STORY COUNTY CONSERVATION

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Memorandum

To: Story County Conservation Board

From: Michael D. Cox, Director

Date: May 11, 2020

Re: Consideration of Acceptance of the Hannum's Mill Lowhead Dam Mitigation Phase 1 Exploratory Report

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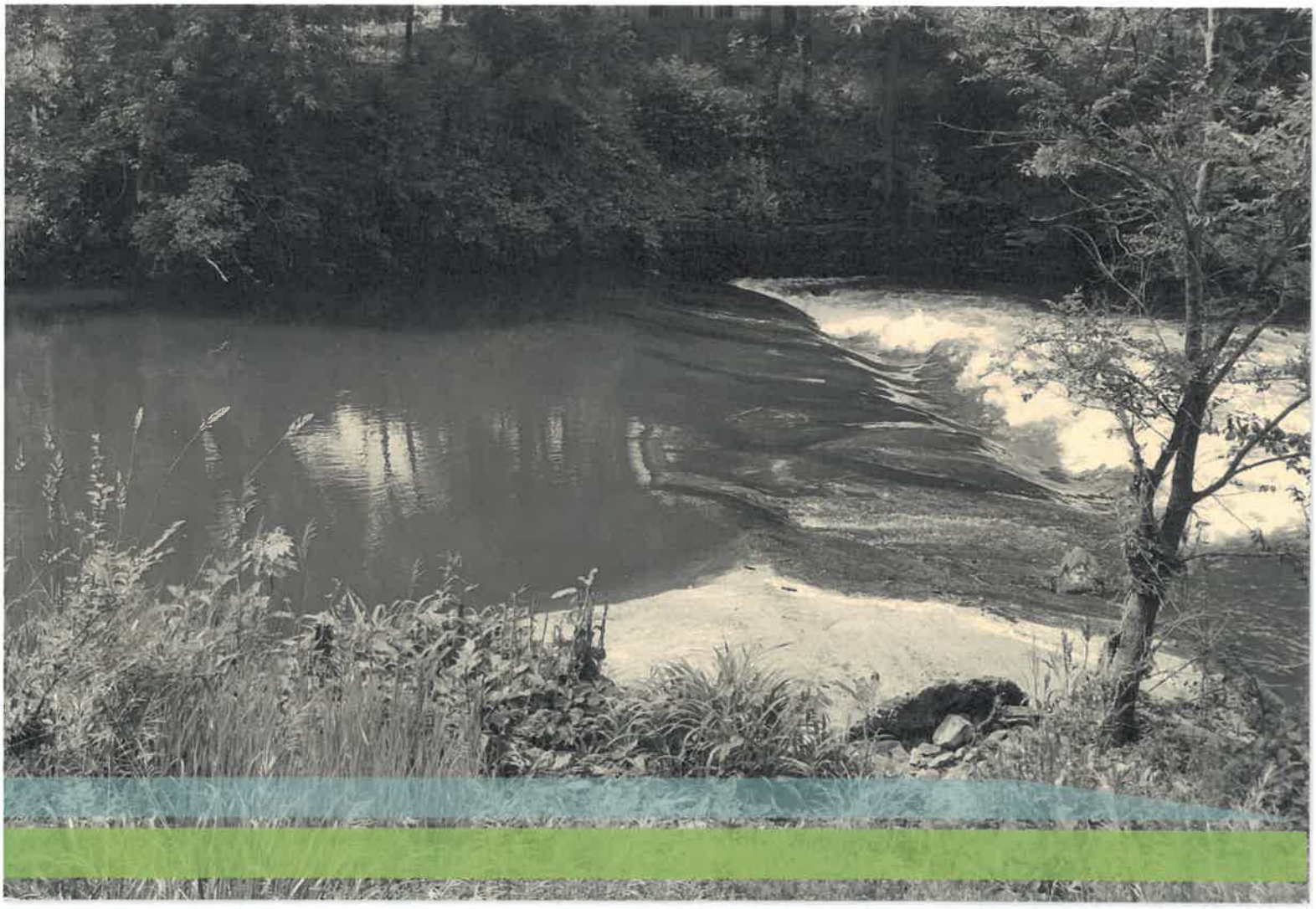
The attached report has been submitted by Houston Engineering. It offers recommendation for mitigation of the dam to allow better fish passage, safer water recreation, and preservation of audible aesthetics. The report is the culmination of stakeholder and public meetings, hydrology, cultural, and geomorphic analysis. Houston Engineering complied with contract requirements and has offered mitigation options.

I urge your acceptance of the report. Consideration of action steps will happen at a later date.

Approval	Disapproval
Date	Date

West Des Moines, IA | HEI No. 10318_001
February 28, 2020
Revised April 21, 2020



HANNUM'S MILL DAM MITIGATION

Phase 1: Exploratory

HANNUM'S MILL DAM MITIGATION

Phase 1: Exploratory

February 28, 2020

Revised April 21, 2020

HOUSTON ENGINEERING INC.

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision, and that I am a duly Licensed Engineer under the laws of the State of Iowa

Lisa Odens

Lisa Odens
P24362

4-21-2020
Date

Houston Engineering, Inc.

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1 EXECUTIVE SUMMARY

This report summarizes assessment conducted by Houston Engineering, Inc. (HEI) and subcontractors addressing the potential removal or mitigation of the Hannum's Mill Dam. This exploratory phase includes a summary of public input, project goals, the identification and initiating of regulatory needs and permitting requirements, and concepts based on identified project goals.

Hannum's Mill Dam, also referred to as the "General Filter Dam" is located on the South Skunk River just north of the City of Ames (Section 23, T84N R24W, Story County, Iowa). Two private parties own the dam on the north and south banks of the river, respectively. The dam is located on a relatively straight, approximately 1,400-foot section of river, with limestone outcroppings constraining the channel. Since the early 2000s, Story County and the greater community have expressed interest in improving paddler safety by removing or mitigating the dam. In 2015, the South Skunk River Water Trail Plan was completed, and construction began on the 13th Street Dam removal (about 2.5 miles downstream of Hannum's Mill Dam). At the same time the community revived its interest in resolving the safety concerns of Hannum's Mill Dam. It sought to ensure a safe recreational opportunity while improving wildlife on the South Skunk River.

Public and core stakeholder responses that represented the greater community (private property owners, water trail users, anglers, historical, and general community interests) were collected by survey to identify primary and secondary project goals. The primary goals, which characterize a successful project, include:

- Increasing safety to paddlers, floaters, and other river users,
- Improving aquatic wildlife habitat (fish/mussel passage) and reducing sediment loading (improved water quality), and,
- Maintaining a positive visual and audible aesthetic.

Secondary goals include objectives that would improve the features of the site, specifically:

- increase the function of the site for recreation,
- maintain land accessibility (with consideration of private land ownership),
- improve the terrestrial habitat,
- maintain or improve fishing, and
- preserve out-of-stream historic remnants in-place.

To determine the complexity of permitting, assessments were performed of the biota and historic features within the anticipated project area near Hannum's Mill Dam. Biota in the project area were assessed and two state-threatened mussel species were identified, the cylindrical papershell (*Anodontoides ferrusacianus*) and the creek heelsplitter (*Lasmigona compressa*), both previously observed in the region in addition to four common mussel species. The archaeological assessment determined that the remaining features of the dam (the timbers and cross sections from the original dam below the concrete cap) retain public importance but are insufficient features to be listed or protected by the State Historical Preservation Office as stand-alone features not contributing to an intact dam and mill site.

Alternatives proposed that achieve all the primary and secondary project objectives include:

- Alternative 1: full dam removal with stream bank restoration to stabilize the channel in the project area
- Alternative 2: full dam removal with rock arch rapids and stream bank restoration to stabilize the channel in the project area.

While primary stabilization is proposed near the project site, secondary and tertiary stream bank stabilization could be implemented beyond the project site. If it is desired to evaluate stream bank stability beyond the project site then each alternative will require further modelling during to determine the necessity of in-channel and stream bank restoration designs.

Similar bank stabilization methods (e.g., J-Hook, boulder revetment, and tree revetment) are shown for both alternatives. Both alternatives propose to preserve historical features, as feasible. Project costs are estimated to be $295,000 for the Alternative 1 (full dam removal and bank stabilization) and $695,000 for Alternative 2 (dam removal and construction of rock arch rapids). This includes construction, engineering, and administrative costs, but easement costs were not considered. While rock arch rapids would in part preserve the visual features of the site, the additional cost is unlikely to be a justifiable expense with the project goals identified by the community, property owners, and core stakeholders.

The recommend course of action by HEI is Alternative 1, the removal of the dam and installation of streambank stabilization to address bank instabilities directly resulting from the dam removal. Private property owners were consulted throughout the exploratory phase and the south property owners (SPO; tax parcel IDs 0523310105 and 0523310001) prefers an inexpensive repair that maintains the audible acoustics while the property owner to the north (NPO; tax parcel ID 0523300200) and Iowa Department of Natural Resources (DNR) fisheries prefer Alternative 1. Attendees at the second public meeting determined Alternative 1 to be the most fiscally responsible solution that achieved primary and secondary project objectives. Story County Conservation (SCC) has identified both efforts as acceptable with stream bank stabilization efforts potentially expanding to address stream bank stability or habitat goals on adjoining county-owned property.

Following the agreement on an alternative and securing project funding, the project can rapidly advance to the final design and construction phases. Constructing either proposed alternative will lead to safer water trails experiences for paddlers on the South Skunk River and enhance wildlife capacity.

2 SITE HISTORY AND PROJECT BACKGROUND

2.1 LOCATION AND SITE DESCRIPTION

Hannum's Mill Dam, also referred to as the "General Filter Dam," is located on the South Skunk River in Section 23, T84N R24W, in Story County, Iowa. The site is just north of the City of Ames. The improved width of the dam, capped with mortar, is approximately 48 feet across and 3 feet tall. It sits on a shallow bedrock on one of three locations where a grade shift from 0.05% to 0.03% occurs (personal communication, Nate Hoogeveen). The dam was maintained by the United States Geological Survey (USGS) until 2004 until ownership interest was transferred to private property owners. Maintenance is currently conducted by the SCC through a maintenance agreement with the NPO. Downstream landowners include the SPOs and Story County. The dam is located within a straight approximately 1,400-foot section of river, with limestone outcroppings on the southwest bank. Approximately 600 feet downstream from the dam the South Skunk River turns nearly 180 degrees against the US Highway 69 embankment. Soper's Mill is located approximately 5.1 miles to the northeast. The 13th Street Dam, within the City of Ames, is located approximately 2.5 miles to the south east. **Figure 1** shows the location of the dam.

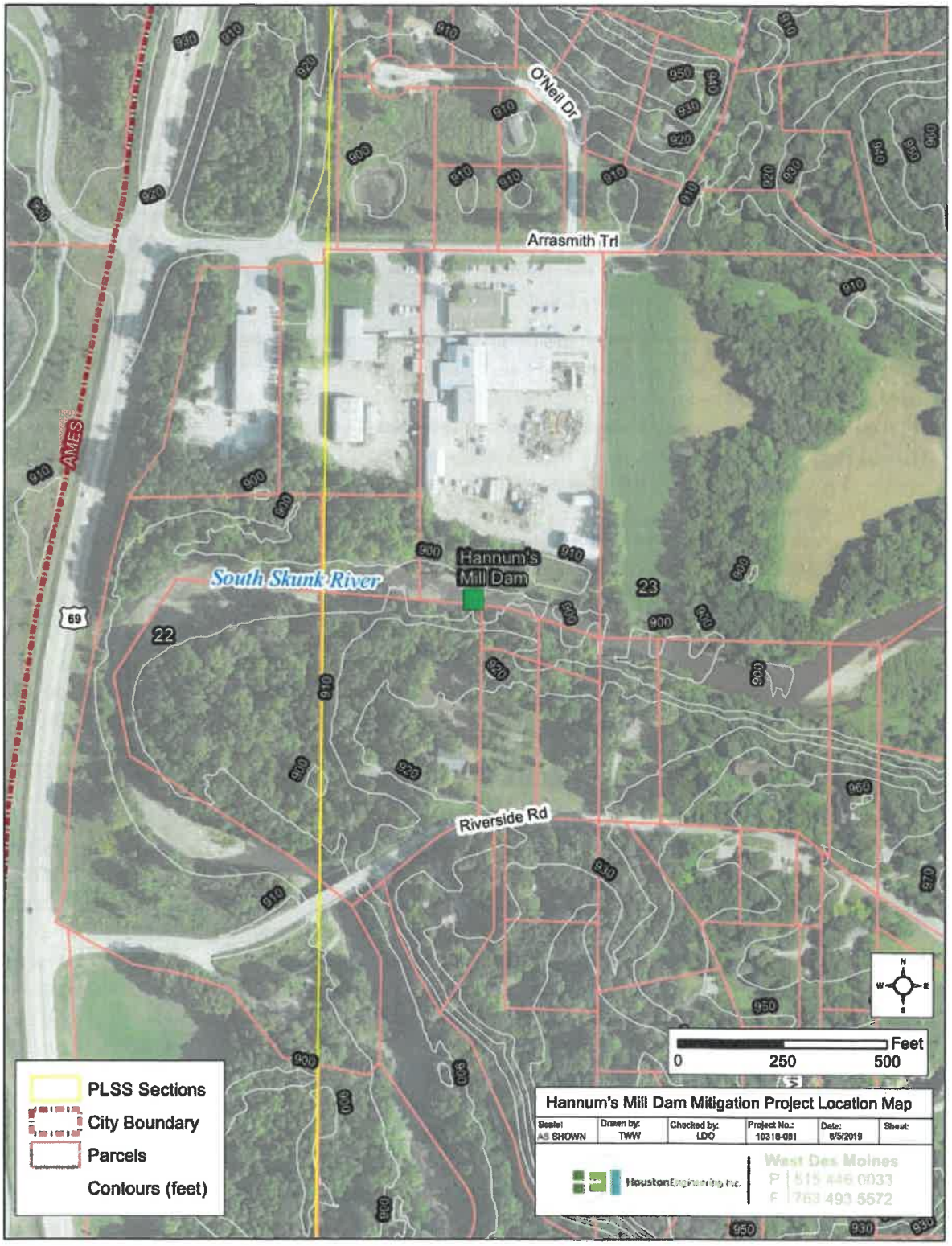


Figure 1: Hannum's Mill Dam Location

The South Skunk River originates in Hamilton County as a non-meandered stream prior to joining the North Skunk River in Keokuk County to become the Skunk River. The South Skunk River upstream of the confluence with Squaw Creek and the northern Story County line is designated a Protected Stream in Iowa Administrative Code (567 – 72.2(455B)). This designation means that no channel changes are allowed due to actual or potential adverse effects on fisheries, water quality, and flood plain management. The contributing watershed to the Hannum's Mill Dam is approximately 318 square miles and lies entirely within the Des Moines Lobe ecoregion. Soils are typical of the region with 88.7% classified as type B hydrologic soils (Soil Survey Staff, 2018) with a low mean basin slope of 1.93% (computed from a 10m digital elevation model (DEM)). The rich soils and drainage support agricultural land use, which constitutes 86.9% of the land base. Urban land use constitutes 8.33% of the basin (USGS, 2019). While the watershed is primarily agricultural, the greatest use of the river as a water trail occurs within the Skunk River Greenbelt that extends from Story City to Ames (Ji, 2010).

From 1921-2018, the daily discharge on the South Skunk River averaged 186.6 cubic feet per second (cfs). During this time a high annual mean of 667.6 cfs in 2010 and a low annual mean of 5.57 cfs in 1956 were observed. The highest daily mean discharge of 12,400 cfs was observed August 11, 2010 and also set the maximum peak stage of 19.04 feet (note that seven additional ungaged floods occurred previously that exceeded gage capacity (Barnes, 2012)). Average annual runoff during the 98-year period has averaged 8.1 inches, while the past 10-year average runoff has been 12.9 inches and 2018 had 13.8 inches. The minimum annual runoff was 1.7 inches in 2012 and the maximum was 28.78 inches in 2010. Discharge is seasonally driven with highest discharges regularly observed from March-June and low discharges commonly observed in December-January. The hydrology of the region continues to change with impacts to both total baseflow discharge and the timing of discharge. These changes are driven by common increases in precipitation in May and June (Ayers, 2018).

The USGS has operated a stream gage near Sleepy Hollow Park since 1919. The dam gage was abandoned in 1986 with the installation of a modern streamflow gage on the Riverside Road bridge approximately 1,850 feet downstream (see **Figure 1**). Ownership interest of the USGS gage number 05470000 on the left bank of the Hannum's Mill Dam—specifically the USGS gaging station—was transferred to the private property owner in the mid-2000s (left bank USGS Agreement Number 8591-07-01, authorized June 25, 2008).

Stream reaches in the vicinity of Hannum's Mill Dam exhibit a range of slope and stability concerns. Eight reaches were identified as having a severe erosion rating based on USDA-NRCS streambank erosion and sediment delivery estimate criteria (EOR, 2018; Wagner, 2016). These reaches are upstream and within 3 miles of Hannum's Mill Dam. Additionally, the right bank immediately downstream of Hannum's Mill Dam exhibits a very severe erosion rating (Wagner, 2016). These areas are identified in this technical memorandum to address known bank instability concerns on the South Skunk River in the vicinity of the Hannum's Mill Dam. The remainder of this memorandum addresses the area of interest within 400 feet upstream and downstream of the Hannum's Mill Dam.

