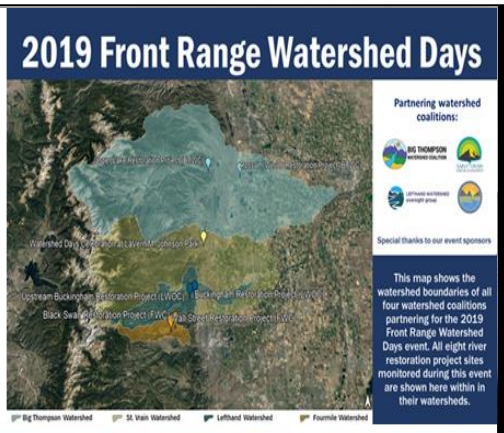

ADAPTIVELY MANAGING THE BIG THOMPSON WATERSHED FOR LONG TERM HEALTH

2019 Year-end Grant Progress Report for CWCB

Produced by the Big Thompson Watershed Coaltion:
Courtney Gutman, Acting Director
Courtney.gutman@bigthompson.co
(970)699-2906 and

Will Davis, Project Coordinator
Wwdavis4992@gmail.com (970)800-1126

for Colorado Water Conservation Board
Chirs Sturm, Stream Restoration Coordinator
chris.sturm@state.co.us
303-866-3989

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WATERSHED COALITION

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Project Overview

Project Goals

Since the floods of 2013, multiple organizations across the Big Thompson Watershed have been hard at work and have invested millions of dollars in federal, state and local funds to improve the resiliency of the watershed and health of the river corridor and ecosystem. As of November 2017, the two lead entities on the project, the Big Thompson Watershed Coalition (BTWC) and Larimer County, had completed projects along 15 miles of the Big Thompson River and the North Fork of the Big Thompson River, an investment of nearly $45 million dollars. While these initial projects and investments were critical to jump-start the recovery of the Big Thompson River ecosystem, ongoing monitoring, adaptive management, maintenance and stewardship is needed to ensure that the systems continue on a trajectory for long-term watershed health, resiliency and ecosystem function. The Adaptive Management project is a partnership that aligns with the recommendations of the Colorado Water Plan, as it will continue the cyclical process of Coalition-building, data collection, planning prioritization, implementation and monitoring, which requires collaboration across political boundaries and requires continued efforts. Further, the project presents a clear opportunity to engage and work with the public through a Community Science and Stewardship Program where volunteers participate in community science monitoring days. Overall, the goals of the Adaptive Management project are as follows:

1. **Formalize a Monitoring and Adaptive Management Protocol**, that builds from existing efforts in the region, and guides additional management work to be completed by the project partners;
2. **Minimize the presence of noxious weeds** and other undesirable plant species that will hinder establishment of desirable native species;
3. **Plant supplemental revegetation treatments** to overcome site mortality that occurs following initial project implementation. This will also help further enhance aquatic habitat within the corridor, which is linked to riparian habitat;
4. **Proactively manage potential erosion issues,** by strengthening BMPs focused on preventing excess sediment from entering the river system;
5. **Continue to enhance aquatic habitat,** by promoting the

SUMMARY

Project implementation partners:

- Larimer County departments of Engineering and Natural Resources.
- Fourmile Watershed Coalition
- State of Colorado (restoration/river monitoring teams)
- Lefthand Watershed Coalition
- Private landowners
- General public

Project funding partners:

- CWCB
- Larimer County
- Department of Local Affairs
- Patagonia

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Establishment of native vegetation and managing erosion and other significant instabilities in the river channel and banks;

6. **Engage community members in the ongoing stewardship of the river ecosystem,** by establishing a citizen science program to assist with monitoring and hosting volunteer planting and weeding days for community groups.

Our Partners

This Adaptive Management and monitoring project was developed in partnership with Larimer County's Natural Resources and Engineering Departments for the Big Thompson watershed. Data collection and consolidation and monitoring plan development was provided by State of Colorado water quality monitoring team, Fourmile Watershed Coalition, and Lefthand Watershed Center for monitoring protocol demonstrations and the creation of the first annual Watershed Days community event (see section III, Community Science & Stewardship program development). Financial contributions to this project included CWCB Restoration Grant funding, Patagonia small grants, Department of Local Affairs through Watershed Resilience- Capacity funding, Larimer County, and BTWC's partnering private landowners and general community members.

