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Department of Agriculture

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Mike Beam, Secretary

Laura Kelly, Governor

MINUTES OF THE STATE CONSERVATION COMMISSION

1. The State Conservation Commission meeting was called to order by Rod Vorhees, Chairman and Area V Commissioner at 10:05 a.m., Monday, February 01, 2021, via Zoom.

2. **ATTENDANCE:**

Elected Commissioners:

Ted Nighswonger, Area I Commissioner
Andy Larson, Area II Commissioner
Brad Shogren, Area III Commissioner
John Wunder, Area IV Commissioner
Rod Vorhees, Area V Commissioner

Ex-Officio & Appointed Members:

Karen Woodrich, State Conservationist, Natural Resource Conservation Service (10:05 to 12:00; 1:15 to 2:00; 2:55 to 3:40)
Dan Devlin, Director, Kansas Center for Agricultural Resources and the Environment (KCARE), K-State Research and Extension (9:55 to 10:03)
Peter Tomlinson, Ph.D., Associate Professor, Extension Specialist for Environmental Quality Agronomy Department, Kansas State University
Terry Medley, P.E., Water Structures Program Manager, Division of Water Resources, Kansas Department of Agriculture
Susan Metzger, Senior Executive Administrator to the Dean and Director of Ag Kansas State University, Associate KCARE/KWRI Director (left meeting at 1:00 and returned)

Division of Conservation, Kansas Department of Agriculture Staff:

Andrew Lyon, Executive Director
Scott Carlson, Assistant Director
Steve Frost, Administrative Manager
Dave Jones, Water Quality Program Manager
Cindy Pulse, Conservation District Program Coordinator
Christy Koelzer, Administrative Specialist

Guests:
Mike Beam, Kansas Secretary of Agriculture
Kelsey Olson, Deputy Secretary Kansas Department of Agriculture (10:45 to 12:00)
Dan Meyerhoff, Executive Director, KACD (11:05 to 12:00)
Matt Meyerhoff, Acting Assistant State Conservationist for Partnerships, NRCS
Amanda Scott, President, KACD-EO

Herb Graves, Executive Director, State Association of Kansas Watersheds (SAKW) (arrived at 2:45, left at 3:45)
Jason Hartman, State Forester, Kansas Forest Service
Dean Krehbiel, Supervisory Soil Conservationist, NRCS (1:05 to 2:30)

3. **CERTIFICATION OF ELECTION:**

A motion was made by Brad Shogren to certify the election to the Conservation Commission for a two-year term beginning January 1, 2021: Area II – Andy Larson and Area IV – John Wunder. The motion was seconded by Ted Nighswonger. Motion carried.

4. **ELECTION OF CHAIRPERSON AND VICE-CHAIRPERSON OF THE COMMISSION:**

A motion was made by Ted Nighswonger to nominate Rod Vorhees to serve as chairperson. The motion was seconded by Brad Shogren. Motion carried.

A motion was made by Ted Nighswonger to nominate John Wunder to serve as vice-chairperson. The motion was seconded by Brad Shogren. Motion carried.

5. **APPROVAL OF AGENDA:**

A motion was made by Brad Shogren to approve the revised agenda. The motion was seconded by Peter Tomlinson. Motion carried.

6. **MINUTES OF THE PREVIOUS MEETING:**

A motion was made by Ted Nighswonger to approve the November 22, 2020, minutes as mailed. The motion was seconded by John Wunder. Motion carried.

7. **OPEN DISCUSSION – 10:05 a.m. to 12:00 p.m.:**

a. Brad opened the discussion with his written update (Attachment A).

i. Brad Shogren shared that it has been a frustrating year, especially the past fall, to perform the duties of a supervisor or chairperson when they don't have access to the office or face-to-face communication with the manager. Brad asked if it might be possible to allow some limited access to CSIMS for supervisors. This would provide supervisors an additional tool to double check things are running right. Brad appreciates the DOC newsletter and said it's very helpful when the district manager shares that.

ii. Peter Tomlinson stated that this is not a new topic amongst the commission. Commissioners used to receive a report detailing counties with delinquent documents. The commissioners could then reach out to the counties that were delinquent and encourage compliance.

iii. Andy Lyon stated that DOC will discuss the ability to run reports more regularly and who needs to have this information and will keep everyone posted.

b. List of newly elected supervisors

i. Rod Vorhees asked if commissioners could receive a list of newly elected supervisors over the past year. Commissioners could reach out to new supervisors regarding what is expected of a supervisor.

ii. Ted Nighswonger stated that they have a new supervisor and the packet of information was very helpful.

iii. Cindy Pulse explained that district managers are to give the supervisor training modules to new supervisors. There are 14 DOC and two KACD modules. Some managers go through a module on a regular basis at monthly meetings. DOC suggests new supervisors review the modules. They are on the website. Cindy suggests the managers review the modules as well. DOC is working on updating the modules.

c. Streambank Stabilization

i. Andy Lyon introduced Kristin Kloft, new Riparian & Wetland Program Manager.

ii. Kristin Kloft informed the commissioners that contracts that were extended to May 1 are in the process of being completed. Two small streambank designs are in the works and DOC is working on getting next projects out to bid.

iii. Andy Lyon informed the commissioners that the KFS staff has been working with Kristin and designers on the projects. If agency staff could provide technical assistance, DOC wouldn't have to hire design on every project.

iv. Brad Shogren said there is a need for more education for the public and shared an example from his county. An individual did a waste treatment system himself for $25,000. After learning that a neighbor did a project and got cost share, he wanted to get cost share. It was too late, and the individual was upset. How do you keep information in front of people?

v. Karen Woodrich said that NRCS has a similar struggle with providing updates on changes in programs. There is a whole sector of people that don't know about NRCS programs. More local outreach programs could let people know about all the programs that are available.

d. Legislative Updates

i. Andy Lyon informed the commissioners that the conservation district law update was introduced on the Senate side, Senate Bill 40. There was language to provide clarification on powers of conservation districts taking projects with other entities. The language was also changed so the four non-elected commissioners can vote. It got passed out of the Senate Ag Committee. DOC sees no problems with the bill moving forward and will keep the commissioners updated.

ii. Andy Lyon informed the commissioners he provided a presentation on DOC programs to the new legislative Water Committee. The committee is learning about various programs across the state.

iii. Kelsey Olson informed the commissioners that Representative Highland wants the Water Committee to look more closely at water issues in the state. He asked for a special task force, but they elected to set up this routine committee to provide more information and education to legislators.

e. Kansas Water Authority Chair

i. Andy Lyon informed the commissioners that Dawn Buehler is the new KWA Chair.

f. EPA Grant

i. Andy Lyon informed the commissioners that DOC was not funded for the EPA Grant opportunity. There were 40 applications and 11 were funded.

g. CCGA Grants

i. Andy Lyon informed the commissioners that a CCGA grant application would focus on filling open conservation technician positions.

h. Education and Information Specialists

i. Andy Lyon informed the commissioners that DOC is exploring the idea of education and information specialists to provide support to managers with communication such as newsletters and social media, and planning events such as field days and workshops.

8. **UNFINISHED BUSINESS:**

a. WR and NPS Cost-Share Funds Discussion – Lyon, Jones (Attachment B)

i. Andy Lyon and Dave Jones provided a handout and explanation of the Water Resources Cost-Share Program Spring 2021 Re-allocation Proposal.

A motion was made by John Wunder to approve the Spring 2021 Re-allocation Proposal as presented by DOC on the Water Resources Cost Share Program. The motion was seconded by Ted Nighswonger. Motion carried.

ii. Andy Lyon and Dave Jones provided a handout and explanation of the Non-Point Source Pollution Reduction Cost-Share Program Spring 2021 Re-allocation Proposal.

(a) There was a discussion regarding on-site waste. As stated in the proposal, $50,000 of the $342,820,74 will be allowed to fund On-Site Waste cost-share contracts but will be limited to $2,000 per contract. Brad Shogren asked if $2,000 is enough as it's less than half the cost. Dave Jones informed the commissioners the amount was set to limit on-site waste applications, so DOC doesn't get inundated with them. The cost-share amount has been decided by each individual district. Andy Lyon stated that DOC wanted to try to limit but is open to suggestions. Rod Vorhees asked and Dave Jones confirmed that not

all districts include on-site waste in their program, so they wouldn't be eligible and that upon reaching the $50,000 limit it wouldn't be an eligible practice.

A motion was made by Brad Shogren to amend the proposal to increase the on-site waste contract limit to $2,500 per contract and approve the non-point source pollution reduction cost share program spring 2021 re-allocation proposal. The motion was seconded by Ted Nighswonger. Motion carried.

b. NACD Virtual Annual Meeting – Lyon

9. NEW BUSINESS:

a. GPGI Presentation/Discussion – NRCS

i. Dean Krehbiel presented a Power Point on the Great Plains Grassland Initiative (GPGI). Karen Woodrich thanked Andy Lyon for allowing Dean to present this initiative for awareness. Andy Lyon informed the commissioners that DOC will look for ways state programs can complement the federal program.

b. CREP Incentive Payment Discussion – Frost (Attachment C)

i. Steve Frost provided a handout on Future CREP Payment Projections and reviewed how the 2018 Farm Bill changed some significant financial requirements for states implementing the Conservation Reserve Enhancement Program.

10. UPDATES:

a. Comments from Guests

i. Jason Hartman, KFS, informed the commissioners that there has been growth in the market. KFS is adding a wildfire position. Tree sales are going on. KFS is working with NRCS partners to re-evaluate which trees and shrubs should be planted in different parts of the state. They have introduced an evaluation with a group called Renew West Quantified Ventures. KFS is looking into possibilities of private lands for riparian and forest projects and ecosystems.

ii. Herb Graves, SAKW, provided a written update. (Attachment D)

iii. Amanda Scott, President, KACD-EO, informed the commissioners that districts are in the middle of annual meetings. A few managers have had questions on end of the year reports. The statewide EO meeting in Wichita will be discussed at the end of February at the next board meeting.

b. Agency Updates

i. Matt Meyerhoff (USDA, NRCS) informed the commissioners that Kevin Norton is NRCS Acting Chief. As of February 14, Karen Woodrich will be the Acting Ecological Science Division Director and Monte Brenneman will be the Acting State Conservationist. There is a $9 million shortfall in the budget and a limit on new agreement dollars. NRCS will continue

to hire for open positions. New executive orders require that masks always be worn in the building unless eating or drinking. Matt provided program updates and an update on future trainings. NRCS is working on working agreements with the districts. CCGA grants are available through March 8. In response to John Wunder's question about cultural resources policies, Karen Woodrich informed the commissioners that there will be some changes in cultural resources practices in the future.

ii. Susan Metzer (KSU, KCARE) had nothing to report.

iii. Peter Tomlinson (KSU Research & Extension) informed the commissioners that there has been administrative reorganization. Three regional directors will support Western, Central, Eastern Kansas. Dan Devlin is the Interim Head for the Western region in addition to his role as Director of KCARE. Dr. Khosla is the new head of the Agronomy department effective January 11. The next five-year cycle of work stared in July with funding through NRCS and the Foundation for Food and Ag Research. An RCPP proposal will look at soil health and conservation around grain sheds for ethanol production. Extension programming is continuing to be offered across the state in a virtual fashion.

iv. Terry Medley (KDA, DWR) provided a written update. (Attachment E)

c. DOC Staff Updates:

DOC provided written updates.

i. Hakim Saadi (Attachment D)

ii. Scott Carlson (Attachment F)

iii. Steve Frost (Attachment G)

iv. Dave Jones (Attachment H)

v. Kristin Kloft (Attachment I)

vi. Cindy Pulse (Attachment J and K)

(a) John Wunder asked if a list could be provided to the commissioners of newly elected supervisors by year for the past three years. Cindy Pulse said she can provide that report.

d. Elected Commissioner Area Updates:

i. Ted Nighswonger (Area 1) informed the commissioners that they have had seven inches of snow. They can't stop and visit with their district manager. Don Paxson was their chairman for 40 years. They have someone they think will take his position and will vote for new officers next week.

ii. Andy Larson (Area II) informed the commissioners that DC Amanda Shaw retired at the end of the year. Casey Robinson is the Interim supervising the counties. There have been some new district managers in their area. It has been very dry lately. A long-time farm broadcaster and personal friend was in a motor vehicle accident caused by high winds and died. They had to move their annual meeting to the 4H building instead of the usual location due to COVID.

iii. Brad Shogren (Area III) provided a written update. (Attachment A and L)

iv. John Wunder (Area IV) provided a written update. (Attachment M)

v. Rod Vorhees (Area V) provided a written update. (Attachment N)

11. ADJOURNMENT:

The next meeting date was not set.

A motion was made by Andy Larson to adjourn the meeting. The motion was seconded by Ted Nighswonger. Motion carried.

The meeting was adjourned at 3:40 p.m.

Andrew Lyon
Executive Director

Brad Shogren, State Conservation Commissioner, District Three

It has been a very difficult time to be a volunteer supervisor and chairman of a county conservation district. The covid restrictions and lock downs have disrupted normal business procedures and made it extremely difficult to oversee operations of district activities and oversight of a relative new district manager. Our board has been locked out of the building and have had meetings via conference calls and in person meetings off site. Communications with district manager and district conservationist are phone or emails.

In December our auditor contacted me about lack of information submitted for our specified procedures audit. It is next to impossible for a volunteer supervisor who has no authority to enter the office premise or access a district computer without a linkpass authorization to gather the required information. In the process I contacted Cindy Pulse for assistance and advice. I also inquired at that time about the status of county submitting required documents to DOC and found we are delinquent in many categories. Once again not having access to computers or access to CSIMS it is again impossible to do my fiduciary duty as a supervisor and board chairman.

I thought we had initiated a policy to contact board chairmen and supervisors when a district has fallen behind on submitting necessary reports to the DOC. What happened to that policy?

We have scheduled our annual meeting in conjunction with our regular scheduled board meeting and will follow all the statutory requirements necessary for an annual meeting.

In our area we have had a renewed interest or inquiries into assistance with some stream bank problems. About one year ago we had developed a strategy to make assistance available to landowners who have stream bank problems. The effort was delayed due to covid and lack of supporting reporting from our new techniques using trees as revetment material. Keri Bigham has been studying the status of these projects and has finally submitted her final report. The report is attached. The McPherson and Saline County Conservation Districts and the City of Salina had an agreement to fund a watershed specialist to assist landowners in evaluating, planning, permitting, and implementing some new projects. The City of Salina has not given final approval, but the conservation districts will discuss at our next meetings partially funding an identified individual to perform these activities. This position will be an employee of K-State and participating parties will pay K-State for the service.

Water Resources Cost-Share Program

Spring 2021 Re-allocation Proposal

1. $75,000 to be allocated to Irrigation Technology category signup. This funding would be available statewide while the original $100,000 would only be eligible in the Rattlesnake Creek Watershed.

2. $43,225.70 to be allocated to bring existing contracts up to maximum cost-share percentage allowed by County. We believe this will keep many underfunded contracts from eventually being canceled.

3. $367,500 ($3,500 per county) for each Conservation District across the state to conduct On Farm Field Trial to demonstrate environmental and economic benefits of Conservation Practices that are applicable to dominant Agricultural Production Systems in each county. Conservation Districts will be allowed to utilize $500 per county for time that District Manager spends to develop and implement Field Trial. Results to be shared by cooperating Producer at Conservation District annual meetings.

   Examples of field trials include but are not limited to:

   - Zone soil sampling and variable rate nutrient application vs. uniform application
   - Intensive rotational grazing vs. set stocking rates
   - Irrigation scheduling and telemetry technology vs. conventional irrigation management
   - Soil health amendment vs no amendment
   - Cover Crop grazing vs. un-grazed cover crop for profitability, yield, weed suppression

Non-Point Source Pollution Reduction Cost-Share Program

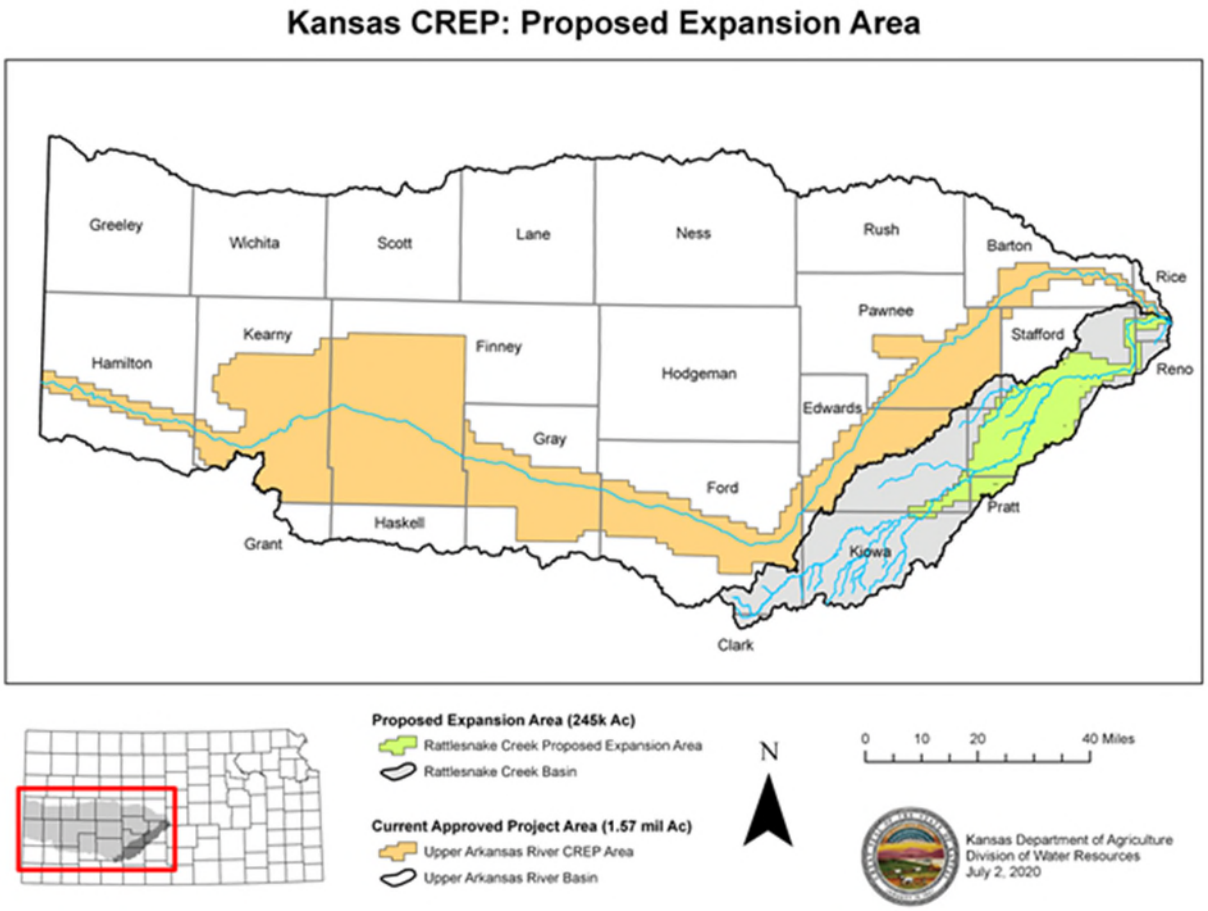
Spring 2021 Re-allocation Proposal

1. $342,820.74 will be allocated to a single source of funding for all Conservation Districts across the state to write contracts from as long as funding remains. All Practices that are currently eligible in each Conservation District's SFY2021 Program will be eligible, and practices (340) Cover Crop, (590) Nutrient Management, and Livestock related practices such as (382t) Temporary Fencing, (382) Fence, (516) Pipeline, (378) Pond, (533) Pumping Plant for Water Supply, (574) Spring Development, (642) Water Well, and (614) Watering Facility will be eligible in all counites on cropland and perennial grass grazing lands.

   $50,000 of the $342,820,74 will be allowed to fund On-Site Waste cost-share contracts but will be limited to $2,000 per contract.

2. $20,000 to be allocated to bring existing contracts up to maximum cost-share percentage allowed by County. We believe this will keep many underfunded contracts from eventually being canceled.

Future CREP Payment Projections



The 2018 Farm Bill changed some significant financial requirements for states implementing the Conservation Reserve Enhancement Program, especially that

1) FSA soil rental rates will be re-established annually according to National Agricultural Statistic Service (NASS) data on a county (not HUC) basis – states will still have a chance to make alternate recommendations**. (The last Kansas rate adjustment was 2015 and we did not have adequate notice to respond to the proposed 2021 rates, which are drastically lower by 10 – 42%.)**

2) FSA will now only provide 90% of the established NASS soil rental rate to the producer over the 14-15 year life of the CRP contract. **(This further reduction in payment rates will be substantially less attractive to Kansas producers who might otherwise consider enrolling their land / water rights in CREP.)**

3) Under any newly approved MOA amendments, the state must still provide a 20% overall match to the federal program costs, 10% of which can be indirect expenses – however, the other 10% must be made as direct cash payments to producers. **(Since 2007, Kansas has been allowed to utilize payments made from the Western Kansas Water Conservation Projects Fund to facilitate surface water efficiency improvements as part of (actually most of) these 10% direct cash payments – this will no longer be allowed if we still wish to amend our current MOA to include the Rattlesnake Creek area.)**

Under these new terms, Kansas will need to significantly increase the incentive payments made to producers as part of the 10% direct cash match commitment and terminate present tier rates. The following payment scenarios illustrate the differences which can be expected in order to continue with the ongoing MOA amendment process:

2020 DOC Landowner Incentive Payment Example

Tier 1 @ $97/acre X 130 acres = **$12,610**; Tier 2 @ $55/acre X 130 acres = **$7,150**
At these incentive rates alone, DOC will not nearly be able to meet the 10% payment to participant requirement.

