twice in Iowa with the most recent compilation, BBA II, from 2008 to 2012. Only one BBA II study block included the South Skunk River; this block was located near the Sleepy Hollow Access in north Ames. BBA I monitoring (1986 to1990) included three blocks on the river.

Story County Conservation augmented the BBA II monitoring in 2014 with additional bird surveys in the Skunk River Greenbelt by independent researcher, Tyler Harms. This survey utilized 29 randomized survey points in the Greenbelt between the Lekwa and Soper's Mill accesses.

A total of 146 bird species were reported using or breeding in either or both the BBA II study block or in the Skunk River Greenbelt, 23% (34) of these are included on Iowa's Species of Greatest Conservation Need (SGCN) List. *Table 17* details SGCN species identified in the study area. A full list of species reported is represented in Appendix A.

The South Skunk River Corridor in Story County contains several known Bald Eagle nest sites. It is also a high potential area for colonial waterbird rookeries including Great Blue Heron and Double-crested Cormorant, both of which have been identified in the river corridor during breeding season.

	Special Concern	Species of Greatest Conservation Need
Bald Eagle	X	X
Black Tern	X	X
Forster's Tern	X	X
Acadian Flycatcher*		X
American Bittern		X
American White Pelican		X
Barn Swallow		X
Bell's Vireo		X
Black-Billed Cuckoo		X
Black-crowned Night-Heron		X
Blue-winged Warbler		X
Bobolink		X
Broad-winged Hawk		X
Chimney Swift		X
Common Nighthawk		X
Dickcissel		X
Eastern Meadowlark*		X

	Special Concern	Species of Greatest Conservation Need
Eastern Towhee*		X
Field Sparrow*		X
Grasshopper Sparrow		X
Least Bittern		X
Least Flycatcher*		X
Northern Mockingbird		X
Northern Pintail		X
Osprey		X
Prothonotary Warbler		X
Red-headed Woodpecker*		X
Sedge Wren		X
Trumpeter Swan		X
Veery		X
Willow Flycatcher		X
Wilson's Phalarope		X
Wood Thrush*		X
Yellow-billed Cuckoo*		X

Table 17

A total of 34 Species of Greatest Conservation Need (SGCN) were identified either with a study block including the South Skunk River near Ames or the Skunk River Greenbelt. No species were listed as endangered or threatened.

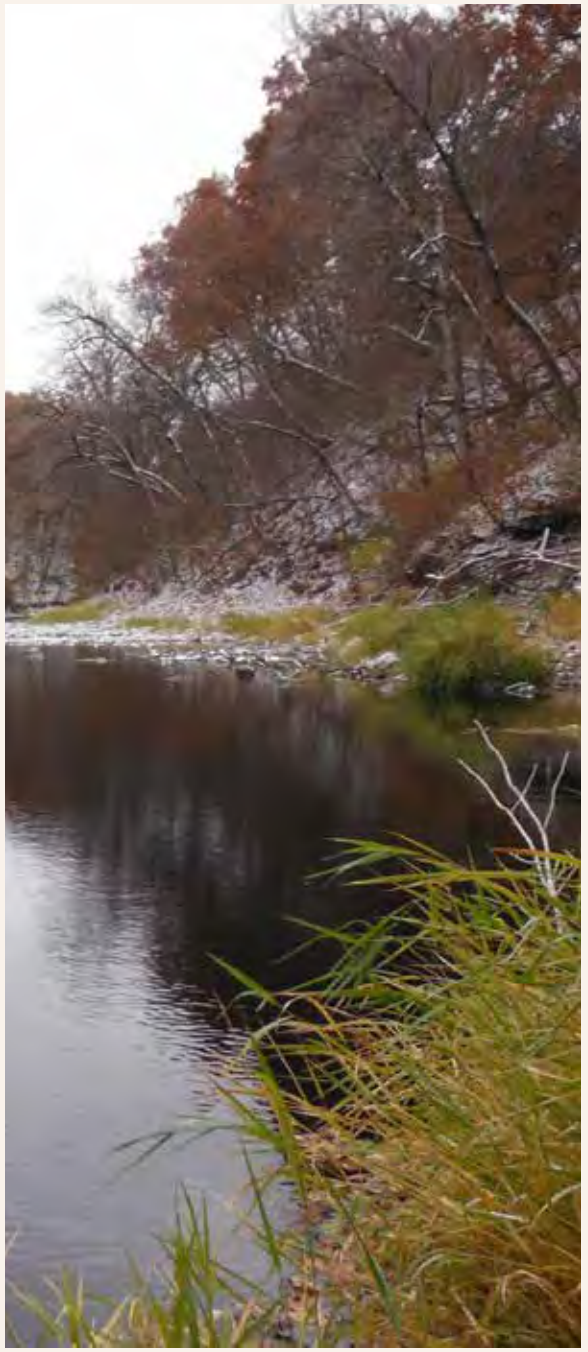
**Denotes breeding birds identified in the Skunk River Greenbelt by independent researcher*

Visual Resources.

The quality of what paddlers look at while on the river is an important element to consider in determining whether to designate a portion of a river as 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 and the streambanks themselves. As discussed previously with the land use and zoning as well as the landform and riparian analysis, the South Skunk River presents two very different identities in Story County. The two different identities are a result of the nature of the landscape, human intervention, the abandoned Ames Reservoir effort in upstream reach of the river.

The upstream, northern portion of the river, from Story City to Ames, is an extraordinary example of a wooded riparian corridor for the Des Moines Lobe ecoregion. Rivers of this size in this ecoregion with broader floodplains have quite fertile soils when drained and are nearly always in annual cropland with modest, if any, riparian buffers. This upstream portion, however, differs significantly in both geologic and soil conditions. These conditions combined with the Greenbelt zoning worked together to provide a spectacular wooded corridor that is enjoyed by many paddlers. The abandoned reservoir project also likely allowed for more riparian land held in public ownership by the County Conservation Board than might have otherwise occurred. Now known as the Skunk River Greenbelt, the area is famous for hikers and equestrian trail users.

Downstream of Ames, particularly downstream of 265th Street Access, the river is visually similar to the Polk County section. A majority of the channelized portions in Story County have been continuously maintained as a channelized ditch. This portion of the river is actually known on official maps as the South Skunk Ditch, rather than the South Skunk River. Riparian buffers with forest vegetation are less common on the South Skunk Ditch, minimizing the alternating sun / shade pattern over the channel so important for water quality, habitat and human enjoyment.

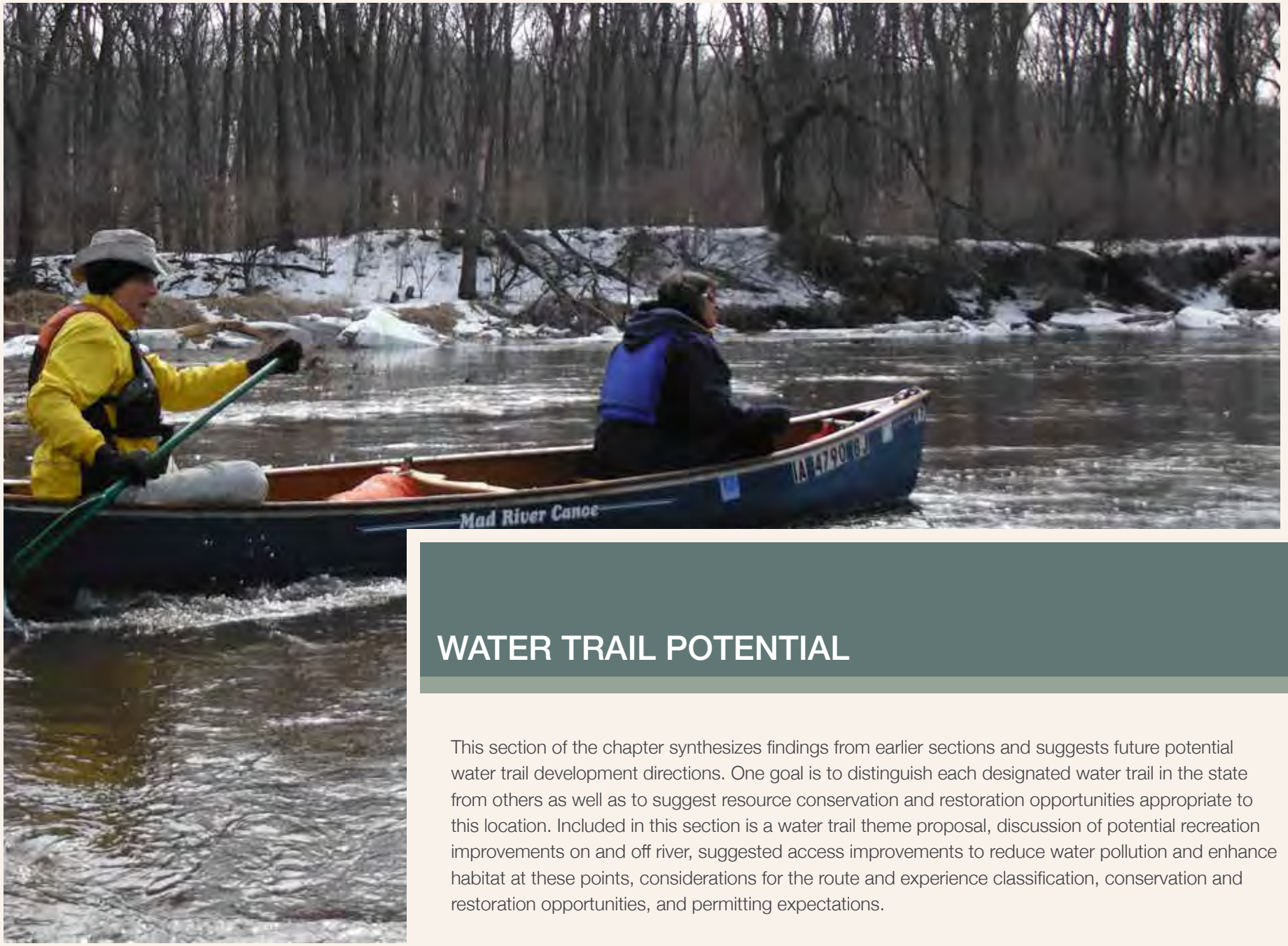


Interpretation Programs and Efforts.

Three public activities or events were held on or near the South Skunk River in Story County in 2014 – 2015 coordinated by Mimi Wagner Landscape Architecture. Event themes related closely to interest areas of local residents and the water trail sponsor and included paddling, invasive species removal and local Meskwaki culture and history. Fifty one people attended a public open house and paddle at North River Valley Park in August 2014. The Iowa Wildlife Center brought several native fauna to interact with participants including a bat and two species of turtle. Local ISU professors Jim Colbert (Biologist) and Bill Simpkins (Hydrogeologist) discussed their research and outreach on the river. Forty-one participants paddled upstream of the low head dam utilizing boats donated for use by Story County Conservation and Jax. The Skunk River Paddlers provided invaluable support for both facilitating and supervising the paddling as well as providing additional display materials, including the interactive model of a low head dam.

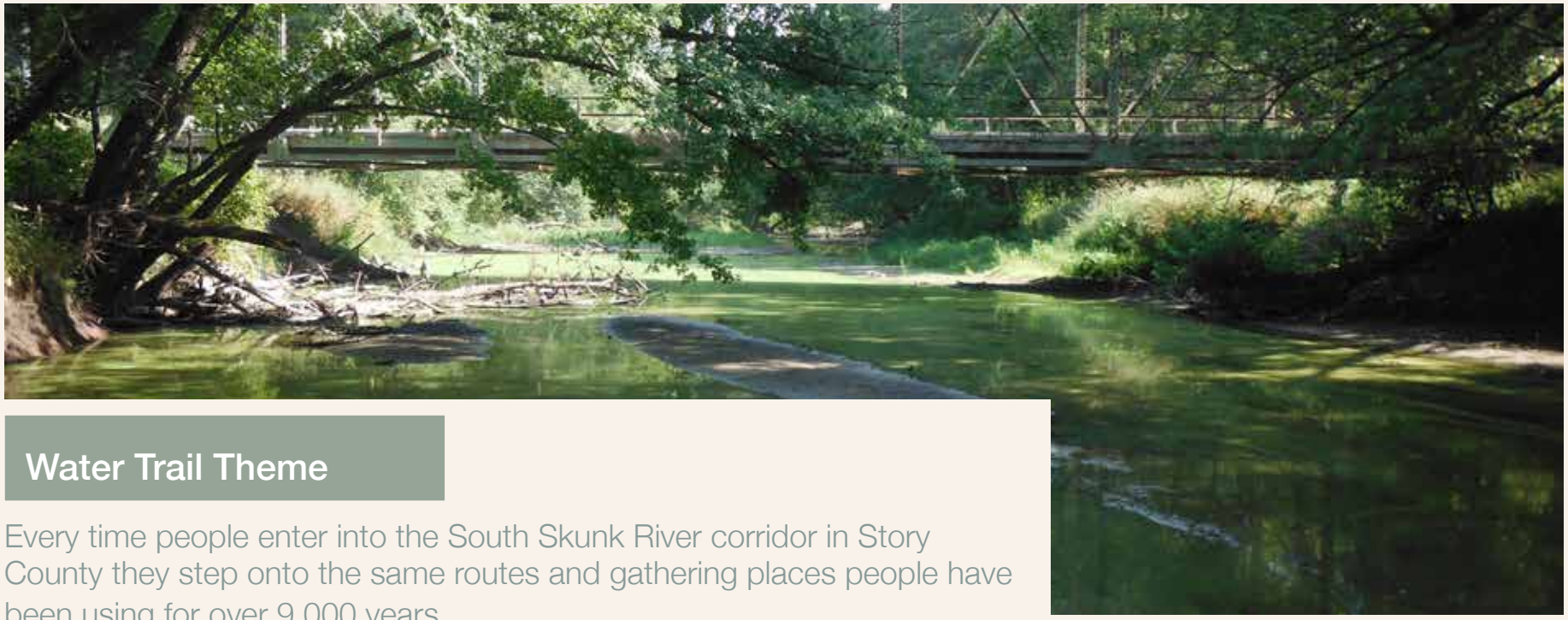
This water trail planning project coordinated with Amy Yoakum, Story County Conservation Natural Resource Specialist, to pilot an invasive plant species removal effort. Japanese Hops (Humulus japonicas) is an invasive non-native hops plant known to be establishing in Story County on Indian Creek, a tributary of the South Skunk River. The vine rapidly outcompetes native plant species and overtakes river banks where at least a half-day of sun occurs. The plant uses seed dispersal in the water, quickly establishing new colonies downstream of where it initially establishes. Amy selected this plant to pilot volunteer removal efforts in fall 2014. With assistance from Mark Wiedelicher, ISU Affiliate Associate Professor of Horticulture, Mimi Wagner Landscape Architecture inventoried hops colonies on Indian Creek near Nevada. They utilized gps to map and quantify 0.48 acres distributed in 29 patches with the most upstream patch located on the Story County Fairgrounds. ISU Biology Department, home to the Skunk River Navy (SRN) semi-annual cleanup program, has an emerging interest in developing an off-water invasive plant removal program for their transfer students modeled after SRN. This public event involved 31 students and volunteers from the public for a total of 78 hours of time and cleared, bagged and removed 0.28 acres of Japanese Hops. Story County Conservation provided garbage bags as well as collected / incinerated the filled bags. Gloves from various sources were also utilized due to the prickly nature of the stems.

The third public event focused on local interest in historic Meskwaki use of the South Skunk River in Story County. Cherie Haury-Artz, Education and Outreach Specialist with the Office of State Archaeologist, presented a 2 hour interactive program on the banks of the river in North River Valley Park in Ames in June 2015. This event site is the closest public land with a hard surfaced parking lot to historic Meskwaki hunting and trapping grounds in Story County. Sixty-one people participated in the event. Artz provided extensive materials and tool examples for the public to interact with, including a corn grinding station and several games. Mimi Wagner Landscape Architecture provided several map graphic boards with results of planning analysis for the public to interact with. Posters included a county wide map of historic Meskwaki use areas as well as illustrations comparing the current river alignment to the pre-channelized river prior to 1893. Understood together, these two maps show how much of the riparian land used by the tribe south of Ames is no longer located on the river due to channelization.



WATER TRAIL POTENTIAL

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



Water Trail Theme

Every time people enter into the South Skunk River corridor in Story County they step onto the same routes and gathering places people have been using for over 9,000 years.

The interdependent relationship between humans and this river run as strong today as it has in the past although much has changed. The landform of valleys, hills, steep cliffs, bedrock outcroppings and rivers are the same features that prehistoric people as well as the historic Meskwaki used for subsistence. The rhythm of the river over thousands of years, combined with climate and geology, has worked to create this ribbon of land with a sense of wildness in the center of the otherwise orderly ecoregion of the Des Moines Lobe.

Nearly all that is known about the hundreds of archaeological sites in the corridor, as well as the establishment of large tracts of rural protected forested lands on the river, are a direct result of landowner objections to a federal flood control reservoir in the 1960's and 70's. This protection, in turn, functioned to preserve the cultural resource sites, including some of the Warsaw dolomitic chert deposits so critical to prehistoric people living in the region. And some lands already purchased by the federal government for the proposed reservoir were transferred to public ownership resulting in the initial establishment of the Skunk River Greenbelt. The communities of Story City and Ames provide an exceptional set of complimentary historic, recreational, lodging and tourist opportunities. Some of these elements are illustrated in *Figure 31*.

The South Skunk continues to motivate and inspire people to take action and to be active today. A strong community has come together to engage around the river through planning for this project. They realize the value of the interplay between people and the river as well as how the river reflects back on the identity of this place. The Skunk River Paddlers are a critically important and valuable example within this community. Their presence providing "eyes on the river" in terms of scouting hazards, collecting trash and communicating with landowners and the water trail sponsor rounds out and separates this river from others in the state.

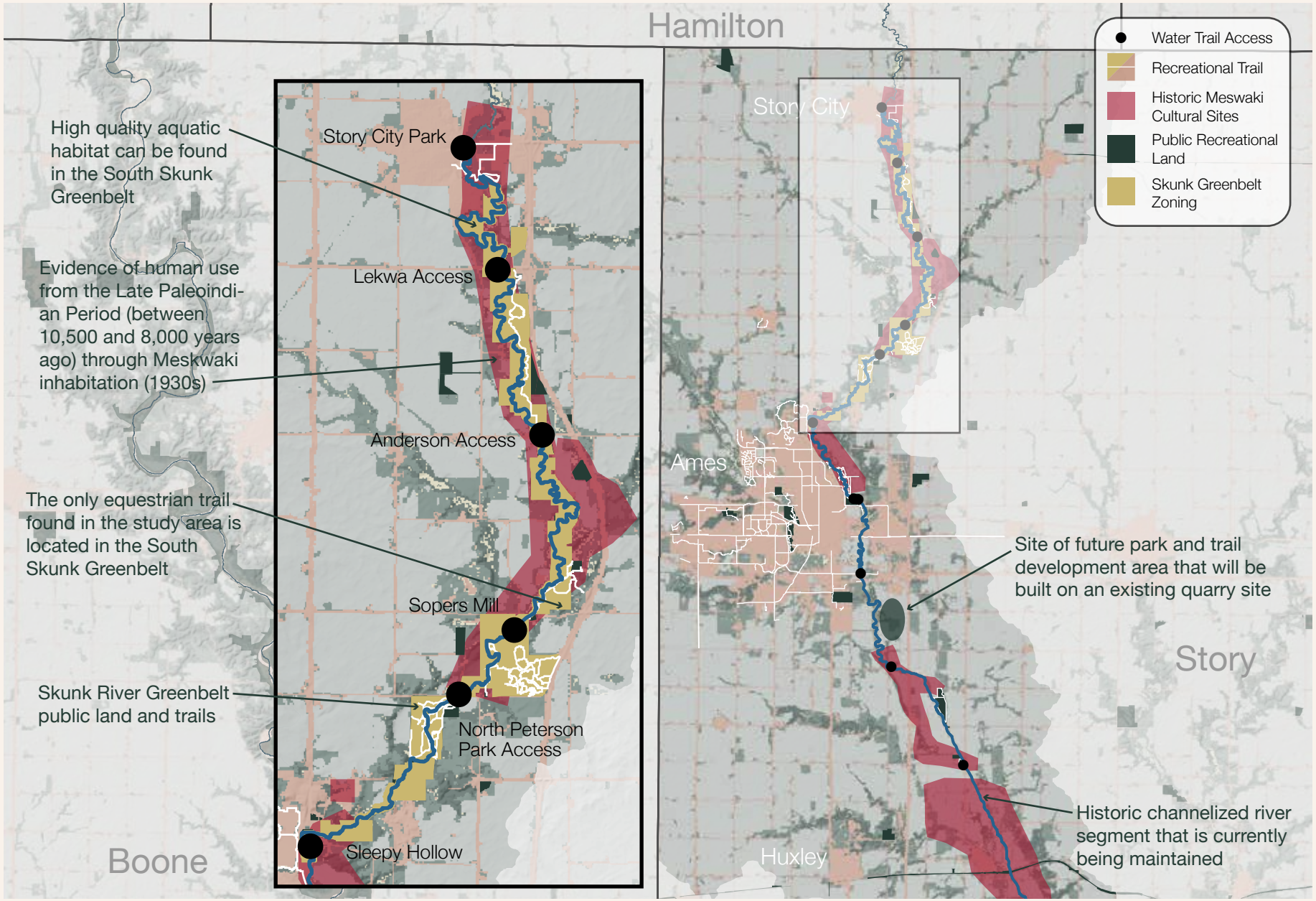


Figure 31

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

Background

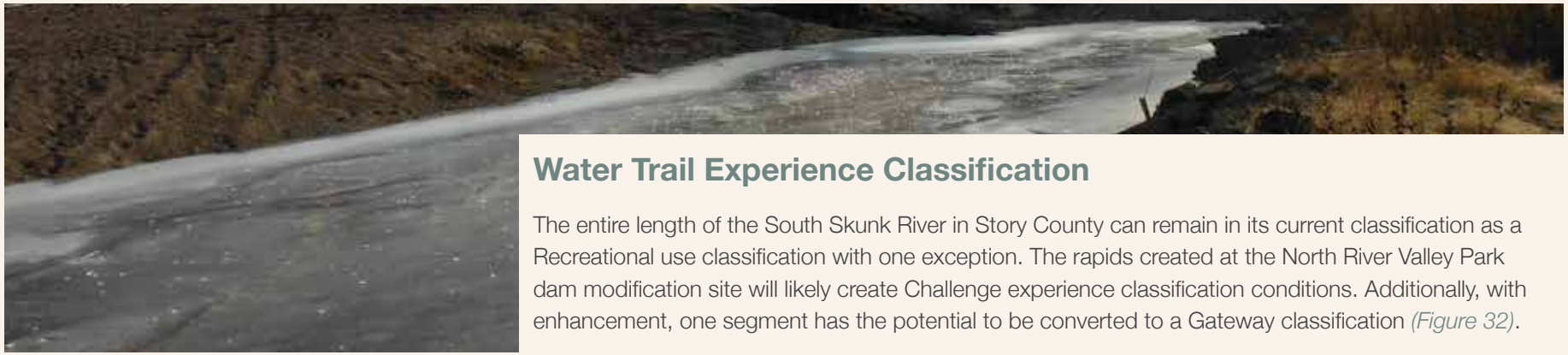
The South Skunk River corridor is a vibrant part of Story County. A total of 8,726 acres of land are known to be in permanent protection within 10 miles of the Story County portion of the South Skunk; 98% of these acres (8,513) are available for public recreation. Outstanding natural, cultural and recreational resources already exist on these lands. The existing Skunk River Greenbelt recreation areas, paired with public lands in Story City and Ames, offer trail opportunities to hikers, bikers and equestrians. Greenbelt property and surrounding parcels hold numerous important cultural and historic resource sites, including deposits of chert in the bedrock that were used for toolmaking during the Late Paleoindian Period (between 10,500 and 8,000 years ago). Prehistoric materials recovered in the upper South Skunk River valley document continual occupation of this area for over 9000 years prior to Euro-American settlement. Recent archaeologic evidence near the river indicates that all prehistoric cultural periods are represented in the upper South Skunk River valley in Story County with the possible exception of Early Paleoindian. Lands of similar recreational and cultural value adjacent to the South Skunk River in Polk and Jasper County are also publicly owned. Together these two counties provide an additional 9,648 acres to those found in Story County.

The Skunk River Greenbelt includes 3,392 acres of public land and a 20.2-mile trail network following 8.5 miles of the South Skunk River. This segment of the river is heavily used by paddlers. Eight species of mussel are known to exist in this reach. Two species, Cylindrical Papershell and Creek Heelsplitter, are classified as Threatened and rare in Iowa and four are considered either rare or uncommon in the state. This study area has the greatest diversity of breeding bird species of any river studied for potential state water trail designation in Iowa. Thirty one Species of Greatest Conservation Need were field identified as likely breeding on or near the river between 2012 and 2015. Three bird species (Bald Eagle, Black Tern and Forster's Tern) are classified as Special Concern.

Paddlers in Story County have the opportunity to examine first-hand the stark difference between a natural channel and a constructed ditch as well as the transition from a constructed channel back to a natural channel. The downstream 14 miles of the river south of Lincoln Way in Ames was channelized in the late 1890's and is legally identified as a "ditch". The upstream 3 miles of the channelized portion has not been maintained as a ditch and is beginning to re-meander. The downstream 11 miles of the channel remains leveed and ditched. Concerns about water quality exist. The entire reach of the river in Story County, except for 10.7 miles in the center, is impaired for indicator bacteria. In addition, three tributaries draining into the study segment are impaired for bacteria and/or biological conditions.

From a geographic and cultural standpoint, this river segment is located in the center of the state. More than 34,000 university students attend Iowa State University, located 2.4 miles from the river, and hundreds of thousands of others visit the university annually. Twenty-one historic sites, both indoor and outdoor, are located within 10 miles of the river and are open to the public.

The two cities and one county organization owning land and accesses have played an active role in preparation of this assessment and will be active in future planning phases of the water trail. 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 Water Trail Route

The South Skunk River upstream of Ames is recognized, compared to other similarly scaled Iowa rivers, for the above-average amount of large woody debris accumulations that exist in the channel. This condition is due to the largely forested edge of the river and its current phase of channel widening. Woody debris poses obstacles for paddlers when it blocks a significant portion of the channel and when piles accumulate and act as strainers on outside bends. However, woody channel debris is an important and valued habitat element in river channels. Currently Iowa DNR does not have a management policy for management of large woody debris on rivers. The Skunk River Paddlers work with landowners to create openings through channel-wide obstructions as they form.

Additionally, future expansion of the water trail north of Story City has been discussed. Story City officials report that many people float between Riverside Bible Camp and the Story City Park. However, no public river access is available upstream of Story City.

Water Trail Experience Classification

The entire length of the South Skunk River in Story County can remain in its current classification as a Recreational use classification with one exception. The rapids created at the North River Valley Park dam modification site will likely create Challenge experience classification conditions. Additionally, with enhancement, one segment has the potential to be converted to a Gateway classification *(Figure 32)*.

The Sleepy Hollow to North River Valley segment is an ideal length for a Gateway classification but requires enhancement. The 2.9 mile length of the segment makes it an ideal shorter distance for beginners and novices. Its juxtaposition in Ames relates well to the urban context, interpretation and service expectations of this experience classification. Upgrades would be necessary to both accesses as well as channel conditions. Other aspects of this segment of the river add value to its classification as a Gateway segment including cultural and historic interpretation and land trail opportunities.

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

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

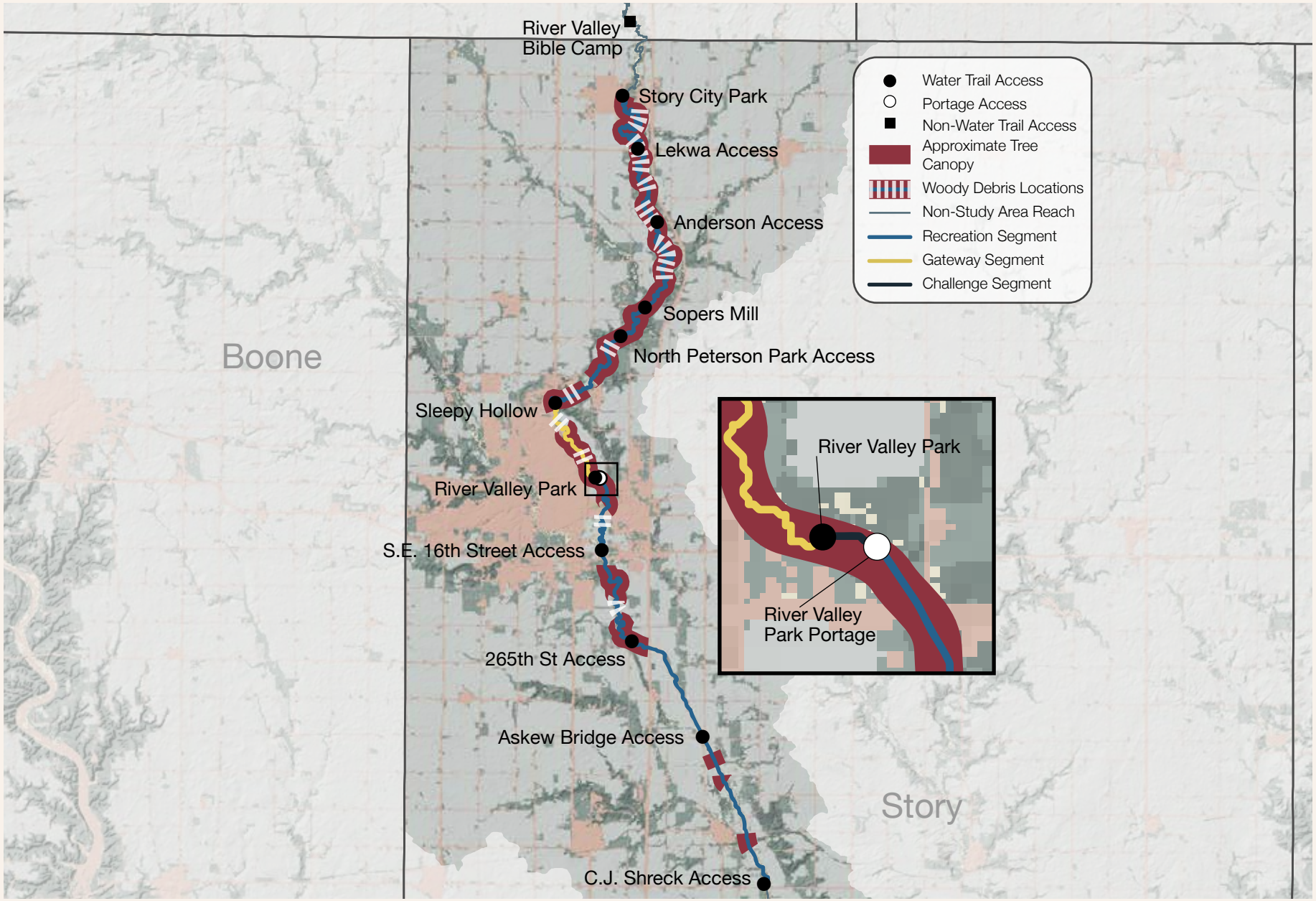
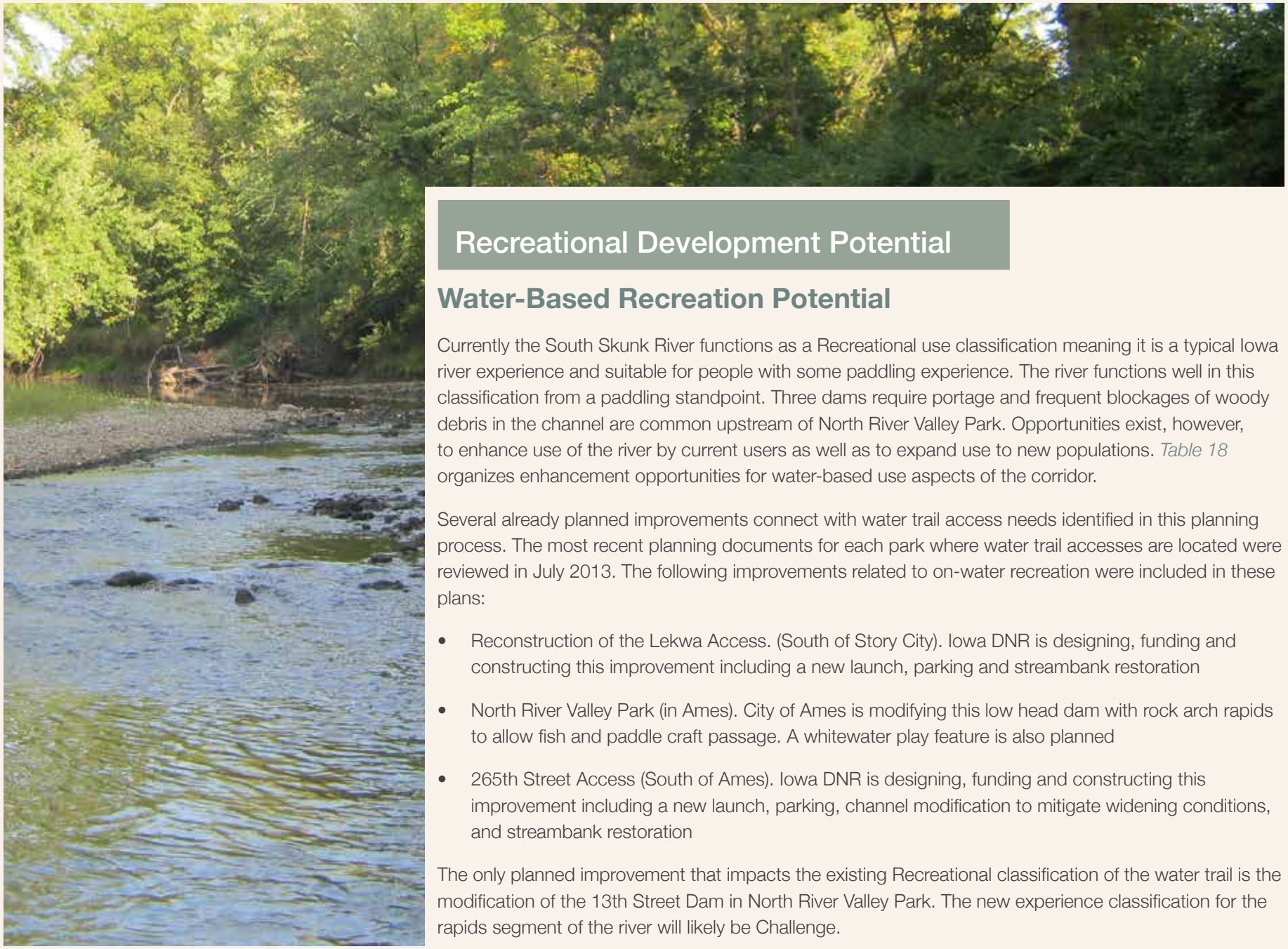


Figure 32

Two modifications of the Recreational Use Classification will exist after the 13th Street Dam is modified. The creation of a Gateway and a Challenge segment near Ames are future opportunities.



Recreational Development Potential

Water-Based Recreation Potential

Currently the South Skunk River functions as a Recreational use classification meaning it is a typical Iowa river experience and suitable for people with some paddling experience. The river functions well in this classification from a paddling standpoint. Three dams require portage and frequent blockages of woody debris in the channel are common upstream of North River Valley Park. Opportunities exist, however, to enhance use of the river by current users as well as to expand use to new populations. *Table 18* organizes enhancement opportunities for water-based use aspects of the corridor.

Several already planned improvements connect with water trail access needs identified in this planning process. The most recent planning documents for each park where water trail accesses are located were reviewed in July 2013. The following improvements related to on-water recreation were included in these plans:

- Reconstruction of the Lekwa Access. (South of Story City). Iowa DNR is designing, funding and constructing this improvement including a new launch, parking and streambank restoration
- North River Valley Park (in Ames). City of Ames is modifying this low head dam with rock arch rapids to allow fish and paddle craft passage. A whitewater play feature is also planned
- 265th Street Access (South of Ames). Iowa DNR is designing, funding and constructing this improvement including a new launch, parking, channel modification to mitigate widening conditions, and streambank restoration

The only planned improvement that impacts the existing Recreational classification of the water trail is the modification of the 13th Street Dam in North River Valley Park. The new experience classification for the rapids segment of the river will likely be Challenge.

Recreational Enhancement	Issue Addressed
Enhance Everyday Management Conditions	
Reinforce capacity for on-water rescue	Emergency staff turn-over is common in Iowa. Reinforcing the network of personnel serving the river corridor in Story County is a good way to learn of new management challenges and share information between agencies.
Enhance communication between water trail access managers	Future coordination of water trail activities and issues would be enhanced with a defined organizational structure and regular communication among access owners/managers
Standardize ordinary maintenance at launches	Better communication and agreement by the 3 access owners/managers could result in more efficient and timely removal of sediment and debris from launches and other ordinary maintenance tasks
Secure proper easement or ownership of land needed for accesses	Multiple accesses are located on land without a formal easement or with very short term easement agreements. One access which requires parking area upgrades to meet minimum requirements does not include an adequate amount of space to make this upgrade
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
Establish a reporting mechanism to report misconduct	Providing public information at launches and major parking areas to report littering, vandalism, intoxication and other disruptive behavior on the river or on public property could ultimately reduce the frequency of these behaviors particularly by boat rental customers. The public may also feel more prepared to respond to the situation in a way that may generate a change in future behavior
Communicate boundaries between public and private property on the land	Updated and the increased frequency of public land signage as well as signage available for private landowners may reduce unintended trespassing and remind river users of their legal rights
Enhance Water Trail Corridor Experience for Current Users	
Modify or remove the dam infrastructure at the 3 locations it exists in the county to allow passage by fish and paddlers	Dam structures at Story City, Hannum's Mill/General Filter and North River Valley require retrofit or removal. The rocks placed at and below the Story City dam requires reconstruction to functionally pass boats. Hannum's Mill and North River Valley Park dams require modification or removal to prevent more drownings
Explore public communication at urban launches that explains the risk/flow relationship for river users	Appropriate water levels in the river are one of the most important determining factors for successful recreational river experiences. Enhanced communication of real-time water levels and how risk increases with flow could help users make informed decisions
Upgrade accesses with overly steep launch and path slopes as well as perpendicular alignment to the thalweg	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; launch angles can also be modified at many launches to minimize deposition on the launch surface

Table 18

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

Upgrade parking availability geared for all users	Parking areas associated with some access points do not meet Iowa DOT minimum requirements for capacity. Some also lack the space for loading boats and gear.
Enhance communication for users before they get to the river	River users will feel better prepared for their experience with updated maps of the river corridor; maps can be printed as well as available to download online.
Update public interpretation	Utilize the resources included in this chapter to produce compelling, varied interpretation of critical issues and resources based on the conditions on this river segment
Expand public ownership of key river's edge properties	Additional land, particularly those parcels currently held by the federal government in the river corridor, will allow expansion of trails and access to the Skunk River Greenbelt
Attract New Recreational User Populations	
Provide remote paddle-in campsites	Paddle-in camp sites are likely to be popular on the South Skunk, given the resources present and the volume of paddling
Enhance angler experiences	Additional bank fishing opportunities are possible on existing public land. The investment of in-stream habitat structure would also provide necessary cover for fish
Upgrade launch types to allow vehicles & people to reach the water's edge	Nine of eleven launches exceed 18% slope and six of the eleven are carry down on 6' high or greater 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
Provide additional paddling miles on the South Skunk	The South Skunk between River Valley Bible Camp (in Hamilton County) and the Story City access is heavily used by anglers and paddlers. However, no infrastructure or signage exists on the upstream access. Future expansion of the water trail to this location would require collaboration with Hamilton County.
Increase river management communication and capacity	Large, downed trees can cause hazards to paddlers on the South Skunk, especially with high water events. Wood in the channel is also an important habitat element. Careful management of large wood is required to minimize streambank erosion. Communication to paddlers on Gateway segments is necessary if large channel blockages occur
Upgrade some access facilities	Restrooms and drinking water are available only at one access facility but not within close range of the river access. More available toilet and water services are an important part of enhancing the user experience and enhancing water quality of the river
Provide connection to regional recreational resources	The Skunk River Greenbelt can be expanded over future decades to physically connect with Chichaqua Bottoms Greenbelt in Polk County. When accomplished users would have access to more than 9000 acres in Polk County

Table 18 (continued)

Land-Based Recreation Potential

Land-based recreation development adjacent to the river suggested during the development of this chapter largely coincides with expansion plans for the land trail network already proposed by Story City, Ames and Story County Conservation. Enhancements to aid in management and increased use of off-river amenities are also included. These elements are documented in *Table 19*.

