The Terry Trueblood Wetland Exploration Trail Adaptation Plan

Presented to the City of Iowa City

Authors:
Gia DeBartolo, Kevin Englebert, Jasmine Frias,
Luke Foelsch, John Jepsen, Mariah Kauder, Paul Schmitt

Faculty advisors:
Dr. Scott Spak, Dr. Lucie Laurian
The University of Iowa School of Urban and Regional Planning

THE UNIVERSITY OF IOWA
IOWA INITIATIVE
FOR SUSTAINABLE COMMUNITIES

THE UNIVERSITY OF IOWA
School of
Urban & Regional Planning

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EXECUTIVE SUMMARY

This adaptation plan is focused on achieving a low-cost means for the City of Iowa City to increase the use and usability of the Terry Trueblood Wetland Exploration Trail (TTWET). This plan seeks to leverage natural, ecosystem, and human assets to create a space that is more ecologically stable and inviting to Iowa City residents, not to mention more reflective of Iowa City's identity as a community built along the river. The site itself is located in a low-lying area along a bend in the Iowa River. This situation presents planners with the site's signal constraint, regular and persistent flooding. In any given year, the site can expect complete inundation for anywhere from one week to several months. In addition to flooding the site also contains a high percentage of invasive species, including Honeysuckle, Japanese Hops, and Narrowleaf Cattail. While these invasive species are well-adapted to site conditions, only few are compatible with local species, thereby presenting an opportunity for the reintroduction of native communities and ecosystems.

This plan contains recommendations for invasive species control, as well as the reintroduction of native plant species. The long-term goal is to promote an enduring, sustainable and native ecosystem for TTWET that increases ecosystem services, promotes wildlife habitats, and provides educational and recreational opportunities for Iowa City residents. In addition to recommending invasive species control and native plant reintroduction, this plan calls for a system of infrastructure-light site improvements to enhance the usability of the site for Iowa City residents. These improvements include signage along the Terry Trueblood Loop Trail inviting people to explore TTWET, but also a system of sign-designated trails for both walking and biking through TTWET. In addition to signs designating the use of the trails, flood-resistant interpretive signage will add an educational element to the experience of TTWET visitors.

TTWET was used as an informal garbage dump prior to its purchase by the city. Detritus on the site continues to present both a hazard for users and detriment to the natural aesthetic of the site. In addition, the site has several large concrete structures that are covered in graffiti. This plan has recommendations for the creation of a local "Friends of TTWET," modeled on the Friends of Hickory Hill. This community group would be tasked with assisting the city in both the cleanup and maintenance of the site. This plan also contains recommendations for the repurposing of the large concrete structures in partnership with local artists. This plan recommends the creation of a community-based, volunteer group to assist in the long-term maintenance of the site, organization of community events, and the fostering of a sense of stewardship among local residents.

This plan has three primary goals, two of which have been touched upon above:

1. Promote resilience, adaptation, and ecological regeneration within TTWET and its surroundings.

2. Facilitate increased human interaction with and understanding of the natural area

3. Create an adaptation plan and planning process template with generalized adaptation strategies and best management practices for other sites along the Iowa River and areas with similar characteristics

This plan identifies the key ecosystem features of TTWET and makes site-specific recommendations for creating a long-term, cost-effective system of environmental planning and adaptation. In addition, the key strategies and methods advanced by this plan are meant to be transferrable to other sites along the Iowa River corridor. This plan presents a series of principals and methods for adapting TTWET that can be applied to these greenspaces as well. Some of these spaces include Waterworks Prairie park, Peninsula/Thornberry Park, Lower City Park, Terell Mill park (by the UI boat house), UI Campus, Hubbard park, Riverfront Crossings Park, Sturgis Ferry Park, Napoleon Park, and Mesquakie Park, as well as Ryerson woods and Southeast Wetlands, east of the wastewater treatment plant which are nearby but not on the river. By implementing this adaptation plan, the City of Iowa City will see both a long-term increase in ecosystem services provided by the site, but also increased positive human interaction with the site.

1 INTRODUCTION

The following is a proposal for a first-of-its-kind adaptation plan for the Terry Trueblood Wetland Exploration Trail (TTWET). TTWET is located next to the extremely popular Terry Trueblood Recreation Area (TTRA), just south of McCollister Road in Iowa City. The area currently exists in a semi-tended state, where mature native trees compete with invasive species and reclaimed soil piles sit across from concrete rubble. TTWET has a long stretch of steep and untended river bank, as well as many native species endemic to Iowa's pre-settlement river bottom ecosystems. The site offers an unparalleled opportunity for fusing recreational and educational goals with environmental and ecosystem service goals, not to mention more reflective of Iowa City's identity as a river community. Located along the banks of the Iowa River, TTWET is used by mountain bikers, birders, and anglers, and has the potential to become a popular destination for educators and their students, families, and nature lovers of all kinds.

This plan provides a comprehensive framework for establishing a long-term, sustainable program for the improvement and maintenance of TTWET. Currently, the site is recognized by the city as an underutilized resource. This plan will elaborate a systematic and scalable process for recognizing the limitations of TTWET and addressing them through cost-effective means. The major priorities of the plan are the following: promoting environmental resilience and ecosystem services at TTWET, maximizing user-value at the site, increasing interpretive and educational opportunities at the site, and generating a portable model of adaptation planning that can be implemented for other sites.

TTWET is one of many public greenspaces located along the Iowa River within Iowa City. This plan presents a series of principals and methods for adapting TTWET that can be applied to these greenspaces as well. Some of these spaces include Waterworks Prairie park, Peninsula/Thornberry Park, Lower City Park, Terell Mill park (by the UI boat house), UI Campus, Hubbard park, Riverfront Crossings Park, Sturgis Ferry Park, Napoleon Park, and Mesquakie Park, as well as Ryerson woods and Southeast Wetlands, east of the wastewater treatment plant which are nearby but not on the river.

2 SITE HISTORY

2.1 Ecological History

On a national level, Iowa City is located on the cusp of both Eastern Temperate Forest and Great Plains ecoregions, and Iowa City is on the edge of both Interior River Lowland and Southern Iowa Rolling Loess Prairies on a more local level.[1] The position of Iowa City and TTWET at the intersection of such distinct ecoregions allows for a variety of ecosystems in a relatively small area—from a small prairie remnant on the northeast corner of S Gilbert Street and McCollister Boulevard, to Ryersons Woods across the Iowa River to the southwest. Though the Des Moines Lobe regions of Iowa to the northwest owe their landforms and soil to the most recent encroachment of glaciers 12-14,000 years ago, much of the Iowa City area has been shaped and eroded more prominently by wind and water from glacial melt. Over the past 8,000 years, prairie has advanced and retreated east and west to the Iowa City area, trading space with oak woodlands and forming a "shifting prairie-woodland mosaic."[2] TTWET is not simply prairie or oak woodland, and thus poses a challenge in establishing ecological integrity that a traditional preservation program might implement.

TTWET itself has never been tilled, farmed, or quarried. However, the historical presence of both industries immediately to the east in what is modern day Terry Trueblood Recreation Area may have had a great environmental impact on the site. Farming has occurred on the TTRA site since the 1860s and a quarry was established there in the 1970's.[3] Regional agricultural development of the area fragmented the forested lowland and prairie habitats. Once the TTRA site was converted to farmland by European settlers, it is possible that TTWET was used for riparian grazing by dairy livestock from the adjacent McCollister/Showers farms. This may have created an opportunity for invasive species to migrate to TTWET. Likewise, the presence of farmland on the TTRA site may have resulted in soil erosion onto the low-lying TTWET.

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[1] James M. Omernik et al. "Level III and IV Ecoregions of Iowa," 1993, accessed June 23, 2018, ftp://newftp.epa.gov/EPADataCommons/ORD/Ecoregions/ia/ia_eco_v1.pdf.

[2] Cornelia F. Mutel, *The Emerald Horizon: The History of Nature in Iowa*, (Iowa City: University of Iowa Press, 2008), 4-6.

[3] Sarita Zaleha, "Terry Trueblood Recreation Area," *Iowa City's Parks: An Environmental History*, University of Iowa, last accessed April 23, 2018, https://dsps.lib.uiowa.edu/iowacityparks/2016/01/01/sand-lake/.
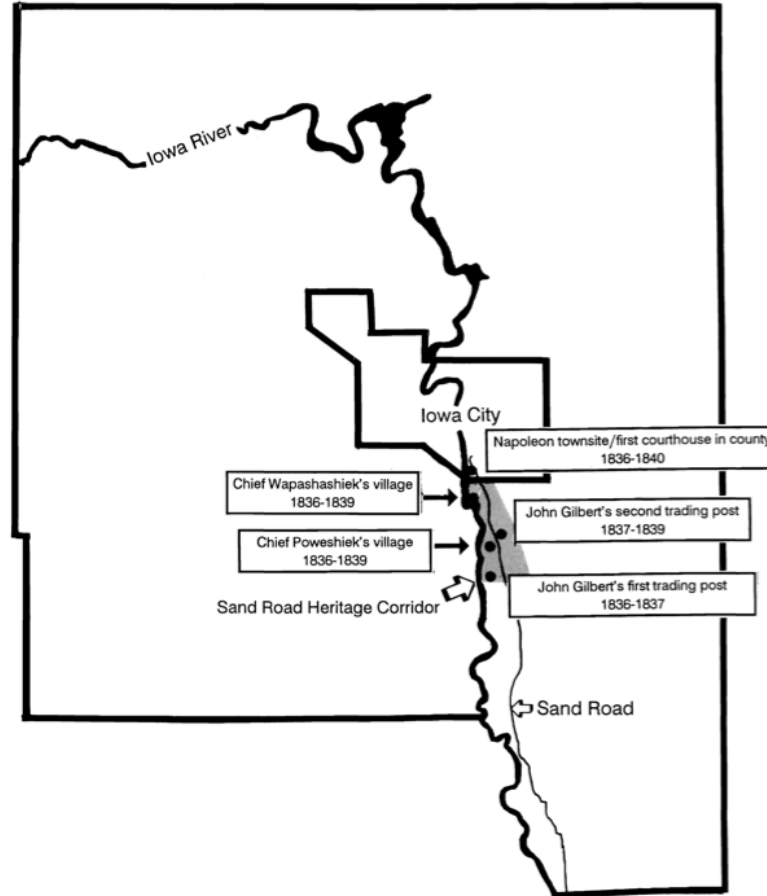
2.2 Settlement and Cultural History

Figure 1 Sand Road Diagram

2.2.1 *Native American Settlement*

TTWET sits near historic Meskwaki-Sac & Fox Tribe of the Mississippi in Iowa (hereafter, Meskwaki) settlements: "A number of Indian towns were located upon the Iowa river, within what are now the limits of the county; the largest of them was about two miles below Iowa City on the Clark farm, now owned by Jas. McCallester [sic], and contained about one thousand of Musquaka [sic] or Fox Indians."[4] This location presents the city with unique opportunities for both a far-reaching community partnership with the Meskwaki Nation in Tama, Iowa and educational or interpretive signage for TTWET. "The placement of the Meskwaki villages, and the trading posts, and an Indian trail (which later became Sand Road) that predates 1833, were all factors in the eventual location of the capital of Iowa Territory at present-day Iowa City."[5] Located near the TTWET site were both Meskwaki "summer settlements" and a fur-trading post. The Native American settlements near TTWET are key historical facts

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[4] History of Johnson County, Iowa, Iowa City, Iowa, 1883. Reproduced by Unigraphic, Inc., Evansville, IN, 1973, p. 297

[5] Peterson, Cynthia L. (2009). "Historical Tribes and Early Forts". In William E. Whittaker. *Frontier Forts of Iowa: Indians, Traders, and Soldiers, 1682–1862. Iowa City: University of Iowa Press. pp. 12–29.*

relating the siting of Iowa City. This history must play a part of any historical-interpretive signage. Specifically, the city should seek input from the Meskwaki Nation on all signage that will make specific reference to their ancestors' inhabitation near the site.[6] Additional resources for the history of and contacts with the Meskwaki include the Iowa State Historical Society and the History Department at the University of Iowa.
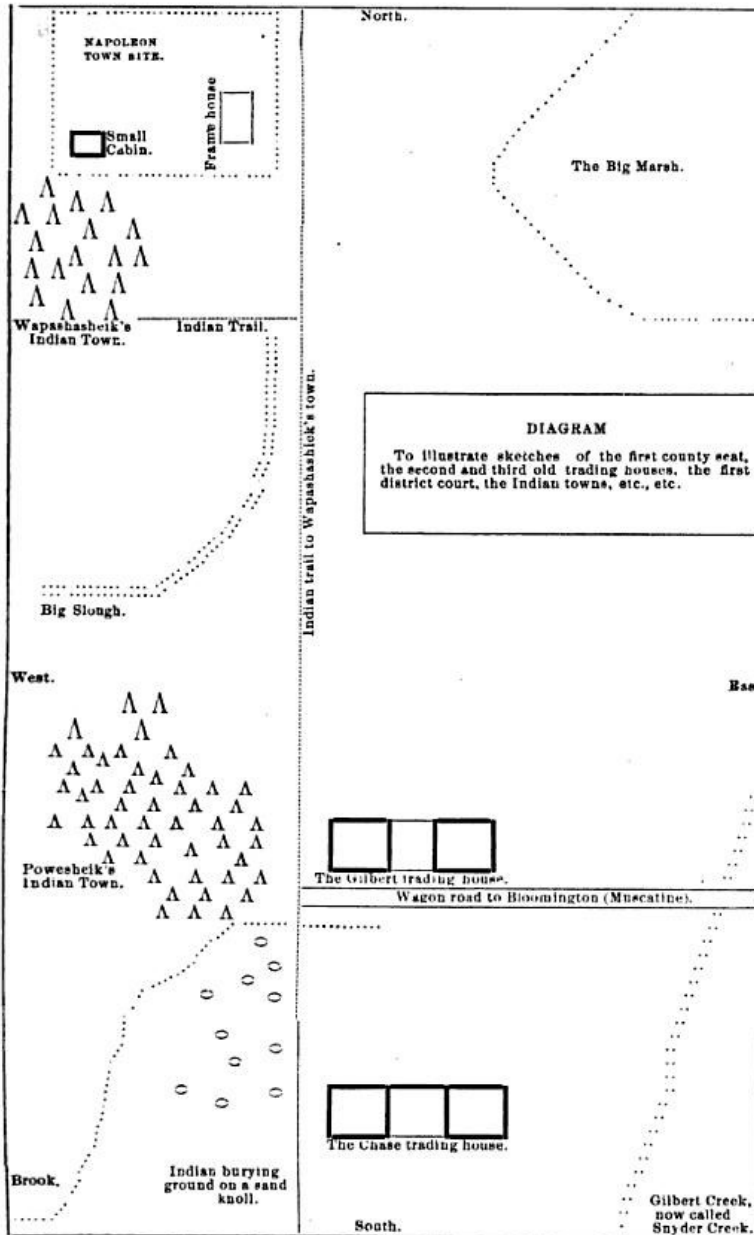

Figure 2 diagram from History of Johnson County, Iowa

Indian Removal
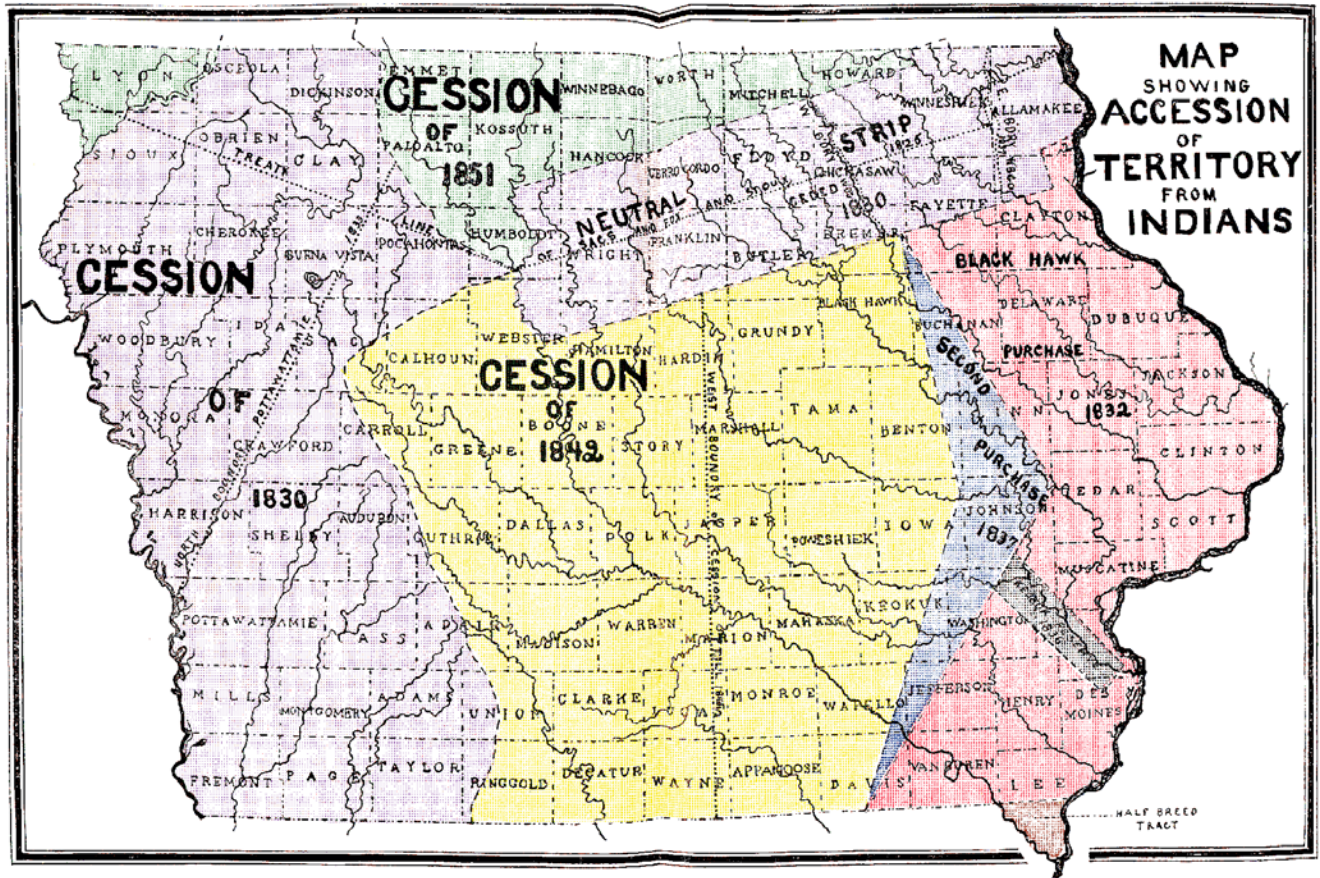
Figure 3 Map of Indian Territorial Accessions in Iowa[7]

The territory now known as Johnson County was taken, in part, after the conclusion of the Black Hawk War in 1832 as part of the Black Hawk Purchase. A second purchase in 1837 contained most of the remainder of the county, with a small southern section of the county had been purchased as part of the Keokuk Reserve in 1836.[8]

2.2.2 European/American Settlement

From the Margins of Empire until statehood 1673-1846:

The first documented European contact with the geographical area now known as the state of Iowa was in 1673, when French Jesuit missionaries Jacques Marquette and Louis Joliet recorded their travels to the area. Subsequently, the area was claimed by the French as part of greater Louisiana, or *La Louisiane française*, from 1682 until 1763. The French ceded control of the western portion of the territory to their Spanish allies in 1763 after their defeat in the French and Indian War fought against the British. Spain loosely controlled the territory until 1800 when Napoleon's France retook control under

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[7] Executive Council, Compiled by, *Census of Iowa*, Des Moines, IA: Bernard Murphy, State Printer, 1905
[8] History of Johnson County, Iowa, pp. 47-51

the terms of the Treaty of San Ildefonso. In 1803 the United States, under President Thomas Jefferson, purchased the Louisiana Territory from France. The purchase was subdivided into two territories, a southern Territory of Orleans and a northern District of Louisiana, which included present day Iowa, under the administrative control of the Territory of Indiana. In 1805 the northern district was renamed the Territory of Louisiana, and again renamed in 1812 as the Missouri Territory.