Example 2020 Kearny County Enrollment ($160 per acre)

Typical total of FSA irrigated soil rental and state incentive payments for a center pivot was about $324,610 ($160 per acre x 130 acres x 15 years = $312,000 from FSA + **$12,610 state incentive payment**).

Example 2021 Kearny County Enrollment ($116 per acre x 90% = $104.40 per acre)

Typical total of FSA irrigated soil rental and state incentive payments for a center pivot will be about $223,938 ($104.40 per acre x 130 acres x 15 years = $203,580 from FSA + **$20,358 state incentive payment** = 10% of federal payment).

Example 2020 Barton County Enrollment ($176 per acre)

Typical total of FSA irrigated soil rental and state incentive payments for a center pivot was about $355,810 ($176 per acre x 130 acres x 15 years = $343,200 from FSA + **$12,500 state incentive payment**).

Example 2021 Barton County Enrollment ($134 per acre x 90% = $120.60 per acre)

Typical total of FSA irrigated soil rental and state incentive payments for a center pivot will be about $258,687 ($120.60 per acre x 130 acres x 15 years = $235,170 from FSA + **$23,517 state incentive payment** = 10% of federal payment).

Example 2022 Stafford County Enrollment ($225 per acre x 90% = $202.50 per acre)

Optimum total of FSA irrigated soil rental and state incentive payments for a center pivot will be about $434,362 ($202.50 per acre x 130 acres x 15 years = $394,875 from FSA + **$39,487 state incentive payment** = 10% of federal payment - **about $303 per acre**).

In this optimum example, the DOC incentive payment responsibility would be 300% greater than the current Tier 1 rate. If the project is expanded to 40,000 acres, the total state commitment to entirely fill the remaining project (16,854 acres) could potentially be as much as approximately $5,106,752 at an FSA irrigated rental rate of $225 per acre.

The current FY2022 recommended budget for CREP / WTAP is $627,046, of which approximately $300,000 is proposed for CREP). **A total of 47,500 acre-feet of annual water appropriations have been permanently retired on 23,146 enrolled acres as of December 31, 2020.**

Watersheds Program Manager Update

Hakim Saadi, P.E.

February 1, 2021

- DOC and Watershed Partnership (SAKW, DWR and NRCS) are working/planning 3 Operation & Maintenance Workshops across the state, this spring 2021 - Bi-annual O&M Workshops – pending pandemic relief.

- 2020 Watershed Districts O&M Reporting: 85 % statewide with 97% for state funded sites.

- Rehabilitation of existing watershed structures:
  - FY 2020: 3 completed, 1 at 95% completion and 4 will start construction this spring, 2021.
  - FY 2021: No construction started yet but soon.

- FY 2022 Rehabilitation: 2 site evaluation inspections.

State Association of Kansas Watersheds Update

Herb Graves

February 1, 2021

- SAKW currently is administering a local contract funded by an Agreement with NRCS to complete Operation and Maintenance Inspections on 277 PL-566 dams in South Central Kansas.

- SAKW and our Watershed Partners have started the planning efforts to conduct O&M Workshops in several locations in Kansas either this spring or next fall.

- Not sure what the protocol will be to make visits or testimony before committee hearings in Topeka. Perhaps it will be discussed during the SCC meeting.

LiDAR: The LiDAR contract with Atlantic was extended to December 31, 2020. All data has been submitted to USGS for Review. DWR and the Natural Resources Conservation Service (NRCS) entered into an agreement for LiDAR acquisition and hydroenforcement in September of 2017, with the original agreement end date of February 28, 2020. LiDAR was acquired in 2 phases between the fall of 2017 through the spring of 2019, with phase 1 delivery dates originally projected at the end of 2018. Due to delivery delays by Atlantic, this agreement was extended for 1-year, and currently has the end date of February 28, 2021. Atlantic has been the LiDAR acquisition vendor for the State of Kansas since 2014. DWR asked for a second no cost extension to the agreement end date to allow time for the USGS to QA/QC the data delivery blocks as well as time to complete the hydroenforcement of the LiDAR data. DWR proposed to extend the agreement end date to February 28, 2022. DWR has contracted with Wood Environment and Infrastructure (Wood) for the hydroenforcement, which is projected to begin in December 2020 upon receipt of acceptable LiDAR data from Atlantic as determined by the USGS. In the previous extension request, the hydroenforcement date was scheduled to begin in April of 2019, but due to errors USGS found within multiple blocks of the LiDAR dataset, Wood was unable to begin processing the data as planned. The proposed extension was approved by NRCS on January 5, 2021.

Floodplain Mapping Kickoff Meetings: Coffeyville levee and Caney levee floodplain mapping kick-off meetings were held December 2 via Zoom. DWR discussed flooding concerns and mapping needs and gave an overview of the floodplain mapping process. This is part of the first phase of a FEMA Risk Mapping, Assessment and Planning (MAP) project, which includes a Discovery process to gain an understanding of the communities mapping and flooding concerns.

Lower Middle Arkansas Discovery Meetings: The Discovery meetings for the Lower Middle Arkansas floodplain mapping update project were held on January 12 and 13 via zoom. The counties involved in the project are Barton, Reno, Stafford, Rice Ellsworth, McPherson, Harvey and Sedgwick counties. The Base Level Engineering (BLE) phase marks the first stage of updating floodplain maps for portions of the counties and will be further enhanced through Data Development that is scoped in FFY21. It will be a few years before there are new effective maps for these counties. These initial draft floodplains are not yet ready to be released to the public since they will be further enhanced and potentially modified due to comments.

Floodplain Mapping Flood Risk Review Meeting: The Flood Risk Review meeting for Mitchell County was held on January 6th via Zoom. The Base Level Engineering (BLE) phase has occurred for Mitchell County but will be further enhanced through additional Data Development. It is important for communities be involved early in this process to begin reviewing the data, provide feedback to DWR and to be aware of the project as it moves forward. DWR also used this meeting to discuss any technical assistance needs and to look at possible mitigation actions.

County Consultation Coordination Officer's (CCO) Meetings: The Nemaha County CCO meeting was held on January 19 via zoom. The meeting was to explain the post-preliminary and due diligence portions of the project. The DWR explained the appeal period, public notification, the Letter of Final Determination (LFD), community adoption of the new map and other community responsibilities. At the CCO Meeting, DWR explained the administrative steps that are now required to make the map official. The goal of the meeting was to ensure that communities understand the process and what they will be responsible for over the next year and a half.

Appeal Periods: The 90-day appeal periods for the Lyon County and Franklin County floodplain mapping updates started on January 19 and the Ellis County appeal period started January 20. The appeal period

is the last opportunity to address mapping issues for this project, however, the end of the appeal period does not mean that the new map can never be changed. In fact, it should change over time. After the Effective Date, changes can be made through the Letter of Map Change (LOMC) process at any time. Large physical changes, such as development or drainage work, can be resolved with a Letter of Map Revision (LOMR) after these maps go effective. If a property owner believes that the map of their lot is wrong and wants to modify it, they can apply for a LOMA (Letter of Map Amendment). When major changes (such as a road redesign or significant commercial/residential development) occur, the community must require that a Letter of Map Revision (LOMR) be done by the entity making the change so that the maps stay up to date.

Dodge City Technical Assistance: The Dodge City technical assistance meeting was held on December 1 via zoom. During the meeting DWR and its contractor, Stantec, gave an overview of the draft report for the Dodge City hydrology methods that were studied. Stantec evaluated four different approaches to estimate the 1% annual chance discharge for the Arkansas River at Dodge City. Approach 4 is a mixed distribution method using the Bulletin 17C based analysis of the entire peak flow record dataset for Arkansas River at Dodge City. Approach 4 utilized the continuous gage record from 1942 and omitted the 82,000 ft3/s peak flow measured in 1965. It is considered a high outlier. However, low flows in the gage records are accounted by assuming the probability of the entire peak flow record dataset as a mixed probability distribution. High frequency flows (low and zero flows) are considered to follow a discrete probability distribution and the low frequency flows (high flows) are considered to follow a continuous distribution. The Log Pearson III (LPIII) distribution was fitted using Bulletin 17C methodology with the low outlier censored dataset. USACE HEC-SSP 2.2 is used for the analysis. This is the approach that will be submitted to FEMA for approval. Dodge City officials were pleased with the analysis.

GMD 1 – Wichita County LEMA Order of Designation: The Order of Decision was issued December 30 with a finding the that LEMA plan was adequate to address the goals in the LEMA plan and therefore acceptable. The next step is formalizing the LEMA with and Order of Designation. Pursuant to K.S.A. 82a1041(d)-(h), an order of designation shall be a final order that designates the boundaries of the LEMA, puts in place the corrective controls proposed in the management plan, and shall be in full force and effect upon its entry in the records of the Chief Engineer's office. DWR is working on an online tool where water users can keep track of their allocations through the LEMA period. The order of Designation is in final draft form and will be issued as soon as we have prepared the accompanying allocation correspondence.

Multi-Agency Water Webinar: KDA coordinated an educational webinar for the benefit of Kansas legislators to highlight the major roles and responsibilities of KDA, KWO, and KDHE on the context of water resources management. The webinar was held January 11.

Letter of Map Change Training: DWR hosted Letter of Map Change (LOMC) training on December 9 and 10 via Zoom. The training was designed to teach engineers, surveyors, and local communities on how to submit the seven different types of LOMC. The course was attended by 50 people throughout the state.

Annual Well Measurements: DWR is actively conducting the annual well measurement program. Our team works in cooperation with the KGS to obtain the static water level of approximately 1400 wells in the High Plains Aquifer. This data, in conjunction with the annual water use report data, is critical to helping manage the Ogallala.

Audubon of Kansas lawsuit: On Friday, January 15, AOK filed its suit in Federal district court seeking protection of Quivira National Wildlife Refuge's Kansas water right from impairment by junior water users. The multi-faceted claim alleges violations of the National Wildlife Refuge System Improvement Act and Administrative Procedures Act, Endangered Species Act, National Environmental Policy Act, and the prohibition on disposing of federal property. The suit also claims that the refuge is entitled to 22,000 acre-feet per year; about 50% more water that its 1957 water right was perfected for, under the 1908 federal reserved water right doctrine. The suit asks the court to order the chief engineer to administer junior water rights that have been and are impairing the refuge's water right.

Staffing: The Water Structures Program has 2 vacant dam safety engineering positions and 1 stream permitting engineering position. The Water Appropriations Program has 7 vacancies. Water Management Services has 1 vacancy.

Mined Land Reclamation Program / Ag Lime Program Update

Scott Carlson

February 1, 2021

- This spring we hope to have the Governor officially present her 2020 Governors Mined Land Reclamation award to ACME Brick as well as get a photo op with Hamm Quarries who won the National award again for their Governors award submittal in 2019.

- Mostly complete with the Reclamation and Ag Lime Information System (RALIS) database. Integration with Docuware is ramping up in February.

<u>Virtual Meeting Equipment Funded by the CARES Act</u>

- Equipment was distributed and more detailed guidance and instruction on set up is being sent as requested by districts. Districts were very appreciative of receiving this equipment.


Flat Panel TV Cart
50"


50"


TRIPP-LITE
50"


KANSAS


Flat Panel TV Cart
KANSAS


Flat Panel TV Cart
KANSAS

Administrative Manager/Water Conservation Programs Manager Update

Steve Frost

February 1, 2021

Current activities and major tasks ahead for the next quarter:

- Completing USDA MOA revisions for the UAR CREP agreement to include the Rattlesnake Creek basin, and all associated components for 2021 re-rollout – training, educational documents, public notifications, data updates, enrollment.
    - A significant question exists regarding the restructuring of incentive payments provided by the State of Kansas (DOC). Changes under the 2018 Farm Bill will require that DOC's incentive payments to landowners increase by as much as 4x, and that just one uniform rate apply to the entire project area (no tiers).
    - Also, the irrigated rental rates established for 2021 are significantly lower than 2020 (10-42% by county). In addition, new rules under the 2018 Farm bill only allow FSA to pay 90% of the established rental rates.

- Preparing for a special early payout of remaining contracts under the Kansas Water Quality Buffer Initiative. The current DOC appropriation for FY2021 is $529,192.75. The current liability for all remaining buffer contracts which will eventually terminate in 2031 is approximately $657,000.

- NRCS is undergoing a substantial statewide hiring action, especially regarding conservation technicians. We expect to see considerable movement from DOC and KACD technicians being hired into NRCS career tracks, which usually means re-processing those positions into new district locations. I still anticipate implementing our 2020 CCGA grant to place four new regional soil conservationists in the state through DOC / conservation district agreements; administering 36 other agreement positions and likely pursuing similar, additional FY2022 grant opportunities.

- Now hoping for a Fall, 2021 WTAP program roll-out on the Wichita & Greeley counties RCPP project. The target areas still need to be officially designated prior to DOC implementation activities taking place. The funding availability for the first-year enrollment is expected to be $200,000.

Water Quality Program Manager Update

Dave Jones

February 1, 2021

Cost-Share/I&E Updates Sent to All Conservation Districts

- I would like to remind everyone that the DOC is offering virtual attendance scholarships for all conservation district employees and supervisors to attend the No-Till on the Plains Winter Conference on January 26th. The conference will be available to view at a later time if you are unable to watch on the 26th. You will need to send in your application spreadsheet to me in order to virtually attend on the day of the conference or watch at a later date. We have had a small response so far, please consider applying for a virtual attendance scholarship.

- The DOC will be providing virtual scholarships to Soil Health U. We have been working with the High Plains Journal on the scholarships. They will be available to all conservation district supervisors and employees.

- All approved FY 2021 contracts that are going to be encumbered will need to be evaluated in the field before May 15, 2021. These evaluations are needed to determine what practices are necessary for the contract. If changes to the contract are needed, they will have to be done in the current fiscal year by cancelling the contract and submitting a new contract that reflects the needed changes. Once a FY 2021 contract has been encumbered the contract practices cannot be changed.

- All regular NPS_NPS and WR_DNA approved contracts that have not been completed in FY 2021 will be encumbered until May of 2023.

- All approved contracts funded with Watershed District funds that have not been completed in FY 2021 will be encumbered until May of 2023.

- The DOC would like to request that you contact all landowners/operators with approved FY 2021 KRPI contracts to see if they have finished planting their fall cover crops. If they have finished and have not submitted bills for payment, please have them do so as soon as possible. All FY 2021 KRPI cover crop contracts that have not been paid need to be submitted for final payment or submitted for cancellation in CSIMS no later than the end of business Friday January 22, 2021. Stay tuned for information about a spring KRPI sign up.

- The DOC will be notifying districts of the plan for cancelled cost-share funds soon after the State Conservation Commission meeting on February 1, 2021.

Riparian & Wetlands Program Update

Kristin Kloft

February 1, 2021

- I started as the new Riparian & Wetlands Program Manager on November 30th. Since then we have had two Streamteam meetings where we have managed to correct some confusion among streambank projects, contracts and contractors. One extension was issued to align all outstanding streambank projects to now have the same completion date of May 1st. Contractors will be monitored to help keep these projects on track.

- There are currently 10 streambank stabilization projects designed, permits complete or nearly complete and ready to bid. Another 7+ projects are designed and are ready to move into the permit stage. Selection of sites and timing of bidding the next round of projects will be discussed at the January 26th Streamteam meeting.

- I've also been working with KFS and Phil to begin designing small streambank stabilization projects within the RQEI program. We've worked on designs for two small streambank projects and have another possible site scheduled to review with the landowner. I spent several days studying for the drone test, took the exam and have attained the drone license.

CONSERVATION DISTRICT PROGRAM COORDINATOR UPDATE

As prepared by Cindy Pulse

State Conservation Commission Meeting

February 1, 2021

1. **New District Manager Training**
   - Continuing virtual training in segments
   - Constantly updating and improving trainings
   - District Managers trained to date:
     - Area 2
       - Grant County – Karrie Meredith
       - Ness County – Kira Pfannenstiel
     - Area 3
       - Sedgwick County – Brenda Matson
     - Area 4
       - Shawnee County – Chalee Braun

2. **Supervisor Training Modules**
   - Reviewing & updating modules into different format

3. **Supervisor Handbook**
   - Complete – waiting on staff to finish review

4. **National Association of State Conservation Agencies (NASCA) Board & NACD Northern Plains**
   - Attend monthly virtual meetings

5. **NACD Annual Meeting**
   - Recorded breakout session entitled “Preserving a Legacy…the Kansas Way”

Attachment K

District Manager Updates

(as of 1-15-21)

1st Quarter (December 1, 2020, to January 15, 2021)

New District Managers

Area	County	Name	Start Date
2	Grant	Karrie Meredith	1/4/2021
2	Ness	Kira Pfannenstiel	12/7/2020
3	Sedgwick	Brenda Matson	11/30/2020
4	Shawnee	Chalee Braun	1/4/2021

Resigned / Retired District Managers

Area	County	Name	End Date
2	Grant	Amber Arrellano	11/30/2020
2	Lane	Stryder Montgomery	12/31/2020
3	Sedgwick	Catherine Johnson	12/11/2020

Upcoming Vacancies

Area	County	Name	End Date

Current Vacancies

Area	County
1	Phillips - Jim Sweat, Smith County, is providing assistance for a period of time.
2	Lane

District Employee Updates

(as of 1-15-21)

1st Quarter (December 1, 2020, to January 15, 2021)

New District Employees

Area	County	Name	Position	Start Date

Resigned District Employees

Area	County	Name	Position	End Date

Attachment L

Woody Revetment Monitoring in the Upper Lower Smoky River Watershed – 2020 Final Report

Site 20 – January 12, 2017 (left) and May 19, 2020 (right)

Submitted to:
KDHE Watershed Management Section
Upper Lower Smoky WRAPS

By:
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Abstract

Streambank erosion can increase sediment and nutrient loading, lead to biological impairment, and have adverse effects on infrastructure and land. Six streambank stabilization projects, using deciduous woody revetments and in some cases bank shaping, were installed in 2015 and 2016 on the flow-regulated, sand-bed Lower Smoky Hill River in central Kansas. A monitoring study was employed to evaluate the short-term effectiveness of these woody revetment designs in stabilizing eroding streambanks. The main objective of this monitoring study was to assess the change in the physical stability of the streambank and stream reach where woody revetments were installed and along control reaches by measuring and observing changes in (1) channel shape, (2) water surface slope, and (3) particle size over the course of a four-year period (2016-2018, 2020). Outside of the main objective, changes in (1) water quality conditions and (2) macroinvertebrate habitat pre- and post-installation of four streambank stabilization sites were also evaluated. Based on the results of this monitoring study, woody revetments were not effective in stabilizing at least 4 out of 6 streambanks. Project failure appeared to occur due to (1) bank material composition, especially those with a high sand content (>45%), (2) extended moderate flow releases of no more than the 4-year return interval discharge from upstream Kanopolis Lake, and/or (3) site-scale bank shaping, starting near the bankfull elevation. In terms of water surface slope and bed material composition, there were no observable differences in each across the monitoring study period. Installation of woody revetment structures did not have a significant effect on reach-scale water quality; rather, water quality constituents were strongly correlated with streamflow. Changes in macroinvertebrate community diversity and the presence of sensitive taxa were not detected following installation of woody revetment structures. However, macroinvertebrate data suggested community composition was more similar within reaches within woody revetment sites, which could be indicative of habitat effects. While failure of restoration projects can be discouraging, using the physical stability collected from this monitoring study, along with continued data collection, numerical modeling, and creativity, effective and low-cost streambank stabilization solutions can still be developed for the Lower Smoky Hill River.

1. Introduction

Streambank erosion is a natural and necessary geomorphic process. It dissipates flow energy and introduces both sediment and organic debris that are essential for the creation, maintenance, and diversification of aquatic habitat (Florsheim et al., 2008). Rates of streambank erosion depend on both its localized shear strength and the gravitational and hydraulic forces that act on the streambank (Simon et al., 2000). Based on these driving mechanisms, streambanks erode in three general ways: via subaerial weakening and weathering, fluvial erosion, and/or mass wasting. Dominant streambank erosion processes and rates often vary through space and time, as boundary conditions change and forces shift or change (Couper, 2004).

Streambank erosion rates can especially be affected by disturbances that occur within the watershed or along the channel (Schumm et al., 1984). Disturbances can cause channel instability and as a result, accelerate streambank erosion due to bed degradation (e.g., increases bank height/angle) and/or aggradation (e.g., shifts hydraulic forces). Channel instability and accelerated streambank erosion is deleterious. It increases sediment and nutrient loading downstream (Walling & Fang, 2003), leads to biological impairment (Vörösmarty et al., 2010), and may have adverse effects on infrastructure and land (Fox et al., 2016; Morris et al., 1996). Both natural and anthropogenic influences can cause stream instability. Natural influences generally occur over a geological timescale and include changes to climate, vegetation, topography, and sediment source. Alternatively, anthropogenic influences can have an almost immediate effect on channel stability. Examples of anthropogenic influences include channelization, construction of dams and levees, deforestation, dredging, human-induced climate change, urbanization, and conversion of land for agricultural purposes (Goudie, 2006; Kondolf, 1997; Simon & Rinaldi, 2000; Trimble, 1997). Furthermore, in streams impaired by excess sediment,

several case studies have identified streambank erosion as the leading source of sediment (Belmont et al., 2011; Gellis & Gorman, 2018; Hassan et al., 2017; Juracek & Ziegler, 2009).