Several already planned improvements on public land in the river corridor were identified during the preparation of this chapter. The most recent planning documents for each park where water trail accesses are located were reviewed in July 2013. The following improvement related to off-water recreation was included in these plans:

- Story City Access (in Story City Park). City of Story City is planning park improvements near the river including native landscaping, a fire pit and gazebo

Recreational Enhancement	Issue Addressed
Enhance Everyday Management Conditions	
Establish a reporting mechanism to report misconduct	Providing public information at launches and major parking areas to report littering, vandalism, poaching, intoxication and other disruptive behavior on public property could ultimately reduce the frequency of these behaviors particularly by boat rental customers. The public may also feel more prepared to respond to the situation in a way that may generate a change in future behavior
Communicate boundaries between public and private property on the land	Unintended trespassing may be reduced with use of updated and more frequent public land boundary signage. Signage reminding river users of their legal rights on adjacent private lands may also reduce trespassing and vandalism
Enhance Water Trail Corridor Experience for Current Users	
Secure proper easement or ownership of land for accesses	Multiple accesses are located on land without a formal easement or with very short term easement agreements. One access which requires parking area upgrades to meet minimum requirements does not include an adequate amount of space to make this upgrade
Upgrade parking availability geared for all users	Parking areas associated with some access points do not meet Iowa DOT minimum requirements for capacity. Equestrians also lack adequate parking at their trailheads
Attract New Recreational User Populations	
Provide additional land trail miles between Ames and Story City	Additional trail miles connecting the two communities may result in new hikers, bikers and equestrians visiting the area
Enhance communication for users before they get to the river	Corridor users will feel better prepared for their experience with updated maps of the river corridor illustrating all recreation amenities; maps can be printed as well as available to download online
Expand public ownership of key river's edge properties	Additional land, particularly those parcels currently held by the federal government in the river corridor, will allow expansion of trails and access to the Skunk River Greenbelt

Table 19

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

Riparian Potential Impacting Habitat and Water Quality

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

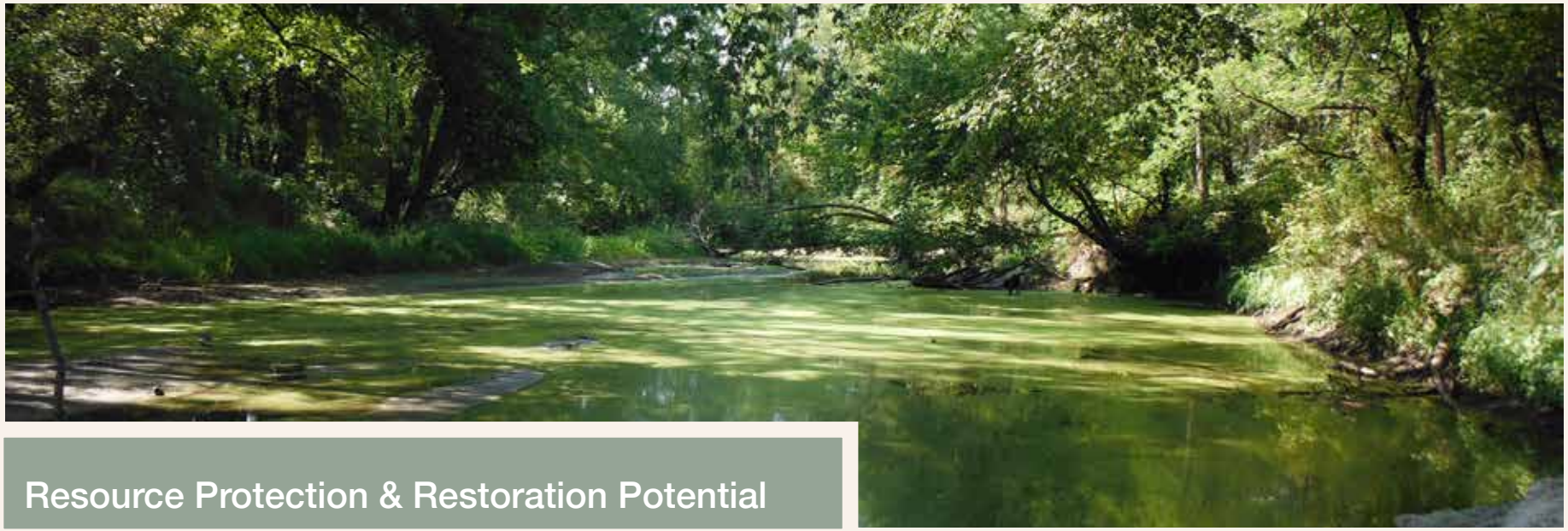
- Low impact stabilization methods should be used to repair sheet and gully erosion occurring at any location on land so additional sediment loading is not occurring as a result of erosion on public land
- Streambank conditions near river access points and other prominent locations should also demonstrate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

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

Facility Where Access is Located	Width of Vegetative Buffer Between Parking and River	Erosion Present at Access	Streambank Conditions Adjacent to Launch	Rip Rap Present at Launch	Elements of Concern
Story City Park	40	No	Minor or no erosion	Yes	
Lekwa Access	53	Yes	Moderate erosion	Yes	
Anderson Access	20	No	Minor or no erosion	Yes	
Soper's Mill Access Area	30	No	Minor or no erosion	No	
North Peterson Park Access	0	No	Minor or no erosion	Yes	
Sleepy Hollow Access	80	No	Minor or no erosion	No	
North River Valley Park	62	No	Moderate erosion	Yes	
S.E. 16th Access	60	Yes	Minor or no erosion	Yes	
265th Street Access	80	No	Moderate erosion	Yes	
Askew Bridge/Cambridge Pond	60	No	Moderate erosion	No	
C.J. Shreck Access	40	Yes	Minor or no erosion	Yes	

Table 20

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



Resource Protection & Restoration Potential

The South Skunk River in Story County 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 and protection. Corridor users would benefit from enhanced conservation and protection as well as from a focused interpretation that builds knowledge about the unique resources present. Existing land protection regulations and substantial public lands adjacent to the river lay a foundation to reach long term conservation goals focused on the full range of these resources, especially those actions which will have the most public benefit, such as flood resilience and water quality enhancement. The following standards relate to all future development efforts intended to bring people to the river corridor:

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

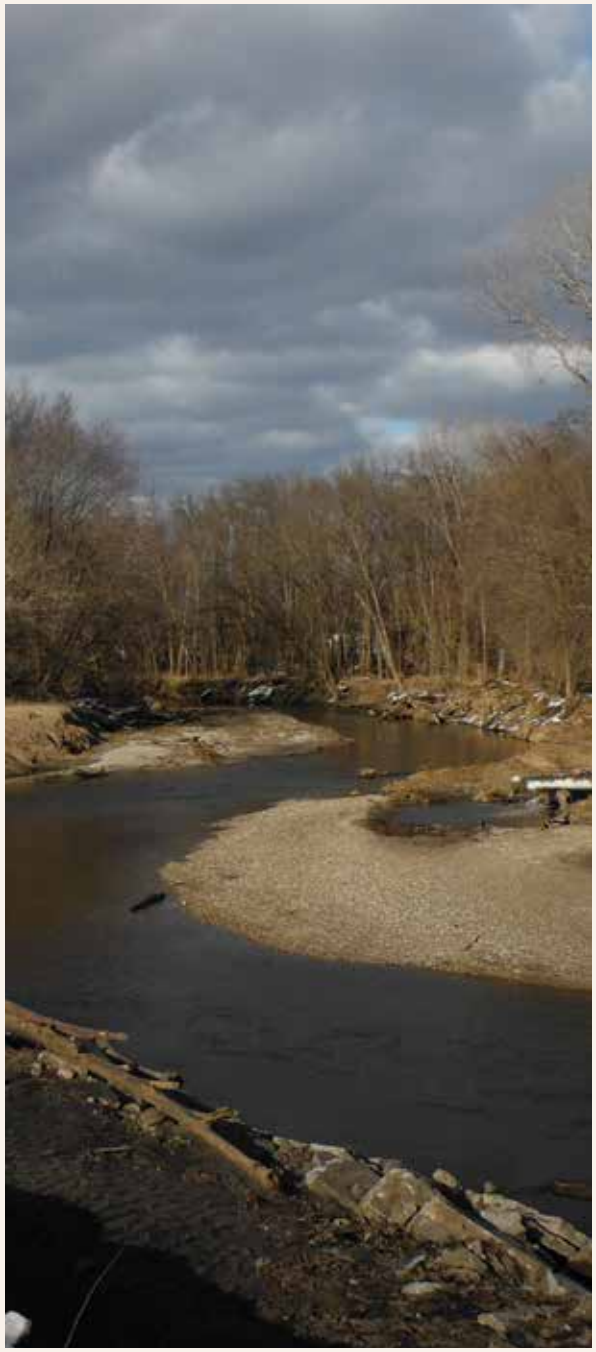
Conservation and Restoration Elements

Multiple conservation and restoration opportunities became apparent from stakeholder input and through research for this chapter. These opportunities and potential partners are described below in *Table 21*; these elements are illustrated in *Figure 33*.

Conservation and Restoration Enhancement	Supporting Organizations and Individuals
Enhance River Structure and Function	
Demonstration of stream bank and floodplain restoration practices on public land that minimize use of riprap and broken concrete	Iowa DNR, Story County Conservation. Cities of Story City and Ames
Conduct professional assessment on the river channel upstream of 265th Street access to establish basic geomorphic parameters appropriate for this river	Iowa DNR, outside consultant
Enhance Aquatic Resource Conditions	
Coordinate public meetings and monthly events for river clean ups, education and log jam mitigation	Skunk River Paddlers
Enhance habitat conditions for mussel habitat on the upper reaches	Iowa DNR, Story County Conservation, Cities of Story City and Ames
Utilize state of the art fish habitat enhancement practices to expand fish habitat options based on a changing climate	Iowa Cooperative Fish & Wildlife Research Unit (ISU), Iowa DNR, local angler organizations
Explore catch and release fishing regulations on the upper reaches	Local angler organizations
Further research on the causes and sources of water quality impairment in the watershed and included on the 303d list, increased participation in voluntary monitoring	Iowa DNR, Story SWCD, IOWATER volunteers, Iowa State University, City of Ames Water & Pollution Control
Coordinate with other organizations to enhance water quality conditions on the South Skunk and its tributaries	Story Soil & Water Conservation District, City of Ames Water & Pollution Control
Enhance Terrestrial Resource Conditions	
Conduct a thorough invasive species inventory on public land	Story County Conservation, local interested residents, ISU
Set habitat goals for public lands in the Skunk River Greenbelt	Story County Conservation, Cities of Story City and Ames
Permanent protection of mature forested riparian land tract “hot spots” in private ownership; doing so provides numerous benefits to the river, inhabitants of the riparian corridor and flood prevention	Story County Conservation, Cities of Story City and Ames, Iowa Natural Heritage Foundation
Explore additional land protection ordinances beyond the current boundaries of the Skunk River Greenbelt	Cities of Story City, Ames and Story County Planning
Establish a continuous perennial stream buffer for the length of the South Skunk River and its tributaries	Story Soil and Water Conservation District, local habitat organizations

Table 21

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



Conservation and Restoration Enhancement	Supporting Organizations and Individuals
Enhance Terrestrial Resource Conditions (continued)	
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	Story Soil and Water Conservation District
Minimize sheet and gully erosion on public lands adjacent to the river	Story County Conservation, Cities of Story City and Ames, Iowa State University
Enhance Cultural and Historic Resource Conditions	
With only 13% of the river corridor surveyed for cultural resources, additional Phase I survey work and research is necessary for a more complete understanding of early occupation	Office of State Archaeologist
Provide contact information for the discovery of archaeological artifacts as well as handout material on how to handle, document and report artifacts	Story County Conservation
Further investigation, prioritization of state-recorded archaeologic and historic resources; pursue permanent protection (from development and exploitation) for priority cultural, historic sites. Doing so allows for their interpretation, future research, and educational opportunities	Dave Ballard, Leo Milleman, Rick Dietz, Office of State Archaeologist, Iowa Natural Heritage Foundation, Preservation Iowa
Pedestrian survey for remnants of early settler church, cemeteries and a number of schools, houses or farmsteads depicted on the 1875 Andreas Atlas; pursue permanent protection for priority cultural, historic sites. Doing so allows for their interpretation, future research, and educational opportunities	Local interested residents

Table 21 (continued)

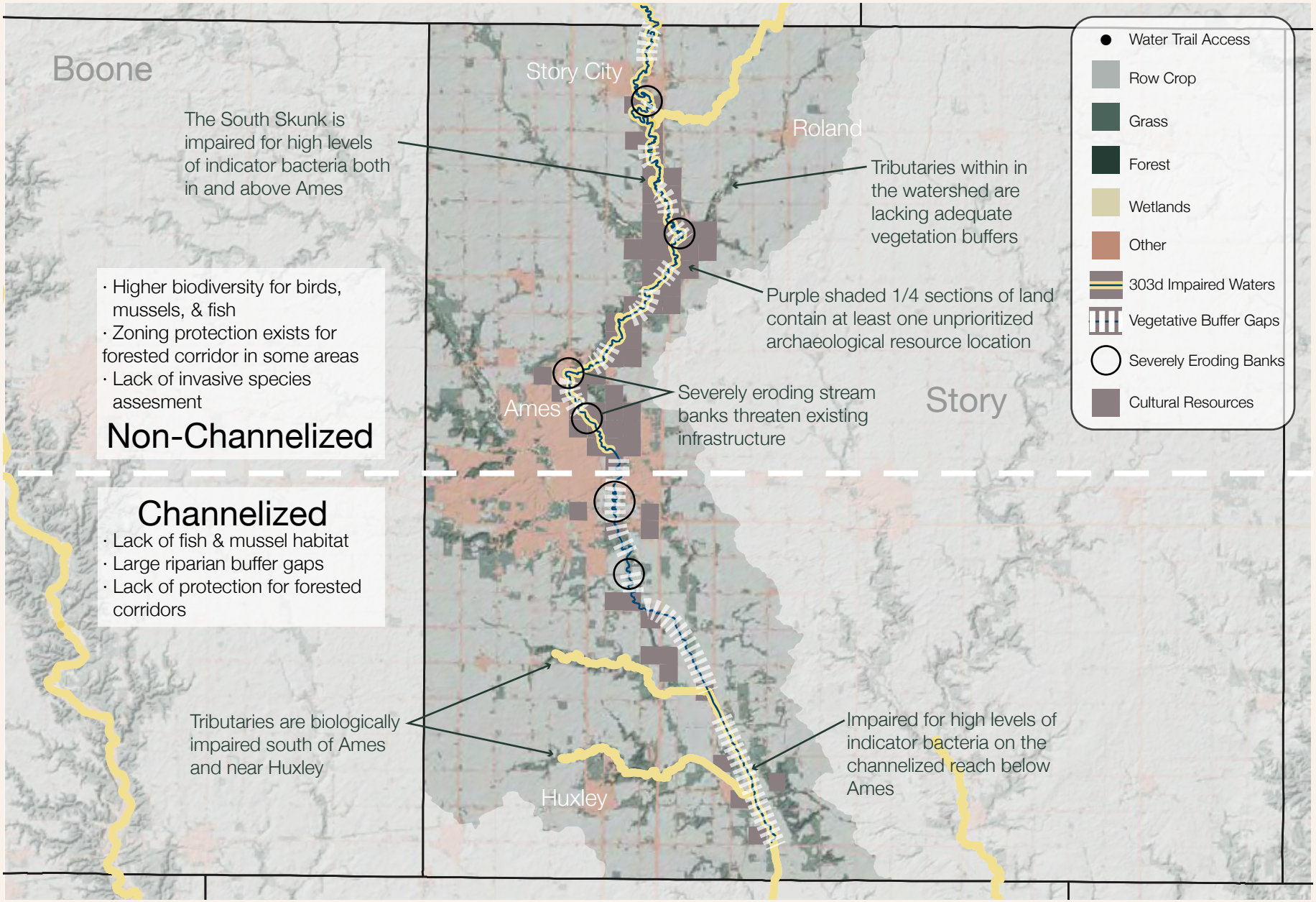


Figure 33

Multiple conservation, restoration and protection opportunities exist. Organizations and municipalities in the county are interested in increased focus and attention on water quality, cultural resource protection and habitat.

Expected Permitting Considerations

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

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

Water Trail Recommendations/Summary

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

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

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

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

The South Skunk Water Trail sponsor, Story County Conservation, has several decisions ahead. Initially they will commit to pursuing whichever experience classifications they believe are most appropriate. This, plus prioritized planning elements, will enable the water trail to competitively acquire funding and other support to reach their goals.

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

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

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APPENDICES

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

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

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

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

Appendix C.
Water Trail Experience Classification Summary

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

Appendix D.
One hundred twelve bird species were identified in the riparian study blocks or the Skunk River Greenbelt that are not listed as a Species of Greatest Conservation Need (SGCN).

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

SPECIES

Acadian Flycatcher*
Alder Flycatcher*
American Coot
American Crow*
American Goldfinch*
American Kestrel
American Redstart*
American Robin*
Baltimore Oriole*
Bank Swallow
Barn Swallow*
Barred Owl*
Belted Kingfisher*
Black-capped Chickadee*
Blue Jay*
Blue-gray Gnatcatcher*
Blue-headed Vireo*
Blue-winged Teal
Brown Thrasher*
Brown-headed Cowbird*
Canada Goose*
Carolina Wren*
Cattle Egret
Cedar Waxwing*
Chestnut-sided Warbler
Chimney Swift*
Chipping Sparrow*
Clay-colored Sparrow
Cliff Swallow
Common Grackle*
Common Yellowthroat*
Cooper's Hawk
Double-crested Cormorant
Downy Woodpecker*
Eastern Bluebird
Eastern Kingbird*
Eastern Phoebe*
Eastern Screech-Owl
Eastern Wood-Pewee*
Eurasian Collared-Dove
European Starling*
Gadwall
Gray Catbird*
Great Blue Heron*
Great Crested Flycatcher*
Great Egret
Great Horned Owl*
Green Heron*
Green-winged Teal
Hairy Woodpecker*
Hooded Merganser
Horned Lark
House Finch*
House Sparrow
House Wren*
Indigo Bunting*
Killdeer*
Lark Sparrow
Least Flycatcher*
Lesser Scaup
Mallard
Marsh Wren
Mississippi Kite

Mourning Dove*

Mourning Warbler*

Northern Cardinal*

Northern Flicker*

Northern Parula

Northern Rough-winged Swallow

Northern Shoveler

Orchard Oriole

Ovenbird*

Pied-billed Grebe

Pine Siskin

Purple Martin

Red-bellied Woodpecker*

Red-headed Woodpecker*

Red-eyed Vireo*

Red-tailed Hawk

Red-winged Blackbird*

Ring-billed Gull

Ring-necked Duck

Ring-necked Pheasant

Rock Pigeon*

Rose-breasted Grosbeak*

Ruby-throated Hummingbird*

Ruddy Duck

Savannah Sparrow

Scarlet Tanager*

Song Sparrow*

Sora

Spotted Sandpiper*

Swamp Sparrow

Tennessee Warbler*

Tree Swallow*

Tufted Titmouse

Turkey Vulture

Vesper Sparrow*

Warbling Vireo*

Western Kingbird

Western Meadowlark

White-breasted Nuthatch*

White-faced Ibis

Wild Turkey*

Wilson's Warbler*

Wood Duck*

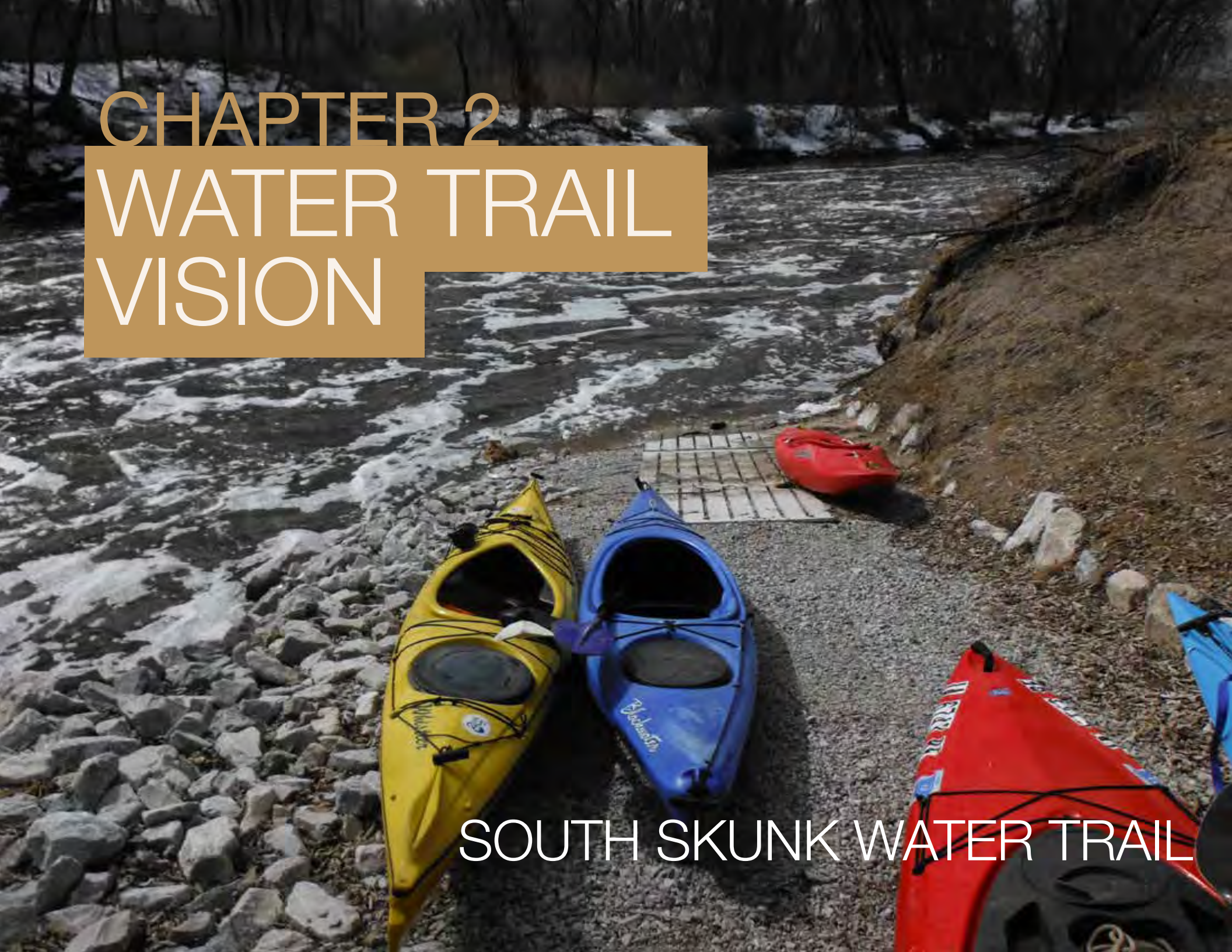
Yellow Warbler*

Yellow-bellied Sapsucker*

Yellow-billed Cuckoo*

Yellow-headed Blackbird

Yellow-throated Vireo



CHAPTER 2
WATER TRAIL VISION

SOUTH SKUNK WATER TRAIL

ACKNOWLEDGMENTS

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

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

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

Keith Abraham, City of Ames Director of Parks and Recreation
David Ballard, Landowner and local archeology
Dean Biechler, Rural Landowner
Rick Dietz, Story County IOWATER Volunteer Water Quality Monitoring
Lisa Hein, Iowa Natural Heritage Foundation Program and Planning Director
Connor Nicholas, ISU Canoe & Kayak Club and Soil & Water Conservation Club at ISU
Leo Milleman, Landowner and City of Ames Parks and Recreation Commission
David Oliver, Skunk River Paddlers
Piper Wall, Whitewater & Kayak Enthusiast
Jeff White, Story County Trail Advisory Committee
Mark Widrlechner, Iowa State University Affiliate Associate Professor of Horticulture & Ecology, Evolution and Organismal Biology
Carol Williams, Story County Conservation Board Special Projects Range
Steve Veysey, Hawkeye Fly Fishing Association
John Moran, City of Story City Parks Department Manager
Mike Jensen, Story City Mayor

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REVISION DATE: DECEMBER 2016

CONTENTS

CHAPTER 2
WATER TRAIL VISION

The reach of the South Skunk River between Story City and Ames has long been enjoyed by local anglers, paddlers, hikers and bird watchers. The downstream reach, south of Ames, is less frequently used but no less important.

No part of the South Skunk is currently designated as a State Water Trail by the Iowa Department of Natural Resources (DNR) River Programs. However, by being a part of the state's family of water trails, the Story County segment has much to offer the public as well as potential conservation efforts in Central Iowa. Story County Conservation Board (SCCB) emerged as the water trail sponsor as a result of planning in 2013 – 2015.

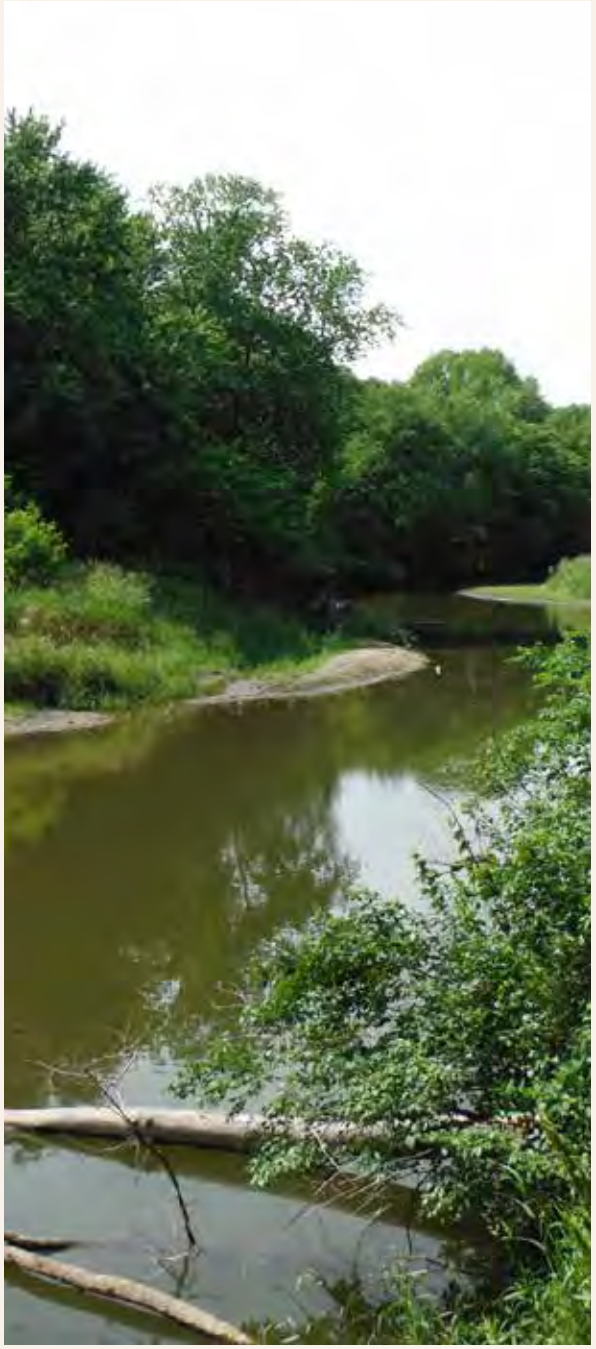
The theme of the South Skunk Water Trail synthesizes and celebrates the role of the river in supporting human populations from as far back as 10,500 to 8,000 years ago up to the present. More recently, the Meskwaki made their homes here followed by the Euro-American settlers who replaced them as Iowa gained statehood. The theme also celebrates the biological conditions found on the river today including exciting diversity in mussel and bird species on the upper reach. Because it is located in the precise center of the state, along with the first land grant institution in the U.S., this water trail has the unique opportunity to bring people from all over the state as well as many other countries onto and near the river to learn about the ecosystems and wildlife resources expected in the Des Moines Lobe ecoregion, one of the youngest landscape regions in Iowa. The water trail includes a water trail sponsor, Story County Conservation Board, and two communities, Story City and Ames, dedicated to enhancing river use and interpretation.

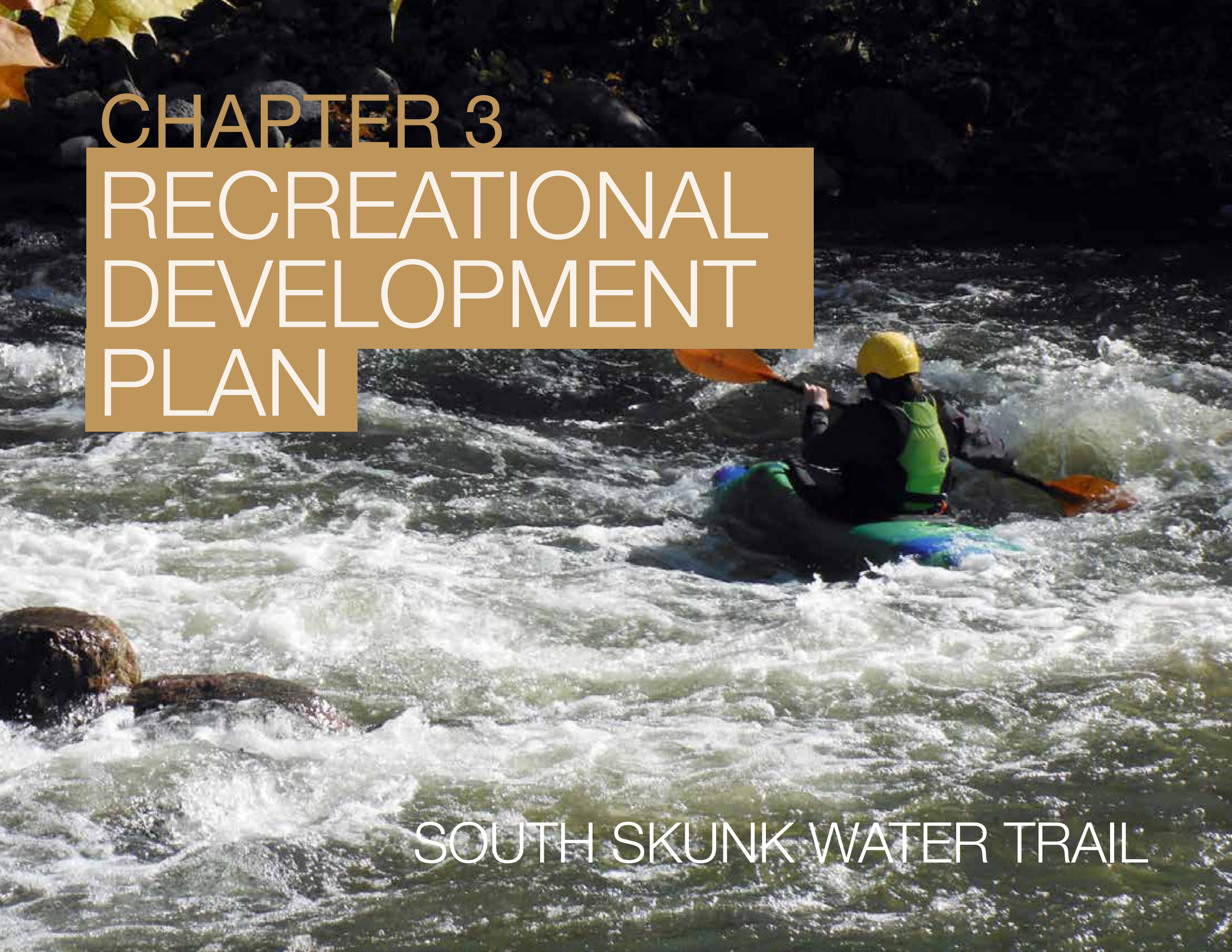
The water trail sponsor shares the values of resource protection held by the state program. They see one of the primary purposes of the water trail as a means to further conservation on and near the river and to communicate this to users. Conditions will be protected for the already high diversity of bird and mussel species. A stable, natural meandering river system is desired where lateral channel migration, mid-channel deposition and excessive streambank

scour are minimized. Further river assessment is required to understand and balance inputs with sediment transport with energy dissipation. In the long term, previously channelized segments of the river can serve as candidates for stream mitigation. The expansion of diverse riparian plantings will create a continuous perennial buffer on the water trail route. Eventually, trail and greenspace connections between Ames and the Story - Polk county line along the South Skunk are desired. Diverse resource enhancement of the river corridors also desired including permanent protection of critical cultural and historic resources and river edge riparian forests. Lastly, bacteria and biologically impaired reaches of the river in Story County impact river users and have the potential to influence the quality of aquatic habitat. This vision includes making gains in water quality enhancement in Story County.

Existing conditions for water trail users include two developed city parks and nine rural or urban-fringe accesses. The vision for these facilities 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 from high flows. Currently the river represents a classic Iowa version of a Recreational Experience Classification. This classification will be maintained for the near future. During this time, organization will occur to enhance river management and safety, coordinate on-the-ground access management and complete access upgrades.

The water trail sponsor and the City of Ames are interested in two opportunities which would alter the Experience Classification on two segments in the future. First, following the City of Ames' plan for modification of the low head dam in North River Valley Park, and its replacement with a series of rock rapids, this segment will likely automatically meet criteria for Challenge Experience Classification rather than Recreation. This determination will be made after construction is complete. The second potential change both are interested in concerns development of a Gateway Experience Classification segment immediately upstream. This 2.8 mile segment between Sleepy Hollow and North River Valley Park accesses could be enhanced and managed to provide a beginning paddler opportunity. River conditions, resource opportunities and size of the adjacent population support this possibility. Enhancements would include access upgrades and river channel improvements to provide a more stable form. Future upstream extension of this water trail upstream of Story City is also a goal. The 3.8- mile segment between Story City and Riverside Bible Camp is already utilized by paddlers, however, there is no access at the upstream location.





CHAPTER 3
RECREATIONAL DEVELOPMENT PLAN

SOUTH SKUNK WATER TRAIL

ACKNOWLEDGMENTS

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CHAPTER 3
RECREATIONAL DEVELOPMENT PLAN

The South Skunk River corridor is a vibrant part of Story County.

A total of 8,726 acres of land are known to be in permanent protection within 10 miles of the Story County portion of the South Skunk; 98% of these acres (8,513) are available for public recreation. Outstanding natural, cultural and recreational resources exist on these lands. The existing Skunk River Greenbelt recreation areas, paired with public lands in Story City and Ames, offer trail opportunities to hikers, bikers and equestrians. Lands of similar recreational and cultural value adjacent to the South Skunk River in Polk and Jasper County are also publicly owned. Together these two counties provide an additional 9,648 acres to those found in Story County. The Skunk River Greenbelt includes 3,392 acres of public land and a 20.2-mile trail network following 8.5 miles of the South Skunk River. This segment of the river is heavily used by paddlers.

From a geographic and cultural standpoint, this study area is located in the center of the state. More than 34,000 university students attend Iowa State University, located 2.4 miles from the river, and hundreds of thousands of others visit the university annually. Twenty-one historic sites, both indoor and outdoor, are located within 10 miles of the river in the county and are open to the public.

The two cities and one county organization owning land and river accesses played an active role in preparation of this plan. Their commitment to their river-edge park facilities demonstrate a continuing level of support for providing recreation amenities at these locations.

Water Trail Existing Conditions

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

Recreation planning for state water trails responds to the individual character of each river, its local support and landscape conditions. Recommended outcomes focus on enhancing both the recreational infrastructure and the experiences of water trail users. The Iowa Water Trails Program recognizes water trail users as all people using the river as well as the adjacent land. On the river itself this includes paddlers and other boaters, anglers, swimmers and tubers. Active and passive users on land adjacent to the river are also included such as land trail users, 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 South Skunk River beginning in Story City on the upstream end to the Story County Line south of Cambridge *(Figure 1)*. The municipal boundaries of Story City and Ames are critically important segments of this water trail. The City of Cambridge lies close to the water trail but is not spatially connected to the river with the exception of its wastewater treatment plant. This recreational plan serves three purposes:

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

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

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

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

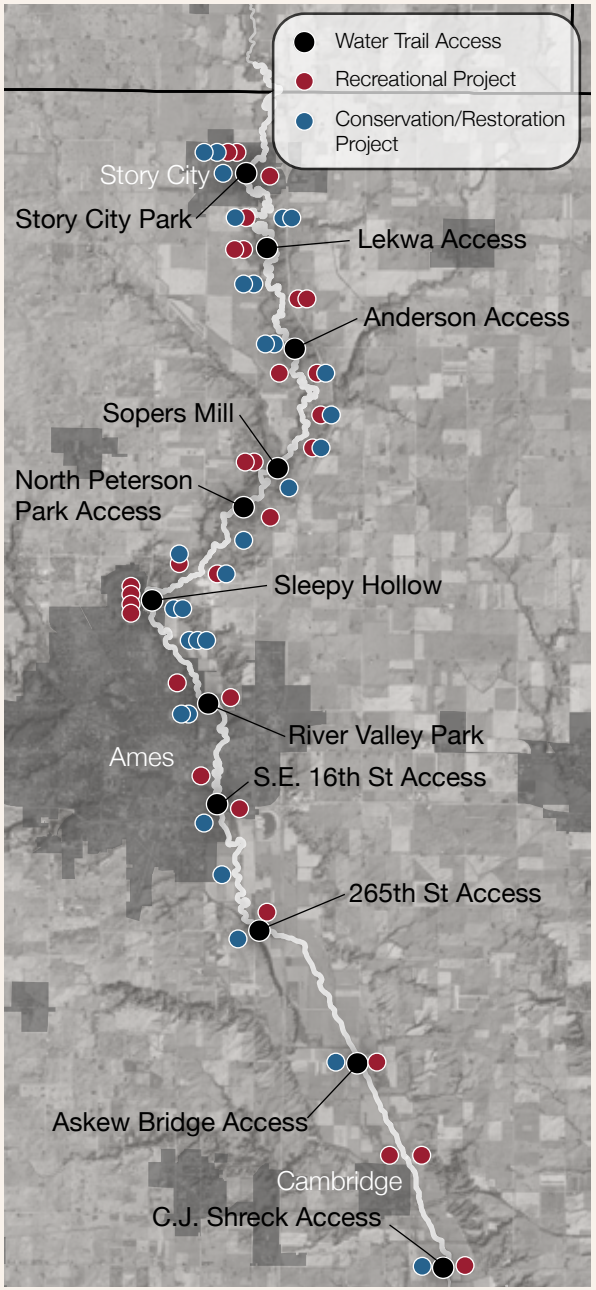


Figure 1
This plan included both recommended recreational and conservation projects

Administrative Rules and Definitions

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

- **Meandered vs Non-Meandered Stream:** Rivers with Meandered status generally allows river users on-foot access rights to the channel bottoms and stream banks up to the ordinary high water mark. Note that overnight camping may not be allowed on the sandbars of meandered rivers within state parks due to park use regulations. Alternatively, the stream bed and banks of rivers classified as "non-meandered" are considered part of the adjacent property. River users on these "non-meandered" rivers may have the right to recreate only on the water surface, with additional incidental rights associated with navigation (see Navigation and Trespass, below) where the bed and banks of the stream are in private ownership. All streams in Story County are non-meandered. *Iowa Code 462A.2, 462.69 IOWA WATER NAVIGATION REGULATIONS; Iowa Attorney General Opinion: Smith to Kremer, State Representative, 2-6-96 (#96-2-3).*
- **Navigation and Trespassing:** Paddlers on Iowa rivers are allowed to portage their boat to safely circumvent a channel blockage or hazard. Users also have the right to portage their boat on dry sandbars and channel bottoms. *Iowa Code 462A.2, 462.69 IOWA WATER NAVIGATION REGULATIONS; Iowa Attorney General Opinion: Smith to Kremer, State Representative, 2-6-96 (#96-2-3*). Entering privately owned land next to the river without the express permission of the owner or remaining there after being notified or requested to leave by the owner is considered trespass. *Iowa Code 716.7 IOWA DAMAGE AND TRESPASS TO PROPERTY REGULATIONS; Iowa Attorney General Opinion: Smith to Kremer, State Representative, 2-6-96 (#96-2-3)*.
- **Tort Liability of Governmental Subdivisions:** Municipal tort law provides a protection from claims of liability for local units of government when recreational infrastructure on rivers is built to current standards. *Iowa Code 670 TORT LIABILITY OF GOVERNMENTAL SUBDIVISIONS*.
- **Iowa's Recreational Use Statute:** Under the Iowa recreational use statute, a landowner is encouraged to open their land and water to others for recreational uses, including swimming and boating, by receiving immunity from liability except for injuries resulting from the landowner's willful or malicious acts, or when a landowner charges a fee for recreational use. *Iowa Code 461C PUBLIC USE OF PRIVATE LANDS AND WATERS*.
- **Littering:** Discarding litter onto water or land is prohibited. Additional fines or penalties may exist based on the jurisdiction of the littering incident such as county or municipal-owned property. *Iowa Code 455B.363 LITTER*.
- **Motorized Vehicle Use in River:** The use of motorized vehicles, including ATVs, in all parts of certain navigable streams, such as the South Skunk River in Story County, is prohibited at all times and conditions. Iowa Administrative Code 461, Chapter 49 provides a list of those navigable streams in

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.

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 321I.14.g ALL TERRAIN VEHICLES*.

- **Bicycle Use in Streams:** There is no restriction of bicycle use on the bed or banks of meandered streams (fat bikes, mountain bikes, etc.). Their use on the dry beds of non-meandered streams without permission of the landowner could result in trespass. *Iowa Code 716.7 IOWA DAMAGE AND TRESPASS TO PROPERTY REGULATIONS*.
- **Livestock Fences Across 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 NUSIANCES 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*.

Figure 2 *(continued)*

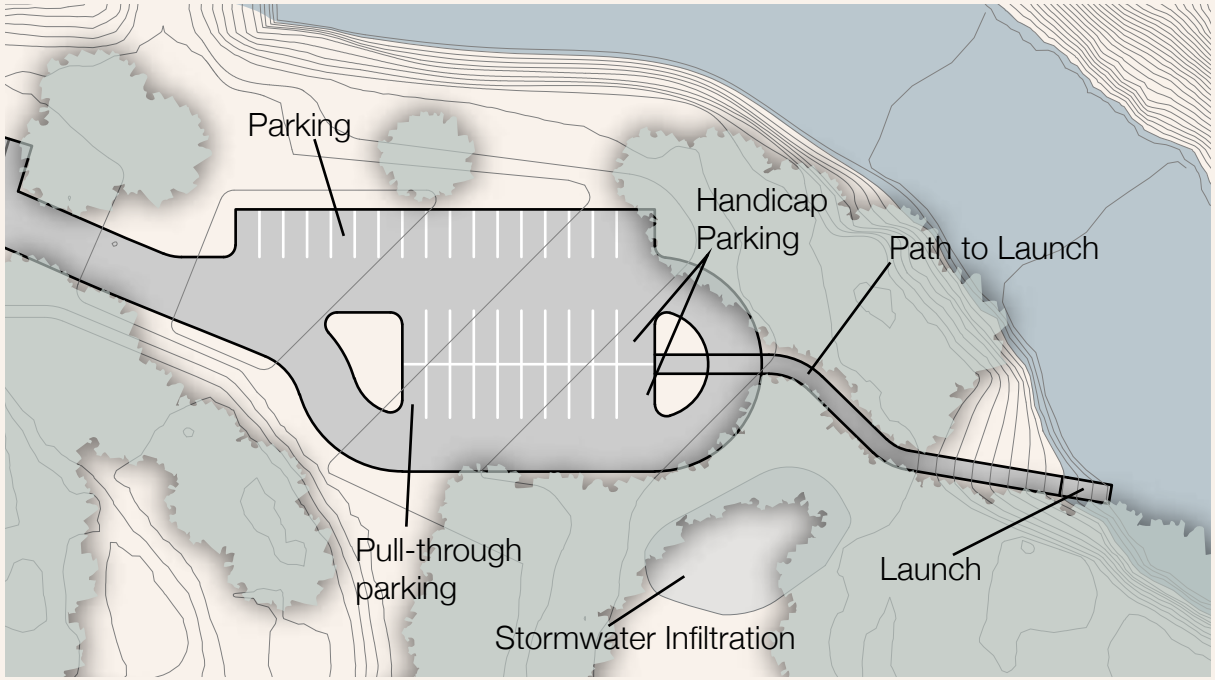
Assumptions and Concepts

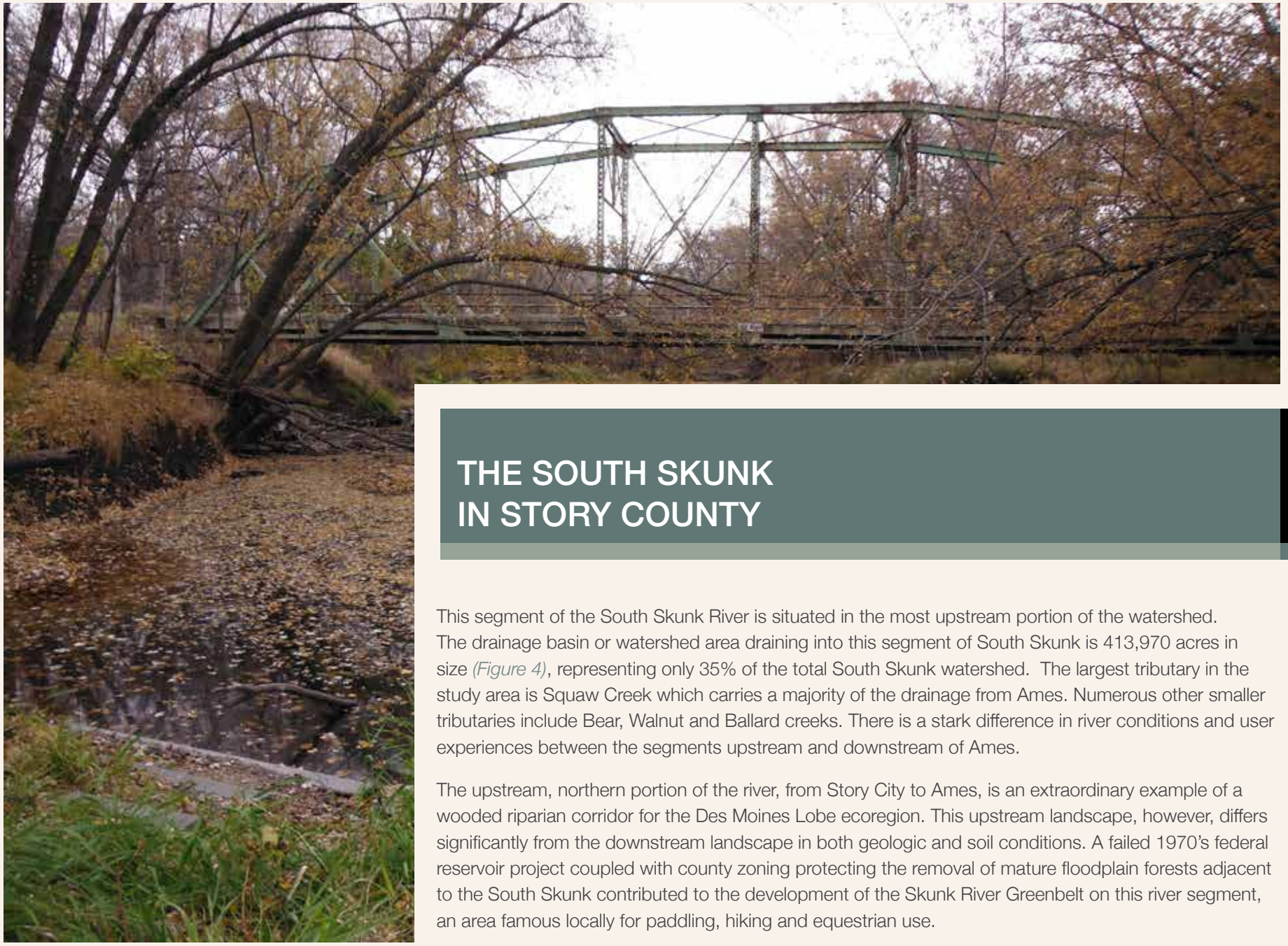
This recreational plan includes concept design for all near-water infrastructure construction. One of the most important recreational development elements in this plan is the upgrade of existing river accesses. River accesses include five functional components: entrance drive, parking surface, launch surface 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. Story County also has a Skunk River Greenbelt zoning classification impacting approximately 40% of the study segment. The Iowa DNR Water Trail development standards also recommend a minimum 50-foot wide unmown riparian buffer between the top of the streambank and all parking areas.