When Missouri became a state on Aug 10, 1821 the area became an unincorporated territory until June 28, 1834 when it was added to the Michigan Territory. Upon Michigan's becoming a state in 1837 the area, then known as the Iowa District, became the western portion of the Wisconsin territory. While the Iowa District was part of the Michigan and Wisconsin Territories, it was divided into a northern Dubuque County and a southern Demoine County. Present day Johnson County is situated in the former Dubuque County. On July 4, 1838 the US Congress approved the creation of the Iowa Territory encompassing an area that now includes all of present-day Iowa, most of western Minnesota, and the eastern halves of North and South Dakota. On Dec 28, 1846 Iowa was granted statehood as the 29th U.S. state.[9]

Johnson County, Napoleon, permanent American settlement 1837-1970:

On December 21, 1837 the territorial legislature of Wisconsin voted to create Johnson county, along with thirteen other counties, out of land formerly known as Dubuque County. The county is named for former Vice President Richard Mentor Johnson. Initially, the county had no independent government and was overseen by the sheriff of Cedar County, James W. Tallman. On June 22, 1838 the territorial legislature approved the designation of county seat to "the town of Napoleon," and the next day appointed Colonel Samuel C. Trowbridge the sheriff of Johnson County. The original Napoleon townsite and courthouse sat across from what is now TTWET on section 22 of Lucas Township, TTWET was on section 27 of the same township.[10] The courthouse was moved to Iowa City in 1842, when Iowa City became the new county seat, the town of Napoleon having been added to Iowa City during its establishment on November 9th, 1840.[11] On January 24, 1853 the City of Iowa City was officially incorporated.[12] TTWET is located near the original Napoleon town site, the first major Euro-American settlement in Johnson County, Iowa. Specifically, "The first settlement of a land claim in Johnson county was made in this township by Philip Clark, on section 27, being the farm now owned by James McCollister."[13]

[9] History of Johnson County, Iowa, Iowa City, Iowa, 1883. Reproduced by Unigraphic, Inc., Evansville, IN, 1973, pp. 17-30

[10] Ibid., pp. 163-172

[11] (1912) Charles Ray Aurner, *Leading Events in Johnson County, Iowa, History, Volume I,* reproduction by Torch Press, Cedar Rapids p 492.

[12] History of Iowa City, Iowa, p. 635

[13] Ibid., 728-9

2.3 Modern History of Terry Trueblood Recreation Area Site

Terry Trueblood Recreation Area has been open to the public since 2013. Prior to 1970, the site was used as farmland to grow soybeans, alfalfa, and corn. From the 1970s to 2005 it was a quarry. Sand and gravel from the quarry was sold for construction projects in the Iowa City area. Notably, the quarrying process at TTRA created Sand Lake. In 2006 City of Iowa City purchased the TTRA site and created the park as it is today. The park's name comes from a former City of Iowa City's Parks and Recreation Department Director, Terry Trueblood, who pioneered efforts for park development and raised support for the park's transformation and funding.

3 SITE CONDITIONS

3.1 *Topography and Flooding*

Terry Trueblood Wetland Exploration Trail is a low-lying area on the eastern bank of the Iowa River. As such, the elevation of TTWET is not substantially higher than the Iowa River. Figure 1 is an elevation map of TTWET with two-foot contour lines depicted. Elevations along the Iowa River range from 636ft to approximately 640ft. The average elevation of the adjacent stretch of the Iowa River is around 632ft. Therefore, it is apparent that the TTWET site is indeed not much higher than the river.

The elevation across the site does not vary tremendously although there is some notable variation on the eastern side of TTWET. Elevations range from 636ft to 650ft from one end of the site to the other. The highest portion of the site is on a ridge that runs north-south along the eastern edge of TTWET. The ridge is about 650ft high with a sharp drop to around 636-638ft. This area is useful to adventurous bikers who like to experience quick topography changes.

Generally speaking, the site drains from east to west. Water collects in a pond and wetland area located in the center of TTWET and water also drains to the river.
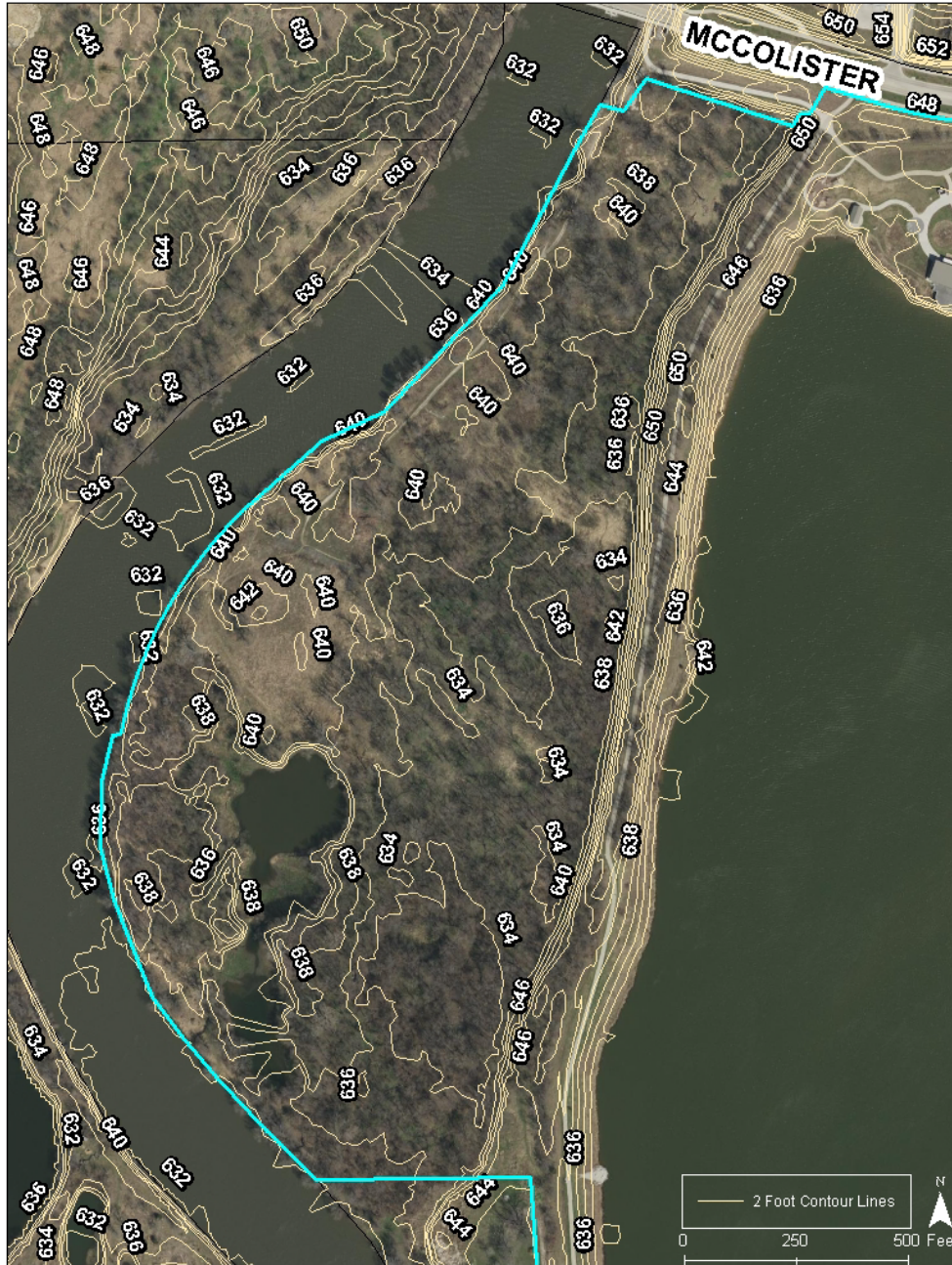
Figure 4 - Topography Map of TTWET

Given its location adjacent to the Iowa River, the TTWET is very susceptible to flooding. Any action taken on site needs to take the possibility of flooding into account. For example, permanent structures are not well suited for construction in TTWET at its base elevation and should therefore be avoided.

Figure 2, depicted below, is a map of the 100-year floodplain boundary for the Iowa River near Terry Trueblood Recreation Area. The 100-year floodplain depicts areas that have a 1% chance of flooding in any given year. As the map depicts, most of TTWET is

located within this area. The 500-year floodplain boundary was also examined but not mapped since it is minimally different than the 100-year floodplain boundary.

The north-south ridge between TTWET on its eastern edge and Sand Lake effectively serves as the floodplain boundary due to its elevation. The river elevations necessary to flood the 100-year floodplain area and 500-year floodplain areas are 29 feet and 32.5 feet respectively.

Figure 5 – 100-year floodplain elevation boundary at TTWET

In addition to looking at floodplain boundaries, it is worthwhile to examine flood elevations lower than the 100-year and 500-year floodplain elevations. Different models can chart the effects of various river elevations and corresponding inundation levels at the TTWET site. Based on information from the USGS National Water Information System and Iowa Flood Information System (IFIS), a river elevation of 22 feet will

inundate portions of TTWET. A river elevation of 26 feet will cover most of TTWET in standing water. Maps from IFIS depicting river elevations of 22 and 26 feet are below. It is worthwhile to note that river elevations are affected by water release upriver from the Coralville Reservoir. The regulation of water release during flood events is entirely within the purview of the Army Corps of Engineers and ensuring that TTWET and similar sites avoid inundation is not their top priority.

Figure 6 - Iowa Flood Information System - TTWET inundation levels at a river elevation of 22 feet
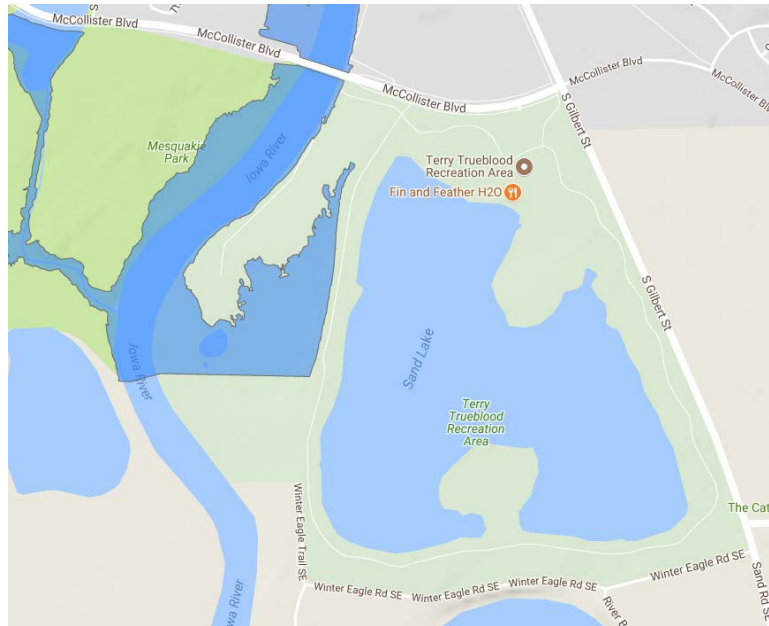
Figure 7 - Iowa Flood Information System - TTWET inundation levels at a river elevation of 26 feet
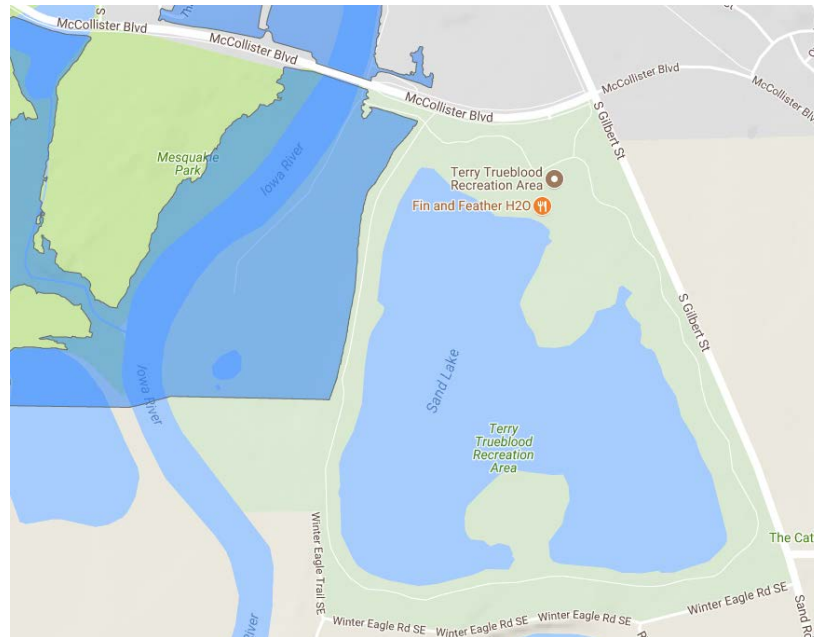
These maps show that portions of the TTWET will be covered in water at flood elevations that are much lower than the 100-year and 500-year floodplain elevations.

In order to develop a complete understanding of expected water conditions on site, historical water levels can be used to try to predict future inundation. Fluctuations in Iowa River water levels (from factors such as snow melt and rain in the spring) may flood the site at any given time. The National Weather Service monitors peak river elevations in the Iowa River. The list below gives the top ten recorded elevations from the Iowa River at Iowa City over the 170 years:

Historic Crests – Iowa River at Iowa City, IA
(1) 31.53 ft on 06/15/2008
(2) 28.52 ft on 08/10/1993
(3) 25.15 ft on 07/12/2014
(4) 24.90 ft on 06/05/2013
(5) 24.10 ft on 06/01/1851
(6) 23.35 ft on 06/13/1991
(7) 22.56 ft on 07/01/2014
(8) 22.44 ft on 06/09/1974
(9) 22.04 ft on 05/01/1973
(10) 21.64 ft on 03/29/1979

Four of the top seven highest water levels recorded on site have occurred within the last ten years. Each of these occurrences has covered most of the TTWET site since they have all been over 22 feet.

Another way of looking at the potential for flooding is to examine historical river discharge rates. Table 1 provides correlations between different river elevations and discharge rates:

River Elevation (ft)	Discharge Rates (cfs)	Condition of TTWET
22.0	13,800	TTWET partially covered in water
26.0	22,600	TTWET mostly covered in water
29.0	31,200	100-year floodplain
32.5	40,900	500-year floodplain

The United States Geological Survey (USGS) collects data of historical river discharge rates. Figure 5 below portrays daily discharge rates of the Iowa River in Iowa City over the last 20 years.
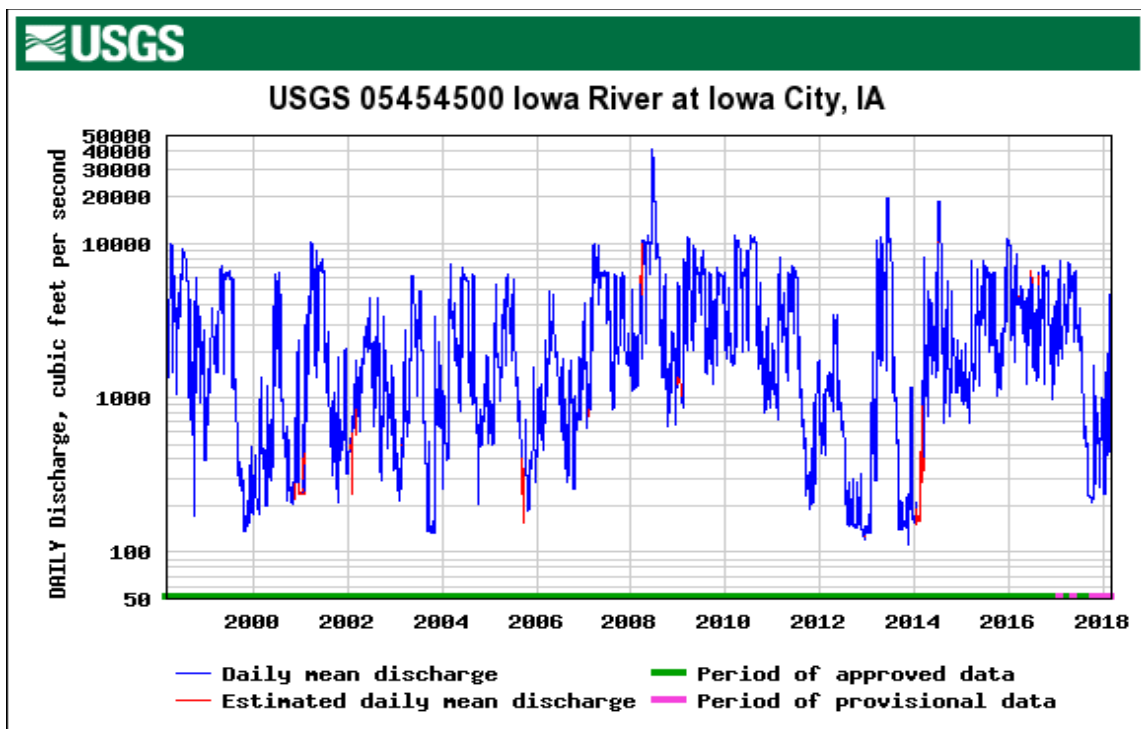

Figure 8 - Daily discharge rates, Iowa River at Iowa City (March 1998 - March 2018)

Given flooding data for the TTWET site, it can be expected that TTWET will be at least partially inundated in water for 0.5-3 months during each flood event. Flood events will likely occur once every 1-10 years. Therefore, site planning should consider the presence of periodic flooding.