Project Expenditures to Date

Project expenses through December 31st, 2019, as indicated in Invoice #6

Description	Total Budget (all parties)	CWCB Grant Funds	Cummulative Totals		Remaining		Percent Complete
			Invoiced to CWCB	Matching Funds	CWCB Grant	Total	
BTWC Staff time--Project (DOLA)	$ 20,000.00	$ -	below	$ 20,000.00	na	$ -	100%
BTWC Staff time--Project (CWCB)	$ 13,400.00	$ 13,400.00	$ 5,080.00	above	$ 8,320.00	$ 8,320.00	38%
BTWC Graduate Research time (BTWC)	$ 12,000.00	$ -	na	$ 12,000.00	na	$ -	100%
LC Staff Time	$ 11,490.00	$ -	na	$ 7,321.00	na	$ 4,169.00	64%
Volunteer Time	$ 29,000.00	$ -	na	$ 10,632.00	na	$ 18,368.00	37%
Materials and 3rd Party Labor	$ 243,838.00	$ 141,942.00	$ 51,290.49	$ 14,907.30	$ 90,651.51	$ 177,640.21	27%
BTWC Staff time--Capacity Building	$ 10,000.00	$ 10,000.00	$ 8,150.19	na	$ 1,849.81	$ 1,849.81	82%
BTWC Staff--Project Management	$ 10,000.00	$ 10,000.00	$ 5,000.00	na	$ 5,000.00	$ 5,000.00	50%
TOTALS	**$ 349,728.00**	**$ 175,342.00**	**$ 69,520.68**	**$ 64,860.30**	$ 105,821.32	$ 215,347.02	38%

Our Staff and Collaborators

Shayna Jones, 2015-2019 Director, spent ten years working on endangered species issues, stream and wetland mitigation, conservation finance, and environmental markets across Colorado and the West. She has a M.S. in Conservation Leadership from the Human Dimensions of Natural Resources department from CSU, and a B.S. in Business and Supply Chain Management from the University of Maryland.

Courtney Gutman, Acting Director and Project Manager, brings ten years of habitat restoration, monitoring, community engagement, and outdoor education experience to our team. While managing two of Audubon California's largest tidal marsh restoration projects, Courtney became fascinated with building habitat resilience into restoration and enhancing community supported initiatives that prepare both wild and human communities for a changing environment.

William Davis, Project Coordinator, brings his background in conservation, community engagement, and event planning, as well as a M.S. in conservation leadership from CSU to our team. Will has done conservation work in varied locations around the western U.S. and worked on a community development project in East Africa. During this time, he found a passion for involving and engaging communities in order to raise awareness and advance conservation goals.

Haley Smith, CSU Human Dimensions of Natural Resource Masters of S research associate, is originally from the Appalachian Mountains of Western North Carolina, and obtained her Bachelor's degree in Biology and Environmental Studies from Washington and Lee University in Virginia. She spent two years leading outreach and education programs as an AmeriCorps member with the Southern Appalachian Highlands Conservancy before moving to Colorado in 2017.

As a part of her Conservation Leadership program, she developed and launched our Community Science & Stewardship program fall 2019.

Review of Progress

BTWC Monitoring Plan

Consultant Hiring

In 2018 Big Thompson Watershed Coalition and Fourmile Watershed Coalition procured a consultant to develop a post-flood recovery monitoring plan that covered respective watersheds and each coalition's completed river restoration projects. Monitoring contractors were solicited for price estimates for associated project monitoring needs adhering to Coalition procurement policies. Alba Watershed Consulting, LLC. (Alba) was selected as the most responsive and responsible firm to produce desired deliverables with a limited budget.

Plan Development

Alba worked closely with BTWC and FWC throughout 2018 and 2019 to produce a comprehensive Final Monitoring Plan for Big Thompson and Fourmile Flood Recovery Projects (Appendix A). This document contains:

1) descriptions of the purpose of implementing each of a variety of monitoring parameters;

2) post-flood conditions, enhancement objectives, restoration details (including consulting firms and restoration techniques), and applicable monitoring parameters for each BTWC and FWC flood recovery projects (separated by CWCB and NRCS EWPs or DOLA disaster relief funds);

3) monitoring protocol and data sheets for each of the suggested monitoring parameters for:

SUMMARY

- Alba Watershed Consultants hired to develop flood recovery restoration project monitoring plan.
- BTWC staff trained in monitoring protocol.