Figure 3

Components of a typical river access area





THE SOUTH SKUNK IN STORY COUNTY

This segment of the South Skunk River is situated in the most upstream portion of the watershed. The drainage basin or watershed area draining into this segment of South Skunk is 413,970 acres in size *(Figure 4)*, representing only 35% of the total South Skunk watershed. The largest tributary in the study area is Squaw Creek which carries a majority of the drainage from Ames. Numerous other smaller tributaries include Bear, Walnut and Ballard creeks. There is a stark difference in river conditions and user experiences between the segments upstream and downstream of Ames.

The upstream, northern portion of the river, from Story City to Ames, is an extraordinary example of a wooded riparian corridor for the Des Moines Lobe ecoregion. This upstream landscape, however, differs significantly from the downstream landscape in both geologic and soil conditions. A failed 1970's federal reservoir project coupled with county zoning protecting the removal of mature floodplain forests adjacent to the South Skunk contributed to the development of the Skunk River Greenbelt on this river segment, an area famous locally for paddling, hiking and equestrian use.

The downstream 14 miles of the river south of Lincoln Way in Ames was channelized in the late 1890's and is legally identified as a "ditch". The upstream 3 miles of the channelized portion has not been maintained as a ditch and is beginning to re-meander. The downstream 11 miles of the channel remains leveed and ditched. The channelized sections of the river are characterized by higher and more vertical streambanks, less perennial vegetation in the riparian buffer, shallower water and less outside bend streambank erosion as compared to the upstream non-channelized segment.

Typical channel width of the South Skunk in Story County ranges between 50 and 75 feet on the natural, non-channelized segment upstream of Ames and approximately 165 feet wide on the downstream channelized ditch segment. Paddling volume is high on a majority of segments upstream of S.E. 16th Street in Ames and substantially lower on the downstream, channelized segments.

Three dams exist on this segment of the river; all three require portage. A total of 8,726 acres of land are known to be in permanent protection within 10 miles of the Story County portion of the South Skunk; 98% of these acres (8,513) are available for public recreation. A total of 120 miles of bike trails are connected directly with water trail accesses on the South Skunk River in Story County.

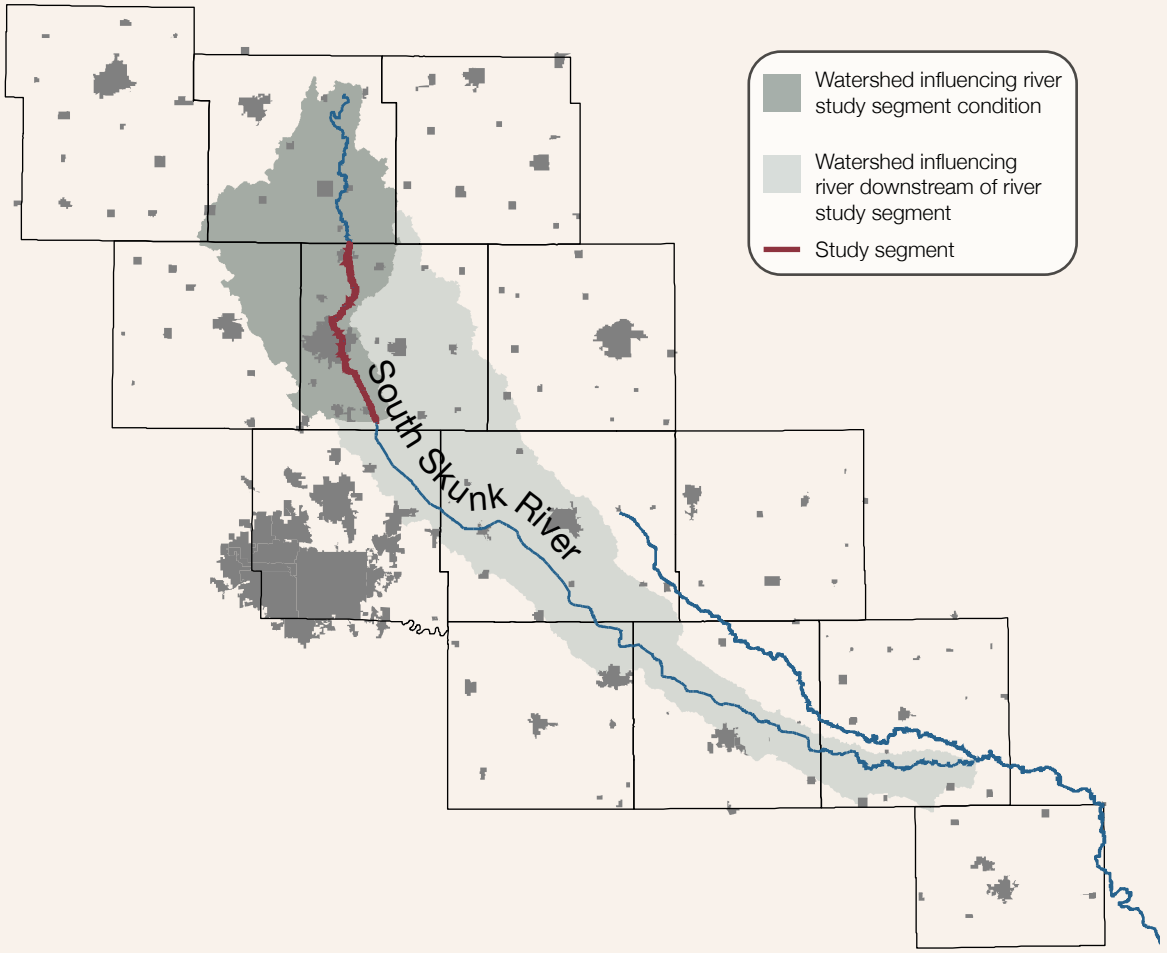
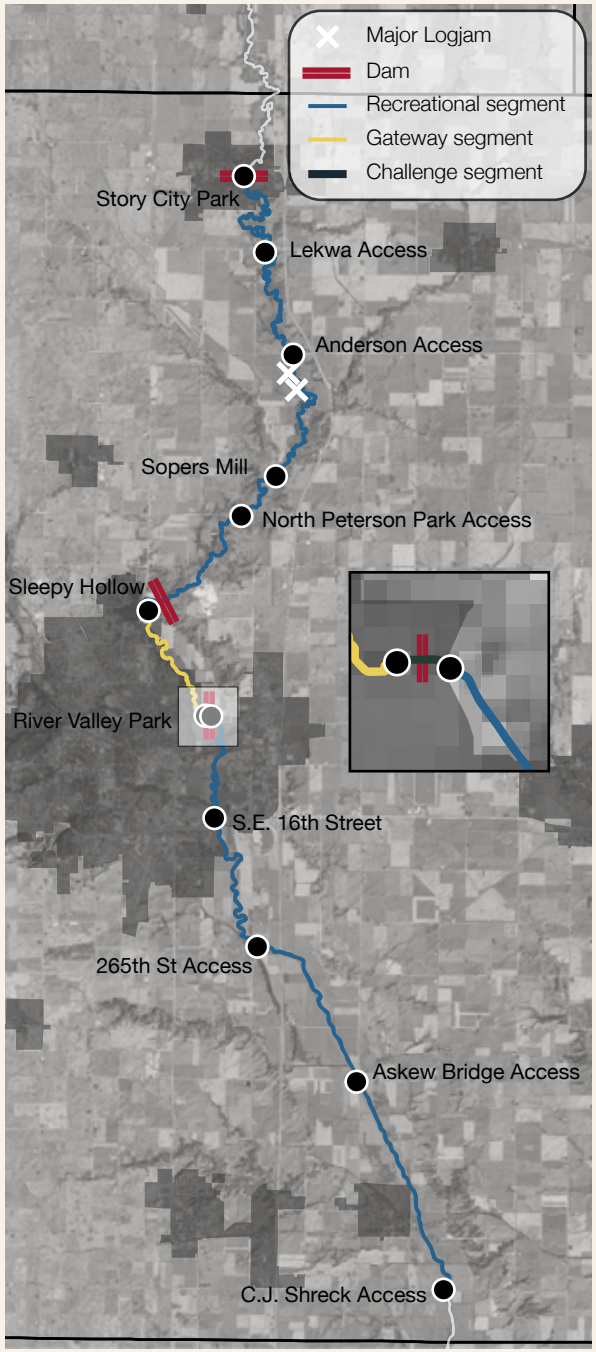


Figure 4
The water trail portion of the South Skunk is located near the top of the Skunk River watershed



Implementation of the South Skunk Vision

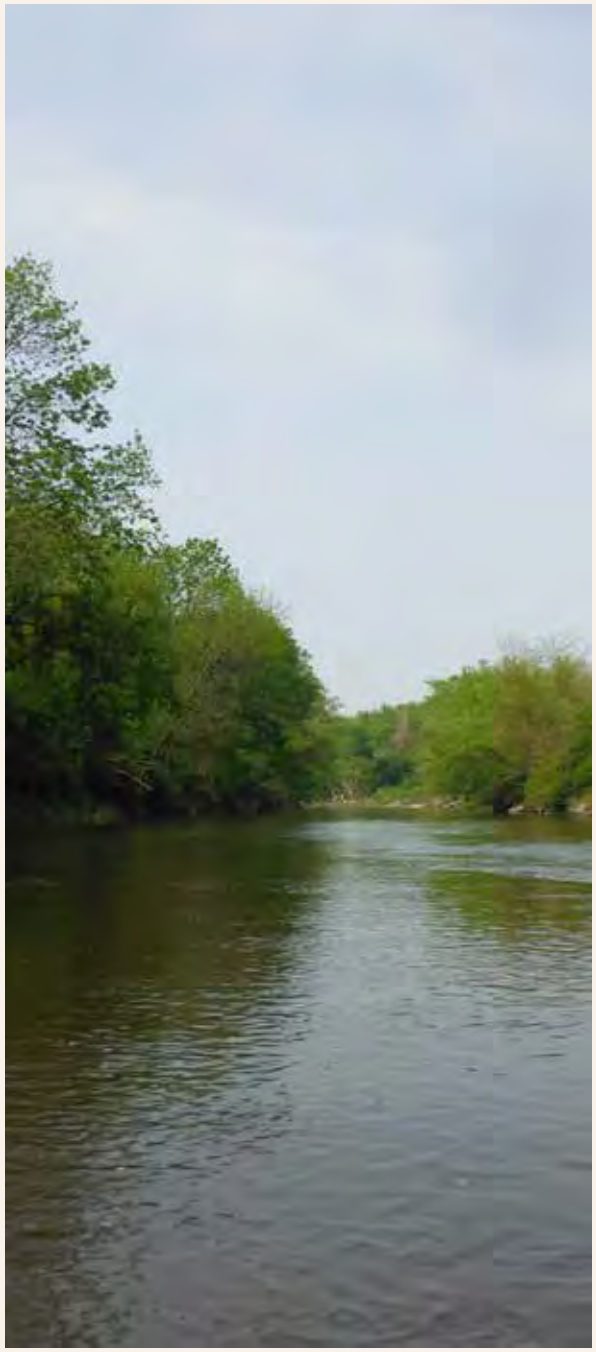
The South Skunk River in Story County will be designated as a Recreational use classification with the exception of two sections *(Figure 5)*. The 2.8 mile segment between Sleepy Hollow and North River Valley Park is envisioned in the future as a Gateway segment. The dam structure in North River Valley Park is being converted a series of rapids in the future; this alteration will change the classification of that segment to a Challenge use. A large part of the vision for this proposed state-designated water trail includes protecting and enhancing the conditions that make this river such a high quality recreational experience today. This includes protecting the already high diversity of bird and mussel species as well as the small-mouth bass population from degradation. Other parts of the vision address resource concerns described earlier in the Existing Conditions chapter. A stable, natural meandering river system is desired where lateral channel migration, mid-channel deposition and excessive streambank scour are minimized.

The vision includes making gains in water quality enhancement in Story County to address the bacteria and biologically impaired reaches of the river in the study segment.

Recreational development included in the vision includes expansion of the Skunk River Greenbelt to the south between Ames and Cambridge on previously channelized segments of the river. A continuous perennial riparian buffer with diverse vegetation is also envisioned. Diverse resource enhancement of the river corridors also includes permanent protection of critical cultural and historic resources and river edge riparian forests. 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 entire water trail will be designated with the Recreational Use Classification. This is the most common classification in Iowa. Potential changes in classification are likely.



Planning Process

This vision was developed through a two-year planning process integrating stakeholders, agencies, university researchers, non-profit organizations and landowners. Three public events were held to generate interest and attention on water trail planning. A steering group composed of 15 local individuals representing special interests such as water quality, angling, 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, Story County Conservation Board.

The existing conditions surrounding this section of the South Skunk 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, Story County Conservation staff, Story County Conservation board members and Iowa DNR. Finally, the recreational development and existing conditions information was presented at a well-attended public open house. All comments received at the open house and following were positive and highly supportive of the planning outcomes.

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, dam modification, paddle-in campsites, future studies for paddler connectivity between the Skunk River and other water bodies and improved angler access. Land-based recommendations in the riparian area include enlarged and improved parking areas, purchase of properties owned by the U.S. Government and conversion of those to public use, the completion of the Skunk River Greenbelt off-road trail connecting Story City with Ames and the construction of an off-road trail connecting Ames with Cambridge and the Heart of Iowa Trail.

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

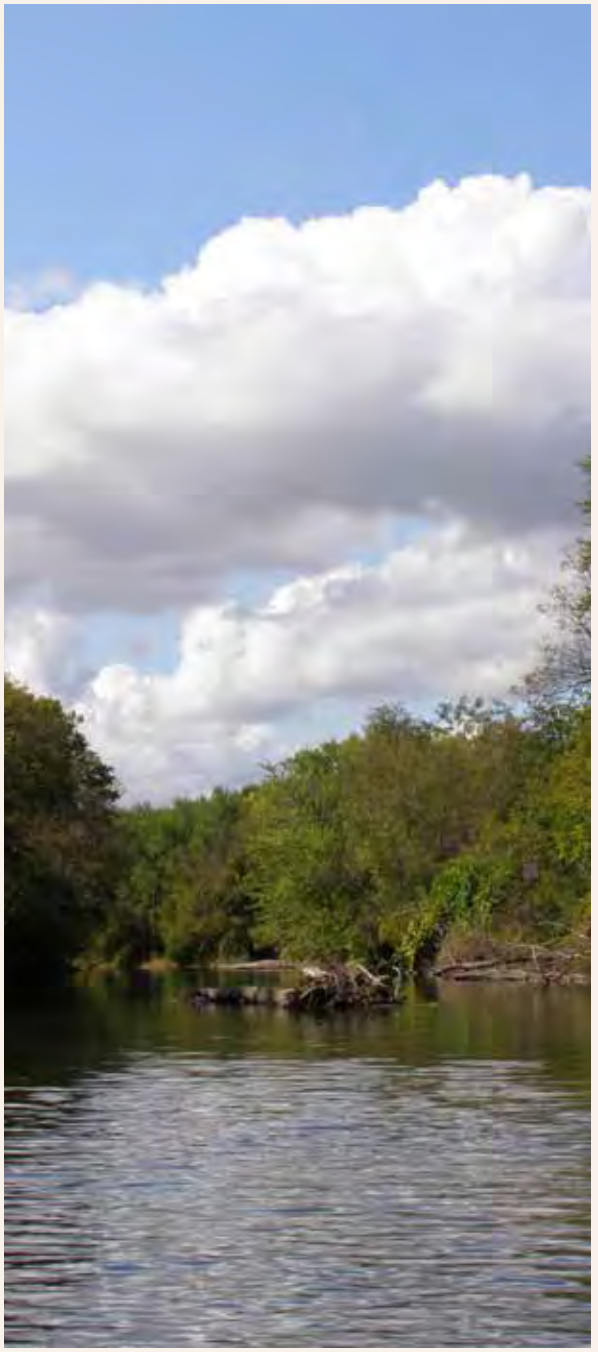
The South Skunk River is a non-meandered stream beginning in Iowa's Hamilton County. The South and North Skunk rivers join in Keokuk County, becoming the Skunk River. The Skunk enters into the Mississippi River in the far southeast part of the state. The Story County portion of the South Skunk River is 37 miles in length. River access points divide the 37 miles into eleven segments.

One sheet pile and two low head dams are located on the South Skunk River in Story County. The river is used for canoeing, kayaking, tubing, fishing and hunting. Locally, residents perceive that more paddling and other river uses occur between Story City and Ames compared to the study segment downstream of Ames. A high number of college students recreate on the river due to the close proximity to Iowa State University; the University rents boats to students and the public.

The primary advocates for the river are the Skunk River Paddlers. This organized local paddling enthusiasts group paddles year round and helps to maintain the general health of the river by removing log jams, trash, etc.

A great deal of municipal and county public recreational land exists adjacent to the South Skunk River Water Trail in Story County *(Figure 6)*. Highly-developed city parks in Story City and Ames straddle both sides of the South Skunk. And Story County's two largest parks as well as three wildlife management areas are also located on the river.

The South Skunk River upstream of Ames is, compared to other similarly-scaled Iowa rivers, recognized for the above-average amount of large woody debris accumulations and outside bend streambank erosion (Hoogeveen 2012). These conditions are due to the largely forested edge of the river, the channels' current phase of widening and the pattern of intense rain events of the past ten years. Woody debris piles blocking the entire channel width are common throughout the calendar year and generally exacerbate streambank erosion. Woody debris poses obstacles for paddlers when it blocks a significant portion of the channel and when piles accumulate and act as strainers on outside bends.



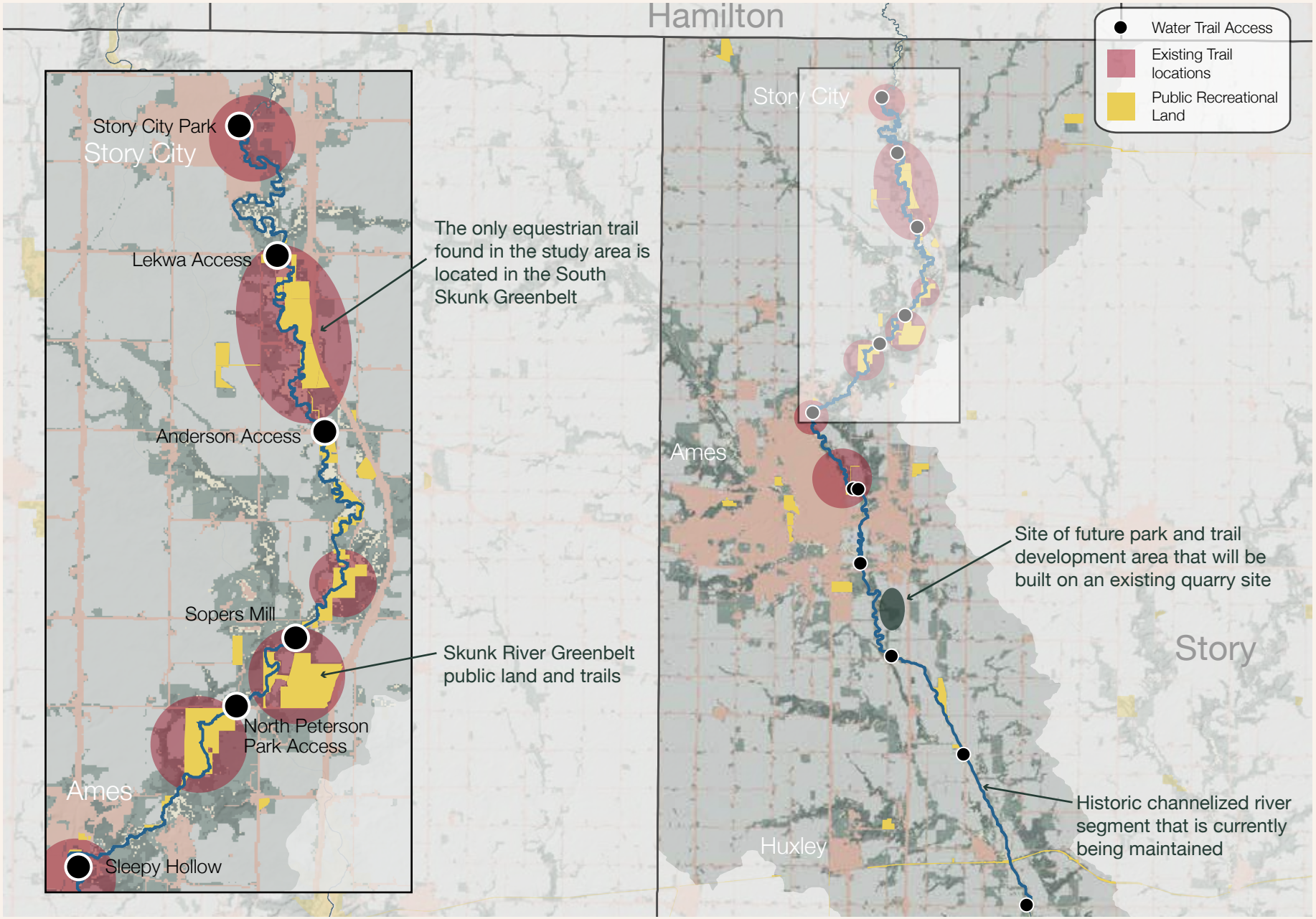


Figure 6

Existing recreational opportunities are concentrated in the northern half of the county

Beyond on-river experiences, the South Skunk River in Story County is a premier location for land-based trails including hiking, biking and equestrian. Regional, urban and rural trails intersect with the South Skunk River. Both Ames and Story City river accesses connect with bike trails. Together, the Heart of Iowa and High Trestle trails span 57 miles in Central Iowa offering views of prairie, forest and wetland remnants, the Des Moines River valley, historic and vernacular buildings and bridges.

Ninety-seven miles of either paved bike trail or shared road trail exist today within the City of Ames, all accessible from both river accesses in Ames. One of these river accesses, S.E. 16th Street, also serves as a node for the bike trail. An additional 43.7 miles of on and off-road Ames bike trails are planned in the near future. Story City has 2.6 miles of either paved trail or shared road trails.

The Skunk River Greenbelt north of Ames is a rural and often remote trail experience. The Skunk River Greenbelt includes a highly planned and developed 20.2-mile trail network following 8.5 miles of the South Skunk River *(Figure 7)*. Greenbelt Trail users can gain access to the river at four water trail access points: North Peterson, Sopers Mill, Anderson and Lekwa. The greenbelt network includes a combination of hiking only (1.5 miles), hiking and biking combination (7.5 miles), on-road (3.3 miles) and multi-use including equestrian (8 miles).

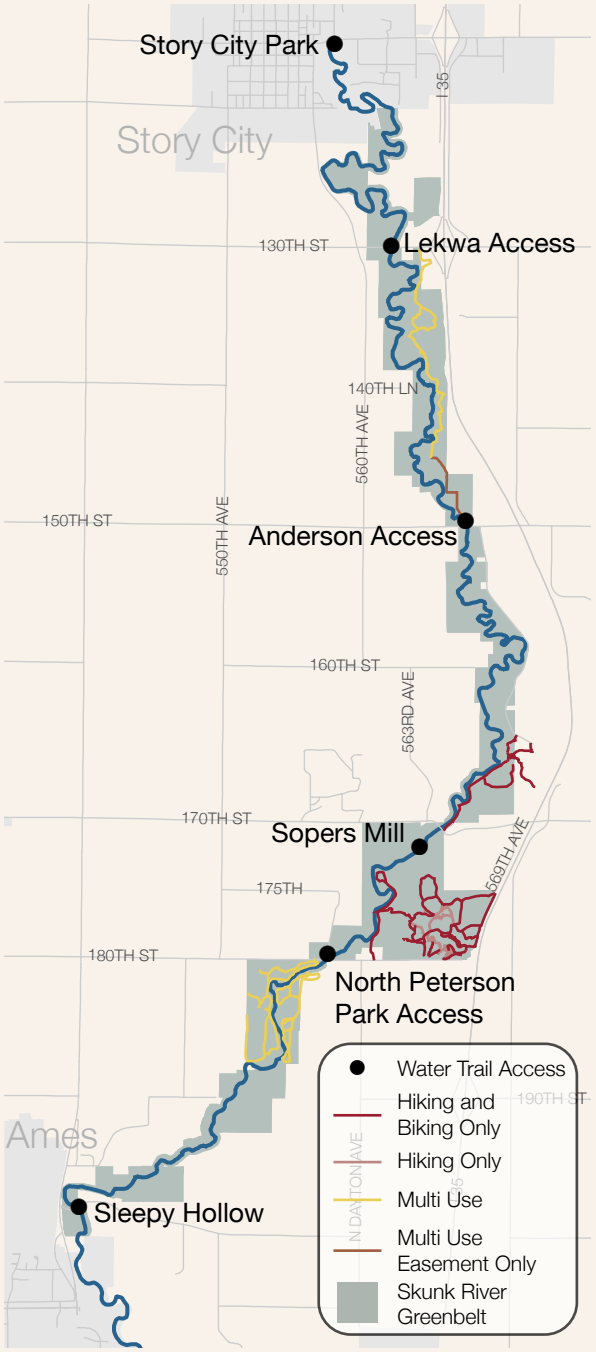


Figure 7
Several gaps in the Skunk River Greenbelt trail route exist south of Story City

Water Trail Management Needs

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

- Increase river management communication and capacity
- Enhance communication between water trail access managers
- Standardize ordinary maintenance at launches
- Secure proper easement or ownership of land needed for accesses
- Develop a livery management policy
- Establish a reporting mechanism to report misconduct
- Reinforce capacity for on-water rescue

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

Table 1

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

Elements Included in this plan	Enhance Everyday Management Conditions	Strengthen Relationship between Land Owners and River Users	Increased Efficiency of Resources and Time	Enhance River Use Experience	Leadership Responsibility For Element
Increase capacity for on-water rescue	√	√		√	Story County/ WT Sponsor
Develop channel management strategies for Gateway Segment experiences			√	√	WT Sponsor, City of Ames & Skunk River Paddlers
Enhance communication between water trail access managers	√	√		√	WT Sponsor / Access Managers
Develop management agreements between access managers and DNR	√			√	WT Sponsor / River Programs Staff
Develop a livery management policy	√	√		√	WT Sponsor / River Programs Staff
Standardize ordinary maintenance at launches	√			√	WT Sponsor & Access Managers

River-Edge Infrastructure Needs

The existing spacing and availability of river accesses in this corridor are adequate and functionally spaced. And while portage routes around 2 of the 3 dams on this river do not have formal paths, paddlers are easily able to portage around the dams. The existing condition of the accesses, in general, is primitive *(Table 2)*. A majority of launch surfaces themselves are natural-surface and have been damaged from high water events. Stormwater runoff from the parking areas is frequently directed toward the river over the launch surface. Runoff from the parking area causes gully erosion on the launch surface if it is gravel or natural surface. 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
Story City Park	246A & B		√		√	√	√	
Lekwa Access	242		√	√	√			
Anderson Access	239	√	√	√		√	√	
Soper's Mill	235	√	√	√	√	√		
North Peterson Park	234		√	√	√	√	√	
Sleepy Hollow	230		√	√	√	√		
River Valley Park	227		√			√		√
S.E. 16th Street Access	224	√	√	√	√	√		
265th Street Access	220		√		√			
Askew Bridge	217		√	√	√	√		
C.J. Shreck Access	212		√	√	√	√	√	

Table 2

The existing spacing and availability of river accesses in this corridor are adequate; however, conditions are often primitive in terms of development. Access needs identified during the existing conditions assessment is detailed later in this chapter.

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

On-Water Desired Outcomes:

- Provide additional paddling miles on the South Skunk
- Modify or remove the dam infrastructure at the 3 locations it exists in the county
- Upgrade some access facilities
    - Upgrade launch types to allow vehicles & people to reach water's edge experiences
    - Upgrade parking availability geared for all users
    - Upgrade accesses with overly steep launch and path slopes as well as perpendicular alignment to the thalweg
- Provide remote paddle-in campsites
- Enhance angler opportunities

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

Land-Based Recreational Outcomes:

- Expand public ownership of key river edge properties
- Provide connection to regional recreational resources
- Provide additional land trail miles between Story City and Cambridge

Communication-Based Recreational Outcomes:

- Explore public communication at urban launches that explains the risk/flow relationship for river users
- Enhance communication for users before they get to the river
- Update public interpretation
- Communicate boundaries between public and private property from the river

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

Table 3

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

Recreational Development Overview

Several site development protocols exist that may differ from traditional construction. Consistent with resource conservation goals and federal, state and local regulations, any existing wetland areas in river access areas are to remain undisturbed. Upgraded launch designs minimized the number of mature trees required to be removed and the amount of earthwork. Only the minimum amount of earth fill is utilized as necessary to construct proper parking surfaces with proper slopes and drainage. Lastly, the water quality volume of stormwater runoff from all parking areas is infiltrated on-site 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 8)*. These elevations were established morphologically by field surveying and verified with quantitative gage analysis. Bankfull elevation is understood as the river stage with discharge for a 1.5 year (on average) recurrence interval. This elevation varies with each river and can change with watershed conditions. Mean bankfull depth at a riffle on this study segment of the South Skunk is approximately 3'. Floodprone elevation represents the area adjacent to the stream that is inundated or saturated during a 50 year recurrence interval. Wetlands are often located in riparian areas and are federally protected.

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

- Communication with users: resource interpretation, recreational expectations and public property boundaries
- On-water recreation infrastructure: Launch upgrades and replacements, parking improvements, paddle-in campsites and angler access
- Land-based recreation enhancements: soft and hard trail expansion, a pedestrian bridge replacement and several feasibility studies

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 (Minnesota, Trails and Waterways Unit 2006. 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.

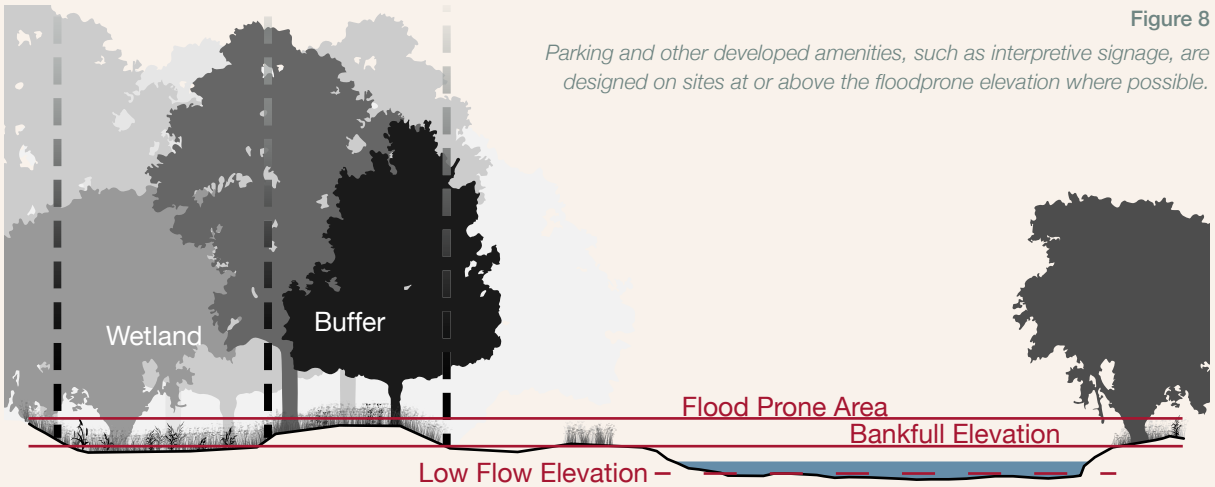
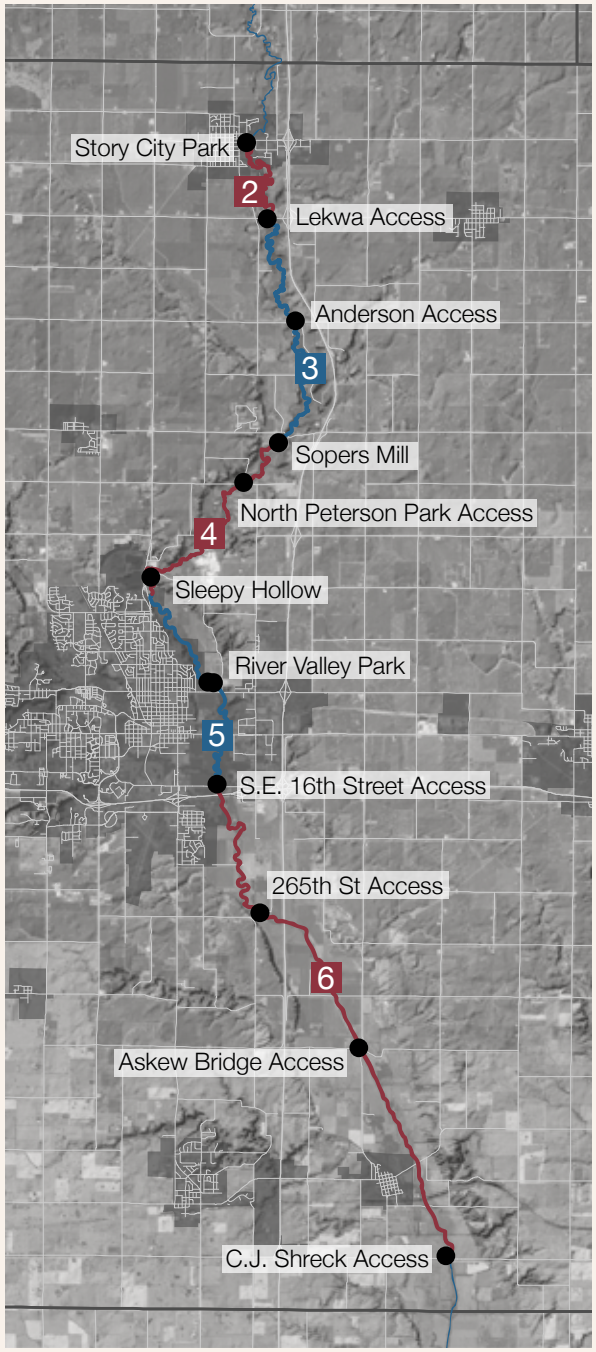


Figure 8

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

The study area river corridor is divided into five segments plus an additional segment referring to the entire river corridor *(Figure 9)*. Recommendations are organized by segment and include maps, drawings and text descriptions. Some recommendations span multiple segments or the entire 37 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. Story County's 2016 Comprehensive Plan, From Cornerstone to Capstone, was integrated as well as information from the Ames Area MPO Long Range Transportation Plan, Ames Mobility 2040.

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, the municipalities of Story City and Ames and Story County. The design of infrastructure utilized technical experts from Iowa DNR and Iowa State University.

Figure 9

The river is divided into six segments for the purpose of this planning

SEGMENT R1: **Corridor-Wide and Multiple Segment Projects**

River User Management Recommendations for the Entire Corridor:

R 1.A
Livery Management Policy

A livery management policy adopted at the county level will enable liveries to improve paddler understanding of appropriate behavior as well as safer use of the river. All entities renting boats will participate in the development and implementation of the policy including private companies, Iowa State University and county conservation.

R 1.B
Mechanism to Report Misconduct

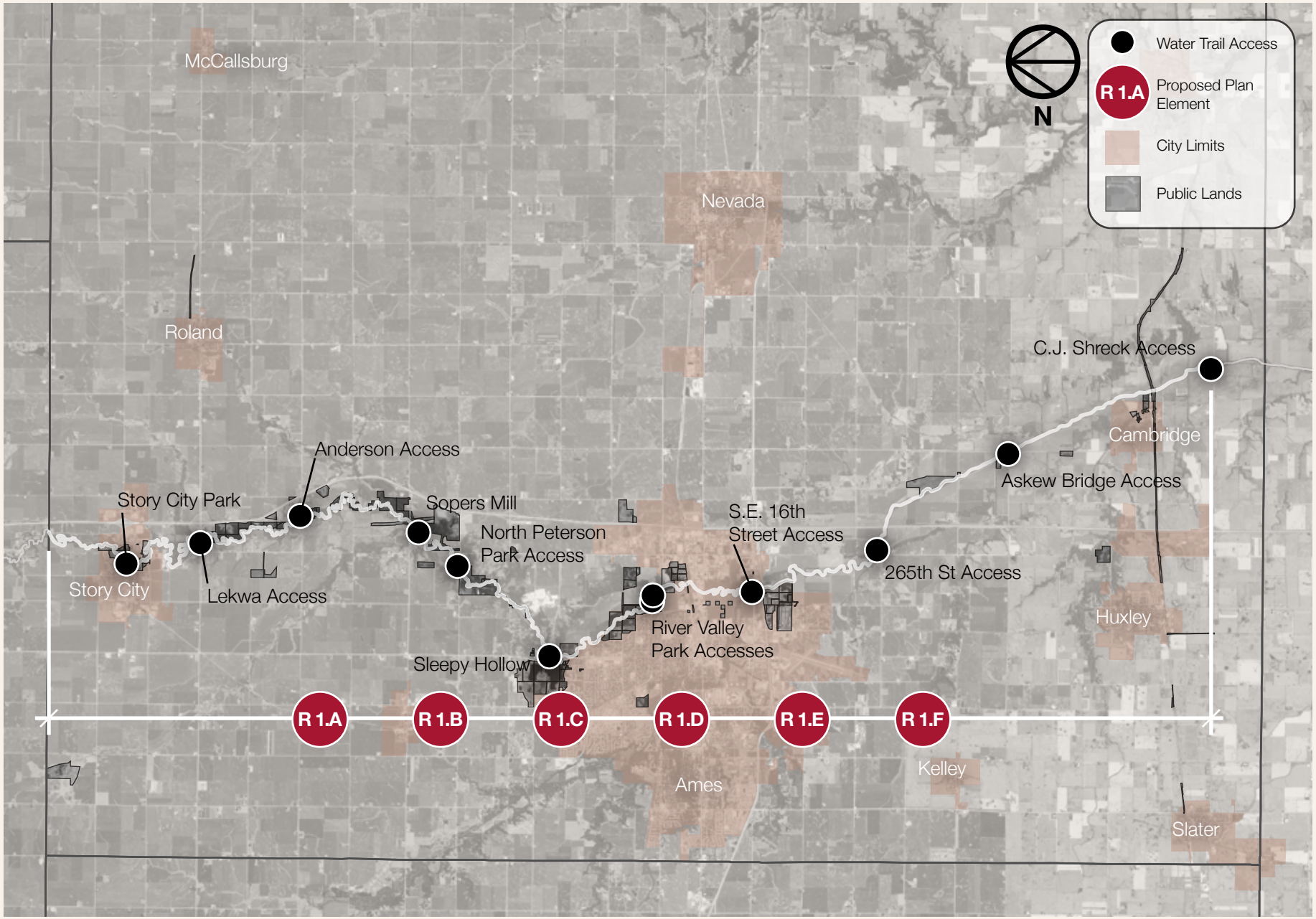
Providing public information at launches and major parking areas to report littering, vandalism, intoxication and other disruptive behavior on the river or on public property is recommended. This could ultimately reduce the frequency of these behaviors particularly by boat rental customers. The public may also feel more prepared to respond to the situation in a way that may generate a change in future behavior.

R 1.C
On-Water Rescue Capacity

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

R 1.D
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.



SEGMENT R1: **Corridor-Wide and Multiple Segment Projects**

Recreation Development Recommendations for the Entire Corridor:

R 1.E
Public Interpretation, Wayfinding & Communication Among Water Trail Access Managers

Improved signage for interpretation, public greenbelt land boundary, private lands, and greenbelt trail 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 issues and resources based on the conditions on this river. This will add to quality of the experience for users.

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

R1.E *Trespassing is an ongoing issue for some landowners. Small signs such as this can be used to improve communication.*

R1.E *Land boundaries in the Skunk River Greenbelt are largely unmarked and few of the original Skunk River Greenbelt property signs remain.*

R1.E *Warning signage at accesses is recommended on segments that are highly used segments and have accumulations of large woody debris.*

R1.E *Enhanced interpretive signage that links resource locations on the river to the paddling route and discusses the importance of protecting private property is recommended.*

R 1.F
Risk/Flow Relationship

Appropriate water levels in the river are one of the most important determining factors for successful recreational river experiences. Enhanced communication of real-time water levels and the relationship between risk, experience and flow are recommended. Painted markers on launch pavement are recommended at Anderson, Soper's Mill and Sleepy Hollow accesses. Marker elevations can be easily survey-located and painted onto the launch pavement corresponding with several water surface elevations based on the USGS gage data. Painted markers for the lowest suggested flow elevation as well as a "caution" and "danger" elevation are recommended. This information is provided as a guide and does not guarantee that any particular rapid or area of the river will not be hazardous at any level. Signage discussing these markers as well as the risk/experience relationship between river use and flow is also recommended.

R1.F *Physical marking of key flow levels for paddlers at the most popular accesses is recommended. These include the lowest suggested flow and the caution/high flow levels. This graphic illustrate the recommended method to communicate this information.*

SEGMENT 1 COST ESTIMATES		
RECOMMENDATION	MAP CODE	COST ESTIMATE
Concessionaire Agreement	R1.A	$0
Misconduct Reporting Policy	R1.B	$0
On-Water Rescue Capacity	R1.C	$0
Communication Between Access Managers	R1.D	Reimbursable from IDNR
Public Interpretation Plan & Education Program	R1.E	$0
Greenbelt Wayfinding Signage (20)	R1.E	$400
Greenbelt - Private Property Limits Sign	R1.E	$250
Water Trail Map	R1.F	$0
Risk/Flow/Experience Communication	R1.G	$1,000

SEGMENT R2: **Story City to Lekwa Access**

Existing Conditions

The segment of the river is 3.7 miles in length and has a moderate level of use by paddlers. Once past Story City, this is a rural paddling experience with few homes or farm operations visible. The corridor is heavily wooded with a moderate amount of large woody debris in the river channel. A sheet pile dam in the Story City Park is no longer passable by boat *(Figure 10)*. One concrete at-grade farm road crossing on this segment can also be challenging at low water *(Figure 11)*.

Issues and Opportunities

Story City is an important anchor on the South Skunk Water Trail. One of only two communities on the route, it provides complete services including lodging. The city maintains park land on both sides of Broad Street, North and South Parks. Water trail amenities are located in the South Park. Access improvements in Story City South Park are recommended to expand the range of positive experiences on this segment. Improvements include addressing the shortage of parking in the park as well as launch improvements and various amenities in the park. Whitewater enthusiasts have utilized the dam retrofit in the past when it was functional. Re-design and construction of the retrofit will add value for both people and aquatic organisms.

Figure 10

Flood damage has impacted the series of rock weirs near the existing sheet pile dam in the Story City South Park. Professional engineering and reconstruction is required to make the retrofit functional for paddlers.

Figure 11

This low-water crossing downstream of Story City rarely causes paddling problems for experienced boaters. The crossing appears to be abandoned.

Figure 12

Whitewater paddlers have created this dirt path to access the damaged rock weir / dam. A more stable launch is recommended.