3.2 *Weather and Climate*

There is a consensus in the scientific community that global climate change will have dramatic effects on Iowa's climate in the future. It is likely that Iowa will experience precipitation events contributing to more flooding, more frequent heat waves, and fewer cold snaps. (Source: Confronting Climate Change in the Midwest: Iowa) If global temperature and weather trends continue their current trajectory, parts of Iowa are expected to experience the following phenomena: extremely hot summers with more than 30 days over 100 degrees Fahrenheit, increased smog events that will decrease air quality and thereby negatively affect public health, and an increase in flash flooding events. The threat of increased flooding events is most concerning to the TTWET, as this site is located within the floodplain.

Figure 9 below contains monthly temperature averages in Iowa City from 1981-2010.

Month:	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average High (°F)	32	37	50	65	75	83	87	85	78	66	50	35
Average Low (°F)	14	18	29	40	51	61	65	63	54	42	31	18
Avg. rainfall (in.)	1.1	1.3	2.3	3.5	4.6	5.1	4.6	4.7	3.2	3.0	2.6	1.7
Avg. snowfall (in.)	8	6	3	1	0	0	0	0	0	0	1	9

Figure 9 Average Temperature and Rainfall

Figure 10 below demonstrates the probability of experiencing freezing temperatures on or after certain dates in the Spring and Fall seasons. The predicted data is based on temperature averages in Iowa City from 1971-2000.

Spring		Fall		Median Days in Growing Season
50%	**10%**	**50%**	**10%**	
April 14th	April 28th	October 13th	October 1st	182

Figure 10 Probability of Freezing Temperatures

At the rate by which the climate is getting hotter, we can expect summer temperatures to increase by 3 degrees on average in the upcoming years, and by 14 degrees by the end of the century.

3.3 *Wetlands*

The U.S. Fish & Wildlife Service (FWS) is the federal agency responsible for educating the public on the status and trends of the nation's wetlands. According to data provided by FWS, the TTWET is a site dominated by wetland conditions.

Figure 8 displays the distribution of U.S. Fish & Wildlife wetland classifications within the TTWET land area. The site is primarily identified as a Freshwater Forested Wetland, while smaller portions are classified as Freshwater Emergent Wetlands. Additionally, there is a 0.36-acre area centrally located within the TTWET that has been categorized as a Freshwater Pond. Ecological descriptions and water regimes for each of these three wetland classifications are provided in Figure 11.

Figure 11 – Wetlands classifications at TTWET

Wetland Classification	Ecological Description	Water Regime
Freshwater Forested Wetland	Nontidal wetland characterized by woody vegetation that is 6 meters or higher in height. In TTWET, this vegetation is dominated by broad-leaved deciduous trees that shed leaves during the cold season.	Seasonally flooded: Surface water is present for extended periods, especially early in the growing season.
Freshwater Emergent Wetland	Nontidal wetland characterized by erect, rooted, herbaceous hydrophytes (excluding mosses and lichens). This area is typically dominated by perennial plants. In some areas of TTWET, these areas have been anthropogenically modified to obstruct water flow.	Seasonally flooded: Surface water is present for extended periods especially early in the growing season.
Freshwater Pond	Nontidal wetland area lacking vegetation. Also characterized by being less than 20 acres in size, being no deeper than 2.5 meters, and lacking a wave-formed or bedrock shoreline.	Semi-permanently flooded: Surface water persists throughout the growing season in most years.

Figure 11 Wetland Classification

3.4 *Soils and Erosion*

The TTWET site contains primarily loamy soils with moderate to high organic content. As presented in Figure 9, the USDA's National Cooperative Soil Survey has identified three soil series present within TTWET. These soil series include Perks-Spillville Complex, Raddle, and Sparta. Roughly 90% of TTWET is characterized by the Perks-Spillville Complex soil series. Smaller parcels containing the Raddle soil series can be found in the northeast and southeast portions of the site, while the Sparta series covers just a small portion of TTWET's northeast corner. The characteristics and limitations for each of these soil series can be found in Figure 13.[14]

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[14] https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx
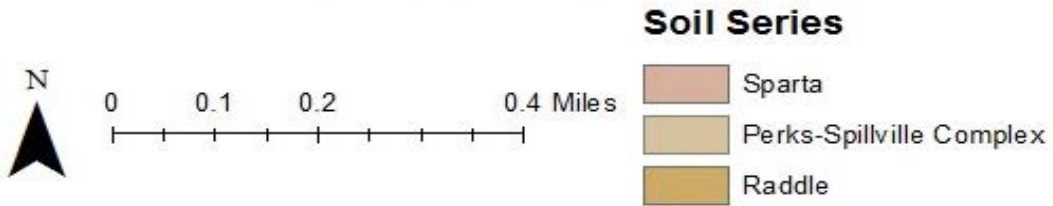
Figure 12 - Soil types at TTWET

Soil Series	Soil Type	Slope	pH	Drainage Class	Organic Content	Frost-Free Days/Year	Native Vegetation
Perks-Spillville	fine-grained loamy sand	~0-2%	6.5	Excessively drained	1%	~185	• Cottonwoods, elms, willows, and other hardwoods • Tall prairie grasses
Raddle	silt loam	~1-3%	6.5	Well drained	4%	~185	• Prairie grasses
Sparta	fine-grained loamy sand	~0-2%	5.9	Excessively drained	1.5%	~190	• Bluestem, switchgrass, and other tall prairie grasses • Widely spaced oak and hickory trees.

Figure 13 Table of Soil and Ecosystem Features

In addition to the features listed in Figure 13, each soil series has a unique erosion factor indicating the soil's susceptibility to erosion. These erosion factors are calculated with consideration for each soil's composition, molecular structure, and saturated hydraulic conductivity.[15] According to data provided by the U.S. Department of Agriculture (USDA), both Perks-Spillville and Sparta soils have an erosion factor of 0.24, while the Raddle series has an erosion factor of 0.32. These values indicate that all three soil series found within TTWET are moderately susceptible to erosion. However, because the soils found within TTWET contain relatively high levels of organic matter (thus influencing heightened infiltration), the overall risk of soil erosion in TTWET is low.

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[15] http://www.iwr.msu.edu/rusle/kfactor.htm

3.5 *Woodlands*

Although the areas of TTRA that are now Sand Lake and the surrounding trail system have a deep history of deliberate human management—from the McCollister farm of the early twentieth century to the quarry from the 1970s-2000s—TTWET has remained a patchwork of forested lowland with a small section of prairie.

Figure 14 below depicts the distribution of tree species in the TTWET site. The predominant tree species in the bottomland forest are, in descending order, silver maple (953), mulberry (911), American elm (634), northern hackberry (552), white mulberry (299), green ash (210), boxelder (187), honeylocust (161), and Siberian elm (72). Of the top ten species present, only the green ash has been listed by the Iowa State University Extension Office as a flood-tolerant species. Siberian elms are flood intolerant while the other species possess intermediate tolerance. The white mulberry and Siberian elm trees are invasive species of concern according to the City of Iowa City Natural Areas Inventory and Management Plan (NAIMP).

Although the green ash is flood-tolerant, it also has the potential to be affected by the Emerald Ash Borer. Figure 15 below shows the locations of ash trees throughout TTWET that may be cut down or die without replacement in the coming years. The American elm is likewise vulnerable to Dutch Elm Disease. Bush honeysuckle is also prevalent throughout much of the site; the species is listed as a major infestation in the NAIMP, with major ecological effect if left uncontrolled.[16] Reed canary grass and varieties of invasive brome are also prevalent throughout the site, as noted in the NAIMP. Additional invasive species include Japanese hop and garlic mustard.

The site has a small number of black cherry trees (22)—a species likely to thrive as climate changes—but its lack of tolerance to flooding may inhibit its ability to adapt fully at this site.

The smooth clustered sedge (*Carex aggregata*), a species of special concern in Iowa, has been observed at TTRA, but it is unclear to what degree the sedge is present at the TTWET site.[17]

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[16] City of Iowa City, "Natural Areas Inventory and Management Plan," January 2018, 48, https://www8.iowa-city.org/weblink/0/edoc/1781877/IA%20City%20NAI%20Final%20Report_reducedsize.pdf.

[17] City of Iowa City, "Natural Areas Inventory and Management Plan," January 2018, 54, https://www8.iowa-city.org/weblink/0/edoc/1781877/IA%20City%20NAI%20Final%20Report_reducedsize.pdf.
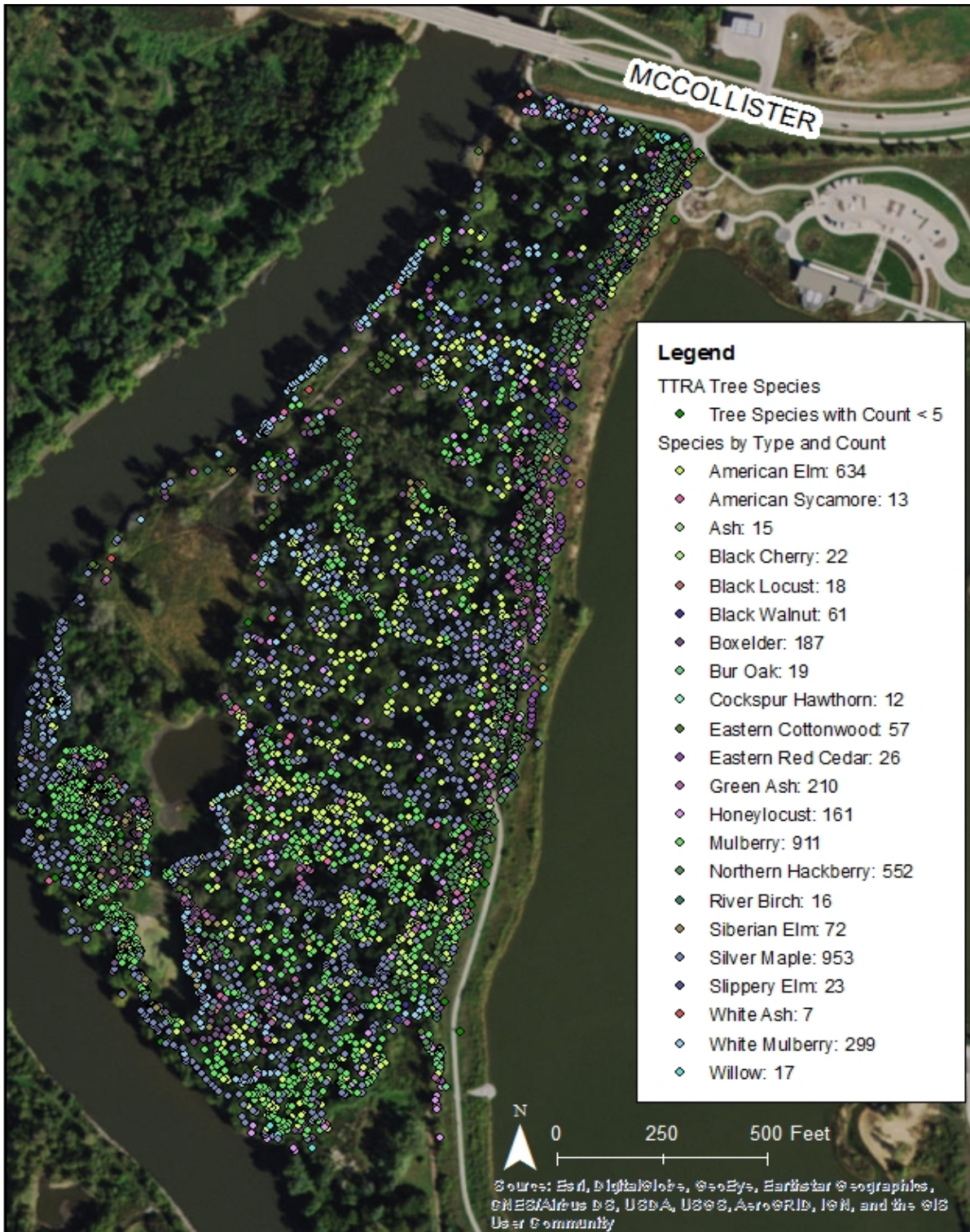
Figure 14 - Tree species at TTWET

Figure 15 - Ash trees at TTWET

3.6 *Animal Life*

The Terry Trueblood Wetland Exploration Trail is a popular location for local birders, including the Iowa City Bird Club. An eagle's nest across the river in Meskwaki Park is visible from a mountain bike trail near the Iowa River. The eastern meadowlark, identified as a species of greatest conservation need in the NAIMP, has been spotted in Terry Trueblood Recreation Area.[18]

It is uncertain whether deer populations heavily use the site, but they are sometimes spotted at the site, and their presence can be inferred by tracks commonly seen on and around the mountain bike trails. Due to the proximity of TTWET to farmland south of Iowa City, and its linkage to wooded areas southward along the Iowa River, it is possible the deer move in and out of the site.

The site also may serve as a potential habitat for the Indiana bat, an endangered species, but there is no indication that any Indiana bat species currently occupies TTWET.[19]

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[18] City of Iowa City, "Natural Areas Inventory and Management Plan," January 2018, 50, https://www8.iowa-city.org/weblink/0/edoc/1781877/IA%20City%20NAI%20Final%20Report_reducedsize.pdf.

[19] City of Iowa City, "Natural Areas Inventory and Management Plan," January 2018, 51, https://www8.iowa-city.org/weblink/0/edoc/1781877/IA%20City%20NAI%20Final%20Report_reducedsize.pdf.

3.7 *Land Cover and Invasive Species*

The Terry Trueblood Wetland Exploration Trail currently consists of several land covers as identified by the City of Iowa City's Natural Areas Inventory and Management Plan. The site is primarily covered by forested lowlands. A dry-mesic forest lies along the site's eastern edge, while a small southeastern portion of the site has been identified as an altered forest. A constructed wet prairie is centrally located within the site, as well as a herbaceous lowland surrounding two ponds. The spatial arrangement of these land covers is provided in Figure 16.
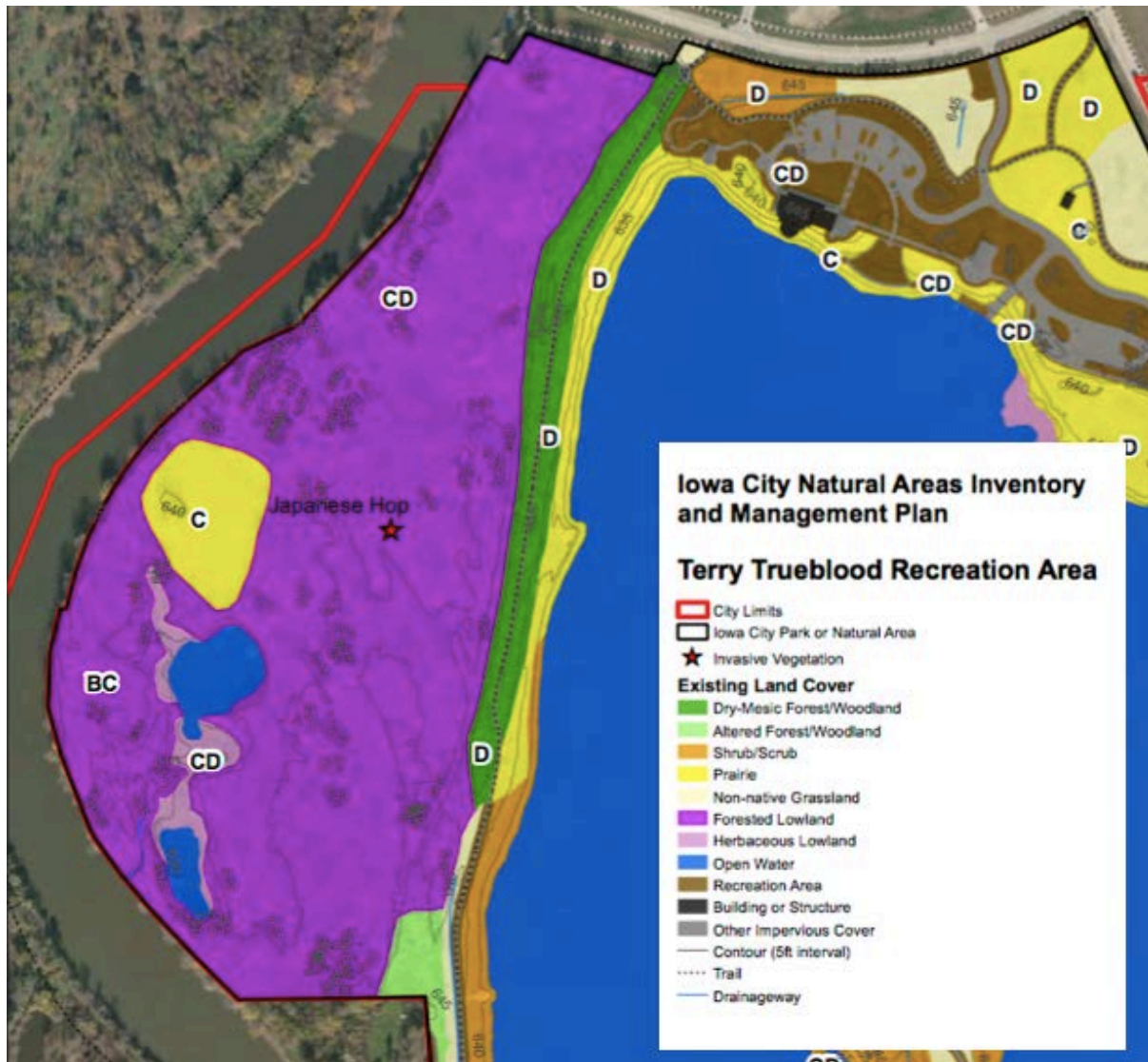
Figure 16 - Land coverage at TTWET

While the TTWET benefits from a variety of land covers providing a multitude of ecosystem services, the ecological integrity of the site is threatened by a concerning level of invasive vegetation. A comprehensive list of invasive species of concern can be found in Appendix 8.1.

