Caribou-Targhee National Forest

Jackknife Watershed Restoration

Priority Watershed Completion Report - FY2014

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Executive Summary

The Caribou-Targhee National Forest had selected Jackknife subwatershed as a priority watershed in 2011 following the National Watershed Condition Framework effort (http://www.fs.fed.us/publications/watershed/). Jackknife watershed (30,425 acres-95%FS) was rated in fair condition and on the verge of change (see vicinity map below). Since restoration projects, both on private and FS lands, were initiated in around 2008 and a strong partnership had been developed the Jackknife watershed become the prime candidate to change improve watershed condition. Upon completing the last essential project on NFS lands in 2014 the watershed within NFS management is improving and meets the criteria to shift from fair to good condition rating.

The watershed contains few roads (12 miles on FS & 3 miles on Private) that are mainly within the riparian corridors and provide access to the lower FS lands. The roads provide key access points to trailheads in a heavily recreated non-motorized area containing 43 miles of trail. It is a stronghold for two FS sensitive species including Yellowstone cutthroat trout (YCT) and northern leathersides (NLC) where 86 miles of perennial stream and 26 miles of fish bearing stream provided important aquatic habitat. Road/trail sedimentation, poor drainage, undersized stream crossing and road/trail failures on unstable hillslope contribute to reduced water quality, impacted aquatic habitat/passage, downcut/straightened channels, and excessive bank erosion. Historic grazing and beaver removal have added to the aquatic impacts. Components on private lands dominated by agricultural practices impact watershed conditions from the presents of unscreened/dilapidated diversion structures, poor road stream crossings, active bank erosion, minimal riparian buffers, and straightened streams.

The implementation of essential projects was critical in making the watershed condition improvement. The C-TNF had completed two Environmental Assessments (EAs) to formulate solutions to resource issues that had a direct effect on improving watershed conditions. Those solutions consisted of relocating and/or decommissioning roads and trails that were next to streams and on slumping landforms or converting road to trails. The old routes that were decommissioned, reduced in size, or relocated further from the stream greatly improved water resource, aquatic habitat, and riparian/terrestrial habitat conditions. Stream restoration and road/trail stream crossing improvements were also critical as unstable stream conditions were getting worse causing additional loss or degradation of water quality, aquatic habitat, and riparian health conditions. Jackknife had downcut as much as 3-4ft and straightened losing around 14% channel length and associated habitat. Active stream restoration occurred on 3.9

miles of stream restoring lost stream function, improving quantity and quality of aquatic habitat, improving water quality, and improving riparian health and function.

In addition to improving watershed conditions on National Forest Lands, efforts on private lands and county roads were also completed addressing poor water diversions, undersized stream crossing and unstable stream conditions to achieve a holistic watershed improvement approach. It is important to note additional restoration efforts downstream and off National Forest Lands still need to occur to continue watershed improvement as a whole within the Jackknife Watershed.

Results

Numerous projects were completed between 2008 and 2014 on an off National Forest Lands to improve Jackknife Watershed conditions as specifically described below. The improvements can be grouped into three categories (1) FS infrastructure improvements such as roads, trails, and bridges (2) On-Forest stream and riparian Improvements such as the active stream restoration on Jackknife and Squaw Creeks and (3) Off-Forest stream and riparian Improvements such as the active stream restoration on Jackknife and Deep Creeks. The overarching and common goal was to improve watershed conditions as a result infrastructure was improved for the public access and safety to enjoy National Forest Lands at the same time these same infrastructure projects and additional stream and riparian projects improves stream conditions, water quality, riparian habitat and aquatic habitat.