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- *Physical Parameters:*
    - Cross-section surveys, Longitudinal profiles, Depth measurements, high flow inundation, substrate, structure, and aquatic habitat feature surveys;

- *Chemical Parameters:*
    - Water quality and chemistry;

- *Biological Parameters:*
    - Vegetation monitoring, Benthic Macroinvertebrate, and Fish population monitoring; and

- *Other qualitative parameters:*
    - Photo Points, Stream Visual Assessments, and Flow data.

The plan was completed in November 2019. Intended outcomes of this project for coalition staff to become versed in understanding aspects of watershed health, to continue to monitor the naturalization of project sites, and to be able to identify when restoration objectives are not being met or if degrading conditions should trigger adaptive management actions. Consultant and Coalitions decided that monitoring data, for the purposes of adaptive management of these project sites, should be viewed in terms of general improvement or general decline of monitoring parameters. This approach differs from some entity's preferred use of specific values or metrics of health vs. non-health, which can be challenging, contentious, and time consuming process. Additionally, many of these protocol suggest 1-3 year or longer monitoring cycles depending on parameters and need. Pebble counts and BMI surveys, for example, can be done on a more frequent basis as costs are low and staff are able to conduct these in the field whereas cross-section or longitudinal profiling should be conducted less-frequently by hired consultants when funding allows.

Field Training

Along with the development of a monitoring plan, Alba trained BTWC staff on monitoring protocol to help establish an understanding of in-field data collection, the goals of each monitoring activity, and to maintain consistency and accuracy in assessments. Over the course of 3 field visits, Alba staff trained BTWC in field collection of protocols and installed staff gauges to monitor water flow at the Fox Creek restoration project (near the Boys and Girls Club property bridge) and Reach 28 restoration project (near the west corner of City of Loveland's Wild Natural Area and their upstream neighbors). While there are US Geological Service flow gauges stationed strategically throughout the Big Thompson Canyon as necessitated by the Colorado-Big Thompson project's water transfer system, these project sites do not have gauges nearby. This information will help staff, partners, and community members better understand low and peak flow, bench activation, and water availability through new

stretches of the Big Thompson watershed. Alba's contract has been extended through June 2020 to advise staff on monitoring plan execution, data analysis, and flow meter equipment rental to staff through the grant's timeline.

Summer 2019 flow monitoring at Fox Creek, an upper watershed tributary of the Big Thompson watershed.

Fall 2019 introduction to monitoring protocol at the recently completed Reach 28 (Wild Natural Area & Neighbors) river restoration site.

Continue on to next page…

Review of Progress

Project Monitoring in the Field

By BTWC Staff

Of BTWC's 14 river restoration project sites, CWCB is monitoring four NRCS-EWP project locations and BTWC is set to monitor and analyze ten sites. BTWC staff initiated monitoring activities in spring 2019 and have thus far completed full habitat, water temperature, pebble count, pool depth surveys, and photo point surveys at four sites (see Figure 1 and Table 1). 2019 Photo points have been collected at five project sites. Peak run-off flow and inundation surveys were conducted for all 14 project sites over May 2019 peak flow when main-stem gauges measured approximately 800CFS.

By Staff and Community Members (also refer to Community Science & Stewardship program plan)

Three of the BTWC led monitoring days have been publically opened to volunteers as a trial period for our Community Science & Stewardship program – a volunteer program developed to educate and engage community members in watershed health and monitoring techniques while collecting real data for BTWC planning and management efforts. Over the course of 3 community monitoring days in fall-winter 2019 BTWC led six volunteers through 33.5 hours of monitoring activities for a total volunteer-match value of $804. Overall, we feel that this approach to monitoring has been only slightly successful because of low turn-out or interest in week-day fall monitoring opportunities. A comparison of the successful Watershed Days event to these casual monitoring experiences will provide more information as to how staff can adapt and improve the Community Science & Stewardship opportunities to reach wider audiences, gain more interest, and build a returning volunteer base.