3.8 *Trash and Detritus*

There is a significant amount of trash, concrete rubble, and metal waste at TTWET. This ranges from small and dispersed fragments of plastic, styrofoam, wood, and household items, to large and immobile concrete cubes (approximately 5' x 5'), at least two automobile chassis, and machinery scraps.

Photos : L. Laurian

4   SITE CONTEXT

Several local and regional plans have informed the writing of this adaptation plan. The State of Iowa's Outdoor Recreation in Iowa Plan offers a regional context. At the local level, the City of Iowa City's Comprehensive Plan and South District Plan, as well as the Parks Master Plan and Natural Areas Management Plan, provide a framework for long-term management of TTWET.

4.1 Urban Growth Context

The City of Iowa City is experiencing steady urban growth. Since 2010, city has witnessed an 8.5% increase in population, with the 2016 American Community Survey 5-year Estimates estimating a population of 72,385 residents.[20]

4.1.1 *Iowa City South District Plan*

TTWET is located within the Iowa City's South District, one of ten planning districts in Iowa City, and the one which boasts the city's first completed district plan. In 2015, the plan was updated to account for changes in the district such as expanded infrastructure and the addition of a new elementary school—both factors indicative of the relatively rapid growth the district has been experiencing. According to American Community Survey estimates, the two census blocks that contain the South District have seen a 12.75% increase in population from 2010-2016, while the population of Iowa City has seen only an 8.43% increase.[21] Growth in this area is likely to remain steady, as much of the undeveloped area east of TTRA is zoned for residential use, and the South District Plan Map indicates the city's intention of including higher-density multi-family uses directly east of TTRA, as shown in Figure 13. This plan also indicates that if the developable land in this district were to be "built out at an average of 2.3 dwelling units per acre ... another 3,900 households could be established within this portion of the community."[22] These expected changes offer an exciting opportunity for the city to position TTRA and TTWET as assets to the surrounding community and its expanding population.

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[20] Social Explorer Tables: ACS 2010 (5-Year Estimates)(SE), ACS 2016 (5-Year Estimates), Social Explorer; U.S. Census Bureau
[21] Ibid.
[22] City of Iowa City, *Iowa City South District Plan* (City 2015), 7.

South District Plan Map

- Low-Medium Density Single-Family Residential
- Low-Medium Density Mixed Residential
- Multi-family
- Commercial
- Mixed Use /Neighborhood commercial
- Mixed use Commercial
- School
- Public Park /Open Space
- Private Open Space / Sensitive Area
- Other Public Property
- ★ Historic Property
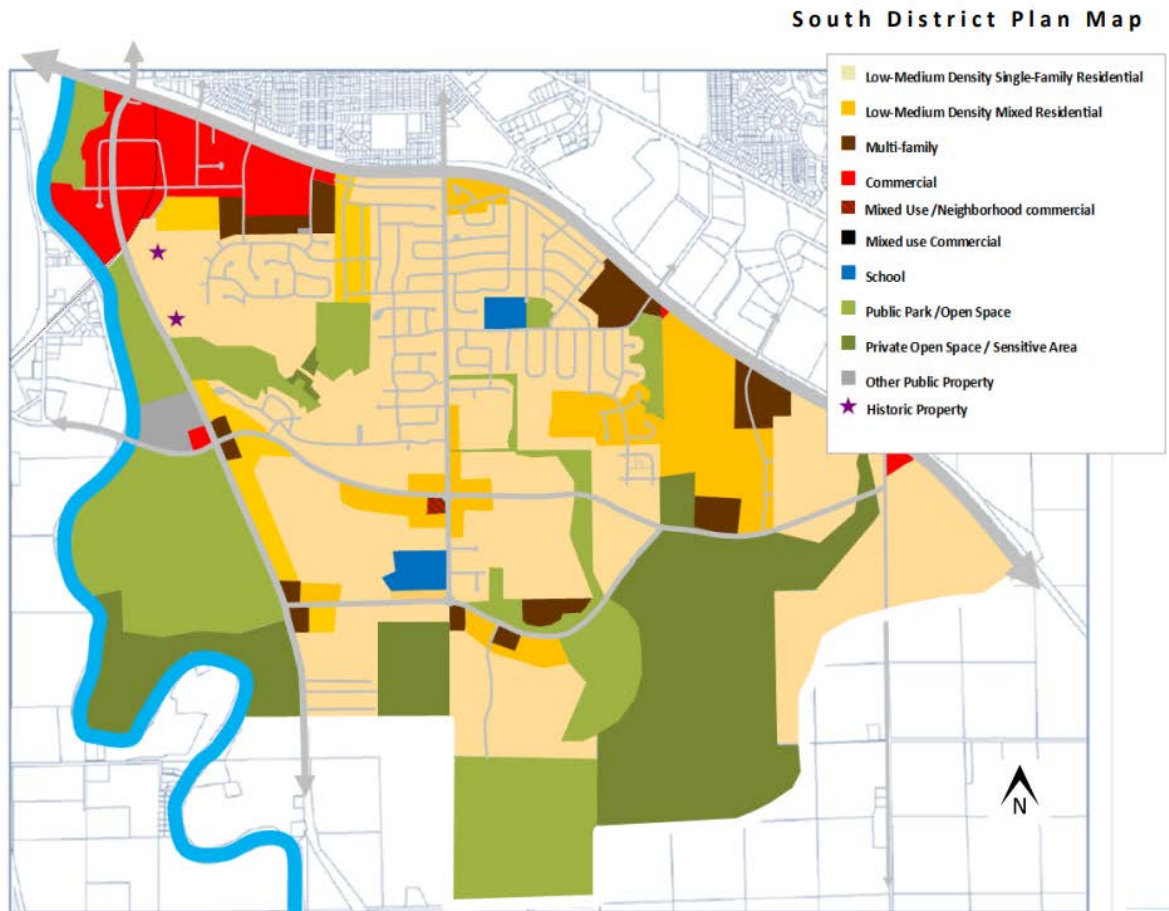
Figure 17 - Iowa City South District Map

This adaptation plan has been crafted to harmonize with plans already established by the City of Iowa City. On a broad scale, one community-wide goal is that "wherever possible, natural features, such as waterways and woodlands, should be incorporated as key amenities within parks and along trail systems."[23] This is essentially the foundational premise of this adaptation plan. The plan intends to recognize and promote resiliency for the natural resources already present in TTWET and to leverage these resources for the benefit of the local community.

The South District Plan's first listed goal under neighborhood quality is to "foster a strong and inclusive sense of community in South Iowa City neighborhoods,"[24] and one of the objectives under this goal is to "promote community stewardship and investment by engaging residents in improving their neighborhood."[25] Two specific actions under

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[23] City of Iowa City, *Iowa City South District Plan* (City 2015), 6.

[24] City of Iowa City, *Iowa City South District Plan* (City 2015), 24.

[25] City of Iowa City, *Iowa City South District Plan* (City 2015), 26.

this objective relevant to our goals are to "encourage annual volunteer events … [such as] park improvement events" and to "involve youth groups in … undertaking improvements and advocacy efforts … [such as] trail/park clean-ups, tree planting, [and] public art."[26] Establishing local community events such as these would provide an opportunity to simultaneously work in favor of promoting ecological regeneration, encourage additional users to experience the site, and educate these users about the site.

The South District Plan's parks, trails, and open space section also lists goals and objectives that are echoed in this plan. The first listed goal of this section is to "create broad community awareness of South Iowa City's extensive park and trail system and its unique environmental areas."[27] Developing a brand for this site that both conveys its unique natural features and encourages exploration and immersion will serve to create community awareness and increased interaction.

4.2 Parks and Recreation Context

4.2.1 *Iowa City Parks Master Plan*

The Iowa City Parks Master Plan classifies each park by scale and by character. TTRA is one of eight Iowa City parks classified as a Regional park, meaning it has a service radius up to 60 miles and "attracts visitors from outside the community due to [its] large size, unique offerings, and/or high quality."[28] In terms of character, TTRA's primary classification is "Go Wild" and its secondary classification is "Connect".

The primary Go Wild designation is for parks the character of which is firmly rooted in the preservation of nature and users' connection and immersion with the natural environment. Goals #1 and #2 of this plan are directly in line with this classification. They should serve to supplement and leverage the existing natural resources already present in the TTWET site and further qualify this area as a place for users to connect with the natural environment.

The secondary Connect designation, for parks with facilities or programming that support social interactions, is due mostly to the Park Lodge event space overlooking the lake—not due to any infrastructure currently present in TTWET. The promotion of various family-friendly activities in TTWET to appeal to a variety of new users year-round, as suggested under Goal #2 of this plan, would add to TTRA's usage as a Connect park.

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[26] City of Iowa City, *Iowa City South District Plan* (City 2015), 26.

[27] City of Iowa City, *Iowa City South District Plan* (City 2015), 34.

[28] City of Iowa City, *Gather Here: Iowa City Parks Master Plan* (City, 2017), 20.

There is also a "Reserve" park classification, intended to "be applied to sites/sub-areas within a park."[29] Depending on the City's intentions with the Reserve classification, the TTWET area could benefit from being branded as a natural Reserve site by the additional emphasis on the area's natural amenities and by integration with similar areas in Iowa City.

4.2.2 *State Conservation and Outdoor Recreation Plan*

This adaptation plan fits within the priorities outlined in Iowa's State Conservation and Outdoor Recreation Plan (SCORP). For example, the State wishes to prioritize natural resource conservation while offering diverse opportunities for recreation that connect Iowans to nature. A few relevant goals detailed in the SCORP are to improve the connectivity of natural habitats, enhance recreational use of water bodies, and offer a variety of recreational opportunities that meet Iowans' wants and needs.[30] These goals correspond directly to the intentions of this adaptation plan to bring visitors closer to nature—and specifically to the Iowa River—while identifying best practices for resource conservation.

4.2.3 *Intended recreational uses/plans for the site (city and state)*

There is a desire to bring Iowa City residents and visitors closer to nature, and to the Iowa River in particular. Consequently, there may be plans to install a ramp to TTWET to connect it for kayaking and canoeing from downtown Iowa City.

To maintain relations with cyclists in the community, we recommend expanding the current cycling track. We spoke with several cyclists in the community who would prefer a longer track with a couple of tactical elements. We recommend the entrance to the cycling track start at the northeast corner of the site, where most cyclists are already entering the site. The track should then flow immediately south and continue until its end at the northwest corner of the site near the bridge. Additionally, one or two of the concrete blocks that are already located within our site should be added along the track to create an exciting option for the cyclists willing to battle the obstacle. Signs should be posted as needed along the trail with directional arrows and bicycle iconography to assist users.

We have also recommended the addition of a pedestrian trail at the site. From the site plan you can see that the pedestrian trail begins in the northeast corner of the site where the bike trail begins, and then heads directly west. Pedestrians also have the option to enter the site from the southeast corner of the site off the paved trail. No directional

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[29] City of Iowa City, "Gather Here: Iowa City Parks Master Plan (City 2017)," September 19, 2017, Page 21

[30] Iowa Department of Natural Resources. "Recreation in Iowa Plan." 2006. Accessed April 2018.

arrows will be necessary for the pedestrian trail as pedestrians can take the trail in either direction.

As one of the main purposes of this site plan is to encourage public exploration of natural areas, we recommend maintaining the current viewsheds that exist at that site. From the paved trail that is already present, looking westward toward the river, visitors can see a variety of existing flora that invites them into the park. It is important to provide the public with natural ecosystem viewsheds that visually "separates" them from nature and the built environment. It is our recommendation to allow several natural viewsheds at TTWET. This would require planting new plants and trees intentionally as to create or maintain viewsheds, as well as considering the overall visual effect when cutting down older, vulnerable vegetation.

4.2.4 *Current recreational uses of the site*

There are several groups who highly value Terry Trueblood Wetland Exploration Trails for its ecological diversity and intimate closeness with nature. The site is currently utilized by a myriad of nature enthusiasts for these reasons. Frequent visitors to the site include birders, anglers, hikers, off-road bicyclists, and many others. Iowa City Off-Road Riders, known as ICORR, is one group that frequents the site and has established a dirt trail for biking. The site's connection to the Iowa River Trail is important as it draws new users to the site and maintains an easy access point for visitors travelling on foot or bike.

4.3 Relationship to Iowa River and other key sites in vicinity

TTWET lies along the Iowa River on the southern boundary of the Iowa City limits. The Iowa River runs for approximately 300 miles in a southeastern direction across the state before draining into the Mississippi River near Oakville. Iowa City is located approximately 65 miles upstream from the river's mouth at the Mississippi. The river is dammed twice on the north side of Iowa City, forming the Coralville Reservoir, and again at Burlington Street near downtown Iowa City.[31]

There are several disjointed pathways either planned or already in existence along the Iowa River. For instance, the paved Iowa River Trail on the river's northern end will run 34 miles through Hardin and Marshall Counties once complete. On the water, the Iowa River Water Trail offers paddlers a 72-mile long route from Sturgis Ferry Park in Iowa City past the Terry Trueblood Recreation Area all the way to the Ferry Landing where the Iowa River meets the Mississippi River near Oakville.[32] In Iowa City, the Iowa River Corridor Trail is a paved trail connecting Terry Trueblood Recreation Area to Terrell

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[31] Iowa Department of Natural Resources. "Total Maximum Daily Loads for Pathogen Indicators Iowa River." 2007.
[32] Louisa County Conservation. "Iowa River Water Trail." Accessed April 2018.
https://www.louisacountyconservation.org/index.php?option=com_content&view=article&id=118&Itemid=563

Mill Park on the north side of City Park.[33] This trail connection presents an opportunity to consider means of supporting an ecological corridor along the river.

Beyond trail connections in the city, there are several other natural areas in the vicinity with which the site could be linked. Iowa City's draft Natural Areas Management Plan suggests there is opportunity for a regional connection from the Terry Trueblood Recreation Area to nearby parks and greenspaces including Sand Prairie, Weatherby Park, the Makada Wetland, Sycamore Greenway, and Ryerson Woods.[34] In addition, the site is located directly across the Iowa River from Mesquakie Park. This park provides several viewsheds from the TTWET site that are indicative of the pre-settlement environment along the Iowa River. When Mesquakie Park is redeveloped we recommend taking the viewsheds from both sides of the river into planning considerations. One long-term goal would be to create a bi-directional viewshed that would give visitors an impression of what a pristine pre-settlement riverine ecosystem would look like. This viewshed could be enjoyed from either park, and from the McCollister Road bridge. Below is a map, Figure 18, showing TTWET in relation to other sites along the Iowa River and in Iowa City.

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[33] Iowa Natural Heritage Foundation. "Iowa by Trail." Accessed April 2018. http://www.iowabytrail.com/find-a-trail/118/iowa-river-corridor-trail/

[34] City of Iowa City, "Natural Areas Inventory and Management Plan," January 2018, 374, https://www8.iowa-city.org/weblink/0/edoc/1781877/IA%20City%20NAI%20Final%20Report_reducedsize.pdf.
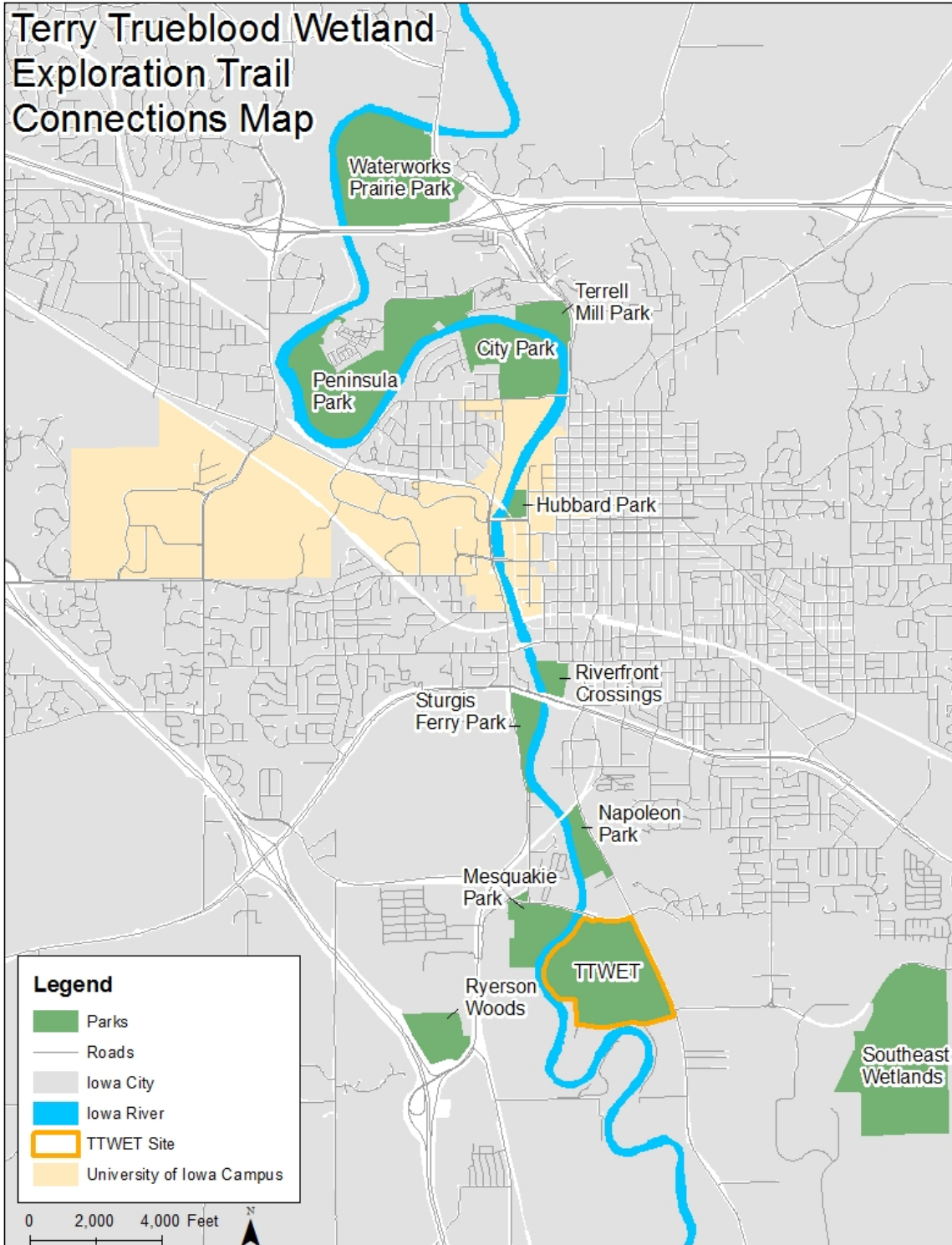
Figure 18 – TTWET and surrounding sites in Iowa City