2.2 SITE HISTORY

Hannum's Mill Dam was originally constructed as a timber mill in the 1856 by millwright Hiram Ferguson. The location was chosen due to the shallow bedrock at the site. The first owner, John Miller, used the waterpower to operate the sawmill. The mill was converted to a grist mill in the 1860's by Robert Hannum and was operated by waterpower until problems with low water forced a steam engine to be added in 1870. The limestone abutments for a bridge are still present upstream of the dam. In 1882 Hannum's Mill

was moved to Odebolt in Sac County (William, 1911; Graham, 2007). **Figure 2** shows a lithograph of the dam, dated 1875, on the South Skunk River near Ames, Iowa.

The dam functioned as an active USGS gaging station from July 1920-2003 when the USGS moved the gaging station. The Hannum's Mill Dam was converted to a weir by the USGS in 1920 and repairs were made in two phases in 1964. At that time, an estimated 180 tons of rock and broken concrete fill were used to fill the hole beneath the dam to a depth of 5 feet. 24 yards of concrete and 31 re-rods were added to the cap. The cap varied in depth from 6 inches to 24 inches deep and was approximately 10-12 feet wide. In 2003, the gaging station was moved to 20 feet downstream from the Riverside Road bridge on West Riverside Road, at which point ownership of the abandoned gaging station reverted to the landowner (USGS, personal communication, 2019).

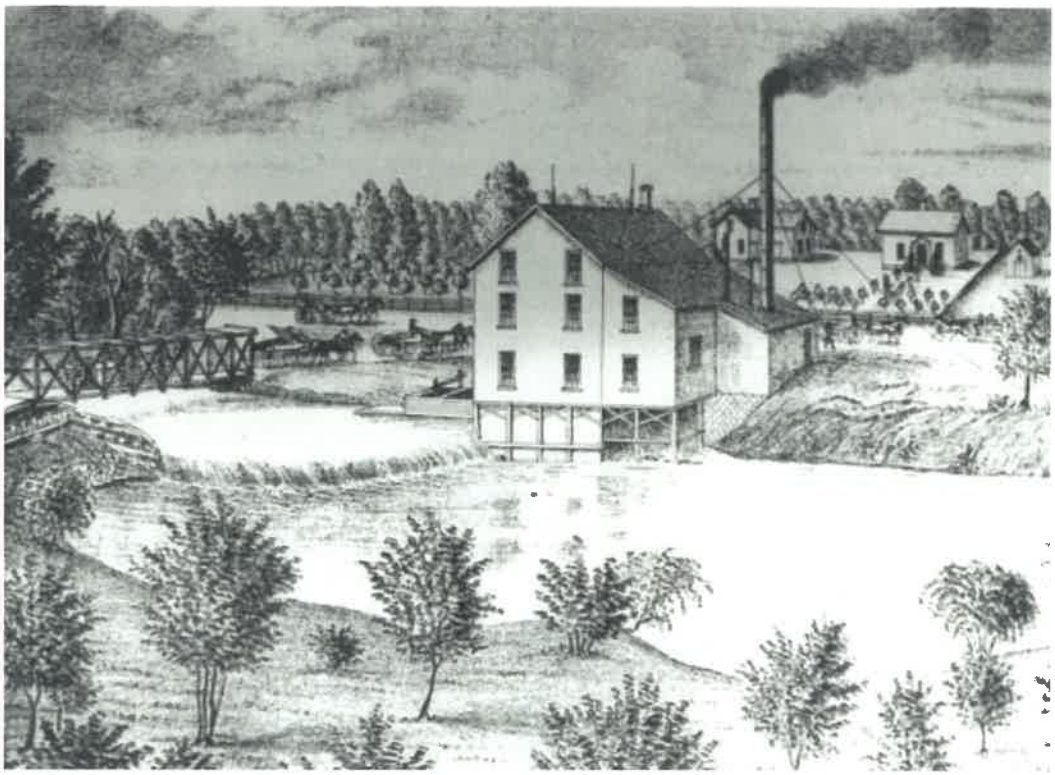


Figure 2: Hannum's Mill Lithograph 1875 (Andreas, 1875).

2.3 DESCRIPTION OF PROBLEM

Dams have historically been an engineering solution to provide recreational opportunities, provide water supply, and address channel instability by providing grade control within a degrading stream or river system. However, this solution is not without several negative effects:

- Depending on flow conditions, low head dams cause a hydraulic roller that poses a major safety concern to the public.
- Dams ecologically disconnect a river system by preventing multiple fish species from traveling upstream to optimal spawning habitats.
- Low head dams may cause bank and channel profile instabilities as they disrupt the natural sediment transport processes of the stream.

- As a structural solution, low head dams deteriorate over time and can require ongoing and expensive maintenance repairs.

These negative effects and their applicability to Hannum's Mill Dam will be discussed in this section.

2.3.1 SAFETY

The site has been responsible for several deaths. On May 3, 1963, 15-year old David Barnhart was floating down the river when his raft capsized over the dam and he was drowned (The Ames Tribune, 1963). On April 17, 2005, canoeist Thomas (Tom) Manatt was drowned (Klein, 2005). Following this death funds were donated to construct the portage around the dam.

Currently rebar protrudes from the concrete cap, increasing the chances of a canoeist or floater being snagged, capsized, and drowned. Other paddlers have noted similar situations of capsizing, though avoiding fatality (Wagner, 2016; HEI online and public surveys 2019).

Hannum's Mill Dam ranks in the 50th-74th percentile in relative risk analysis of all the low head dams as identified in the Iowa Stream Mitigation Method Version 2.0 (US Army Corps of Engineers, 2019). Factors used to assess risk include:

- proximity to population centers,
- known fatalities,
- height,
- type,
- near university/college,
- on designated water trail,
- river usage survey (total visits), and
- river usage (in-water visits).

Hannum's Mill Dam was ranked in each category, and as such is identified as a site that would benefit by improving public safety.

2.3.2 ECOLOGICAL

The South Skunk River upstream of the Hannum's Mill Dam site lies entirely within the Des Moines Lobe landform region. Agricultural land use dominates the contributing basin (greater than 85%) with less than 10% developed area in the watershed. Conversion of what was historically largely, prairie, wetland slough, and riparian wetlands (Government Land Office records) has changed the floristic nature of the catchment upstream of the Hannum's Mill Dam (US Geological Survey, 2018). The Greenbelt Conservation District — encompassing the South Skunk River riparian corridor from the northern Story County line to the City of Ames — protects the riparian corridor natural and agricultural lands through zoning regulations. The promotion of natural resource protection through soil and water conservation, drainage, and water retention, and cultural/historic restoration ordinances in this reach supports wildlife and serves as a migratory corridor. Multiple wildlife and avian assessments have been conducted during the development of the corridor to the present (e.g., Iowa Ornithologists' Union, 2019; Wagner, 2016) that support the preservation of riparian habitat to protect mature forests and fauna.

The South Skunk River has been regularly monitored by the Iowa DNR for fish and invertebrate communities. The aquatic life use for the Upper South Skunk improved from severely impaired in tributaries to moderately impaired in the main stem as of the early-2000s assessment (Wilton, 2004).

Recent surveys conducted by the DNR and the state hygienic laboratory (under contract by the DNR) to conduct fish and invertebrate survey assessments have shown an improvement in fish and benthic macroinvertebrates communities with multiple records at the nearest downstream site scoring 'fair' to 'good' (range from 'poor' to 'good'; Iowa DNR BioNet Site #811; ADBNet segment 03-SSK-934) with consistent biological communities similarly observed upstream (Iowa DNR BioNet Site #38; ADBNet segment 03-SSK-934). Iowa DNR biologist Jennifer Kurth conducted a statewide mussel survey (Kurth, 2017) and identified two species on the state-threatened species list, the Creek heelsplitter (*Lasmigona compressa*) and Cylindrical papershell (*Anodontoides ferussacianus*; Jennifer Kurth, personal communication, 2019) at multiple locations on the South Skunk River. Both species disperse with the assistance of host fish to transport developing mussels that are common within the South Skunk River (i.e., crappie, sculpin, channel catfish).

The emphasis on managing and restoring natural lands in the South Skunk River riparian zone varies by the four counties (Hamilton, Story, Boone, and Hardin) that contribute to the drainage basin in order of contributing area. Story County has set the most ambitious natural lands and wildlife goals of the four counties that are summarized in the 2016 Cornerstone to Capstone (C2C) Plan, Chapter 4. Dam mitigation for Hannum's Mill would directly address the following Story County C2C plan goals:

- NRR1.2: Preserve, enhance, and, where possible, restore the natural and beneficial functions of wetlands, streams, rivers, creeks, and lakes;
- NRR3.2: Preserve and protect the existing native plants and animals as well as re-establish them where they historically occurred; and
- NRR4.5: Provide safe biking, hiking, watercraft, fishing, hunting, camping, swimming, and equestrian opportunities within the county.

Dam removal or mitigation efforts would support C2C goals as well as facilitate community educational opportunities. These opportunities will result in community engagement and recreational opportunities.

The mitigation or removal of the Hannum's Mill Dam could improve the dispersion of both mussel species that have been observed downstream of the Hannum's Mill Dam, but in-stream habitat also determines a species range. With the mitigation of the downstream 13th Street Dam in Ames (currently in progress) the improvement of fish passage at Hannum's Mill Dam could improve upstream fish dispersal at low-flow conditions by 8.5 miles of river channel (mainstem of the South Skunk River). Analysis completed by the DNR for low head dams in Iowa rank the Hannum's Mill Dam an aquatic life passage multiplier of 0.14[1] (dimensionless ratio from 0-1, 0 low and 1 high).

2.3.3 MAINTENANCE

The dam was capped with concrete in 1964, however this cap is reaching the end of its lifespan and is due for maintenance (flow is currently passing beneath the cap at all water elevations). Rebar protrudes from the cap and river users report significant undercutting on the downstream side. The dam currently has no formal maintenance agreement or schedule, and as such will continue to deteriorate with the potential for failure increasing over time. Failure may result in a significant discharge, exacerbating downstream bank instability or an influx of sediment in the downstream channel. The US Highway 69 embankment is 1,190 feet downstream from the dam, and a dam failure could impact this embankment.

[1] Iowa Stream Mitigation Method 2.0, February 2019, 'Aquatic Life Passage Table', https://www.iowadnr.gov/Portals/idnr/uploads/RiverRestoration/Mitigation_Calculator_022819.xlsx.

2.4 PROJECT INITIATION

With these issues in mind, particularly safety, the SCC Board sought services for exploratory engineering and survey.

The exploratory phase will assess the current state and potential future management of the Hannum's Mill Dam. This assessment will include soliciting public input, establishing project goals, researching and initiating regulatory needs and permitting, and developing several concepts. The concepts will be evaluated based on the project goals and public input. This exploratory phase was completed during the summer and fall of 2019. Following completion of the exploratory phase, SCC may choose to move forward with preliminary engineering of a selected concept.

2.4.1 PARTICIPANTS

Participants facilitating and funding the exploratory phase process included SCC, the motivating local entity behind the review of the Hannum's Mill Dam, and the Iowa DNR Water Trails and Dam Mitigation program. Pat Shehan was the project manager on behalf of SCC and coordinated project activities on behalf of the facilitation team.

Core stakeholders identified by the facilitation team—representative of private property owners, public organizations, and stakeholder groups—were contacted to ensure organizational staff and volunteers were aware of public stakeholder meetings. Public participation in meetings and the review of alternatives and concepts was crucial to the success of this project. Core stakeholders are discussed further in **Section 4**.

The public was informed of this project through public outreach conducted by SCC staff. Public meetings were advertised by email to the SCC listserv, public notification on the SCC website and Facebook account, and distribution to local media.

3 FIELD SURVEYS

The dam site project area includes the bridge approach immediately upstream of the Hannum's Mill Dam extending to the upstream bend approximately 790 feet upstream and approximately 400 feet downstream. Primary goals of the exploratory phase include assessing the current condition of the dam and regulatory requirements related to potential concepts. The following sections describe data gathered through topographic, archeological, and mussel survey.

3.1 CONCEPT LEVEL TOPOGRAPHICAL SURVEY

HEI completed a field survey on August 9th, 2019. Survey was completed using a Total Station. This survey assessed the South Skunk River upstream and downstream of the Hannum's Mill Dam to best reflect the topography and stream morphology of the site. Transects were identified in advance of field survey work using imagery of the South Skunk River at low-flow conditions and with LiDAR data.

3.1.1 SEDIMENT QUANTIFICATION

Field survey topography was integrated with LiDAR data (Iowa Lidar Consortium, 2007) to assess channel slope within the impoundment, specifically to assess the upstream extent of the pool, and floodplain topography above the left and right bank elevations. Using a three-dimensional wedge analysis, the likely sediment in the upstream pool is estimated to be 8,435 tons. The annual sediment

transport through Hannum's Mill Dam is estimated to be 9,041 tons per year (RUSLE analysis completed by Andy Asell with the Iowa DNR using 10-meter DEM). The sediment stored behind the dam is less than the annual sediment load estimated to be delivered to the dam annually from normal runoff, which is important as removal or mitigation is unlikely to result in a large amount of sediment that would have negative impacts on aquatic biota (e.g., smother mussel beds, impact spawning fish or nesting habitats, feeding habitat for macroinvertebrates, etc.). The low sediment volume is likely in part a result of the concrete cap being undermined and the flow of water, and the conveyance of sediment, beneath the concrete cap at all flow conditions. Based on the sediment load estimate behind the dam the removal or mitigation of the dam is unlikely to require additional management during activities nor require activities to be conducted in phases to control sediment release during each step.

3.1.2 GEOMORPHIC ASSESSMENT

The dam was originally constructed at the site due to the limestone bedrock throughout the reach. The limestone banks are not easily erodible; however, the right bank has experienced significant erosion in recent years during high water levels that induce scouring immediately downstream of the dam with the associated hydraulic drop. In addition, water velocities immediately downstream of the dam are increased (due to the change in slope), while velocities behind the dam are decreased (water impoundment by the dam and the abandoned bridge approach). This disruption in natural sediment transport processes is exacerbated by other changes within the watershed, such as changes in land use or storm intensity, which increase runoff and precipitation, respectively. Bank instability on the South Skunk River is common in the meandered reach upstream and immediately downstream of Hannum's Mill Dam. Infrastructure protection downstream of the dam along the right bank is critical to the protection of US Highway 69, receiving a very severe erosion rating, with eight upstream reaches on the outside bends of the river classified with a severe erosion designation (Wagner, 2016). Additional reaches of likely streambank instability and erosion are identified in the 2018 Countywide Watershed Assessment (EOR, 2018) with several opportunities to address severe or greater bank instability issues upstream of the dam and to enhance wildlife habitat in the region. Unstable banks and concern about property loss have been regular concerns in this reach of the river that are sand- and gravel-dominated.

Changes in sediment conveyance are observed elsewhere in this reach beginning approximately 700 feet upstream and continuing upstream to the 190th Street crossing. The channel centerline has completely inverted its form (rivers follow an approximate sine pattern to dissipate energy) since the 1930s to the late 2000s when LiDAR was flown. Since the late 2000s, the channel structure has continued to migrate over the past decade towards the previous state observed in the 1930s. Change in the river form has consistently been within the low floodplain north of Ames, Iowa, but the form is likely to continue to change with altered hydrology, characterized by higher and more sustained flows, in the watershed (Ayers, 2018). This reversal of sin curve is shown in **Figure 3**.