SUMMARY

2019 monitoring progress:

- Flow and inundation monitoring completed at 14 sites
- Photo points completed at 8 sites
- Full aquatic, water temp, pool depth, and pebble count surveys completed at 4 sites with volunteers

Goals for 2020 include:

- More community and staff monitoring volunteer days
- Enter, analyze, and disseminate monitoring data to organizations and the public

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2020 Community Monitoring Efforts

Approximately 6 more volunteer monitoring days will be set for spring 2020 between March and May to monitor sites identified as "volunteer friendly" through the monitoring plan development process (as indicated in Table 1). Additional dates will be set for staff to complete remaining sites that are unfit for volunteer access. Staff will continue network development to identify interested community and education groups and classes that may want to assist with particular or general monitoring activities. Benthic macroinvertebrate and vegetative surveys have been identified as charismatic monitoring activities best fit to develop long-term or community-led science initiatives. We believe we have identified particular community groups (such as TU-Rocky Mountain Flycasters and CSU Extension –Native Plant Master) that would be interested in committing to a longer monitoring series - assisting with data collections of a particular parameter at all 10 sites, rather than carrying out all protocol at one or two sites. For these specific protocol, community members would be asked to commit to a certain number of project collection locations and dates, train with BTWC staff members, and coordinate the process from year to year. A pilot of these longer-term volunteer monitoring programs will be further developed in spring 2020.

BTWC will work with the Big Thompson Watershed Forum, Colorado Parks and Wildlife, and other data collecting entities to determine the most efficient, affordable, and transferable approach to sampling remaining protocols (cross-section surveys, longitudinal profiles, fish population monitoring, and water quality/chemistry). In 2020, BTWC will develop databases for, analyze, and disseminate restoration project status data to other watershed coalitions, organizations, and the public. We have an expert volunteer with experience in data analysis who has volunteered her time to help with this effort. BTWC will initiate research and development efforts to create an interactive online resource where watershed decision-making data can be shared and visualized through maps and other mediums. Outside of data interpretation, staff plan to continue utilizing time with volunteers to determine best practices for community outreach, engagement, and volunteer retention.

Note on benthic macroinvertebrate sampling: BTWC and project partners TU- Rocky Mountain Flycasters have met with Colorado Parks and Wildlife to discuss interest in aligning BMI surveying protocol and sampling schedule to create comparable and transferable data. BTWC's project sites have the potential to provide 14 additional BMI collection sites to CPW's existing 7 sites along the Big Thompson River and the North Fork of the Big Thompson River. BTWC will consult with CWCB an interest in expanding the granting period to allow for fall 2020 BMI collection and processing to align with CPW's collection season. This request would allow data to be comparable and transferable along the Big Thompson River and across state-wide CPW BMI sampling locations.

Community monitoring volunteer day at Cedar Cove on 12/6/2019 – staff and volunteers take depth measurements and discuss habitat features

Figure 1: Map of BTWC watershed and BTWC led restoration and improvement projects along the Big Thompson River.