Streambank stabilization techniques can be implemented to maximize localized streambank shear strength and/or minimize the forces acting on a streambank with the intent of halting or minimizing lateral retreat. Examples of streambank stabilization techniques include instream and streambank toe structures, soil bioengineering approaches, and bank shaping. Even though many streambank stabilization techniques have been around for centuries, the success of streambank stabilization techniques methods vary widely and depend largely on the location and conditions of the site (Bigham, 2020). Furthermore, understanding and modeling the spatiotemporal effects of streambank stabilization systems on flow, sediment transport, and bank erosion, especially on a reach- to river-scale, is currently lacking in the literature (Bigham, 2020).

The purpose of this monitoring study was to evaluate the short-term effectiveness of woody revetments using deciduous trees, in conjunction with bank shaping (Figure 1), in stabilizing eroding streambanks on reaches of the Smoky Hill River located in central Kansas. Changes in water quality conditions and macroinvertebrate habitat were also assessed.

Figure 1. Example of Woody Revetments and Bank Shaping following construction on the Smoky Hill River, Kansas (Site 27, January 2017).

2. Site Description

2.1 Watershed and River Description

The Smoky Hill River watershed drains 19,800 square miles of northwestern Kansas and a portion of eastern Colorado. Woody revetments were installed within two HUC-10 watersheds of the Lower Smoky (1026000801 & 1026000803) on reaches of the Smoky Hill River located in Saline and McPherson counties of central Kansas (Figure 2). The drainage areas of the most upstream and the most downstream woody revetment sites are 8,100 and 8,300 square miles, respectively.

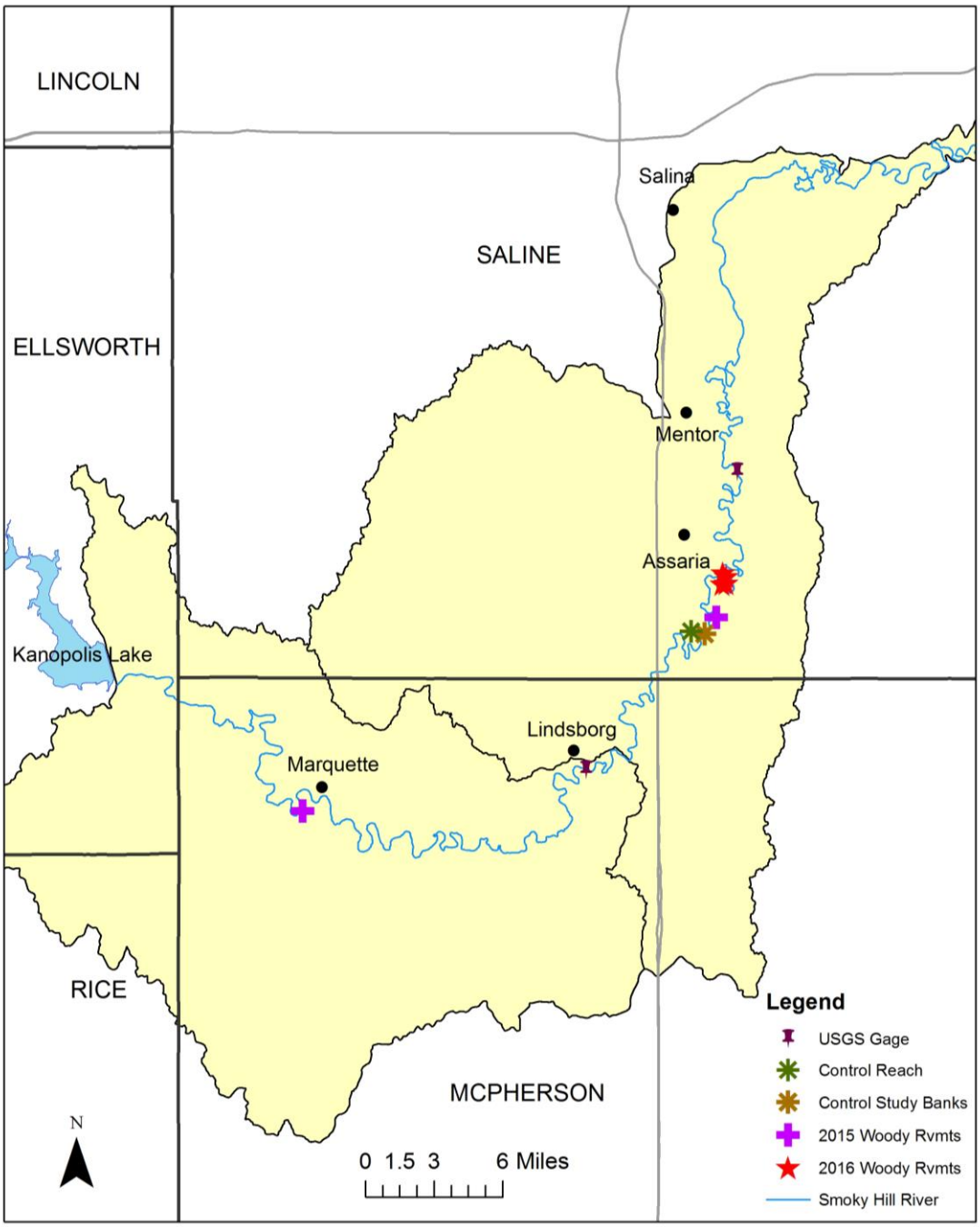


Figure 2. Woody Revetment, Control, and USGS Gage Sites on the Lower Smoky Hill River, Kansas.

The Lower Smoky Hill watershed is located in the Central Great Plains ecoregion with the majority of the area within the Smoky Hills (Chapman et al., 2010). Geology of this region consists of sandstones, limestones, and chalks (Brosius, 2005). Soils consist of silts and loams with areas of sand deposits. Land use includes a mixture of grassland and cropland (Chapman et al., 2010). The climate in this region is near a transitional zone but consists mainly of hot, humid summers and cold winters (Peel et al., 2007). Average precipitation for this region ranges from 28 to 32 inches annually (NRCS, 2007).

The Lower Smoky Hill River, between Kanopolis Lake and the city of Salina, is a sand-bed stream with measured particle sizes ranging from medium to coarse sand. Similar to the soil makeup of the watershed, the banks are

composed mainly of loam, clay loam, and silt loam soils with occasional deposits of more sandy material. The Lower Smoky is a meandering river, with a high measured sinuosity that ranges from 1.7 to 2.6. Reaches typically classify as a slightly to moderately entrenched channel that can be susceptible to both vertical and lateral channel movement. Width-to-depth ratios at the estimated bankfull discharge (2,000 cfs) range from 11 to 14. The channel gradient is extremely flat, having a measured slope of 0.02% to 0.04%. Given the gradient and the bed sediment composition, the bed consists of a ripple-dune sequence rather than a riffle-pool.

Based on multiple years of geomorphic survey, it is likely that this portion of Smoky Hill River is in the widening and/or aggradational stage of the Schumm et al. (1984) channel evolution model (Stages III and IV). Notable causes of instability include conversion of areas of the Lower Smoky Hill watershed from prairie to cropland in the late 1800s to early 1900s, installation of Kanopolis Lake for flood control in the 1940s, and channelization measures conducted on the Smoky Hill River through the city of Salina in the 1960s. Finally, measured Rosgen (1996) stream classification types range from a B5c to a C5c-, with measurements nearing the G and F stream type classification at some locations.

The Lower Smoky Hill River has two long-term USGS stream gages: USGS 06866000 near Lindsborg and USGS 06866500 near Mentor (Figure 2). The Mentor USGS gage was used to evaluate flow return intervals using a Log Person Type III flood frequency analysis of annual peak flows from 1949 to present (post-construction of Kanopolis Lake, See Appendix A). Finally, according to the Kansas Department of Health & Environment 2020 303(d) List of Impaired Waters, the Lower Smoky Hill River is impaired by total suspended solids, biology, total phosphorus, and *E.coli* bacteria.

2.2 Design Description

Six streambank stabilization projects on the Smoky Hill River were installed in 2015 (2) and 2016 (4; see Figure 2). Three projects consisted of individual woody revetment structures placed at the streambank toe in combination with bank shaping that started near the bankfull elevation, while the remaining only consisted of woody revetments.

Woody revetment design, completed by an outside engineering consulting firm, was loosely based on a field observation of bank erosion-induced large wood recruitment that created a low bench near the streambank toe on the Lower Smoky Hill River. Woody revetments designs called for a single deciduous tree, roughly one-third of the bankfull width long and a diameter at breast height of about 12 inches, angled downstream at 30 degrees from the bank tangent line and placed with the root wad buried 10 feet into the streambank toe. In addition to keying the tree into the streambank, a 12-inch diameter by 10-foot long footer log was placed on top of the root wad and perpendicular to the woody revetment. The footer log was secured by placing a 5-foot cable around the tree and driving it into the streambank with a 3-inch duckbill anchor (Figure 3). The root wad and footer log were then buried in a series of compacted soil lifts. Exposed lengths of woody revetments were designed to be 0.2 times the bankfull width with spacing of three times the exposed length. In cases where streambank shaping occurred, a minimum slope of 2H:1V was utilized starting near the bankfull elevation. Woody revetments consisted of mainly walnut, hedge with a few ash, elm, and hackberry logs while footer logs were all hackberry. Mulberry was tested as a woody revetment log but had to be replaced after significant beaver damage occurred immediately following installation.

Figure 3. Woody Revetment Installation on the Lower Smoky Hill River, Kansas.

2.3 Study Site Descriptions

The four woody revetment sites (Sites 20, 23, 27, and 27b) installed in 2016 were split into two study reaches while the revetments installed in 2015 (Sites 19 and 22) were divided into two smaller reaches. Site numbers were taken from the "Stream Bank Assessment of the Upper Portion of the Lower Smoky Hill Watershed" conducted by The Watershed Institute in 2009. In addition to these streambank stabilization sites, one control reach and three control eroding streambanks were also installed. Figure 2 provides a site map of these locations. Table 1 summarizes these reaches. Appendix B provides site maps of each reach.

3. Methods

The main objective of this monitoring study was to assess the change in the physical stability of the streambank and stream reach where woody revetments were installed by measuring and observing changes in channel shape, water surface slope, and particle size over the course of a minimum three-year period (2016-2018). Outside of the main objective, the following were also assessed:

- Change in water quality conditions pre- and post-installation of 2016-installed woody revetments
- Change in macroinvertebrate habitat pre- and post-installation of 2016-installed woody revetments

This monitoring study was set-up as a Before-After-Control-Impact (BACI) study in order to better assess whether changes in physical stability, water quality, and/or macroinvertebrate habitat were due to woody revetment installation rather than other outside factors. In some scenarios (e.g., Reaches 1 and 4), pre-installation data was not obtained and therefore cannot be included in a BACI analysis. The following sections provide more information about each of these three monitoring objectives.

Table 1. Summary of Constructed and Control Reaches on the Lower Smoky Hill River, Kansas.

Reach	Coordinates	Site	Reach Length	Woody Revetment Installation	No. of Woody Revetments Installed (Failed*)	Bank Shaping?
1	38.543906, -97.845758	Site 19	641 feet	Winter 2015	3 (N/M)	No
2	38.632428, -97.600647	N/A	2,718 feet	Control	N/A	N/A
		N/A				N/A
		N/A				N/A
3	38.631747, -97.590729	Site 21	798 feet	Control	N/A	N/A
4	38.639304, -97.584001	Site 22	878 feet	Winter 2015	5 (0)	No
5	38.660581, -97.578617	Site 23	2,311 feet	Fall 2016	3 (3)	No
		Site 20		Fall 2016	7 (5)	2.5-3.3H:1V
		Site 24		Control	N/A	N/A
6	38.656085, -97.579527	Site 27	2,041 feet	Winter 2016	9 (5)	3.5-4H:1V
		Site 26		Control	N/A	N/A
		Site 27b		Winter 2016	3 (3)	2.1-2.4H:1V

*Notes: (1)Number of failed structures was based on site reviews as of May 2020. Additional information is provided in Section 4.2. (2) N/A: not applicable, N/M: not measured.

3.1 Objective 1 – Physical Stability of Woody Revetment and Control Reaches

The main monitoring objective was to assess the change in the physical stability of the streambank and stream reach by measuring and observing changes in channel shape, water surface slope, and particle size along all reaches over at least a three-year period. In addition, changes in geomorphic classification was also assessed along Reaches 2, 5 and 6 shown in Table 1. Pre-installation physical stability data was also collected on Reaches 5 and 6.

Channel shape data provide valuable information regarding streambank lateral retreat and/or deposition, bed erosion/deposition, and changes in the channel width-to-depth ratio. To obtain information pertaining to channel shape, repeated cross sections were conducted annually when flow and site conditions allowed. These cross sections were surveyed with total station equipment referenced to at least two control points or benchmarks identified by a rebar and cap. In total, 27 cross sections were installed. If possible, permanent, monumented points identified by ½"x2' rebar and cap were placed at cross section end points to allow for ease of re-survey. These permanent points were not tied to any known georeferenced coordinate or elevation datum. Cross section data was plotted, overlaid, and assessed using the software, RIVERMorph. When calculating average lateral retreat rates (or bank erosion rates) based on cross sectional data, the following equation (Eq. 1) was used:

$$Avg.\,Lateral\,Retreat\,Rate\,\left(\frac{ft}{yr}\right) = \frac{(\Delta\,Cross\,Sectional\,Area\,at\,Bank\,of\,Interest, ft^2)}{(Bank\,Height, ft)(Time\,Between\,Surveys, yrs)} \quad \textit{(Eq. 1)}$$

Longitudinal profiles of a stream reach provide information regarding channel slope and bed erosion/deposition. Water surface slope and the streambed profile were also measured annually along all six reaches when flow and site conditions allowed. Similar to the repeated cross sections, total station surveying equipment referenced to at least two control points was used to obtain coordinate and elevation data over-time. Longitudinal section data was also plotted, overlaid, and assessed using the software, RIVERMorph.

Particle size was assessed through pebble counts using the modified Wolman method as described by Rosgen (1996). Pebble counts were conducted annually, when possible, at 22 of the 27 cross sections and along the reach length of Reaches 2, 5 and 6. Since the Lower Smoky Hill River is a sand-bed stream where measurement of sediment size is difficult with a ruler, a sand grain sizing folder was utilized to properly identify sediment sizes that fall within the very fine to very coarse sand grain size categories. Any other measurements were obtained by measuring the intermediate axis of the particle with a ruler. Pebble counts were plotted on a graph with log-normal scale to identify the D_{50} size particle.

Geomorphic classification using the Rosgen (1996) stream classification system were obtained annually along Reaches 2, 5, and 6. All three reaches met the length requirement of at least 20 bankfull widths long to obtain stream classification. Repeated geomorphic classifications help inform channel stability over-time, identifying where the channel may be in the channel evolution process using either the Schumm et al. (1984) or Rosgen (2014) models.

Finally, to supplement data collection, photographs and detailed field notes of all reaches were obtained throughout the course of the monitoring study. Additionally, soil samples were obtained at four of the six reaches at apparent layers observed on the eroding streambank face. Soil samples were analyzed in the KSU Biological and Agricultural Engineering (BAE) soil analysis laboratory using the Hydrometer Method (UW, 2004) and the USDA Soil Classification System. Table 2 summarizes the physical stability data collected at each reach.

Table 2. Summary of Monitoring Data Collected at Study Reaches along the Lower Smoky Hill River, Kansas.

Reach	Cross Sections	Pebble Counts?	Geomorphic Classification?	Survey Years**	Water Quality? (2016-19)	Aquatic Insect Habitat? (2016-18)	Bank Material Compositon? (2016)
1	2	Cross sections only	No	2016-18	No	No	No
2*	7	Reach + Cross Sections (6)	Yes	2016-18	Yes	Yes	Yes
3*	2	No	No	2016-18	No	No	No
4	2	Cross sections only	No	2016-18	No	No	Yes
5	7	Reach + Cross Sections (6)	Yes	2016-18 (20)	Yes	Yes	Yes
6	7	Reach + Cross Sections (6)	Yes	2016-18 (20)	Yes	Yes	Yes

Notes: *Control reach; Longitudinal profiles were conducted at all reaches for the entire reach length (see Table 1); Pebble counts were not conducted along study banks (referred to 'SB' on site maps in Appendix B); **Survey years shown in parentheses (e.g., 20) indicate that some physical stability data were collected but not all in 2020.

3.2 Objective 2 – Water Quality of 2016-Installed Woody Revetments

The second monitoring objective was to assess the change in water quality conditions pre- and post-installation of 2016-installed woody revetments by measuring localized changes in total suspended solids (TSS), total nitrogen (TN) and nitrate (NO_3), total phosphorus (TP), and bacteria (*E. coli* and *total coliform)* concentrations. From 2016 to 2019, grab samples were collected in 7 to 10 months of a given year from Reaches 2, 5 and 6. Samples were obtained at the start and end of the longitudinal profile of each reach and at one cross-section located in the middle of each reach. Samples were collected at the downstream site first, then at the midpoint and then, lastly, at the upper end of the reach. Water quality grab sample collection coincided with macroinvertebrate sample collection (see Section 3.3).

Sample collection and preservation followed standard water quality sampling methods as outlined by the USGS (2000) were collected and composited to a single 1-L sample from which aliquots for chemical analysis were drawn. All samples were labeled and immediately stored in a cooler with ice, then refrigerated at 4 degrees Celsius until further analysis could be completed. At the time of sampling, water temperature, electrical conductivity, and pH were measured in-situ at each sample point using a YSI multi-meter probe. Salinity and total dissolved solids (TDS), which can be calculated as a function of electrical conductivity, were reported as well. The probe was calibrated periodically using standard solutions to maintain accurate readings.

E. coli and *total coliform* were analyzed within 24 hours of sample collection in the KSU BAE water quality lab using the Colilert system (Method SM9223B). The remaining water quality parameters were analyzed by the KSU Agronomy Soil Testing Laboratory within seven days of the sample collection date.

3.3 Objective 3 – Macroinvertebrate Habitat of 2016-Installed Woody Revetments

The final monitoring objective was to assess the change in macroinvertebrate habitat pre- and post-installation of 2016-installed woody revetments by measuring changes in Shannon diversity, Jaccard similarity, and KDHE macroinvertebrate biotic indices. Macroinvertebrates were sampled in spring of 2016 through 2018 based on the protocol for soft-bottom, semi-quantitative macroinvertebrate collection from Stark et al. (2001) and methodology from Testa et al. (2010). The final year of macroinvertebrate sampling was not completed due to high flows during spring of both 2019 and 2020, which limited access to sampling sites. Using D-frame dip nets, ten samples, each from approximately 1 ft^2 area, were collected within all stream reach cross-over cross sections of Reaches 2, 5, and 6. An additional ten samples were collected longitudinally along woody revetment structures, pre- and post-installation on Reaches 5 and 6, and along eroding streambanks of the control reach (Reach 2). Macroinvertebrates were collected at the same locations annually. Macroinvertebrate sampling occurred jointly with water quality grab sampling and began at the most downstream end of a given reach. After sampling, macroinvertebrates were transferred to the KSU BAE water quality laboratory where they were identified to family, genus, and/or species levels.

4. Results and Discussion

The following sections outlines first the flows experienced over the five-year period in which data was collected, followed by the results and discussion of the physical stability, water quality, and macroinvertebrate analyses completed as part of monitoring the effectiveness of woody revetments for streambank stabilization on the Lower Smoky Hill River.

4.1 March 2016 through September 2020 Hydrograph

Flows were recorded at the Mentor USGS gage (USGS #06866500), located downstream of all monitored sites (see Figure 2). Figure 4 provides the March 2016 through September 2020 hydrograph, which represents the beginning and end time period for this monitoring study. This monitoring study was originally planned to end in December of 2019, but as shown in Figure 4, high flow events experienced throughout the entirety of 2019

delayed the end date to September of 2020. Unfortunately, while flow events experienced in 2020 were more typical of that of 2017, due to several large rain events that occurred in the Smoky Hill watershed and among most of the Missouri River watershed the year prior, low flows experienced in 2020 were higher than normal as water continued to be released at a slower rate from the upstream Kanopolis Lake. This made it difficult, if not impossible, to complete the fourth year of data collection from all six reaches.