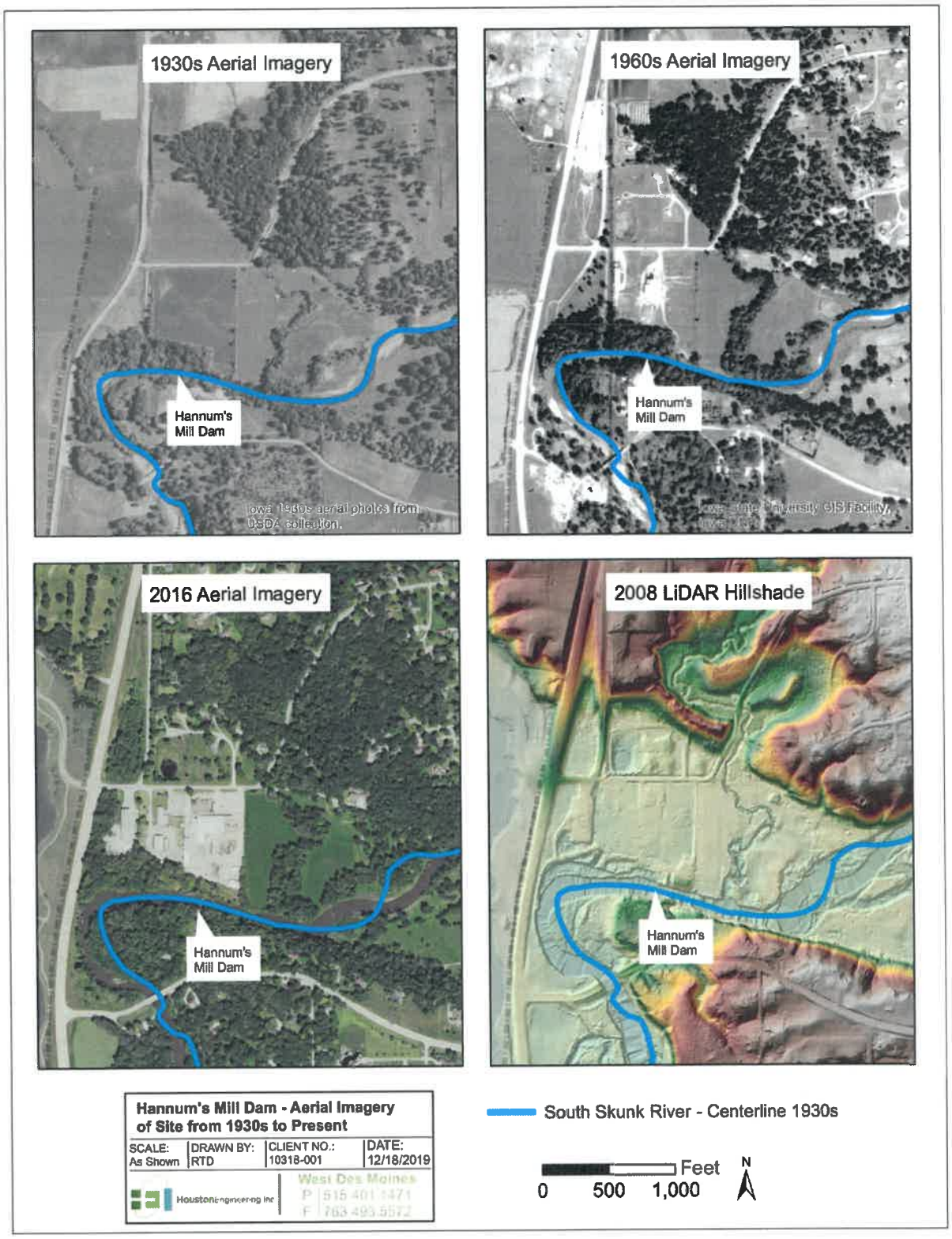


Figure 3: Comparison of Channel Location - 1930's to Present

Within 500 feet upstream of the dam, bank stability and cross-section form vary within the assessed reach, primarily as a function of the Mississippian limestone bedrock outcrop. The channel form has a broader cross-sectional profile relative to the assessment completed by the Iowa DNR at Sleepy Hollow Park downstream of the project area in 2018. The South Skunk River is restricted by the bedrock outcropping that subsequently increases the cross-sectional area from approximately 650 square feet (reference reach at Sleepy Hollow Park) by greater than 50% as discharge is consistent within the reach but the constrained channel prevents lateral connectivity of the main channel to the floodplain (inundated during 10-year or larger flood event per the FEMA 2015 statewide flood risk areas assessment[2]). The change in channel form is distinct to the South Skunk River upstream and downstream of the dam that is characterized as a C4 stream (slightly meandering and gravel-bottomed stream) to a G1 (channel constrained by bedrock with little sinuosity).

3.2 ARCHAEOLGICAL SURVEY

The Hannum's Mill Dam historic nature was identified as requiring further study due to the potential historical nature of the site by project partners as well as in previous studies of the South Skunk River (e.g., Wagner, 2016; Ballard, 1984). The area around the dam has been assessed by community residents at low flow over the decades with the most detailed professional analysis prior to the current survey completed in 1970s by David N. Ballard, Jr. (Ballard, 1984). Ballard assessed the timber structure within the dam and mapped the original upright logs from the crib and timber dam. Subsequent management by private property owners, SCC staff or volunteers, and partnerships with conservation organizations such as the National Civilian Community Corps (NCCC) or Conservation Corps Minnesota and Iowa (CCI), have improved passage for passive recreation on the South Skunk River but altered the dam structure (super- and sub-structure). The conversion of the crib and timber structure to a concrete-capped weir by the USGS is not considered historical in nature and assessment of the site reviewed below pertains to the original crib and timber structure as well as pre-European settlement history.

The project area around the Hannum's Mill Dam was assessed by Tallgrass Archaeology, LLC. between August 12-19, 2019, led by primary investigator and principal archaeologist Leah D. Rodgers. The results are presented in the report "Hannum's Mill Dam Mitigation (Phase 1: Exploratory) in Franklin Township, Story County, Iowa, Phase I Archaeological Investigation" (provided to SCC staff; not for public release by state code). The proposed project is currently in the concept stage but may be a federally assisted undertaking as it moves forward, thus falling under the requirements of Section 106 of the National Historic Preservation Act of 1966, as amended (NHPA). Section 106 requires Federal agencies to consider the effects of their undertakings on historic properties, and to afford the Advisory Council on Historic Preservation (ACHP), the State Historic Preservation Officer (SHPO), and others as appropriate, a reasonable opportunity to comment on such undertakings.[3]

The field investigation was led by Cindy L. Nagel, Ashlynn Brown, Lisa Goffstein, Addison Marsengill, Dan McCullough, and Jeb Rosebrook. Survey included a pedestrian surface survey to identify landforms and current field conditions within the project area, systematic subsurface testing conducted as auger tests at intervals no greater than 10 meters apart. Subsequent shovel and Seymour bucket auger tests as described in Rodgers 2019. Hannum's Mill Dam was the single known site (13SR173) prior to the survey conducted by Rodgers in 2019 that identified two additional sites (13SR368 and 13SR369) that are not

[2] Iowa DNR. Flood Risk Areas. March 2015. https://geodata.iowa.gov/dataset/flood-risk-areas
[3] ACHP Section 106 Regulations Summary, accessed at http://www.achp.gov/106summary.html, February 2015 and 36 CFR Part 800 - Protection of Historic Properties incorporating amendments effective August 5, 2004, accessed at http://www.achp.gov/regs-rev04.pdf.

eligible for inclusion in the NRHP as an individual site or a contributing site to any potential historic district.

The Hannum's Mill Dam site has been significantly disturbed through the conversion of the log crib dam to a gauging weir for the USGS and the loss of all contributing infrastructure regarding mill operation. In comparison to other known mill and dam sites in Iowa, the dam and associated sites that comprise site 13SR173 do not retain sufficient integrity to be considered eligible for NHRP as an individual archaeological site.

3.3 MUSSEL SURVEY

A mussel survey was conducted August 9, 2019, by the State Hygiene Laboratory by project led by Michael W. Birmingham and joined by Iowa DNR mussel biologist Dr. Jennifer Kurth. The reach immediately upstream of the dam, including the sediment wedge, to West Riverside Road was assessed at approximately 60 cfs (USGS station 05470000 located at the West Riverside Road) with fair to marginal visibility. The survey of 300 meters of stream reach included 10 people that provided visual search of shallows as well as mask/snorkel collecting in water approximately knee to chest depth. Surveys of pools greater than 4 feet in depth was not attempted. The sample reach had mixed habitat.

Greatest mussel abundance was observed in runs with stable rocky substrates that is characteristic of riffle reaches of the South Skunk River (Survey of Sleepy Hollow Park, 2017). A total of six living species were collected, including two state-listed threatened species the cylindrical papershell (*Anodontoides ferrusacianus*) with four mussels and the creek heelsplitter (*Lasmigona compressa*) with only a single mussel. Common living and empty mussel shells included five fragile papershell (Leptodea fragilis), 13 white heelsplitter (Lasmigona complanata), 33 fatmucket (Lampsilis siliquoidea), and 66 plain pocketbook (Lampsilis cardium) with only shells found of the threeridge (Amblema plicata).

3.4 STREAM BIOTA

Monitoring of the South Skunk River in Sleepy Hollow Park has been regularly occurring since the early 2010s with macroinvertebrate and fish survey results available through the Iowa BioNet[4] web portal. Site 972 at Sleepy Hollow Park—designated 'South Skunk River Ames (US1)'—is anticipated to reflect the biological assemblage at the dam as the site is within a half mile of Hannum's Mill Dam. The indices for the warm-water system (use designations include classes A1, B(WW-1), and HH) regularly receives 'fair' to 'good' Benthic Macroinvertebrate Index of Biotic Integrity (BMIBI) with no state or federal threatened or endangered species observed. Similarly, at station 38, designated 'South Skunk River Ames' approximately 5 miles upriver of Hannum's Mill Dam, the macroinvertebrate and fish communities score good to excellent and poor to good, respectively, with no state or federal threatened or endangered species observed. The South Skunk River north of the City of Ames is a popular Small Mouth Bass fishery by river anglers and habitat improvements that improve benthic stability and reduce in-stream sedimentation are likely to improve habitat for game species.

[4] https://programs.iowadnr.gov/bionet/

4 PUBLIC INPUT IN IDENTIFYING PROJECT GOALS

Another of the primary goals of this exploratory phase is to establish goals and priorities of the project. These goals will be based on community input as well as regulatory and technical requirements.

4.1 OVERVIEW OF PUBLIC INPUT GOALS

Public infrastructure, such as dams that have a historic value to a community, require active dialogue to ensure that members of the community are provided the opportunity to share their opinions about management decisions that may alter the function or appearance of the feature. Conversations that first characterize the site, specifically what is important to the public, are critical to prioritizing features that are characteristic of the site or recreating those features as part of the future managed state. It is critical to effectively prioritize features that are unique to that community including private property owners, the public, and permitting agencies. Engagement facilitates the identification of community goals and potential permitting regulations required to identify a course of action that achieves future management goals for all parties. While permitting and regulations may require the prioritization of other unique features to the site to protect historical, ecological, or infrastructure needs of a site, the diverse community identifications are core to developing a future management conceptual design.

4.2 PUBLIC INPUT DATA GATHERING

The Hannum's Mill Dam is a historic structure. There are several local groups that are invested in the management decisions to protect the historical nature of the dam, the safety of residents using the water trail on the South Skunk River, private landowners adjacent to the dam, and angling clubs that fish the South Skunk River. The management of the dam also impacts regional partners such as the City of Ames that has invested in improving water quality in the South Skunk River, is mitigating the 13th Street Dam in the North Riverside Park on City of Ames property, and co-operates the jointly named Highway 69/Grand Avenue. Additional partners include the Iowa DNR, who is invested in ensuring public safety on state-designated water trails, and the USGS, who took ownership of the dam following the conversion of the crib and timber structure to a gauging weir in 1919. The future management decisions for the Hannum's Mill Dam impacts many vested stakeholders. Soliciting their knowledge of the site to potential impacts of management decisions that affect site features is crucial to develop an informed framework to support conceptual designs proposed for future site management.

Central stakeholders to the public input process include those participants directly impacted by management decisions to the Hannum's Mill Dam as well as those indirectly or potentially affected by modifications. Central stakeholders, including the primary representatives, identified by SCC staff are identified in **Table 1** by organization as well as primary area of interest with respect to the Hannum's Mill Dam. Individual stakeholders were informed of planned public meetings beginning in May 2019 by way of the SCC web page.

***Table 1: Stakeholder groups** involved with **management and local planning** efforts on the South Skunk River.*

Organization	Organization Priority	Primary Contact
Hawkeye Fly Fishing Association	Angling	Steve Veysey
Outdoor Alliance of Story County	Water Trails	Diane Birt
Ames Anglers	Angling	Lee Huey
Skunk River Paddlers	Water Trails	Rick Dietz
Iowa DNR	Water Trails	Nate Hoogeveen

Organization	Organization Priority	Primary Contact
Iowa DNR	Fisheries	Ben Dodd
City of Ames	Infrastructure (noncontiguous)	Dustin Albrecht
Ames Historical Society	History	Carly Hlubek
Story County Historical Society	History	
Iowa DOT	Infrastructure (noncontiguous)	
USGS	Structure owner	
North Property Owner(parcels 0523310105 and 0523310001)	Landowner (right bank)	*
South Bank Owner (parcels 0523300200)	Landowner (left bank)	*

* Private property owners contacted by SCC representatives Pat Shehan and Mike Cox regarding property management goals, access, and maintenance agreements.

4.3 PUBLIC INPUT SOLICITATION FORMAT

Public input was solicited through two public meetings with an open forum as well as through an online survey. Open public input is critical to engaging the community in identifying risks or priorities not previously identified by consulting researchers or the project manager. However, forums provide qualitative feedback that prevents public responses from being equally considered amongst all participants. Surveys facilitate public response and allow for quantitative assessment across participating organizations and individuals.

4.3.1 ONLINE SURVEY FORMAT

The survey used for the Hannum's Mill Dam exploratory phase was designed to assess:

- how participants use the South Skunk River around the Hannum's Mill Dam,
- what is important to the site to them as a user,
- whether they perceive the community interests as different than their individual interests,
- what about the site is critical in representing the historic dam site, and
- what site characteristics are desirable to them as a user if the site is modified by dam removal or mitigation.

Responses encompass primary goals identified by the SCC and summarized as three groups: safety for water trail users (paddlers and tubers), ecological (fish and mussel passage, bank stability), and historical (maintenance of existing site features either on- or off-site). Permitting and infrastructure needs will also influence conceptual design criteria and will likely outweigh public priorities for conceptual design if there are areas where prioritized goals conflict.

The online survey was emailed to residents on the SCC email list July 16, 2019, posted on the SCC webpage, and advertised by social media. The survey questions were identical to those asked during the public meeting.

The online survey template can be found in **Appendix A**.

4.3.2 PUBLIC FORUM FORMAT

The first public forum was held on July 30th, 2018 at 6:00 PM at the McFarland Park Conservation Center. A presentation was given overviewing the exploratory phase of the project, the planning process,

and a history of the dam. A questionnaire was distributed after the presentation. This questionnaire had the same questions as the online survey and is shown in **Appendix B**. Following the questionnaire, the planned activity was to break into small groups to discuss the questions. This would facilitate evaluating changes in attendee response after community discussion, to evaluate community vs. individual goals. However, the group of attendees was small (10 people signed in) and mostly consisted of regulatory agency representatives, the SCC Board, and several Skunk River Paddlers. Attendees were all very well informed of the problems and issues, thus a change in questionnaire responses was deemed unlikely. Questions were discussed as a group to facilitate more robust qualitative feedback. The second public meeting (see **Section 7.5**)facilitated the review of primary and secondary goals identified in part through the first public meeting in conjunction with the review of conceptual alternatives.

4.4 ANALYSIS OF PUBLIC INPUT

Following the public forum, the questionnaires results were appended to the online survey results to form one dataset. The online survey and public forum resulted in a total of 37 responses. The following sections will describe the results of the public input solicitation.

4.4.1 RESPONDENT USER GROUPS

The first two question asked respondents 1) "How often do you use the area immediately adjacent to Hannum's Mill Dam?") and 2) "How do you enjoy the South Skunk River around the Hannum's Mill Dam? - select all ways you use the river." These two questions were used to identify user groups based on frequency and type of use. Four categories were used based on frequency: non-users, low frequency users (1 time per year), medium frequency users (2-5 times per year), and high frequency users (5 or more times per year). The categories based on use were: Water Trails (Paddler/floater), Visual Appreciation, Fishing, Audible Appreciation, and Historical Appreciation.

4.4.2 NUMERIC CODING

Multiple questions on the survey asked users to agree with statements of importance using a "Strongly Agree, Agree, Neutral, Disagree, and Strongly Disagree" format. For the purposes of quantitative analysis these statements were transformed into numerical values. Five (5) was used to signify characteristics that were important to respondents, and one (1) was used to signify characteristics that were not important to respondents.

4.4.3 IMPORTANCE OF CHARACTERISTICS (INDIVUDUAL AND COMMUNITY)

Survey participants were asked to agree with statements on the importance of characteristics of the site, (i.e., strongly agree, agree, neutral, disagree, and strongly disagree). Participants were asked their opinion and also asked about their perceived community opinion. The numeric results of these two questions are shown in **Table 2** and **Table 3** respectively. Among individual responses, the average equivalent scores indicate that all user groups "strongly agree" that "safety for river users (paddlers and tubers)" is important. All user groups except non-users strongly agreed that "Aquatic wildlife (fish/mussel passage)" is important. Generally, the average of all respondents agreed that "recreation (water trail)," "accessibility by land," "terrestrial habitat," and "fishing" are important. Participants were neutral on "water levels (maintain current elevation)" and "historic nature of the site." Some responses for "other" included: kayak canoe access, no crowds, downstream bank stability, and water quality. Unsurprising, the fishing and historical appreciation user groups ranked fishing and "historic nature of the site" respectively as more important compared to the average participant.

Survey participants' perception of community opinions generally followed similar trends. Participants perceived that "aquatic wildlife (fish/ mussel passage)" is less important to the community, but still agreed it was important. Participants perceived that fishing is more important to the community than displayed in individual responses.