SEGMENT R2: **Story City to Lekwa Access**

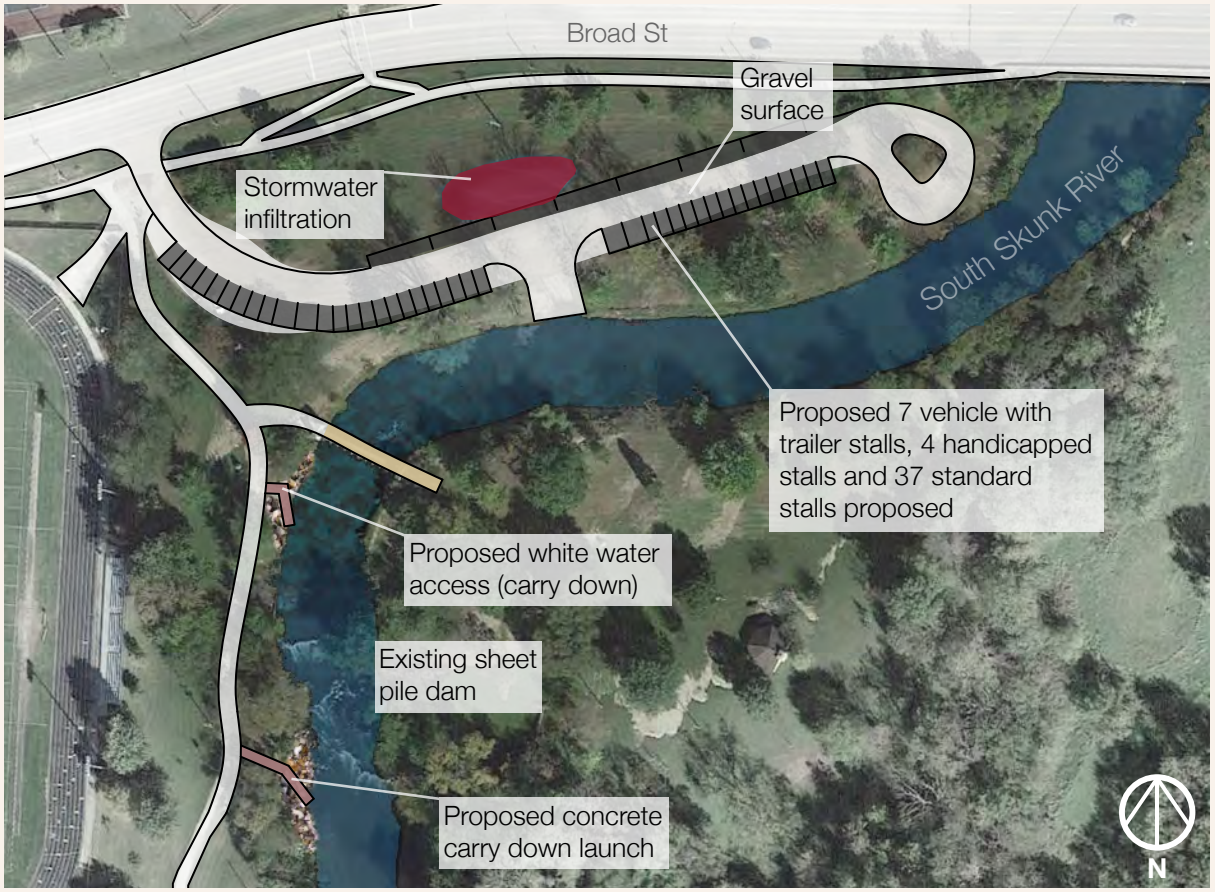
Story City North Park

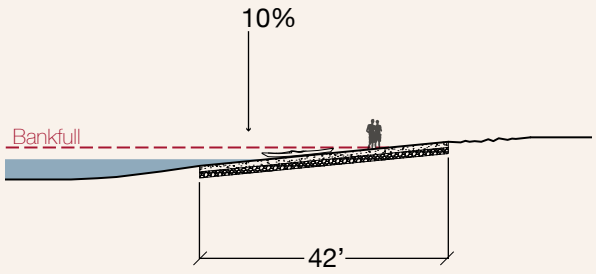
- Playground equipment
- Lighted basketball court
- 2 tennis courts
- Swimming pool
- Little league baseball diamond
- Enclosed Scandinavian style shelter house with restrooms and kitchen
- Lighted band-shell
- 2 open air picnic shelters
- Picnic grills & tables
- Drinking Fountains
- Enclosed antique Carousel

R 2.A
New Story City Park River Access Upgrades

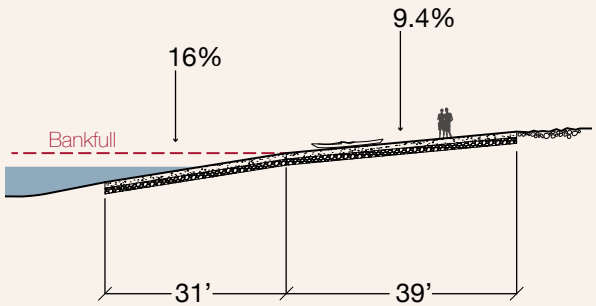
A hard-surfaced carry down launch is recommended below the dam in Story City Park at the same location as the existing natural surface launch. Additionally, a more narrow and steeper version is recommended slightly upstream of the dam *(Figure 12)*; this second launch will serve the needs of whitewater paddlers wanting to run the rapids created by the future repaired boulder weirs.

R2.A *Story City Park River Access Upgrades*





R2.A *Creating a hard-surfaced launch in conjunction with whitewater use will reduce streambank erosion caused by repeated use of the streambank by boaters.*



R2.A *The existing boat launch downstream of the Story City dam is a natural surface carry-down. Recommendations include a hard-surfaced launch and approach path.*

R 2.B
Story City (South) Park Improvements

Planned improvements for Story City South Park include a concrete trail, shelter reconstruction, picnic tables near the river and 2 river overlooks with fire pits. Expansion of the existing parking lot near the historic bridge is recommended and an additional new 80 foot x 20 foot gravel parking lot is also planned.

Story City South Park

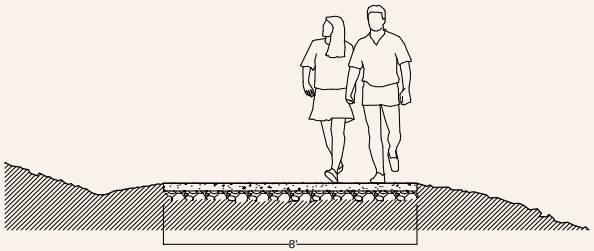
- Enclosed picnic shelter with fireplace
- Swing set
- Bike path
- Lighted ball diamond with concession stand & restroom
- 9 hole disc golf course
- Picnic grills and picnic tables
- Suspension/swinging bridge

R 2.C
Story City (North) Park Improvements

Planned improvements for Story City North Park include streambank stabilization, construction of a pedestrian bridge replacements, play equipment replacements, improvements to the ball diamond area and construction of a plaza near the Carousel.

R 2.D
Story City Trail Extension

An additional 3.5 miles of off-road bike trails near the South Skunk River are included in Story City’s long term plans. These trail segments will link the Lekwa Access / E 18 Greenbelt Access, Story City Park and Whispering Oaks Campground with Story City.



R2.D *Paved multi-use trail extensions will connect County Greenbelt trails with Story City and two water trail accesses.*

E-18 Greenbelt Area

- Hiking
- Equestrian
- Cross-county Skiing
- Mountain Bike Trails
- Hunting & Trappings

R 2.E
Lekwa Access Upgrades

Lekwa Access includes a launch situated on a steep and eroding streambank and an undersized parking area. The launch has been damaged by streambank scour due to high flow and its proximity to the road bridge. Iowa DNR River Programs staff redesigned this access in 2015 and construction is planned for summer 2016.

R2.E *Lekwa Access is located on property leased to Story County Conservation. This launch has been difficult to use and maintain due to its location immediately downstream of a road bridge and the undersized lot available for development of the parking.*

R2 Permitting Considerations

Construction at the proposed Story City Access is located at sites of previous disturbance so Phase I archaeological investigation would likely not be required. If past disturbance cannot be verified, Phase I investigation would likely be required. No additional archaeologic investigations are needed at Lekwa Access if the footprint of disturbance lies within the footprint of the E-18 Bridge construction disturbance area.

SEGMENT 2 COST ESTIMATES		
RECOMMENDATION	**MAP CODE**	**COST ESTIMATE**
Story City Park River Access: New Whitewater Access Above Dam & New Carrydown Launch Downstream	R2.A	$11,020
Story City (South) Park Parking Expansion	R2.B	$32,793
Story City (South) Park New Gravel Parking Lot	R2.B	
Story City (North) Park Improvements	R2.C	
Story City Trail Extension	R2.D	

SEGMENT R3: **Lekwa Access to Sopers Mill**

Existing Conditions

The segment of the river is 7.3 miles in length and has a moderate to high level of use by paddlers. This is the most upstream segment of the river within the limits of the Skunk River Greenbelt. This segment is remote with only one road crossing at Anderson Access. Very few if any homes are visible from the river depending on the season. It is a heavily wooded segment with a moderate amount of large woody debris in the river channel *(Figure13)*. Blockages across the entire channel are common on this segment. One large woody debris blockage, slightly downstream from Anderson Access, is considered a semi-permanent hazard and is actively managed. A constructed boulder riffle is located at the Sopers Mill access. The riffle is navigated by most paddlers but it can be easily portaged if paddlers are interested in avoiding it.

Figure 13

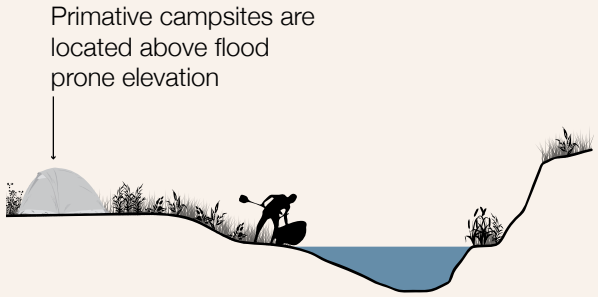
Large woody debris in the South Skunk is generally caused by collapsing streambanks during high water events. Paddlers generally need boat maneuvering-ability to paddle the upper reaches of this water trail.

Issues and Opportunities

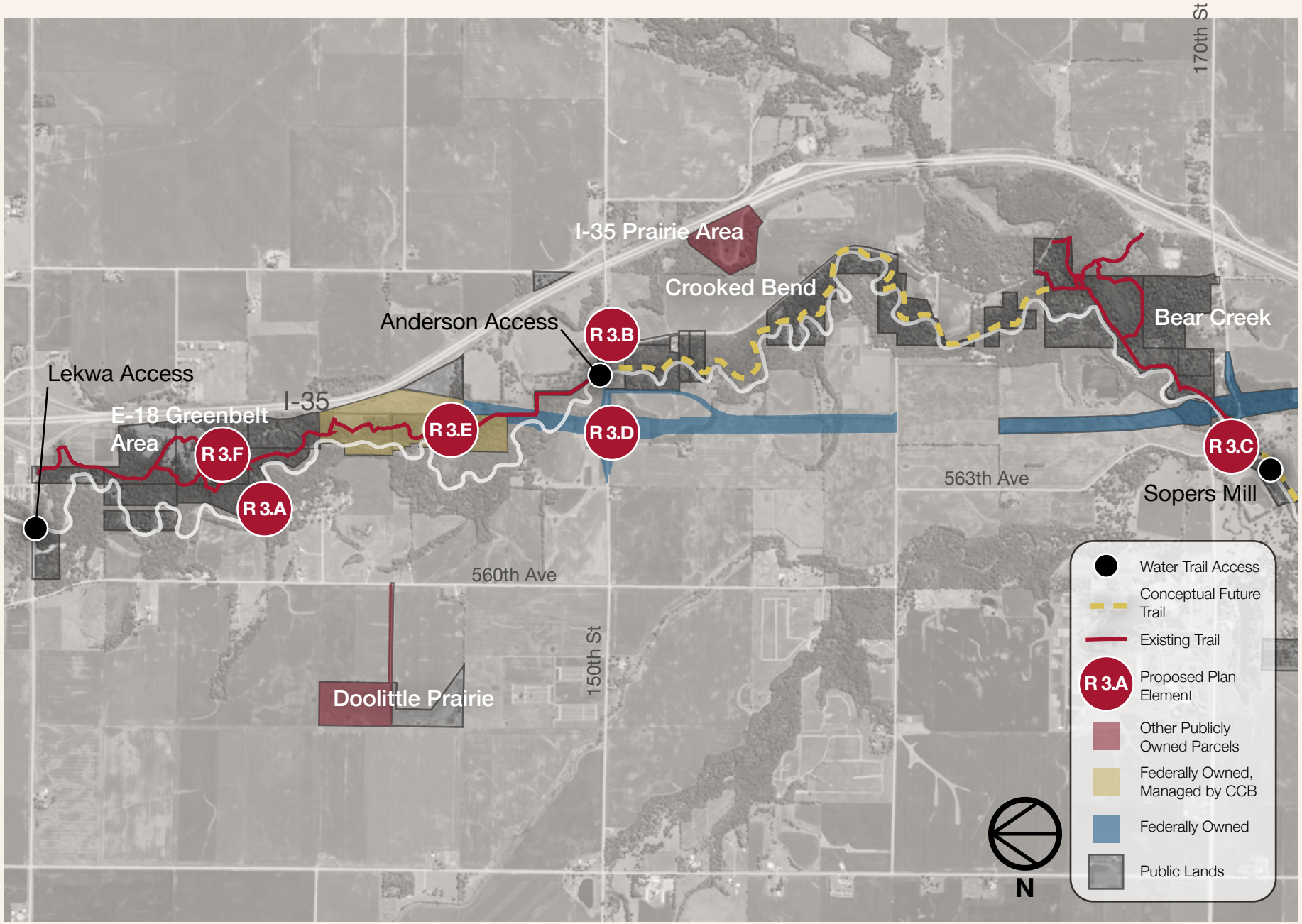
The existing Skunk River Greenbelt trail parallels the river corridor for approximately 75% of this water trail segment. A gap in the land trail exists between Anderson Access and the Bear Creek confluence, near Pleasant Valley Drive. The trail segment between Lekwa and Anderson accesses is open to equestrians. Recent flood damage (2015) exacerbated lateral channel migration on many parts of this reach, particularly upstream of Anderson Access. Access improvements at Anderson Access are a high priority as the available parking does not meet Iowa DOT minimum standards. Existing equestrian use of the trail is frequent and parking for horse trailer vehicles at Anderson Access is extremely awkward.

R 3.A
Paddle-in Camp Site

Construction of a paddle-in campsite is recommended on this segment. Access would be limited to paddle-in; there would be no vehicular access. Iowa DNR water trail standards for this amenity include primitive amenities.



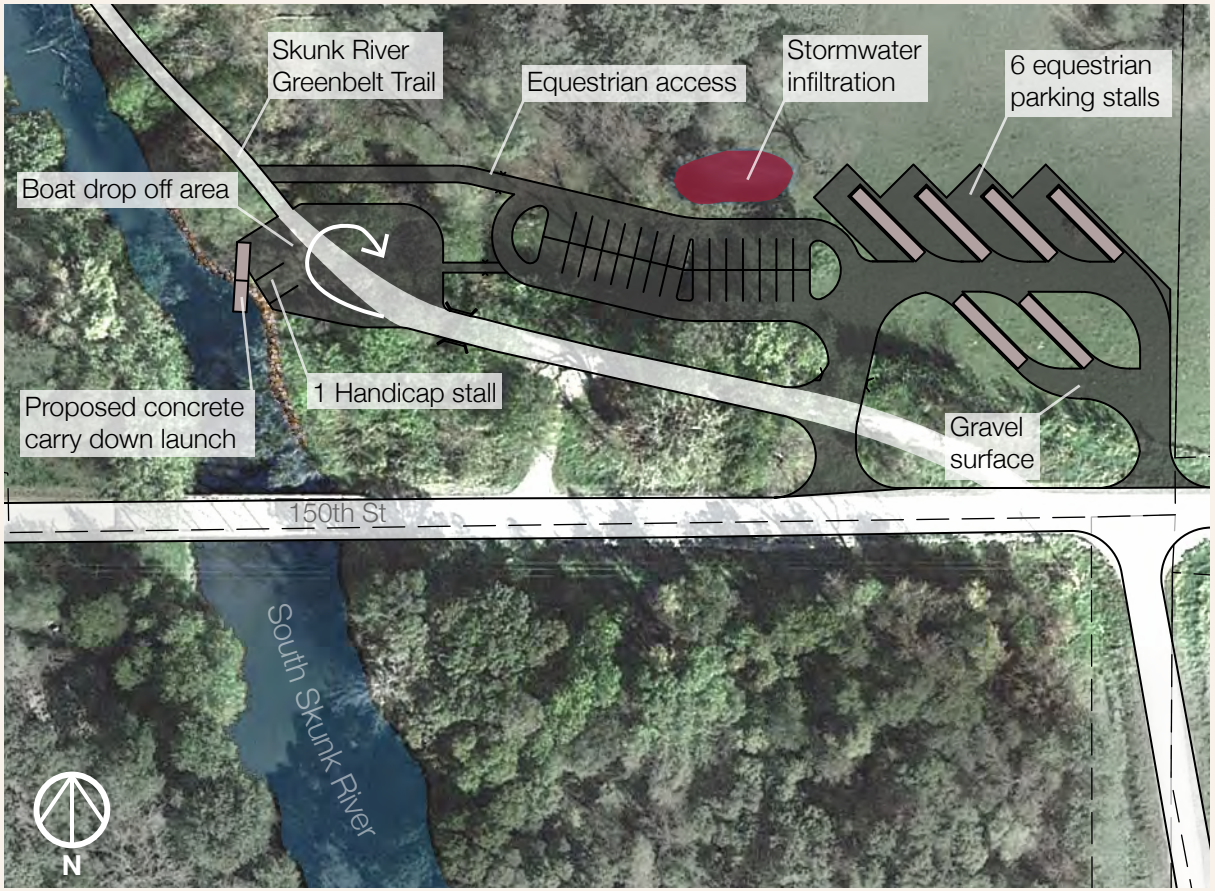
R3.A *This campsite would be located somewhere between Lekwa and Anderson accesses on county property. An exact location is yet to be determined.*



SEGMENT R3: **Lekwa Access to Sopers Mill**

R 3.B
Anderson Access Upgrades

Launch reconstruction is recommended due to the stair step nature of the existing launch *(Figure 14)*. The angle of the existing launch is stable and relatively self-cleaning and can be reused for a new hard-surfaced carrydown launch. The existing parking area is insufficient to meet Iowa DOT minimum standards. Equestrian use of this trail segment makes parking and navigation in the access area even more difficult. Additional land is required to construct a parking area for the multiple types of users: paddlers, bikers/hikers and equestrians (Hancock et al. 2009). Management of stormwater generated by the new parking area is also recommended.



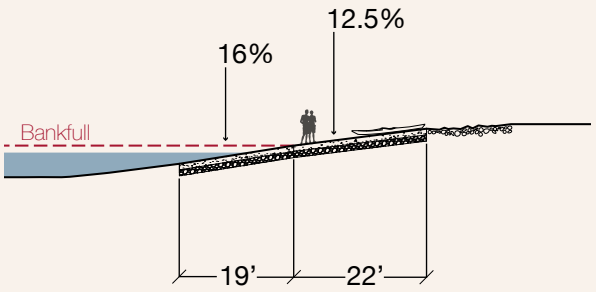
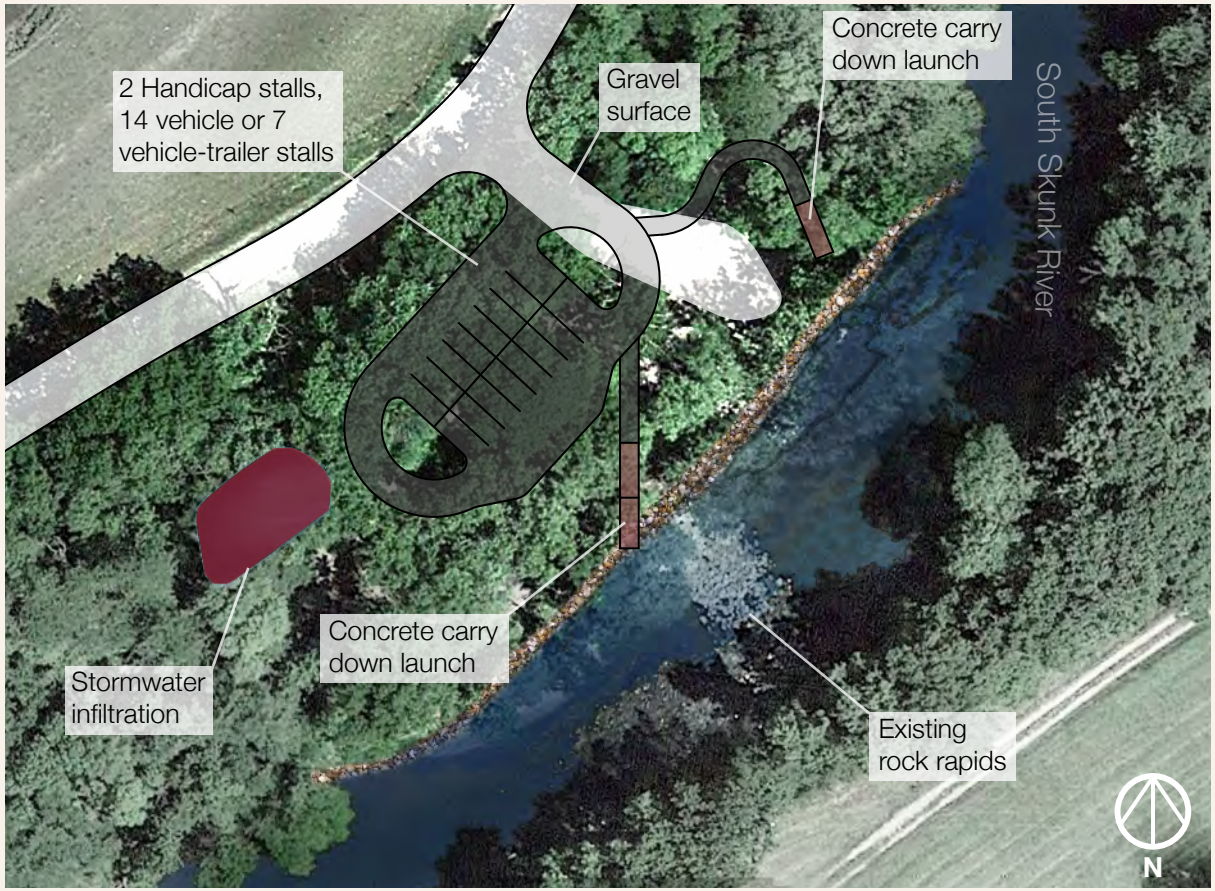


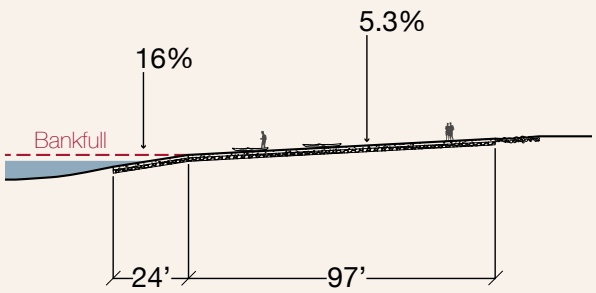
Figure 14
A hard-surfaced launch is recommended to replace the stairs at the existing Anderson Access.

R3.B
Minimal earthwork is required to construct a new hard-surfaced launch at Anderson Access.

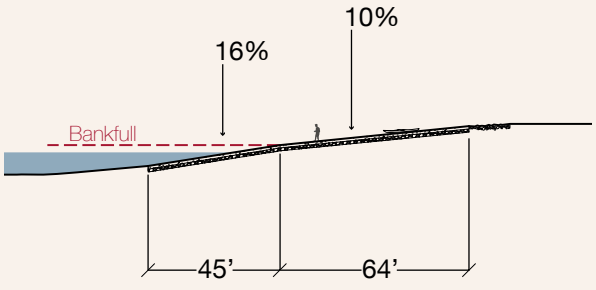


R 3.C
Sopers Mill Access Upgrades

Sopers Mill Access with its rock riffle is one of the most heavily utilized accesses by anglers, wildlife watchers, paddlers and tubers on the water trail *(Figure 15)*. Existing launch locations are appropriate and have low banks, however, they lack a durable surface. Existing parking and vehicle circulation is inefficient, awkward and floods frequently. Reconfiguration of the existing vehicle circulation is recommended to eliminate one entrance drive and relocate the formal parking area to a slightly higher elevation downstream of the existing parking. Management of stormwater generated by the new parking area is also recommended.



R3.C *The launch upstream of the rock riffle is a take-out point for most paddlers. It is also used by paddlers wanting to portage the rock riffle.*



R3.C *The launch downstream of the rock riffle exists as a natural, highly uneven surface. This launch is used by those wanting to avoid the rock riffle or those paddling further downstream.*

Figure 15

The rock riffle at the Sopers Mill Access was constructed to prevent further erosion and is popular with kayakers and tubers.

R 3.D
Land Acquisition from U.S. Government for trails

It is recommended that land currently owned by the U.S. Government, resulting from the failed reservoir project, be used by Story County Conservation or traded for the land necessary to extend the Skunk River Greenbelt Trail *(Figure 16)*.

R 3.E
Greenbelt Trail Extension

It is recommended that the trail connection between Lekwa and Sopers Mill access be completed. This is a natural surface, multi-use trail *(Figure 17)*.

Figure 16

Many of the Skunk River Greenbelt trails are built and maintained by volunteer trail crews.

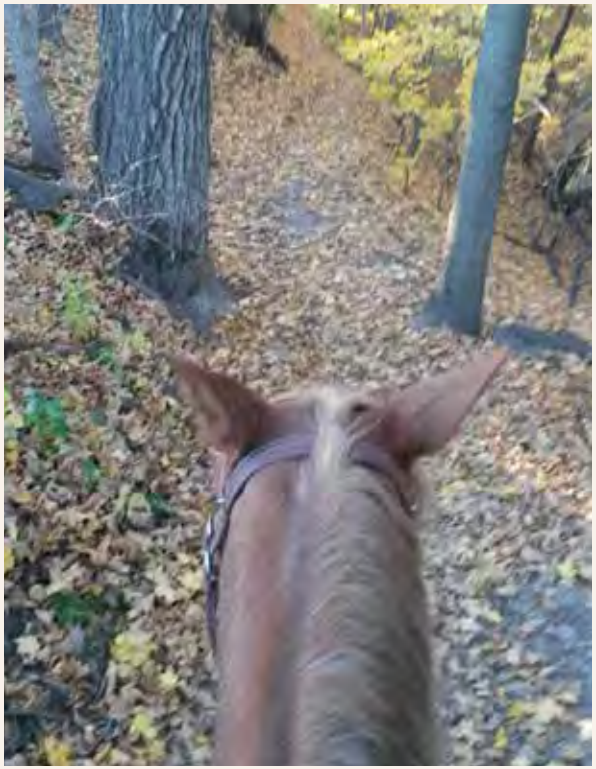
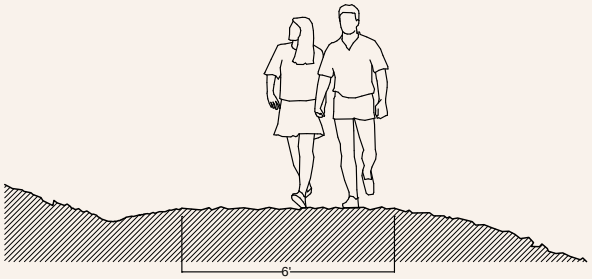


Figure 17

This segment of the Skunk River Greenbelt is the only one with designated equestrian trails.

I-35 Prairie Area

- Hiking
- Scenic Overlook



R3.E *These natural surface trails are located in a heavily forested area and will be used by bikers, hikers and equestrians. Snowshoers and cross-country skiers are frequent winter users.*

Crooked Bend

- Hunting
- Stream Fishing
- Bird Watching

Bear Creek

- Hunting
- Hiking
- Mountain Bike Trails
- Birdwatching
- Geocaching

R3 Permitting Considerations

The proposed parking expansion north and east of the existing parking area at Anderson Access will require a Phase I archaeological investigation as this area has not previously been disturbed by road or bridge construction.

Disturbance for launch and parking improvements at Sopers Mill will likely require a Phase I archaeological investigation.

R 3.F
4th Try Bridge Replacement

Reconstruction of this pedestrian and equestrian bridge is recommended due to damage from past floods.

R3.F *This bridge was established and has been repaired multiple times with volunteers. Replacement with a more formal bridge is recommended.*

SEGMENT 3 COST ESTIMATES		
RECOMMENDATION	**MAP CODE**	**COST ESTIMATE**
Paddle-in Campsite	R3.A	$500
Anderson Access Launch, Parking and Entrance Upgrades	R3.B	$118,447
Sopers Mill Launch Upgrades	R3.C	$10,360
Upgrades to Sopers Mill Parking	R3.C	$81,900
Land Acquisition	R3.D	
Greenbelt Trail Extension	R3.E	

SEGMENT R4: **Sopers Mill to Ames Municipal Boundary**

Existing Conditions

This segment of the river is 5 miles in length and is the most popular segment of the water trail with paddlers and tubers. This segment includes the southern limit of the Skunk River Greenbelt *(Figure 18)* and ends at the municipal boundary of Ames near Ada Hayden Park and Sleepy Hollow Access. This segment is remote with only one road crossing at North Peterson Park Access. In addition to the Skunk River Greenbelt, three major parks exist on or near the river on this segment: McFarland, Peterson and Ada Hayden Heritage. Very few if any homes or farms are visible from the river depending on the season. It is a heavily wooded segment often with a high amount of large woody debris in the river channel. Blockages across the entire channel can occur on this segment. The Hannum's Mill/General Filter dam is located between North Peterson Park and Sleepy Hollow accesses.

Figure 18
This segment is well-liked due to the intact riparian corridor on both sides of the river.

Issues and Opportunities

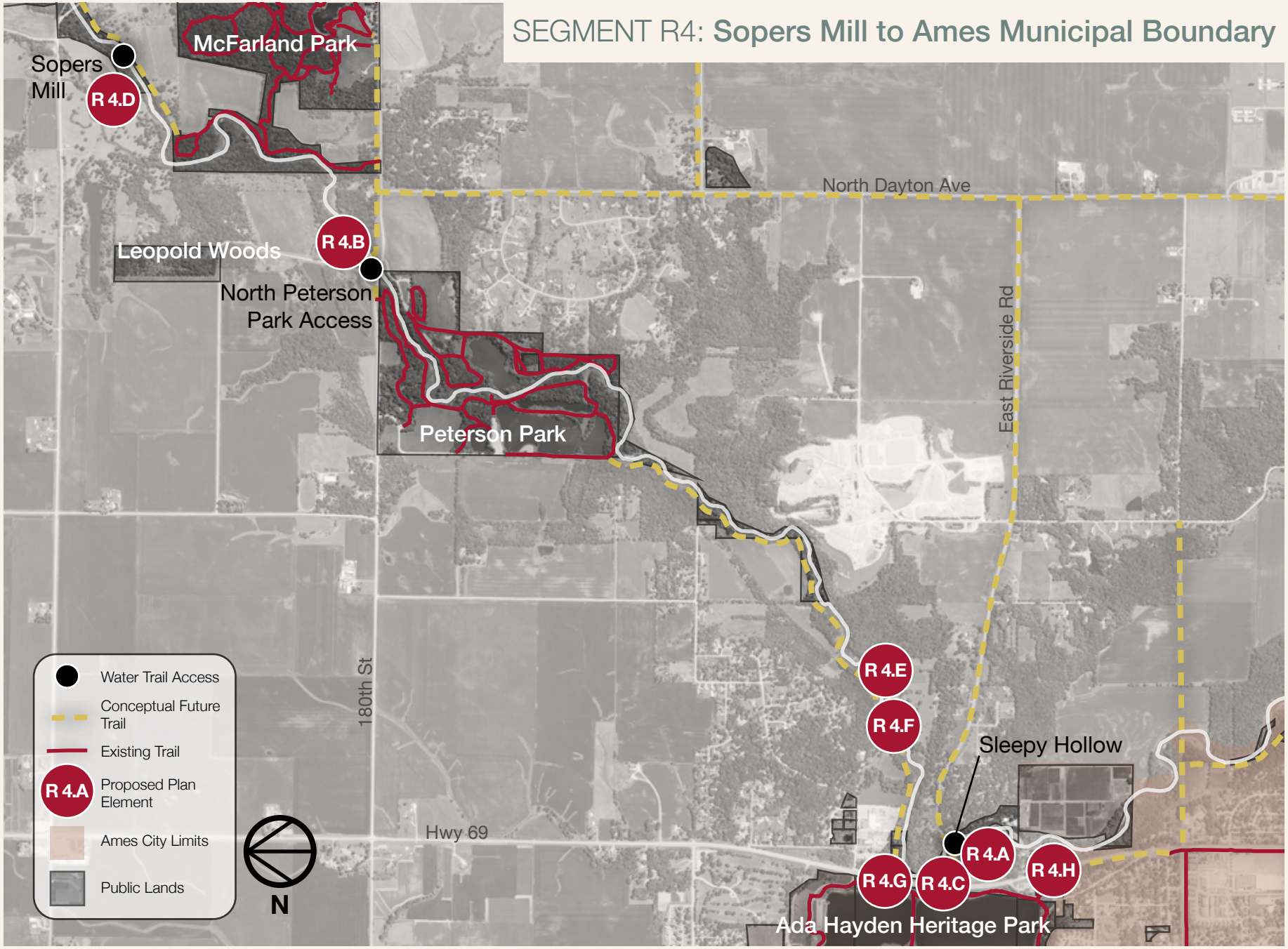
There is high use of existing land trails along parts of this water trail segment. However, several incomplete segments exist between 170th Street (near Sopers Mill) and the existing Sleepy Hollow Access (across Highway 69 from Ada Hayden Park). Approximately 2 river miles of land trail distance is missing. Recommended river access improvements include launch reconstruction, parking improvements and stormwater management. At least 2 paddlers have drowned at the Hannum's Mill/General Filter dam since the 1960's. Sleepy Hollow Access, at the downstream limits of this segment, is the beginning of the proposed Gateway Water Trail segment.

R 4.A
LWD Hazard Warning Signage to Paddlers

Following flood events, large woody debris (LWD) can occur in this channel segment *(Figure 19)*. Sleepy Hollow Access, at the downstream end of this segment, is also the upstream end of the proposed gateway experience classification segment. Large woody debris hazard warning signage is required at Sleepy Hollow when conditions are appropriate. Signage will warn paddlers on the Gateway segment of the possibility of debris so they are not surprised.

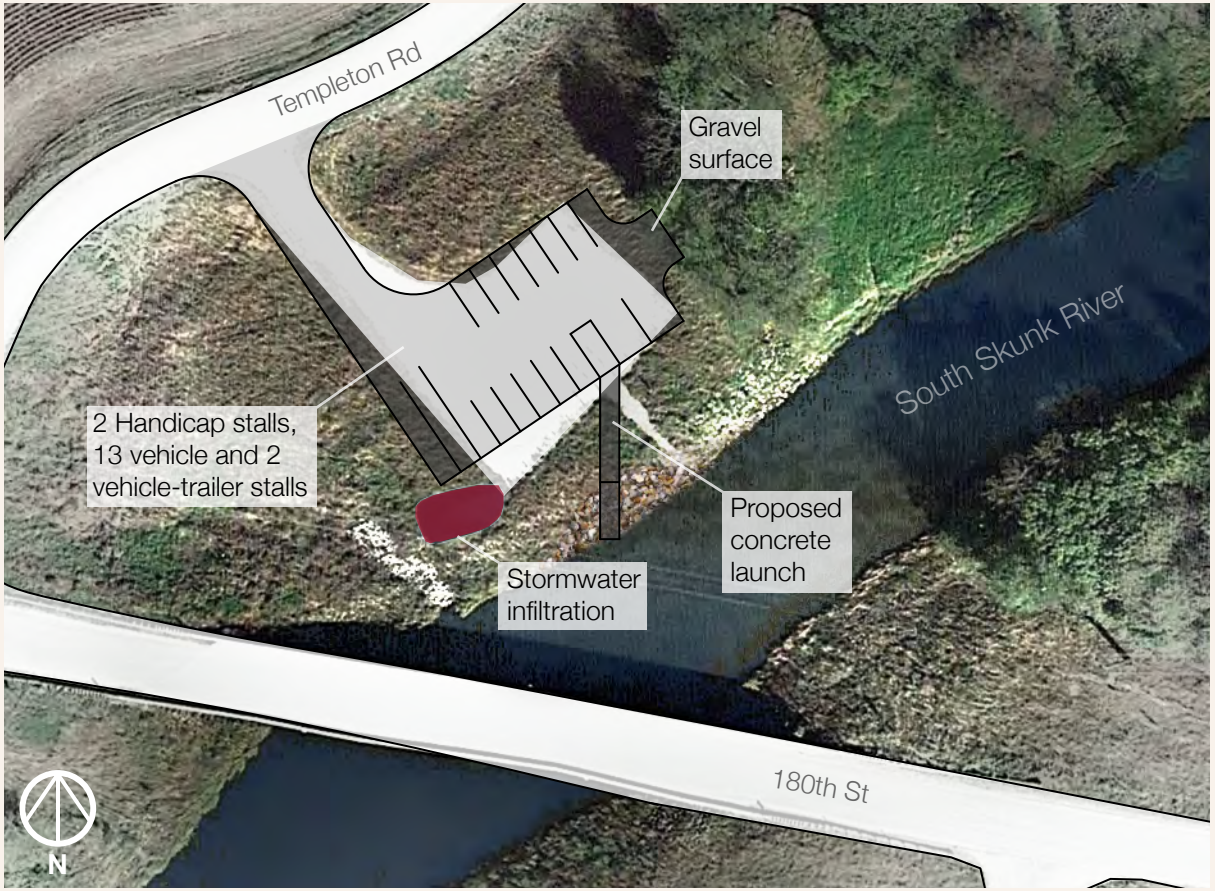
Figure 19
Accumulations of large woody debris on bridges is common seasonally on this river.

SEGMENT R4: **Sopers Mill to Ames Municipal Boundary**

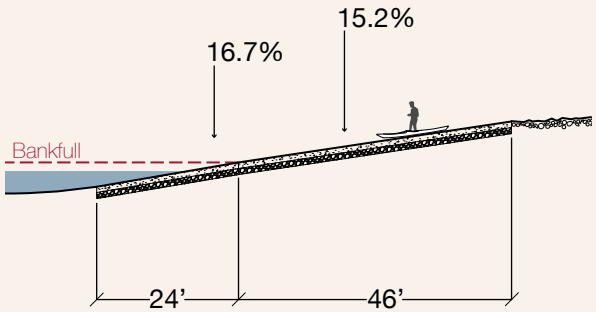


R 4.B
North Peterson Park Access Upgrades

Launch reconstruction is recommended due to the slope, materials and angle of the existing launch. The existing parking lot is properly sized but its drainage is directed onto the launch surface, causing erosion. In addition to reshaping the parking drainage direction, management of stormwater generated by the parking area is also recommended.



R4.B *North Peterson Park Access Upgrades*



R4.B *This launch will replace the existing eroded streambank surface and will provide improved access.*

McFarland Park

- Conservation Center
- Education Displays
- Lake Fishing/Ice Fishing
- Accessible Fishing Dock
- Cross-country Skiing
- Hiking
- Off-road Biking Trails
- Supervised Youth Camping
- Picnic ares with grills, some accessible
- ADA Touch-a-Life Trail hard surfaced walking trail
- Adams Observatory

R 4.C
Sleepy Hollow Access Relocation

Relocation of the Sleepy Hollow Access, to the north side of Riverside Road, is recommended due to the future modification of the Hannum's Mill / General Filter Dam *(Figures 20, 21)*. A series of rock arch rapids, or similar engineered structure, with river edge treatments for stabilization and public access is recommended. Public interest in this feature is expected to be high following dam modification, including anglers.

The Sleepy Hollow Access and parking should be located adjacent to the rock arch rapids, rather than at the existing location across Riverside Road *(Figure 22)*. This spatial relationship will also allow paddlers a functional portage route as well as a very active put-in location. The existing launch surface and primitive parking on the south side of Riverside Road is already popular with anglers and can continue to be used in that manner.

Figure 20

Existing hazard warning signs exist at this dam and portage location.

Figure 21

A portage trail around this dam was constructed by Iowa Conservation Corps volunteers in 2014.

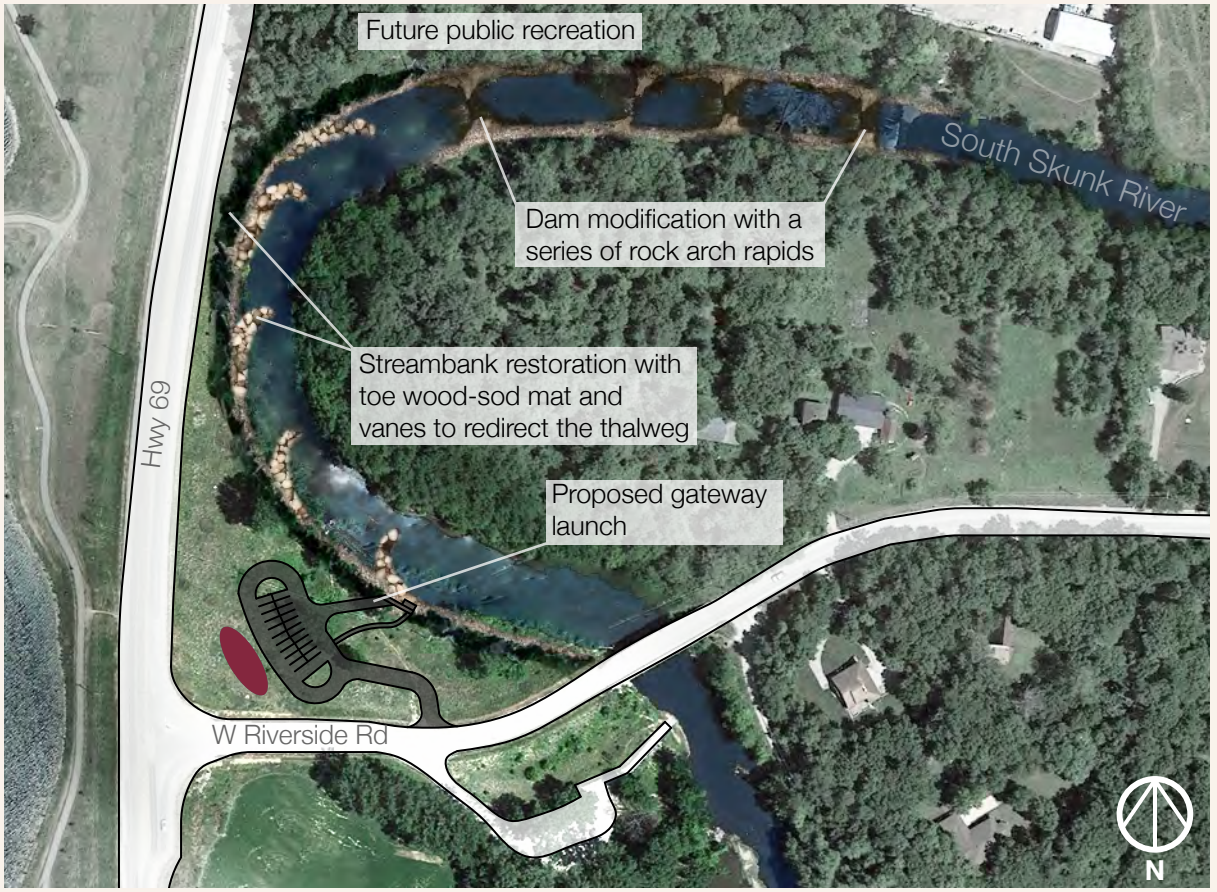
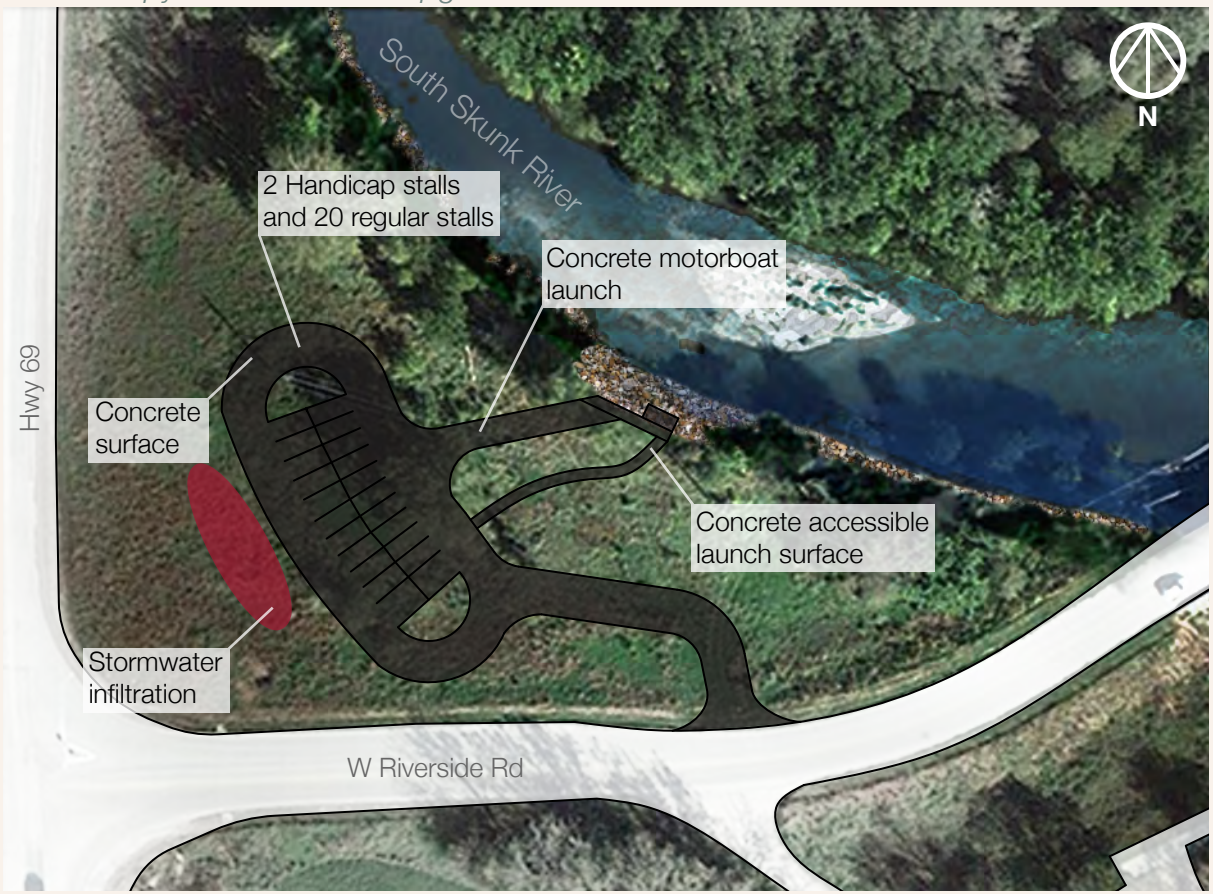
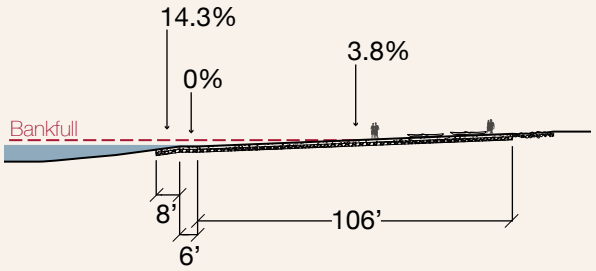


Figure 22

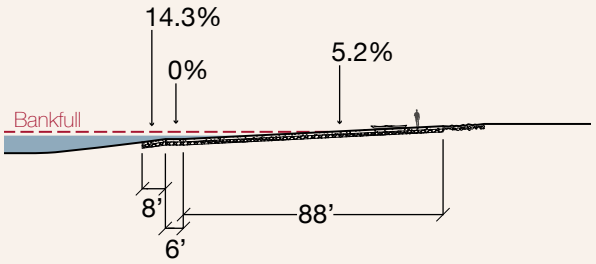
Although relocation of the Sleepy Hollow Access is recommended, the existing launch will remain in place to serve anglers and others.