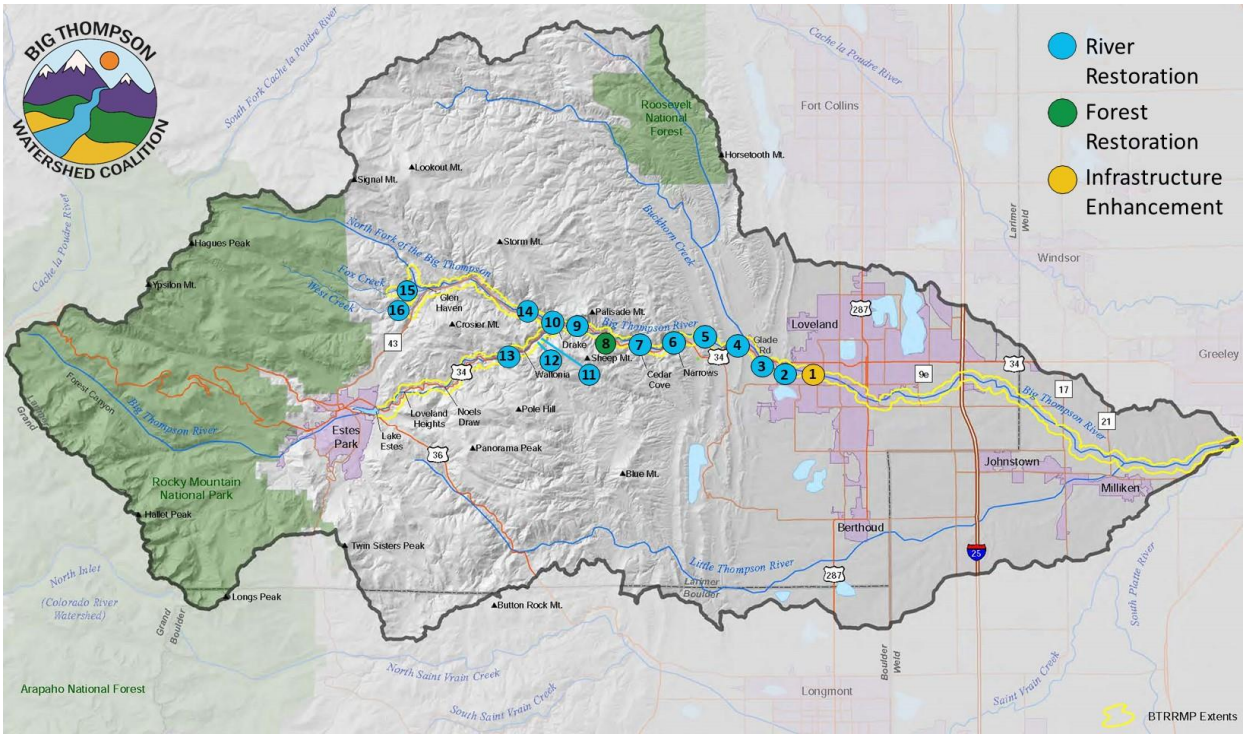

Table 1: BTWC 2019 Monitoring Progress

Project Site (map reference #)	Yr post-completion	Flow and Inundation	Photo Points	Aquatic Habitat	Pebble Count	Water Temp.	Pool Depths
Fox & West Creeks (15)*	Yr-2	X	X				
West Creek (16)*	Yr-2	X	X				
North Fork (14)*	Yr-2	X					
Mtn. Shadows (11+12)	Yr-1	X					
Waltonia (13)	Yr-1	X					
Moodie St (10)	Yr-1	X					
Cedar Cove (7)*	Yr-2	X	X	X	X	X	X
Jasper Lake (6)*	Yr-2	X	X	X	X	X	X
Sylvan Dale (5)*	Yr-2	X	X				
Water Plant (4)	Yr-2	X					
Reach 28 (3)*	Yr-0	X	X	X	X	X	X
Rossum-Wilson (2)*	Yr-0	X	X	X	X	X	X
Rist/Goss DD (1)*	Yr-0	X	X				

*Project site determined to be "volunteer-friendly" based on considerations such as access, parking, bank slopes, landowner receptiveness, and other preferences.

Review of Progress

Student Research: Community Science & Stewardship plan and Other Deliverables

Project Development and Process

In Spring 2019, BTWC partnered with a Master's student research associate in order to create a guide that will serve as an aid in the development of our Community Science and Stewardship Program. Haley Smith, the student research associate, worked to pull from the wealth of information available in academic literature, interviewed volunteer managers in Northern Colorado, and surveyed the preferences of current and prospective volunteers in order to create a better understanding of volunteer outreach, engagement, and retention.

Haley conducted a thematic analysis of 20 academic articles related to volunteer motivations and volunteer monitoring programs. She also held seven interviews with a total of ten volunteer managers to discuss volunteer management and address gaps in the information needed for practical implementation of a volunteer program. With this information in mind, Haley then developed surveys to gain insight from volunteers about their preferences. In total, three surveys were developed. The first was a general survey that was dispersed both digitally and as hard copies. A total of 93 responses were received from this survey. Additionally, pre and post-surveys were distributed at the Watershed Days event (further information below).

SUMMARY

- Led inaugural Watershed Days event with 3 other Northern Colorado watershed coalitions
- Led 24 volunteers through 87.7 hours of monitoring activities, equating to a value of $2,100 volunteer match
- Completed monitoring protocol at 4 restoration sites

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General Survey Results

Using the interviews with volunteer managers and the 93 survey responses, Haley Smith explored a number of themes related to volunteering. She began by exploring the demographics and backgrounds of the survey respondents then went on to look at their preferences, motivations, and interests. She then combined the thematic analysis of academic literature and interview transcripts to identify 16 major themes related to a successful volunteer program. Of the 16 the top five themes were: Benefits and challenges of community science, establishing clear goals, recruitment and advertising, communication, and training. Each theme was then explored further in the report (refer to report in appendix).