*Table 2: Numeric Score by User Group: Importance of Characteristics to Individuals (**5** = High Importance, 1 = Low Importance)*

Group	Count	Safety for River Users (Paddlers and Tubers)	Aquatic Wildlife (Fish/ Mussel passage)	Recreation (Water Trail)	Accessibility by Land	Terrestrial Habitat	Fishing	Water levels (Maintain Current Elevation)	Historic Nature of the Site	Other
Water Trails (Paddler/floater)	21	4.9	4.6	4.8	3.9	4.0	3.6	3.1	2.7	2.9
Visual Appreciation	17	4.9	4.7	4.4	3.8	4.2	3.6	3.3	3.4	2.7
Fishing	11	4.7	4.5	4.6	4.3	3.8	4.9	3.1	2.6	2.7
Audible Appreciation	10	4.9	4.7	4.5	4.0	4.3	3.8	3.0	3.4	2.7
Historical Appreciation	8	4.8	4.9	4.3	3.9	4.4	3.5	3.5	3.9	2.9
High Frequency Users	8	4.6	4.9	4.6	4.4	4.4	4.4	3.9	2.6	2.9
Medium Frequency Users	11	5.0	4.5	4.5	3.9	4.1	3.4	3.5	2.8	2.5
Low Frequency Users	9	4.7	4.6	4.2	4.1	4.0	3.3	1.9	3.2	3.0
Non-Users	9	4.9	4.1	4.3	3.7	3.3	3.2	2.6	3.0	3.0
All	37	4.8	4.5	4.4	4.0	4.0	3.5	3.0	2.9	2.8

*Table 3: Numeric Score by User Group: Importance of Characteristics to the Community as perceived **by** Individuals (5 = High Importance, 1 = Low Importance)*

Group	Count	Safety for River Users (Paddlers and Tubers)	Aquatic Wildlife (Fish/ Mussel Passage)	Recreation (Water Trail)	Accessibility by Land	Terrestrial Habitat	Fishing	Water levels (Maintain Current Elevation)	Historic Nature of the Site	Other
Water Trails (Paddler/floater)	21	4.7	4.0	4.4	3.7	3.7	4.1	3.7	3.2	3.0
Visual Appreciation	17	4.8	4.3	4.5	3.6	3.9	4.1	3.5	3.6	2.8
Fishing	11	5.0	3.6	4.3	3.9	3.4	4.5	3.5	3.4	2.8
Audible Appreciation	10	4.7	4.3	4.3	3.5	4.1	4.0	3.5	3.7	2.8
Historical Appreciation	8	4.6	4.4	4.5	3.6	4.0	4.0	3.6	4.0	2.8
High Frequency Users	8	4.9	3.5	4.4	4.0	3.8	4.4	4.1	3.4	2.9
Medium Frequency Users	11	4.7	4.1	4.6	3.7	3.8	3.9	3.8	3.2	2.9
Low Frequency Users	9	4.7	4.2	4.1	3.8	3.7	4.1	2.8	3.3	2.8
Non-Users	9	5.0	3.7	4.4	3.7	3.3	3.6	2.9	3.6	2.9
All	37	4.8	3.9	4.4	3.8	3.6	4.0	3.4	3.4	2.9

4.4.4 PRESERVATION OF HISTORICAL REMNANTS

Survey participants were asked, "What potential remnant structures of the Hannum's Mill Dam are important to you to preserve?" Results of this survey question by user group are shown in **Table 4**. All user groups considered both "upstream dam pool elevations" and "in-stream dam/mill remnants as neutral or marginally important. The survey prompted for participants to list historic remnants that may be important under "other." Some responses for "other" included: remains of the historic bridge and roadbed and the out of stream mill remnants.

Table 4: Numeric Score by User Group: Preservation of Potential Historical Remnants (5 = High Importance, 1 = Low Importance)

Group	Count	Upstream Dam Pool Elevation	In-stream Dam/Mill Remnants	Other
Water Trails (Paddler/Floater)	21	2.4	2.0	2.4
Visual Appreciation	17	2.7	2.7	3.0
Fishing	11	2.5	2.2	3.0
Audible Appreciation	10	2.6	2.7	2.5
Historical Appreciation	8	2.8	3.1	3.5
High Frequency Users	8	2.5	2.1	3.5
Medium Frequency Users	11	2.8	2.3	1.0
Low Frequency Users	9	1.9	2.3	2.8
Non-Users	9	1.9	2.2	2.7
All	37	2.3	2.2	2.4

4.4.5 QUALITATIVE INPUT – WRITE-IN COMMENTS

Survey participants were asked for additional input within the survey and at the public information meeting. Through these prompts, several people commented on the safety hazard of the site in its current condition. Some participants commented on the maintenance of the portage, which has had erosion issues, and the smallmouth fishing opportunities.

When asked about what qualities make Hannum's Mill Dam unique, participants commented on its proximity to Ames and the Iowa State University (and therefore less experienced floaters), the limestone wall on the downstream south side, and the potential existence of the cribbing (protecting historic features) under the concrete cap. Public comments are summarized by survey question in **Appendix C**.

During the first public input meeting, attendees displayed similar opinions, ranking safety and recreation for paddlers as a top priority. Attendees discussed the proximity of Hannum's Mill Dam to Soper's Dam, which has already been remediated for water trail passage, and the 13th Street Dam, which is under construction to be mitigated with the construction of rock arch rapids. Attendees recognized the opportunity to create a recreational paddler feature in-between these other features, but also recognized that Hannum's Mill Dam is on private property, while the other two sites are within public parks. No consensus was formed on whether the Hannum's Mill site should be accessible and/or part of a larger park plan or if the site should be a less noticed pass through, and simply prioritize safety.

5 PROJECT GOALS

The project goals will be based on community input and regulatory requirements. Generally, it appears the community goals will not be in opposition to any regulatory requirements. Some designs may meet several project goals but fall short of meeting other goals. Therefore, it is important to establish a goal prioritization prior to reviewing concept plans. Based on the public input, field surveys, and regulatory requirements, the following list of prioritized goals has been developed.

5.1 PRIMARY GOALS

Primary goals are those necessary for the project to be considered successful.

- Increase safety to paddlers, floaters, and other river users.
- Improve aquatic wildlife habitat (fish/mussel passage)
    - Reduced sediment loading, water quality, smallmouth bass fishery, mussel habitat, etc.
- Maintain positive visual and audible aesthetic.

Increased safety for paddlers may be achieved by numerous means: removal, partial removal, rock arch, riffle, or dam modifications. Improvements to aquatic wildlife habitat may be a secondary benefit from the same actions that will increase safety for paddlers. Technical design criteria developed in support of the Iowa Stream Mitigation Method will be adhered to in the development of conceptual designs. Based on the responses to the survey, many users enjoy the visual and audible aesthetic of the area, which must be considered during concept development.

5.2 SECONDARY GOALS

Secondary goals are not necessary for the project to be successful, but achievement will improve the site's function for the community and/or stakeholders. Most of the goals listed below can be achieved by strategic design of the future selected alternative.

- Increase function of the site for recreation
- Maintain land accessibility, with consideration of private land ownership
- Improve terrestrial habitat
- Maintain or improve fishing
- Preserve out-of-stream historic remnants in-place and salvageable in-stream historic remnants off-site

Increasing the function of the site for recreation may be achieved solely with completed safety improvements; however, the project may incorporate riffles or white-water features that will make the site more of a destination for paddlers. The SCC Board should weigh the value of such features compared to the estimated project costs.

The site is owned by private property on both sides, and as such has not previously been a destination, but rather a pass through. Paddlers can get to the site via access at the North Peterson Park Access (or other upstream access), and the selected mitigation practice should be designed such that these accesses are maintained. The SCC Board should consider whether future projects should increase land accessibility to the site or maintain the current level of access.

Terrestrial habitat may include the bank vegetation and immediate floodplain vegetation. The downstream north bank has eroded significantly in recent years, and terrestrial habitat may be a consideration when designing practices to stabilize this bank.

Community members currently access the site through the portage and fish in the area from the concrete cap on the north side. While this specific fishing location may be altered during construction, fishing throughout the reach should be a consideration of the project. Fish habitat may be improved simply by improving the aquatic habitat, a primary goal, but access is not planned to be improved as the dam is located on private property.

While in-stream historic remnants did not have a significant value to the community—and are likely in a very deteriorated state—the out-of-stream historic remnants, particularly the roadway bed, are of value to the community and should be preserved. As a part of this project, SCC may choose to highlight out-of-stream historic remnants as identified in the Story County C2C Plan and South Skunk Water Trail Plan.

5.3 TECHNICAL DESIGN CRITERIA

Technical design criteria are more specific then project goals and provide a design metric by which to gauge the success of meeting project goals. Upon selection of a mitigation approach or concept, specific technical design criteria will be developed. Design criteria will be based on site specific conditions, specifically site stability as identified through hydrologic, hydraulic, and geotechnical modelling and field assessment; and DNR guidelines.

6 PERMITTING AND REGULATIONS

As a component of the Exploratory Phase 1 of the Hannum's Mill Dam project, HEI reviewed all potential regulatory/permitting requirements and implications for the proposed project alternatives. This included a review of federal, state, and local rules and laws. Through this process, we have identified the permit requirements for both alternatives and established a general strategy for each permit and agency. The following summarizes those permits, their conditions, and identifies next steps.

6.1 FEDERAL CLEAN WATER ACT PERMIT - US ARMY CORPS OF ENGINEERS

Section 404 of the federal Clean Water Act (CWA) requires permits for the discharge of dredged or fill material within a Waters of the US (WOTUS). The project will qualify for Nationwide Permit #53 for Low Head Dam Removal, rather than a more exhaustive individual permit.

The USACE cannot issue a permit without a determination regarding compliance with Section 7 of the Endangered Species Act (ESA) and Section 106 of the National Historic Preservation Act (NHPA). Regarding the ESA, there are no protected species found within the project area that may be impacted by the project. There are four ESA protected species identified as potentially present within the general area of the project, including the endangered Northern Long-Eared Bat (*Myotis septentrionalis*), the threatened Indiana Bat (*Myotis sodalist*), and upland plant species the threatened Prairie Bush-clover (*Lespedeza leptostachya*) and the threatened Western Prairie Fringed Orchid (*Platanthera praeclara*). The project area does not include any suitable habitat (prairie) for either of the flowering plant species. Regarding the two bat species, the project area likely does not include any areas suitable for roost nests or hibernacula, however, we recommend that we plan to complete any required tree removals outside of the nesting period of June-July 31.

HEI retained Tallgrass Archaeology for the investigation of the dam and surrounding structures to determine the qualification of these areas for listing as a National Register of Historic Places (NRHP). Tallgrass Archaeology determined that there are no features within or adjacent to the project area,

including what remains of the mill/dam structure, that would qualify for listing in the NRHP. Their report will be submitted to the USACE at the time of permitting to initiate coordination with the Iowa State Historic Preservation Office.

A pre-application meeting was held with Kirsten Brown with the Rock Island District of the USACE on December 4, 2019. Based on discussion with her regarding our project alternatives, we are confident that either of the project alternatives will meet the standards of the NWP #53. Next steps for permitting through the USACE include submittal of a pre-construction notification (PCN) to the Rock Island District. The PCN will include a detailed project description, construction plans (when complete), the Phase I report by Tallgrass Archaeology, and a project schedule. We recommend submitting this PCN to the USACE at least 2 months in advance of anticipated construction to ensure that the agencies have adequate timelines to complete their review.

6.2 IOWA STATE FLOODPLAIN PERMIT/STORY COUNTY FLOODPLAIN PERMIT

The project proposes construction activities within a floodplain; therefore, a permit will be required at the state level from the Iowa DNR, and the county level from Story County. A joint application form can be prepared for both to initiate project review and permit issuance. Because the project doesn't propose fill material or increasing flood elevations of the South Skunk River, we do not anticipate any difficulties with permit issuance for either alternative.

6.3 IOWA STATE SOVEREIGN LANDS PERMIT

A review of the Iowa Department of Natural Resources Sovereign Lands Program resulted in the determination that the South Skunk River is not listed as a sovereign land waterbody, and therefore a Sovereign Lands Permit is not required for the project. This was confirmed via email correspondence with Seth Moore with the Iowa DNR.

7 CONCEPTUAL DESIGNS

Alternatives proposed include Alternative 1, full dam removal with stream bank restoration to stabilize the channel in the project area and Alternative 2, full dam removal with rock arch rapids and stream bank restoration to stabilize the channel in the project area. Each alternative proposed in this exploratory phase will require further modelling during the design phase to identify the stable channel form to ensure in-channel and stream bank restoration designs are stable.

7.1 ALTERNATIVE 1 – FULL DAM REMOVAL

Alternative 1 – Full Dam removal is shown in **Figure 4**. The removal of the mortar- and concrete-capped weir that is affixed to the remnants of the original crib and timber dam structure is anticipated to undermine the integrity of the substructure. Therefore, all in-channel remnants associated with all aspects of the dam from initial construction to present day are proposed to be removed. Concrete from the weir cap would be used as fill on the right bank and covered (rebar removed prior to burial). Due to the interest in preserving original substructure components—primarily the timbers from the dam—dependent on the integrity of logs and contractor ability to remove full or partial sections, materials will be salvaged for future use by SCC, the Ames Historical Society, or use by the private property owners.

Stabilization downstream of the dam on the right bank would be needed to ensure long-term stability and protection of infrastructure. Several options are feasible, such as root wad revetment, toe-bank stabilization with limestone boulders, or J-Hook Vanes (stone or combination with trees). Stabilization would be tied into the existing downstream portage outlet. Stabilization is also proposed upstream of the dam on the north bank, where current issues may be exacerbated due to dam removal.

Alternative 1 proposes a J-hook to provide an instream feature to provide additional audible aesthetic during low flows and grade control. However, this feature is not necessary from a technical standpoint, or to meet primary project goals, but would help with channel alignment and hard armoring of the right bank. Avoiding the use of large boulders and rip rap improve the natural appearance of restoration efforts.

Additional modeling would be required to complete the design plans for the full removal of the Hannum's Mill Dam. Channel downcutting associated with dam removal is unlikely due to shallow bedrock. However, further geotechnical analysis during the next project phase could evaluate this further. With removal of the dam, the bankfull elevation upstream of the existing dam site would be lowered which may exacerbate existing upstream bank stability problems.

The cross-sectional area of the river is already restricted and exhibits a different geomorphological form than the South Skunk River both upstream and downstream beginning approximately 700 feet upstream of the current dam site (transition from a C4 to a G1 channel form). The lower water elevation and resulting bankfull elevation could impact bank stability upstream of the existing dam site requiring stabilization through toe protection and bank grading. Detailed geotechnical and hydraulic analysis to determine stable channel elevation associated with dam removal would determine bank stabilization needs upriver to ensure bank stability per the Iowa DNR River Restoration standards. Approximate stable channel form based on the cross-sectional area of the river within the project area were identified for this preliminary phase assessment to estimate project costs associated with the full removal of the Hannum's Mill Dam.

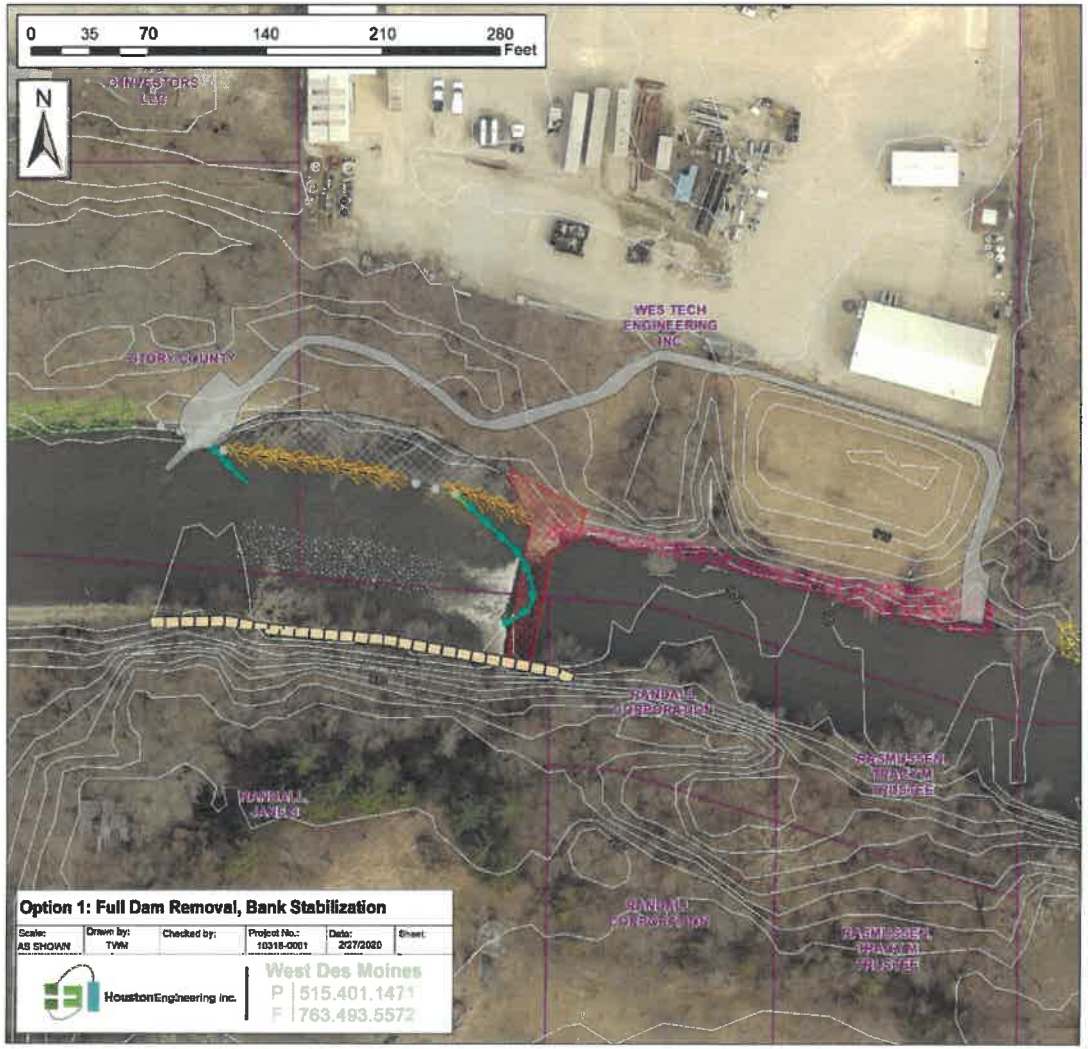
7.2 ALTERNATIVE 2 – DAM REMOVAL WITH ROCK ARCH RAPIDS

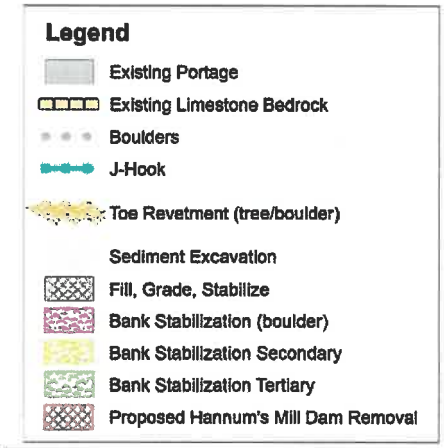
Alternative 2 – Dam removal with Rock Arch Rapids is shown in **Figure 5**. Like Alternative 1, the dam remnants are to be removed and preserved where feasible. Additional hydraulic modeling, geomorphic assessment, and geotechnical assessment can be used to design upstream and downstream streambank stabilization features.