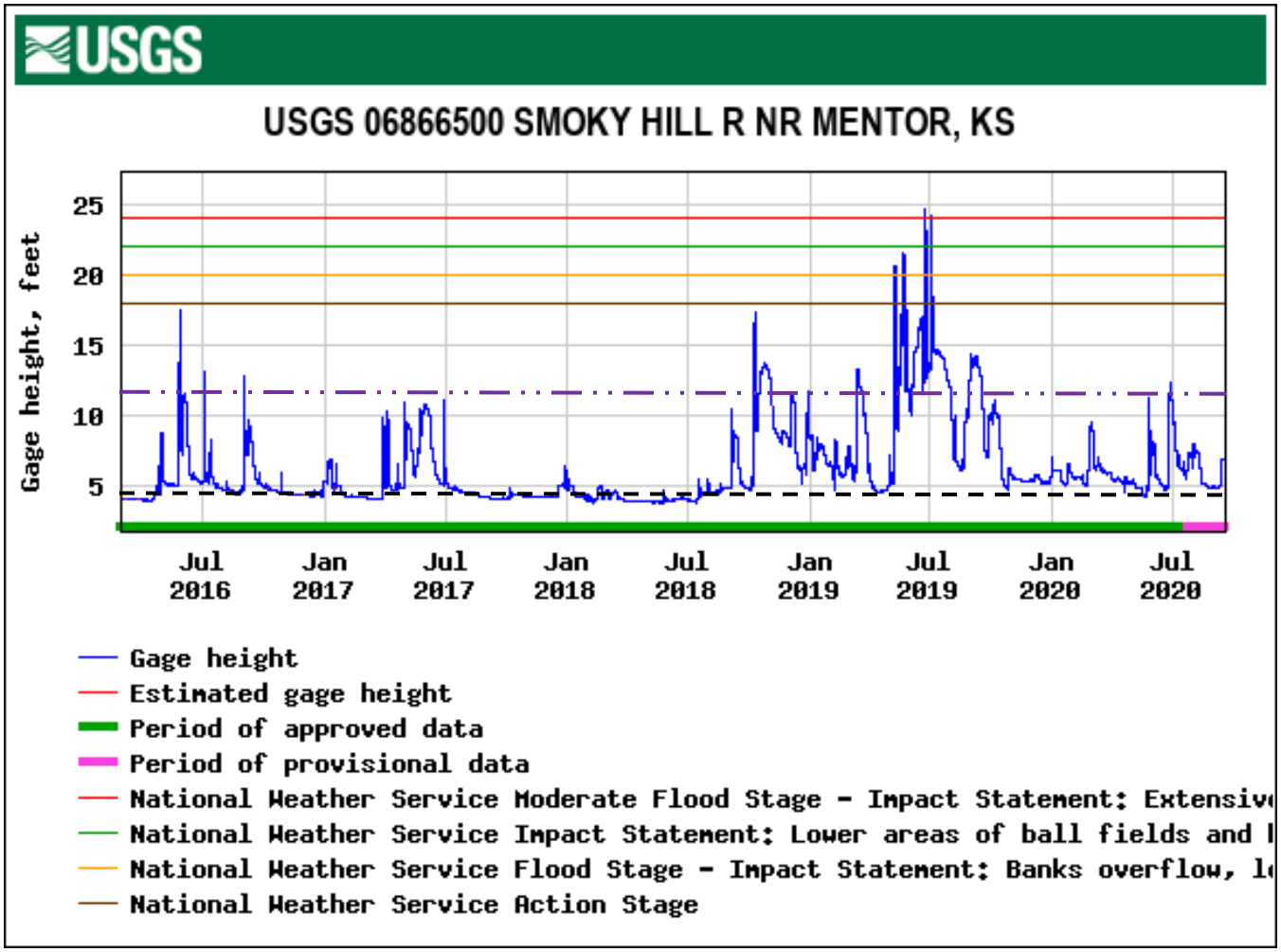


Figure 4. March 2016 through September 2020 Smoky Hill Flow Events recorded at USGS Gage near Mentor, KS (#06866500). The purple dashed line represents the bankfull stage, the black dashed line represents the stage of safe data collection.

While water quality sampling continued without any issues through 2019, physical stability and macroinvertebrate data collection could only be collected during the short time windows of "safe wading" conditions (as shown by the dashed black line in Figure 4). Furthermore, in terms of the physical stability data collection, excessive flooding that occurred in summer of 2019 resulted in the loss of established control points and benchmarks near Reaches 2 (control) and 4 (2015-installed). Since these control points were not tied to a georeferenced coordinate and elevation system, loss of control points resulted in loss physical stability data post-2018. Fortunately, cross section re-surveys from Reaches 5 (6 out of 7 cross sections) and 6 (5 out of 6 cross sections) were obtained in spring and late summer of 2020. However, because of the short time windows of safe wading conditions, no other physical stability data were collected and the fourth year of macroinvertebrate sampling was not able to be completed.

In terms of evaluating the flows experienced over the course of these five years, there were:

- 6 bankfull events (between 11ft to 13ft stage): 2 in 2016, 0 in 2017, 2 in 2018, 1 in 2019, and 1 in 2020
- 4 flow events above bankfull stage (13ft) but below the National Weather Wervice Flood Action Stage (18ft): 1 in 2016, 0 in 2017, 2 in 2018, 1 in 2019, and 0 in 2020
- 2 flooding events (greater than 18ft stage) in 2019, with the maximum flood event having a return interval of 3.5 years (6700 cfs) based on a Log-Pearson Type III gage analysis of 70 years of annual peak floods (see Appendix A)

In terms of extended moderate flow releases from upstream Kanopolis Lake (>10ft stage and ≥6 days):

- There were 6 total extended flow releases from 2016 through 2020: 1 in 2016, 1 in 2017, 1 in 2018, 3 in 2019, and 0 in 2020.
- The longest extended flow release was in May through August of 2019 and lasted for 80 days (11.5 weeks) with a maximum dischage of 6700 cfs and an average discharge of 2800 cfs.
- In total, extended flow releases occurred over 169 days (24 weeks) during this 5-year period with 74% of those days occuring in March through September of 2019.

From this analysis of the March 2016 through September 2020 hydrograph, 2019 had a significant effect on both measured bank erosion rates and the effectiveness of installed woody revetment structures. Additional information regarding the three monitoring objectives are presented in the following sections.

4.2 Objective 1 – Physical Stability Results and Discussion

Over at least a three-year period, it was observed that changes in water surface slope, particle size, and geomorphic classification was minimal along both stabilized and control reaches. Since these parameters were fairly stable, a summary of these results was included in Section 2.1 that provides a detailed description of the watershed and the river. In addition, Tables 3 through 5 summarize the results of these three parameters. Figure 5 provides an example overlay from 2016 through 2018 of a longitudinal profile of Reach 6. Figure 6 provides an example overlay of a cross-over cross section, which were used to obtain geomorphic classifications, from Reach 6 from 2016 to 2018, as well as the 2020 cross section survey overlay. While not enough data were collected to obtain a reach geomorphic classification in 2020, the 2020 cross-over cross section suggests that this reach would have again classified as a C5c-, regardless of the observed channel migration that has occurred at this cross section since 2018. The measured bankfull cross sectional area in 2020 was 643 ft^2, which was only 11 ft^2 larger than the 2018 survey. Additionally, the 2020 measured mean depth and channel width at bankfull were all within the range of values obtained in previous years.

Table 3. Summary of Measured Water Surface Slopes from Study Reaches along the Lower Smoky Hill River. Note: Slopes may be inaccurate from Reaches 1 and 4 due to the short surveyed length of these reaches.

	Measured Water Surface Slope (ft/ft)		
Reach	**2016**	**2017**	**2018**
1	0.0004	0.0004	0.0004
2*	0.0004	0.0004	0.0004
4	0.0005	0.0004	0.0004
5	0.0002	0.0002	0.0003
6	0.0002	0.0003	0.0002

*Control reach

Table 4. Summary of Measured Particle Size D_{50} from Study Reaches along the Lower Smoky Hill River. Note: Particle size may be inaccurate from Reaches 1 and 4 due to a reduced number of pebble counts obtained.

Reach	Particle Size D_{50} (mm)			Particle Size Category
	2016	2017	2018	
1	0.92	0.71	0.68	Coarse Sand
2*	0.58	0.66	0.34	Medium to Coarse Sand
4	0.68	0.38	0.41	Medium to Coarse Sand
5	0.38	0.33	0.28	Medium Sand
6	0.35	0.48	0.32	Medium Sand

*Control reach

Table 5. Summary of Measured Geomorphic Classifications from Study Reaches 2, 5 and 6 on the Lower Smoky Hill River.

Reach	Geomorphic Classification (Rosgen, 1996)		
	2016 (Pre)	2017 (Post)	2018 (Post)
2*	B5c	B5c	B5c
5	B5c	B5c	B5c
6	C5c-	C5c-	C5c-

*Control reach

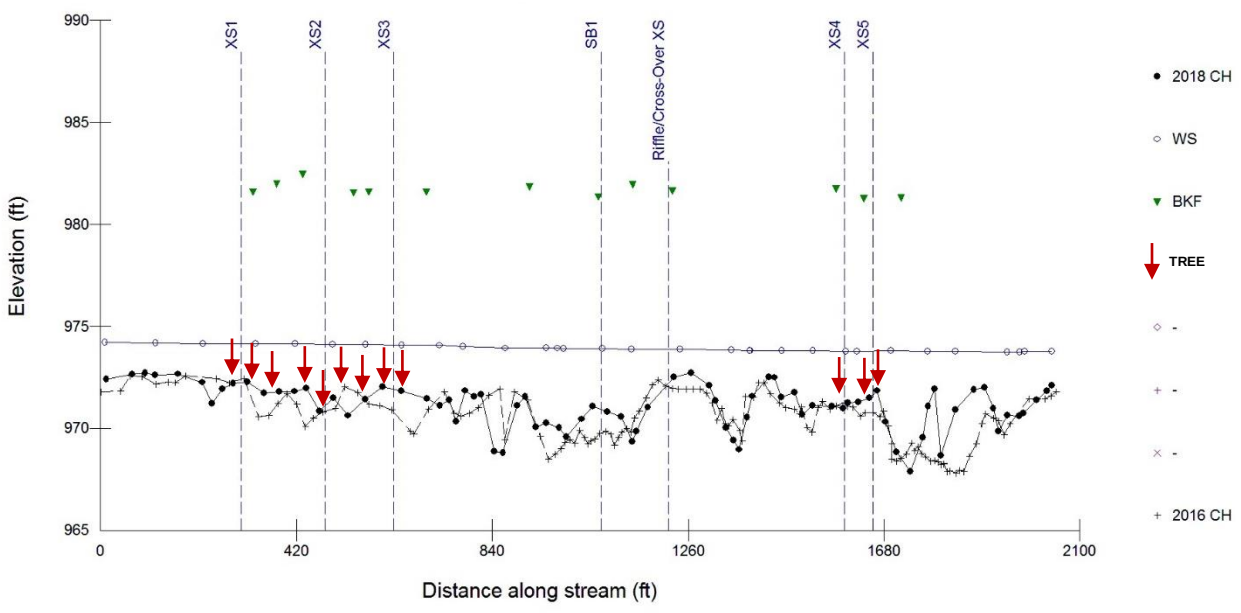


Figure 5. Example Longitudinal Profile from Reach 6, March 2016 and March 2018. Note: CH: thalweg; WS: water surface; BKF: bankfull; XS: cross section; SB: study bank; TREE: installed woody revetment

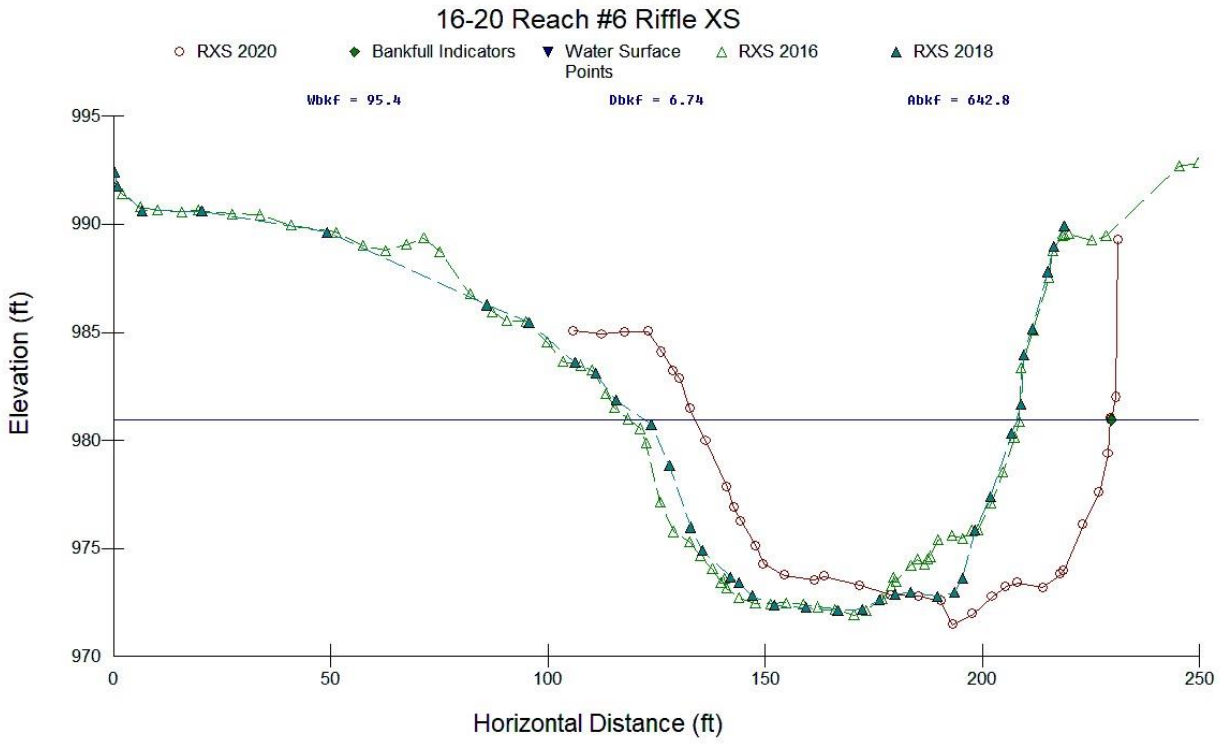


Figure 6. Example Cross-Over Cross Section (XS) Survey from Reach 6, March 2016, March 2018, and May 2020. The solid blue line indicates the suspected bankfull elevation.

As made apparent in Figure 6, changes in channel shape, and primarily continued streambank erosion and channel migration, did occur over the course of the monitoring study. Unfortunately, this also means that failure of woody revetments also occurred. As shown in Table 1, 16 of 27 woody revetment structures had been washed away on 5 of the 6 stabilized streambanks as of May 2020 (due to access issues, review of Reach 1 - Site 19 - was not possible in 2019 or 2020). Time-lapse photographs of Sites 27 (Reach 6) and 20 (Reach 5) are shown in Figure 7 and the cover page figure, respectively. Of the sites with failing structures, more than half of the installed woody revetments had been washed away at each site, with most woody revetments failing in the middle to downstream end of the meander bend where forces from both helicoidal and cross stream flow are the greatest. Additionally, Sites 27 and 27b had already lost 3 (out of 9) and 2 (out of 3) woody revetments, respectively, during the first year after construction in which measured flow events never reached the bankfull discharge (see Figure 4). Only one visited site, Reach 4 (Site 22), had all installed woody revetments as of May 2020. However, bank slumping in areas of excavation and fill had occurred at all five revetment locations (example shown in Figure 8) suggesting that installation of woody revetments causes enough bank disturbance to reduce the bank's long-term stability. Similar observations were made when overlaying cross sections to estimate bank erosion, or lateral retreat rates. A summary of lateral retreat rates is provided in Table 6. An example cross section overlay of a stabilized streambank (Site 27) on Reach 6 is provide in Figure 9.

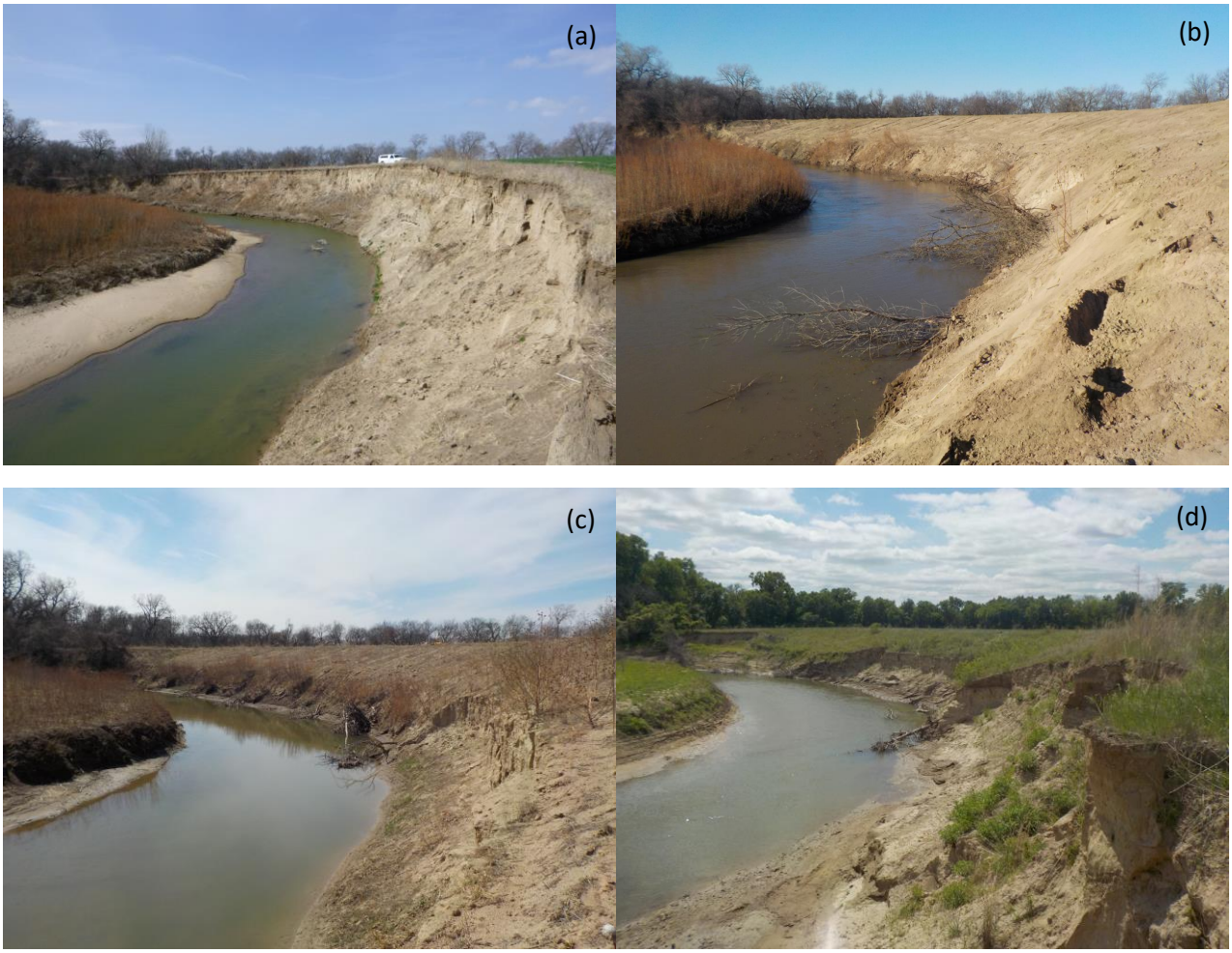


Figure 7. Site 27 on Reach 6 in (a) March 2016, (b) January 2017, (c) March 2018, and (d) May 2020. As of May 2020, only 4 woody revetments of 9 remain.

Figure 8. Bank Slumping on Site 22 (Reach 4) in Region of Woody Revetment Installation, May 2020.

Table 6. Summary of Lateral Retreat Rates on Eroding Streambank Sites on the Lower Smoky Hill River.

Reach	Site Number	Purpose	Average Lateral Retreat Rate (ft/yr)			Avg. Bank Material Composition
			2016-17	2017-18	2018-20	
1	Site 19	2015 Stabilized	0.02	0.06	N/M	Clay Loam*
4	Site 22	2015 Stabilized	0.64	0.15	N/A	Silty Clay*
5	Site 23	2016 Stabilized	0.78 (Pre)	0.18	2.24	Silt Loam
	Site 20	2016 Stabilized	1.28 (Pre)	1.09	2.77	Silty Clay Loam
6	Site 27	2016 Stabilized	1.80 (Pre)	2.61	4.84	Loam
	Site 27b	2016 Stabilized	1.14 (Pre)	4.02	N/A	Loam
2	N/A	Control	1.20	0.20	N/A	Silty Clay
	N/A	Control	1.60	1.90	N/A	Clay Loam
	N/A	Control	2.30	1.37	N/A	Loam
3	Site 21	Control	2.08	0.41	N/A	Clay
5	Site 24	Control	0.29	2.61	2.40	Loam
6	Site 26	Control	14.45	7.00	13.63	Sandy Loam

Notes: Red text represents an increase in erosion rate from the previous year while green text represents a decrease in erosion rate. *Average bank material composition for Reaches 1 and 4 was determined based on NRCS Web Soil Survey analysis and measured soil classification from nearby sites.