R4.C *Sleepy Hollow Access Upgrades*





R4.C *The recommended vehicle launch serves as a means to deliver people and boats to the waters edge.*



R4.C *The recommended pedestrian walkway and launch surface also serves as a carry-down surface.*

Skunk River Greenbelt

- Hunting
- Biking
- Hiking
- Stream Fishing

R 4.D
Land Acquisition from U.S. Government for Trail Extension

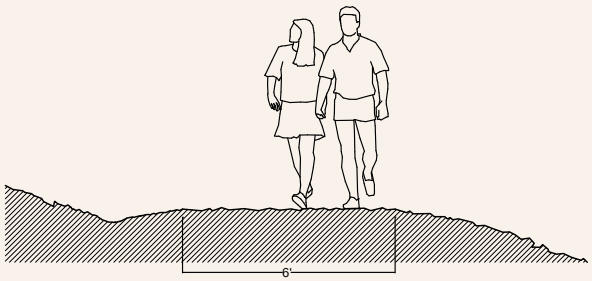
It is recommended that land currently owned by the U.S. Government, resulting from the failed reservoir project, be used by Story County Conservation or traded for the land necessary to extend the Skunk River Greenbelt Trail.

R 4.E
Conservation Easement/ Land Acquisition from Willing Landowners for Trail Extension

It is recommended that the additional land required for extension of the Skunk River Greenbelt Trail either be purchased from willing landowners or a conservation easement be agreed upon.

R 4.F
Greenbelt Trail Extension

It is recommended that the remaining segments, approximately 3 miles of natural surface, multi-use trail be constructed to complete the connection between Sopers Mill and Ada Hayden.



R4.F *This trail segment will connect Skunk River Greenbelt trail users with Ames.*

East & West Peterson Park

- Swimming Beach
- Lake Fishing
- Hiking
- Equestrian
- Picnicking
- Bird Watching
- Electric motor boat
- McMichael Pioneer Cemetery
- Segments of Stagecoach Trail

R 4.G
Land Trail Connection to Ada Hayden Park

A land trail connection between Riverside Road and the Skunk River Greenbelt to Ada Hayden Park is recommended. A land bridge may be necessary as this requires crossing Highway 69 / Grand Avenue.

R 4.H
Water Trail Connection between Ada Hayden Lake & South Skunk River

People currently carry boats across Highway 69 in order to move back and forth between Ada Hayden Lake and the South Skunk River. This presents a hazard to both the paddlers as well as drivers due to fast and often heavy traffic on this road. A study is recommended to determine if it is possible and feasible to utilize the spillway channel between Ada Hayden Lake and the South Skunk to move paddle craft back and forth. While the outflow channel appears wide enough to float a kayak or canoe, boats would need to be removed from the lake and hand carried over and past the outflow flume before being placed in the channel.

Ada Hayden Heritage Park

- Boat Access
- Covered Shelters
- Drinking Fountain
- Fishing
- Grills
- Lighted & Handicapped Accessible
- Nature Area
- Off Street Parking
- Paved Bike Path
- Picnic Area
- Picnic Tables
- Restrooms
- Walking Path
- Water Spigot

R4 Permitting Considerations

The site of North Peterson Access was recently disturbed by recent reconstruction of the 180th Street Bridge and will not require additional investigation. The Sleepy Hollow Access relocation may likely require a Phase I archaeological investigation as some parts of the site appear not to have been previously disturbed by construction. Retrofit of the Hannum's Mill Dam and associated streambank restoration will require a Phase I archaeological investigation.

SEGMENT R4 COST ESTIMATES		
RECOMMENDATION	MAP CODE	COST ESTIMATE
Hazard Warning Signage	R4.A	$200
Upgrades to North Peterson Launch	R4.B	$14,081
Sleepy Hollow Launch & Parking Relocation	R4.C	$82,287
Land Acquisition from U.S. Governement for Trail Extension	R4.D	
Resource Protection Easement	R4.E	
Trail Extension Easements	R4.F	
Trail Extension	R4.F	
Ada Hayden Trail Connection	R4.G	
Water Connection Study	R4.H	

SEGMENT R5: **Ames Municipal Boundary to S.E. 16th Street Access**

Existing Conditions

The first 3 miles of this segment, from Sleepy Hollow to North River Valley access, has moderate use by paddlers and tubers. This segment is entirely inside the municipal boundary of Ames. There are two road and one rail crossing. The majority of the segment is heavily wooded, often with LWD accumulations in the river channel. The downstream 3 miles, past North River Valley Park, has a lower amount of use. Despite its urban juxtaposition, the downstream section of this segment has a remote character due to the lack of development near the river edge. Portions of this segment were channelized in the early 20th century and are very severely eroding.

Issues and Opportunities

The upstream 2.9 miles of this segment is planned to be transitioned to a Gateway segment in the future. Both North and South River Valley Parks, heavily used and well-developed city parks, are on this segment of the water trail. The 13th Street low head dam is inside North River Valley Park and is being modified in 2017 to allow paddler and fish passage. There is high use of existing land trails along parts of this water trail segment. However, several incomplete segments exist including between North River Valley Park and the existing Sleepy Hollow Access and Ada Hayden Park. Recommended river access improvements, in addition to modifying the 13th Street dam, include launch reconstruction, parking improvements and stormwater management.

R5 Permitting Considerations

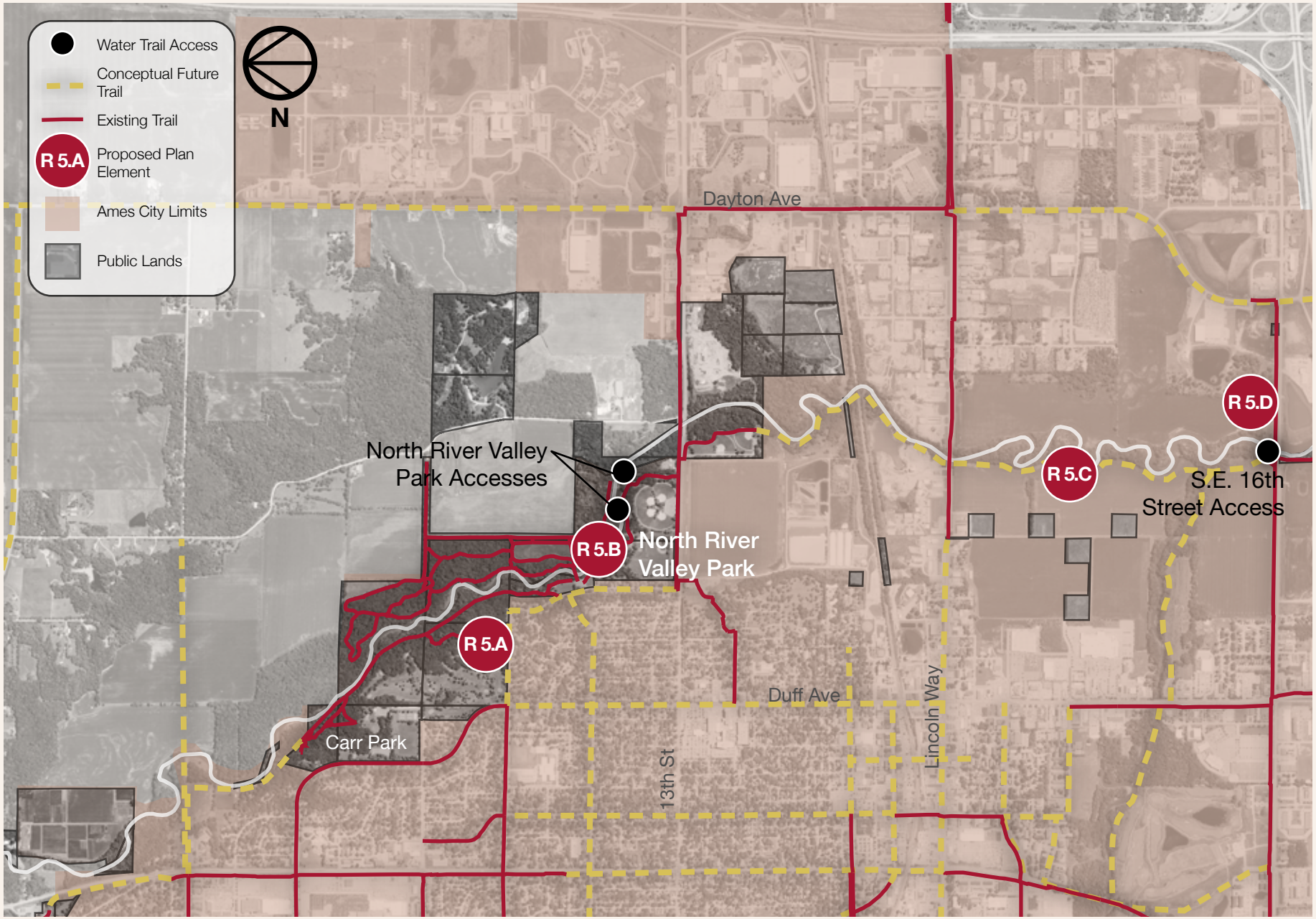
The site of North River Valley Access will likely require a Phase I archaeological investigation. It's possible, however, that the proposed area was included in the Phase I investigation for the dam modification. If the S.E. 16th Street Access is reconstructed at its current location, additional archaeological investigation will not be required as the site was disturbed with reconstruction of the S.E. 16th Street Bridge. If the access is moved downstream to the Hunziker Youth Sports Complex, a Phase I archaeological investigation would likely be required, unless prior disturbances can be verified.

R 5.A
Restroom Relocation at North River Valley Park

No restroom that is open during regular park hours exists near the water trail amenities in this park. The closest restroom of this type is located near the former Carr Pool site *(Figure 23)*. Given the future popularity of the future modified dam, relocating this restroom closer to the 13th Street dam is recommended. This will serve water trail users as well as others in the park and contribute to the Gateway segment character.

Figure 23

These restrooms are scheduled to be relocated nearer the water trail access and dam modification area.



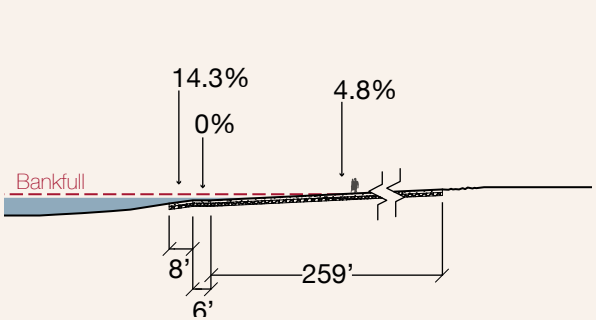
SEGMENT R5: **Ames Municipal Boundary to S.E. 16th Street Access**

R 5.B
North River Valley Park Access Upgrades

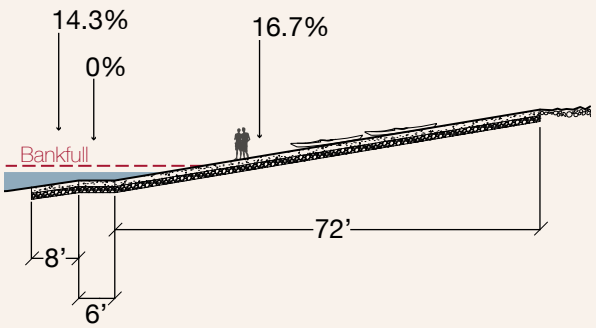
The existing launch upstream of the 13th Street dam is functional but has been damaged by high water *(Figure 24)*. The launch is situated on an outside bend of the streambank and is fairly unstable. The construction of a Gateway style launch is recommended at the same location as the existing upstream launch. A rigging lane and a small adjacent parking area are also recommended near this launch.

The position of the existing launch near the downstream end of the dam leads to high amounts of sediment deposition on the launch surface. This location will also be impacted by the dam modification construction. A newly constructed launch is recommended at a location slightly further downstream. These improvements will enhance use and enjoyment of the river as well as the dam modification area in general.

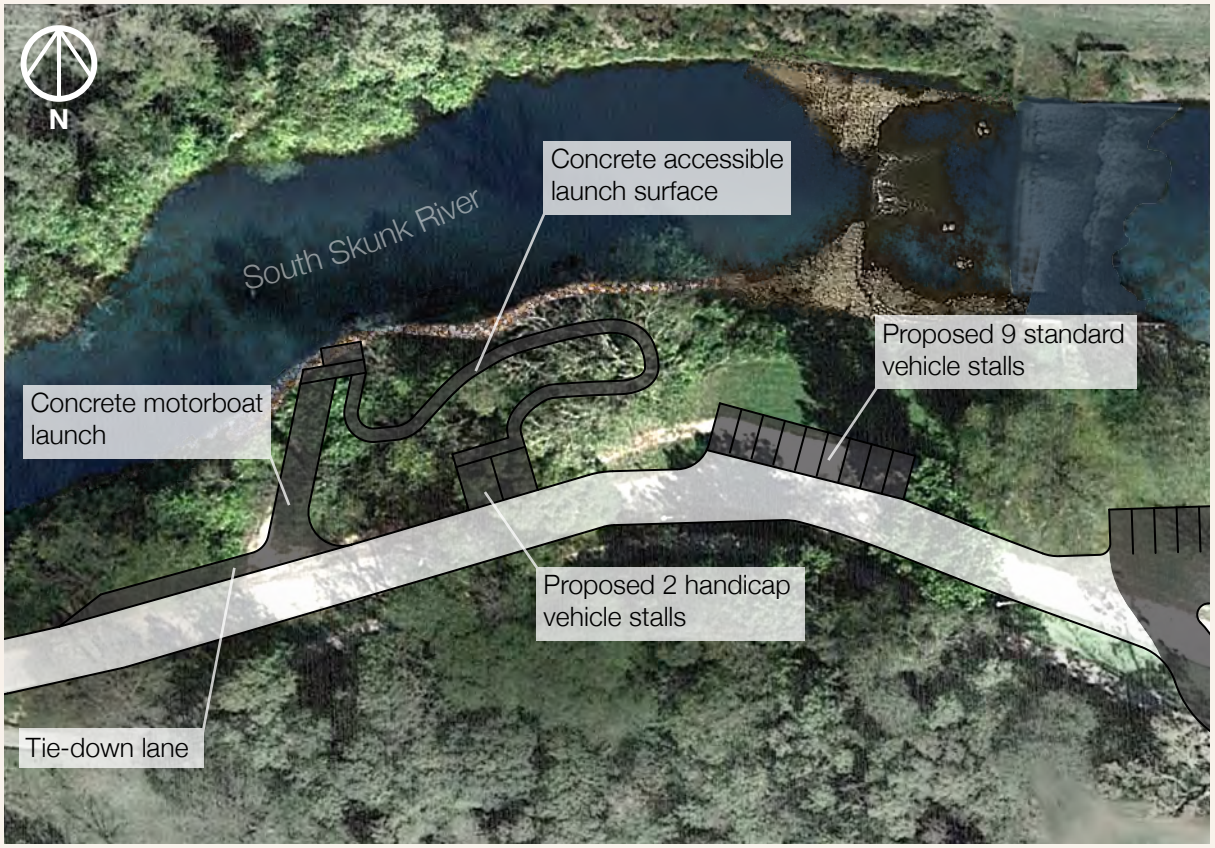
Figure 24
This existing launch is upstream of the dam and has been damaged at the river edge by high flows.



R5.B *This launch is located above the existing dam. This pedestrian walkway and launch connects the small parking area associated with this access to the river edge. This walkway meets ADA requirements.*

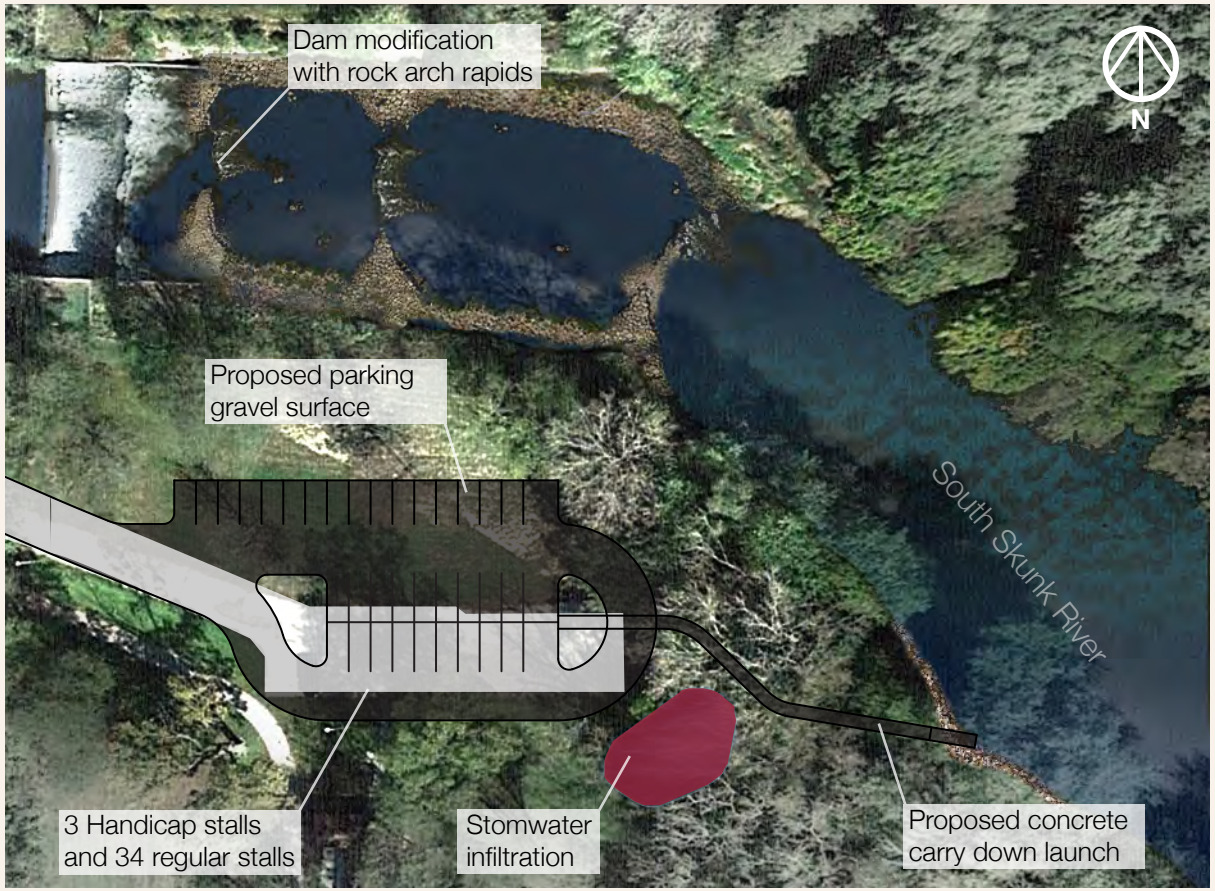


R5.B *This launch is located above the existing dam. This launch is intended to be used either as a motor boat launch for vehicles for as a carrydown.*



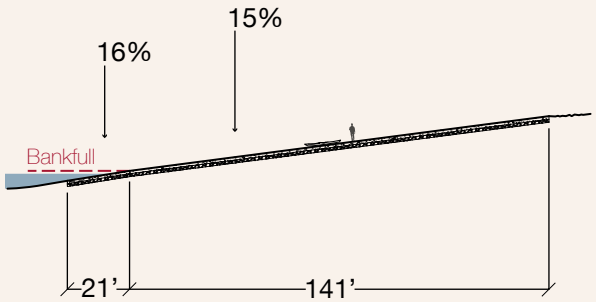
R5.B *North River Valley Access Upgrades Upstream of 13th Street Dam*

R5.B *North River Valley Access Upgrades Downstream of 13th Street Dam*



River Valley Park

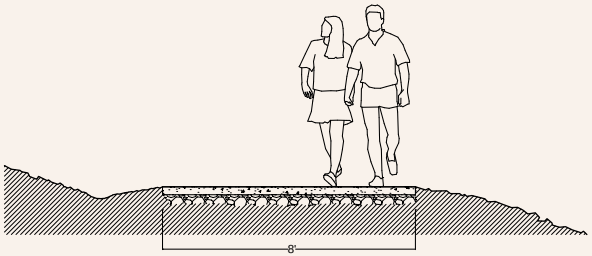
- Drinking Fountain
- Electrical Outlets
- Grills
- Lighted and Handicapped Accessible
- Picnic Tables
- Restroom
- Nature Area
- Off Street Parking
- Walking Path
- Cross-country Skiing



R5.B *This proposed launch is located downstream of the dam. It is a carrydown launch with a direct connection to the parking area.*

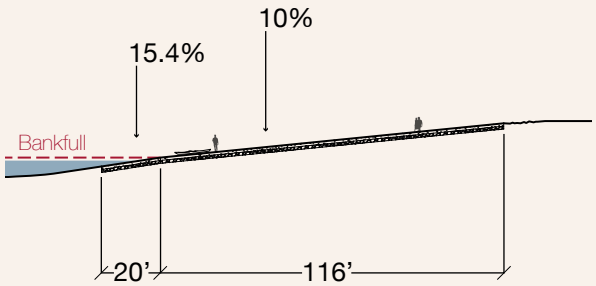
R 5.C
Ames Trail Extension

It is recommended that the remaining trail segment between the River Valley Park and the S.E. 16th Street Access be constructed as well as segments connecting the river to downtown Ames and Ada Hayden Park.



R5.C *This segment would complete the trail along the South Skunk River within the City limits.*

R5.D *S.E. 16th Street Access Upgrades*



R5.D *This access is designed as a concrete carrydown style launch.*

Figure 25

The existing surface of the S.E. 16th Street access is heavily damaged by high water and drainage from the parking area.

R 5.D
S.E. 16th Street Access Upgrades

The existing access at S.E. 16th Street is located adjacent to the Ames bike trail system. The launch itself is located on private property without an easement from the landowner. The location of the existing launch is successful as paddlers often float the lower reaches of Squaw Creek, enter the South Skunk and leave the river at S.E. 16th Street access. The launch surface is an eroded, vertical streambank *(Figure 25)*. Construction of a properly designed launch surface is recommended as well as expansion of the parking area and management of stormwater from access area. The actual location of this upgraded launch could also be moved slightly downstream to the Hunziker Youth Sports Complex.

SEGMENT R5 COST ESTIMATES		
RECOMMENDATION	**MAP CODE**	**COST ESTIMATE**
Restroom Relocation	R5.A	
North River Valley Gateway Launch Construction	R5.B	$12,215
North River valley Parking Improvements in Main Parking Area Including Tie Down Lane	R5.B	$77,840
North River Valley Carry Down Launch Construction	R5.B	$6,500
Ames Trail Extension Including Land	R5.C	
S.E. 16th St Access Improvement (assuming land is already in public ownership or easement has been obtained)	R5.D	$32,976

SEGMENT R6: **S.E. 16th Street Access to CJ Shrek Access**

Existing Conditions

This 11.8 mile segment is minimally developed and used for recreation. Only one community, Cambridge, is located near the river. There are four rural road crossings, including I-35, on the segment. Currently there is one public recreation area on the segment, Skunk Flats WMA. The Heart of Iowa Nature Trail crosses the river near Cambridge. The three water trail accesses on this segment are stand-alone facilities adjacent to bridges. All have damage to the launch surface and are in need of eventual reconstruction. This segment of the river was channelized in the early 20th century and a majority continues to be maintained as a ditch.

Issues and Opportunities

While there is little existing recreation infrastructure in this southern portion of the county, formalized future plans include expansion of a bike trail between the Heart of Iowa Trail and Ames. The Hallet Materials Extraction Site is located SW of I-35/US 30 mix master, and less than one mile from the South Skunk on this segment. The Hallet site has been formally identified as a high priority area for future recreation and resource conservation by the county. A land trail between this facility and the South Skunk would provide a dynamic opportunity for recreational users. Recommended water trail access improvements include launch and parking modifications as well as stormwater management.

Hunziker Youth Sports Complex

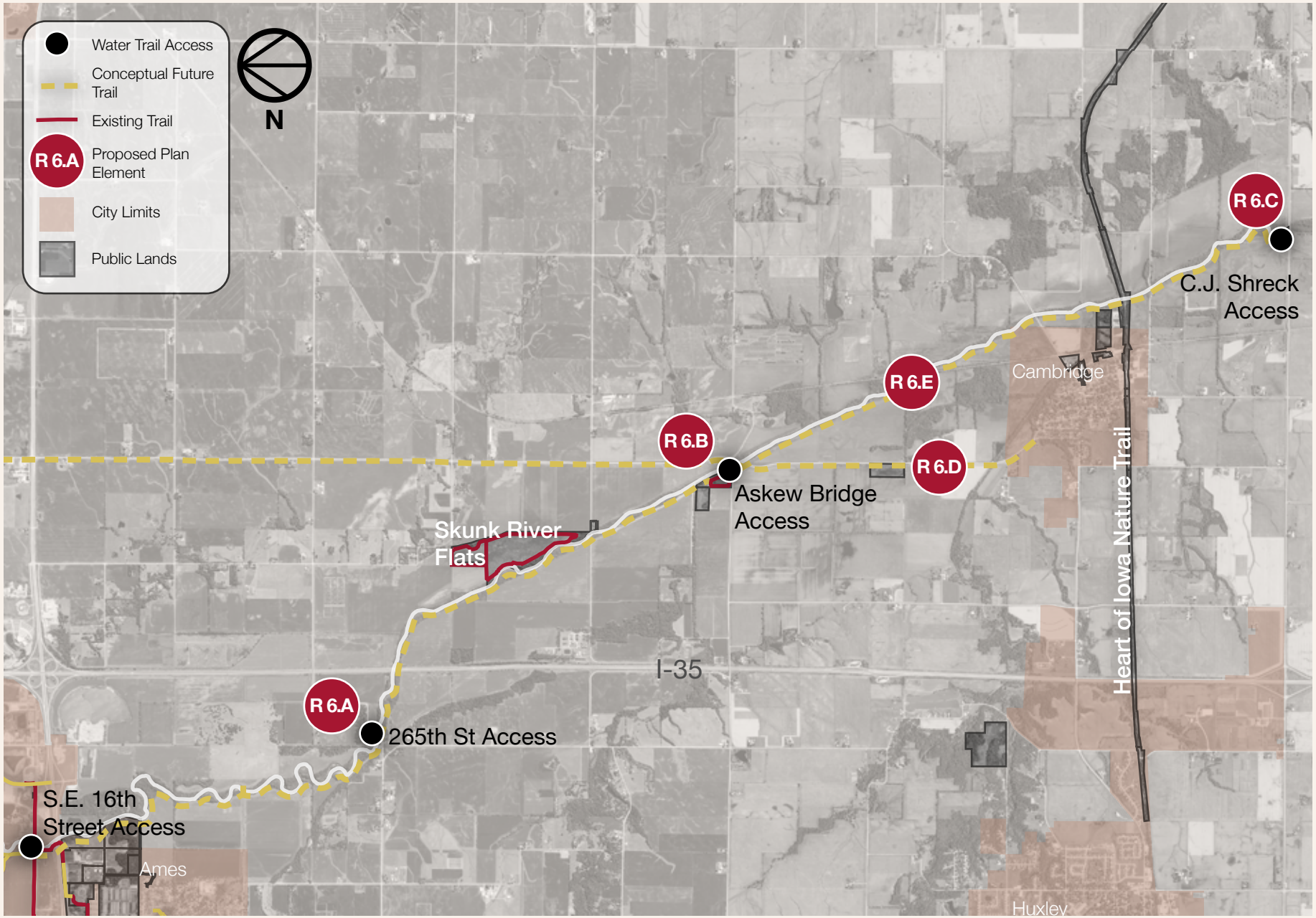
- Baseball Fields
- Softball Fields
- Soccer Fields

R 6.A
265th Street Access Upgrades

Upgrades to the 265th Street Access and enhancement of the immediate river channel area were addressed by Iowa DNR River Programs staff in 2015 *(Figure 26)*. A staged construction process is planned to begin in 2017. The recent acquisition of 165 acres surrounding this river access will provide new recreational uses including trails and interpretation. The site will be converted from agricultural use to restored oxbow wetland, prairie and woodland.

Figure 26

265th Access has been redesigned by Iowa DNR River Programs staff. Construction is expected within 2-3 years.



SEGMENT R6: **S.E. 16th Street Access to CJ Shreck Access**

Figure 27

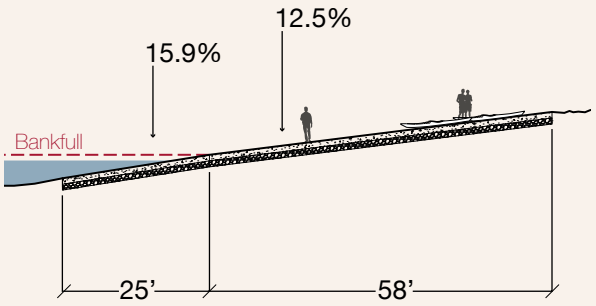
Upgrades at Askew Bridge Access include a hard-surfaced carrydown launch to replace the existing stairs.

Skunk River Flats Wildlife Management Area

- Mown Walking Trails
- Hunting & Trapping
- Bird Watching

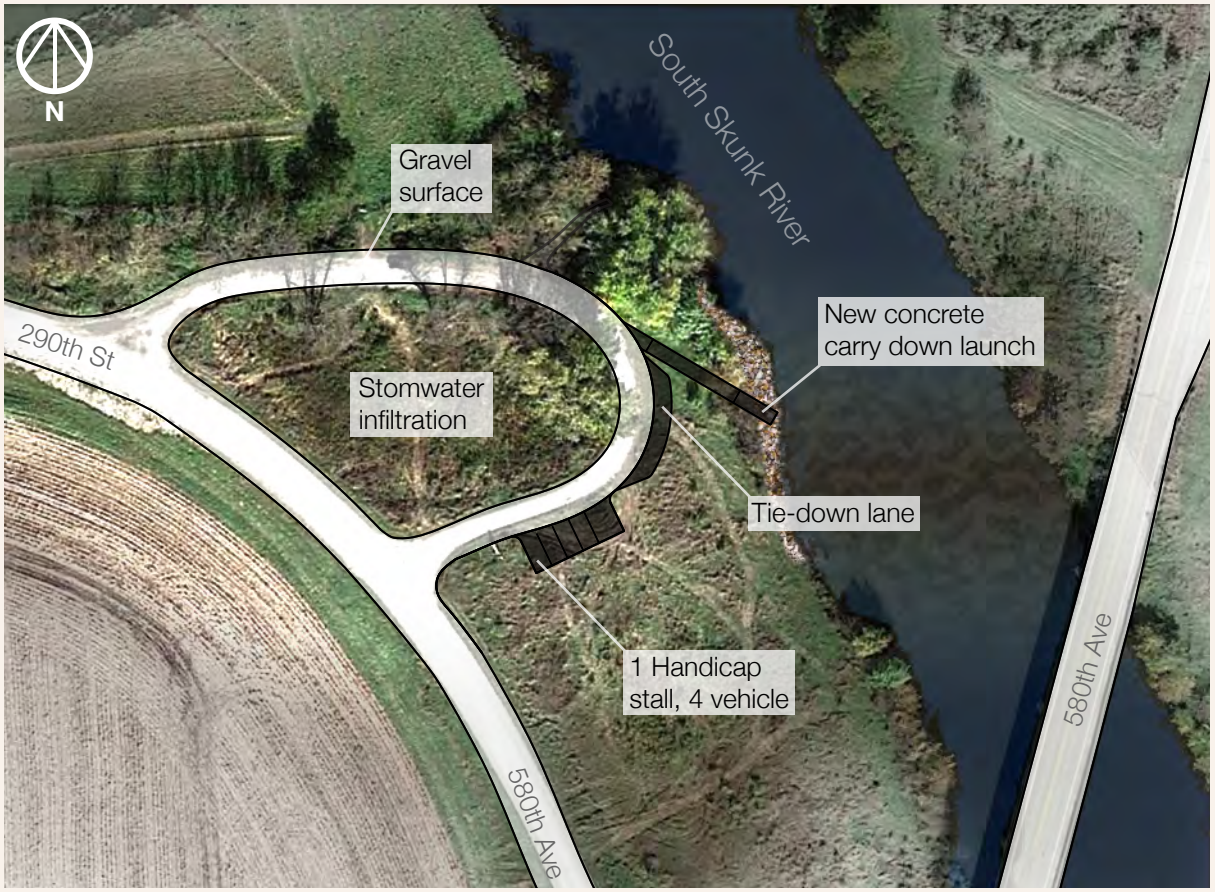
R 6.B
Askew Bridge Access Upgrades

This launch was built parallel to a drainage way leading to the South Skunk and is prone to flooded conditions, scour and deposition *(Figure 27)*. The parking area at this access does not meet Iowa DOT minimum size requirements and requires enhancement. Reconstruction of the slope, angle and location of this launch is also recommended.



R6.B *The proposed launch is hard-surfaced, sloped ramp oriented downstream.*

R6.B *Askew Bridge Access Upgrades*

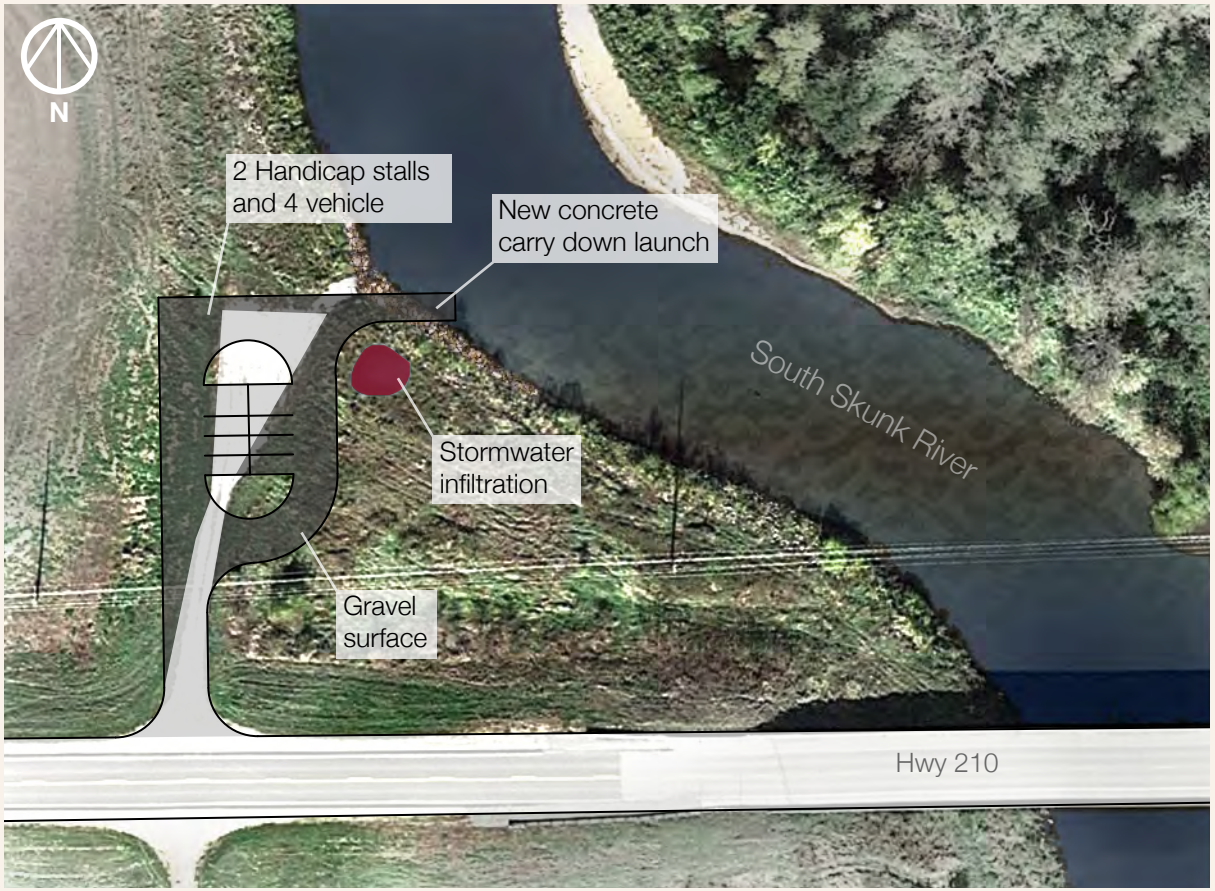


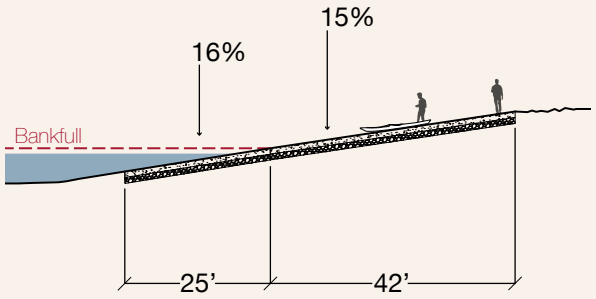
R 6.C
CJ Shreck Access Upgrades

Reconstruction of the slope and angle of this launch is recommended. The on-site management of stormwater from the parking area is also recommended rather than draining it through the launch surface as it currently exists *(Figure 28)*. The height of the existing levee was inadvertently altered when this access was constructed. Adjacent farmland floods at times of high water. Redesign and grading of the flood levee, incorporating the access design shown, is recommended.

Figure 28

This view of the CJ Shrek launch from the river illustrates the erosion caused by drainage from the access parking area. The proposed replacement launch is concrete and includes resolution of stormwater drainage patterns.





R6.C *The existing launch is upgraded to a hard-surfaced sloped ramp. Drainage from the parking area is directed into infiltration areas, rather than draining on the launch surface.*

R6 Permitting Considerations

The site of 265th Street and Askew Bridge access will likely require a Phase I archaeological unless prior disturbances can be verified. The C.J. Shrek Access upgrades are occurring on the site of the existing parking and access. Previous survey results at this location provide evidence to support a recommendation that Phase I archaeological investigation is not warranted.

R 6.D
Land Acquisition for Trail Extension

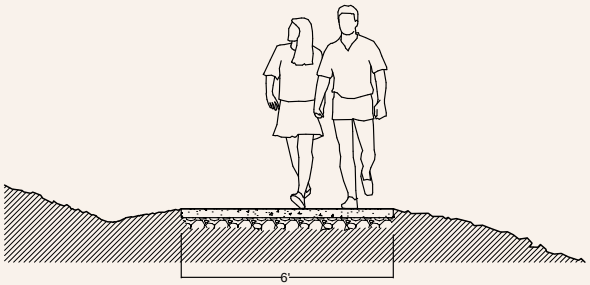
It is recommended that the additional land required for extension of the land trail either be purchased from willing landowners or a conservation easement be agreed upon. Story County Conservation Board's longterm goals include expansion of the Skunk River Greenbelt in this area of the county *(Figure 29)*.

Figure 29

This segment is known for mature floodplain forests and a high diversity of bird life.

R 6.E
Trail Extension

It is recommended that the remaining trail segment between the Heart of Iowa Nature Trail and Ames be constructed. This includes 9 miles of bike trail adjacent to the South Skunk River. A bridge crossing on the South Skunk may be desirable to connect with amenities on the east side of the river.



R6.E *This multi-use trail adjacent to the river will be an important link between the Heart of Iowa & High Trestle trails and Ames.*

Heart of Iowa Nature Trail

- 24-Mile Recreational Trail
  - -Pedestrians
  - -Equestrians
  - -Snowmobilers
  - -Bicyclist

Askew Bridge & Cambridge Pond

- Stream Fishing
- Lake Fishing
- Hunting & Trapping

SEGMENT R6 COST ESTIMATES		
RECOMMENDATION	**MAP CODE**	**COST ESTIMATE**
265th Street Access Upgrades	R6.A	$0
Askew Bridge Launch, Parking & Tie-down Lane Upgrades	R6.B	$19,320
CJ Shrek Launch & Parking Upgrades	R6.C	$65,177
South Story County Trail Extension Including Land Acquisition or Easements	R6.D	
Land Trail Extension	R6.E	

RECREATIONAL DEVELOPMENT CONCLUSIONS

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

Permitting Considerations

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

- Local City (Story City and Ames) and Story County have permitting processes for developing on a floodplain
- Joint permit application shared between the DNR flood plain development program, the DNR sovereign lands program, and the U.S. Army Corps of Engineers
- Story County zoning permit for vegetation removal within the South Skunk River Greenbelt Conservation District

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

Potential Partners and Funding Sources

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

- Non-Profit Organizations such as Iowa Natural Heritage Foundation, Outdoor Alliance of Story County, Iowa Prairie Network, Iowa Ornithologists' Union and Iowa Archaeological Society
- Local and State Agencies including Story 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 (Ames Area Metropolitan Planning Organization), 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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Wagner, M., & Hoogeveen, N. (2010a). Iowa Water Trails: Connecting People with Water and Resources. Des Moines, IA: Iowa DNR.