In addition to the features of Alternative 1, Alternative 2 includes rock arch rapids, and no J-hooks. The rock arch rapids are proposed to crest at an elevation of 893.5 (resulting in half of the current dam height). The rapids are proposed with a 2% overall slope (riffle to riffle) and would be located at the site of the current dam. Rock arches are designed on a 0.6-foot drop per arch (resulting in 5 boulder arches) with continuous flow over sited boulders with water elevations at or above normal water levels. Arches on the left bank would be tied into the existing limestone bedrock. Arches on the right bank would be tied into a graded slope comprised of native field stone or other stabilization features. Native materials (limestone or glacial erratics) would be used to the greatest extent feasible.

Additional modeling would be required to complete the design plans for the rock arch rapids to ensure bank stability within the project area. Proposed arches are generic representations and the positioning of pools (including the number of arches and pools) are anticipated to be changed in the design phase based on modelling that would assist in the identification of the stable channel form.

Figure 4: Alternative 1 - Full Dam Removal





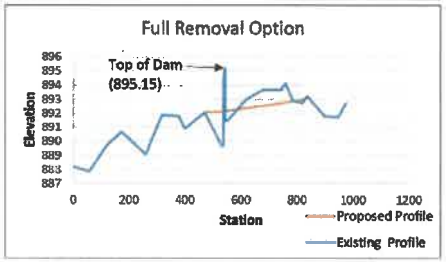
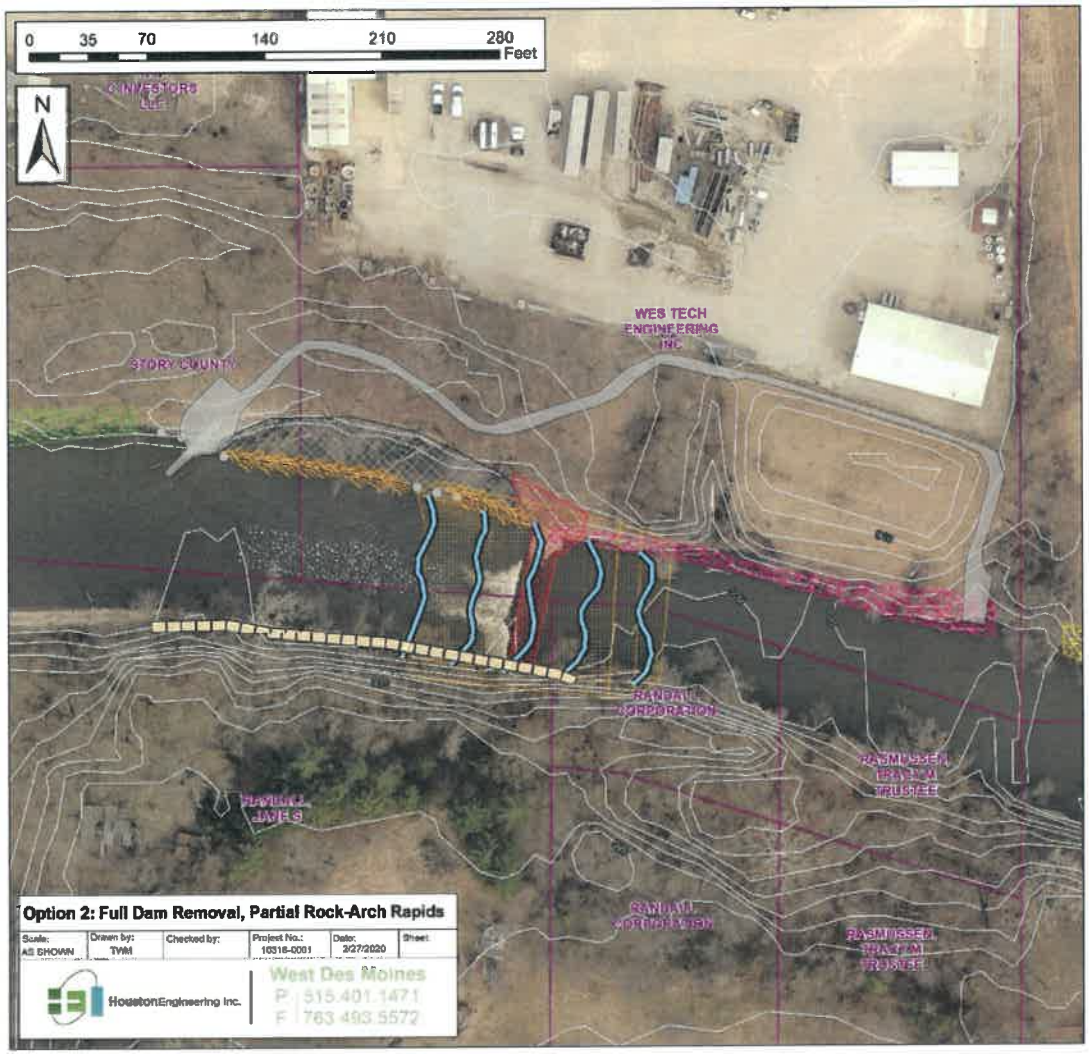
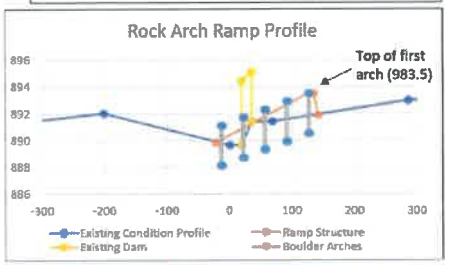


Figure 5: Alternative 2 - Full Dam Removal with Rock-Arch Rapids



Legend

- Existing Portage
- Existing Limestone Bedrock
- Proposed Rock riffles (partial removal)
- Proposed Ramp Structure
- Boulders
- Toe Revetment (tree/boulder)
- Sediment Excavation
- Fill, Grade, Stabilize
- Bank Stabilization (boulder)
- Bank Stabilization Secondary
- Bank Stabilization Tertiary
- Proposed Hannum's Mill Dam Removal



7.3 SECONDARY AND TERTIARY BANK STABILIZATION

Either alternative results in a lowering of the bankfull discharge water surface elevation. Additional modeling may need to be completed to calculate the specific risk to upstream banks due to this change. As described in Section **3.1.2**, the upstream channel is currently in a state of instability, and lowering the bank full discharge water surface elevation may exacerbate the instability. Project stake holders should decide whether it is advantageous to calculate and remedy these instabilities as a part of this project or evaluate them after a mitigation strategy for Hannum's Mill Dam has been pursued and the stream has responded to the alterations.

Additionally, project stakeholders may choose to extend the scope of the construction project downstream to stabilize banks that will not be negatively affected due to removal of the dam, but would benefit from stabilization, taking advantage of economies of scale due to a contractor being mobilized to the site.

A variety of bank stabilization techniques may be pursued including toe-wood sod mat, tree revetment, root wad revetment, boulder revetment, and/or J-hook. Examples of these stabilization techniques are shown in **Figure 6** through **Figure 10.** These practices vary by the degree of permanence (i.e. hard-armoring vs soft-armoring) and are not all applicable or appropriate in all situations. Site velocities and dimensions should be considered when choosing a stabilization practice.

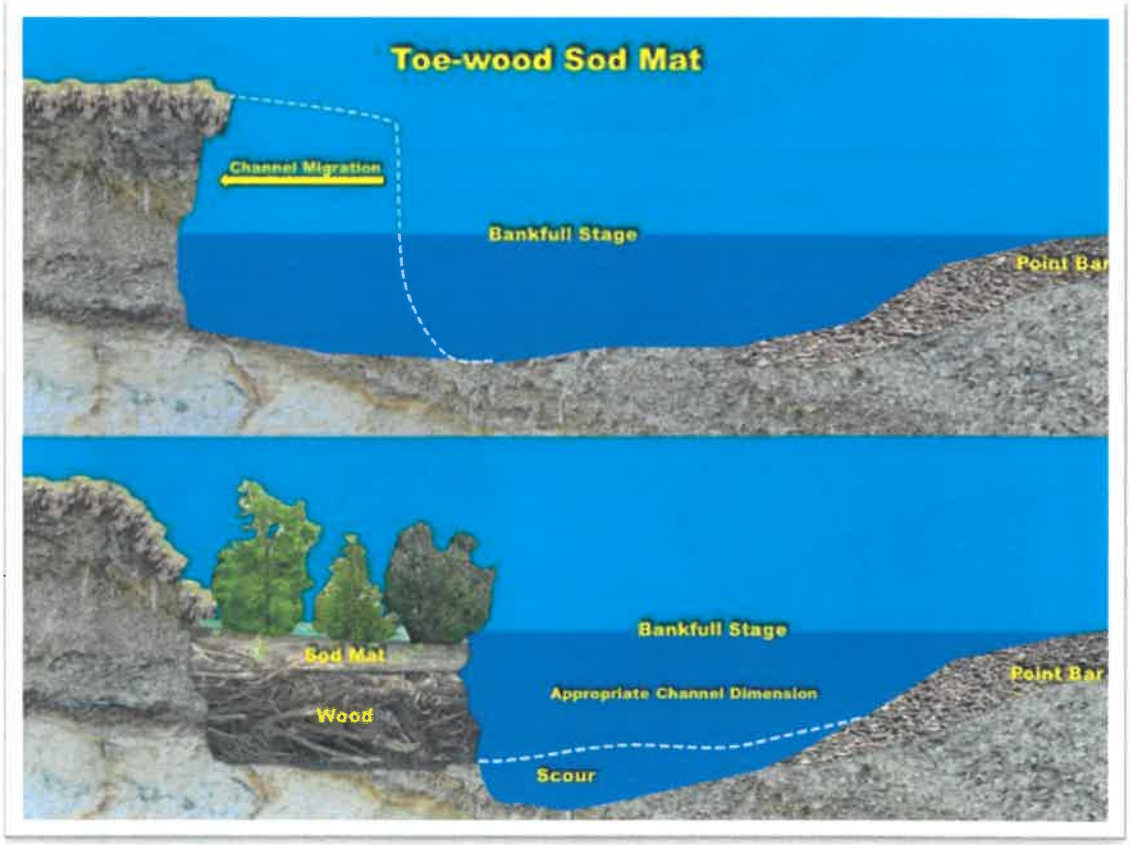


Figure 6: Toe-wood Sod Mat Typical Cross Section (MN DNR Stream Habitat Program)

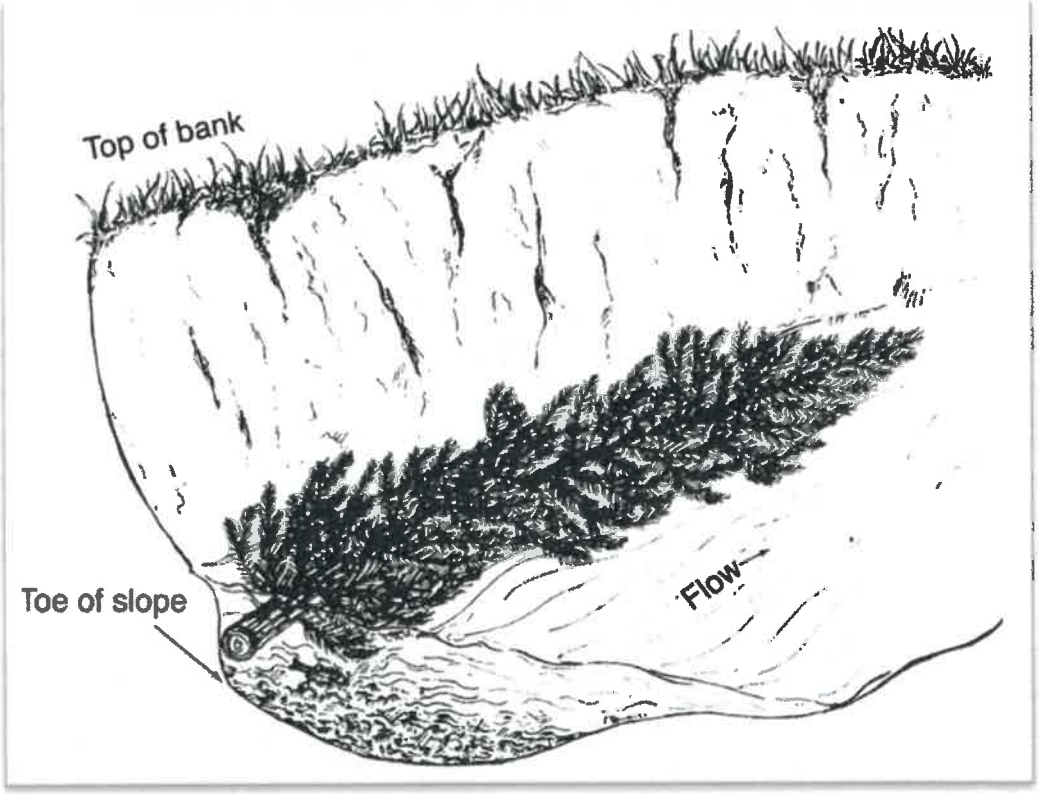


Figure 7: Tree Revetment (Ohio Division of Water)

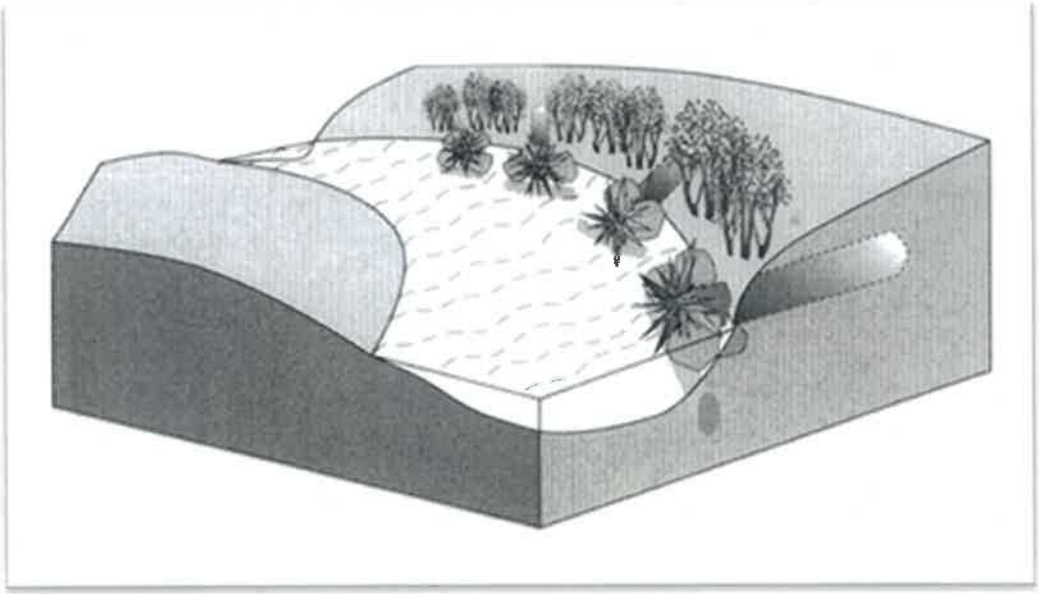


Figure 8: Root Wad Revetment (Partnership, n.d.)