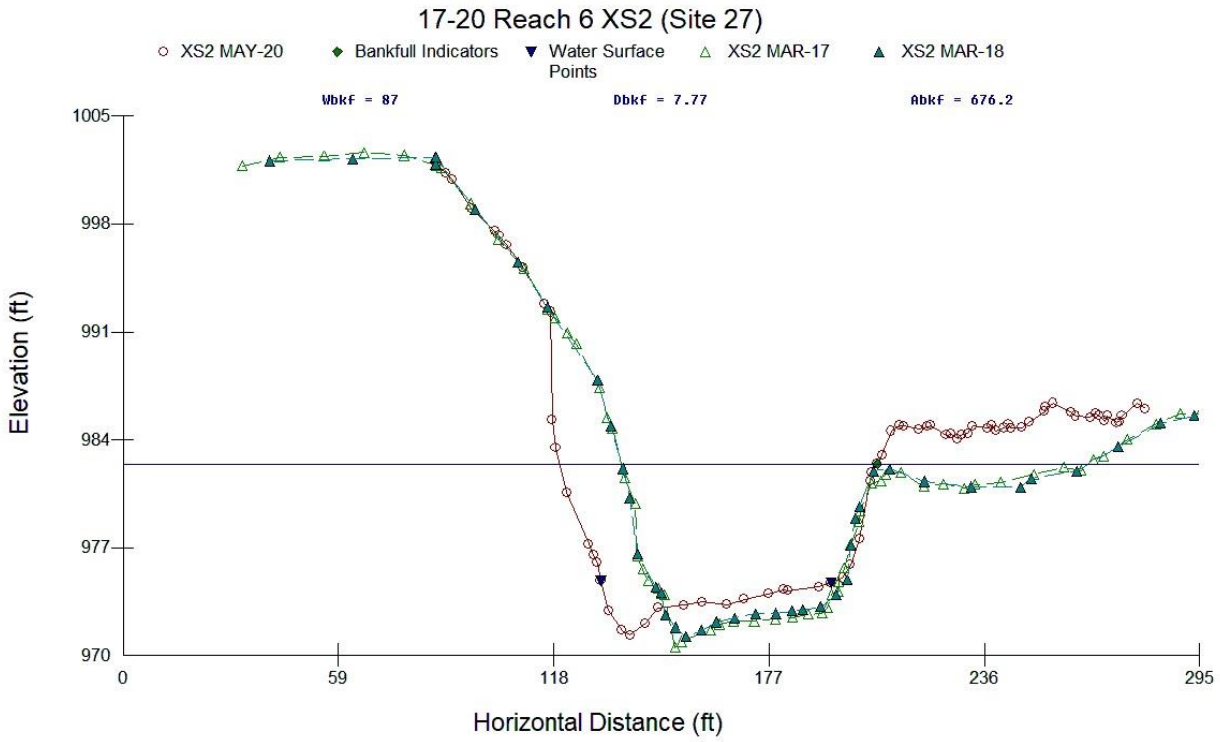


Figure 9. Example Cross Section (XS2) at Site 27 on Reach 6, March 2017, March 2018, and May 2020. This cross section went through the fifth (of 9) woody revetment and still remains in 2020.

Based on the analysis of Table 6, bank erosion rates varied from stable (little to no erosion, Site 19) to nearly 15 feet per year (Site 26). However, 50% of the erosion rates obtained from both control and stabilized sites, had a range of 0.2 ft/yr to 2.6 ft/yr. Site characteristics, primarily bank material composition, likely had a large effect on observed erosion rates. Sites containing loam or sandy loam (i.e. sand content >45%) experienced greater erosion rates on average, compared to the remaining sites with less sand and more silt/clay. This is especially true for loamy sites disturbed by construction activities (Sites 27 and 27b). Erosion rates prior to construction activities at these sites were comparable to sites containing more silt and clay material (2016-17, Table 6). However, following installation of woody revetments, erosion rates increased at Sites 27 and 27b while they remained steady or even decreased at control sites with similar materials, suggesting that installation of structures reduced the overall stability of the bank and its resistance to fluvial erosion.

When evaluating Sites 23 and 20, erosion rates were steady and/or decreased the year following construction. Based on the review of control site erosion rates in 2017-18, it is not clear if this was due to the installation of woody revetments or its bank material composition, as banks with higher clay content are more resistant to fluvial erosion. However, reviewing observed erosion rates from 2018-20 at both constructed and control sites, it appears that disturbance due to construction activities may have resulted in higher than normal erosion rates compared to pre-installation years.

Appendix C provides cross section overlays from 2017 to 2020 at all sites surveyed in 2020. While reviewing these overlays, it was noted that toe erosion along the downstream ends of Sites 23, 20 and 27 from March 2017 (immediately post-construction) to 2020 ranged from 5 feet to 20 feet. As stated in Section 2.2, root wads of woody revetments were buried roughly 10 feet into the streambank toe, suggesting that once woody revetments began to get pulled from the streambank, accelerated bank erosion rates occurred in the toe region due to the cut/fill disturbance caused by woody revetment installation.

Another hypothesis considered was whether more time between construction and higher flow events would have improved the long-term success of stabilized sites constructed in 2016, since Site 23, constructed in 2015, did not experience any revetment failures over the course of the monitoring study. Based on a review of the hydrograph for January 2015 through March 2016, Sites 19 and 22 (both installed in 2015) experienced two bankfull events and one flow event between bankfull and the National Weather Service Action Stage, which is identical to the flow events experienced in 2016. Therefore, it is assumed that more time to allow for the constructed bank to settle would not have benefited the long-term success of these projects.

Finally, bank shaping occurred on Sites 20, 27 and 27b. While the shaping might have temporarily reduced bank erosion rates conceptually, due to a decrease in bank height and thus bank weight (Simon & Rinaldi, 2000), it does not appear that the bank shaping that started near the bankfull elevation at these sites was beneficial in reducing bank erosion rates over the long-term. On Site 27, bank shaping on the downstream end (near cross section 3, Reach 6), was no longer present as of 2020 (see Appendix C) and from observation only (no measurements), bank shaping had been completely washed out along Site 27b by 2020. Furthermore, sites without bank shaping (Sites 19, 22, and 23) had lower overall erosion rates than sites with bank shaping, as shown in Table 6.

4.3 Objective 2 – Water Quality Results and Discussion

Thirty-five sample events were conducted from March 2016 to January 2020 from within three locations (lower end, middle and upper end) of Reaches 2 (control), 5 (woody revetment treatment) and 6 (woody revetment treatment). As indicated in Figure 10, samples were collected over a range in flow conditions, including during conditions representative of baseflow (river stage 4 ft; flow 50 cfs) as well as flows approaching bankfull (12 ft; 2,000 cfs). The maximum flow during a sampling event was approximately 3,730 cfs (stage 16.6 ft). Flows

exceeding baseflow were collected near the hydrograph peak following runoff events as well as during extended release periods from Kanopolis Lake.

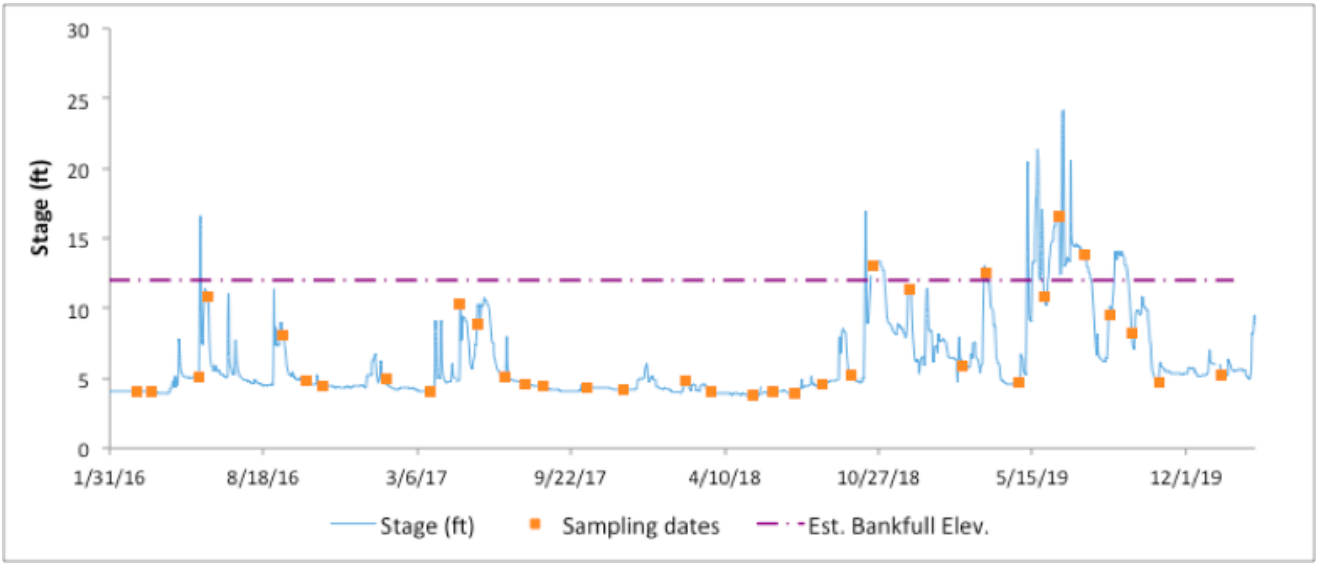


Figure 10. Stream Stage Reported at the USGS Gage on the Smoky Hill River near Mentor, KS (#06866500) Overlain with 35 Sample Events (solid orange squares) over the Duration of the Project. The estimated bankfull stage is indicated by the dashed line.

A primary aim of this objective was to determine if installing woody revetments along eroding streambanks was associated with changes in water quality. Differences in water quality were not detected between the control reach and the woody revetment treatment reaches before or after woody revetment installation (Figure 11). Numerous limitations of the grab sampling strategy employed in this study may have constrained the ability to detect differences. The relative success/failure of individual revetment structures within Reaches 5 and 6, both of which lost woody structures during the post-construction monitoring period which likely decreased the capacity for sediment and other pollutant retention within these reaches, may have also contributed to the lack of treatment effect. It is also possible that the scale of the river system relative to the scale of the woody revetment treatment sites is too large, and thus precludes detection of treatment effects. We suspect that all these factors (and probably more) were at play.

The water quality data collected do suggest that concentrations of water quality constituents in this system were influenced more by environmental conditions, particularly streamflow, than by reach-scale conditions. For example, TSS, TN, NO_3-N and TP concentrations all exhibited a positive and statistically significant correlation with stream stage (Figure 12), indicating that, as expected, higher concentrations of these constituents are transported during high flow events. Consistent with the analysis presented in Figure 11, pollutant concentrations in each of the three reaches responded similarly to increases in streamflow (or stream stage as presented here). Flows were grouped into qualitative categories indicative of the flow driver (e.g., rainfall-runoff peak versus sustained reservoir release) but a difference in response in TSS or other pollutants within these categorical groupings was not detected. The cluster of points in the TSS, TP and TN plots that fall well above the trend lines are associated with samples collected on May 1, 2017, which coincided with a storm peak (Figure 10).

While significant water quality effects were not detected for woody revetment treatments in this study, the data collected may provide additional insight to broader water quality management goals in this river system. Over the course of the monitoring period (March 2016 to January 2020), median TSS concentrations measured with

the three reaches (94 to 106 mg/L) exceeded the 50 mg/L target currently set as part of the sediment TMDL for this system. It is noted that median TSS concentrations during baseflow conditions (which was defined as flows at stream stages of about 4 ft, or 50 cfs, in this study) ranged from 41 to 49 mg/L, which is within the current TMDL. In contrast, median TP and NO_3-N concentrations within each reach remained near or below current Water Quality Impairment Limits (0.201 ppm for TP; 10 mg/L for NO_3). In the case of TP, median concentrations ranged from 0.21 to 0.22 mg/L while NO3-N ranged from 0.35 to 0.4 mg/L in the three reaches. Median *E. coli* concentrations ranged from 108 to 119 MPN within the three reaches; however, we note that the method used to quantify and report *E. coli* and total coliform concentrations as most probable numbers (MPN) in this study are not directly comparable with the colony forming unit (CFU) counts conducted by the State as part of its monitoring program. Appendix D provides a summary of the water quality sampling results from 2019.

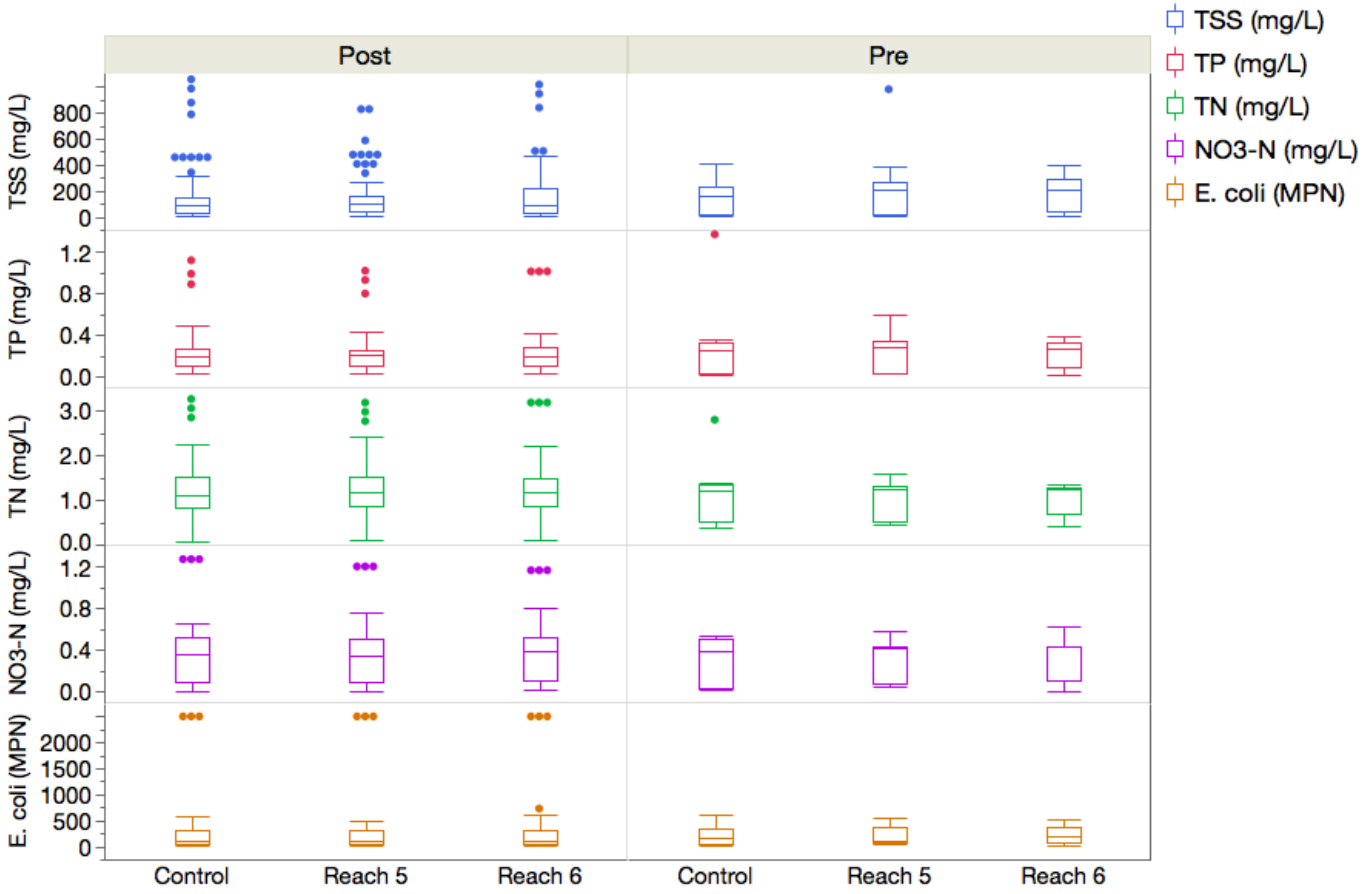


Figure 11. Box plots representing Distribution of Water Quality Data collected from Control (2) and Woody Revetment Treatment Reaches (5 and 6), Before (right panel) and After (left panel) Woody Revetment Installation. For reference, current TMDL or Water Quality Impairment Limits are: TSS = 50 mg/L; TP = 0.201 ppm; NO3 = 10 mg/L.

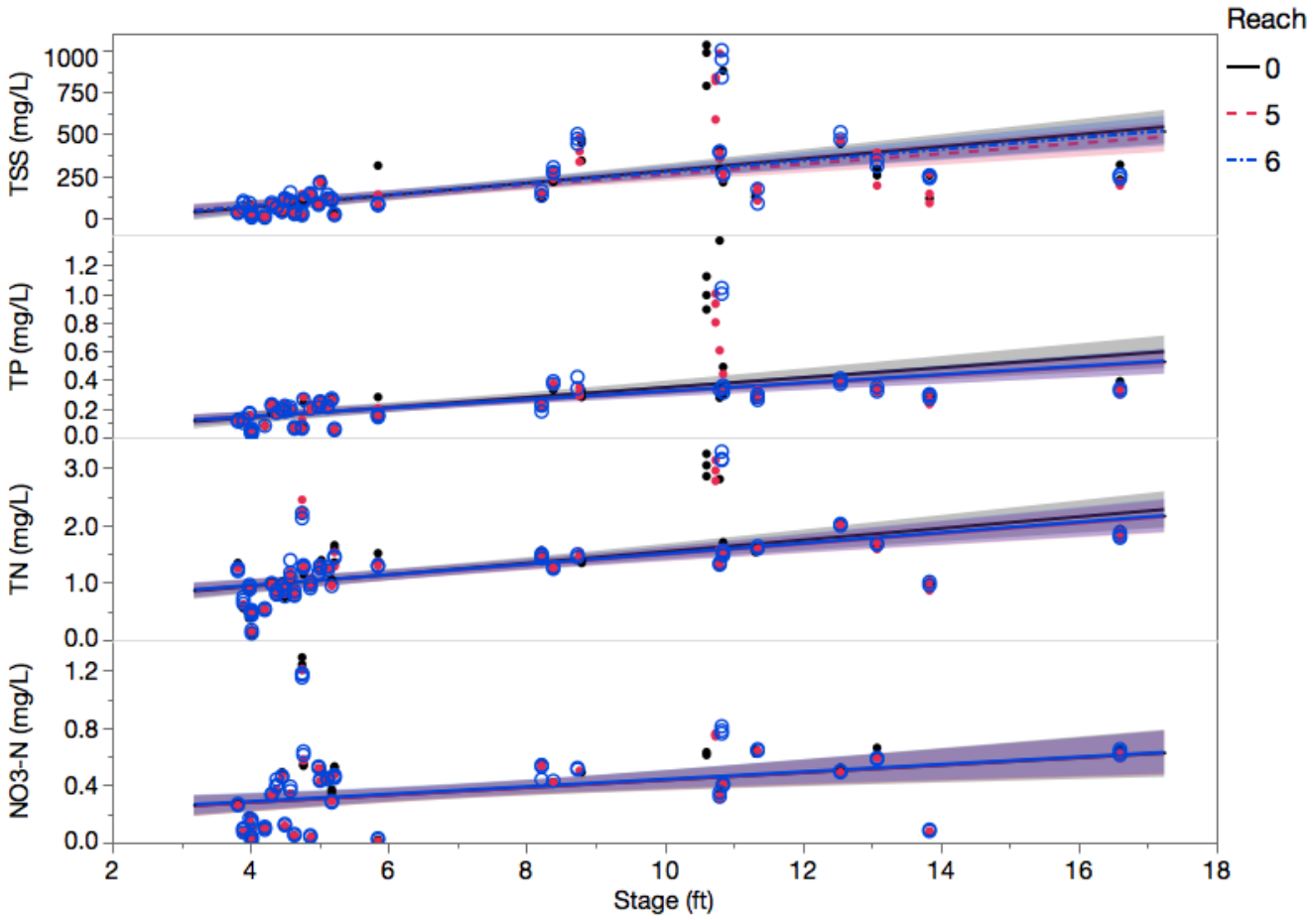


Figure 12. Relationship between Concentrations of Measured Water Quality Constituents and Stream Stage at the time of Sampling for Control (0), Reaches 5 and 6 (woody revetment treatments).

4.4 Objective 3 – Macroinvertebrate Analysis Results and Discussion

Benthic macroinvertebrates (benthos) were collected in 2016, 2017 and 2018 from a control reach (Reach 2) and two of the woody revetment treatment reaches (Reaches 5 and 6) in early spring at or near baseflow conditions. Sampling could not be conducted in the fourth year of the study due to sustained high flows which made wading in the river unsafe. Benthos were classified to the family level and characterized by the Shannon diversity, Jaccard similarity, and KDHE macroinvertebrate biotic indices (MBI). Benthos collected included relatively sensitive taxa such as caddisflies, mayflies, stoneflies, as well as taxa that are more tolerant of poorer water quality, such as aquatic worms, midges, and mosquito larvae. The range in stream stage (3.98 to 4.02 ft), water temperature (49 F to 56 F) and conductivity (0.24 to 1 mS/cm) were similar across all macroinvertebrate sample events.