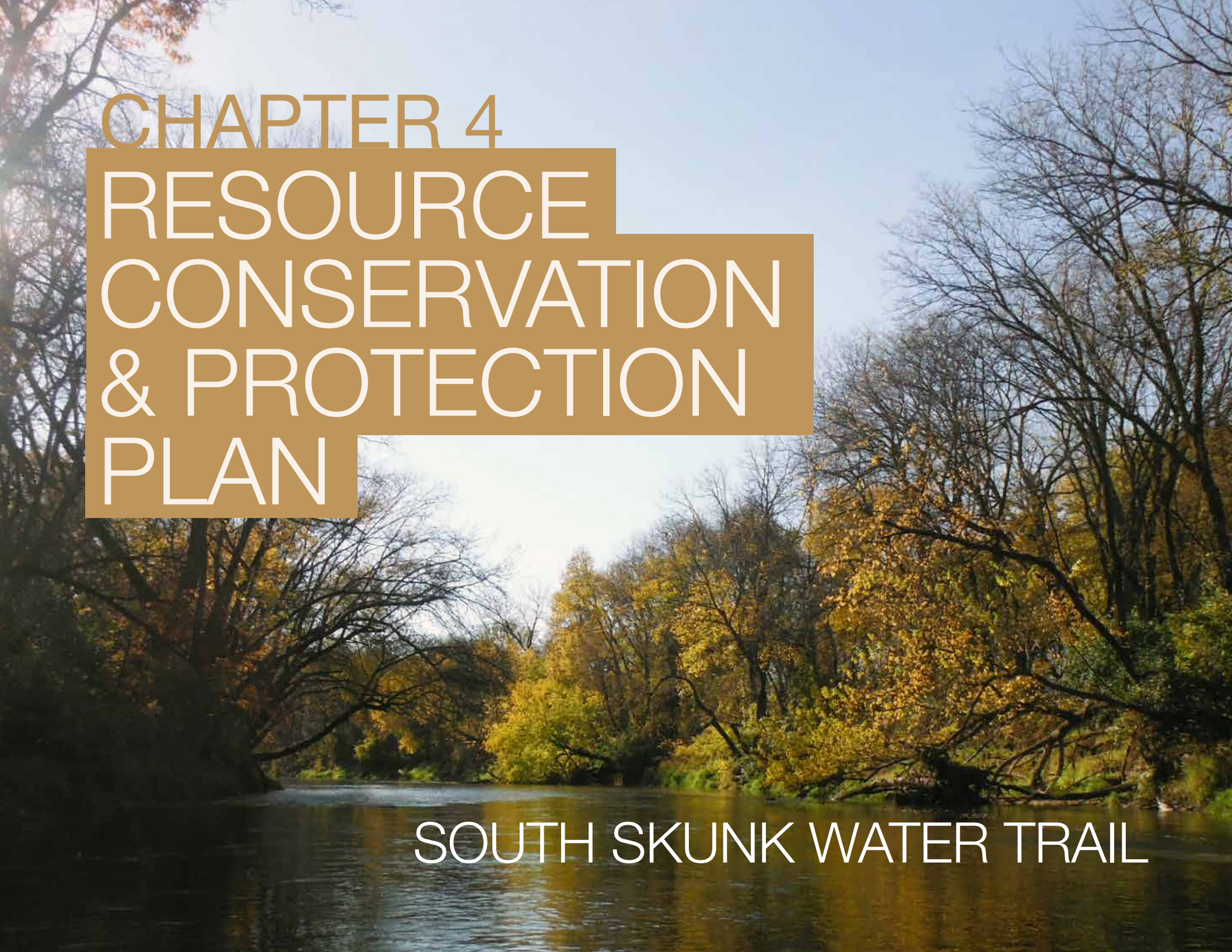
APPENDICES

Map Code	Location	Lead Jurisdiction	Recommendation	Local Prioritization	Budget Estimate for River-Related Recommendations	Other Collaborators
R1.A	River Corridor	Iowa DNR	Concessionaire Agreement	3	$0	Story CCB, Liveries, ISU Rec. Services
R1.B	River Corridor	Iowa DNR	Misconduct Reporting Policy	2	$0	Story County Sheriff, ISU
R1.C	River Corridor	Iowa DNR	On-water Rescue Capacity Building	1	$0	Story County, City of Ames
R1.D	River Corridor	Water Trail Sponsor	Communication Among Access Managers	1	Reimbursable from IDNR	Story City, Ames
R1.E	River Corridor	Iowa DNR	Public Interpretative Plan & Education Program	2	$0	Iowa DNR, Skunk River Paddlers, Volunteers
R1.E	Skunk River Greenbelt	Story CCB	Greenbelt Wayfinding Signage (20)	2	$400	
R1.E	Skunk River Greenbelt	Story CCB	Greenbelt- Private Property Limits Sign	2	$250	
R1.F	River Corridor	Iowa DNR	Water Trail Map	1.5	$0	Iowa DNR
R1.G	Anderson, Sopers Mill, North Peterson, Sleepy Hollow Accesses	Story CCB	Risk/Flow/Experience Communication	1	$1,000	Iowa DNR, Skunk River Paddlers
C1.A	River Corridor	Water Trail Sponsor	Archaeological Study: Phase IA continuation	2.5	$5,000	Outside Consultant, Iowa Office of the State Archaeologist
C1.A	River Corridor	Water Trail Sponsor	Phase I Professional Field Survey at Selected Sites	3		Outside Consultant, Iowa Office of the State Archaeologist
C1.A	Ames to Cambridge	Water Trail Sponsor	Phase IA Pedestrian Study between Ames and Cambridge	3	$2.000	Outside Consultant, Iowa Office of the State Archaeologist
C1.B	River Corridor	Story CCB	Cultural Resource Promotional Materials	2.5	$3,000	Iowa DNR, Outside Consultant, Iowa Office of the State Archaeologist
C1.C	River Corridor	Water Trail Sponsor	Vegetative Buffer Establishment (entire length)	1	$54,750	Willing Landowners, Story Soil & Water Conservation District
C1.D	South Skunk Watershed	Water Trail Sponsor	Tributary Vegetative Buffer Study	1	$4,500	Iowa DNR, ISU
C1.E	South Skunk Watershed	Water Trail Sponsor	Increase Voluntary Monitoring	1		IOWATER
C1.E	South Skunk Watershed	Water Trail Sponsor	Bacteria Impairment Assessment	1		Iowa DNR
C1.F	River Corridor	Water Trail Sponsor	River Technical Assessment	1.5	$80,000	Iowa DNR, City of Ames, City of Story City, Outside Consultant
C1.G	Skunk River Greenbelt	Story CCB	Establish Habitat Goals	2		

Map Code	Location	Lead Jurisdiction	Recommendation	Local Prioritization	Budget Estimate for River-Related Recommendations	Other Collaborators
C1.H	River Corridor	Story CCB	Enhance Aquatic Habitat for Fish and Mussels	2		Iowa DNR
C1.I	Story City Park to North River Valley Park, Ames	Story CCB	Smallmouth Bass Population Study	2.5	$6,500	Iowa DNR, Iowa Cooperative Fish and Wildlife Research Unit
C1.J	River Corridor	Water Trail Sponsor	Explore Riparian Forest Protection	2		Iowa Natural Heritage Foundation
R2.A	Story City South Park	City of Story City	Story City Park River Access: New Whitewater Access Above Dam & New Carrydown Launch Downsteam	1	$11,020	
R2.B	Story City South Park	City of Story City	Story City (South) Park Parking Expansion	3	$32,793	
R2.B	Story City South Park	City of Story City	Story City (South) Park New Gravel Parking Lot	3		
R2.C	Story City North Park	City of Story City	Story City (North) Park Improvements	1		
R2.D	Story City	City of Story City	Story City Trail Extension	1		
C2.A	Story City South Park	City of Story City	Story City Dam Modification Repair	1	$10,000-$50,000	Iowa DNR
C2.B	Story City North & South Parks	City of Story City	Story City South Park Vegetative Buffer Establishment	3	$750	
C2.C	Sowers Cemetery	Water Trail Sponsor	Streambank Restoration to Protect Sowers Cemetery (2 vane structures)	1	$24,000	Willing Landowner, Iowa Office of State Archaeologist, Iowa DNR, Story County
C2.D	Story City	City of Story City	Legacy Dumpsite Cleanup, Story City property	2		
C2.F	Story City South Park	City of Story City	Gully Repair in Story City South Park	3		
R3.A	Skunk River Greenbelt	Story CCB	Paddle-In Campsite	1.5	$500	
R3.B	Anderson Access	Story CCB	Anderson Access Launch, Parking and Entrance Upgrades	1.5	$118,447	
R3.C	Sopers Mill Access	Story CCB	Sopers Mill Launch Upgrades	2	$10,360	
R3.C	Sopers Mill Access	Story CCB	Upgrades to Sopers Mill parking	2.5	$81,900	
R3.D	Skunk River Greenbelt	Story CCB	Land Acquisition	1		
R3.E	Skunk River Greenbelt	Story CCB	Greenbelt Trail Extension	1		
R3.F	Skunk River Greenbelt	Story CCB	4th Try Bridge	3	$30,000	
C3.A	Skunk River Greenbelt	Water Trail Sponsor	Legacy Dumpsite Cleanup (private)	2		Willing Landowner, Skunk River Paddlers
C3.B	Skunk River Greenbelt	Story CCB	Gully Repair (Greenbelt property)	2		

Map Code	Location	Lead Jurisdiction	Recommendation	Local Prioritization	Budget Estimate for River-Related Recommendations	Other Collaborators
C3.C	Skunk River Greenbelt	Story CCB	Tree Protection (Greenbelt property)	2		
C3.D	Skunk River Greenbelt	Water Trail Sponsor	Biechler Avulsion Study (cost included in C1.F)	3	$0	Iowa DNR, Outside Consultant
C3.E	River Corridor	Water Trail Sponsor	Resource Protection Easement (chert outcroppings & others)	2.5		Willing Landowners
R4.A	Sleepy Hollow Access	Story CCB	Hazard Warning Signage	1	$200	Iowa DNR
R4.B	Sopers Mill Access	Story CCB	Upgrades to North Peterson launch	1.5	$14,081	
R4.C	Sleepy Hollow Access	Story CCB	Sleepy Hollow Launch & Parking Relocation	2	$82,287	
R4.D	River Corridor	Story CCB	Land Acquisition from U.S. Government for Trail extension	1		
R4.E	River Corridor	Story CCB	Resource Protection Easement	1		Iowa Natural Heritage Foundation
R4.F	River Corridor	Story CCB	Trail Extension Easements	1		
R4.F	River Corridor	Story CCB	Trail Extension	1		
R4.G	Sleepy Hollow Access & Ada Hayden Park	Story CCB, City of Ames	Ada Hayden Trail Connection	2		Iowa DOT
R4.H	South Skunk & Ada Hayden Drop Structure	Story CCB	Water Connection Study	3	X	Iowa DOT, City of Ames, Skunk River Paddlers
C4.A	Skunk River Greenbelt	Story CCB	Gully Repair (Story County land)	2		
C4.B	Peterson Park	Iowa DNR	Peterson Park Bank Restoration	1		Story CCB
C4.C	Hannum's / General Filter Dam	Story CCB	Hannums Dam Retrofit	1.5	$120,000-$150,000	USGS, Iowa DNR, Outside Consultant
C4.C	Hannum's / General Filter Dam	Story CCB	Hannums Downstream Bank Restoration		$130,000	Iowa DOT, Iowa DNR
C4.D	River Corridor	ALL	Resource Protection Easement (adjacent to Greenbelt)	2.5		Iowa Natural Heritage Foundation, Willing Landowners
R5.A	North River Valley Park	City of Ames	Restroom Relocation	2		
R5.B	North River Valley Park	City of Ames	North River Vally Gateway Launch Construction	2	$12,215	
R5.B	North River Valley Park	City of Ames	North River Valley Parking Improvements in Main Parking Area Including Tie Down Lane	1	$77,840	
R5.B	North River Valley Park	City of Ames	North River Valley Carry Down Launch Construction	1	$6,500	

Map Code	Location	Lead Jurisdiction	Recommendation	Local Prioritization	Budget Estimate for River-Related Recommendations	Other Collaborators
R5.C	River Corridor	City of Ames	Ames Trail Extension including land	1		
R5.D	S.E. 16th St. Access, Ames	City of Ames	S.E. 16th St. Access Improvement (assuming land is already in public ownership or easement has been obtained)	2	$32,976	
C5.A	North River Valley Park	City of Ames	Gully Repair (North River Valley Park, County and ISU land)	1		
C5.B	North River Valley Park	City of Ames	13th Street Dam Modification	1	$845,000	Iowa DNR, Outside Consultant
C5.C	North River Valley Park	City of Ames	Streambank Restoration (North River Valley Park)	1	$290,000	
C5.E	River Corridor	City of Ames	Implement Cultural Resource Policy (City of Ames area)	3	$5,000	Iowa Office of State Archaeologist, Iowa DNR
C5.F	River Corridor	Water Trail Sponsor	Resource Protection Easement (Existing mature riparian forests & Buchanan Bog)	2.5		Iowa Natural Heritage Foundation, Willing Landowners
R6.A	265th St Access	Iowa DNR	265th St. Access Upgrades	1	$0	Story CCB
R6.B	Askew Bridge Access	Story CCB	Askew Bridge Launch, parking & tie-down lane Upgrades	1	$19,320	
R6.C	CJ Shrek Access	Story CCB	CJ Shrek Launch & Parking Upgrades	1	$65,177	
R6.D	River Corridor	Story CCB	South Story County Trail Extension including Land Acquisition or Easements	2		Willing Landowners
R6.E	Ames to Cambridge	Story CCB	Land Trail Extension	2		Willing Landowners
C6.A	Cambridge	City of Cambridge	Gully Repair at Wastewater Treatment Plant Outfall	3		
C6.B	River Corridor	Water Trail Sponsor	Resource Protection Easement (existing mature riparian forests)	2.5		Iowa Natural Heritage Foundation, Willing Land Owners
C6.C	265th St Access	Story CCB	Ronald “Dick” Jordan Family Wildlife Area restoration	1		Iowa DNR, Iowa Natural Heritage Foundation
C6.D	Ken Maril Road & South Skunk River	Story CCB	Ken Maril Road Historic Bridge Site (Story County)	2		Story County Engineer
C6.E	CJ Shrek Access	Story CCB	Resolution of CJ Shrek Levee Conditions (Story County)	1		



CHAPTER 4
RESOURCE CONSERVATION & PROTECTION PLAN

SOUTH SKUNK WATER TRAIL

ACKNOWLEDGMENTS

This Water Trail Plan prepared by Mimi Wagner, Lucas Buscher and Jacob Wilson of Iowa State University. Story County Conservation Board staff and the Skunk River Paddlers provided leadership and local support of the project throughout the process. Carol Williams, Ryan Wiemold, Amy Yoakum and Mike Cox of Story County Conservation provided review and interpretation. Nate Hoogeveen, John Wenck and Heath Delzell of Iowa Department of Natural Resources provided technical support. University of Iowa Office of State Archaeologist provided support for cultural resource planning.

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

Keith Abraham, City of Ames Director of Parks and Recreation

David Ballard, Landowner and local archeology

Dean Biechler, Rural Landowner

Rick Dietz, Story County IOWATER Volunteer Water Quality Monitoring

Lisa Hein, Iowa Natural Heritage Foundation Program and Planning Director

Connor Nicholas, ISU Canoe & Kayak Club and Soil & Water Conservation Club

Leo Milleman, Landowner and City of Ames Parks and Recreation Commission

David Oliver, Skunk River Paddlers

Piper Wall, Whitewater & Kayak Enthusiast

Jeff White, Story County Trail Advisory Committee

Mark Widrlechner, Iowa State University Affiliate Associate Professor

Carol Williams, Story County Conservation Board Special Projects Ranger

Steve Veysey, Hawkeye Fly Fishing Association;

John Moran, City of Story City Parks Department Manager

Mike Jensen, Story City Mayor

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

REVISION DATE: DECEMBER 2016

DNR

MIMI WAGNER
Landscape Architecture

Story County Conservation

City of Ames

City of Story City

earthview environmental

Iowa State University
of Science and Technology

CONTENTS

CHAPTER 4

RESOURCE CONSERVATION & PROTECTION PLAN

Every time people enter into the South Skunk River corridor in Story County they step onto the same routes and gathering places people have been using for over 9,000 years.

The interdependency between humans and this river runs as strong today as it has in the past although much has changed. The landform of valleys, hills, steep cliffs, bedrock outcroppings and rivers are the same features that prehistoric people, as well as the historic Meskwaki, used for subsistence. The rhythm of the river over thousands of years, has worked to retain a sense of wildness in this ribbon of land in the center of the otherwise orderly, modern ecoregion of the Des Moines Lobe. The communities of Story City and Ames provide an exceptional set of complimentary historic, recreational, lodging and tourist opportunities.

The South Skunk continues to motivate and inspire people to take action and to be active today. A strong community has come together to engage around the issues of resource conservation and protection in this corridor through planning for this project. They realize the value of the interplay between people and the river as well as how the river reflects back on the identity of this place.

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 those scouring streambanks and sandbars in search of historic chert nodules, bird watchers and volunteer water quality monitors 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 South Skunk River beginning in Story City on the upstream end to the Story County Line south of Cambridge *(Figure 1)*. The municipal boundaries of Story City and Ames are critically important segments of this water trail. The City of Cambridge lies close to the water trail but is not spatially connected to the river with the exception of its wastewater treatment plant. The South Skunk River watershed area draining into study segment is 413,970 acres in size *(Figure 2)*. This resource conservation and protection plan serves three purposes:

- To provide guidance for future cultural resource protection development including artifact handling, educational interpretation and continued local mapping of resources
- Set long term goals for enhancing natural resource conditions
- Define future river assessment and restoration needs and conceptual designs to demonstrate stream restoration practices

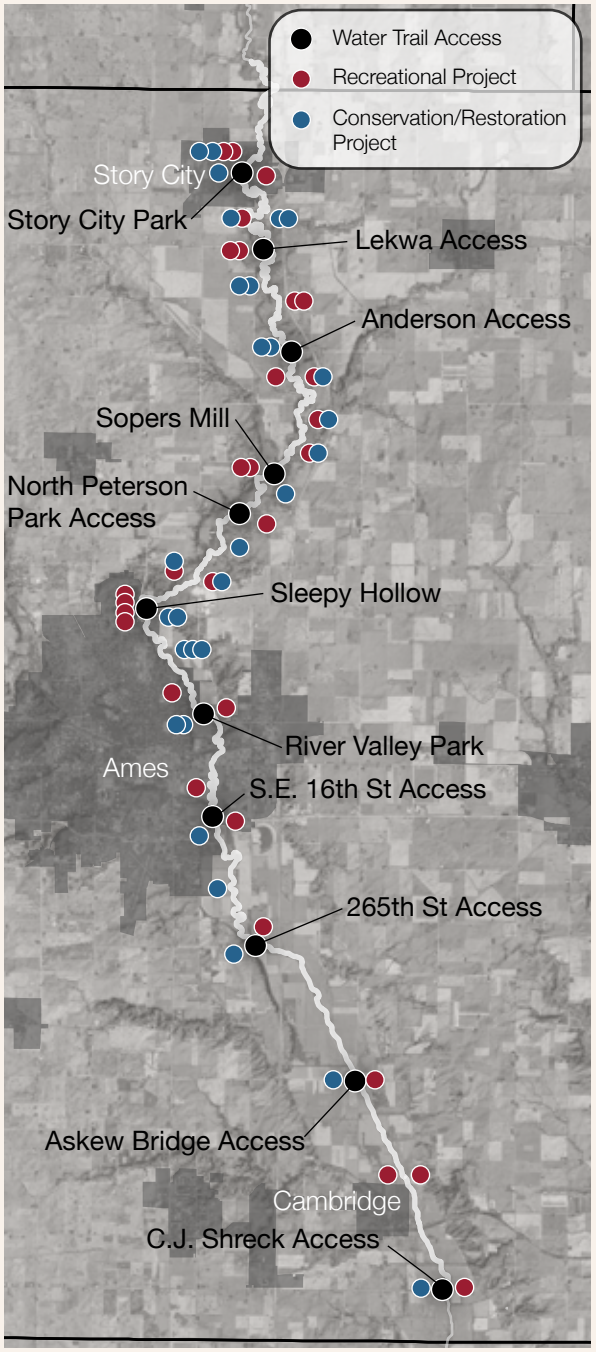


Figure 1
Project recommendations for both resource conservation and protection as well as recreational development are distributed throughout the river corridor.

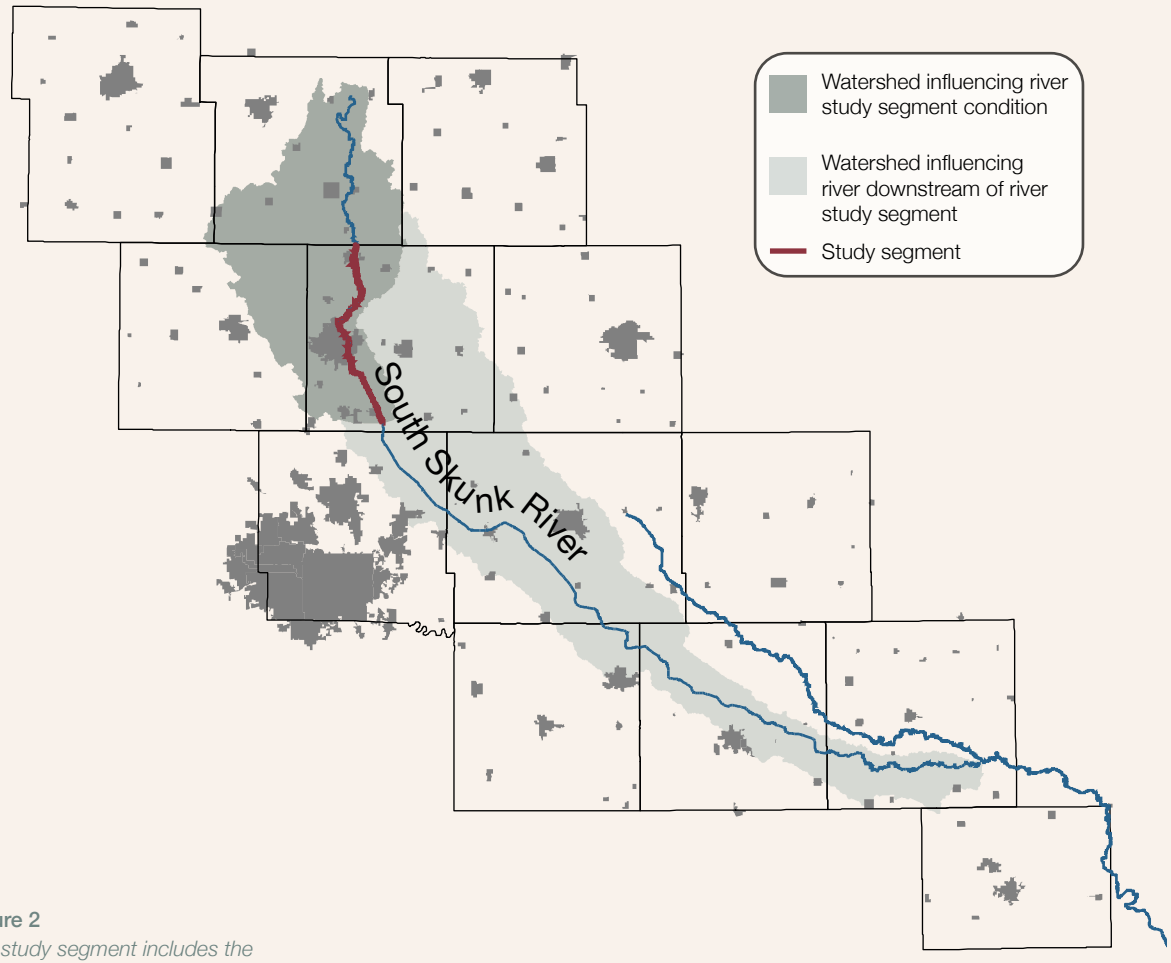


Figure 2
The study segment includes the top-most portion of the South Skunk watershed.

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

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

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

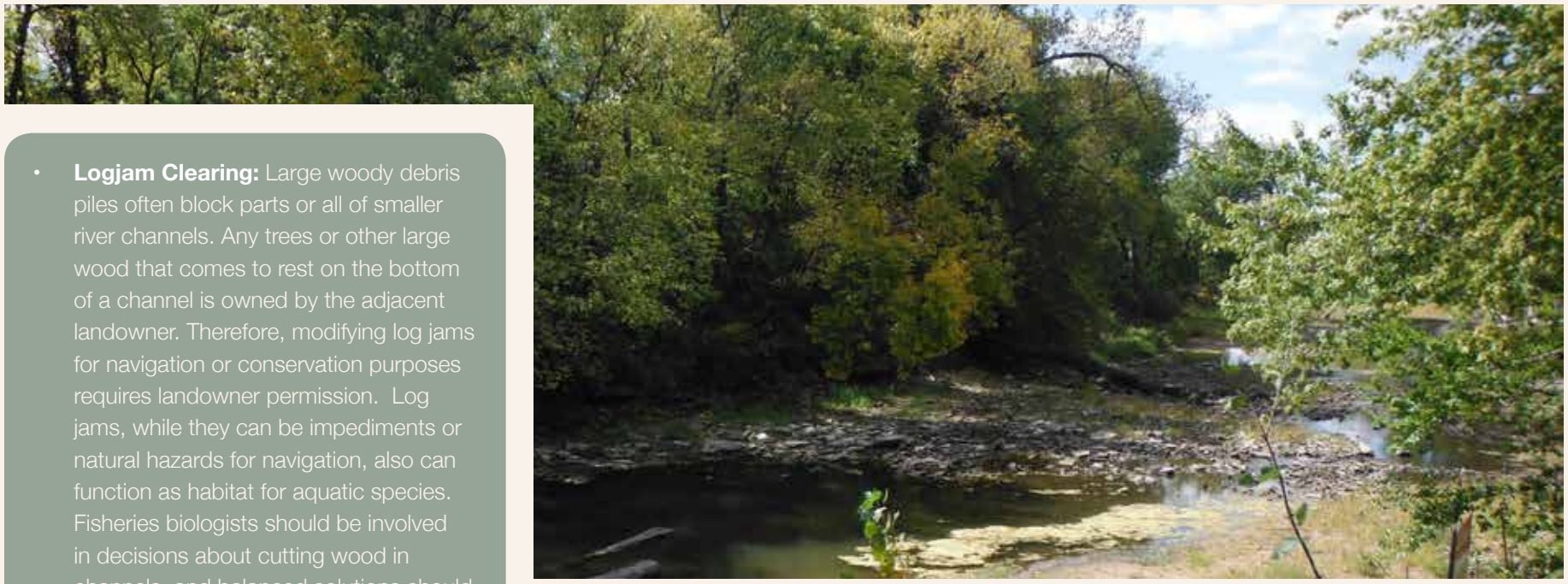
Administrative Rules and Concept

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*.

- **South Skunk River Greenbelt Conservation District:** Story County Zoning includes a district designed to prevent removal of naturally occurring tree cover adjacent to the South Skunk River between Ames and Story City by agriculture practices or other types of development. Additionally, the Greenbelt ordinance contains language that promotes natural resource protection including soil and water conservation, drainage and water retention, and cultural/historic restoration as permitted uses.
- **Protected Streams:** The South Skunk River upstream of the Squaw Creek confluence in southeast Ames is designated a protected stream in Iowa. This means that no channel changes are allowed because of actual or potential significant adverse effects on fisheries, water quality, flood control, flood plain management, wildlife habitat, soil erosion, and public recreation. *Iowa Administrative Code 567 – 72.2(455B) Channel Changes*.
- **Cultural Resource Protection:** Additional site improvements or development at some river access points on the South Skunk River will likely require a Phase I archaeological investigation due to cultural resources known to exist in the area. See Phase IA Archaeological Reconnaissance of the South Skunk Water Trail Corridor, Story County Iowa, 2014; *Section 404 of the Clean Water Act; Section 106 of the National Historic Preservation Act of 1966. Federal transportation funded projects also have additional specific cultural review requirements in Section 4(f) of the Department of Transportation Act of 1966*.
- **Illegal Dumping:** The dumping or depositing of solid waste or debris in rivers, on streambanks, in public areas, and on others' property is illegal. This includes tires, appliances, construction and demolition waste, trash, and hazardous chemicals. *Iowa Code 455B.307 Dumping*.
- **Farm Waste:** Farm waste includes machinery, vehicles, and equipment used in conjunction with crop production or with livestock or poultry raising and feeding operations and trees, brush, and grubbed stumps from the same property. Farm waste and farm buildings cannot be dumped or deposited within 100 feet of streams, lakes, ponds, or intermittent streams. *IOWA ADMINISTRATIVE CODE 567—100.4(455B)*.
- **Floodplain Filling, Changing a Channel, Placement of Rip Rap or Rubble on Streambanks:** A permit is required when floodplain elevation or channel alignment changes are proposed and when rip rap or rubble is proposed. A joint permit application is required that includes federal and state reviews. At the federal level, the U.S. Army Corps of Engineers issues permits under Section 404 of the Clean Water Act. In the state of Iowa, Iowa DNR grants floodplain and sovereign land permits. *Iowa Administrative Code 571, Chapter 13; Iowa Administrative Code 567, Chapters 71, 72; Section 404 of the Clean Water Act*.

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.



- **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 *(continued)*

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 South Skunk, in particular is known to include high quality cultural as well as aquatic and terrestrial natural resources. Construction and vegetation clearing on the floodplain, in the floodway and on the river's edge is regulated at the federal, state and local 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 known 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. The South Skunk Greenbelt Conservation District included in Story County zoning impacts approximately 40% of the study segment. Iowa DNR Water Trail development standards also recommend a minimum 50-foot wide unmown riparian buffer between the top of the streambank and all parking areas.

THE SOUTH SKUNK IN STORY COUNTY

The South Skunk River corridor in Story County is a study in contrasts *(Figure 4)*. One contrast is the appearance and function of the river channel itself. The upstream, northern portion of the river, from Story City to Ames, is an extraordinary example of a wooded riparian corridor for the Des Moines Lobe ecoregion. A failed 1970s federal reservoir project coupled with county zoning protecting the removal of mature floodplain forests adjacent to the South Skunk contributed to the development of the South Skunk River Greenbelt recreational area. The Greenbelt lands are located between Story City and Ames and are famous locally for paddling, hiking and equestrian use.

The bottom 14 miles, downstream of Ames, was channelized in the late 1890s; much of this segment continues to be maintained as a "ditch" with annually cultivated cropland up to the top of the streambank. The portion of the channelized section located near the 265th Street Access, however, has never been cropped annually and remains largely undisturbed. Remnants of old oxbow channels and floodplain vegetation persist on the landscape. The downstream 11 miles of the channel remains leveed and ditched.

Outstanding natural, cultural and recreational resources exist near the river segment between Story City and Ames. The existing Skunk River Greenbelt recreation areas, paired with public lands in Story City and Ames, provide habitat to 8 mussel species and the greatest diversity of breeding bird species of any river studied for potential state water trail designation in Iowa. Thirty-one bird Species of Greatest Conservation Need have been field identified as likely breeding on or near this segment of the river between 2012 and 2015. Greenbelt property and surrounding parcels hold numerous important cultural and historic resource sites, including deposits of chert in the bedrock that were used for toolmaking during the Late Paleoindian Period (between 10,500 and 8,000 years ago). Prehistoric materials recovered in the upper South Skunk River valley document continual occupation of this area for over 9000 years prior to Euro-American settlement.

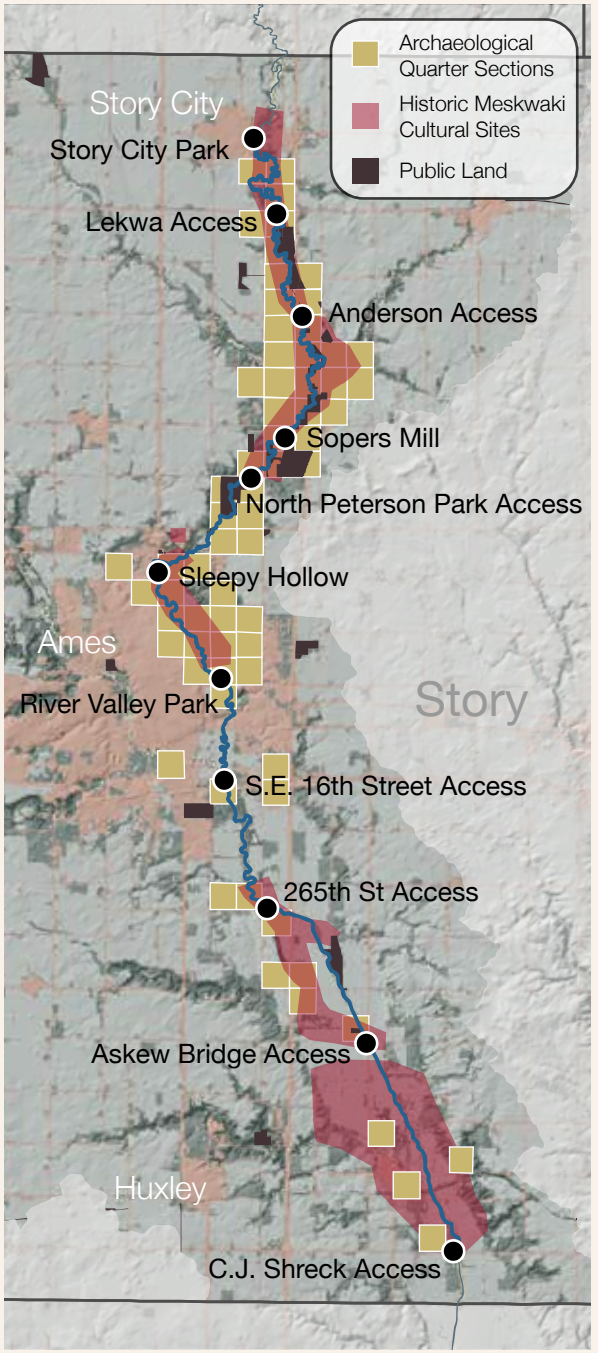


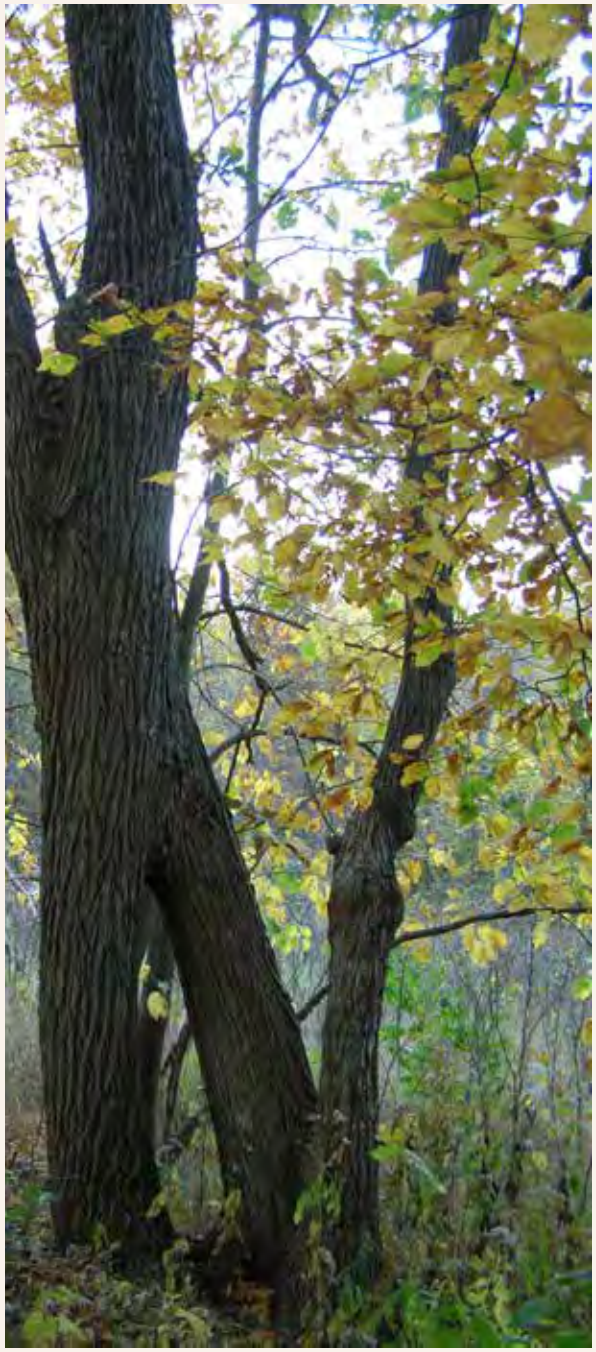
Figure 4
Although a majority of known archaeological sites are located upstream of Ames, much less archaeological survey and exploration has been completed downstream portions of the floodplain.

The South Skunk River in Story County 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 and protection. Corridor users would benefit from enhanced conservation and protection as well as from a focused interpretation that builds knowledge about the unique resources present. Existing land protection regulations and substantial public lands adjacent to the river lay a foundation to reach long term conservation goals focused on the full range of these resources, especially those actions which will have the most public benefit, such as flood resilience and water quality enhancement.

Implementation of the South Skunk Vision

The entire South Skunk River in Story County will be designated as a state water trail despite the contrasts between upstream and downstream segments. A large part of the vision for this proposed water trail includes protecting and enhancing the conditions that make this river a high quality recreational experience today. This includes protecting the already high diversity of bird and mussel species as well as the small-mouth bass population from degradation. Other parts of the vision address resource concerns described earlier. A stable, natural meandering river system is desired where lateral channel migration, mid-channel deposition and excessive streambank scour are minimized. The vision includes making gains in water quality enhancement in Story County to address the bacteria and biologically impaired reaches of the river in the study segment.

Recreational development included in the vision includes expansion of the Skunk River Greenbelt to the south, between Ames and Cambridge, on previously channelized segments of the river. A continuous perennial riparian buffer with diverse vegetation is also envisioned. Diverse resource enhancement of the river corridor also includes permanent protection of critical cultural and historic resources and river edge riparian forests.



Planning Process

This vision was developed through a two-year planning process integrating stakeholders, agencies, non-profit organizations and landowners. Three public events were held to generate interest and attention on water trail planning. A steering group composed of 15 local individuals representing special interests such as water quality, angling, botany, archaeology and landowners guided development of both the vision and this plan. The resource conservation and protection priorities included in this plan were developed by the Steering Group and the Water Trail Sponsor, Story County Conservation Board.

The existing conditions surrounding this section of the South Skunk River were assessed and researched concurrently with the resource conservation planning. Planning for recreation development occurred during the same two-year time period. An extensive review period occurred with the Steering Group, Story County Conservation staff, Story County Conservation board members, Story Soil and Water Conservation District and Iowa DNR. Finally, the resource conservation and protection recommendations and existing conditions information was presented at a well-attended public open house. All comments received at the open house and following were positive and highly supportive of the planning outcomes.

Scope of the Plan

Conservation and protection elements are recommended for both the river channel as well as the riparian corridor and selected upland locations. River channel recommendations include dam modification, streambank restoration demonstration projects and aquatic species habitat enhancement. On-land recommendations center on permanent protection of cultural resource sites, expansion of the riparian perennial vegetation buffer, water quality and terrestrial habitat enhancement. *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 do not include physical changes on the land 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 additional studies of archaeological resources, research on the cause of impaired water quality and studies to guide natural channel design for the future river restoration.

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	Expanded Tourism Opportunities
Establish Habitat Goals for Corridor			√	√		√	√
Explore Additional Land Protection Strategies	√	√	√	√	√	√	√
Modify 3 Existing Dams	√	√	√			√	√
Cleanup Legacy Dumpsites, Repair Gully Erosion		√		√		√	√
Conduct Fluvial Geomorphic River Assessment	√	√	√			√	
Streambank Restoration	√	√	√	√		√	√
Establish Perennial Vegetation Buffer	√	√	√	√		√	
Permanently Protect and Designate Significant Cultural & Historic Sites				√	√	√	√
Restore Oxbow Channels and Riparian Landscapes	√	√	√	√		√	√
Develop Partnerships With Other Watershed Efforts and Organizations	√	√	√	√			

Table 1

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

RESOURCE CONSERVATION AND PROTECTION NEEDS IN THE CORRIDOR

Existing Conditions

The downstream channelized segment presents different challenges and needs compared to the upstream natural channel segment *(Figure 5)*. A great deal of lateral channel migration and a pattern of channel widening and aggradation exist between Story City and the 265th Street Access. The resulting streambank instability ranges from severe to very severe and threatens infrastructure in some cases. An enormous amount of sediment erodes annually from this area. Directly related to the existing unstable streambanks, the river upstream of Ames is also recognized for the above-average amount of large woody debris accumulations compared to other similarly-scaled Iowa rivers. These conditions are due to the largely forested edge of the river, the channels' current phase of widening and the current pattern of intense rain events. Woody debris piles blocking the entire channel width commonly occur throughout the calendar year and generally exacerbate streambank erosion.

Although streambanks are generally higher on the channelized downstream section, less lateral channel migration and streambank instability is present because the channel is maintained as a straightened ditch. Concerns about water quality exist throughout the county. All except for 10.7 miles in central Story County is impaired for indicator bacteria. In addition, three tributaries draining into the study segment are impaired for bacteria and/or biological conditions.

Landcover in the first 100' on either side of the South Skunk River is a stark anomaly compared with landcover watershed-wide. Looking at the river corridor in Story County as one unit, 92% (2015 acres) of the total acres in the first 100' are perennial vegetation landcover such as forest, grassland or wetlands. Watershed-wide, only 13% (2015 acres) of the landcover is perennial. The northern-most segments between the Story – Hamilton County line and North River Valley Park in Ames consist of 95% - 100% perennial vegetation landcover. This very high percentage of primarily forest landcover promotes habitat stability. The percentage of perennial landcover decreased significantly downstream of North River Valley

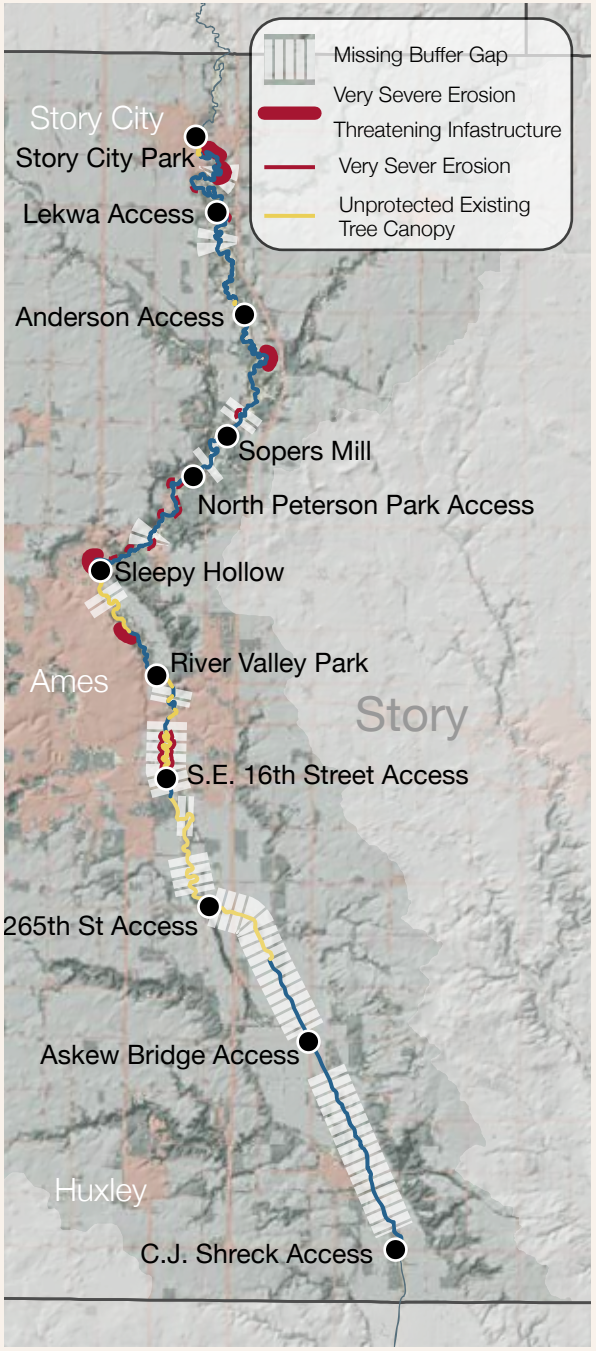


Figure 5

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

Park. The Askew Bridge to C.J. Shrek segment of the river had only 81% perennial vegetation cover in the initial 100' and the highest percentage of annually cultivated cropland on either side of the channel.

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 South Skunk, cause further instability in streambank soils and often exacerbate eroding streambank conditions.

Acres of public ownership, recreation opportunities and both aquatic and terrestrial habitat downstream of Ames are low compared to upstream. Story County Conservation Board has long range goals and plans to extend the Skunk River Greenbelt into this area.