Accomplishments:

- Professional Video Production in partnership with Trout Unlimited called. “Restoring Hope” (http://youtu.be/TU-Q_MZRLCo) along with various New Paper and Magazine article were released to inform the public of the Jackknife Watershed Improvements.
- 20,780 feet of active restoration and fisheries enhancement on Jackknife Creek, Squaw Creek and Deep Creek streams. Of those 2,400 feet of channel was improved off National Forest Lands but was critical to improve connection to National Forest Lands.
- 1.3 miles of road decommissioned
- 2.5 miles of road converted to trail narrowing the disturbance width in the riparian area reducing Aquatic Influence Zone (AIZ) and stream impacts
- 6 miles of trail relocated and improved to standard (TL-IMP-STD) & 20 miles of trail maintained to standard (TL-MAINT-STD).
- 7 trail stream crossing were upgraded to bridges and 1 trail stream crossing was eliminated.
- 9 undersized road stream crossing were upgraded to open bottom structures to improve stream function, restore aquatic passage, and improve water quality.
- 6.3 miles of road improved via heavy reconstruction, drainage improvements and re-surfacing.
- The projects resulted in 166 acres of watershed improvements (S&W-RSRC-IMP)
- 1,131 acres of wildlife habitat improvement (HBT-ENH-TERR)

- 23 miles of stream habitat was improved or made available for aquatic organisms through barrier removal (HBT-ENH-STRM) that directly benefited the Yellowstone cutthroat trout (YCT) and northern leathersides (NLC) FS sensitive fish species.
- Maintained jobs in SE Idaho through local contracts and agency involvement

Funding Contributions

Overall the Forest Service had the largest financial contribution, contributing around 80% of the funds and the partners contributed around 20% as shown in the tables below. Special internal funds such as Legacy and special allocated NFRR carrier over fund made up nearly 80% of those FS funds. However, if you look at the Off-Forest project component separately the partners have contributed nearly 60% of the funding necessary to improve watershed conditions as shown in the Off Forest Project Costs table below.

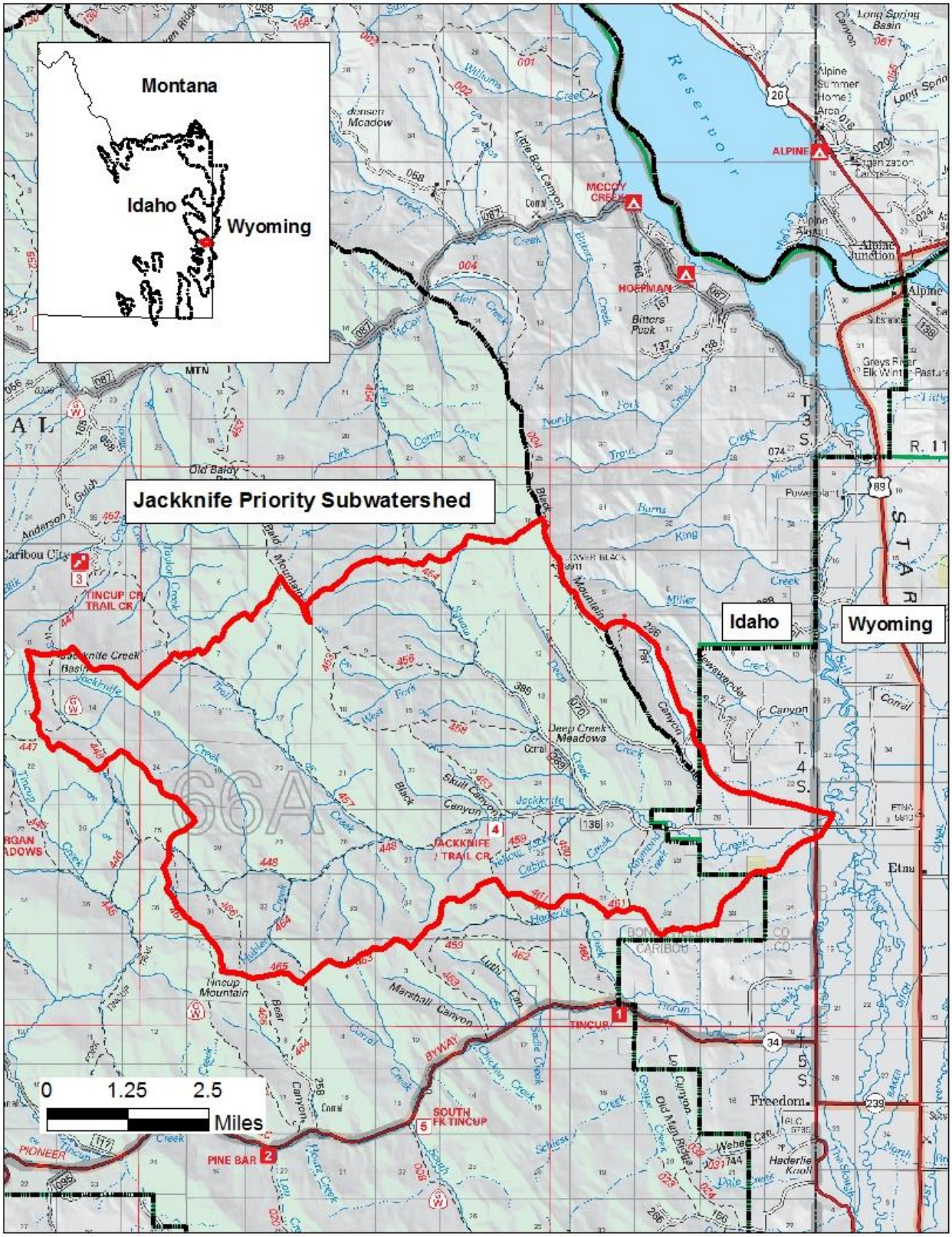
Overall Project Costs			
Location	**FS**	**Partners**	**Grand Total**
Jackknife	$242,700.00	$96,000.00	$338,700.00
Squaw Creek	$166,800.00	$2,000.00	$168,800.00
Deep Creek	$264,850.00	$76,500.00	$341,350.00
Grand Total	**$674,350.00**	**$174,500.00**	**$848,850.00**
Percent Contribution	***79***	***21***	***100***