Table 7 provides a summary of 2016, 2017 and 2018 Shannon diversity and KDHE MBI scores for each reach. Shannon Diversity Index values between 1.5 and 3 are typical of most ecological communities; thus, with the exception of the 2017 sample from the control reach, sampled benthos communities have remained relatively diverse and even across both the woody revetment treatment (Reaches 5 and 6) and control reaches. There were, however, a high number of Chironomidae (midges) collected along the Control reach relative to other species, suggesting this reach may experience poorer water quality or habitat conditions. The MBI indicates the relative sensitivity of the macroinvertebrate community to poor water quality conditions. Index values less than 4.51 indicate the community is relatively sensitive, which would suggest aquatic habitat conditions are relatively

good, while MBI values greater than 5.39 are indicative of a water quality conditions that do not support more sensitive organisms (KDHE, 2008). The MBI for both the Control and woody revetment treatment reaches ranged from 5 to 7.4, with lower values in 2016 and 2017 (5 to 5.8) and higher values in 2018 (6.1 to 7.4). These values indicate that the macroinvertebrate community in all three reaches tends to be dominated by taxa that are more tolerant of lower water quality conditions. However, it should be noted that, despite high MBI values, benthos samples from Reaches 5 and 6 contained a large proportion (20% to 30%) of the moderately sensitive taxa *Leptoceridae* (long-horned caddisflies) as well as mayfly (*Beatidae*) and dragonfly (*Gomphidae*) larvae. At all sites, the relatively high proportion of pollutant tolerant taxa, namely mosquito larvae (*Culicidae*) and midges (*Chironomidae*) resulted in high MBI values. The relatively short sampling period (3 years) makes conclusive statements regarding the relative roles of local habitat conditions through time versus natural variability on observed macroinvertebrate communities tenuous at best. However, given apparent persistence of TSS concentrations that exceeded the TMDL for the Smoky Hill River (see Section 4.3), it is likely that the macroinvertebrate community in this system will be dominated by species that are tolerant of sediment.

Table 7. Reach Shannon Diversity Index (SDI) and KDHE Biotic Index (MBI) for 2016-2018.

Location	2016 SDI	2017 SDI	2018 SDI	2016 MBI	2017 MBI	2018 MBI
Reach 5	2.34	1.90	1.99	5.05	4.98	6.91
Reach 6	2.41	2.02	1.64	5.78	5.47	6.11
Control	2.22	1.07	1.63	5.29	5.79	7.38

Table 8 summarizes the Jaccard Similarity Index, which provides an indication of the degree to which the study reaches support the same macroinvertebrate families. Index values obtained in 2016, prior to woody revetment installation, were quite similar between all reaches. Index values obtained in 2017 and 2018 can be used to indicate how woody revetment installation may influence habitat conditions and associated macroinvertebrate community structure. As indicated in Table 8, the two reaches with woody revetments (5 and 6) exhibited greater similarity to one another than with the control in 2017 and 2018, which coincides with woody revetment installation. Index values for comparisons with the control site were lower post-construction, indicating that macroinvertebrate communities were less similar. Based on these data, it appears that the macroinvertebrate community has responded to the presence of woody structures; however, given the relatively short time frame over which sampling was conducted (1 year pre-installation and 2 years post) this observation is not conclusive.

Table 8. Jaccaard Similarity Index (JSI) between reaches, 2016-2018. Higher JSI values indicate greater degree of similarity in macroinvertebrate community composition.

Comparison	2016 JSI	2017 JSI	2018 JSI
Reach 5 vs. Reach 6	0.58	0.65	0.46
Reach 5 vs. Control	0.52	0.35	0.38
Reach 6 vs. Control	0.54	0.59	0.33

5. Conclusion and Next Steps

Accelerated bank erosion due to channel instability increases sediment and nutrient loading, leads to biological impairment, and can have adverse effects on infrastructure and land. Streambank stabilization techniques can be implemented to maximize localized streambank shear strength and/or minimize the forces acting on a streambank with the intent of halting or minimizing lateral retreat. Six streambank stabilization projects, using deciduous woody revetments and in some cases bank shaping, were installed in 2015 and 2016 on the Lower Smoky Hill River near Salina, KS. A monitoring study was employed to evaluate the short-term effectiveness of

woody revetments in stabilizing eroding streambanks. The main objective of this monitoring study was to assess the change in the physical stability of the streambank and stream reach where woody revetments were installed and along control reaches by measuring and observing changes in (1) channel shape, (2) water surface slope, and (3) particle size over the course of a minimum three-year period (2016-2018). Outside of the main objective, changes in (1) water quality conditions and (2) macroinvertebrate habitat pre- and post-installation of four streambank stabilization sites were also evaluated.

Based on the results of this monitoring study, woody revetments were not effective in stabilizing at least 4 out of 6 streambanks on the Lower Smoky Hill River. This conclusion was based on (1) majority loss of installed woody revetments and (2) an observed increase in bank erosion rates at stabilized sites, compared to pre-construction rates and control site rates. Furthermore, structures began to fail following flow events of less than the bankfull discharges on two sites with banks composed of high sand content (>45%) and then following extended moderate flow events of around a 4-year return interval on two other sites with more of a silt/clay bank composition. This observation provides evidence that this design is not resilient against higher flow events, especially on a flow-regulated river where flows can be kept at higher stages for long periods of time. Bank shaping, starting near the bankfull elevation, also appears not to be beneficial in providing long-term bank stability and may have also caused bank erosion rates to increase when compared to stabilized sites where bank shaping did not occur. In terms of water surface slope and bed material composition, there were no observable differences in each across the monitoring study period.

Water quality and macroinvertebrate data collected over the monitoring period indicated (1) no significant effect of woody revetment structures on water quality, macroinvertebrate diversity or presence of sensitive taxa but (2) introducing woody revetments *may* alter macroinvertebrate community composition at a local scale. Due to the limited time frame over which macroinvertebrate data were collected, this latter statement is not conclusive but could have merit given changes in local habitat conditions (e.g., flow dynamics, woody material) created by woody revetments. Given the number of individual structures that failed, it is possible that the full potential for woody revetments to influence reach-scale water quality or macroinvertebrate community structure was not attained. Thus, employing a similar water quality and macroinvertebrate sampling effort on sites where woody revetments may be more successful could provide further insight to the ability to gain broader ecological benefits by stabilizing streambanks with woody structures.

While the majority of the woody revetment stabilization projects have failed along the Lower Smoky Hill River, additional monitoring would benefit the scientific understanding of bank erosion processes, especially downstream of a man-made reservoir installed to reduce flooding. The long-term moderate stage flow releases from upstream Kanopolis Lake may have impacted the effectiveness of this design, especially in 2019, as increased and extended flow events can cause bank saturation, reduce bank shear strength, and result in mass wasting following a decrease in flow rate, also referred to rapid drawdown condition (Simon et al., 2000). At a minimum, continued cross section surveys where benchmarks are still in place should occur long-term when funding allows. In August 2020, benchmarks and cross section pins that were still present on Reaches 5 and 6 were surveyed using RTK GNSS surveying equipment. Appendix E provides a summary of the coordinates and elevations of these pins tied to Kansas State Plane North Zone coordinate system and the North American Vertical Datum of 1988 (NAVD88). This will allow for long-term surveys of cross sections at these reaches even if pins have been lost due to erosion or farming activities.

Furthermore, observed bank erosion rates were high especially on banks having a high sand content, even during small and frequent flow events (e.g., 2018). Finding a solution to reduce lateral retreat should remain a top priority not only to improve water quality and aquatic habitat but also for protection of arable land. With the physical stability data that was collected along these selected reaches, plus additional geotechnical

information like *in-situ* bank shear strength and critical shear stress estimates, a calibrated, one-dimensional bank erosion and sediment transport model could be employed to (1) assess bank erosion mechanisms and rates under various flow conditions and (2) test alternatives streambank stabilization solutions.

The use of woody revetments to stabilize streambanks is an ideal solution as it not only mimics the natural process by which large woody debris is introduced to stream systems through streambank erosion, but is also low-cost compared to more rigorous solution that may require riprap. Woody revetments for stabilization have been effective in many areas throughout the world (e.g., Brooks et al., 2004; Dhital et al., 2013; Veller & Doyle, 2001) and could still be effective on the Smoky Hill River with proper design modifications and monitoring. As stated by Kondolf (1995), a stream restoration project that fails might be of more value than one that is successful, assuming that the failure mechanism(s) are properly understood and disseminated. With continued geotechnical data collection, numerical modeling, creativity, and monitoring, effective solutions, potentially using woody revetments, can be developed for the Smoky Hill River and other flow-regulated, sand-bed streams.

References

Belmont, P., Gran, K. B., Schottler, S. P., Wilcock, P. R., Day, S. S., Jennings, C., ... Parker, G. (2011). Large shift in source of fine sediment in the upper Mississippi River. *Environ. Sci. Tech.*, 45(20), 8804-8810. https://doi.org/10.1021/es2019109

Bigham, K. A. (2020). Streambank stabilization design, research, and monitoring: The current state and future needs. *Transactions of the ASABE*, 63(2), 351-387.

Brooks, A. P., Gehrke, P. C., Jansen, J. D., & Abbe, T. B. (2004). Experimental reintroduction of woody debris on the Williams River, NSW: geomorphic and ecological responses. *River Res. Appl.,* 20(5), 513-536. https://doi.org/10.1002/rra.764

Brosius, L. (2005). Smoky hills. Retrieved from http://www.kgs.ku.edu/Extension/smoky/smoky.html

Chapman, S. S., Omernik, J. M., Freeouf, J. A., Huggins, D. G., McCauley, J. R., Freeman, C. C., . . . Schlepp, R. L. (2010). *Ecoregions of Nebraska and Kansas*. Reston, Virginia: U.S. Geological Survey.

Couper, P. R. (2004). Space and time in river bank erosion research: A review. *Area*, 36(4), 387-403. https://doi.org/10.1111/j.0004-0894.2004.00239.x

Dhital, Y. P., Kayastha, R. B., & Shi, J. (2013). Soil bioengineering application and practices in Nepal. *Environ. Mgmt.,* 51(2), 354-364. https://doi.org/10.1007/s00267-012-0003-7

Florsheim, J. L., Mount, J. F., & Chin, A. (2008). Bank erosion as a desirable attribute of rivers. *Bioscience*, 58(6), 519-529. https://doi.org/10.1641/b580608

Fox, G. A., Sheshukov, A., Cruse, R., Kolar, R. L., Guertault, L., Gesch, K. R., & Dutnell, R. C. (2016). Reservoir sedimentation and upstream sediment sources: Perspectives and future research needs on streambank and gully erosion. *Environ. Mgmt.,* 57(5), 945-955. https://doi.org/10.1007/s00267-016-0671-9

Gellis, A. C., & Gorman Sanisaca, L. (2018). Sediment fingerprinting to delineate sources of sediment in the agricultural and forested Smith Creek watershed, Virginia, USA. *JAWRA,* 54(6), 1197-1221. https://doi.org/10.1111/1752-1688.12680

Goudie, A. S. (2006). Global warming and fluvial geomorphology. *Geomorphology*, 79(3), 384-394. https://doi.org/10.1016/j.geomorph.2006.06.023

Hassan, M. A., Roberge, L., Church, M., More, M., Donner, S. D., Leach, J., & Ali, K. F. (2017). What are the contemporary sources of sediment in the Mississippi River? *Geophys. Res. Lett.,* 44(17), 8919-8924. https://doi.org/10.1002/2017gl074046

Juracek, K. E., & Ziegler, A. C. (2009). Estimation of sediment sources using selected chemical tracers in the Perry Lake basin, Kansas, USA. *Intl. J. Sediment Res.,* 24(1), 108-125. https://doi.org/10.1016/S1001-6279(09)60020-2

Kondolf, G. M. (1997). Hungry water: Effects of dams and gravel mining on river channels. *Environ. Mgmt.,* 21(4), 533-551. https://doi.org/10.1007/s002679900048

Kondolf, G. M. (1995). Five elements for effective evaluation of stream restoration. *Restoration Ecology*, 3(2), 133-136.

Morris, L. L., McVey, M. J., Lohnes, R. A., & Baumel, C. P. (1996). Estimates of future impacts of degrading streams in the deep loess soil region of western Iowa on private and public infrastructure costs. *Eng. Geol.,* 43(4), 255-264. https://doi.org/10.1016/S0013-7952(96)00035-X

NRCS (Natural Resources Conservation Service). (2007). *Kansas annual precipitation*. Salina, KS: United States Department of Agriculture.

Peel, M. C., Finlayson, B. L., & McMahon, T. A. (2007). Updated world map of the the Köppen-geiger climate classification. *Hydrology and Earth System Sciences, 11*, 1633-1644.

Rosgen, D. (1996). *Applied river morphology* (Second ed.). Pagosa Springs: Wildland Hydrology.

Rosgen, D. (2014). *River stability field guide* (Second ed.). Fort Collins: Wildland Hydrology.

Schumm, S. A., Harvey, M. D., Watson, C. C. (1984). *Incised channels, morphology, dynamics and control.* Littleton, Colorado: Water Resources Publications.

Simon, A., & Rinaldi, M. (2000). Channel instability in the loess area of the midwestern United States. *JAWRA*, 36(1), 133-150. https://doi.org/10.1111/j.1752-1688.2000.tb04255.x

Simon, A., Curini, A., Darby, S. E., & Langendoen, E. J. (2000). Bank and near-bank processes in an incised channel. *Geomorphology, 35*, 193-217.

Stark, J. D., Boothroyd, I. K. G., Harding, J. S., Maxted, J. R., & Scarsbrook, M. R. (2001). Protocols for sampling macroinvertebrates in wadeable streams. (New Zealand Macroinvertebrate Working Group No. 1). Ministry for the Environment.

Testa, S., Shields, D., & Cooper, C. M. (2010). Macroinvertebrate response to stream restoration by large wood addition. *Ecohydrology*, 4(5), 631-643.

Trimble, S. W. (1997). Contribution of stream channel erosion to sediment yield from an urbanizing watershed. *Science*, 278(5342), 1442-1444. https://doi.org/10.1126/science.278.5342.1442

USGS (U.S. Geological Survey). (2000). *Interagency field manual for the collection of water-quality data.* (Open-File No. 00-213). Austin: U.S. Geological Survey.

UW (University of Wisconsin). (2004). In John Peters (Ed.), *Lab procedures and methods*. Madison: University of Wisconsin-Extension-Madison.

Veller, J. C., & Doyle, P. F. (2001). Field performance of conventional tree revetment bank protection. *Canadian Water Resour. J.*, 26(1), 91-105. https://doi.org/10.4296/cwrj2601091

Vörösmarty, C. J., McIntyre, P. B., Gessner, M. O., Dudgeon, D., Prusevich, A., Green, P., ... Davies, P. M. (2010). Global threats to human water security and river biodiversity. *Nature*, 467(7315), 555-561. https://doi.org/10.1038/nature09440

Walling, D. E., & Fang, D. (2003). Recent trends in the suspended sediment loads of the world's rivers. *Global Planetary Change*, 39(1), 111-126. https://doi.org/10.1016/S0921-8181(03)00020-1

Appendix A – Log Pearson Type III Flood Frequency Plot for USGS Gage #06866500

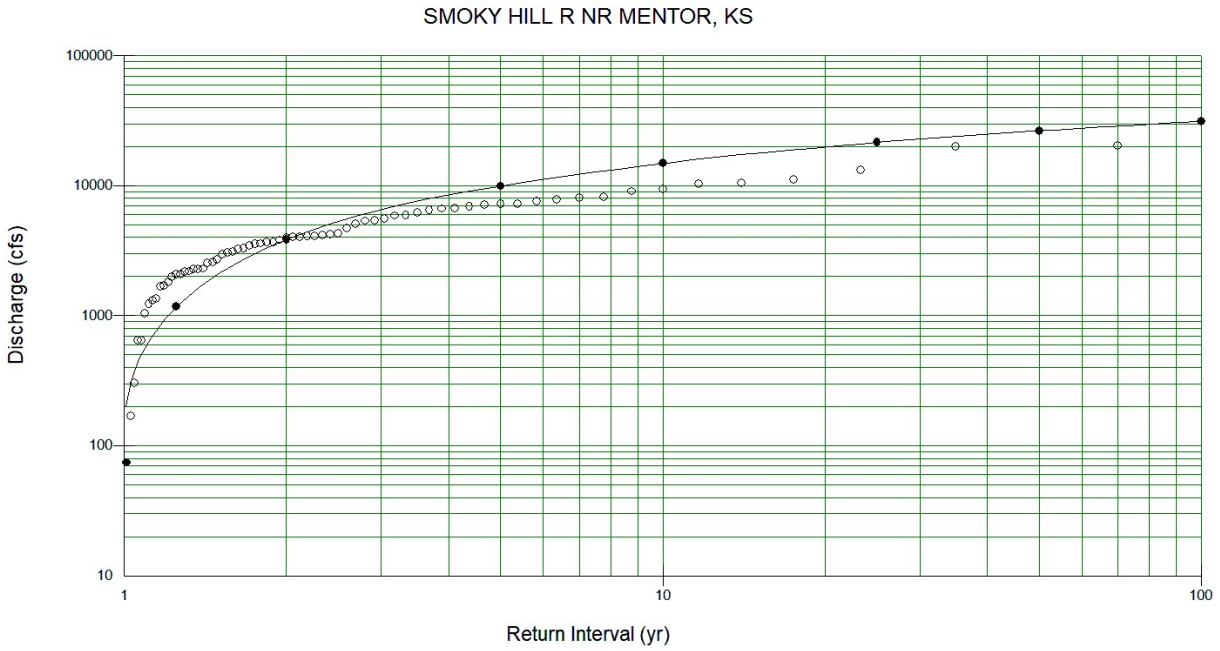


Figure A.1. Log Pearson Type III Flood Frequency Plot for USGS Gage #06866500 (1949 to Present)

Appendix B – Reach Maps

Notes: (1) All identified locations on maps are approximate. (2) XS: cross section; RXS: riffle/cross-over cross section; SB: study bank; BM: benchmark; SL: sampling location; Temp: temporary benchmark. (3) Previous annual reports used different reach names, as stated in figure captions.

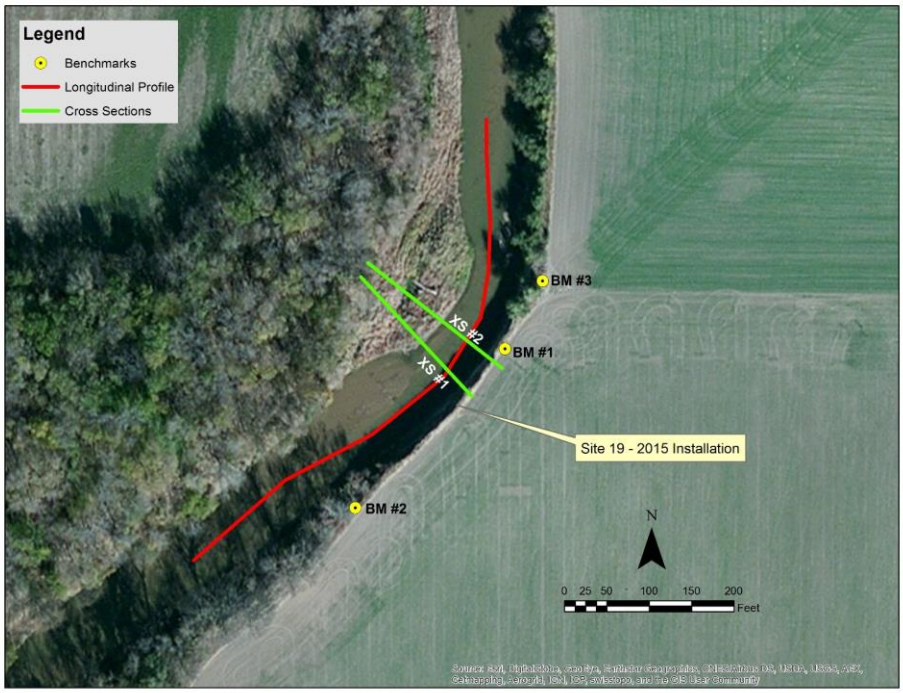


Figure B.1. Aerial Photograph of Reach 1 (formerly 'Existing Reach #2').

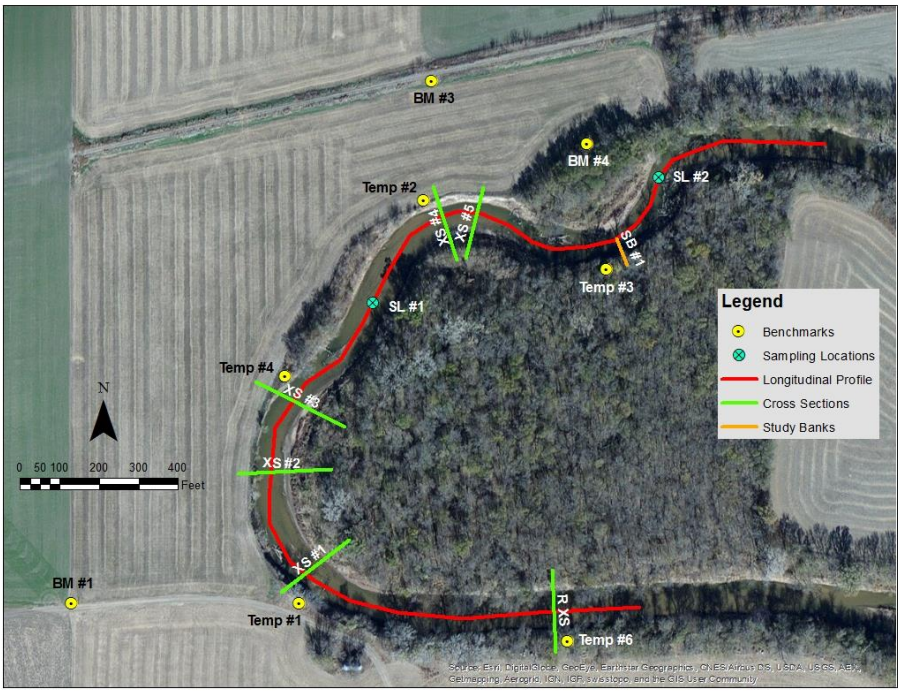


Figure B.2. Aerial Photograph of Reach 2 (formerly 'Control Reach').