A great deal of what is known about prehistoric habitation of the river corridor is due to the work of ISU archaeological researchers responding to the threat of a proposed federal flood control project in the 1970's. Although the proposed flood control effort was abandoned, further large scale investigations have not occurred. As such, much archaeological evidence is likely undisturbed due to the effectiveness of the South Skunk Greenbelt Conservation District zoning. Additional investigations are possible to target riparian areas suggested as having a high probability for cultural resources by archaeologists.

River Channel Conservation Needs

A number of issues were identified during this planning directly related to the river itself. Of all the issues identified in both the recreational development and resource conservation and protection planning, none are quite as urgent as these. Addressing these issues will alleviate further strain on aquatic habitat conditions and some water quality impairment issues. Addressing these issues may also open up opportunities for state river restoration funding as well as funding from other external sources. The following desired outcomes related to the river channel were identified during planning:

- Conduct professional assessment on the river channel to establish basic geomorphic parameters appropriate for this river
- Demonstration of stream bank and floodplain restoration practices on public land utilizing natural channel design and other low-impact practices
- Enhance habitat conditions for mussel habitat
- Utilize state of the art fish habitat enhancement practices particularly for small mouth bass based on a changing climate
- Explore catch and release fishing regulations for small mouth bass on the upper reaches
- Coordinate public meetings and monthly events for river clean ups, education and channel-wide log jam mitigation

Land-Based Resource Conservation Needs

A number of land management and potential landscape change issues were identified during this planning. Addressing these issues will elevate conditions on the South Skunk and assist local land managers to reach habitat goals efficiently. The following desired outcomes related to land-related issues were identified during planning:

- Further research on the causes and sources of water quality impairment in the watershed and included on the 303d list, increased participation in voluntary monitoring
- Coordinate with other organizations to enhance water quality conditions on the South Skunk and its tributaries
- Set habitat goals for public lands in the Skunk River Greenbelt
- Consider landscape restoration of undisturbed riparian corridor areas in southern Story County
- Conduct a thorough invasive species inventory on public land
- Establish a continuous perennial stream buffer for the length of the South Skunk River and its tributaries
- Permanent protection of existing mature forested riparian land tracts in private ownership
- Explore additional land protection ordinances beyond the current boundaries of the South Skunk Greenbelt Conservation District zoning area
- Minimize sheet and gully erosion on public lands adjacent to the river

Cultural Resource Protection Needs

An enormous opportunity exists in Story County to integrate the unique identity of this river with physical landscape places. The culture, history and remaining cultural sites separate this river from others in the state. However, the majority of these places are not permanently protected and there is no assurance that they will be available and undisturbed for future generations. The following desired outcomes related to cultural and historical issues were identified during planning:

- With only 13% of the river corridor surveyed for cultural resources, additional Phase I survey work and research is necessary for a more complete understanding of early occupation
- Provide contact information for the discovery of archaeological artifacts as well as handout material on how to handle, document and report artifacts
- Further investigation, prioritization of state-recorded archaeological and historic resources; pursue permanent protection (from development and exploitation) for priority cultural, historic sites.
- Pedestrian survey for remnants of early settler church, cemeteries and a number of schools, houses or farmsteads depicted on the 1875 Andreas Atlas

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 n.d.).

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).

Multiple resource conditions distinguish this segment of the South Skunk from other rivers in the region. The purpose of this chapter is to identify and organize the resources that are currently understood and integrate them with local and state priorities for conservation and protection.

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.

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

- River Channel Conservation: river channel assessment, dam mitigation, streambank and floodplain restoration, in-stream habitat enhancement and river cleanup events
- Land-Based Resource Conservation: sources of bacteria-impaired water quality research, continuous perennial stream buffer establishment, invasive species assessment, enhanced habitat conditions for Species of Greatest Conservation Need (SGCN), erosion repair and riparian forestland protection
- Cultural Resource Protection: additional professional and volunteer field studies, local prioritization of resources and voluntary permanent protection and designation status for high priority sites

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

The South Skunk River Greenbelt, owned and managed by Story County Conservation Board, is a critically important aspect of this water trail. The existing greenbelt lands, located upstream of Ames, also include the most heavily used sections of the South Skunk River. Story County Conservation plans to expand the greenbelt downstream of Ames to the Polk County border. This expansion, combined with existing municipal river corridor lands in Story City and Ames, will create a contiguous greenbelt ribbon through the entire County. Additionally, some private landowners in southern Story County have already placed conservation easements on their high-conservation value land or placed their floodplain cropland in federal conservation programs. These actions protect existing natural and cultural resources from further degradation for future generations of residents.

RECOMMENDED CONSERVATION AND PROTECTION PROJECTS

A broad range of resource conservation and protection strategies are recommended to protect and enhance conditions on the South Skunk River in Story County. The strategies include in-channel and shoreline, streambank, and inland / upland areas. The study area river corridor is divided into five segments *(Figure 6)* and one additional segment that includes the entire corridor. Recommendations are organized by segment and include maps, drawings and text descriptions. Some recommendations span multiple segments or the entire 37 mile study area. Preliminary cost estimates for water trail-related enhancements based on recent restoration material and construction costs in Iowa.

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

Figure 6

The 37 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**

Resource Conservation and Protection Recommendations for the Entire Corridor:

C 1.A
Conduct Additional Archaeological Investigations

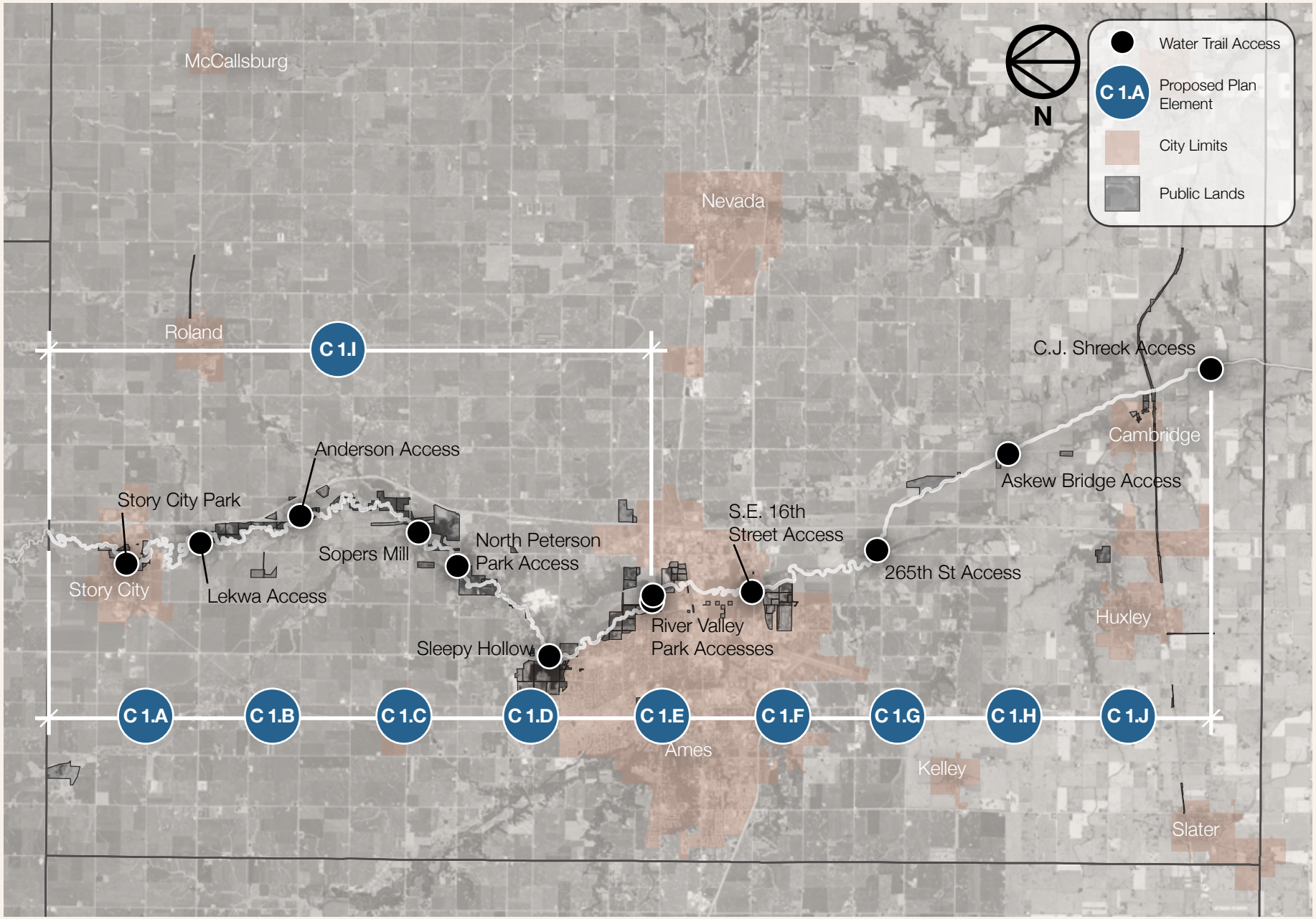
Archaeological surveys most closely related to the river corridor were conducted by Iowa State University Archaeological Laboratory for the proposed Ames Reservoir in 1972. These investigations consisted largely of surface survey and would not qualify as an intensive Phase I survey by modern standards. Other sites of known significance beyond the near-river area include the Buchanan Locality. However, previous archaeological surveys have covered only 13% of the study area. Development of a locally prioritized set of known cultural resources to protect is recommended in three stages, which would require contracting with private sector or university-based cultural resource management organizations.

(1) Continuation of Phase 1A desktop reconnaissance is recommended for the entire study area comprising (a) interviews with past investigators involved in previous studies; (b) a detailed review of known archaeological sites including prioritization by historical significance and preservation threats; and (c) detailed GIS modeling to predict the potential for unknown cultural resources.

(2) Already-identified sites of high priority should be investigated by intensive Phase I field survey.

(3) A Phase I pedestrian survey is recommended for river terraces and valley margins between Ames and Cambridge. Surface survey would only be productive on older landforms not subject of historic overbank flooding. All downstream surfaces have potential for buried prehistoric sites, and detailed geological mapping with limited drilling would be able to identify areas with the most buried site potential.

These additional archaeological investigations would provide a basis for a cultural resource management plan for the study area.



SEGMENT C1: **Corridor-Wide and Multiple Segment Projects**

C 1.B
Improve Handling of Cultural Artifacts Discovered by the Public

A great deal of stone tool, animal bone and other materials are discovered in the river corridor each year due to continual streambank erosion. However, many of these finds are not properly identified or recorded. The development of promotional materials for the public is recommended that detail contact information for the discovery of archaeological artifacts. Information should include how to handle, document and report artifacts as well as who to contact for more information as well as the link to the OSA website with I-Sites File.

C1.B *Significant tools, such as this Milnesend-like point, have been recovered on the slopes surrounding the South Skunk. Better communication with the public would encourage state registration of the artifacts. A more cohesive record of prehistoric habitation could be developed with this data.*

C 1.C
Establish a Continuous Riparian Buffer

Development of a 100' wide perennial stream edge buffer is recommended for the entire 37 miles of the South Skunk in Story County. The buffer width is measured beginning at the top of the streambank. Only 72 acres are missing from this buffer (2015). Establishment of either a Type [A] Woody Tree and Shrub Mix, comprised of native trees and shrubs or a Type [B] Herbaceous Mix, comprised of herbaceous plants only, is recommended.

C1.C *Ninety-two percent of the assessed riparian buffer area in Story County included perennial cover such as this riparian forest and grass area*

C 1.D
Research Riparian Buffer Conditions on Tributary Streams

The condition of 100' wide riparian buffer on all tributaries of the South Skunk River has not been quantitatively documented. Development of data is recommended based on data from the most recent cropping year. Results will be useful in enhancing water quality as well as building the identity of the water trail.

C1.D *Gaps in perennial land cover in the riparian area of the South Skunk are likely to be filled with annually cultivated cropland such as in this photo. Large scale streambank instability and erosion occur in these conditions.*

C 1.E
Research Causes and Sources of Water Quality Impairment

Three types of activities related to water quality enhancement are recommended. (1) Additional IOWATER volunteer monitoring on the South Skunk will provide a valuable snapshot understanding of water chemistry. (2) Professional research on the causes and sources of water quality impairment, particularly bacteria, in the watershed. Results will be useful in approaching landowners about voluntary pollution reduction. When bacteria sources are better understood, additional agricultural program funding may be available to enhance water quality. (3) Coordinate with other organizations to encourage farmers in the watershed to voluntarily Increase the use of cover crops and other conservation practices to reduce soil erosion. River clean up events are also recommended to reduce the volume of trash in the river *(Figure 7)*.

C1.E *More volunteers are needed for IOWATER sampling on the South Skunk and its tributaries.*

Figure 7

River clean-up events are popular activities. The Skunk River Navy and the Skunk River Paddlers organize annual clean-up days each year.

C 1.F
Technical Assessment and Restoration of River Function and Condition

An ecologically-based method of river assessment and restoration, habitat preservation, and erosion control based on geomorphology is recommended. This assessment will develop alternatives for river restoration in which erosion protection is balanced with sediment transport. Consideration for future stream mitigation on appropriate channelized segments of the river downstream of 265th Street Access is also recommended. This recommendation would require contracting with private sector consultants.

Resource Conservation and Protection Recommendations for the Corridor Upstream of 265th Street Access:

C 1.G
Establish Habitat Goals for Skunk River Greenbelt

An invasive species inventory on public land adjacent to the river in Story County is recommended. Recommendations also include establishment of regional ecological goals that balance flood control, water quality, biodiversity and recreation. Specific focus centers on developing and maintaining diverse habitats for Species of Greatest Conservation Need.

Figure 8

Mussel conservation is a high priority of the steering group.

C 1.H
Enhance Aquatic Habitat for Fish and Mussels

The modification of the 13th Street and Hannum's Mill/General Filter Dams in the near future will contribute to enhancing fish and mussel diversity. Conservation of existing mussel species (Table 2) is a high local priority. Additional types of ecological enhancements are recommended including those in-stream and in the riparian corridor.

C 1.I
Smallmouth Bass Population Study

Modification of the 13th Street and Hannum's Mill/General Filter dams in the near future will enhance conditions for fish species in the South Skunk River. Maintaining a population of mature smallmouth bass in the river is important for the long term viability of the species. However, population data on this section of the river is very limited.

Recommendations include working with Iowa Cooperative Fish and Wildlife Research Unit at ISU and Iowa DNR fishery biologists to collect quantitative data on existing conditions. Further modeling is also recommended to determine the potential impacts of habitat enhancement and various type of regulations.

Mussel Species	Living Mussel	Recently Dead Mussel	Notes
Paper Pondshell		X	SGCN, Rare in Iowa, populations declining
Cylindrical Papershell	X		Listed as a Threatened Species in Iowa; Rare in Iowa, declining populations
Creek Heelsplitter		X	Listed as a Threatened Species in Iowa; Rare in Iowa, declining populations
White Heelsplitter	X		Uncommon in Iowa
Mapleleaf		X	Uncommon in Iowa
Threeridge	X		Uncommon in Iowa
Fatmucket	X		Uncommon in Iowa
Plain Pocketbook	X		Common in Iowa

Table 2

The South Skunk River in Story County is already home to a great diversity of mussel species. Local priorities include further enhancement of areas where mussels are known to live as well as expanding areas of favorable habitat.

C 1.J
Explore Additional Land Protection Strategies for Riparian Forest

The exploration of various strategies is recommended to protect all existing, privately-owned mature riparian forest tracts adjacent to the South Skunk River. Potential strategies include (1) creation of a zoning overlay district for these areas (although not truly permanent protection), similar to the Story County Greenbelt Overlay District, within the incorporated limits of Story City and Ames and in rural portions of the County not included in the original zoning limits; (2) Donation or purchase of permanent conservation easements from willing landowners. (3) Donation or purchase of fee title from willing landowners.

C1.I *This segment of the South Skunk is popular with local anglers. Many teach their children to fly fish in this river. Local priorities include research to understand options for maintaining a stable fish population.*

C1.I *This segment of the South Skunk is home to one of several local smallmouth bass populations. The minimum catch size on this river is 12 inches.*

C1.J *Large undisturbed tracts of mature riparian forest in private ownership exist in both Ames and the rural portions of the County. These forests provide multiple ecosystem services, including flood damage reduction. Where located outside of the South Skunk River Greenbelt Conservation Zoning limits, the landcover in these areas is vulnerable to removal for agricultural purposes or industrial purposes.*

SEGMENT 1 COST ESTIMATES		
RECOMMENDATION	MAP CODE	COST ESTIMATE
Archaeological Study: Phase 1A Continuation	C1.A	$5,000
Phase 1 Professional Field Survey at Selected Sites	C1.A	
Phase 1A Pedestrian Study Between Ames and Cambridge	C1.A	$2,000
Cultural Resource Promotional Materials	C1.B	$3,000
Vegatative Buffer Establishment (entire length)	C1.C	$54,750
Tributary Vegatative Buffer Study	C1.D	$4,500
Increase Voluntary Monitoring	C1.E	
Bacteria Impairment Assessment	C1.E	
River Technical Assessment	C1.F	$80,000
Establish Habitat Goals	C1.G	
Enhance Aquatic Habitat for Fish and Mussels	C1.H	
Smallmouth Bass Population Study	C1.I	$6,500
Explore Riparian Forest Protection	C1.J	

SEGMENT C2: **Story City to Lekwa Access**

Existing Conditions

This segment of the river is 3.7 miles in length and is located largely on privately owned land. The corridor is heavily wooded with a moderate amount of large woody debris in the river channel. Many outside bends on this section show evidence of lateral migration though most do not threaten infrastructure.

Issues and Opportunities

Paddlers are unable to navigate the sheet pile dam in the Story City Park. A private concrete at-grade crossing exists midway in this segment with a significant drop off during low water conditions. Three legacy dumpsites exist on this segment near the edge of the river in forested areas.

C 2.A
Story City Park Sheet Pile Dam Modification

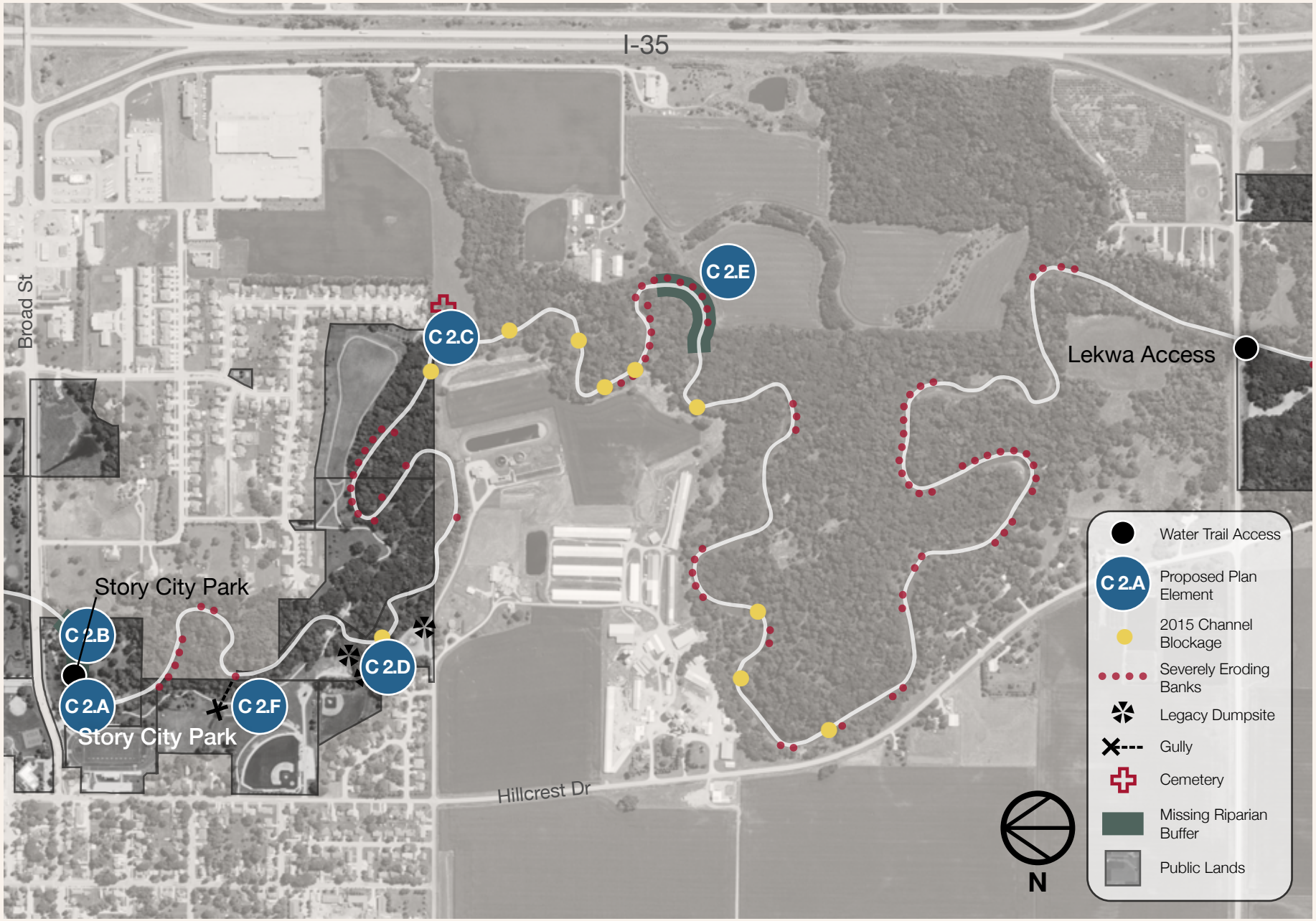
Past retrofit attempts to this dam have failed due flood events. Professional engineering and construction of a set of boulder weirs is recommended to allow whitewater paddlers and fish to pass over the dam. Alternatives include repair of the rock arch rapids or lower the sheet pile dam structure by one foot. The latter option would reduce water levels by approximatley 1 foot in the golf course, but would be substantially less expensive.

C2.A *The City of Story City is interested in refurbishing this dam, seen ahead in this photo. Rock structures designed to mitigate the dam have failed twice due to high water. Retrofit of this dam will leave only one dam on the South Skunk in place - the Hannum's Mill Dam near Ames.*

C 2.B
Vegetative Buffer Establishment

A planting of short, native grass mix is recommended for a minimum of the first 10' beyond the top of the stream bank to replace mown grass in Story City (South) Park. Dormant cuttings of native shrubs can be used as desired above the bankfull elevation in the park to stabilize streambank conditions.

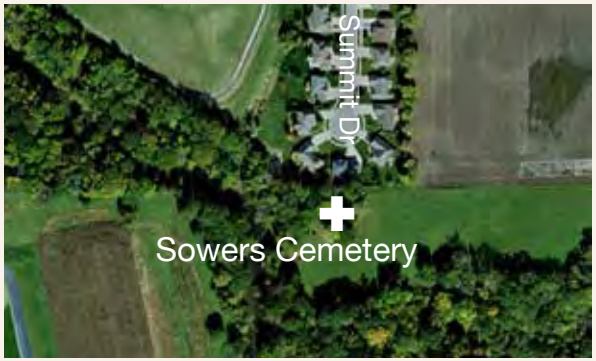
C2.B *The existing riparian area above the Story City Dam is mown lawn up to the top of the streambank. The river floods frequently in this area leaving sand deposits. Conversion of this area to native herbaceous vegetation will reduce flood cleanup, protect the streambank and create higher quality habitat.*



SEGMENT C2: **Story City to Lekwa Access**

C 2.C
Streambank Restoration to Protect Sowers Cemetery

Sowers Cemetery is one of the oldest cemeteries in Story County and contains 14-18 graves. It is a private cemetery; the oldest marked grave is 1854. The cemetery is located on a bluff top overlooking the South Skunk River. Due to lateral migration of the channel, the gravesites are vulnerable to exposure and erosion. A series of J-hooks are recommended to redirect the thalweg away from the eroding bank.



C2.C *Sowers Cemetery is classified as an ancient burial by Iowa law and is protected from disturbance. The Iowa Office of State Archaeologist works with entities to understand their responsibilities and options.*

C2.C *J-Hook rock structures are minimally-invasive structures keyed into the streambank. The rock formation redirects the thalweg (the deepest part of the channel) away from the eroding streambank.*

C 2.D
Clean up Legacy Dump Sites

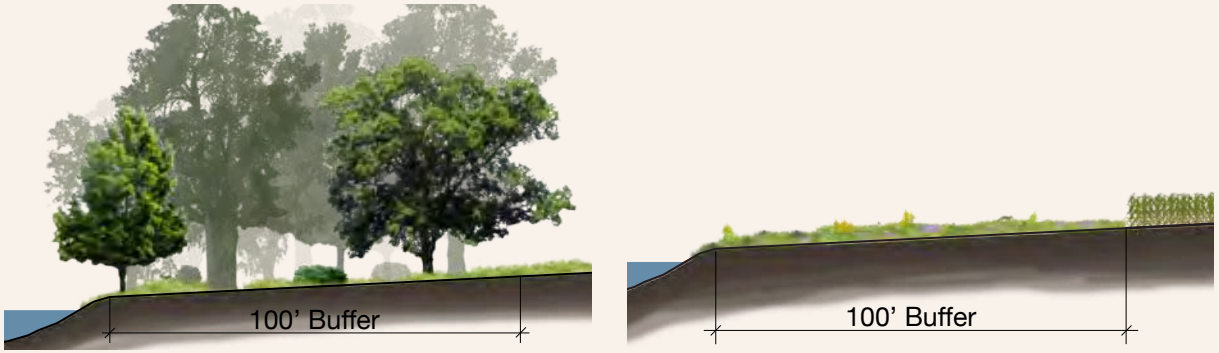
Three legacy dumpsites exist along the river's edge on this segment. All are located on public property. Various materials are included in each of the three dumpsites including yard waste, broken concrete and asphalt and discarded building materials such as ceramics, clay tile and metal. Removal and relocation of all material is recommended above the bankfull elevation. Relocation can be anywhere beyond the top of the streambank. The use of dormant cuttings of shade tolerant native shrubs are recommended to stabilize newly opened streambank areas above the bankfull elevation. Carefully placed concrete debris is recommended below the bankfull elevation.

C2.D *Dumpsites are common near populated areas. Upland locations are appropriate dump sites for rubble and other waste.*

C2.D *Following removal of surface debris, revegetation with native shrubs and herbaceous plants is recommended similar to this illustration.*

C 2.E
Vegetative Buffer Establishment

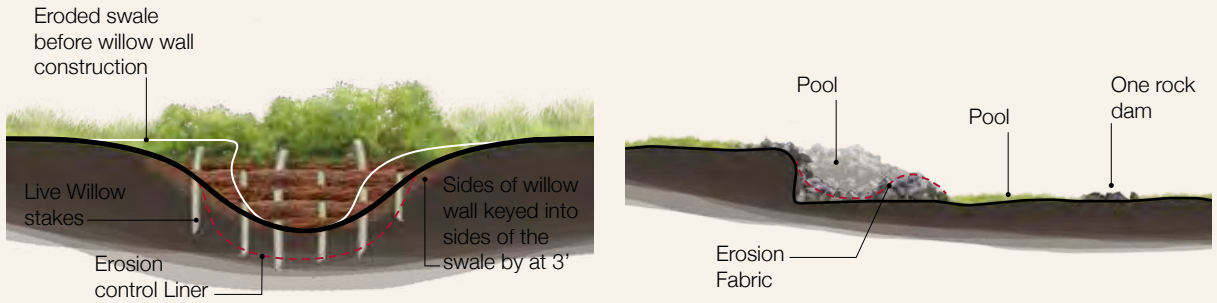
Only one 1-acre patch of riparian buffer is missing within the first 100' on either side of the river on this segment. The first 100' from the top of the streambank on both sides of segment 2 has only one acre of missing perennial riparian buffer. The land is currently is privately owned and is in annually-cultivated crops. The missing buffer is located at the top of an eroding 8' high streambank on an outside bend of the river. Establishment of either a Type [A] Woody Tree and Shrub Mix, comprised of native trees and shrubs or a Type [B] Herbaceous Mix, comprised of herbaceous plants only, is recommended.



C2.E. *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.*

C 2.F
Gully Repair

An intermittent tributary has created a 150' long gully on the west side of the South Skunk River in Story City South Park. Stabilization is recommended using two different techniques. A Willow Wall design method is recommended for portions in a downcutting stage. The Low Rock Structure design method is recommended for gully segments with a stable channel bottom.



C2.F. *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 (left) rely largely on dormant woody vegetation while the low rock structures (right) rely largely on rock.*

C2 Permitting Considerations

Construction at the proposed Story City Access is located at sites of previous disturbance so Phase I archaeological investigation would likely not be required. If past disturbance cannot be verified, Phase I investigation would likely be required. No additional archaeologic investigations are needed at Lekwa Access if the footprint of disturbance lies within the footprint of the E-18 Bridge construction disturbance area.

SEGMENT 2 COST ESTIMATES		
RECOMMENDATIONS	MAP CODE	COST ESTIMATE
Story City Dam Modification Repair	C2.A	$10,000 - $50,000
Story City South Park Vegetative Buffer Establishment	C2.B	$750
Streambank Restoration to Protect Sowers Cemetery (2 vane structure)	C2.C	$24,000
Legacy Dumpsite Cleanup, Story City Property	C2.D	
Gully Repair in Story City South Park	C2.F	

SEGMENT C3: **Lekwa Access to Sopers Mill**

Existing Conditions

This 7.3 mile segment flows through the heart of the Skunk River Greenbelt, including the area where the widest section of the flood control reservoir proposed by the Corps of Engineers would have been located. The corridor is heavily wooded with a moderate to high volume of large woody debris in the river channel. Many outside bends on this section show evidence of lateral migration. High numbers of cultural and historic resource sites are documented in this segment including outcrops of dolomitic chert used by prehistoric people for tool fabrication.

Issues and Opportunities

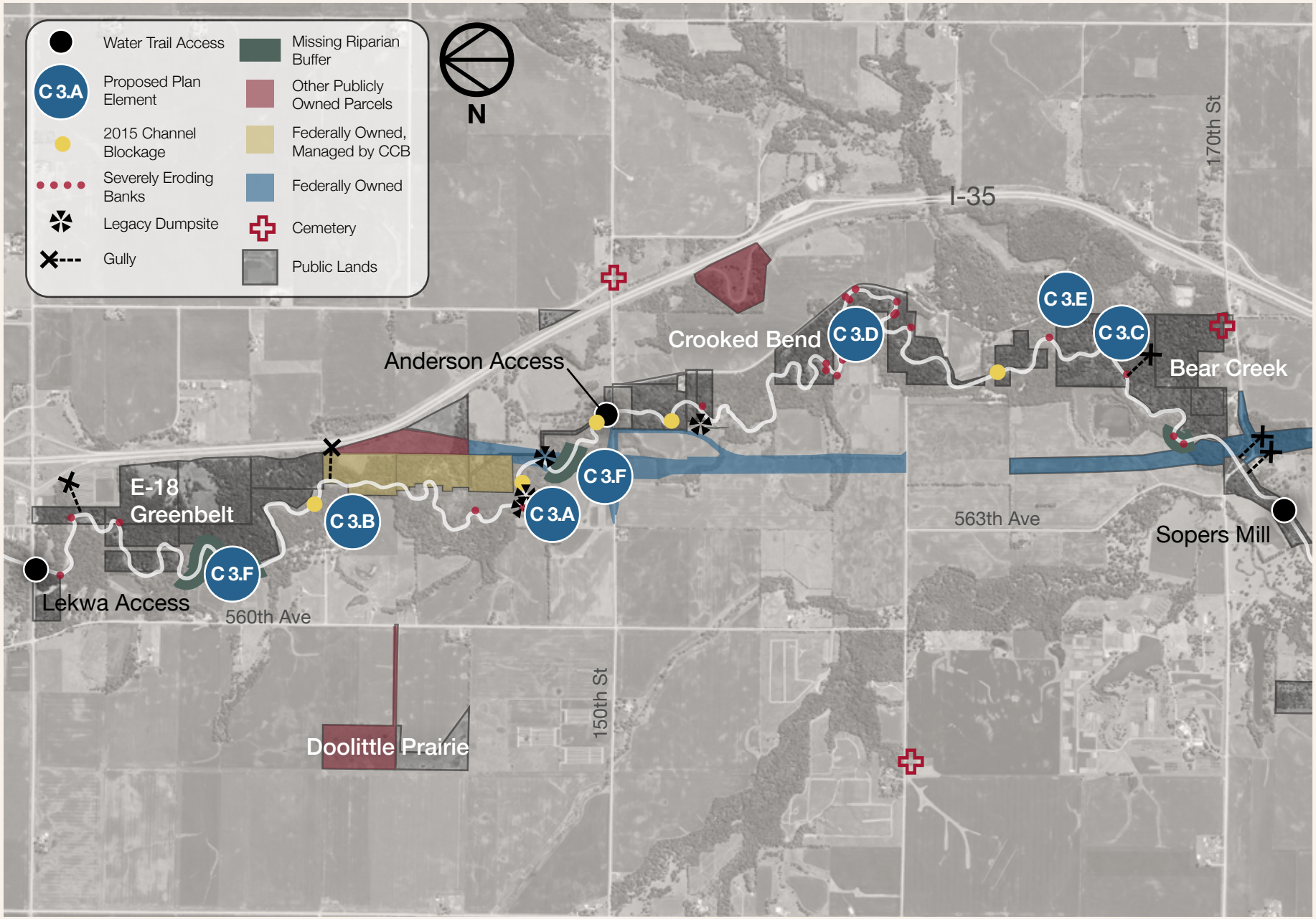
Multiple opportunities exist to enhance water quality conditions on this segment as well as protect cultural, natural and historic resources. Many of the known prehistoric sites are not permanently protected and only a partial understanding exists about culture along this river. Addressing the minimal number of legacy dumpsites, eroding gullies and a very small amount of missing riparian buffer will positively impact biological conditions as well as human experience of the river corridor.

C 3.A
Clean up Legacy Dump Sites

Four legacy dumpsites exist on this segment. All but one are on private property and one is located on property owned by the US Government (and not managed by Story County Conservation). Auto bodies make up the majority of the dumped material although scrap metal and broken concrete is also present. The auto bodies appear to have dumped as bank stabilization and portions are deeply embedded. Spot removal is recommended during low water conditions. Material that can be removed above the bankfull elevation should be removed to the elevation of the existing streambank; Embedded material should remain undisturbed. The use of dormant cuttings of shade tolerant native shrubs are recommended to stabilize newly opened streambank areas above the bankfull elevation.

C3.A *Existing dumped materials protruding above the top of the soil should be removed. Care should be taken to protect the integrity of the streambank itself during clean-up.*

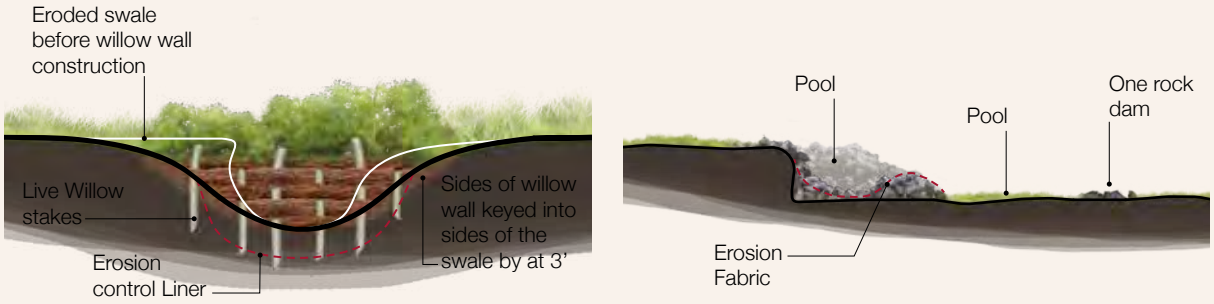
C3.A *Following removal of surface material, rip rap should be carefully placed below the bankfull elevation in the gaps where the streambank is newly exposed. Revegetation can then occur.*



SEGMENT C3: **Lekwa Access to Sopers Mill**

C 3.B
Gully Repair

An intermittent stream has created a 300’ long gully at the 4th Try Bridge crossing of the Skunk River Greenbelt Trail. Six additional gullies were identified in this segment with a total of 955LF of erosion. Stabilization is recommended using two different techniques. A Willow Wall design method is recommended for portions in a downcutting stage. The Low Rock Structure design method is recommended for gully segments with a stable channel bottom.



C3.B. *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 (left) rely largely on dormant woody vegetation while the low rock structures (right) rely largely on rock.*

C 3.C
Protect Native Red Mulberry Trees

Multiple mature, native red mulberry trees (Morus rubra) were identified near the confluence of Bear Creek with the South Skunk River. Every effort is recommended to protect these trees from damage due to future construction and other human activities.

C 3.D
Biechler Avulsion Study

The South Skunk channel is in the process of cutting off a meander bend adjacent to Pleasant Valley Road near property owned by Dean and Denise Biechler. Recent flood damage (2015) has exacerbated erosion and lateral channel movement at this location and threatens Pleasant Valley Road. A professional fluvial geomorphic investigation is recommended for this river reach to determine the most appropriate course of action.

C 3.E
Permanent Conservation Easements for Cultural Resource Sites

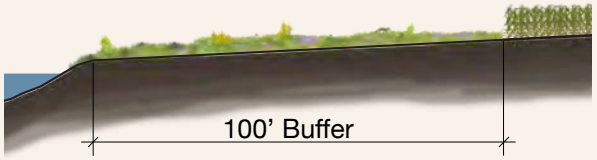
The purchase of permanent conservation easements from willing landowners is recommended for sites identified with important archaeological or historic value including dolomitic chert outcrops in bedrock utilized for tool manufacture by prehistoric people. The intent is to protect these sites from disturbance or destruction of the cultural or historic value, not necessarily for public access.

C3.F. *Bedrock outcroppings known to have been used by Prehistoric people for tool material represent a direct connection to the earliest occupation of the river valley.*

C 3.F
Vegetative Buffer Establishment

The first 100' from the top of the streambank on both sides of segment 3 has only 1.53 acres of missing perennial riparian buffer with the largest being 0.5 acres. Six very small patches comprise the 1.53 acres of missing buffer. All patches of missing buffer are on privately owned land with the exception of one which is owned by the U.S. Government and leased to a private landowner. In each instance the land is currently in annually-cultivated crops. Establishment of either a Type [A] Woody Tree and Shrub Mix, comprised of native trees and shrubs or a Type [B] Herbaceous Mix, comprised of herbaceous plants only, is recommended.

C3.F *Cropland has gradually replaced forest cover on this federally-owned parcel. This area is leased by a private landowner.*



C3.F. *Perennial vegetation buffers are recommended beginning at the top of the streambank for both sides of the river. The Woody Tree and Shrub Mix when mature (top) provides diverse habitat for multiple species as well as the most successful, natural reinforcement for streambank protection. The Herbaceous Mix (bottom) provides excellent filtering capability for sheet erosion from adjacent crop fields as well as important bird habitat.*

SEGMENT 3 COST ESTIMATES		
RECOMMENDATIONS	**MAP CODE**	**COST ESTIMATE**
Legacy Dumpsite Cleanup (private)	C3.A	
Gully Repair (Greenbelt Property)	C3.B	
Tree Protection (Greenbelt Property)	C3.C	
Biechler Avulsion Study (cost included in C1.F)	C3.D	$0
Resource Protection Easement (chert outcroppings & others)	C3.E	

C3 Permitting Considerations

The proposed parking expansion north and east of the existing parking area at Anderson Access will require a Phase I archaeological investigation as this area has not previously been disturbed by road or bridge construction.

Disturbance for launch and parking improvements at Sopers Mill will likely require a Phase I archaeological investigation.

SEGMENT C4: **Sopers Mill to Ames Municipal Boundary**

Existing Conditions

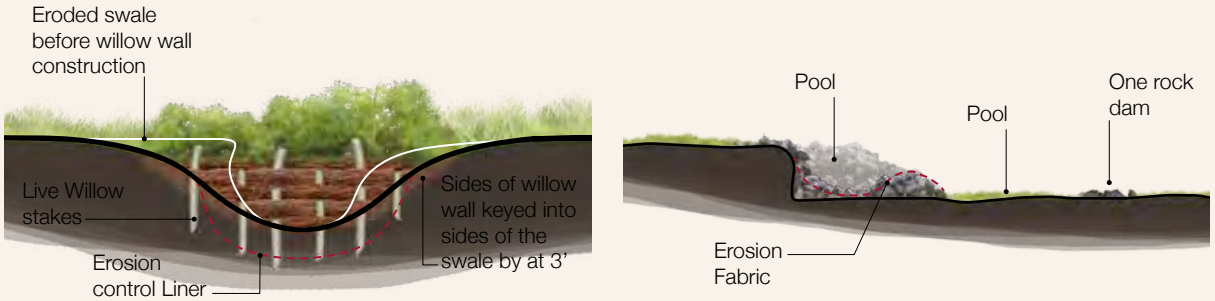
This segment of the river is 7.8 miles in length and is located on a combination of public and privately owned land. The corridor is heavily wooded with a moderate amount of large woody debris in the river channel. Nearly the entire length of this segment lies within the Skunk River Greenbelt zoning district, providing some protection against the removal of mature floodplain forests.

Issues and Opportunities

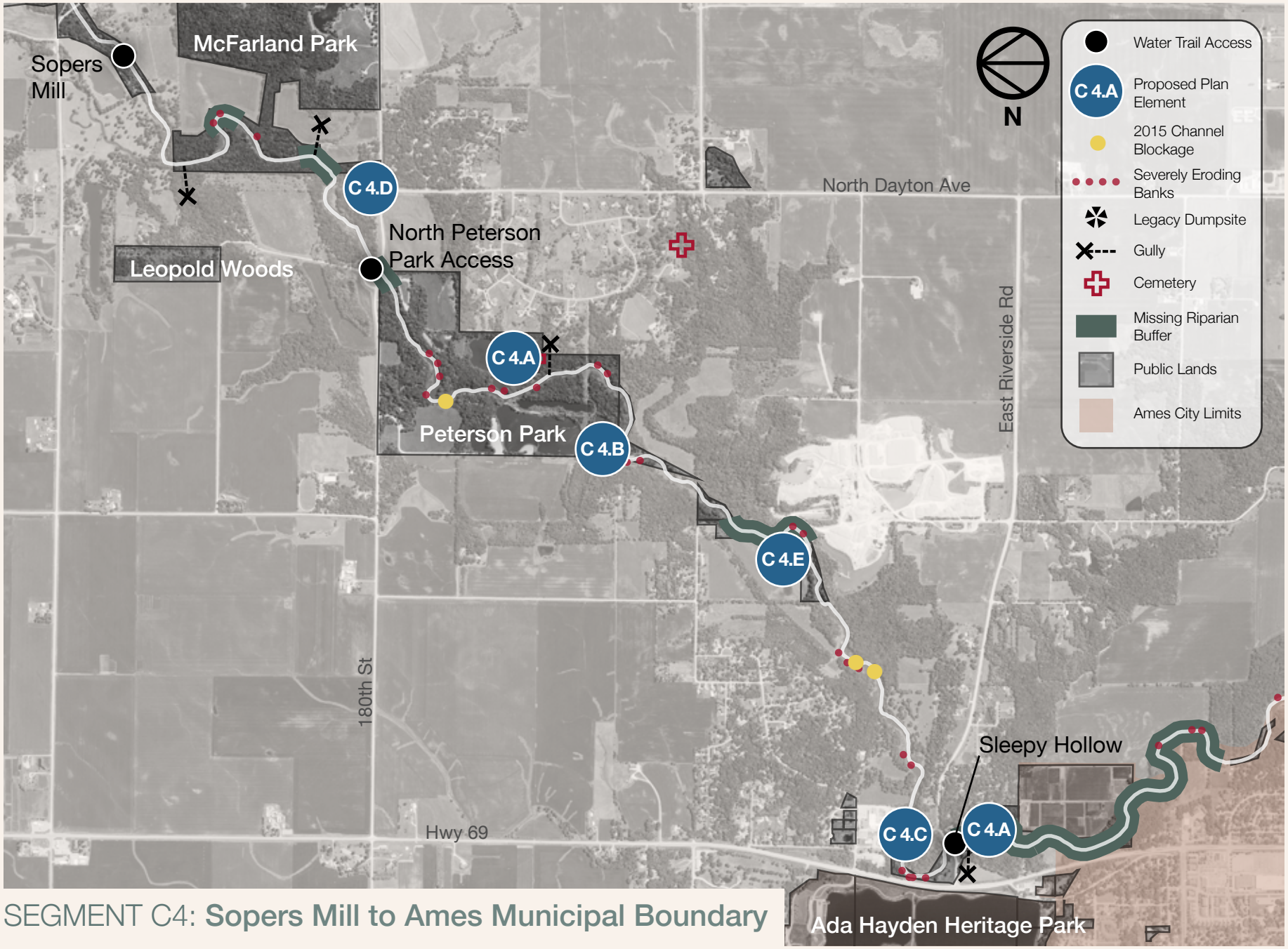
A number of eroding gullies and patches of missing riparian buffer exist on this segment. In addition to the presence of Hannum's Mill / General Filter Dam, two instances of very severe bank erosion exist on this segment that threaten infrastructure.