Off Forest Project Costs			
Off Forest Project Costs	**FS**	**Partners**	**Grand Total**
Jackknife	$30,000.00	$84,000.00	$114,000.00
Squaw Creek	$0.00	$0.00	$0.00
Deep Creek	$83,700.00	$76,500.00	$160,200.00
Grand Total	**$113,700.00**	**$160,500.00**	**$274,200.00**
Percent Contribution	***41***	***59***	***100***

External Partners: The tremendous partnership development and the collaboration centered around common goals were brought together by Trout Unlimited, USFWS, Bonneville County, NRCS, Eastern Idaho RAC, Private landowners, Idaho Fish and Game, Idaho Parks and Recreation, Eagle Rock Backcountry Horsemen and NW Youth Corp. Without the efforts by each and every one of these partners none of the Jackknife Watershed Improvements would have been possible.

Internal Partners: In addition to external partner the strong internal integration with District Rangers, Staff Officers, Forest Supervisor, Engineers, Recreation Specialist, Fisheries Biologists, Hydrologists, Soil Scientists, Botanists, Range Specialists, force account Road Crew and equipment all made this possible.

Vicinity Map of the Jackknife Priority Subwatershed on the Caribou-Targhee National Forest



Specific Projects Details

The following are a list of watershed restoration projects (essential projects) by Fiscal year in which they were completed. The project details described below indicate how these projects aided in changing the Jackknife Watershed condition from fair to good on National Forest Lands and started improvements off National Forest Lands.