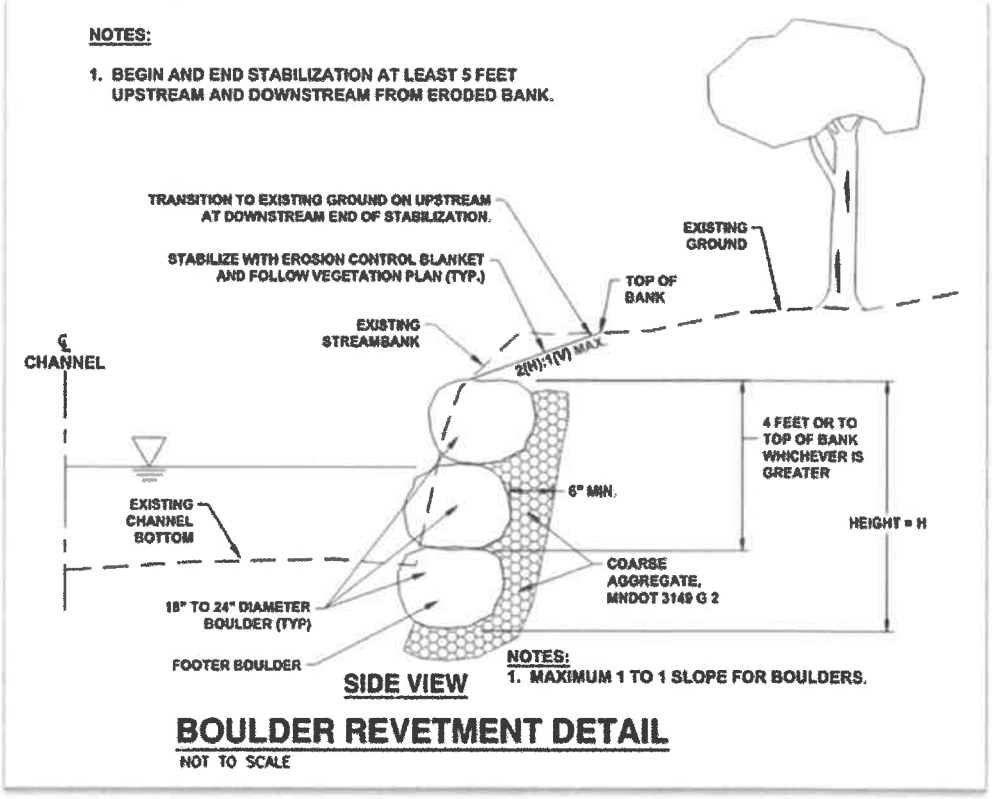


Figure 9: Boulder Revetment (live tree staking incorporated above boulders for stabilization)

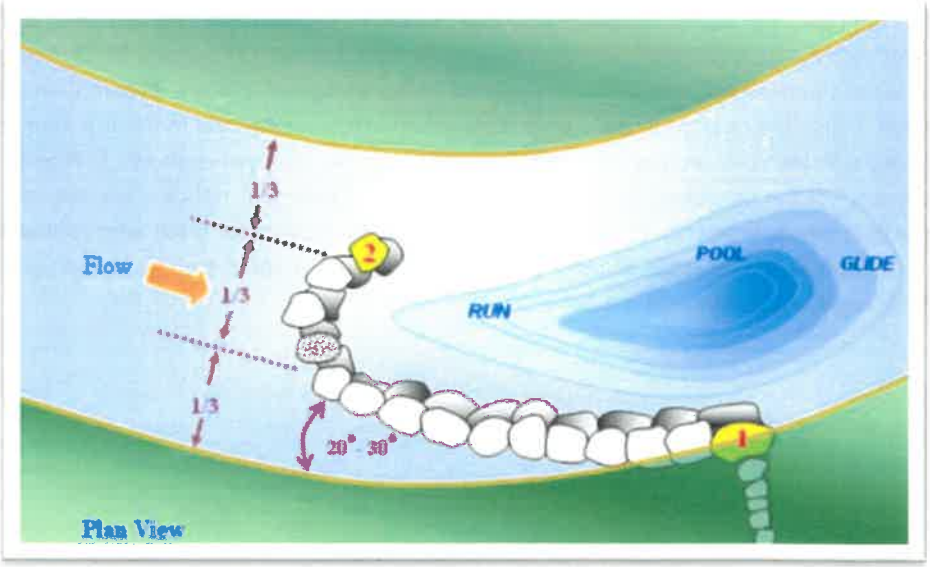


Figure 10: J-Hook (USDA Natural Resources Conservation Service, 2013)

7.4 PRELIMINARY OPINION OF PROBABLE CONSTRUCTION COST

Probable opinion of probable construction costs (POPCC) were developed for Alternatives 1 and 2. Potential funding sources are considered after to identify feasible funding opportunities and local support to achieve the project goals. The alternatives both require the removal of the dam cap (mortar and concrete weir) and salvage of the original timbers as there is insufficient remnants of the original dam to remain structurally sound during high flow events. Streambank stabilization costs and rock arch rapids costs differ between alternatives based on final bankfull elevation estimates with dam removal.

To facilitate construction, access is required from adjacent property owners in the form of a construction easement. Maintenance of the site following construction could be achieved through an ingress and egress easement for site maintenance or by warranty deed for full or partial parcels. A current maintenance agreement with the NPO (parcel 0523300200) to access the portage above the right bank could be modified to maintain site access for basic maintenance activities. Depending on the scope of the project, specifically if streambank stabilization extends greater than 250 feet upstream of the current dam site, construction easements and maintenance plans for tax parcels 0523300305 and 0523310220 may be needed. Easement costs are presumed to be comparable between the two alternatives.

7.4.1 ALTERNATIVE 1 – FULL DAM REMOVAL

Full dam removal facilitates the use of dam materials (concrete and mortar from the weir cap) on site. The resulting change in the bankfull elevation is projected to be most costly project component through either toe-bank protection or bank stabilization through grading and floodplain construction where appropriate. The proposed concept is shown in **Figure 4**. A detailed breakdown of the proposed cost estimate is shown in **Table 5**. The estimated project cost for a full dam removal is $295,000 and includes $236,000 in construction and habitat establishment, and $59,000 for engineering, legal and administrative costs.

7.4.2 ALTERNATIVE 2 - DAM REMOVAL WITH ROCK ARCH RAPIDS

Dam removal with rock arch rapids facilitates the use of dam materials (concrete and mortar from the weir cap) on site but also the incorporation of native stone (glacial erratics or limestone blocks) to construct step pools to lower the river elevation in a controlled manner designed to protect recreationists and permit wildlife passage. While the change in the bankfull elevation is less compared to the full dam removal, the costs associated with the rock arches is significant. The proposed concept is shown in **Figure 5**. A detailed breakdown of the proposed cost estimate is shown in **Table 5**. A detailed breakdown of the proposed cost estimate is shown in **Table 5**. The estimated project cost for a full dam removal with rock arch rapids is $695,000 and includes $556,000 in construction and habitat establishment, and $139,000 for engineering, legal and administrative costs.

Table 5: Concept Preliminary Opinion of Probable Construction Cost

No.	Description	Unit	Unit Price	QTY - Alternative 1	Extension- Alternative 1	QTY - Alternative 2	Extension- Alternative 2
1	Mobilization/Demobilization/Protections/ Bonding/Insurance	LS	$30,000.00	1	$30,000	1	$30,000
2	Erosion and Sediment Control & Spill Prevention/Control	LS	$10,000.00	1	$10,000	1	$10,000
3	Care of Water Plan	LS	$25,000.00	1	$25,000	1	$25,000
4	Clearing and Grubbing	ACRE	$5,000.00	0.8	$4,000	0.8	$4,000
5	Removal/Reuse of Concrete Weir Cap (demo and rebar removal, disposal of rebar off-site)	LS	$10,000.00	1	$10,000	1	$10,000
6	Remove, Protect, and Deliver Historic Remnants	LS	$10,000.00	1	$10,000	1	$10,000
7	Channel Excavation (in-stream)	CY	$12.00	405	$4,860	405	$4,860
8	Furnish and Install Clay Backfill	CY	$20.00	240	$4,800	744	$14,880
9	Furnish and Install Backfill	CY	$12.00	420	$5,040	0	$-
10	Generalized Bank Stabilization	LF	$85.00	250	$21,250	250	$21,250
11	Bank Stabilization (Boulders)	LF	$90.00	60	$5,400	60	$5,400
12	Bank Stabilization (tree revetment/toe-wood)	LF	$70.00	150	$10,500	150	$10,500
13	Furnish and Install Select Boulder (4'x2'x2')	TON	$125.00	74	$9,250	270	$33,750
14	Furnish and Install Boulder (12"-24")	TON	$90.00	60	$5,400	1758	$158,220
15	Furnish and Install Backfill (12-inch minus)	CY	$75.00	165	$12,375	1015	$76,125
16	Stripping, Salvaging, and Spreading Topsoil	CY	$12.00	150	$1,800	150	$1,800
17	Furnish and Install Erosion Control Blanket	SY	$4.00	1000	$4,000	1000	$4,000
18	Misc. Plantings	LF	$7.00	475	$3,325	475	$3,325
19	Seeding and Mulching - Riparian	SF	$0.45	8700	$3,915	8700	$3,915
20	Seeding and Mulching - Upland	SF	$0.20	2600	$520	2600	$520
	Subtotal				$181,435		$427,545
	Contingency (30%)				$54,431		$128,264
	Total Construction Cost				**$235,866**		**$555,809**
	Easements	Acre		Not Evaluated		Not Evaluated	
	Engineering (15%)				$35,380		$83,371
	Legal and Administrative (10%)				$23,587		$55,581
	Total				**$294,832**		**$694,761**

7.4.3 SECONDARY AND TERTIARY STABLIZATION

The range in cost for bank stabilization features varies significantly based on available on-site materials, cost of importing necessary materials, and the contractor's familiarity with the construction effort. Bank stabilization costs may range from $70/LF (linear foot) to $150/LF depending on the practice utilized. Typically stream barbs, and j-hooks are the most expensive, although soft-armoring, such as tree revetment can be costly if materials are imported from off site. The lowest cost stabilization is generally to reslope and vegetate the banks. Approximately 450 LF and 1,620 LF of bank stabilization are identified as secondary and tertiary respectively. Therefore, the addition of secondary and tertiary stabilization may range in price from $32,000 to $68,500 and $113,000 to $243,000 respectively.

7.5 PUBLIC INPUT

This exploratory phase provides the opportunity to identify project goals and evaluate alternatives based on stakeholder input. Integral to the process is the incorporation of comments—from core stakeholders, private landowners, and the public—into conceptual designs that balance stakeholder objectives, permitting, and preservation of materials into conceptual designs that achieve goals, objectives, and preferred characteristics regarding the future of the site. Public input was solicited in the form of two public meetings to inform the community response to the exploratory phase. The first public meeting assisted in identifying primary and secondary project objectives (**Sections 5.1** and **5.2**) through general feedback and a survey. The second public meeting was held to review primary and secondary project goals and to receive comments on proposed alternatives.

The second public meeting was hosted at the Ames Public Library, Danfoss Room on December 11, 2019 from 6:00 – 7:30 PM. Public attendance included 31 members of the general public, three SCC staff engaged in project management (Patrick Shehan, Mike Cox, and Ryan Wiemold), and three HEI staff (Lisa Odens, Rob Davis, and Greg Bowles). The presentation given at the public meeting is included in **Appendix D.**

Public attendance at the second public meeting was representative of community groups engaged with passive recreation and historical preservation. Attendees represented all community groups identified in the first public survey with participation reported as an approximate percentage of the audience as follows: 75% paddlers, 30% anglers, historic <5%, and visual and audible <5% (participants were allowed to identify with multiple user groups so the sum of audience participation groups does not equal 100%). Primary participation and interest by recreation type were similar between the two meetings. Private property owners for the NPO and an upstream property owner were in attendance. SCC met privately with the SPO on the morning of December 11, 2019, to review proposed alternatives.

Community interest in addressing the safety risk posed by the Hannum's Mill Dam increased between the two meetings, more than twice the number of public attendees than the first meeting, indicative of long-term project support. Stakeholders were engaged within the public meeting to become better informed regarding the two proposed alternatives. Generally, the public asked questions for more specific descriptions of project components and details that may be considered during final design. Examples of questions asked by the public are as follows: What natural features and materials can be incorporated into bank stabilization practices (and availability on site)? Would restoration downstream of the dam site be necessary under the current mitigation scenario? Is restoration upstream of the dam needed to stabilize the banks in the project area? Could the dam be removed, and bank stabilization not be

considered? What material would be lost with dam removal or mitigation (sediment in upstream pool behind the dam) and is there potential that boulders, cobble, and gravel are already present and could eliminate the need for restoration activities? What are components of alternatives with greater costs?

Specific feedback was provided by the Iowa DNR Fisheries Bureau, referencing that dam removal (Alternative 1) would be the preferred course of action, and rock arch rapids could continue to negatively impact fish passage when water levels are below normal elevations. The northern landowner representative stated preference towards Alternative 1, siting the lowering of water surface elevations as a priority. Nate Hoogeveen, Iowa DNR River Programs Coordinator, emphasized the importance of considering the South Skunk River has meandered since the 1930s (when first aerial imagery was taken and the sine function of the river has completely reversed itself upstream of the dam, indicating current instability.

Primary concerns and themes consistent regardless of concept focused on the following themes:

- Identify a fiscally responsible project that allows for recreational user safety during all flow levels (when paddling is viable) and avoiding the impact of cost-loading on private property owners.
- Avoid building unnecessary project features that increase the cost, as those funds may be more judiciously used to expand the scope of bank stabilization extents or on a project with higher community visibility.
- Use natural material and channel design to the greatest extent feasible for whichever alternative is selected.

Participants in the meeting were asked to select their preferred alternative within the meeting:

- approximately 40-50% of attendees preferred Alternative 1;
- approximately 20-30% preferred Alternative 2;
- 5- 10% were indifferent; and
- 10-20% abstained from the poll.

Comments and themes from the public meeting regarding recreational user safety, fish and mussel passage, and cost were incorporated into the final project goal matrix in the following section.

7.6 COMPARISON OF ALTERNATIVES TO THE PROJECT GOALS

Hannum's Mill Dam is structurally unsound with the concrete-capped weir reaching the end of the its usable life span. However, deferred or minimal maintenance of the structure remains an option with ongoing or recurring risks to the public using the South Skunk River Water Trail. The removal or mitigation of the dam would achieve or enhance all primary and secondary project goals (as identified in **Sections 5.1** and **5.2**) and the two alternatives assessed towards achieving those goals in **Table 6**. Alternatives are broadly characterized in the table towards achieving a goal with the goal having been achieved classified as "Met," failing to achieve goals as "Not Met," partially achieving the goal as "Partially Met," or "N/A" if the current status of the site is the baseline criteria and no comparison can be made.

Public and DNR staff comments regarding visual and audible aesthetics and fish passage were used to update the project goal matrix compared to the table presented at the second public input meeting. Full dam removal was received more favorably by the Iowa DNR as there would be no in-channel impediment to fish or mussel passage under any flow regime. Additional armoring of the right bank of the dam could stabilize the bank as well as disturb flow sufficiently to allow for the sound of flowing water while the

removal of the hydraulic drop associated with the dam was not prioritized (scenic river with unimpeded flow publicly desirable).

Table 6: Comparison of Proposed Alternatives to the Project Goals

Project Goal	Current Condition	Full Dam Removal	Dam Removal with Rock Arch Rapids
Primary Goals			
Improve Paddler Safety	Not Met	Met	Met
Improve Fish Passage	Not Met	Met	Met
Visual & Audible Aesthetic	N/A	Met	Met
Secondary Goals			
Enhance Passive Recreation	Not Met	Met	Met
Maintain Land Accessibility	Met	Met	Met
Improve Terrestrial Habitat	Not Met	Met	Met
Maintain or Improve Fishing	Met	Met	Met
Preserve Cultural Sites	Not Met	Met	Met

Both proposed alternatives include features to improve paddler safety, specifically decreasing elevation changes to less than one foot per individual feature in the project area (drops <1 foot in the case of rock arches and <1% for dam removal). Boulders sited within the river channel in both options would be sited to allow continuous flow over boulders except in low-flow conditions for both scenarios. In the case of dam removal, boulders may be sited along the edge of the river channel for stabilization purposes but would not obstruct passage in the thalweg and the center third of the channel. Enhancing flow conditions for users similarly enhances migration and movement of aquatic wildlife (i.e., fish and mussels) for both full dam removal or dam removal with rock arch rapids. The use of natural channel design and the prioritization of native materials in restoration activities would enhance in-stream habitat for aquatic wildlife within the project area and improve the function of the local stream community.