5 PROJECT GOALS

After visiting the site, conducting research, and discussing the project, our group has identified three goals to be completed in the upcoming years. We have also developed a series of objectives to achieve these goals. An overarching theme of this project, and our first goal, is to promote and enforce adaptive and resilient regenerative practices so the TTWET site can thrive in the midst of climatic and ecological change. Our second goal is to encourage individuals, families, and groups to explore this area in as many ways as possible. In addition to attracting users, our second goal intends to inform users of the historical, ecological, and cultural characteristics of the site. Finally, we hope to provide an adaptation plan process and a set of generalizable adaptation principles useful to sites along the Iowa River or sites with similar characteristics.

goal #1 | *promote resilience, adaptation, and ecological regeneration within TTWET and its surroundings*

Objectives:

1. Work towards long-term ecological integrity
   i. Plant species that are well suited for prolonged exposure to flooding and future climate change and provide habitat
   ii. Remove species that are not well-suited (now or in the near future) or that, as invasive species, pose a risk to the wider ecology of the site
2. Attract and retain local and migratory wildlife
3. Use flood-resilient materials and locations for the construction of amenities and signage
4. Clean up garbage and other detritus throughout the site
5. Establish a system for ecological monitoring

Goal number one reinforces the City of Iowa City's commitment to stewardship of public land. The TTWET site is unique within Iowa City and contains natural assets worth protecting. Retaining its ecological integrity will be beneficial in improving the City's STAR rating and fulfilling the City Council's strategic plan priority to "promote environmental sustainability." A thriving, robust environment will also serve as a draw for site-users.

goal #2 | *facilitate increased human interaction with and understanding of the natural area*

Objectives:

1. Create varied and compatible opportunities for all current and planned site use appealing to all ages and families year-round
2. Educate visitors and the public about natural, historical, and cultural uses of the site and region by utilizing natural, built (including signage), and digital environments
3. Preserve natural viewsheds
4. Involve local residents and park users in decision-making regarding park use and monitoring
   a. Institute comprehensive use and citizen science monitoring
   b. Form a group of volunteers that regularly holds events/meetings at/about TTWET

The City of Iowa City desires to offer more opportunities for residents and visitors to experience nature and interact with the Iowa river. Given extensive university and private land ownership, there is limited access to the Iowa River in Iowa City. TTWET offers a prime location for humans to interact with the natural environment. Due to the site's seclusion, users can immerse themselves in a natural landscape without leaving the city limits. Although residents are already free to explore this space, a lack of awareness and poor access to the area keeps most people away. Inviting current Terry Trueblood users and local residents to explore a variety of recreational endeavors in this area will encourage more individuals to take advantage of the site's great potential.

TTWET is the center of a tremendous amount of local history, and the general vicinity surrounding the site was once home to indigenous populations and subsequent European settlements. This presents an exciting opportunity to inform users about a piece of local history they otherwise would be unlikely to discover. The preservation of natural viewsheds will become an increasingly important practice as the expanding built environment continues to erase remaining portions of untouched nature. As native habitats continue to grow sparser across the state and region, it is increasingly important to take advantage of what remains to educate residents and visitors alike about Iowa's natural landscape.

goal #3

create an adaptation plan and planning process template with generalized strategies and best management practices for other sites along the Iowa River

Objectives:

1. Recommend transferable plan development methods
2. Recommend transferable principles for managing heavily modified ecosystems in frequently flooding areas
3. Recommend transferable steps for informing the public about ecological, historical, and cultural processes in adaptation-oriented management plans

Given the current void of adaptation plans in the state, it is important to consider how this plan's recommendations can be transferred to similar locations. The process used to create this plan is unique but can be replicated for other areas with relative ease. The recommendations that are produced in this plan will be especially applicable to other frequently flooded sites on the Iowa River and elsewhere. For example, City Park, Peninsula Park, and Mesquakie Park are well-suited candidates for adaptation planning in Iowa City. These places and others exhibiting similar characteristics beyond TTWET should be examined for adaptation plan application. Lastly, the plan's approach to education should be used for other sites in Iowa City and beyond. The adaptation-oriented model of planning used herein deserves consideration and use for a range of other location across the region, state, and country.

6 PLANNING APPROACHES & BEST MANAGEMENT PRACTICES (BMPs)

6.1 Invasive Species Management

In order for the Terry Trueblood Wetland Exploration Trail to perform at an ecologically optimal level, it is essential that the invasive vegetation occupying the site be managed effectively. In the site's canopy, there are only two identified invasive species of concern – the Mulberry and the Siberian Elm. While the Mulberry trees are indeed an invasive, their eradication from the site is not feasible as there are over one thousand Mulberry trees located within the TTWET. Instead, because these trees offer an abundance of ecosystem services and are well adapted to the site, it is suggested that the Mulberry trees stay and be carefully managed as to prevent further invasion.

In the understory of the TTWET, there are 28 identified invasive species outcompeting native herbaceous communities. It is advised that an integrated approach of prescribed burns, mowing, and manual removal be taken to address these species, as each invasive has a unique and sometimes negative response to the various management tactics. The optimal management strategy for each of the 30 invasive species of the TTWET can be found in appendix 8.2.

6.2 Proposed Ecosystems

The removal of invasive species from the TTWET will present an opportunity for the reintroduction of native plant communities. These communities in turn will have the potential to stabilize and enforce the various land covers of the TTWET into healthy, resilient ecosystems. Based on the current and projected environmental conditions of the site, this plan proposes the establishment of five distinct ecosystems: a dry-mesic bottomland forest, a mesic bottomland forest, a wet-mesic tallgrass prairie, a palustrine forested wetland, and a palustrine emergent wetland. These proposed ecosystems, presented in Figure 19, are to be spatially arranged as to create a natural transition from drier upland sites to wet lowland sites along the river. Potential native species to introduce for each ecosystem are provided in the table below, Figure 20. These species were chosen with consideration of the hydrology of the site as well as their ability to attract ecosystem-specific wildlife.
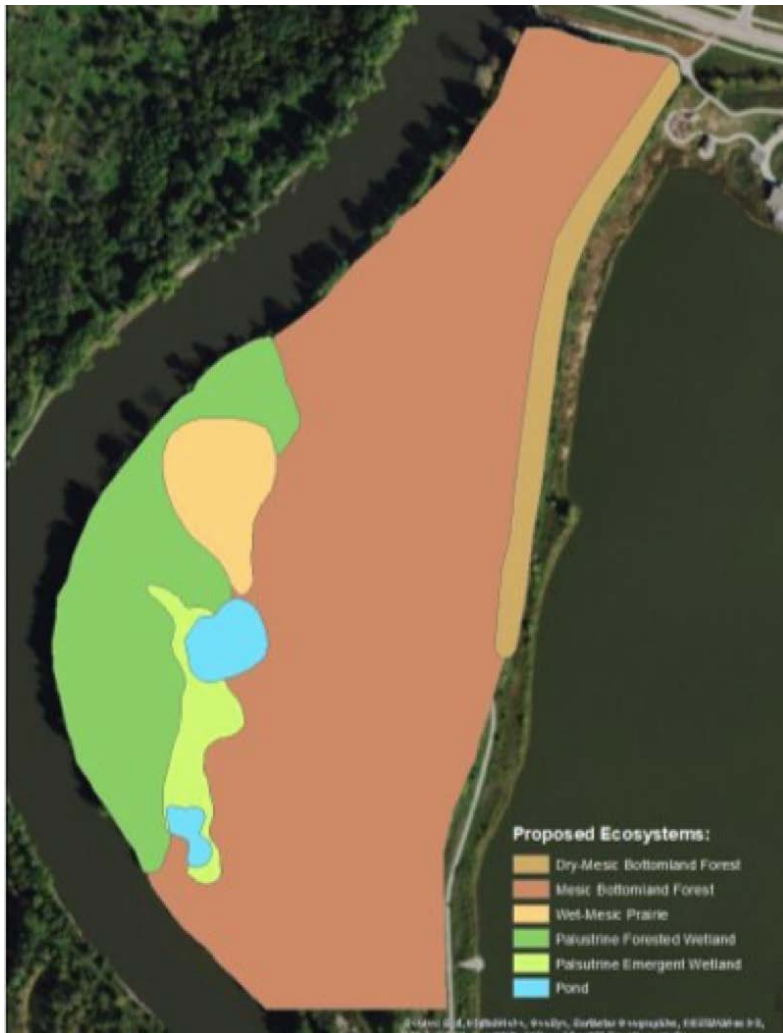
Figure 19 - Proposed Ecosystems at TTWET

Dry-Mesic Bottomland Forest	Bur Oak, Pin Oak, Trumpet Creeper, Spreading Oval Sedge, Jewelweed, Honewort
Mesic Bottomland Forest	Red Oak, Sugar Maple, Black Cherry, Dutchman's Breeches, White Dogtooth Violet, Bluntlobe Cliff Fern
Wet-Mesic Tallgrass Prairie	Purple Meadow Rue, Bottle Gentian, Bristly Sedge, Eastern/Western Prairie Fringed Orchid
Palustrine Forested Wetland	Pawpaw, Black Willow, Fox Sedge, Canada Wild Ginger, Chicory, Manna Grass
Palustrine Emergent Wetland	Swamp Milkweed, Blue Flag Iris, Virginia Wild Rye, Slender Mountain Mint, Smooth Clustered Sedge

Figure 20 Table of Proposed Species for Introduction

The clearance of invasive species from the TTWET will additionally present an opportunity for the introduction two unique ecosystem features – a Pawpaw and Cypress grove.

6.3 Walking and Biking Trail

The existing bike trail at TTWET, shown in Figure 21 below, was created by local mountain biking enthusiasts originally for fat biking only. A fat bike is an off-road bicycle with wide, oversized tires that provide extra grip and cushioning when riding over soft or unstable terrain, such as marshes or snow-covered ground. According to a local representative of the Iowa Coalition of Off-Road Riders (ICORR), this trail was christened in January 2013 during the first-annual fat bike endurance race which has recently boasted its fifth consecutive race as of the writing of this plan. As this trail has grown in popularity over the intervening years, it has started to see more year-round use which has in turn caused the trails to become more well defined. This trail is not officially sanctioned by the City of Iowa City and does not appears on the City's Trail Map. Officially endorsing this already existing off-road bike trail, of which there is no equivalent within Iowa City, is an excellent opportunity to promote a healthy activity for residents and further increase public awareness of TTWET without the need for significant infrastructure additions.

Figure 21 - Existing bike trail at TTWET

Consulting with members of ICORR who use the site regularly has brought to light a few pertinent factors concerning this trail. Since neighboring municipalities such as Coralville and North Liberty have made new off-road bike trail investments, ICORR members believe this site will gradually see less use as the infrastructure develops in nearby areas. Given this factor, as well as the physical size constraints at TTWET, this biking trail will likely never become a destination trail for mountain bikers. Instead, it is likely to be more of a draw for mountain bikers who live nearby and are looking for a short, casual workout. Because of this, significant infrastructure changes to the trail would be unwise.

With the addition of a pedestrian trail alongside the riverfront on the western boundary of TTWET, adjustments will need to be made to the existing bike trail to ensure harmony among all users of the site. ICORR members who use the trail frequently believe that along the stretch where the biking and pedestrian trails would coincide there is enough room to accommodate both uses without having to adjust the existing bike trail route. By mowing a wider path around the current bike trail, pedestrians would be able to step to one side or the other as bikers approach. Installing signage with reminders to all trail users to be courteous to other users and for bikers to yield to pedestrians should promote an environment of coexistence and safety among walkers and bikers. See Section 6.7.3 for additional information on trail signage.

Other proposed changes to the trail, as mentioned by local stakeholders in the mountain biking community, are increased visual interest along the trail and additional help with trail maintenance during the summer months. Utilizing some of the larger debris present in TTWET, added visual interest could be attained through their integration along the trail with the potential for local artists or volunteers to enhance these objects further with graffiti art.

The most important need identified by ICORR members contacted for this plan was for additional assistance in maintaining the trails during the spring and summer, specifically landscaping/trimming plant growth. This is an obvious opportunity to involve neighborhood volunteer organizations or local residents in a regular TTWET Trail Clean Up event, further providing a chance to draw in more users and help spread the word of this site's existence. The ICORR members also mentioned the possibility of adding a small shed somewhere on site to store their lawncare equipment, as they are currently constrained by the necessity of transporting the necessary equipment to and from the site. If financially feasible, this is an opportunity for a gesture of goodwill from the City and would further legitimize the presence of these current TTWET users.

6.4 Edible Landscaping

In keeping with Iowa City's interest in embracing edible landscaping, the TTWET site is an ideal candidate to introduce this practice in a new ecosystem. Through a partnership with local nonprofit Backyard Abundance, the City has been working to educate the public about edible landscaping through a variety of sites, such as Wetherby Edible Forest and the Children's Discovery Garden outside Robert A. Lee Recreation Center. It

is advisable the City maintain this partnership with Backyard Abundance for continued guidance in establishing and maintaining this latest site. In the interest of containing such landscaping within the TTWET site and promoting only plants that are readily edible, the Table below, Figure 22, provides suggestions of plant species to begin fostering an edible ecosystem on site. In keeping with the hydrophilic theme at TTWET, all of these species prefer either moist or wet soil and will be suitable around the pond and wetland area near the north end of the site.

Common Name	Species Name	Use
Black Berried Aronia	Aronia melanocarpa	Edible fruit
Brookweed	Samolus valerandi	Edible leaves
Bunchberry dogwood	Cornus canadensis	Edible fruit
Duck Potato/Broadleaf Arrowhead	Sagittaria latifolia	Edible root and tubers
Iowa golden saxifrage	Chrysosplenium alternifolium	Edible leaves
Pawpaw	Asimina triloba	Edible fruit
Pickerel Weed	Pontederia cordata	Whole plant is edible
Red Mulberry	Morus rubra	Edible fruit and leaves
Spearmint	Mentha spicata	Edible leaves
Wapato/arumleaf arrowhead	Sagittaria cuneata	Edible root and tubers
Water Mat	Chrysosplenium americanum	Edible leaves used as a spice in salads
Watercress	Nasturtium officinale	Edible leaves; seeds can be a mustard substitute

Figure 22 Edible Plants

6.5 Concrete and Debris

Given the preponderance of debris scattered throughout the site, some clean-up efforts will be required to make the site both safe and aesthetically appealing. Volunteer crews can be dispersed to remove some of the smaller debris on-site. Other debris items are large or in difficult locations for removal and require machinery for removal from the site.

Our recommendation is for all the litter and metal detritus to be cleared from the site. This will encourage higher use of TTWET because families will feel more comfortable taking children on walks or hikes and exploring the site. It will also improve the aesthetic charm of our site and make it a place that people want to spend time in.

Although some off-road bikers have recommended leaving the automobile chassis near the bike path for visual interest along the trail, the graffiti on them detracts from their aesthetic value and the rusted metal remnants may be a safety liability.

As displayed on the site map, there are four large concrete blocks. The cycling community, specifically the Iowa Coalition of Off-Road Bikers, has expressed interest in integrating the concrete blocks into the off-road biking track. The addition of concrete blocks to the track would give the bikers a tactical piece and make the track more interesting. Alternatively, the addition of safety measures (such as sealing the open sides of the cubes and providing additional steps to mitigate the height differential) on the blocks could render them useful as a small climbing and exploration area for visitors.

Secondly, we recommend the concrete blocks be used as surfaces for public murals, which would be sealed with anti-graffiti coating. Since the blocks are already covered in graffiti, this will add to the visual appeal and family-friendliness of the site. It will also foster community engagement and encourage more use of TTWET. Given the high incidence of flooding at the site, the murals may have to be repainted annually. Rather than acting as a drawback of this public art initiative, the need to repaint the murals can serve as a community-building asset as a variety of local artists get the chance to display their work from year to year. Artists may be encouraged to make their work relevant to the natural or cultural history of the site, thereby providing another means of educating park users.

Art currently at the site. Photo: L. Laurian

6.6 Viewshed Retention

The distance of TTWET from any existing built environment provides an opportunity to highlight the many natural viewsheds present throughout the site. Although they do not provide any ecosystem services, these viewsheds are an aesthetic asset of the site that can add to an immersive experience for park users. In some cases, viewsheds may be highlighted by signage that will either invite users to explore the park further or provide education on the natural history of the site (see section 6.8). In addition, the site is located directly across the Iowa River from Mesquakie Park. This park provides several viewsheds from the TTWET site that are indicative of the pre-settlement environment along the Iowa River. When Mesquakie Park is also redeveloped we recommend taking the viewsheds from both sides of the river into planning considerations. One long-term goal would be to create a bi-directional viewshed that would give visitors an impression of what a pristine pre-settlement riverine ecosystem would look like. This viewshed could be enjoyed from either park, and from the McCollister Road bridge.