2008 - Jackknife Watershed Restoration Projects

Deep Creek Restoration

The Caribou-Targhee National Forest has cooperatively worked with Rec Spackman the private landowner, Bonneville Co. and other important partners to replace a fish barrier culvert on Deep Creek and restore over 1100 feet of excessively down-cut and straightened stream channel. Deep Creek is a tributary to Jackknife in the Salt River drainage and a Yellowstone Cutthroat trout stronghold. Replacement of the 4ft diameter culvert with an 8ft wide natural bottom arched pipe by Bonneville Co. on Jackknife Road (FS 136) restored Yellowstone Cutthroat trout passage up Deep Creek onto National Forest Lands. The channel was restored using stable reference conditions. The nearly 8ft down-cut channel bed was elevated a maximum of 5 feet to reconnect the channel to a newly constructed floodplain. The existing flood prone width was increased fivefold from approximately 15ft to nearly 80ft increasing stream stability during flooding events. The straightened channel was re-meandered to match reference condition (sinuosity increase from 1.1 to 1.5) lengthen the channel nearly 220 ft. Stream bed materials of gravel and cobbles mixture were imported to mimic the natural channel. Channel bank reconstruction consisted of outside meander log complexes, whole willow clumps; transplanted sedge clumps, nature sod solutions matting, and native seed mixes were used to provide stream stability.

Partnership & Funding: A total of $76,000 in cash was used to implement this project with Eastern Idaho RAC providing $10,000, Forest Service Legacy program $32,000, Forest Service TRTR program $25,000 and other FS funds $8,000. Rex Spackman provided in-kind labor and equipment contributions worth approximately $2,000. Bonneville Co. provided in-kind labor and equipment for culvert installation totaling about $15,000. Volunteer labor for vegetation planting and erosion control installation totaled nearly $5,000.

Deep Creek Restoration Results Photos

		
2004 Aerial Photo -Before	**2011 Aerial Photo- 3 years After**	**2013 Aerial Photo- 5 years After**

BEFORE – Top of project at culvert outlet looking downstream

AFTER – Fall 2008 right after restoration work was completed.

AFTER – 4 years after restoration was implemented (5-22-2012)

		**Before-Fish barrier for Yellowstone Cutthroat to get on National Forest upstream**
		**After: 8-2008 - Road surface elevation stayed the same. Stream bed elevated up 5 feet at culvert outlet**
		**After: 7-11-2012**

Parking Lot Improvements and Stream/Riparian Protection

Constructed a designated parking lot 90ft x 150ft to reduce dispersed impacts and improve recreational conditions at the new Jackknife Trailhead. The old Jackknife Trailhead was 1.9 miles further down the Jackknife Road but was administratively close due to slumps taking out the road. This trail head is one of the heaviest used trail systems on the Soda Springs Ranger Districts. Also placed barrier rock to protect about 900 feet (average 190 foot stream buffer) of stream and riparian vegetation to improve water quality and stream health.

View of the constructed parking area and placed barrier rock along Jackknife Cr.

Partners & Funding: A total of $21,400 was provided by the Eastern Idaho RAC to fund the FS Road Crew and equipment to construct the new trailhead parking lot and place barrier rock to protect the riparian area. In-kind contributions totaling an estimated $38,000 were provided by FS staff for project oversight and coordination and from Simplot at Smoky Canyon Mine where the barrier rock was obtained.

2011 - Jackknife Watershed Restoration Projects

Upper Jackknife Creek Trail #448 (non-motorized)

Approximately one mile of system trail was relocated out of the creek bottom, eliminating sever eroding stream crossing. The project had also reconstructed some existing pack trails and connected them with the new constructed sections

Jackknife Creek from new trail section, looking down where trail used to be.