Watershed Days

As part of our Master's student's project and our Community Science and Stewardship Program BTWC partnered with three other Northern Colorado watershed coalitions who have similar objectives to create the inaugural Watershed Days event. The event was a flash bio-blitz citizen science event that we, and the other watershed groups, hope to turn into an annual recurrence.
This bio-blitz event occurred Saturday, September 28th across four watersheds in Northern Colorado. The Big Thompson group monitored two project sites—Rossum-Wilson and Jasper Lake from 9am-12pm. We had two staff, one intern, one board member, and one macroinvertebrate expert, in addition to 15 volunteers for a total of 18 people who donated their time to monitoring. Each person worked three hours, at an hourly volunteer rate of $24.00, leading to a total of 54 volunteer hours and a total value of $1,296. During those three hours, volunteers alternated between different monitoring protocols, including: substrate counts, benthic macroinvertebrate surveys, aquatic habitat feature surveys, depth measurements, and pool temperatures. As aforementioned, we also used the event to collect pre and post-surveys from volunteers to help us to better understand volunteer outreach, engagement, and retention.

Watershed Days Survey Results

The data from the pre and post-Watershed Days surveys were compiled in spreadsheets. Through these surveys we hoped to capture volunteer enjoyment, interest in returning, and likelihood of their referring friends to BTWC volunteer opportunities.

In reviewing the surveys, some relevant findings include:
Volunteers had an overall increase between their pre and post-survey understanding and familiarity with watershed terms, such as watershed and macroinvertebrates. In general, the favorite volunteer activity was benthic macroinvertebrate sampling, but others. The main reason volunteers gave for their

reason for coming was to "gain knowledge" and the most frequent response to what they were looking forward to was to "get outside and/or in the river". All in all, volunteers had a positive response to the event, and every respondent listed "yes" to both "would you come back again?" and "are you likely to recommend BTWC?"

Deliverables

Over approximately nine-months Haley contributed 277.5 hours to this project, equating to a value of $6,660. Her completed project resulted in five deliverables to BTWC. These deliverables include:

1. Community Science and Stewardship Program Development Guide (included in the appendix)
2. A community contacts list of groups and individuals to reach out to about future monitoring events
3. A timeline of best times of year to carry out each monitoring protocol
4. A list of recommendations and best practices for each monitoring protocol
5. A compiled database of all the data gathered over the course of the project

2019 Watershed Days - Courtney Gutman leads an introduction to concepts of watershed health, restoration monitoring, and activity schedule for the morning monitoring session.

Aquatic habitat surveys at Rossum-Wilson project site

Other Volunteer Events

Throughout 2019 BTWC conducted several other community volunteer opportunities to assist with vegetation adaptive management needs such as native plant installations and invasive, non-native weed management. Over the course of the year staff led approximately 30 volunteers through 200 project-hours of work, contributing an additional $5,000 of volunteer match to the program.

BTWC will continue to expand volunteer restoration on project sites throughout spring and summer 2020. In addition to vegetative work, BTWC hopes to work with Larimer County Engineering and Natural Resource management staff to 1) identify new project locations in need of on-the-ground adaptive management efforts (suitable for community engagement opportunities) and 2) provide a Weed ID Workshop for landowners in the Big Thompson Canyon to learn to identify and manage species of concern on their own properties in the future. A new adaptive management site was identified by Larimer County on HWY 43, but BTWC was not able to initiate contact with landowners to gauge interest in riparian and native plant enhancement efforts.

Volunteer planting day at Cedar Cove and Drake flood recovery projects.

Review of Progress

Weed Management

Task Accomplishments

2019 was the second year of BTWC partnering with the Larimer County Land Stewardship program to monitoring and manage weeds on BTWC river restoration project sites. Larimer County and BTWC staff collaborative on a monthly basis to discuss landowner access, treatment preferences, non-native invasive species of concern, and billing. Partners also consistently communicate on weed and native plant identification, held 2 BTWC staff field trainings for plant identification and management techniques, and manage landowner concerns.

In 2020, Larimer County staff will continue to prioritize and manage non-native, invasive species on BTWC project sites with landowner approval, will continue BTWC staff training of weed ID and management techniques, and will host seasonally appropriate public workshops on weed management for land owners.

Weed Management Report

Please refer to Appendix C for 2019 Weed Management report produced for the Big Thompson Watershed Coalition by Larimer County Weed Management Team.

SUMMARY

- As of September 2019, Larimer County has been compensated $20,000 for noxious weed management and erosion and sediment management needs…
- Assisting restoration of 6 restoration sites and 1 new project site in Larimer County
- Covering approximately 6.68 acres of riparian habitat in the Big Thompson watershed.

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