6.7 Signage

Signage is a vital aspect of this adaptation plan, as quality interpretive signage can effectively facilitate increased human interaction with and understanding of the natural, historical, and cultural aspects of the site. Along with simple wayfinding and pedestrian/bike trail delineation signage, we are proposing seven distinct signs in seven distinct locations, with the contents of each being deliberately chosen to create an engaging narrative for site users as they progress along the trail. The proposed interpretive signage, or wayside exhibits, will not only educate users about features of the site but serve as features themselves, creating learning opportunities for visitors of all ages. According to the National Park Service, "four key factors lead to successful wayside exhibits: a significant landscape feature with a well-documented story; at least one compelling, site-specific, reproducible-quality graphic that illuminates the story; a safe, accessible place for visitors; and routine maintenance of the site and the sign."[35] These key factors are necessary in ensuring each exhibit is engaging as a standalone feature and as part of a cohesive whole.

Figure 23 below displays the proposed locations for seven interpretive signs, or wayside exhibits. The numbers correlate with the following signs:

1. Cultural history
2. Flooding and climate change adaptation
3. Flora
4. Birds
5. Mammals
6. Ecosystems

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[35] National Park Service. *Wayside Exhibits: A Guide to Developing Outdoor Interpretive Exhibits*. (Harpers Ferry: Center for Media Services, 2009), 7.
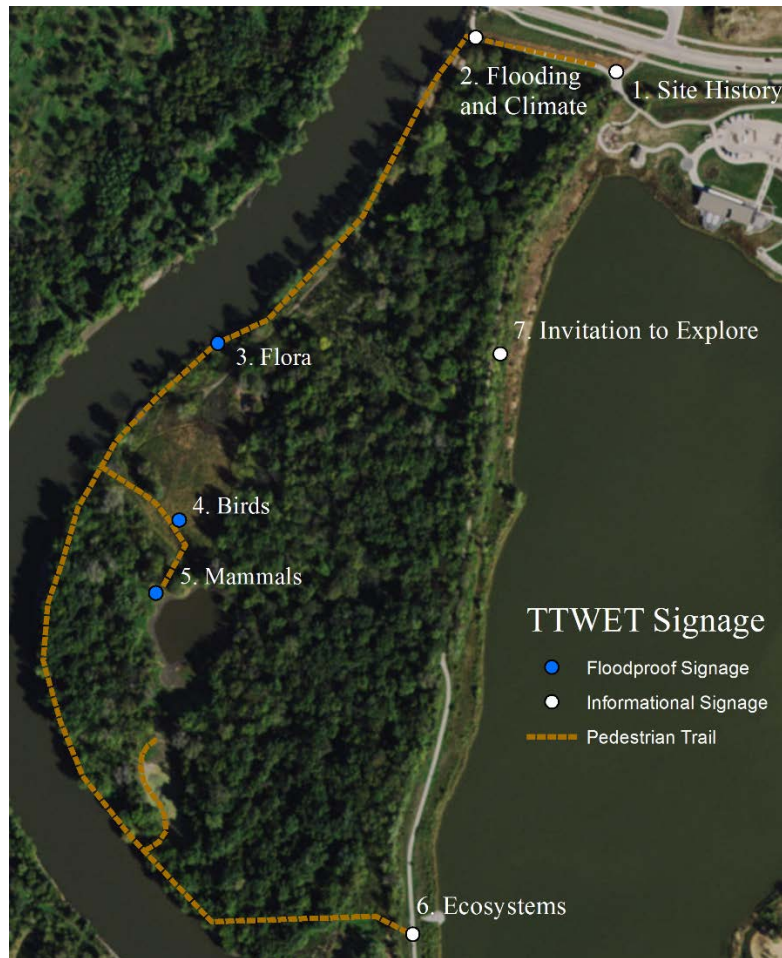
7. Invitation to explore

Figure 23 - Proposed signs at TTWET

6.7.1 Content

Cultural History

This sign, along with signs 6 and 7, is in a highly visible location and should therefore contain particularly compelling content as to pique the interest of passing trail users and entice them to explore the rest of TTWET. The site and surrounding area have a relatively robust anthropogenic history as discussed earlier in this plan, from the Native Americans that once called the area home to the early European settlers of present day Iowa City. These narratives provide the foundation for the creation of an interpretive panel regarding site history. When telling the history of the Native American settlements, it will be important to contact the groups themselves in order to accurately and faithfully represent the story from their perspective. Given that this will be the first of the seven signs, in terms of creating a linear narrative, it would be logical to begin with the history and context of the site leading up to the present day. Figure 24 shows an example of a similar type of interpretive panel constructed in local Hickory Hill Park

and can serve as a model for TTWET. As the main entrance to TTWET, apart from the interpretive exhibit, this location will also need to include a specific use/trail map of TTWET, general pertinent trail information, and gentle prescriptive reminders to be courteous users of the area.

Flooding and Climate Change Adaptation

Here the sign should focus on the most prominent ecological characteristic of TTWET: flooding. Information presented in the preceding sections of this plan regarding flooding in the local area and TTWET can be repackaged into an easily-digestible panel along with eye-catching visuals. This presents

Figure 24 - Interpretive Panel at Hickory Hill Park

an opportunity to include information about climate change and the effects felt on a real, personal, local level, and to educate visitors on ways our society will need to adapt in the foreseeable future. Figure 25, an interpretive panel from Noel Design for North Cascades National Park, is a good example of a similar panel executed in a visually appealing and accessible way and can serve as a model for this signage location.
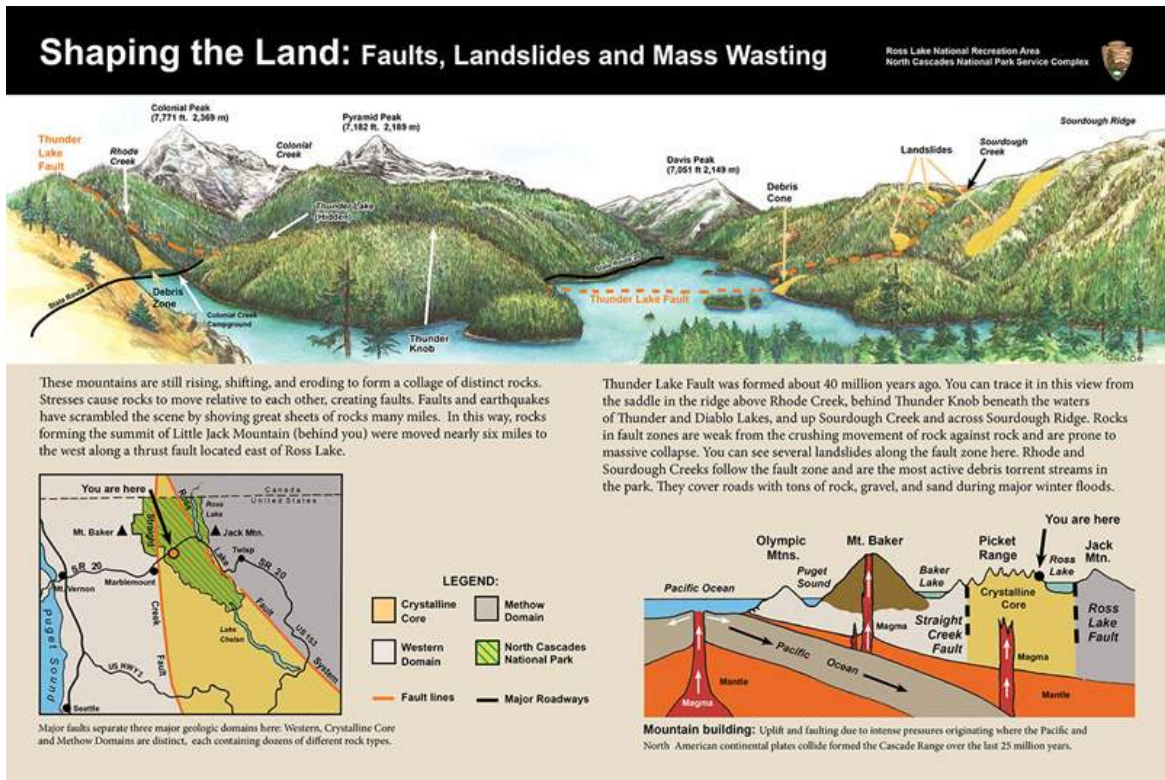
Figure 25 - Interpretive panel, North Cascades National Park

Flora

When following the trail north to south, this sign will be located immediately prior to users encountering the proposed ecosystems. It should therefore serve to educate on specific flora that users will start to encounter as they continue along the pedestrian trail. Images and information regarding notable plants present at the site should be displayed here to give even the least ecologically-savvy users some context as to why these species are notable and to provide general information regarding these species. A map detailing the locations of edible landscapes, potentially including mint, pawpaw, and mulberry, would be well-suited within this sign, encouraging users to explore the wilderness around them and hunt for a mid-hike snack.

Bird Species

As birding is an activity that already has a foothold within TTWET, a sign categorizing and illustrating bird species that are present in the area is an obvious choice for inclusion along the trail. By providing a baseline level of information on bird species and displaying pictures of birds that can potentially be seen at the site, even the youngest of trail users can have fun engaging in birdwatching as they continue along the trail. When crafting the content for this interpretive panel, the Iowa City Bird Club would be an excellent organization to consult as they have an established presence at TTWET and site-specific knowledge. This interpretive panel can also dovetail nicely with the digital

environment explored later in the adaptation plan by including QR codes for existing web addresses or mobile apps users can visit on their smartphones to identify, catalog, and monitor bird species in the area themselves.

Mammals

While mammal presence within TTWET is not currently as robust or as well-documented as is the case with bird species, the proposed constructed ecosystems might provide an opportunity to attract new wildlife to the area. A sign detailing the types of mammals that currently reside, are planned to reside, or might potentially reside within TTWET would be well-suited for this area to further capture user interest. Associating the proposed constructed ecosystems with the species of mammals that inhabit them would also serve as another opportunity to educate users and create increased appreciation for nature and wildlife.

Ecosystems

With the introduction of constructed ecosystems within TTWET and the current presence of a prairie ecosystem in the south portion of Terry Trueblood, a sign centrally located at this point could contain information regarding the ecosystems in both locations. This is an educational opportunity to describe the five types of proposed ecosystems within TTWET (dry-mesic bottomland forest, mesic bottomland forest, wet-mesic tallgrass prairie, palustrine forested wetland, and palustrine emergent wetland) as well as how this site fits into the broader ecological context of the region.

Invitation to Explore

Figure 26 - Creative frame signage in use at Chiswick House Gardens, London

This site is located directly on the existing Terry Trueblood paved trail, adjacent to an ash tree concentration that will be cleared either by decay or removal due to the presence of Emerald Ash Borer. This creates an opportunity to utilize the future clearing as an overlook from the widely-used main trail into TTWET and to locate a sign that catches the attention of regular Terry Trueblood visitors who may not be aware of the existence of TTWET and its natural features. This sign should be distinct and eye-catching while integrating the TTWET overlook into its design. Figure 26, from the Chiswick House Gardens in west London, is an excellent example of creative frame-usage in signage design, and if financially feasible would be a memorable feature that piques curiosity of main Terry Trueblood users and invites them to explore the natural amenities present just beyond the ridge.

6.7.2 Materials

The Iowa City Parks Master Plan includes a design guidelines section which offers formats and recommendations when constructing new park signage and which should be consulted to inform the signage design process for TTWET. Figure 27 shows the Iowa City Parks Master Plan's recommendation for information centers.[36]

If financially feasible, this design would be ideally suited for the highly visible signage locations 1 and 6, at the north and south pedestrian trailheads. In addition to the

interpretive panels proposed for these locations, these signs should be very similar in the information and instructions they contain, as they will be the sole providers of prescriptive direction users will encounter along a trail populated by interpretive and simple wayfinding signage. Constructing these two signs to be aesthetically similar--in keeping with the Parks Master Plan guidelines--will help establish a cohesive visual element for TTWET.

The locations of signs 3, 4, and 5 in particularly low-lying areas will necessitate a different approach to construction given that they will be exposed to floodwater inundation on a somewhat regular basis. The two basic approaches to constructing signage in a floodplain are to use flood resistant materials or to make the signs removable. Constructing gabions on which to mount the interpretive panels would be a relatively cost-effective and flood-resilient option. To decrease costs of this option further, the possibility of sourcing rocks from city-owned endeavors should be explored. Panels should be mounted facing downriver to protect from flowing debris during flood events. Figure 28, by Rankinfraser Landscape Architecture for Battleby House in Perth, Scotland, demonstrates the pleasing visual element possible with gabion-mounted signage.
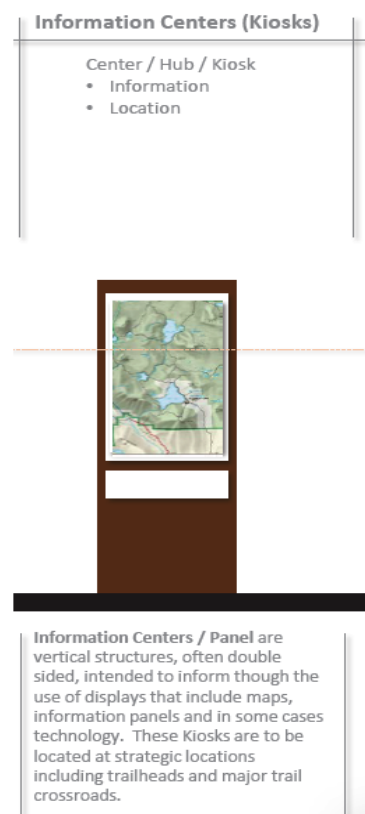

Figure 27 - Information center, Iowa City Parks Master Plan

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[36] City of Iowa City, *Gather Here: Iowa City Parks Master Plan* (City, 2017), 119.

Figure 28 - Gabion-mounted signage

Options for removable signage are numerous, but the National Park Service lists options that might be well-suited for this site in their guide to developing outdoor interpretive exhibits.

A direct embedment socket mount, shown in Figure 29, is a sturdy option that would allow for the posts and panel of the sign to be removed prior to any flood events.[37] Although this would require additional human resources during flood watches, it should increase the longevity of the signs and decrea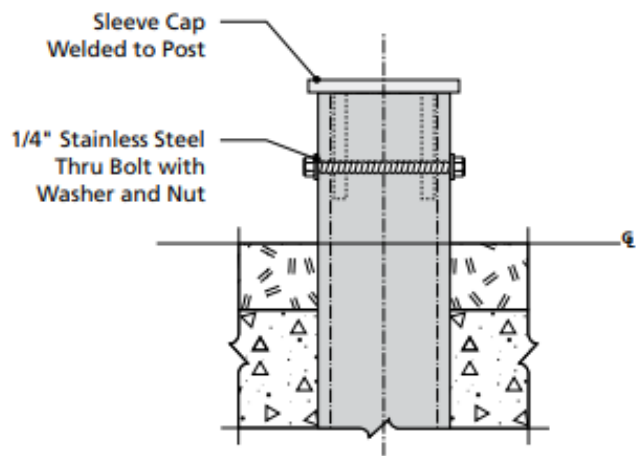se costs associated with maintenance and replacement in the long run. An additional concern regarding removable signage is the increased potential for theft, so care should be taken to ensure the signage is not capable of being removed by opportunistic vandals with a simple toolset.

Depending on resource constraints, different floodplain signage options can be attempted one at a time and the results monitored to determine the best method regarding price, upkeep, and appearance, then applied to all three floodplain sign locations.

Figure 29 - Direct embedment socket mount

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[37] National Park Service. *Visitor Information Sign System: VIS and Wayside Hardware Specification Manual*. (Harpers Ferry: Center for Media Services, 2008), 163.

6.7.3 Trail Delineation

A large portion of the proposed pedestrian trail will run alongside the bike trail, and although we are proposing that the bike trail potentially be shifted inland a safe distance, it will be important to clearly demarcate these points to ensure a safe and enjoyable experience for all users of TTWET. Utilizing natural barriers such as logs or small mounds of earth to physically separate the trails if space allows should be considered but adding a few small strategically-placed signs will help to prevent confusion regardless. For multi-use stretches of the trail when both bikers and walkers will be present, messages denoting yield hierarchy should be incorporated. Pedestrians should yield to bikers, and this can be conveyed using simple iconography.

Rather than large, unattractive, prescriptive aluminum signs on each trail, simple iconography or one-word messages can be utilized to alert users of the different trails in a way that can blend in with the natural environment. Carved wooden signs mounted on short posts placed between the trails along stretches where they start to merge together would be an inexpensive solution. The creation and installation of these wooden signs and posts would also provide an opportunity to involve kids in the local community, giving them a chance to become familiar with TTWET while making a hands-on contribution to the site.

6.8 Digital Environments

An existing website covering the environmental history of TTRA already exists through the University of Iowa Libraries' Digital Scholarship and Publishing Studio,[38] and features information on past land use, indigenous history, and some ecology. The website is accessible via mobile device, but is text-centric and requires a lot of scrolling (Figure 30). Apps such as those published by the National Park System feature more cell-phone-friendly browsing with smaller quantities of specific information accessible through a landing page menu (Figure 31). The NPS Yellowstone app might provide one model for a more intuitive digital environment with which to interact in TTWET.
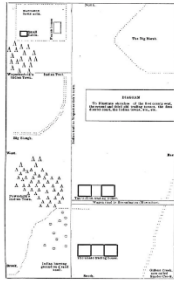
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[38] Sarita Zaleha, "Terry Trueblood Recreation Area," *Iowa City's Parks: An Environmental History*, University of Iowa, last accessed April 23, 2018, https://dsps.lib.uiowa.edu/iowacityparks/2016/01/01/sand-lake/.

Figure 30 (Above) - University of Iowa Libraries' Digital Scholarship and Publishing Studio website

Figure 31 - NPS Yellowstone app

Existing apps for the identification of wildlife include the "Merlin Bird ID" app, made by the Cornell Lab of Ornithology. The app features a user-friendly walkthrough of questions asking for details about a bird sighting that help identify the various

possibilities of species seen. If advertised on TTWET entrance signage, the app could serve as an educational tool for amateur birders and curious park users.

This identification app, along with the websites iNaturalist, eBird, and Budburst, can educate park users about what species of flora and fauna they might encounter more generally throughout TTWET. In turn, these apps and websites can be integrated into a citizen science monitoring program.