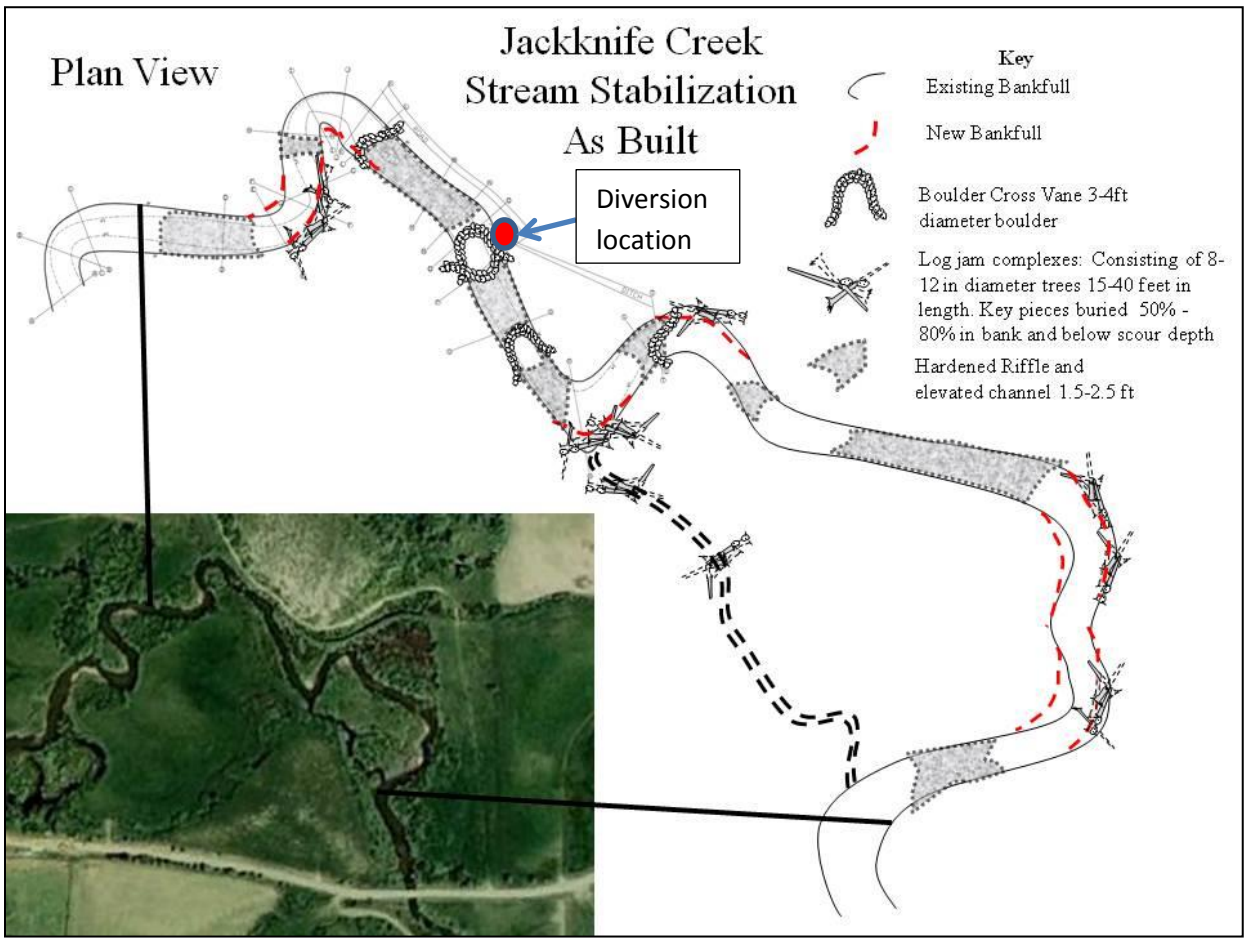
Jackknife Trail and Riparian Improvements

Upon final approval of the 2011 Jackknife Restoration EA and decision a small amount of work was completed in October of 2011 to improve trail and riparian conditions. Nearly 650ft of a road was converted to a trail narrowing the disturbance width and relocating a portion away from Jackknife Creek. The old road fill was removed to match the riparian elevation to allow flooding to utilize the full flood plain. The trail bed was improved via installing geo-textile fabric capped with a layer of angular pit run and crushed gravel.

Partner(s)/Funding: Legacy project where this portion was completed by the FS road Crew $5,000.

Jackknife Diversion Stream Restoration

Restoration of watershed and stream function continued off National Forest lands due to the strong partnership collaboration efforts. In preparation for the Jackknife diversion structure improvement project a section of Jackknife had to undergo restoration to ensure proper stability. A total of 1,300ft of stream channel was rehabilitated and stabilized. The downcut channel was elevated between 1.5-3.0 feet above and below the point of diversion, using boulder grade control and hardened riffle structures. This reconnected that channel to its floodplain to ensure long-term stability and channel function. The downcutting had caused accelerated bank erosion whereby nearly 400ft of stream bank was treated with whole tree revetment and relocated whole willow clumps to mimic log jam complexes and create stream stability. A threating human enhanced meander cutoff of about 275ft was kept as a flood flow channel with the use of log jam complexes type structures placed in the cutoff channel. This increased stream stability and created aquatic habitat complexity.