While mitigation or removal would improve in-channel structure and passage, both alternatives would alter the appearance of the river reach. The dam currently has a small hydraulic drop downstream of the structure that regularly offers the sound of flowing water and is positively received by the community and private property owners who reside near the dam. The full removal of the dam would eliminate the hydraulic drop and eliminate the associated sounds across the width of the entire channel. Rock arch rapids would maintain the sound of flowing water with the three elevation changes. However, in the case of Alternative 1, features to stabilize the right bank of the dam site at or near the current dam tie-in to the right bank or placement of boulders could be strategically placed to maintain the sound of flowing water but at a lower level of intensity. Restoration activities would otherwise use the narrowest scope feasible to stabilize the stream banks identified through modeling and site assessment during the design phase in the adjoining reaches directly impacted by dam removal.

Secondary objectives are holistically characterized as a restored river reach with an intact ecosystem and passive recreation coinciding with private property use. Existing site characteristics would be impacted to the least extent possible during removal or mitigation activities with SCC maintaining site access to complete future site maintenance as needed.

8 POTENTIAL FUNDING MECHANISMS

Funding the selected alternative can be achieved through local support, state grants, or federal grants. Federal grants exist within the region, but funds are allocated to priority basins or project areas (e.g., Fishers and Farmers funds designated projects areas, Fishers funds to eastern Iowa basins). Current funding mechanisms are summarized in **Table 7** (additional options may become available at a later time or identified funding options may be deemed infeasible or undesirable to project implementation).

Stream mitigation banking on the South Skunk River is competitive at the time this report was drafted. There are no stream mitigation banks in the USACOE Iowa Service Areas (US Army Corps of Engineers, 2019). Stream mitigation banks have been released for credits sale in Iowa with several additional pending but none within the South Skunk River Watershed (US Army Corps of Engineers, 2020) that would facilitate credit sales to city, county, or state programs requiring credit acquisition. Banking could be pursued for future stream improvements with the process requiring time to develop a prospectus for USACOE approval prior to the bank being established.

Project support could be sought through bonding or by local project supporters such as the Skunk River Paddlers, Outdoor Alliance, Iowa State Fishers Club, Ames Anglers, or local businesses.

Table 7: Potential funding mechanisms for dam or stream restoration, and range of potential funds for the project.

Organization	Funding Mechanism	Funding Type	Funding Range ($)	Notes
US Fish and Wildlife Service		NA		Funding currently allocated to priority watersheds (Cedar, Iowa, and Maquoketa)
Mitigation Banking (administered by Story County)	Stream mitigation bank	Banking instrument sales (internal credits to SCC, Iowa DOT, Iowa Dep. of Natural Resources, Developers)	Estimate at 30% design cost *	*Prospectus required to estimate credits value (credits commonly sell at $100-$200 / linear foot)
Iowa Dep. of Natural Resources	Dam Mitigation and Water Trail	Competitive grant	$50,000 (total)	
	Fisheries	Competitive grant	70,000 (total)	Grant assistance for land acquisition and development of fish habitat.
	Wildlife Grants	Competitive grant	$7,500	Small habitat or education grant
	Wildlife Grants	Competitive grant	$2,500	Small habitat or education grant
US Army Corps of Engineers	Stream mitigation bank	Banking instrument sales (Iowa DOT, Iowa Dep. of Natural Resources, Developers)	TBD - common costs $100 - $200 / linear foot that estimates $120,000 - $240,000 in total credit income for a 2,000-foot project (15% of credits available for sale upon approval of prospectus)	Conservation easement partner (SCC, Outdoor Alliance, Prairie Rivers of Iowa)
Iowa Economic Development Authority	Enhance Iowa (Community Attraction and Tourism (CAT), River Enhancement Community Attraction and Tourism (RECAT))	Competitive grant (65% funds raised)	Dependent on general funds allocation	Applications are accepted quarterly – January 15, April 15, July 15, and October 15 **

*Stream bank mitigation is feasible and competitive on a perennial river. A larger phased project would likely be more cost effective than mitigating a single dam with greater costs per foot river restored.

** The Enhance Iowa Board allocated all the FY 2020 CAT funds due to overwhelming demand in the first granting cycle. The next opportunity to apply will likely be April or July of 2020

9 RECOMMENDATION

Primary goals associated with the mitigation or removal of Hannum's Mill Dam were identified by the community and core stakeholders within the exploratory phase to foremost improve the safety of passive recreation on the South Skunk Water Trail (e.g., paddlers and tubers), improve the local habitat, and to maintain a positive visual and audible aesthetic. To achieve those goals all exploratory phase participants prioritized natural channel appearance for whichever alternative is selected to ensure that the project is fiscally responsible. The recommendation for dam removal is made in the interest of preserving historical components of the original dam structure while prioritizing public safety at the lowest possible cost. The recommendation also aligns with C2C goals for the county. This project is a classic public-private partnership in that the dam and banks are privately owned, and the public interest lies in the safe passage while using the public waters of the South Skunk River.

The two alternatives prepared for this exploratory phase achieve the primary and secondary project goals and mobilization of sediment is not a prohibitive concern based on sediment loading estimates. Similar bank stabilization methods (e.g., J-Hook, boulder revetment, and tree revetment) are prioritized for both alternatives to efficiently use materials that would be impacted on site. Using materials that are available on-site and minimizing materials for the project will keep project costs low. The primary difference between the two concepts is the cost directly associated with the rock arch rapids. For both alternatives the primary material from the cap would be used on site for fill of the right bank immediately downstream of the dam; however, in the case of the rock arch rapids suitable boulder sourcing and installation costs are a major cost (estimated to be $268,000 See **Section 7.3**). The construction of rock arch rapids following the removal of the dam to partially reduce the water elevation has potential to function as a recreational attraction, then serve the primary objective of improving water trail user safety. While rock arch rapids would, in part, preserve the visual features of the site, the additional cost is unlikely to be a justifiable expense with the project goals identified by the community, property owners, and core stakeholders.

With good fiscal stewardship being a priority within the community, the preference of property owners to remove the dam, and the Iowa DNR fisheries encouraging removal of Hannum's Mill Dam, the recommend course of action is the removal of the dam and streambank mitigation to address streambank instabilities directly resulting from the dam removal.

To support next steps the stakeholders must be engaged and in consensus so that funding can be pursued for the selected alternative. Private landowners must be consulted regarding the alternatives and what features satisfy their property management goals. Once private property owners agree on an option with SCC, in turn representing the publics' interests, agreements to support the agreed upon alternative can be implemented (e.g., access agreements, conservation easement, etc.). Identifying funding mechanisms for the removal or mitigation of the dam at the same time easements are being pursued could facilitate the identification of matching funds, if needed, and ease potential funding limitations in the following design and construction phases. Developing support for an alternative shortly after the exploratory phase will assist with maintaining momentum for removal or mitigation within the community and demonstrate strong community support to potential funders. With the strong community support that led to the current exploratory phase assessment of Hannum's Mill Dam, there is potential to rapidly advance to design and construction phases to facilitate safer water trails experiences for paddlers on the South Skunk River and to enhance wildlife capacity.

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APPENDIX A: ONLINE SURVEY

Introduction

Thank you for your interest in the Hannum's Mill Dam on the South Skunk River and what the resource means to the community. Your feedback about what is important to you, and the community, will help how the site is managed in the future by Story County Conservation.

Your feedback will help to inform three management options regarding the Hannum's Mill Dam. Responses will be anonymous and your name will only be used for follow-up contact in the events of any questions or concerns noted in your responses. Thank you for completing the survey your willingness to share your knowledge and insight about the Hannum's Mill Dam and community goals around the resource.

Questions? Please contact Rob Davis (rdavis@houstoneng.com) the project manager for Houston Engineering or Pat Shehan (pshehan@storycountyconservation.gov) the project manager for Story County Conservation.

NEXT

Page 1 of 2

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Introduction

* Required

Survey

1. How often do you use the area immediately adjacent to Hannum's Mill Dam? *

- ◯ More than 10 times a year
- ◯ 5-9 times a year
- ◯ 2-4 times a year
- ◯ 1 time a year
- ◯ NA

2. How do you enjoy the South Skunk River around the Hannum's Mill Dam? - select all ways you use the river. *

- ☐ Water trail (paddling/tubing)
- ☐ Fishing
- ☐ Visual (looking at the river)
- ☐ Audible (listening to the river)
- ☐ Historical (appreciation of historical significance)
- ☐ NA
- ☐ Other:

3. The following characteristics are important TO ME about the Hannum's Mill Dam and immediately adjacent area. *

	Strongly agree	Agree	Neutral	Somewhat disagree	Disagree
Historic nature of the site	○	○	○	○	○
Accessibility by land	○	○	○	○	○
Safety for river users (paddlers and tubers)	○	○	○	○	○
Fishing	○	○	○	○	○
Recreation (water trail)	○	○	○	○	○
Water levels (maintain current elevation)	○	○	○	○	○
Terrestrial habitat	○	○	○	○	○
Aquatic wildlife (fish/mussel passage)	○	○	○	○	○
Other	○	○	○	○	○

4. If 'other' to the previous question, "The following characteristics are important TO ME about the Hannum's Mill Dam and immediately adjacent area", please briefly describe how the enjoy the area around the dam.

Your answer

5. The following characteristics are important to THE COMMUNITY about the Hannum's Mill Dam and immediately adjacent area. *

	Strongly agree	Agree	Neutral	Somewhat disagree	Disagree
Historic nature of the site	○	○	○	○	○
Accessibility by land	○	○	○	○	○
Safety for river users (paddlers and tubers)	○	○	○	○	○
Fishing	○	○	○	○	○
Recreation (water trail)	○	○	○	○	○
Water levels (maintain current elevation)	○	○	○	○	○
Terrestrial habitat	○	○	○	○	○
Aquatic wildlife (fish/mussel passage)	○	○	○	○	○
Other	○	○	○	○	○

6. If 'other' to the previous question, "What do you think is most important to the community about the Hannum's Mill Dam and immediately adjacent area?", please briefly describe how the enjoy the area around the dam.

Your answer

7. What potential remnant structures of the Hannum's Mill Dam are important to you to preserve? *NOTE* - permitting may require the preservation of part(s) of the dam independent of part(s) important to the community.

	Very important	Important	Neutral	Marginally important	Not important
In-stream dam/mill remnants	☐	☐	☐	☐	☐
Upstream dam pool elevation	☐	☐	☐	☐	☐
Other	☐	☐	☐	☐	☐

8. If 'other' to the previous question, "What do you think is most important to the community about the Hannum's Mill Dam and immediately adjacent area?", please briefly describe how the enjoy the area around the dam.

Your answer

9. Optional - Please describe any experiences you might have had with the Hannum's Mill Dam.

Your answer

10. Optional - Are there features of the Hannum's Mill Dam compared to other low head dams that stand out to you?

Your answer

11. Optional - Any additional comments?

Your answer

Name

Your answer

Address (optional - please enter as single line)

Your answer

Phone (optional)

Your answer

Email (optional)

Your answer

BACK SUBMIT Page 2 of 2

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APPENDIX B: PUBLIC SURVEY QUESTION HANDOUT FOR PARTICIPANTS AT THE JULY 30, 2019 PUBLIC MEETING.

Hannum's Mill Dam: Public Information Meeting 1 Survey

Thank you for your interest in the Hannum's Mill Dam on the South Skunk River and what the resource means to the community. Your feedback about what is important to you and the community will help how the site is managed in the future by Story County Conservation.

Your feedback will help to inform three management options regarding the Hannum's Mill Dam. Responses will be anonymous, and your name will only be used for follow-up contact in the events of any questions or concerns noted in your responses. Thank you for completing the survey, your willingness to share your knowledge and insight about the Hannum's Mill Dam, and community goals around the resource.

1. How often do you use the area immediately adjacent to Hannum's Mill Dam?

- ☐More than 10 times a year
- ☐5-9 times a year
- ☐2-4 times a year
- ☐1 time a year
- ☐NA

2. How do you enjoy the South Skunk River around the Hannum's Mill Dam? - select all ways you use the river.

- ☐Water trail (paddling/tubing)
- ☐Fishing
- ☐Visual (looking at the river)
- ☐Audible (listening to the river)
- ☐Historical (appreciation of historical significance)
- ☐NA
- ☐Other: _____

3. The following characteristics are important TO ME about the Hannum's Mill Dam and immediately adjacent area.

	Strongly Agree	Agree	Neutral	Somewhat Disagree	Disagree
Historic nature of the site	☐	☐	☐	☐	☐
Accessibility by land	☐	☐	☐	☐	☐
Safety for river users (paddlers and tubers)	☐	☐	☐	☐	☐
Fishing	☐	☐	☐	☐	☐
Recreation (water trail)	☐	☐	☐	☐	☐
Water levels (maintain current elevation)	☐	☐	☐	☐	☐
Terrestrial habitat	☐	☐	☐	☐	☐
Aquatic wildlife (fish/mussel passage)	☐	☐	☐	☐	☐
Other	☐	☐	☐	☐	☐

4. If 'other' to the previous question, (The following characteristics are important TO ME about the Hannum's Mill Dam and immediately adjacent area), please briefly describe how you enjoy the area around the dam:

5. The following characteristics are important to THE COMMUNITY about the Hannum's Mill Dam and immediately adjacent area.

	Strongly Agree	Agree	Neutral	Somewhat Disagree	Disagree
Historic nature of the site	☐	☐	☐	☐	☐
Accessibility by land	☐	☐	☐	☐	☐
Safety for river users (paddlers and tubers)	☐	☐	☐	☐	☐
Fishing	☐	☐	☐	☐	☐
Recreation (water trail)	☐	☐	☐	☐	☐
Water levels (maintain current elevation)	☐	☐	☐	☐	☐
Terrestrial habitat	☐	☐	☐	☐	☐
Aquatic wildlife (fish/mussel passage)	☐	☐	☐	☐	☐
Other	☐	☐	☐	☐	☐

6. If 'other' to the previous question, (What do you think is most important to THE COMMUNITY about the Hannum's Mill Dam and immediately adjacent area?), please briefly describe how you enjoy the area around the dam:

7. What potential remnant structures of the Hannum's Mill Dam are important to you to preserve?*

	Very Important	Important	Neutral	Marginally Important	Not Important
In-stream dam/mill remnants	☐	☐	☐	☐	☐
Upstream dam pool elevation	☐	☐	☐	☐	☐
Other	☐	☐	☐	☐	☐

**permitting may require the preservation of part(s) of the dam independent of part(s) important to the community.*

8. If 'other' to the previous question, (What potential remnant structures of the Hannum's Mill Dam are important to you to preserve?), please briefly describe the remnants that are important to you to preserve:

9. Optional - Please describe any experiences you might have had with the Hannum's Mill Dam:

10. Optional - Are there features of the Hannum's Mill Dam compared to other low head dams that stand out to you?

APPENDIX C: PUBLIC COMMENTS ABOUT HANNUM'S MILL DAM FROM THE ONLINE AND PUBLIC MEETING SURVEYS.