6.9 Citizen Science Monitoring

Citizen science monitoring involves citizens themselves as researchers in the monitoring of an ecosystem to which they have access and with which they likely interact somewhat regularly. Ecological monitoring can be a time-consuming and costly practice for local governments to implement, but citizen science can help mitigate those costs while encouraging citizens to engage more substantially with their local natural areas.

Apps like the Merlin Bird ID can help citizen-scientists better identify species they see in TTWET. Each sighting is logged in a user's personal catalog, which can later be referenced to upload the observation onto eBird (Figure 32).
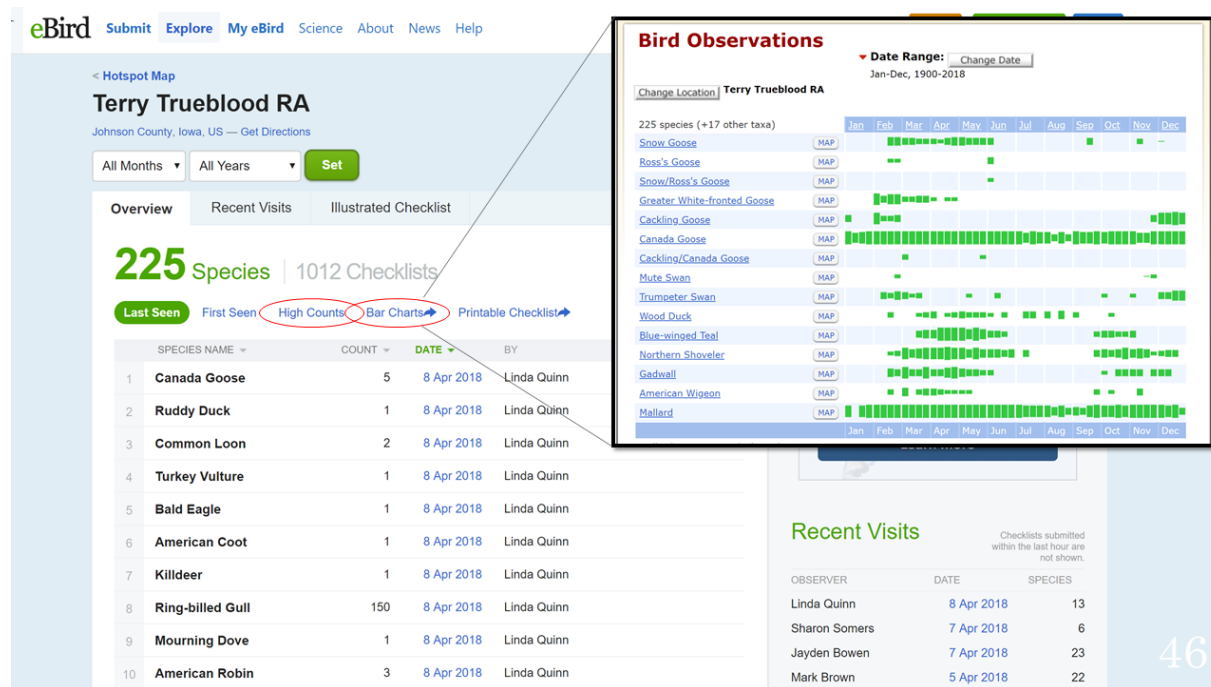
Figure 32 - eBird dashboard

The eBird website already features a page for TTRA, which likely includes data from within TTWET as well. A separate page could be made for TTWET, but this may accidentally skew observation data for birders who already catalog TTWET sightings in the TTRA log. The eBird data is sortable by recency of sighting and by "high counts" of

large groups of birds seen at once. The "Bar Charts" feature allows users to see the seasonal frequency of sightings for each species logged.

iNaturalist, a website and mobile app (Figure 33), might serve as an overall compendium for citizen-scientists, but lacks an identification tool to help ensure the accuracy of sightings. However, it is one of the only apps that allows users to catalog observations of any species—not just plant *or* animal.
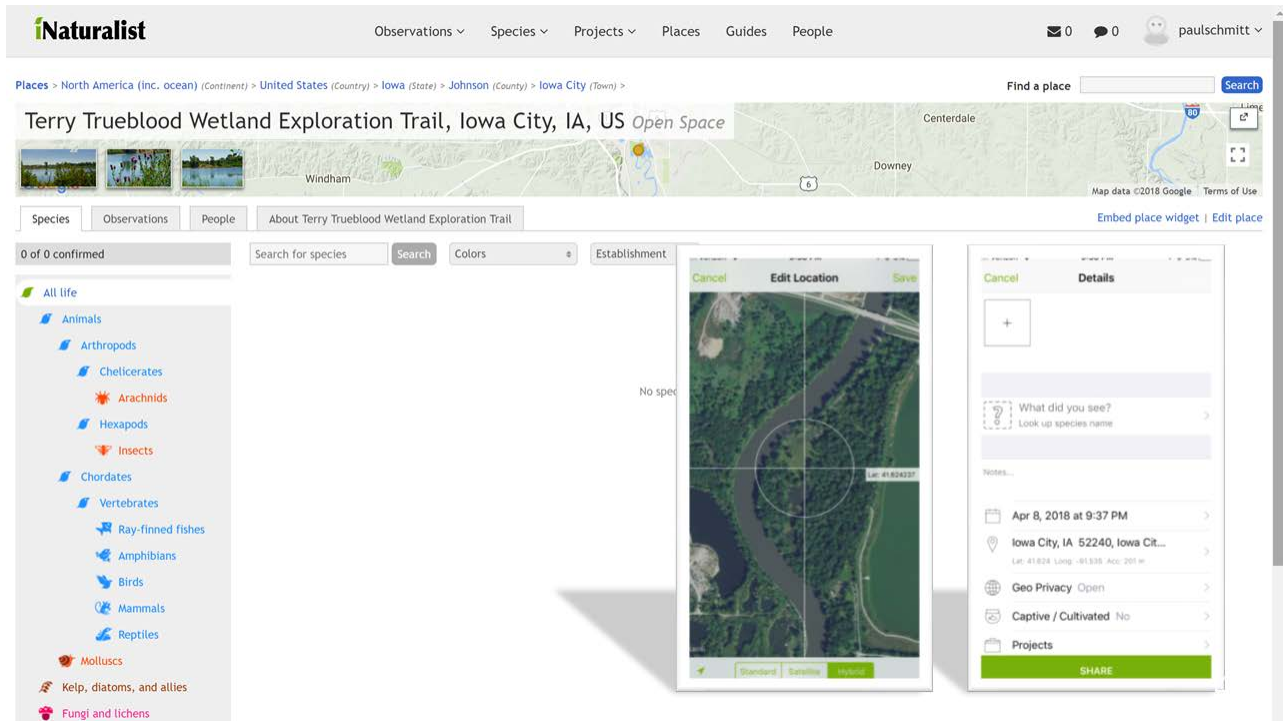
Figure 33 - iNaturalist webpage

Budburst lacks a mobile app, but its website helps users identify plant species and what phenophase, or life event, they are undergoing when observed. This could be particularly useful in monitoring the recuperation of plant species after flood events. If users take photos on site, assemble data at home, and upload it to Budburst, the data would become publicly accessible for city officials and ecologists to use.

Table 1 Summary of pros and cons of governance structures for CBM groups

	Consultative/functional	Collaborative	Transformative
Details	Gov. led, community run; gov. recognizes problem and uses CBM group to monitor	Involves as many stakeholders, individuals, etc. as possible; often based on a non-politically demarked area (i.e. watershed)	Community led, run and funded; community recognizes problem- trying to get gov. attention
Pros	May lead to long-term data sets; often successful in short term	Often more decision making power than other structures	Can be successful with community and stakeholder support
Cons	Dependant on gov. funding; less diverse stakeholders	None published	May not be diverse (i.e. only activists), problems with credibility and capacity Monitoring issues that are not governed by legislation

Figure 34 – Governance in citizen science monitoring

Conrad and Hilchey identify three main categories of governance in citizen science monitoring (Figure 34). Consultative/functional monitoring includes projects such as the Cornell Ornithology Lab's "Merlin Bird ID" and "eBird" apps. These apps require substantial institutional support, and establishing a new initiative of this type would be difficult on a city scale. However, given that data on eBird and "Budburst" is publicly accessible, there is opportunity for citizens (either individually or as a part of a "transformative" governance structure) to use these already-existing web platforms to log location-specific data that could then be accessed and used by other researchers or Parks and Recreation to inform ecosystem management.

6.10 Neighborhood Associations

Another avenue of community engagement can be explored through TTWET's nearest neighbors. Establishing a support organization similar to the model of 'Friends of Hickory Hill Park' in Iowa City can be a mutually beneficial means of connecting residents with the site and garnering funding and volunteers for education and maintenance. Rather than seeking to establish such a stand-alone organization, or perhaps as a precursor to one, Iowa City could be well-served to partner with neighborhood associations nearby TTWET in a similar fashion.

Wetherby and Sandhill Estates are the two nearest neighborhood associations already in existence where residents could experiment with this model. In particular, the Alexander neighborhood and Alexander Elementary School could serve as well-suited partners, given the opportunity to bring students on site for educational field trips and even allow each grade level to 'adopt' a certain task at the site. Another strong candidate could be the yet-to-be-developed neighborhood to the east of TTRA. This area is expected to fill in with relatively dense residential development over the coming years. As shown in Figure 35 below, this area is already referenced as the 'Trueblood Neighborhood' within the City's South District Plan adopted in 2015. In this way, the entire Terry Trueblood Recreation Area could serve as an anchor for this neighborhood,

inviting residents to identify with its rich cultural and ecological history and to take part in preserving and enhancing these features for future generations.

Figure 35 - Trueblood neighborhood, Iowa City South District Plan

6.11 Contacts for Outreach

For general outreach and to gain public participation we have spent time in the community talking with various individuals and groups on how they use the site, what they observed while using it, and what they would like to see take place at the site. Like any thought-out plan, we aimed at respecting the community's input and producing changes that they would like to see, as well as what changes would initiate more use of the site while still maintaining our goals and objectives for the site.

For a complete list of contacts that were used in the preparation of this plan see Appendix 8.3 *Community Engagement.*

6.12 Transferable Principles

Rather than demanding planners to mitigate climate change, adaptation asks planners to acknowledge the already-inevitable local impacts of climate change and prepare for them. An adaptation plan must take into account future changes in the physical conditions of a given site even while facing a level of uncertainty about when or to what degree those changes will take place.

In composing an adaptation plan, planners should assume that both sudden and incremental environmental changes will take place. The adaptation plan should aim to reduce the vulnerability of social and ecological systems to these changes, on both short- and long-term timescales. For riverine sites similar to TTWET, much of this aim entails reducing the impacts of flooding on humans and non-humans alike.

Generally speaking, adaptation for other sites should strive to be:

- *Protective of unique ecological resources:* an adaptation plan should identify and protect any species or resources that are unique to the subject parcel
- *Feasible, low cost, economically efficient:* as adaptation plans are generally centered around vulnerable ecological locations that are prone to climatic and weather events like flooding, it is important and central to the definition of "adaptation plan" to keep updates and changes at low cost
- *Flexible, reflexive, iterative:* an adaptation plan should have some general principles that make it repeatable to other locations
- *Equitable and protective of health and safety:* an adaptation plan should be conscious of and sensitive to defenseless species
- *Cognizant and protective of existing vulnerable species (plant and animal):* as our climate continues changing, an adaptation plan should be aware of increasingly unstable ecosystems and plan for current and future needs

Thus, it is up to planners to identify existing site characteristics and needs before moving on to determine what tools (whether already-existing or possible to use with budget constraints), institutions, and site features should be used or leveraged to most adequately address the site-specific needs in a responsible time frame.

6.13 Data Collection

In order to identify site characteristics and constraints that will inform the goals, objectives, and eventual recommendations of an adaptation plan, substantial data collection is necessary.

To collect data on the 100- and 500-year floodplain, use the Johnson County Property Information Viewer.[39] Zoom in on the park area being considered for adaptation, and open the Layers List using the icon second from the left in the top-right toolbar. Uncheck all layers except for FEMA. Open the drop-down menu for FEMA, and check the 100 or 500 year floodplain box.

The data on historic crests in Iowa City (see section 2.1.1), provided by the USGS[40], is transferable to other sites along the Iowa River south of the Coralville Reservoir. By using this data as a general predictive tool, planners can gauge the potential inundation

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[39] Johnson County, Iowa, *GIS Property Information Viewer,* accessed 2018, https://gis.johnson-county.com/piv/.

[40] USGS Current Conditions for USGS 05454500 Iowa River at Iowa City, IA. Accessed March/April 23, 2018. https://waterdata.usgs.gov/nwis/dv/site_no=05454500&agency_cd=USGS&referred_module=sw.

of a site with the Iowa Flood Information System's Inundation Map.[41] The Flood Map Controller slider tool allows users to see the varying levels of inundation by river stage and corresponding discharge rate.

Tree inventory data is available from the Iowa City Parks and Forestry Division, and can aid in identifying on-site flood-tolerant and -intolerant species, as well as the prevalence of ash trees that will eventually need to be removed.

The USDA Web Soil Survey tool can be used to identify soil types on any site (see section 3.4).[42]

In addition to these mapping and data tools, web-accessible research from state University extension offices can assist in identifying practices for ecosystem management. If working with a city park, data collated in the City of Iowa City Natural Areas and Inventory Management Plan should also be consulted for information regarding invasive species and species of concern already identified, as well as connections to other local habitats.

6.14 Stakeholder Identification

Because an adaptation plan does not assume stable conditions on-site in the foreseeable future and instead plans for climate change and its resultant effects on specific ecosystems—such as an increase in significant precipitation events—consideration of stakeholders should extend to human and nonhumans alike, in the past, present, and future.

In part, this entails an understanding of the cultural history of the proposed site so as to allow for the inclusion of indigenous and settler narratives in educational material such as signage or digital environments. In the present, identification of and communication with conventional human stakeholders such as local neighborhoods, recreational organizations, educational groups, and citizens is key to building community support for any project. Looking into the future, these same stakeholders and future generations have much to gain or lose depending on choices made during the adaptation planning process.

Entwined with these human stakeholders are the nonhuman stakeholders of the site: the local and migratory organisms that have inhabited the site in the past (before

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[41] Iowa Flood Center, "Inundation Maps," *Iowa Flood Information System,* accessed April 2018, http://ifis.iowafloodcenter.org/ifis/app/?snap_view=fmap.

[42] United States Department of Agriculture, *Web Soil Survey,* accessed April 2018, https://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx.

European settlement and land use, and perhaps even before indigenous use), present (including invasive and native species, as well as existing ecotypes or lack thereof), and future (ecotypes and species suited to shifts in climate, precipitation, and inundation).

It is important to consider during the planning process not just who currently uses a site, but also how that constituency might grow and change in coming years. The ways in which various constituencies use and interact with the site may potentially shift as the site itself adapts to climate change and its effects. In considering these interrelations and how they may change in the future, an adaptation plan can build in measures to ensure the long-term integrity and usefulness of any given site.

6.15 The Planning Process

The formation of an adaptation plan for Terry Trueblood Wetland Exploration Trail is a novel undertaking. One goal of the plan is to recommend transferable plan development methods to other groups whom are interested in creating an adaptation plan. Below is an overview of the planning process for this plan that may be replicated elsewhere.

The development process for this adaptation plan started in January 2018 and unfolded over the course of four months. Dr. Lucie Laurian and Dr. Scott Spak directed a group of seven students enrolled in the Environmental Policy course in the University of Iowa's Urban and Regional Planning Department to complete the plan.

The planning process began with a site visit to Terry Trueblood Recreation Area and the TTWET site on January 22, 2018 (see Figure 29 below). Students met with staff members from the City of Iowa City Parks and Recreation Department and toured the site.

Figure 36 – Site visit at TTWET, January 22, 2018. Source: The Gazette Newspaper

Shortly thereafter, the team of students brainstormed goals for the project and arrived at a consensus of preliminary goals. At the same time students began collecting baseline information about the site such as flood data, soil types, and site history. Students also found relevant plans that already included the TTWET site including the City of Iowa City's planning and parks department documents.

Halfway through the project, students presented their preliminary list of goals, baseline information, and preliminary site plan to the City of Iowa City Parks Department, the Iowa Parks and Recreation Association Conference, and the City of Iowa City Parks Commission for input. Stakeholders provided ideas and feedback, and the students incorporated their comments into the plan's formulation.

Throughout the planning process, students had many workshops and meetings to discuss the plan and monitor plan progress. Based on site information and stakeholder input, students generated recommendations for the site to carry out the plan's goals. These recommendations constitute the second half of this plan and range from citizen science monitoring to physical infrastructure installation. The students synthesized complete baseline information, plan goals, and recommendations, and the result is this document. The planning process concluded in early May of 2018.