Partner(s)/Funding: Cooperatively worked with the private landowner, water users, NRCS, TU, & USFWS to improve restore and stabilize Jackknife Creek prior to the installation of the diversion structure and screen. The USFS provided the technical expertise to survey and design the channel restoration portion of this project which was performed in concert with the NRCS

diversion and pipeline design. The USFS provided restoration materials (rock and trees) and provide the implementation oversight of the design. USFWS and NRCS provided funding that was managed by TU to administer a contract to perform the on the ground work. This project was closely coordinated with the landowners and water users. Approximate contributions were as follows: the USFWS $20,000 cash, USFS $8,000 salary $5,000 materials, NRCS $3,000 cash $2,000 project coordination, and TU $2,000 (project coordination).

2012 - Jackknife Watershed Restoration Projects

Several projects were implemented in 2012 that were associated with the 2011 Jackknife Restoration EA decision. This consisted of Road decommissioning, road to trail conversion, stream crossing improvements associated with the road to trail conversion and stream restoration. The Forest Service worked with the Northwest Youth Corps (NYC) and Trout Unlimited to accomplish the projects listed below.

Jackknife Road Decommissioning and Conversion to Non-Motorized

- Decommissioned 1.6 miles of Jackknife road that was within the riparian zone and located on unstable slumping land type features. Sections of the road had failed in the past and were a direct sediment contribution into Jackknife Creek.
- Constructed 1.3 miles of new trail around slump area to replace road access to trail network.
- Converted 0.6 miles of road to trail and narrowed disturbance width from 12ft to 2ft.

Before: Road located in the Aquatic Influence Zone (AIZ) and across active slumps decommissioned

After: Full re-contouring road decommissioning to remove AIZ and stream impacts.

	**North West Youth Corp constructing a section of new trail that is further away for the Jackknife Creek and avoid unstable slump land features.**

Upgraded 4 Stream Crossing on the Road to Trail Conversion

- The main undersized Jackknife Road Bridge (25ft span) was replaced with a non-motorized trail bridge with a 55ft wide span allowing the 30ft wide bankfull channel to function with constriction.
- Black Canyon perennial flowing stream cross contain a 24 inch culvert and was replaced with a 10 foot timbered bridge. The new bridge utilized timbers off of the main Jackknife road bridge to reduce project costs and recycle useable material.
- Skull Canyon perennial flowing crossing was also an undersized with a 3 foot culvert which was replaced with a 15 foot recycled timber bridge components from the main Jackknife road bridge.
- Upgraded an undersized (18 inch CMP) crossing on a No-Name Spring Channel with a recycled 3 foot diameter culvert from Skull Canyon.

Stream Crossing Project Photos

	
Before: Looking downstream at the old road bridge with an undersized 25ft bridge span in a stream with a 30ft bankfull width.	**After: Looking downstream at the new non-motorized trail bridge with a 55ft bridge span.**

Black Canyon Stream Crossing

Before: Left photo showing the undersized 24 inch culvert stream crossing on the old road bed.

After/During: Bottom photo with a 10ft span timber structure that utilized salvaged timbers off the bigger Jackknife crossing. Old road bed narrowed from 12 to 2 feet to minimize riparian and stream disturbance.

Jackknife Stream Restoration Phase 1

Associated with the main Jackknife road bridge to trail bridge conversion Phase 1 of the Jackknife stream restoration was initiated. Unstable stream conditions caused Jackknife to downcut 3-4ft and straightened losing around 14% channel length and associated aquatic habitat. Restoration efforts in collaboration with Trout Unlimited were initiated address 3,200 feet of channel. The restoration had re-active nearly 750 feet of lost channel in a meander cutoff and re-elevated the channel as much as 3 feet. Eroding outside banks were also stabilized using whole tree revetment type structures intermixed with whole willow clumps. The re-elevation of the channel and the lowering of the cross valley road fill allowed to stream and floodplain to function naturally increasing channel stability and improving water quality, aquatic habitat and riparian health. In cooperation with Trout Unlimited a video was produced to highlight our effort and is on YouTube: http://youtu.be/TU-Q_MZRLCo .