8. If 'other' to the previous question, "What do you think is most important to the community about the Hannum's Mill Dam and immediately adjacent area?", please briefly describe how the enjoy the area around the dam.
As a kayaker, because of the dam as it exists now, I spend little time here. It is enough to enjoy the foliage obstructions to get around it by portage.
There's not much here to preserve historically, IMO [in my opinion]. The exposed limestone wall is the most attractive part of the area and I don't think that was man-made.
Removal of debris that could harm a person and/or damage a boat. Note a rocky drop is okay, a drop with exposed rebar or logs with nails is not acceptable.
Remains of an historic bridge and roadbed are still visible and could easily be preserved.
I feel the mill remnants are significantly more important for the historical understanding of the community than the in-stream dam--that could be removed or modified for the safety of paddlers and fish/mussel passage.
I would like it to be a natural area.
9. Optional - Please describe any experiences you might have had with the Hannum's Mill Dam.
When boating, it has been the practice to obey the "Exit Now" sign hanging over the river and exit to portage further downstream. However, one incident had my boat caught in tree limbs, etc., very close to the dam, and capsized it. It was only the considerable assistance of another paddler that probably prevented my being sucked into the dam's recirculation. Beyond that, I cannot comment for relatives of two people who drown here not long ago in similar circumstances.
Very dangerous low head dam that has proved lethal. At times there has been excellent fishing in the waters below the dam. Stagnant water above the dam during low water periods.
Paddling. Trees below that can cause obstructions and difficulty paddling through.
I have been over the dam 100's of times including kayaking over it last night. It isn't near as dangerous as it once was. However, the portage is very long for those who don't want to float over. Our group of eight had 7 get out at the rock and portage over. I went over the dam with life vest/kayak.
I've waded and fished the area for almost 40 years.
We love to fish this spot in the spring an early summer for suckers and smallmouth bass. If the water is low in the mid-summer, we wade upstream to fish it because the paths are overgrown.
This dam is an obstacle/hazard to those who use the river, it blocks fish and mussel migration, the artificial pool upstream of the structure negatively impacts water quality, water temperature, etc.
I have enjoyed "shooting" the dam in my canoe a number of times over the years, but realize the risk that may pose to less experienced paddlers or those that choose to try it when the river conditions are not safe.
I witnessed a couple tubers floating over the dam who were quite surprised to be flipped and held momentarily in the wave. I know of a couple canoeists that have capsized there but have not witnessed an incident. And I know that the concrete cap is undercut along much of the downstream edge - you can see 5-6 feet upstream, under the concrete, when the river is low.
I had to look it up on google to find where it is as the name is not familiar. What I saw said it is on the river basically across from Ada Hayden and I have not been on the river in that area. I still care that it is safe for paddlers and support removal/modification if necessary, to allow safe passage.
If it's in my territory, I check this stretch for the Ames Xmas Bird Count

The dam is a hazard to tubing or kayaking. Take it down!
I paddle through there with the Skunk River Paddlers fairly often. Although we are aware of the dangers of low head dams, we will often portage at the concrete skirt of the dam instead using the long and difficult portage trail. This seems fine for folks with good boat control but the backflow along river right can be significant and concerning. Also, downstream strainers, and bank erosion on river right make passage through this area more difficult.
A fellow paddler lost control below the dam and needed assistance to safely get back into his boat.
Frequently paddle this stretch of river. Portage around or over dam.
- The dam in its current condition is a public safety hazard -- the concrete apron is totally undercut and creates a dangerous underflow current. - At low water levels remains of the crib dam can be seen in the river bed below the right bank. Remains of the crib dam probably extend under the right bank, and original portion of the concrete dam. The large logs that protrude downstream from under the concrete apron may or may not be part of the crib dam. - From an archaeological standpoint, structural remains of a crib dam would consist of logs and limestone blocks. - I would recommend monitoring the site during removal of the concrete dam; and documenting and mapping any remains of the crib dam exposed.
I watched a canoe go over and capsize - had to help rescue the canoe but the paddlers came through okay. Portaged the dam many times. Worked on the portage.
Small mouth fishing up/down stream
I have paddled the section of the South Skunk containing Hannum's Mill Dam many times with family and friends and Iowa State University students.
10. Optional - Are there features of the Hannum's Mill Dam compared to other low head dams that stand out to you?
From photos of Hannum's and other dams, addition to the expected recirculation dangers. Hannum's apparently also has submerged beneath the water level several long logs of some unknown purpose, parallel to the water flow, which may easily contribute to boat capsizing.
Because of its proximity to Ames this dam is particularly dangerous to less experienced River users.
It has private property that runs up to it. Rebar has been removed for the most part so safer than in the past.
Yes. The smooth concrete area next to the dam makes it easier to access and fish.
The old logs that were part of the original dam are a tie to the past.
Yes, the fact that the original log and rock cribbing remain under the concrete cap. And that the eddy (north side) presents a hazard to paddlers at some levels of flow and is severely eroding the streambank.
Exposed rebar, downstream strainers and bank erosion on river right
Mississippian bedrock on the east side
The undercut makes this dam even more hazardous.
11. Optional - Any additional comments?
As an avid paddler, I have enjoyed the removal of low head dams. I also value the passage of fish and mussels.

Removal of dams has ecological and hydrologic benefits that outweigh any short term discomfort while we adjust to any changes in water level/channel location, even a drastic change will be the new normal within a short time.
I would like to see better access to the dam. A wide walking path would be nice. A well maintained portage trail is needed for kayaks, canoes and tubers.
A riffle dam like the one at Soper's Mill might be a better option for paddlers and anglers.
In addition to the remains of the original crib dam, the abutments of an historic bridge remain immediately upstream of the dam. It might be interesting to use part of the old roadbed (Marietta Road) as a trail, and the abutment/roadbed area as an overlook.
I've lived in Ames 30 years, been very active outdoors, kayaked central Iowa and have never heard the name before today. If you can update the survey to provide a short intro about the dam location and maybe an aerial map, that would help others.
I appreciate that the County is asking the community to get input.
depending on water levels, land access can be tricky
Safety of users is the highest priority
I think it's great that you plan to address this unnecessary and dangerous obstacle on the Skunk. I worry that more boaters, tubers and inexperienced kayakers especially, will fall prey to a relic of the past.
I think it is merely a matter of time before there is another drowning at this dam location if the existing hazard is not removed.

APPENDIX D: 2ND PUBLIC MEETING PRESENTATION

Hannum's Mill Dam on the South Skunk River:
Community Visioning
December 11, 2019: Ames, Iowa Library, Danfoss Room

1

THE STORY COUNTY CONSERVATION TEAM
Pat Shahan
Project Manager
Special Projects Ranger
Mike Cox
Director
Ryan Wiemold
Parks Superintendent

2

THE HEI TEAM
Rob Davis, MS
Project Lead
Watershed Planner
Greg Bowles, PE*
Civil Engineer
Lisa Odens, PE
Civil Engineer
Emmy Baskerville, CWD
Environmental Scientist

3

A LITTLE BACKGROUND ON HEI
Local
Offices throughout the Midwest - Des Moines is the home base for this project
National
Consulting experience across the US

4

PUTTING THE PIECES TOGETHER

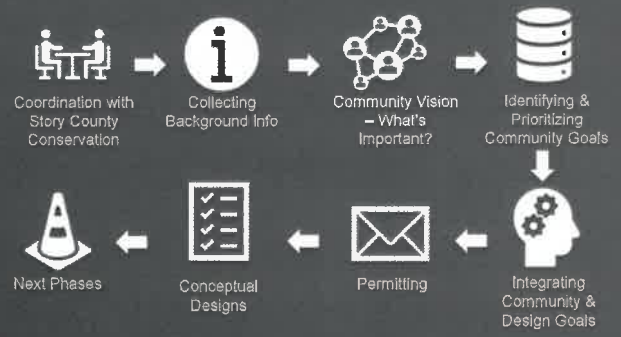
5

OVERVIEW OF TONIGHT'S PROGRAM

- Overview of the Planning Process
- Review of 1st Public Meeting – Survey Summary
- Site Data Collection – What is in the Field?
- Permitting – What is Important from a Regulatory Perspective
- Conceptual Designs - The Pieces of the Puzzle
- Next Steps
- Question and Answer Session (cards for written comments available)

6

OVERVIEW OF THE PLANNING PROCESS



7

HANNUM'S MILL TODAY

- The dam today: a 48' concrete-capped weir
- Benefits & Risks to the Community:
  - Risky drop at low flow for paddlers
  - Barrier to fish and mussels at low flow

8

1ST PUBLIC MEETING - SURVEY SUMMARY

- Participation helped craft and prioritize goals
- Survey was designed to assess individual and community responses by general use type, specifically:
  1. Paddlers *(recreational)*
  2. Anglers *(recreational)*
  3. Historic *(cultural preservation)*
  4. Visual *(general use)*
  5. Audible *(general use)*
- Total of 37 survey responses (online and public meeting)

9

1ST PUBLIC MEETING - SURVEY SUMMARY

- Take-home points from the surveys

- Primary objective amongst user groups was user safety on the river
- Secondary objective was a free-flowing river

10

1ST PUBLIC MEETING - SURVEY SUMMARY

Primary Project Goals
1. Increase safety to paddlers, floaters, and river users;
2. Improve aquatic habitat (fish/mussel passage);
3. Maintain positive visual and audible aesthetic

Secondary Project Goals
1. Increase function of the site for passive recreation
2. Maintain land accessibility (within consideration of private land ownership)
3. Improve terrestrial habitat
4. Maintain or improve fishing
5. Preserve out-of-stream cultural sites in-place

11

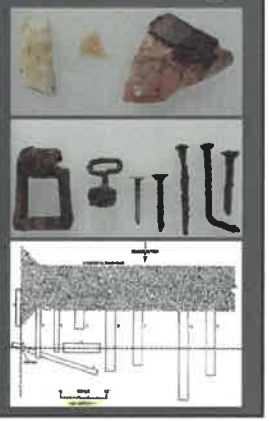
SITE DATA COLLECTION – TOPOGRAPHY

- Surveyed August 9-10, 2019 at low flow period
- Survey was to assess for bank stability and the amount of sediment behind the dam

12

SITE DATA COLLECTION – ARCHAEOLOGY

- Assessed by Tallgrass Archaeology August 12-19, 2019 by Leah D. Rodgers
- Sites in the project area do not retain enough of the original integrity for inclusion in the National Registry of Historic Places



13

SITE DATA COLLECTION - BIOTA

- For the anglers! Fish and benthic communities are doing 'fair' to 'good' in the South Skunk River
  - More information can be found at Iowa BioNet for stations 972 (Sleepy Hollow Park) and 38 (near Soper's Mill Park)
- Mussel survey conducted by the Iowa State Hygienic Laboratory, led by Mike Birmingham, and Dr. Jennifer Kurth (Iowa DNR) on August 9, 2019.
  - Two living state-threatened species were found, the cylindrical papershell (*Anodontoides ferrusacianus*) and the creek heelsplitter (*Lasmigona compressa*)

14

SITE DATA COLLECTION – THE RIVER AS A WHOLE

- The dam and other sites identified are not considered intact and eligible for protection Section 106, NHPA 1986)
- Biota in the river are fair to good quality for a warm-water river in Iowa with some state-protected species present

15

PERMITTING – WHAT IS IMPORTANT FROM A REGULATORY PERSPECTIVE

- Permitting is designed to protect infrastructure, protect wildlife, ensure passage of navigable waters, and ensure the protection of water resource functions and public services
- Permits associated with dam mitigation:
  - Story County Floodplain Management Permit
  - Iowa DNR Floodplain Permit
  - US Army Corps of Engineers Section 404 Clean Water Act Permit

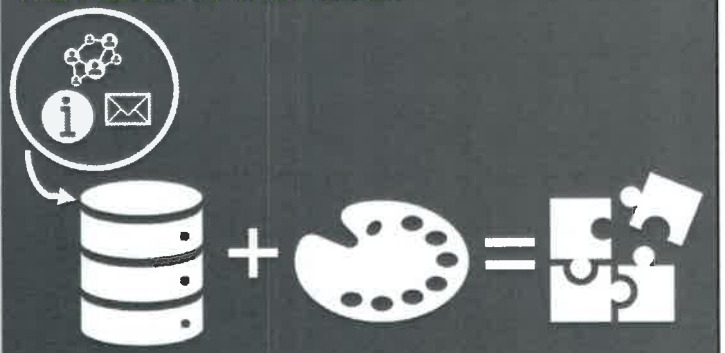
16

PERMITTING – WHAT IS IMPORTANT FROM A REGULATORY PERSPECTIVE

- With the mitigation of the dam, the environmental functions of the South Skunk River and habitat will be improved, thus resulting in a gain of resource function
- Therefore, low-head dam removal (removal or mitigation) can be pursued under Nationwide Permit 53 with the Army Corps of Engineers
- Nationwide permits are utilized for projects where the environmental impacts are minimal, and for projects that result in a net increase in resource functions.
- Iowa DNR and Story County Floodplain Permits to ensure no negative impacts to adjacent lands and water resources from conducting work in the floodplain

17

CONCEPTUAL DESIGNS – THE PIECES OF THE PUZZLE



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CONCEPTUAL DESIGNS - THE PIECES OF THE PUZZLE

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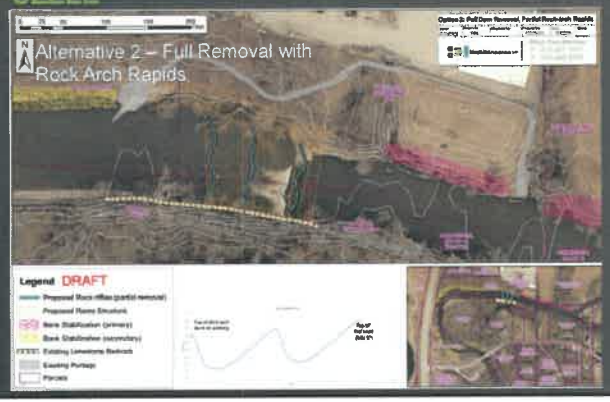
CONCEPTUAL DESIGNS - THE PIECES OF THE PUZZLE



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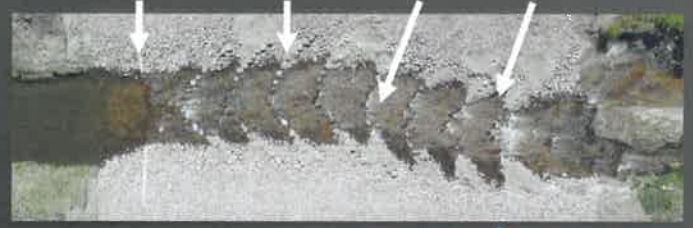
FROM THE AIR



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ON THE GROUND

22

CONCEPTUAL DESIGNS - THE PIECES OF THE PUZZLE

- What differs between the two options for the goals identified for the project?

Project Goal	Current Condition	Full Dam Removal	Dam Removal with Rock Arch Rapids
Primary Goal			
Improve Paddler Safety	Not Met	Met	Met
Improve Fish Passage	Not Met	Met	Met
Visual & Audible Aesthetic	N/A	Partially Met	Met
Secondary Goal			
Enhance Passive Recreation	Not Met	Met	Met
Maintain Land Accessibility	Met	Met	Met
Improve Terrestrial Habitat	Not Met	Met	Met
Maintain or Improve Fishing	Met	Partially Met	Met
Preserve Cultural Sites	Not Met	Met	Met

- What might change:

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NEXT STEPS

- Decisions to implement a plan of action to remove or mitigate Hannum's Mill Dam must address:
  - ☐ Select an Alternative (dam removal or rock arch rapids)
  - ☐ Confirm Private Landowner Support for Course of Action
  - ☐ Confirm Public Support for Course of Action
  - ☐ Identify Funding Mechanism
  - ☐ Initiate Permitting

24

NEXT STEPS

- How do the options stack up relative to the project goals? (private and public support)
  - Biggest Changes:
  - Smaller Changes:
- Funding
  - Greatest opportunity for grant match is available for ecological restoration
  - Confer with supporters and ensure the route will not impact financial support for the project

25

NEXT STEPS

- Check the boxes in order to ensure project support
  - ☐ Select an Alternative (dam removal or rock arch rapids)
  - ☐ Confirm Private Landowner Support for Course of Action
  - ☐ Confirm Public Support for Course of Action
  - ☐ Identify Funding Mechanism
  - ☐ Initiate Permitting
- Use the support in this room to develop and maintain support for the design and ultimately the construction phases

26

QUESTION AND ANSWER
(BOX FOR WRITTEN COMMENTS NEXT TO THE DOOR)

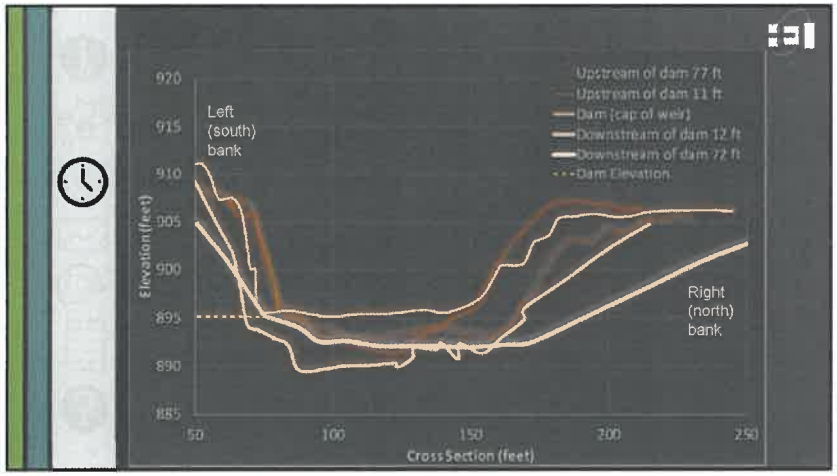
27

Please leave written comments if you have a question you were not able to ask, have a general question about next steps, or would like to assist with next phases.

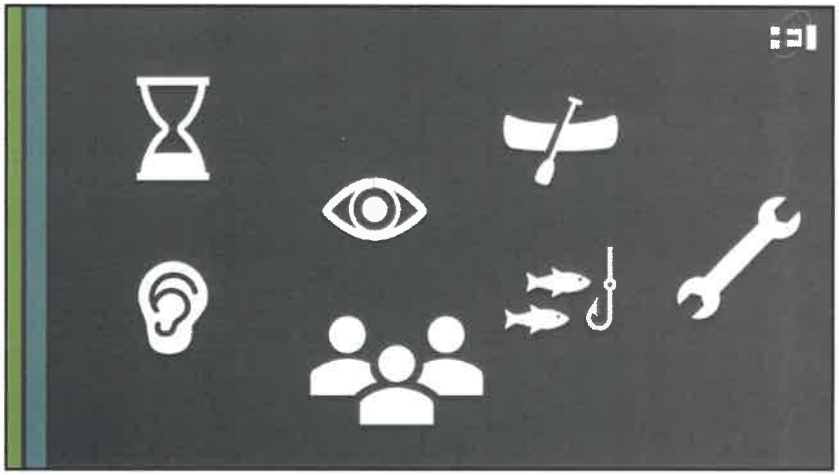
We'll stick around to mingle!

Business cards are on the table in the back if you want to contact us in the coming days or weeks.

28


Upstream of dam 77 ft
Upstream of dam 11 ft
Dam (cap of weir)
Downstream of dam 12 ft
Downstream of dam 72 ft
Dam Elevation
Left (south) bank
Right (north) bank
Elevation (feet)
920
915
910
905
900
895
890
885
50
100
150
200
250
Cross Section (feet)

29



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