7 FINAL SITE PLAN

After taking the site's history, natural conditions, and the plan's goals into account, this plan proposes a comprehensive site plan for the Terry Trueblood Wetland Exploration Trail. The TTWET site plan is depicted below in Figure 37.
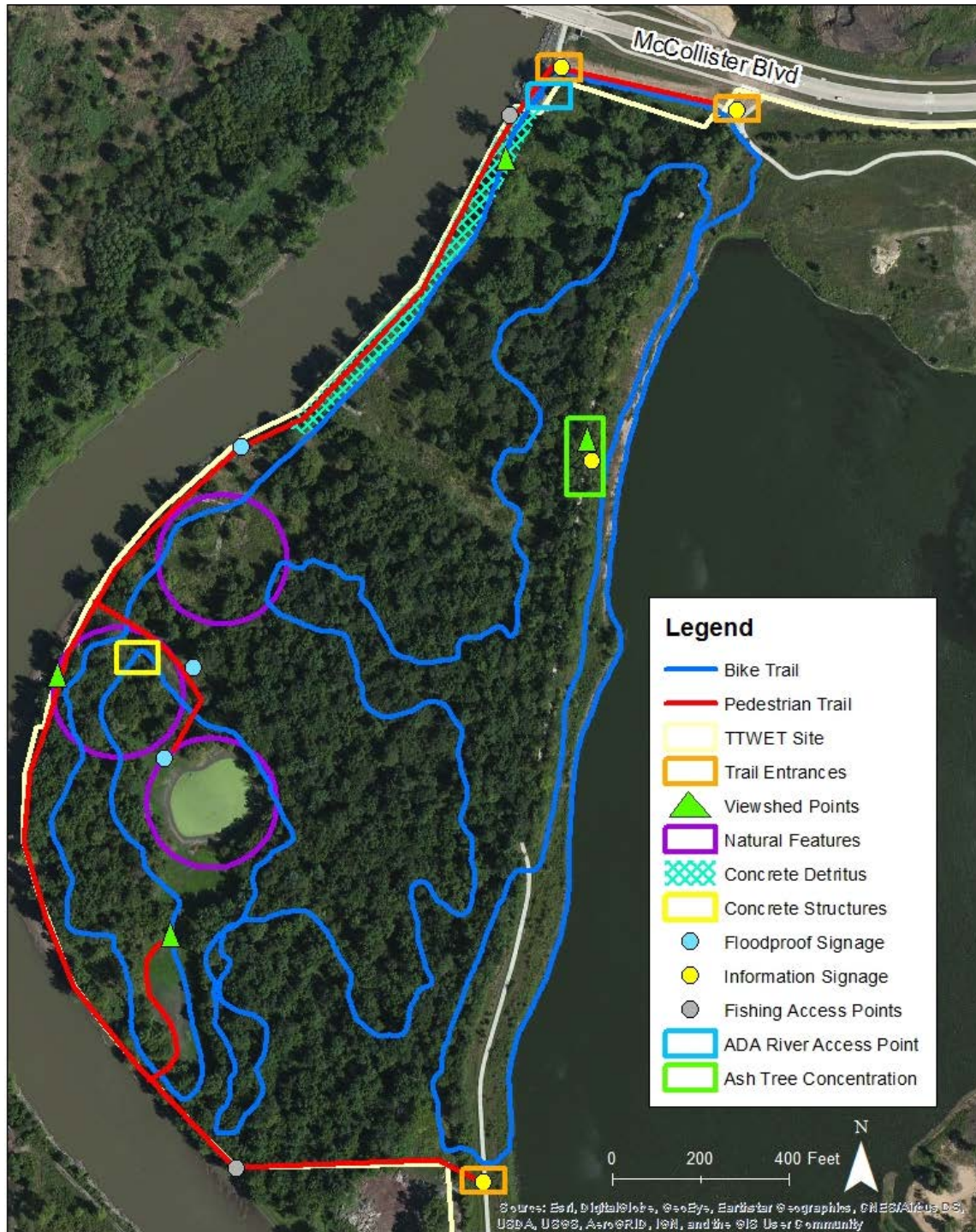

Figure 37 - TTWET proposed site plan

The most significant feature in the site plan is the trail network. A pedestrian trail (shown in red) is proposed along the west side of the site with two entrances: one on the north side and one on the south side of TTWET. Along with the walking trail along the river, two pedestrian access paths into the TTWET site are suggested. These pedestrian paths allow trail users to access the interior of the site and immerse themselves in the unique natural terrain of the TTWET site. The northern access trail takes pedestrians to the rehabilitated concrete structures as well as two informational signs for viewing. The southern access trail culminates at a unique natural viewshed point overlooking the small pond in the center of the site.

A bike trail system is also recommended on the TTWET site and is shown in blue on the site plan. The bike routes are separated from the pedestrian trails to keep some distance between the two uses. The trail system covers a large area in TTWET, which allows bikers to traverse several different types of terrain. The site plan also provides enough trail space for bike events should there continue to be demand for them in the future.

Another noteworthy aspect of the site plan is the viewshed points. As previously mentioned, a viewshed point is designed at the terminus of the southern access trail. This will provide an area for contemplation where visitors can look out across the pond on the TTWET site. A viewshed point is also proposed on the western edge of the pedestrian trail. This point will enable trail users to take-in the Iowa River and Meskwaki Park, in which an eagle's nest is visible in the treetops. A final viewshed point is proposed on the east side of the site. This point is located on top of the eastern ridge near a cluster of ash trees that are anticipated to fall in the years to come. As the tree line clears, the viewshed point will provide a nice overview of the TTWET site from a high point.

Signage is proposed throughout the site as discussed extensively in Section 6.8. Two fishing access points are suggested along the pedestrian trail and are depicted in grey. The southern point will give anglers access to a secluded fishing spot. The northern fishing access point is conveniently located close to McCollister Boulevard and the parking lots at Terry Trueblood Recreation Area. The spot is also located adjacent to a proposed ADA-compliant river access point. The access point should be designed for kayak and small craft access to the Iowa River.

It is our belief that the implementation of the proposed site plan will transform Terry Trueblood Wetland Exploration Trail into a regional asset. When the site plan is fully implemented, it will highlight the unique history and ecology of the TTWET site while furthering the City of Iowa City's commitment to reorient itself towards the river. The site plan will allow for a range of uses and encourage visitors to enjoy the site and learn about its assets. With careful ecological management, the site plan will enable the site to thrive. It will carry out the goals outlined in this plan and the provide the Iowa City

community with a wonderful place to visit, nurture, and enjoy. The Terry Trueblood Wetland Exploration Trail will serve human and natural needs for many years to come.

8 APPENDICES

8.1 Invasive Species of Concern

8.1.1 Dry-Mesic Forest

Invasive Species of Concern	Common Name	Stratum	Cover Class
Morus alba	White Mulberry; Russian Mulberry; Silkworm Mulberry	Canopy	<10%
Lonicera maackii	Amor Honeysuckle; Bush Honeysuckle	Shrub	<10%
Morus alba	White Mulberry; Russian Mulberry; Silkworm Mulberry	Shrub	<10%
Ulmus pumila	Siberian Elm	Shrub	<10%
Allaria petiolata	Garlic Mustard	Herbaceous	<10%
Arctium minus	Common Burdock; lesser Burdock	Herbaceous	<10%
Lonicera maackii	Amor Honeysuckle; Bush Honeysuckle	Herbaceous	<10%
Leonurus cardiaca	Motherwort	Herbaceous	<10%

8.1.2 Altered Forest

Invasive Species of Concern	Common Name	Stratum	Cover Class
Morus alba	White Mulberry; Russian Mulberry; Silkworm Mulberry	Canopy	10-30%
Ulmus pumila	Siberian Elm	Canopy	>50%
Lonicera maackii	Amur Honeysuckle; Bush Honeysuckle	Shrub	>50%
Toxicodendron radicans	Poison Ivy	Shrub	<10%
Lonicera maackii	Amur Honeysuckle; Bush Honeysuckle	Herbaceous	10-30%
Allaria petiolata	Garlic Mustard	Herbaceous	<10%

8.1.3 Prairie

Invasive Species of Concern	Common Name	Stratum	Cover Class
Ailanthus altissima	Tree of Heaven	Shrub	<10%
Morus alba	White Mulberry; Russian Mulberry; Silkworm Mulberry	Shrub	<10%
Bromus inermis	Smooth Brome	Herbaceous	10-30%
Bromus japonicus	Japanese Brome	Herbaceous	<10%
Bromus tectorum	Downy Brome; Downy Chess; Cheatgrass	Herbaceous	<10%
Cirsium arvense	Canada thistle	Herbaceous	<10%
Helianthus annuus	Wild Sunflower	Herbaceous	<10%
Lotus corniculatus	Birds-foot Trefoil	Herbaceous	<10%
Medicago lupulina	Black Medic	Herbaceous	10-30%
Melilotus officinalis	Yellow Sweet Clover	Herbaceous	10-30%
Phalaris arundinacea	Reed Canary Grass	Herbaceous	10-30%
Poa pratensis	Kentucky Bluegrass	Herbaceous	10-30%
Rumex crispus	Curly Dock	Herbaceous	<10%
Securigera varia	Crown Vetch	Herbaceous	<10%
Toxicocodendron radicans	Poison Ivy	Herbaceous	<10%
Ulmus pumila	Siberian Elm	Herbaceous	<10%
Varbascum thapsus	Common Mullein	Herbaceous	<10%

8.1.4 Forested Lowland

Invasive Species of Concern	Common Name	Stratum	Cover Class
Morus alba	White Mulberry; Russian Mulberry; Silkworm Mulberry	Canopy	10-30%
Lonicera maackii	Amur Honeysuckle; Bush Honeysuckle	Shrub	10-30%

Toxicocodendron radicans	Poison Ivy	Shrub	<10%
Ulmus pumila	Siberian Elm	Shrub	10-30%
Allaria petiolata	Garlic Mustard	Herbace ous	<10%
Arctium minus	Common Burdock; Lesser Burdock	Herbace ous	10-30%
Bromus inermis	Smooth Brome	Herbace ous	30-50%
Cirsium arvense	Canada Thistle	Herbace ous	<10%
Commelina communis	Day-flower	Herbace ous	<10%
Festuca arundinacea	Tall Fescue	Herbace ous	10-30%
Glechoma hederacea	Creeping Charlie	Herbace ous	10-30%
Humulus japonicus	Japanese Hop	Herbace ous	<10%
Leonurus cardiaca	Motherwort	Herbace ous	<10%
Lotus corniculatus	Birds-foot Trefoil	Herbace ous	<10%
Melilotus officinalis	Yellow Sweet Clover	Herbace ous	10-30%
Morus alba	White Mulberry; Russian Mulberry; Silkworm Mulberry	Herbace ous	10-30%
Phalaris arundinacea	Reed Canary Grass	Herbace ous	30-50%
Poa pratensis	Kentucky Bluegrass	Herbace ous	10-30%
Rumex crispus	Curly Dock	Herbace ous	<10%
Securigera varia	Crown Vetch	Herbace ous	<10%
Stellaria media	Chickweed; Common Chickweed	Herbace ous	<10%
Ulmus pumila	Siberian Elm	Herbace ous	<10%
Verbascum thapsus	Common Mullein	Herbace ous	10-30%

8.1.5 Herbaceous Lowland

Invasive Species of Concern	Common Name	Stratum	Cover Class
Cirsium arvense	Canada Thistle	Herbaceous	<10%
Echinochloa crus-galli	Common Barnyard Grass; Barnyard Millet; Cockspur	Herbaceous	<10%
Phalaris arundinacea	Reed Canary Grass	Herbaceous	>50%
Poa pratensis	Kentucky Bluegrass	Herbaceous	30-50%
Typha angustifolia	Narrowleaf Cattail	Herbaceous	>50%

8.2 Invasive Species Management

Invasive Species of Concern	Common Name	Optimal Management Strategy
Lonicera maackii	Amor Honeysuckle; Bush Honeysuckle	Prescribed burns in early spring or fall; Burn every year for 5 years to control viable seed in the soil
Lotus corniculatus	Birds-foot Trefoil	Manual removal of root fragments; Frequent mowing at height of two inches for several years may reduce seed production and speed; Burning not recommended as it increases seed germination
Medicago lupulina	Black Medic	Reduction of soil compaction; Aeration of soil; Manual removal; Responds well to herbicides
Cirsium arvense	Canada thistle	Burning not recommended as prescribed fire fails to destroy root system and is likely to increase thistle presence; Best controlled by post emergent broadleaf herbicide
Stellaria media	Chickweed; Common Chickweed	Manual removal effective for seedlings; Herbicides are most effective
Echinochloa crus-galli	Common Barnyard Grass; Barnyard Millet; Cockspur	Herbicides are most effective; Placing mulch over species can help suppress germination
Arctium minus	Common Burdock; lesser Burdock	Herbicides and mowing are most effective
Verbascum thapsus	Common Mullein	Manual removal of root crown below lowest leaves; Responds to prescribed burning

Glechoma hederacea	Creeping Charlie	Manual removal effective for seedlings; Herbicide application in early fall; Responds to prescribed burning
Securigera varia	Crown Vetch	Responsive to both herbicides and mowing; Prescribed burning in late spring is effective
Rumex crispus	Curly Dock	Difficult to control manually; Herbicides are most effective management tool
Commelina communis	Dayflower	Manual removal only effective in moist soil; Herbicides and mowing recommended
Bromus tectorum	Downy Brome; Downy Chess; Cheatgrass	Establishing native perennials to outcompete the species; Mowing is effective; Prescribed burning not recommended
Allaria petiolata	Garlic Mustard	Reduction of soil disturbance; Fire only effective prior to emergence of desirable plants; Integrating herbicide treatments with fire is most effective
Bromus japonicus	Japanese Brome	Responds well to manual removal; Prescribed burns before seed dispersal; Herbicides
Humulus japonicus	Japanese Hop	Mowing and herbicides are most effective; Prescribed burns not recommended unless integrated with other techniques; Avoid cutting down trees as
Poa pratensis	Kentucky Bluegrass	Best to introduce native grasses to outcompete species; Irregular prescribed burns are effective
Leonurus cardiaca	Motherwort	
Typha angustifolia	Narrowleaf Cattail	Prescribed burning before spring season; Herbicides not recommended
Toxicocodendr on radicans	Poison Ivy	Manual removal; Fire not recommended
Phalaris arundinacea	Reed Canary Grass	Manual removal is optimal but far too labor-intensive for large infestations; Prescribed fire repeated in late autumn or late spring for several years (~5-6) can control this species
Ulmus pumila	Siberian Elm	Proper removal must destroy entire root system; Seedlings with stem diameter less than 3/8 inch can be easily removed by hand; Small trees with diameters between 3/8 and 2.5 inches can be removed by shovel or weed tools; Herbicides may be effective; Prescribed burning typically not effective
Bromus inermis	Smooth Brome	Application of herbicide in the fall; Prescribed burning effective after strands have greened up to 4-10 inches tall
Festuca arundinacea	Tall Fescue	Herbicides are most effective; Prescribed burning and mowing are not effective

Ailanthus altissima	Tree of Heaven	Manual removal effective for seedlings; Mechanical cutting and burning must be followed by herbicide application
Morus alba	White Mulberry; Russian Mulberry; Silkworm Mulberry	Manual removal of seedlings; Introducing native species
Helianthus annuus	Wild Sunflower	Manual removal; Select herbicides
Melilotus officinalis	Yellow Sweet Clover	Late spring to early fall burns; Mowing; Herbicides prior to flowering

8.3 Community Engagement

In order to ensure a successful implementation of this adaptation plan, further efforts should be made to engage diverse stakeholders for feedback on plan recommendations. This engagement should take a number of mediums, including digital, print, and in-person meetings. A number of public open house meetings could be held at the Terry Trueblood Recreation Area lodge at different times on different days of the week to invite the general public to learn about and respond to the TTWET plan. Printed post-cards mailed to residents within approximately a one-mile radius can keep neighbors informed. Utilizing the City's online social media presence around the time of the general public meeting can provide a forum for the wider community to participate if unable to attend in person. In addition, speaking engagements at stakeholder meetings or meetings with representatives of these groups should be coordinated to ensure the area's current and most likely future users have opportunities to express their opinions. Below is a preliminary list of such stakeholders to contact.

Stakeholder Interest	Organization
Bicycling	Geoff's; Iowa Coalition of Off-Road Riders (ICORR); World of Bikes
Birding	Iowa City Bird Club
Edible Landscaping	Backyard Abundance
Fishing / Paddling / Winter Sports	Fin & Feather
Iowa River Corridor Trail	Johnson County MPO
Iowa River Water Trail	Iowa Water Trails Association
Neighborhood	Wetherby / Sandhill Estates / Alexander / Thatcher Neighborhoods
Native American History	Meskwaki Nation, Tama, Iowa
Youth / Education	Alexander Elementary

Suggested Questions/Survey:

1. How often do you visit Terry Trueblood Recreation Area (TTRA)?

□ Never   □ Rarely   □ Sometimes   □ Frequently

2. If you visit TTRA, do you visit the western side, to be known as Terry Trueblood Wetland Exploration Trails (WET)? [image/map to the side]

□ Never   □ Rarely   □ Sometimes   □ Frequently

3. How satisfied are you with the current state of TTRA? (on a scale of 1-5 with 5 being the most satisfied)

1   2   3   4   5

4. What do you like the most about TTWET?

5. What do you like the least about TTWET?

6. What would you like to see change at TTWET?

7. Please share any other comments or recommendations.

8.4 Costs & Funding Possibilities

In-house or Volunteer actions / No cost estimates provided:

Item
Mowing
Prescribed Burns
Manual Invasive Species Removal
Artwork for Concrete Blocks
Outreach
Advertising/Printing

Necessary Costs:

Item	Description	Quantity	Price
Forest Seed Mix	(9 lbs grasses, 2 lbs forbs per acre)	28 acres x $150	$4,200
Prairie A Seed Mix	(10 lbs grasses, 2 lbs forbs, 20 lbs cover crop per acre)	6 acres x $100	$600
Prairie B Seed Mix	(1 lbs grasses, ½ lbs forbs per acre)	7 acres x $75	$525

Optional Costs:

Item	Description	Cost
Signage	Single Post 24"x18"	$800
Signage	Double Post 24"x36"	$1,000-$1,200
Cypress Grove	Approx. 10 @ $25/tree	$250
Pawpaw Grove	prox. 10 @ /tree	$70

Funding sources for desired improvements:

A number of possible grant opportunities exist to fund the implementation of this adaptation plan. A primary source of locating applicable funding options is the U.S. Climate Resilience Toolkit (https://toolkit.climate.gov/content/funding-opportunities) . The toolkit is a project of United States Global Change Research Program managed by the National Oceanic and Atmospheric Administration (NOAA). The toolkit provides the most recent information on a variety of funding opportunities related to climate resilience, adaptation, and conservation.[43] Additional examples of applicable funding sources include the U.S. Environmental Protection Agency's environmental education grants (https://www.epa.gov/education/environmental-education-ee-grants)[44] and the People for Bikes community grants for bike trails (https://peopleforbikes.org/our-work/community-grants/).[45]

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[43] "U.S. Climate Resilience Toolkit." Last modified June 2016. Accessed April 2018. https://toolkit.climate.gov/content/funding-opportunities

[44] U.S. Environmental Protection Agency. "Environmental Education Grants." Accessed April 2018. https://www.epa.gov/education/environmental-education-ee-grants

[45] People for Bikes. "Community Grants." Accessed April 2018. https://peopleforbikes.org/our-work/community-grants/

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