Stream Restoration Project Photos

	
2011 Before - Straighten eroding stream channel	**2014 After - Restored abandon stream meander.**

Before: Old undersized road bridge (25ft) which constricted the active channel (30ft) causing it to downcut straighten and erode banks. Elevated road way also force flood flows through the bridge causing additional stream erosion.

After: Road Bridge replaced with a 55ft span non-motorized trail bridge which allows the stream and flood plain to function naturally. The road bed fill material (2-3ft high) was removed to allow floodplain to function

naturally. The channel was re-elevated as much as 3 feet which can be seen in comparing the bank heights on the left side (downstream) of the before and after photos.

Before: Looking downstream of Old Road Bridge. 6-8 foot tall eroding bank.

During Restoration installing whole tree revetment and whole willow clump bank stabilization structures

After (Sept, 2014) – Stream re-elevated 3ft and stabilized.

2013 - Jackknife Watershed Restoration Projects

Jackknife Diversion Upgrade

The improvements on private lands just downstream of National Forest lands continued as project was initiated in 2011 with 1,300ft of stream restoration being implemented. The restoration ensured the long-term stability for the diversion upgrade project that occurred in 2013. The diversion upgrade project consisted of the installation of a fish screen and diversion structure along with over 2000 feet of piped ditch. TU, FS and USFWS required that the fish screens designed for Yellowstone cutthroat trout and meet NOAA criteria. Idaho Fish and Game designed, fabricated and oversaw the installation of a single drum modular unit that was solar powered. This structure diverted water from Jackknife Creek providing the water users with the legal allocated amount that protected instream flow amounts from illegal use. The pipe line would go under Deep Creek and eliminate the old re-diversion point out of Deep Creek whereby additional water had been illegally diverted in the past. This bypass protected instream flow in Deep Creek and the stream restoration that had occurred in 2008 on Deep Creek (see project details above).

Jackknife Diversion Project Photos

Diversion head and sluice gates associated with a boulder cross vane in-channel structure.

Fenced off solar power drum screen unit. Head gate structure can be seen to the right of the drum screen.

Photo of the installed solar driven drum screen unit. Looking up ditch line with a fish bypass pipe on the lower left and the ditch pipeline entrance on the lower right.

Looking down the Jackknife valley at the buried ditch pipeline location that eliminated the open ditch.

Partners/funding: The strong continued partnerships in South East Idaho has helped make this project possible. Funding from NRCS, UWFWS and the FS totaling around $82,000 helped fund this project. Other in-kind contributions were essential to this project possible and included the cooperation of the private landowners and water users, TU with its lead coordination role and managing the overall project funds, Idaho Fish and Game in the design, fabrication and installation oversight of the diversion structure, and FS and NRCS involved in the installation oversight.

Squaw Creek EA Related Projects

The next two projects (1) Squaw Creek Road to Trail Conversion and (2) Squaw Creek Road Improvements were part of the 2012 Squaw Creek EA decision. Squaw Creek is a tributary to Jackknife Creek and had a FS road running next to the stream and crossing it several time. A portion of the road was located on unstable land type causing elevated maintenance need and stream and riparian impacts

such as road failures. As a result of the project the upper portion (1.8 miles) was converted to a trail and upgraded two stream crossing. The lower portion (1.6 miles) leading to a trail head and sheep corral was improved. The details of these two projects are listed below.

Squaw Creek Road to Motorized ATV Trail Conversion

- Converted 1.8 miles of road to an ATV trail narrowing the travel width which reduced erosion and riparian impacts.

The old road bed that is being converted to an ATV trail that runs up along Squaw Creek.