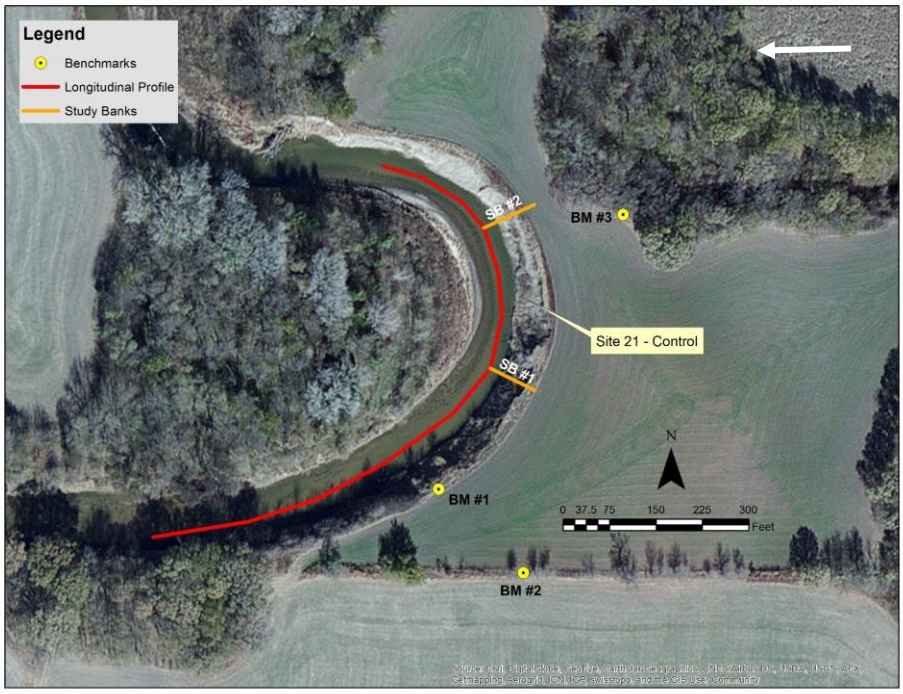


Figure B.3. Aerial Photograph of Reach 3 (formerly 'Control Study Banks Reach').

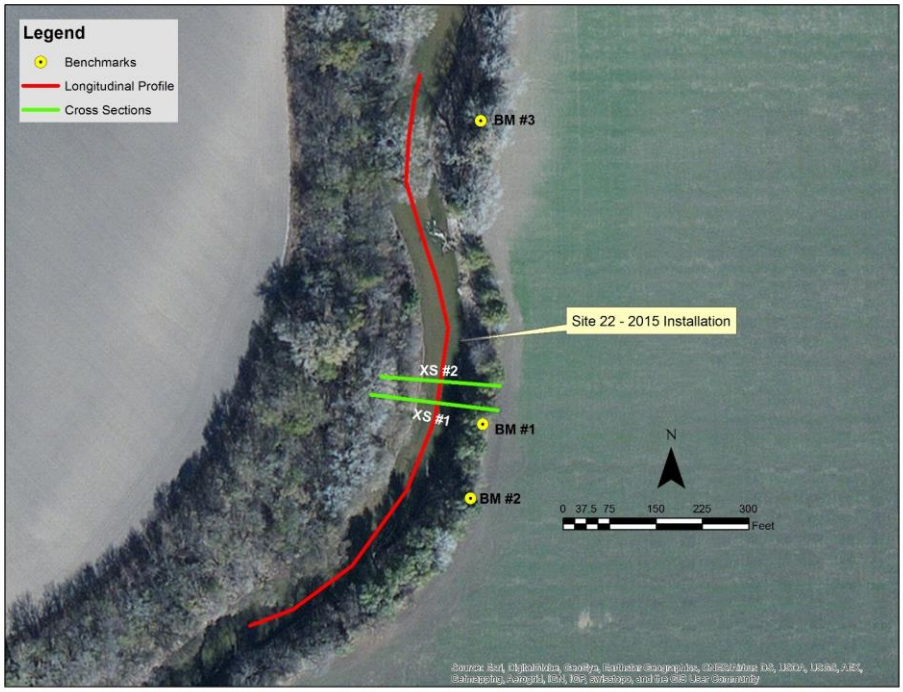


Figure B.4. Aerial Photograph of Reach 4 (formerly 'Existing Reach #1').

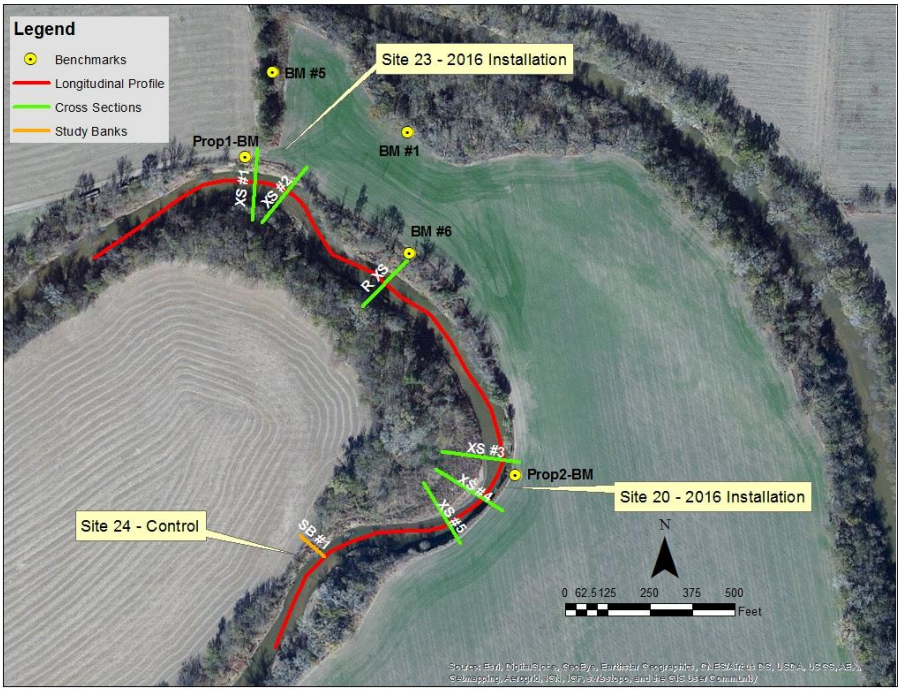


Figure B.5. Aerial Photograph of Reach 5 (formerly 'Proposed Reach #1-2').

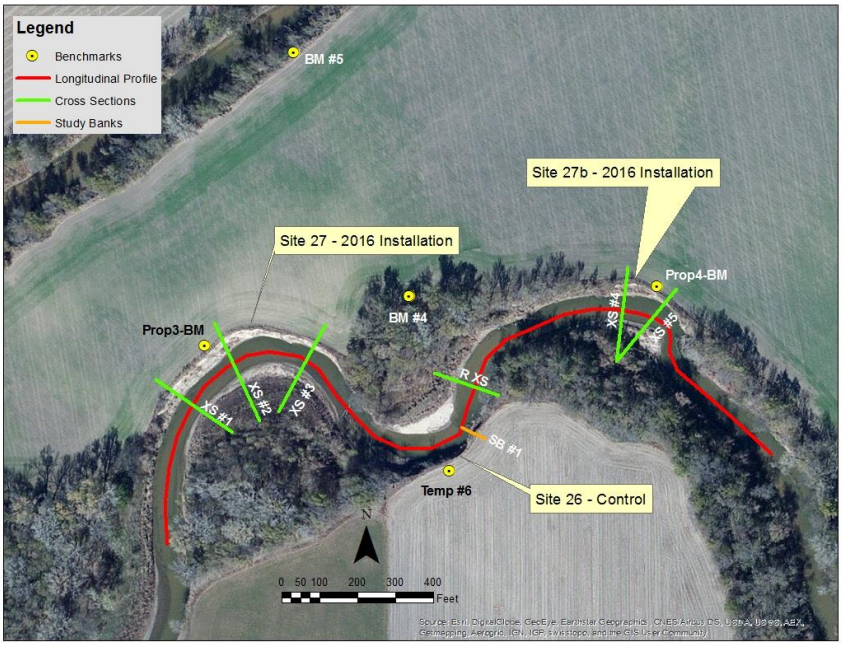


Figure B.6. Aerial Photograph of Reach 6 (formerly 'Proposed Reach #3-4').

Appendix C – 2020 Cross Section Results

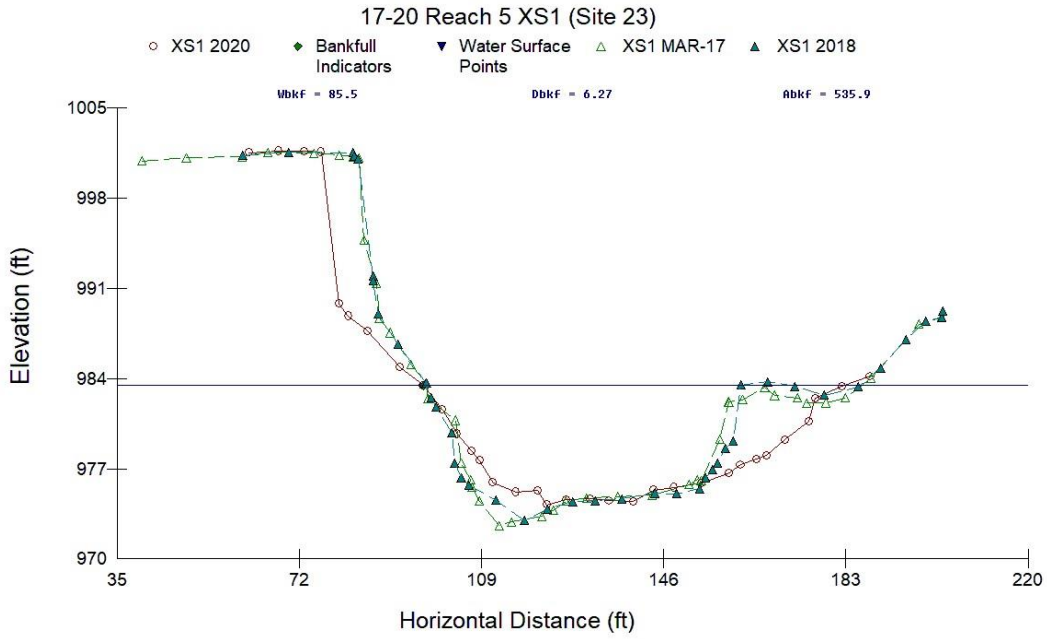


Figure C.1. Reach 5 Cross Section (XS) 1 at Site 23 Survey, March 2017, March 2018, and September 2020. This cross section went through the middle of woody revetment 1 (of 3) that was washed out by 2020.

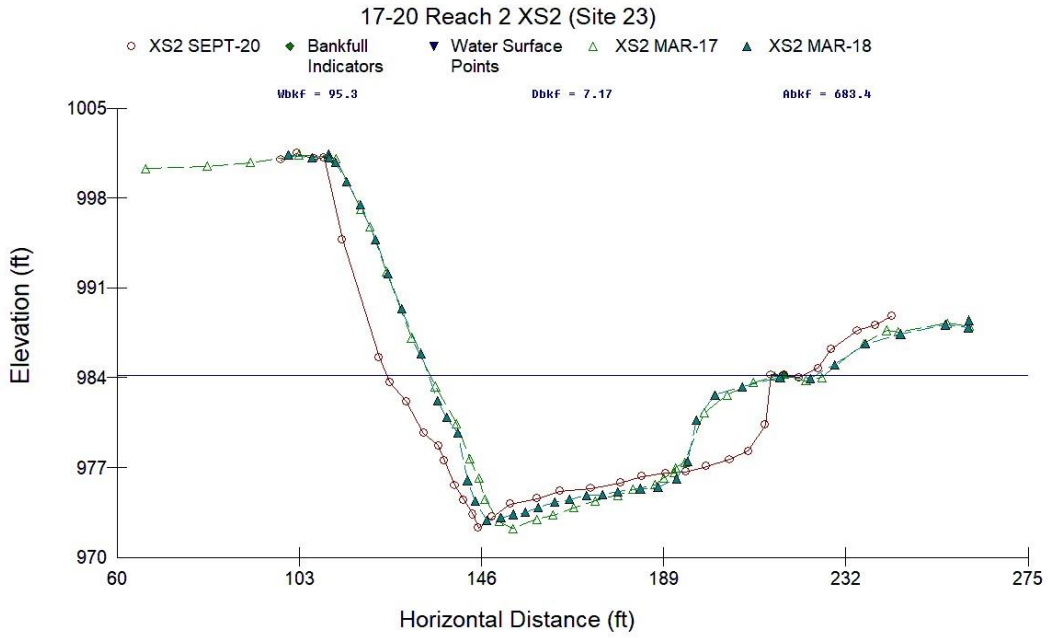


Figure C.2. Reach 5 XS2 at Site 23 Survey, March 2017, March 2018, and September 2020. This cross section went through the middle of woody revetment 3 (of 3) that was washed out by 2020.

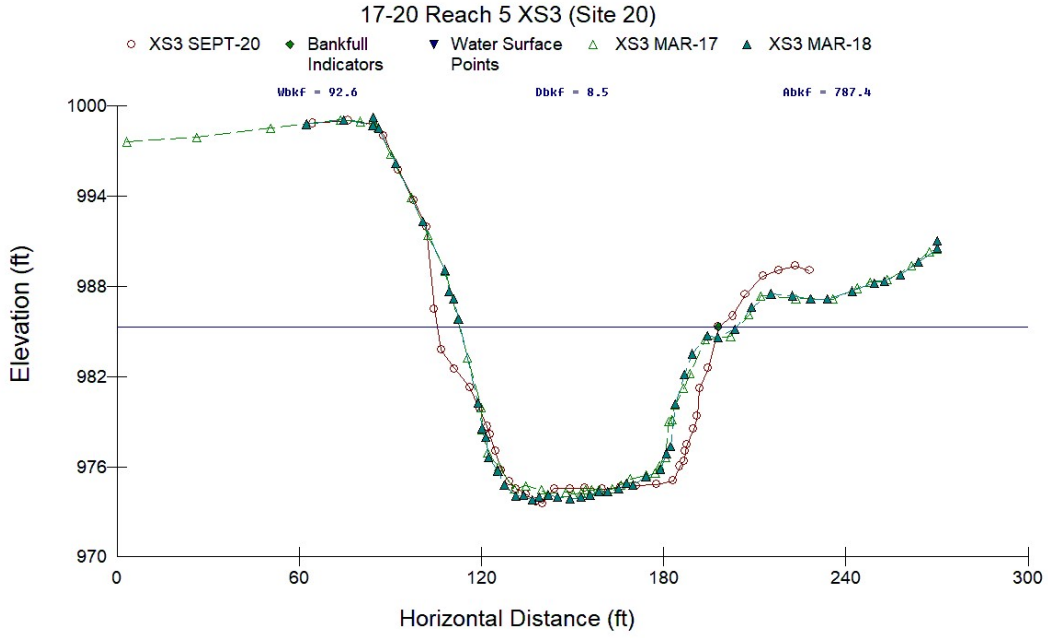


Figure C.3. Reach 5 XS3 at Site 20 Survey, March 2017, March 2018, and September 2020. This cross section is just downstream of revetment 1 (of 7) that still remains in 2020.

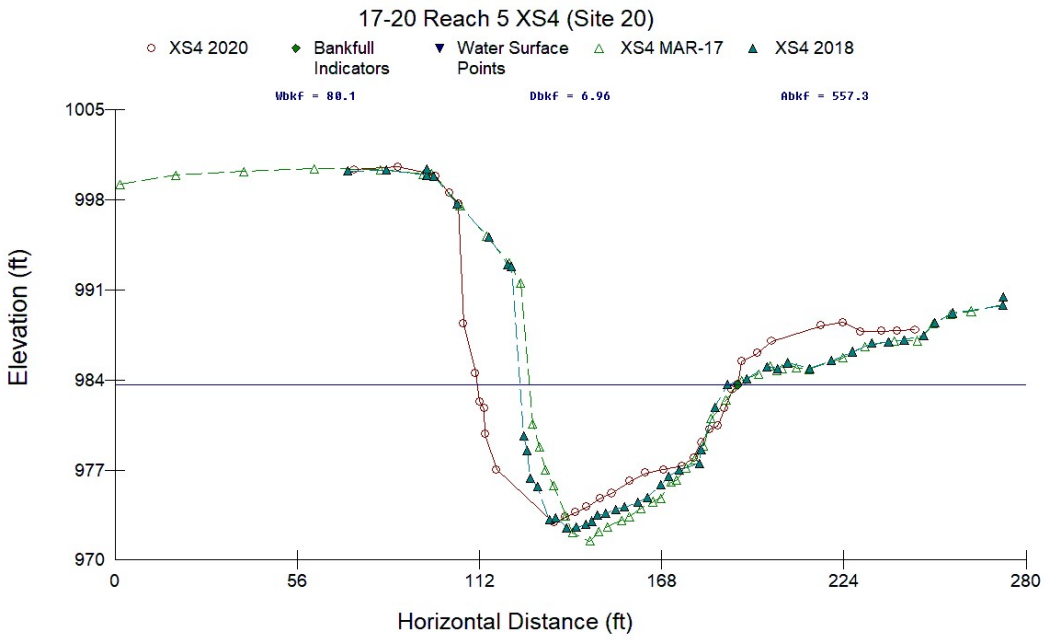


Figure C.4. Reach 5 XS4 at Site 20 Survey, March 2017, March 2018, and September 2020. This cross section is just downstream of revetment 4 (of 7) that was washed out by 2020.

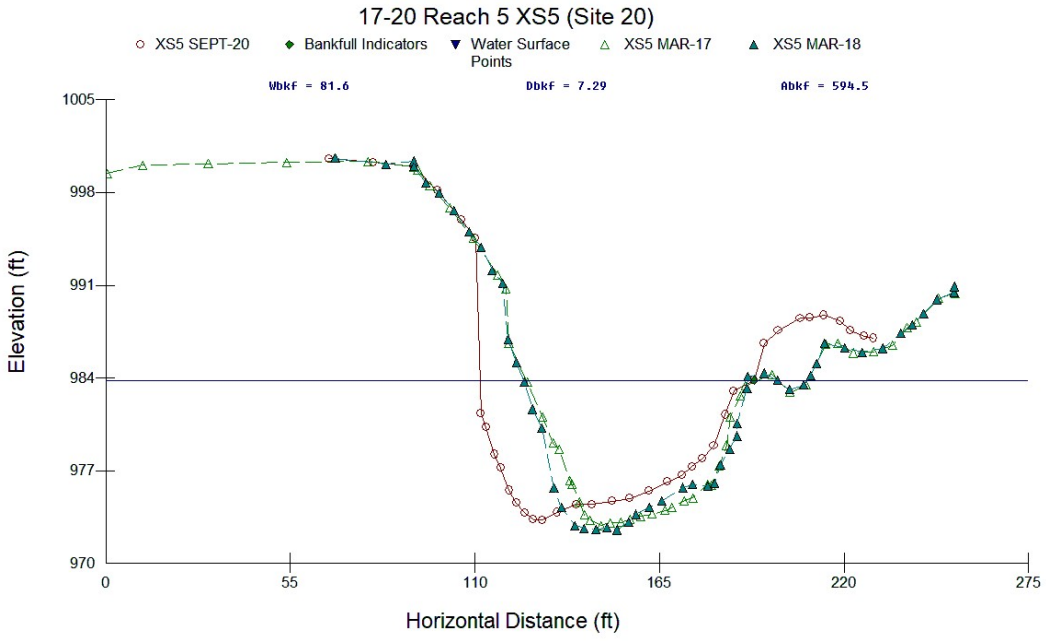


Figure C.5. Reach 5 XS5 at Site 20 Survey, March 2017, March 2018, and September 2020. This cross section is between revetments 5 and 6 (of 7) that was washed out by 2020.