C 4.A
Gully Repair

Three eroding gullies, all draining into the South Skunk River, are located on this segment. All gullies are located on county property. The longest gully measures 225 feet and the shortest measures 125 feet. Stabilization is recommended using two different techniques. A Willow Wall design method is recommended for portions in a downcutting stage. The Low Rock Structure design method is recommended for gully segments with a stable channel bottom.



C4.A. *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 (left) rely largely on dormant woody vegetation while the low rock structures (right) rely largely on rock.*



SEGMENT C4: **Sopers Mill to Ames Municipal Boundary**

C 4.B
Bank Restoration at Peterson Park Pond Outfall

Peterson Park Ponds overflow into the South Skunk River near the southwest corner of the park. The channel is laterally migrating toward the outfall, putting additional stress on the outfall channel. Iowa DNR recommends the construction of a toe-wood-sod mat along the entire distance of the eroding bank as well as a rock lined drainage channel for outflow drainage. Story County Conservation plans to implement this design in 2016.

C4.B *Erosion at this location is exacerbated by pressure on the streambank from the channel and outflow from Peterson Ponds.*

C 4.C
Hannum's Dam Retrofit & Downstream Bank Restoration

Modification of the Hannum's Mill / General Filter Dam is recommended to allow paddlers and fish to safely navigate the dam. A series of rock arch rapids, or similar engineered structure, with river edge treatments for stabilization and public access is recommended. Another alternative would be to remove the dam entirely which would be less expensive. Approximately 1,300 LF of very severely eroding streambank exists on an outside bend immediately downstream of the dam. This outside bend is within or near Highway 69 right-of-way. Either a Wood Toe Sod Mat or a Stone Toe is recommended to restore the streambank.

C4.C *A number of people have drowned at Hannum's Mill dam while paddling, both experienced paddlers and inexperienced adolescents.*

C4.C *A series of rock arch rapids are commonly used in Iowa and Minnesota to remove the roller-motion created by low head dams.*

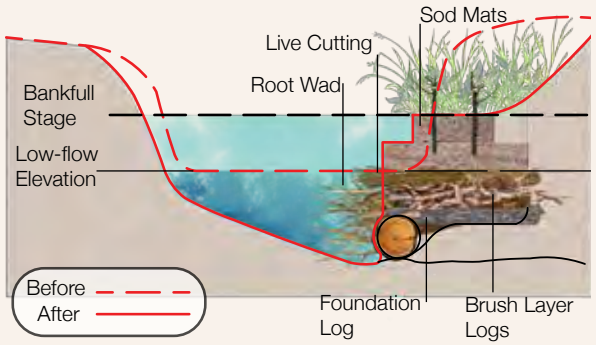
C 4.D
Permanent Conservation Easements for Cultural Resource Sites

The purchase of permanent conservation easements from willing landowners is recommended for sites identified with important archaeological or historic value including dolomitic chert outcrops in bedrock utilized for tool manufacture by prehistoric people. The intent is to protect these sites from disturbance or destruction of the cultural or historic value, not necessarily for public access.

C4.D *Chert outcroppings are subtle features are several specific locations on this segment of the South Skunk.*

C 4.E
Vegetative Buffer Establishment

The first 100' from the top of the streambank on both sides of segment 4 has only 1.75 acres of missing perennial riparian buffer. Three very small patches comprise the 1.75 acres of missing buffer. The largest tract is 1.43 acres and is 82 feet wide; this is the widest buffer gap in Story County upstream of Ames. All patches of missing buffer are on privately owned land. In each instance the land is currently in annually-cultivated crops. Establishment of either a Type [A] Woody Tree and Shrub Mix, comprised of native trees and shrubs or a Type [B] Herbaceous Mix, comprised of herbaceous plants only, is recommended.



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

C2.E. *Perennial vegetation buffers are recommended beginning at the top of the streambank for both sides of the river. The Woody Tree and Shrub Mix when mature (top) provides diverse habitat for multiple species as well as the most successful, natural reinforcement for streambank protection. The Herbaceous Mix (bottom) provides excellent filtering capability for sheet erosion from adjacent crop fields as well as important bird habitat.*

C4 Permitting Considerations

The site of North Peterson Access was recently disturbed by recent reconstruction of the 180th Street Bridge and will not require additional investigation. The Sleepy Hollow Access relocation may likely require a Phase I archaeological investigation as some parts of the site appear not to have been previously disturbed by construction. Retrofit of the Hannum's Mill Dam and associated streambank restoration will require a Phase I archaeological investigation.

SEGMENT 4 COST ESTIMATES		
RECOMMENDATIONS	**MAP CODE**	**COST ESTIMATE**
Gully Repair (Story County land)	C4.A	
Peterson Park Bank Restoration	C4.B	
Hannums Dam Retrofit	C4.C	$120,000-$150,000
Hannums Downstream Bank Restoration	C4.C	$130,000
Resource Protection Easement (adjacent to Greenbelt)	C4.D	

SEGMENT C5: **Ames Municipal Boundary to S.E. 16th Street Access**

Existing Conditions

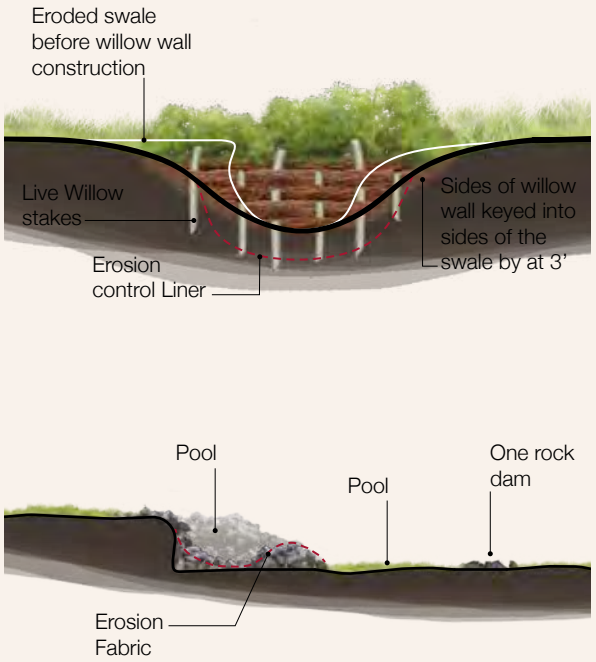
This segment of the river is 5.9 miles in length. A large part of this segment includes public land on one or both sides including Iowa State University and City of Ames. The corridor is heavily wooded with a moderate amount of large woody debris in the river channel. The largest intact sections of mature riparian forest in the county, outside of the Skunk River Greenbelt zoning district, occur on this water trail segment.

Issues and Opportunities

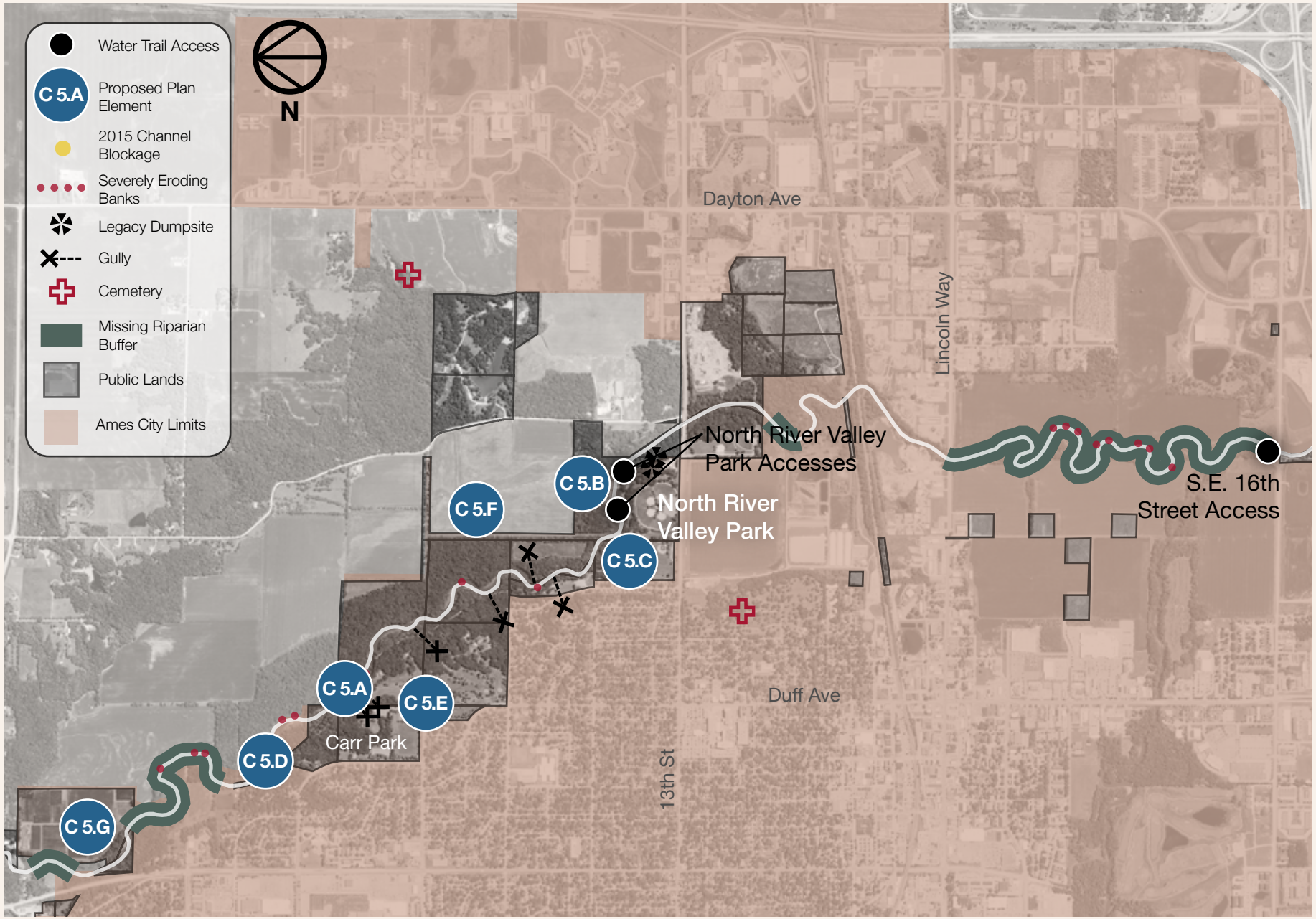
The existing low head 13th Street Dam in North River Valley Park is a hazard for paddlers and impassable by fish. Three legacy dumpsites and numerous large gullies exist near the edge of the river in forested areas on this segment. Portions of this segment downstream of the railroad crossing near Lincoln Highway were channelized in the early 20th century. Very severe lateral channel migration is occurring on sections of the river where annually cultivated crops are grown up to the edge of the streambank. This highly sinuous section has numerous fallen trees and large woody debris accumulations.

C 5.A
Gully Repair

Seven eroding gullies, all draining into the South Skunk River, are located on public land in this segment. Five of the 7 (totaling 770 LF) are located in North River Valley Park and easily observed from the existing trail or by walking along the river edge. Urban drainage from the upland, steep moraine surface onto the floodplain is creating these gullies. One additional gully is located on both county and ISU owned land (each approximately 200 LF). Stabilization is recommended using two different methods based on the condition of each gully. A Willow Wall design method is recommended for portions in a downcutting stage. The Low Rock Structure design method is recommended for gully segments with a stable channel bottom.



C5.A. *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 (top) rely largely on dormant woody vegetation while the low rock structures (bottom) rely largely on rock.*



SEGMENT C5: **Ames Municipal Boundary to S.E. 16th Street Access**

C 5.B
13th Street Dam Modification

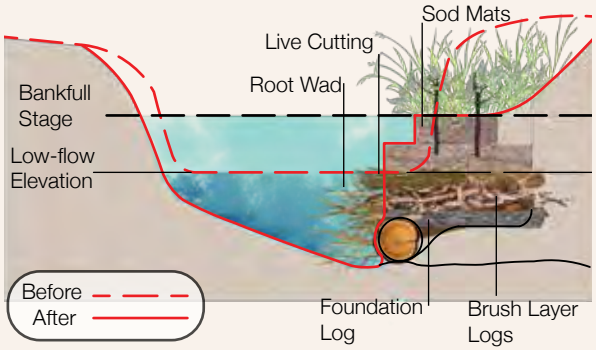
The 13th Street Dam structure is being modified to allow passage of paddlers and fish. A series of rock arch rapids or similarly engineered structures are anticipated. Restoration of eroding streambanks near the existing dam are also recommended in conjunction with the dam modification. Construction is anticipated for winter 2016-2017.

C5.B *This low head dam at North River Valley Park is popular with anglers. A playground, picnic area and ballfields are adjacent to the dam and water trail accesses.*

C5.B *Rock arch rapids utilized for dam modifications such as the 13th Street Dam enhance the value of fishing on the river.*

C 5.C
Streambank Restoration at North River Valley Park

Approximately 350 feet of very severely eroding streambanks are located within North River Valley Park upstream of the 13th Street Dam. Streambank restoration is recommended using a sod wood-toe mat construction along with a series of vanes, such as J Hooks. Vanes are recommended to protect the outside bend streambank, transport sediment and maintain a stable channel. Another streambank restoration alternative is a Stone Toe.



C5.C *Wood Toe Sod Mats or other natural channel design features are recommended for eroding streambanks in this segment where appropriate.*

C 5.D
Gateway Segment Channel Management: Sleepy Hollow & North River Valley Park

Gateway segments are selected partially on the basis of having no permanent hazards for paddlers. Occasionally there are temporary hazards present following high flow events, such as accumulations of large woody debris (LWD). This is a very common condition in the South Skunk River. Large wood in the channel is also an important component of aquatic habitat. LWD accumulations can also cause dangerous conditions for paddlers and tubers. Careful management of LWD can balance the need for habitat with low risk paddling conditions.

C 5.E
Cultural Resource Review Policy

A high density of projectile points and other in-situ evidence of prehistoric use has been reported in and surrounding the Sleepy Hollow to North River Valley segment. These sites and discoveries have not been recorded with the Office of State Archaeologist in many cases. Development of a cultural resource review policy is recommended for all areas from bluff top to bluff top within this segment with the exception of annually cultivated cropland. All major ground disturbing activities for wells, underground utilities, road earthwork, etc. should be evaluated prior to construction to establish sensitivity and consider alternatives if necessary. Limited scraping activities, light trail earthwork, seeding operations, drainage ditch clean out and any other activity that excavates or shifts soil should be monitored by an archaeologist or, preferably, the Office of the State Archaeologist. The archaeologist's role is to inspect the cleared surfaces and excavated spoils for pre-historic evidence.

C 5.F
Permanent Conservation Easements for Cultural and Natural Resources

The purchase of permanent conservation easements from willing landowners is recommended for sites identified with important archaeological or historic value including those prehistoric sites eligible for registry on the National Register of Historic Places and dolomitic chert outcrops in bedrock utilized for tool manufacture by prehistoric people. The intent is to protect these sites from disturbance or destruction of the cultural or historic value, not necessarily for public access. The purchase of permanent conservation easements on privately-owned sites with mature riparian forests is also recommended, where landowners are interested. Easements restricting future mining activities could also be considered for sites with known deposits.

C5.F *Specific point bars on the South Skunk are commonly scouted for chert and other materials by local residents. Artifacts are often dislodged from streambanks by erosion and found in the channel during summer months.*

C 5.G
Vegetative Buffer Establishment

The first 100' from the top of the streambank on both sides of segment 5 has nearly 14 acres of missing perennial riparian buffer, a majority of which is at one location. A total of 0.67 acres of the missing buffer is upstream of North River Valley Park. Approximately one third of this area is owned by Iowa State University while two-thirds is privately owned. In each instance the land is currently in annually-cultivated crops. Establishment of either a Type [A] Woody Tree and Shrub Mix, comprised of native trees and shrubs or a Type [B] Herbaceous Mix, comprised of herbaceous plants only, is recommended for these missing buffers.

The largest concentration of missing riparian buffer on the water trail is located slightly upstream of S.E. 16th Street Access and inside the Ames municipal boundary. The land on both sides of the river is planted in annually-cultivated crops right up to the top of the streambanks and the banks are 12-20' high (Figure 9). Paddlers report large chunks of soil with crops sloughing into the channel each year. While buffer establishment would have value on this segment, it is not recommended at this time. The high streambanks will continue to erode until the channel has developed a stable plan form. Establishment of a Type [A] Woody Tree and Shrub Mix, comprised of native trees and shrubs is recommended at that time.

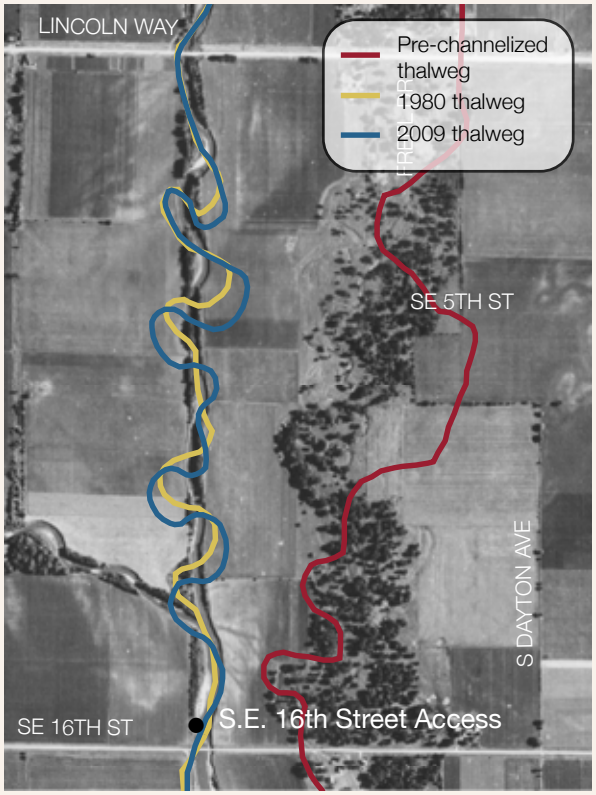


Figure 9. *The late-1800's river channel in southeast Ames (shown in red, above) was located east of the current, dredged channel. Mature floodplain forests still remain in many of areas of the historic channel.*

C5 Permitting Considerations

The site of North River Valley Access will likely require a Phase I archaeological investigation. It's possible, however, that the proposed area was included in the Phase I investigation for the dam modification. If the S.E. 16th Street Access is reconstructed at its current location, additional archaeological investigation will not be required as the site was disturbed with reconstruction of the S.E. 16th Street Bridge. If the access is moved downstream to the Hunziker Youth Sports Complex, a Phase I archaeological investigation would likely be required, unless prior disturbances can be verified.

SEGMENT 5 COST ESTIMATES		
RECOMMENDATIONS	**MAP CODE**	**COST ESTIMATE**
Gully Repair (North River Valley Park, County and ISU land)	C5.A	
13th Street Dam Modification	C5.B	$845,000
Streambank Restoration (North River Valley Park)	C5.C	$290,000
Implement Cultural Resource Policy (City of Ames area)	C5.D	$5,000
Resource Protection Easement (Existing mature riparian forests & Buchanan Bog)	C5.F	

SEGMENT C6: **S.E. 16th Street Access to C.J. Shrek Access**

Existing Conditions

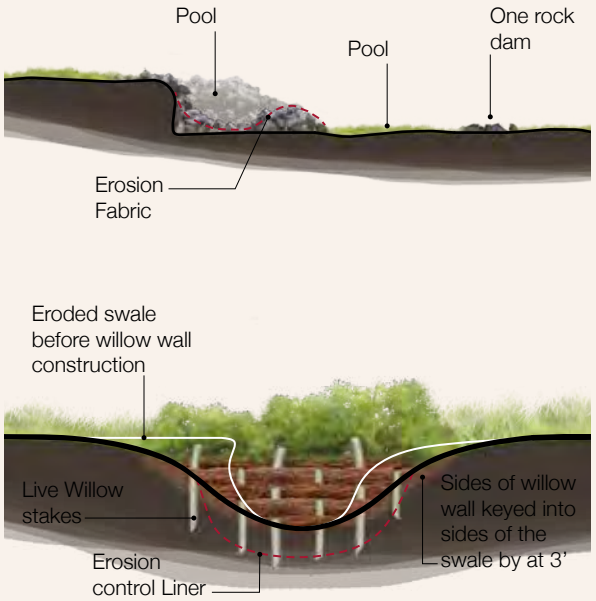
This segment of the river is 11.8 miles in length and is located nearly entirely on privately owned land. Annually cultivated cropland is at or near the edge of the streambank for the majority of this segment. This segment of the river was formally channelized but in some instances the channelization has not been maintained. Channelization has been maintained only on the most downstream 11 miles of the river in Story County.

Issues and Opportunities

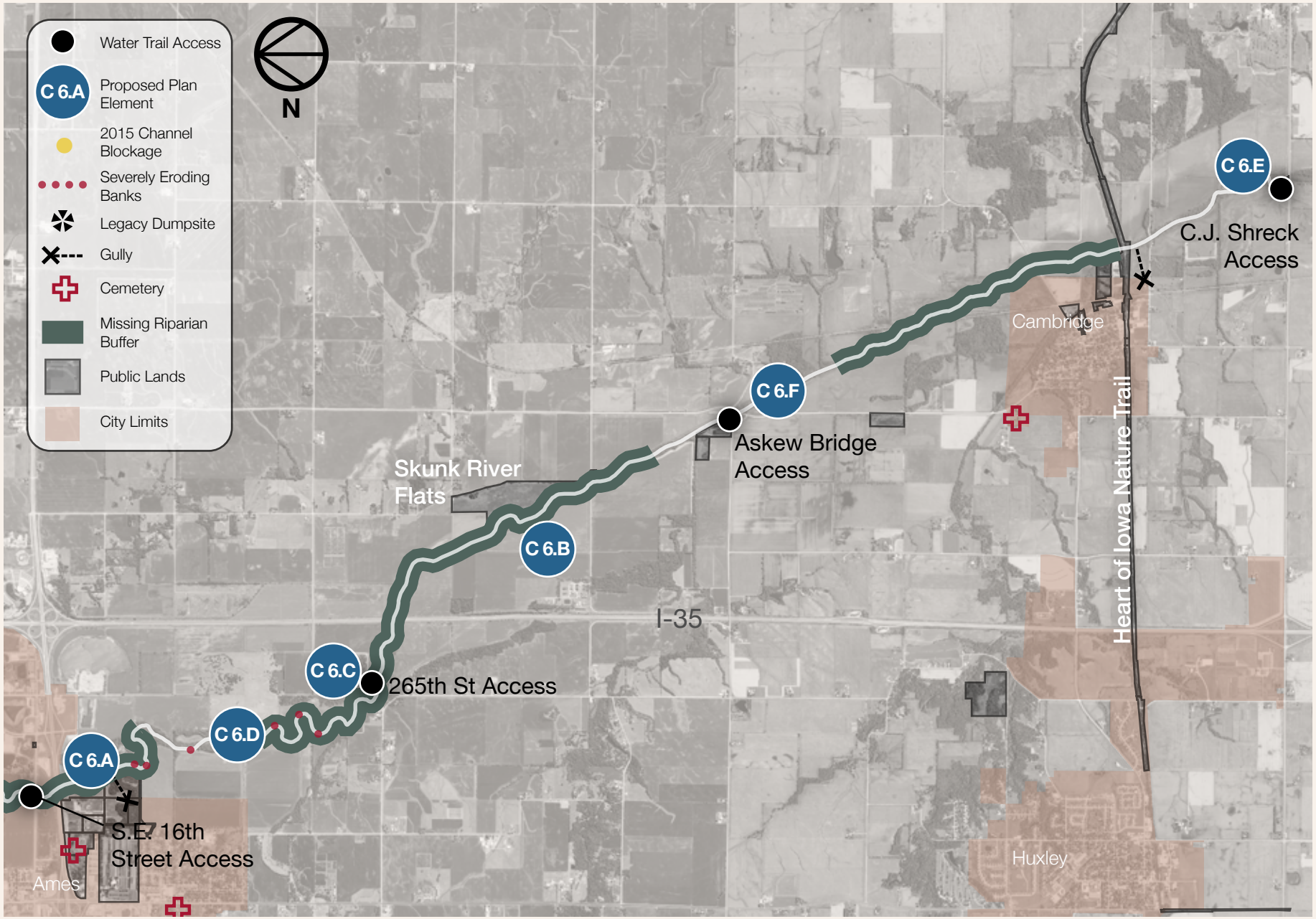
Fewer instances of lateral channel migration are found on this segment compared to segments upstream of Ames. This is largely due to the fact that the channelized ditch banks are maintained in a relatively straight alignment. Flood control levees exist on some areas of this segment. This segment includes the largest amount of missing buffer, due to annually cultivated cropland, of any segment in Story County. A minimal amount of gully erosion exists on public land and no legacy dump sites were identified. Enormous opportunities for conservation and restoration exist on this segment.

C 6.A
Gully Repair

Two eroding gullies draining into the South Skunk River are located on public property on this segment. The first is located approximately 1 mile downstream of the Highway 30 bridge and is 50 feet in length. The second is located near the Cambridge Wastewater Treatment Facility and measures 150 feet in length. Stabilization is recommended using two different methods based on gully condition. A Willow Wall design method is recommended for portions in a downcutting stage. The Low Rock Structure design method is recommended for gully segments with a stable channel bottom.



C6.A. *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 (left) rely largely on dormant woody vegetation while the low rock structures (right) rely largely on rock.*



SEGMENT C6: **S.E. 16th Street Access to CJ Shreck Access**

C 6.B
Permanent Conservation Easements for Cultural Resources

The purchase of permanent conservation easements from willing landowners is recommended for sites identified with important archaeological or historic value including those prehistoric sites eligible for registry on the National Register of Historic Places. The intent is to protect these sites from disturbance or destruction of the cultural or historic value, not necessarily for public access. The purchase of permanent conservation easements on privately-owned sites with mature riparian forests is also recommended where landowners are interested.

C 6.C
Landscape Restoration near 265th Street Access

The 175 acre site adjacent to the 265th Street Access, known locally as the Ronald "Dick" Jordan Family Wildlife Area, currently includes cropland near the river and severely overgrazed pasture. Landscape restoration is planned to restore oxbow wetlands and convert the remaining land to prairie and woodland. Weirs are planned in the over-widened channel to shift the location of the thalweg and reduce shear stress on the outside bends. The objectives of this effort is to enhance floodwater retention, enhance water quality and provide fish and wildlife habitat. Project partners include Iowa Natural Heritage Foundation, Iowa DNR and Story County Conservation.

C6.C *Following channelization, former channels of the South Skunk were abandoned and often used for grazing. Many, such as those near the 265th Street Access, are excellent candidates for oxbow restoration.*

C6.C *Streambanks near the 265th Street Access are unstable due to lateral channel migration. The channel is now in an over-widened condition. Iowa DNR Engineers are completing design and construction of practices to encourage the channel to be more narrow.*

C 6.D
Conservation Near Ken Maril Road Historic Bridge

The Pinned Connection Warren truss bridge crossing the South Skunk on 260th Street / Ken Maril Road was originally constructed near Cambridge in 1876. The bridge was moved to its present location near Ames, adjacent to the Ames Airport, in 1916. It was one of three wrought iron bridges built in Story County over the South Skunk in 1876-7 and the only one remaining. The bridge is listed on the National Register of Historic Places. Only a few Warren trusses were built in Iowa and this bridge is the oldest remaining in the state. The bridge condition is severely degraded and it is unusable. Its location is fairly remote and few people use the site. The bridge site is less than 0.5 mile from the incorporated limits of Ames.

In addition to its poor condition, the location of the bridge provides both an opportunity and a challenge. Story County has identified the area near the adjacent Hallet Materials Extraction Site, located SW of I-35/US 30 mix master, as a high priority area for resource conservation. The bridge location is less than 1 mile from the Hallet's site. The county will be working with the City of Ames to explore and prioritize the potential reuse and revitalization of the mining area after production ceases. It's possible a river crossing for a land trail will be needed near the Hallet's site and the existing bridge is an excellent location for that crossing. However, the bridge is likely not salvageable. Large woody debris (LWD) accumulations piled up against the bridge footings have been an issue for many years. In some part due to the LWD accumulations, the channel is laterally migrating at the bridge location and exposing the footings on the east side of the river. Consultation with adjacent landowners is recommended to determine their interest in conservation, recreation and restoration. Non-profit conservation organizations may also have interest in additional land conservation at this location.

C6.D *The historic bridge (right) has been abandoned for many years and is beginning to collapse due to lateral channel migration, causing large-scale streambank collapse near the historic bridge. Large woody debris accumulates near the bridge (right), exacerbating high water damage.*

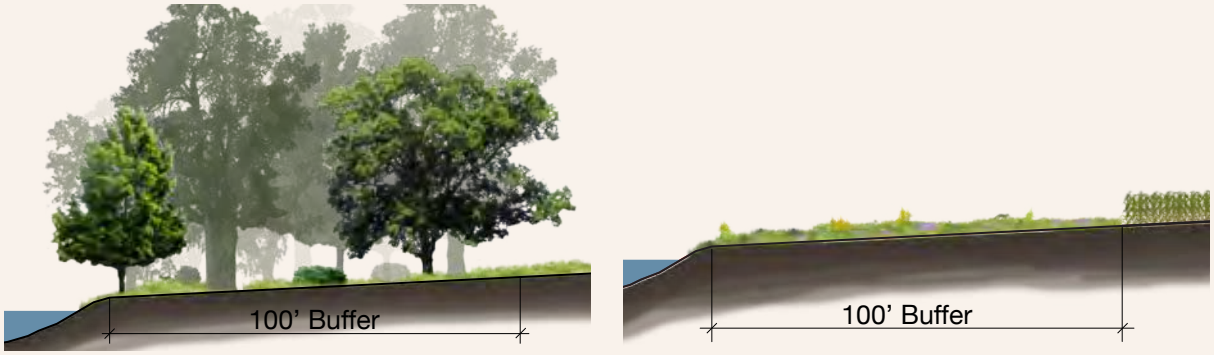
C 6.E
Drainage at C.J. Shrek Access

The adjacent land manager reports that the levee elevation may have been lowered at the time this access was constructed. Floodwater enters his field through the launch and parking lot. The adjacent landowner is requesting the correction of this inadvertent earthwork change.

C6.E *The adjacent landowner reports water reaches his field during high water through the boat launch at CJ Shrek Access. It appears that when the launch was constructed, the existing elevation of the levee was lowered to accommodate the launch. Resolution of this drainage issue can occur in conjunction with design and construction of an upgraded access.*

C 6.F
Vegetative Buffer Establishment

The first 100’ from the top of the streambank on both sides of Segment 6 has a total of 43.2 acres of missing perennial riparian buffer. All patches of missing buffer are privately owned. In each instance the land is currently in annually-cultivated crops. Multiple patches are 100’ wide, indicating that annually cultivated crops are planted up to the top of the streambank. Establishment of either a Type [A] Woody Tree and Shrub Mix, comprised of native trees and shrubs or a Type [B] Herbaceous Mix, comprised of herbaceous plants only, is recommended.



C2.E. *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.*

R6 Permitting Considerations

The site of 265th Street and Askew Bridge access will likely require a Phase I archaeological unless prior disturbances can be verified. The C.J. Shrek Access upgrades are occurring on the site of the existing parking and access. Previous survey results at this location provide evidence to support a recommendation that Phase I archaeological investigation is not warranted.

SEGMENT 6 COST ESTIMATES		
RECOMMENDATIONS	MAP CODE	COST ESTIMATE
Gully Repair at Wastewater Treatment Plant Outfall	C6.A	
Resource Protection Easement (existing mature riparian forests)	C6.B	
Ronald “Dick” Jordan Family Wildlife Area restoration	C6.C	
Ken Maril Road Historic Bridge Site (Story County)	C6.D	
Resolution of CJ Shreck Levee Conditions (Story County)	C6.E	

RESOURCE CONSERVATION AND PROTECTION OVERVIEW

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

Permitting Considerations

Some recommended conservation and protection plan elements require earthwork and other disturbance. As with all construction on and near rivers, multiple permits may be required prior to any disturbance. The following are expected:

- Local City (Story City and Ames) and Story County have permitting processes for developing on a floodplain
- Joint permit application shared between the DNR flood plain development program, the DNR sovereign lands program, and the U.S. Army Corps of Engineers
- Story County zoning permit for vegetation removal within the South Skunk River Greenbelt Conservation District

Additional investigations and permits will likely be 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 (Appendix A) with oversight from the water trail manager. A number of local and state partner organizations and agencies are organized and positioned to assist with development of individual plan elements. Examples of partners include:

- Non-Profit Organizations such as Iowa Natural Heritage Foundation, Outdoor Alliance of Story County, Iowa Prairie Network, Iowa Ornithologists' Union and Iowa Archaeological Society
- Local and State Agencies including Story Soil and Water Conservation District, Iowa Department of Transportation, Iowa Office of State Archaeologist, State Historical Society of Iowa, Iowa Department of Natural Resources, Iowa Economic Development Authority

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

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APPENDICES

Map Code	Location	Lead Jurisdiction	Recommendation	Local Prioritization	Budget Estimate for River-Related Recommendations	Other Collaborators
R1.A	River Corridor	Iowa DNR	Concessionaire Agreement	3	$0	Story CCB, Liveries, ISU Rec. Services
R1.B	River Corridor	Iowa DNR	Misconduct Reporting Policy	2	$0	Story County Sheriff, ISU
R1.C	River Corridor	Iowa DNR	On-water Rescue Capacity Building	1	$0	Story County, City of Ames
R1.D	River Corridor	Water Trail Sponsor	Communication Among Access Managers	1	Reimbursable from IDNR	Story City, Ames
R1.E	River Corridor	Iowa DNR	Public Interpretative Plan & Education Program	2	$0	Iowa DNR, Skunk River Paddlers, Volunteers
R1.E	Skunk River Greenbelt	Story CCB	Greenbelt Wayfinding Signage (20)	2	$400	
R1.E	Skunk River Greenbelt	Story CCB	Greenbelt- Private Property Limits Sign	2	$250	
R1.F	River Corridor	Iowa DNR	Water Trail Map	1.5	$0	Iowa DNR
R1.G	Anderson, Sopers Mill, North Peterson, Sleepy Hollow Accesses	Story CCB	Risk/Flow/Experience Communication	1	$1,000	Iowa DNR, Skunk River Paddlers
C1.A	River Corridor	Water Trail Sponsor	Archaeological Study: Phase IA continuation	2.5	$5,000	Outside Consultant, Iowa Office of the State Archaeologist
C1.A	River Corridor	Water Trail Sponsor	Phase I Professional Field Survey at Selected Sites	3		Outside Consultant, Iowa Office of the State Archaeologist
C1.A	Ames to Cambridge	Water Trail Sponsor	Phase IA Pedestrian Study between Ames and Cambridge	3	$2.000	Outside Consultant, Iowa Office of the State Archaeologist
C1.B	River Corridor	Story CCB	Cultural Resource Promotional Materials	2.5	$3,000	Iowa DNR, Outside Consultant, Iowa Office of the State Archaeologist
C1.C	River Corridor	Water Trail Sponsor	Vegetative Buffer Establishment (entire length)	1	$54,750	Willing Landowners, Story Soil & Water Conservation District
C1.D	South Skunk Watershed	Water Trail Sponsor	Tributary Vegetative Buffer Study	1	$4,500	Iowa DNR, ISU
C1.E	South Skunk Watershed	Water Trail Sponsor	Increase Voluntary Monitoring	1		IOWATER
C1.E	South Skunk Watershed	Water Trail Sponsor	Bacteria Impairment Assessment	1		Iowa DNR
C1.F	River Corridor	Water Trail Sponsor	River Technical Assessment	1.5	$80,000	Iowa DNR, City of Ames, City of Story City, Outside Consultant
C1.G	Skunk River Greenbelt	Story CCB	Establish Habitat Goals	2		

Map Code	Location	Lead Jurisdiction	Recommendation	Local Prioritization	Budget Estimate for River-Related Recommendations	Other Collaborators
C1.H	River Corridor	Story CCB	Enhance Aquatic Habitat for Fish and Mussels	2		Iowa DNR
C1.I	Story City Park to North River Valley Park, Ames	Story CCB	Smallmouth Bass Population Study	2.5	$6,500	Iowa DNR, Iowa Cooperative Fish and Wildlife Research Unit
C1.J	River Corridor	Water Trail Sponsor	Explore Riparian Forest Protection	2		Iowa Natural Heritage Foundation
R2.A	Story City South Park	City of Story City	Story City Park River Access: New Whitewater Access Above Dam & New Carrydown Launch Downsteam	1	$11,020	
R2.B	Story City South Park	City of Story City	Story City (South) Park Parking Expansion	3	$32,793	
R2.B	Story City South Park	City of Story City	Story City (South) Park New Gravel Parking Lot	3		
R2.C	Story City North Park	City of Story City	Story City (North) Park Improvements	1		
R2.D	Story City	City of Story City	Story City Trail Extension	1		
C2.A	Story City South Park	City of Story City	Story City Dam Modification Repair	1	$10,000-$50,000	Iowa DNR
C2.B	Story City North & South Parks	City of Story City	Story City South Park Vegetative Buffer Establishment	3	$750	
C2.C	Sowers Cemetery	Water Trail Sponsor	Streambank Restoration to Protect Sowers Cemetery (2 vane structures)	1	$24,000	Willing Landowner, Iowa Office of State Archaeologist, Iowa DNR, Story County
C2.D	Story City	City of Story City	Legacy Dumpsite Cleanup, Story City property	2		
C2.F	Story City South Park	City of Story City	Gully Repair in Story City South Park	3		
R3.A	Skunk River Greenbelt	Story CCB	Paddle-In Campsite	1.5	$500	
R3.B	Anderson Access	Story CCB	Anderson Access Launch, Parking and Entrance Upgrades	1.5	$118,447	
R3.C	Sopers Mill Access	Story CCB	Sopers Mill Launch Upgrades	2	$10,360	
R3.C	Sopers Mill Access	Story CCB	Upgrades to Sopers Mill parking	2.5	$81,900	
R3.D	Skunk River Greenbelt	Story CCB	Land Acquisition	1		
R3.E	Skunk River Greenbelt	Story CCB	Greenbelt Trail Extension	1		
R3.F	Skunk River Greenbelt	Story CCB	4th Try Bridge	3	$30,000	
C3.A	Skunk River Greenbelt	Water Trail Sponsor	Legacy Dumpsite Cleanup (private)	2		Willing Landowner, Skunk River Paddlers
C3.B	Skunk River Greenbelt	Story CCB	Gully Repair (Greenbelt property)	2		

Map Code	Location	Lead Jurisdiction	Recommendation	Local Prioritization	Budget Estimate for River-Related Recommendations	Other Collaborators
C3.C	Skunk River Greenbelt	Story CCB	Tree Protection (Greenbelt property)	2		
C3.D	Skunk River Greenbelt	Water Trail Sponsor	Biechler Avulsion Study (cost included in C1.F)	3	$0	Iowa DNR, Outside Consultant
C3.E	River Corridor	Water Trail Sponsor	Resource Protection Easement (chert outcroppings & others)	2.5		Willing Landowners
R4.A	Sleepy Hollow Access	Story CCB	Hazard Warning Signage	1	$200	Iowa DNR
R4.B	Sopers Mill Access	Story CCB	Upgrades to North Peterson launch	1.5	$14,081	
R4.C	Sleepy Hollow Access	Story CCB	Sleepy Hollow Launch & Parking Relocation	2	$82,287	
R4.D	River Corridor	Story CCB	Land Acquisition from U.S. Government for Trail extension	1		
R4.E	River Corridor	Story CCB	Resource Protection Easement	1		Iowa Natural Heritage Foundation
R4.F	River Corridor	Story CCB	Trail Extension Easements	1		
R4.F	River Corridor	Story CCB	Trail Extension	1		
R4.G	Sleepy Hollow Access & Ada Hayden Park	Story CCB, City of Ames	Ada Hayden Trail Connection	2		Iowa DOT
R4.H	South Skunk & Ada Hayden Drop Structure	Story CCB	Water Connection Study	3	X	Iowa DOT, City of Ames, Skunk River Paddlers
C4.A	Skunk River Greenbelt	Story CCB	Gully Repair (Story County land)	2		
C4.B	Peterson Park	Iowa DNR	Peterson Park Bank Restoration	1		Story CCB
C4.C	Hannum's / General Filter Dam	Story CCB	Hannums Dam Retrofit	1.5	$120,000-$150,000	USGS, Iowa DNR, Outside Consultant
C4.C	Hannum's/General Filter Dam	Story CCB	Hannums Downstream Bank Restoration	1.5	$130,000	Iowa DOT, Iowa DNR
C4.D	River Corridor	ALL	Resource Protection Easement (adjacent to Greenbelt)	2.5		Iowa Natural Heritage Foundation, Willing Landowners
R5.A	North River Valley Park	City of Ames	Restroom Relocation	2		
R5.B	North River Valley Park	City of Ames	North River Vally Gateway Launch Construction	2	$12,215	
R5.B	North River Valley Park	City of Ames	North River Valley Parking Improvements in Main Parking Area Including Tie Down Lane	1	$77,840	
R5.B	North River Valley Park	City of Ames	North River Valley Carry Down Launch Construction	1	$6,500	

Map Code	Location	Lead Jurisdiction	Recommendation	Local Prioritization	Budget Estimate for River-Related Recommendations	Other Collaborators
R5.C	River Corridor	City of Ames	Ames Trail Extension including land	1		
R5.D	S.E. 16th St. Access, Ames	City of Ames	S.E. 16th St. Access Improvement (assuming land is already in public ownership or easement has been obtained)	2	$32,976	
C5.A	North River Valley Park	City of Ames	Gully Repair (North River Valley Park, County and ISU land)	1		
C5.B	North River Valley Park	City of Ames	13th Street Dam Modification	1	$845,000	Iowa DNR, Outside Consultant
C5.C	North River Valley Park	City of Ames	Streambank Restoration (North River Valley Park)	1	$290,000	
C5.E	River Corridor	City of Ames	Implement Cultural Resource Policy (City of Ames area)	3	$5,000	Iowa Office of State Archaeologist, Iowa DNR
C5.F	River Corridor	Water Trail Sponsor	Resource Protection Easement (Existing mature riparian forests & Buchanan Bog)	2.5		Iowa Natural Heritage Foundation, Willing Landowners
R6.A	265th St Access	Iowa DNR	265th St. Access Upgrades	1	$0	Story CCB
R6.B	Askew Bridge Access	Story CCB	Askew Bridge Launch, parking & tie-down lane Upgrades	1	$19,320	
R6.C	CJ Shrek Access	Story CCB	CJ Shrek Launch & Parking Upgrades	1	$65,177	
R6.D	River Corridor	Story CCB	South Story County Trail Extension including Land Acquisition or Easements	2		Willing Landowners
R6.E	Ames to Cambridge	Story CCB	Land Trail Extension	2		Willing Landowners
C6.A	Cambridge	City of Cambridge	Gully Repair at Wastewater Treatment Plant Outfall	3		
C6.B	River Corridor	Water Trail Sponsor	Resource Protection Easement (existing mature riparian forests)	2.5		Iowa Natural Heritage Foundation, Willing Land Owners
C6.C	265th St Access	Story CCB	Ronald “Dick” Jordan Family Wildlife Area restoration	1		Iowa DNR, Iowa Natural Heritage Foundation
C6.D	Ken Maril Road & South Skunk River	Story CCB	Ken Maril Road Historic Bridge Site (Story County)	2		Story County Engineer
C6.E	CJ Shrek Access	Story CCB	Resolution of CJ Shrek Levee Conditions (Story County)	1