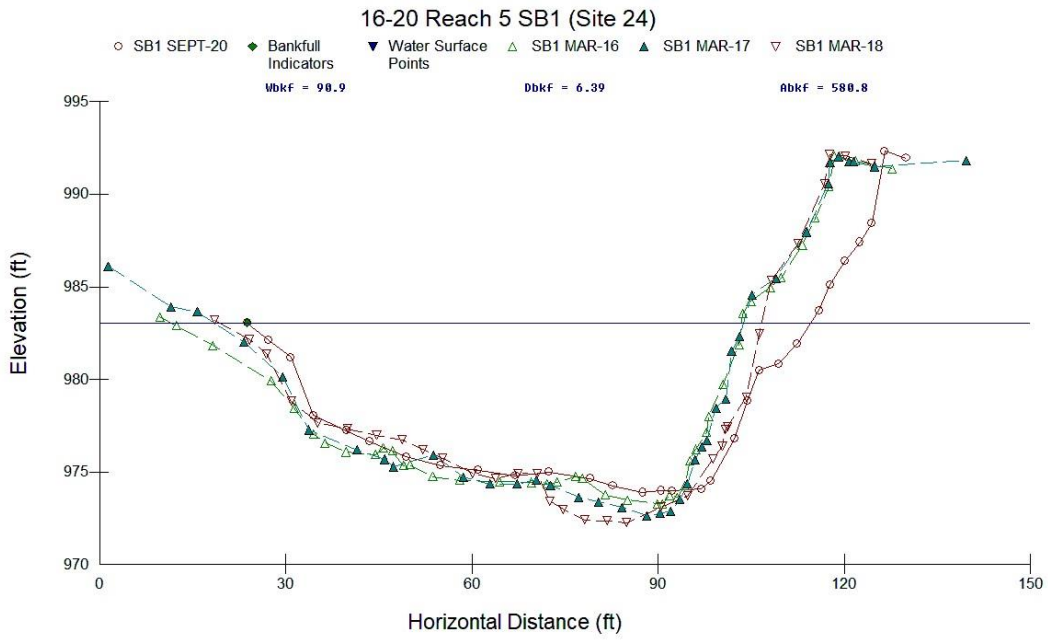


Figure C.6. Reach 5 Study Bank 1 (SB1) at Site 24 Survey, March 2016-2018, and September 2020.

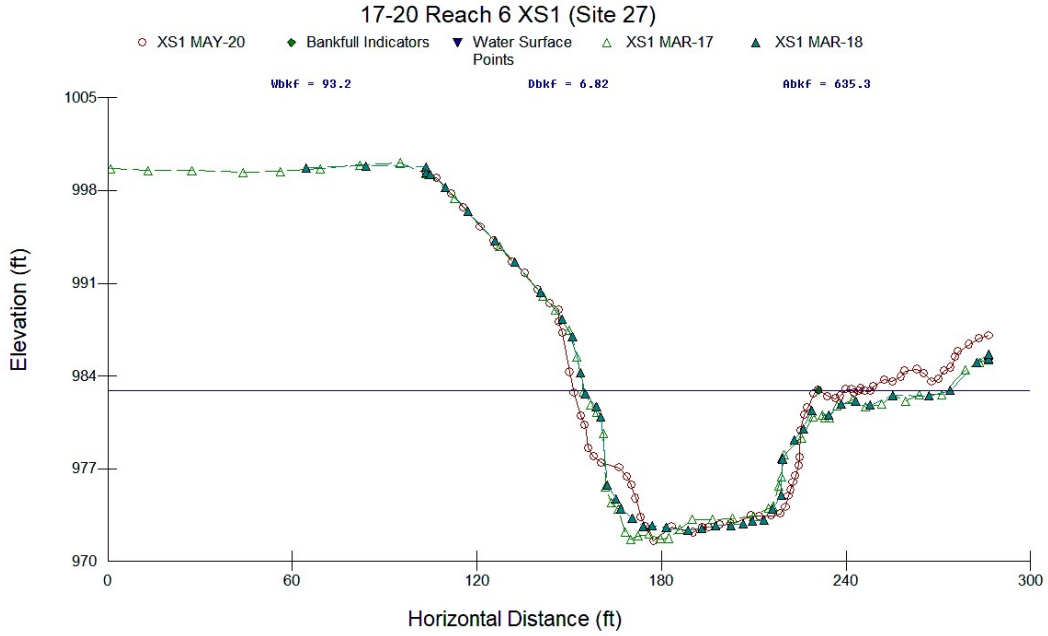


Figure C.7. Reach 6 XS1 at Site 27 Survey, March 2017, March 2018, and May 2020. This cross section is between woody revetment 1 and 2 (of 9) that still remains in 2020.

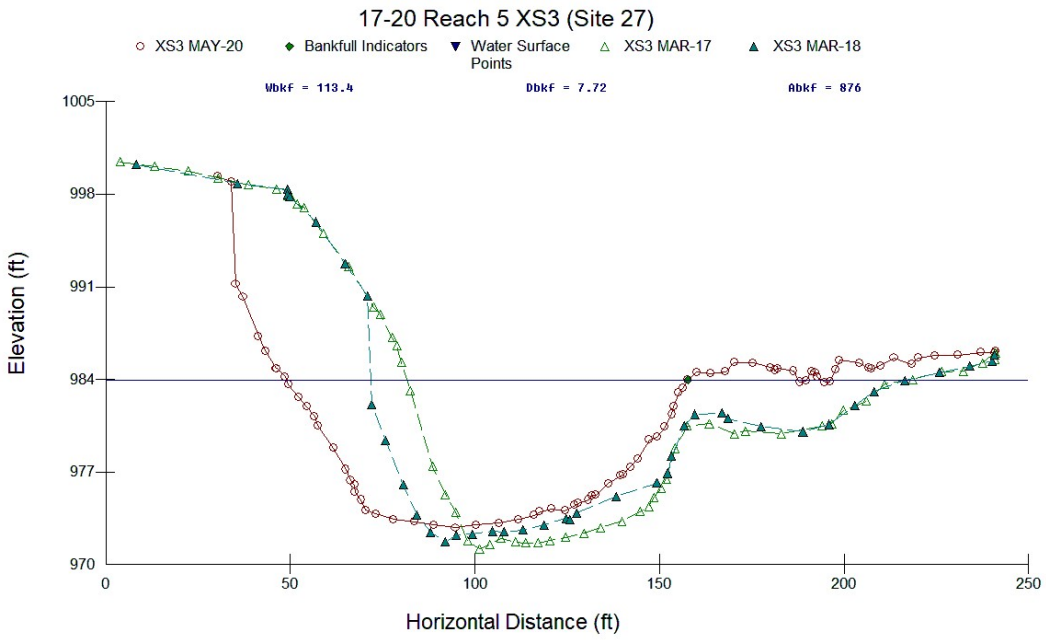


Figure C.8. Reach 6 XS3 at Site 27 Survey, March 2017, March 2018, and May 2020. This cross section is located just upstream of woody revetment 9 (of 9) that was washed out in 2017.

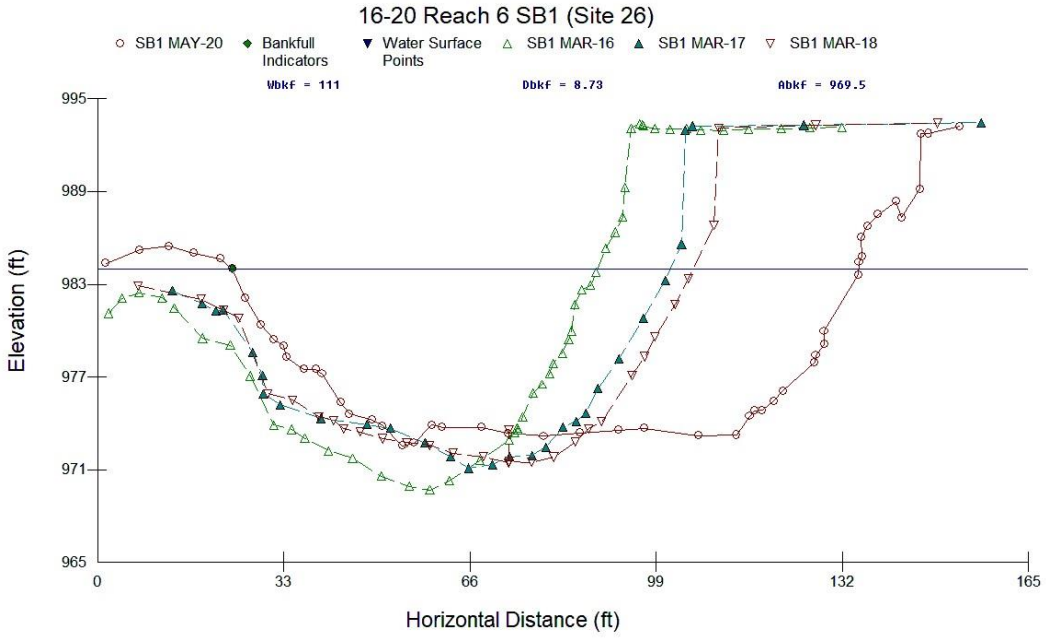


Figure C.9. Reach 6 SB1 at Site 26 Survey, March 2016-2018 and May 2020.

Appendix D – 2019 Water Quality Summary Table

Table D.1. Summary of Water Quality Data Collected in 2019 on Reaches 5, 6 and Control (Reach 2).

Sampling Event	Date	Stage (ft)	Location	TSS (mg/L)	TP (ppm)	TN (ppm)	NO_3 (mg/L)	*Total coliform* (MPN)	*E.coli* (MPN)
1	2/14/19	5.85	Control	147	0.19	1.41	0.01	824	35
			Reach 5	100	0.17	1.33	0.01	1024	29
			Reach 6	81	0.15	1.29	0.03	783	62
			Overall	109	0.17	1.34	0.02	871	40
2	3/15/19	12.55	Control	457	0.39	2.01	0.50	-	-
			Reach 5	461	0.38	2.00	0.49	1553	93
			Reach 6	482	0.39	2.01	0.50	1648	96
			Overall	467	0.39	2.01	0.50	1600	94
3	4/27/19	4.64	Control	29	0.06	0.80	0.05	-	-
			Reach 5	31	0.06	0.83	0.04	-	-
			Reach 6	28	0.07	0.80	0.05	-	-
			Overall	29	0.06	0.81	0.05	-	-
4	5/30/19	10.85	Control	440	0.37	1.55	0.41	>2419.6	148
			Reach 5	254	0.39	1.55	0.41	>2419.6	162
			Reach 6	259	0.34	1.52	0.41	>2419.6	198
			Overall	318	0.37	1.54	0.41	>2419.6	168
5	6/19/19	16.60	Control	273	0.37	1.91	0.65	-	-
			Reach 5	206	0.33	1.82	0.61	-	-
			Reach 6	249	0.33	1.82	0.63	-	-
			Overall	243	0.37	1.85	0.63	-	-
6	7/22/19	13.84	Control	208	0.27	0.97	0.07	>2419.6	63
			Reach 5	166	0.27	0.94	0.08	>2419.6	57
			Reach 6	247	0.29	0.97	0.09	>2419.6	59
			Overall	207	0.28	0.96	0.08	>2419.6	60
7	8/23/19	9.56	Control	-	-	-	-	289	-
			Reach 5	-	-	-	-	230	-
			Reach 6	-	-	-	-	241	-
			Overall	-	-	-	-	252	-
8	9/21/19	8.22	Control	137	0.22	1.52	0.56	>2419.6	101
			Reach 5	148	0.22	1.49	0.54	>2419.6	116
			Reach 6	142	0.21	1.46	0.50	>2419.6	134
			Overall	142	0.22	1.49	0.53	>2419.6	116
9	10/26/19	4.75	Control	12	0.08	2.24	1.27	1044	15
			Reach 5	59	0.08	2.28	1.20	1211	17
			Reach 6	21	0.07	2.18	1.17	905	10
			Overall	31	0.08	2.23	1.21	1046	14
10	1/16/20	5.22	Control	17	0.05	1.53	0.52	907	32
			Reach 5	9	0.05	1.37	0.48	687	53
			Reach 6	19	0.05	1.44	0.46	688	43
			Overall	15	0.05	1.45	0.49	754	42

* Yellow highlighted cells represent exceedance of TMDL.

Appendix E – Georeferenced Coordinates and Elevation of Remaining Control Points on Reaches 5 and 6

Table E.1. Georeferenced Coordinates and Elevation of Remaining Control Points on Reaches 5 and 6.

Reach	Northing (ft)	Easting (ft)	Elevation (ft)	Description
5	118968.544	1432859.032	1288.038	Prop2-BM
	119036.028	1432872.463	1287.727	XS3 LPINTOP
	118879.911	1432794.360	1289.102	XS4 LPINTOP – OPUS
	118826.298	1432728.813	1288.849	XS5 LPINTOP
6	117801.054	1431995.803	1290.604	Prop3-BM
	117692.432	1431883.465	1288.603	XS1 LPINTOP
	117831.193	1432051.917	1291.149	XS2 LPINTOP

Notes: (1) Kansas State Plane North Zone and NAVD88 (US Survey Feet). (2) LPINTOP: top of cap on left cross section pin; OPUS: GNSS data submitted to NOAA National Geodetic Survey Online Positioning User Service

John Wunder
Area IV Commissioner Update
2/1/2021

Hello from Area IV. Since we last met in November, in Northeast Kansas there has been conservation work going on in November, December and part of January. We are fortunate enough for most of the area to have received moisture in various forms during that time frame. A good portion of the area received around an inch of rain Saturday, so most field work is shut down now.

I have had lots of conversations with district supervisors and employees. Topics of concern are in no particular order: decrease in aid to conservation districts, a decrease in water resources cost share, and health care for employees. Another area of concern due to COVID is the chance to have face-to-face meetings and patrons being able to enter service center offices. Having said all of that, I feel it is important that we discuss and address those issues at a commission meeting. We need to discuss and address ways to accomplish a positive outcome for these topics.

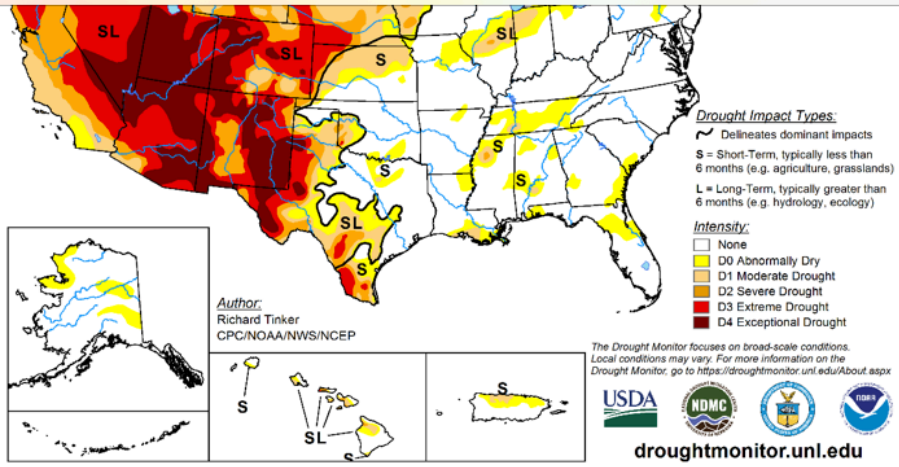
Another area of concern as was mentioned back in November, is potential drought this year. I am including in my report drought monitor maps for this year and for this time in 2012 which was extremely dry. We need to come up with strategies and eligible practices and possibly ways to fund this so that we are prepared if this were to occur this year.

CRP rental rates are also of concern. The maximum rental rate in Jefferson County is $50.00 with some soil rental rates being $37.00. This is nearly a 50% decrease in soil rental rates in recent history. The state of Kansas has spent a substantial amount of money promoting CRP. Reality check. Would you continue to work at your job if it is 50% less pay and 50% below the market rate? Last time I checked a significant portion of Jefferson County was above a federal reservoir. Do the math.

A final topic that needs to be addressed is a communication strategy. No matter how good we do, we can always improve our communications between districts and partners. I am also including in my report an article from Farm Futures/Farm Progress. Good communication is always important. These past months, due to COVID, we have been working off the goodwill that has been built up over the last 75 years of face-to-face and in person contact. It is important that we find additional ways to replenish this goodwill until such a time comes that we can have face-to-face and in person contact. Remember, there are always new and different faces whether they be supervisors, employees, personnel in other partnering agencies, conservation participants, county commissioners or legislators.

Thanks to all for the role they play in the conservation effort.

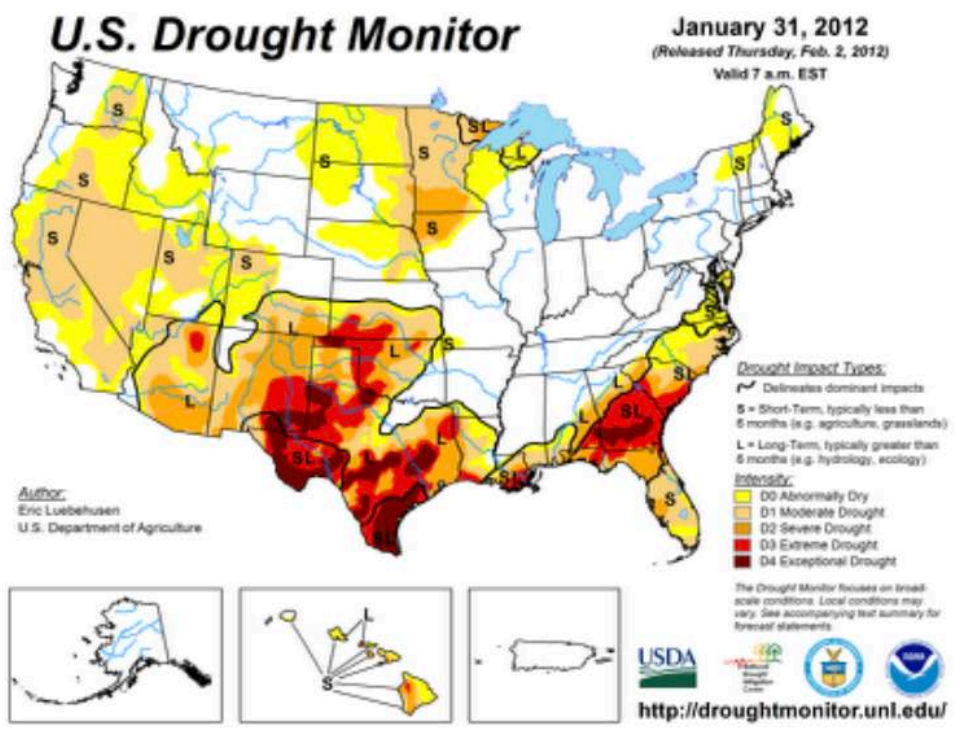
John Wunder
Area IV Commissioner



Moderate precipitation and/or heavy snow hit eastern Kansas and Nebraska, and isolated but heavy precipitation fell on some of the higher elevations of Colorado. Other areas received light amounts at best. Areas farther north experienced another dry week, resulting primarily in a fairly broad expansion of severe drought into northeastern Wyoming and the western Dakotas.

In other words, it's *dry* in the west. For comparison, consider the Drought Monitor at this time back in 2012, what became a historically awful year for dryness. So, what

◀ Mail LTE 10:24 AM 95%
ksgrainsorghum.org



Farm Futures Communication

Communication greases the wheel, part two

Davon Cook - FPFF - Mon Jan 25, 1:29PM CST

Facing the uncomfortable: How to address a problem or conflict in your farm operation.

Last week I wrote about the frequent daily or weekly operational coordination that keeps the wheels of your operation turning without too many squeaks. This week let's consider communication when you need to address a problem or conflict.

When you hear a knocking sound in the engine, you stop to investigate and fix it *before* it gets worse, right? That's the first tip.

Some degree of annoyance and conflict is likely in any family or team, and even more likely in families working together. When difference of opinion or conflict causes stress or distraction, too often I see folks grumble but do nothing, because it's uncomfortable to address.

Yes, it's wise to stay calm and see if the problem dissipates with time. However, if it doesn't, avoidance is not a strategy!

Usually, the stress is simmering in plain view—impacting not just those in conflict but also the rest of the team watching. How do you go about communicating in that situation?

First, the logistics

Let the other party know you'd like to discuss the thorny topic so they aren't blindsided. "I can tell we've been grating on each other the last few weeks. Can we go to lunch tomorrow to figure it out?"

Second, try to understand the drivers. Most conflicts are based on three core drivers: content, process, or relationship.

- **Content** conflict means we disagree on the *what* of a decision. *I think we should not trade tractors this year to be fiscally conservative. You insist it's too good a deal to pass up.*
- **Process** conflict means we disagree about *how* a decision was made or implemented. *You agreed to higher rent when I was out of town and didn't consult with me first.*
- **Relationship** conflict means our perception of each other and history together is derailing us. I see this one build up over time in unhealthy partnerships, such that we assume the worst about each other's intentions no matter the topic at hand.

When preparing for a tough conversation, take time to identify which of these is really the issue, so your proposed solutions address the right problem.

You can also think of those three components from the positive viewpoint of *preventing* conflict, called the "satisfaction triangle" of working together. To maintain satisfying interactions, you have to attend to all three points of the triangle: content, process, and relationship.

In every partnership, make sure you're nurturing all three. When making major decisions as an ownership or management team, not only gather the relevant facts and information, but also have a process that gives everyone time to study the information, ask questions, and provide input.

Invest in your relationships. That might mean having a conversation before the meeting with the person you know will be most anxious about it, for example.

While this triangle may sound academic, it's a practical way to diagnose the knocking sound and design a solution to address the problem.

The opinions of the author are not necessarily those of Farm Futures or Farm Progress.

Area V Commissioner Report

Challenges continue from 2020 into this year. The foundation of Conservation Districts is the trusted relationships that exist between Conservation Partners at the local and state levels. I continue to commend the dedication and commitment of all the partners for being adaptive and creative in finding ways to communicate with and assist those we represent and serve.

Like many I have been living in the "Virtual" world and long for in person meetings. I am looking forward to face-to-face time with you again, but believe we are all learning how to be more effective when that time is realized.

District Managers are the Face and Voice of Conservation at the local level. You may feel a disconnect but know that I believe you are literally the grass roots that hold our world together.

Rod Vorhees