The old road bed was narrowed to accommodate the ATV trail and outsloped to reduce disturbance and erosion.

- Placed barrier road at the end of the ATV trail where it switches over to a non-motorized trail to eliminate illegal use.

- Decommissioned 0.3 miles of an old logging road where illegal vehicle use was occurring.

- Upgraded two Squaw Creek stream crossings in the road to ATV trail conversion. One was a ford to a new timbered trail bridge (30ft span) the other was a replacement of an undersized culvert (5ft round) to a 30ft span timbered trail bridge. Restored and stabilized stream and banks at the old crossing location.

Road ford stream crossing that was washed out in the 2011 spring runoff event and closed the road.

During the project when the road was being converted to an ATV trail. New trail bridge was being installed. Old ford was temporarily improved to allow equipment up valley to install the other trail bridge.

Right after the completion of the trail bridge final installation and the rehabilitation of the old road crossing.

One year after the trail bridge was installed the old road crossing rehabilitated.

- Reclaimed the 300 feet of washed out trail and restored a 200 foot section of stream that was eroding into the old road bed.

Squaw Creek Road Improvements

- Elevated 0.3 miles of road in multiple locations to prevent beaver dam inundation to impact road conditions. Installed cross drain culverts and reshaped and graveled 1.6 miles of road leading to the corrals and the Squaw Creek Trailhead. Also graveled the parking lot at sheep corrals.
- Stabilized a total of 600ft of stream banks eroding into road edge of the Squaw Creek Road at three different locations.

One of three eroding stream banks along the Squaw Creek Road before treatment

After bank stabilization treatments which incorporated whole willow clump transplants

Trial Bridge Replacement at Squaw Creek Trailhead

Replace washed out trail timbered bridge with a larger 35ft long trail bridge to span the active channel and portion of floodplain. Reconstructed a degraded stream channel (200 feet of Squaw Creek) and tributary confluence (100 feet of tributary channel).

Before trail bridge construction and stream restoration. Project improved poor trail, riparian & stream conditions. Previous bridge collapsed and the over widened channel caused excessive aggradation and a braided channel to occur.

During construction of Squaw Creek trailhead bridge.

Completed Trail Bridge & Stream Restoration in the fall of 2013 looking downstream

One year after completing Trail Bridge & Stream Restoration (fall 2014) project. Vegetation recovery is occurring and is further reducing erosion below pre-project conditions.

Deep Creek Road Stream Crossing Enlargements and Road Improvements

Collaborated with Bonneville Country and the C-T NF Force Account Road Crew replaced 8 undersized stream crossings that had caused channel instability and erosion and were fish barriers to the Yellowstone cutthroat trout. The road/stream crossing upgrades eliminated fish barriers opening up more than 6 miles of stream for fish migration. In association with the

culvert upgrades the about 2 of the 4 miles of road was reshaped and spotted graveled improving drainage and reducing erosion.

Specific Cross Upgrade Details

- MP 0.2 – Replaced a perched 48"x54" squashed pipe with a 10 foot open bottom arch. Installed by Bonneville County.
- MP 0.7 – Replaced a perched 47"x56" squashed pipe to 10 foot open bottom arch. Installed by Bonneville County.
- MP 1.01 - Pat Canyon Crossing of Deep Creek Rd existing 24" replace with a 4ft squash. Installed by FS Road Crew.
- MP 1.10 - Replaced a perched 36" x 55" squashed pipe with an 8 foot open bottom arch. Installed by FS Road Crew.
- MP 1.4- Replaced a perched 36" x 48" squashed pipe with an 8 foot open bottom arch. Installed by FS Road Crew.
- MP 2.9- Replaced a perched 36" x 53" squashed pipe with an 8 foot open bottom arch. Installed by FS Road Crew.
- MP 3.3- Replaced a 5 foot perched 36" x 54" squashed pipe with an 8 foot open bottom arch. Installed by FS Road Crew.
- Pat Canyon road stream cross ford of Pay Canyon creek was replace with a 4ft squashed pipe to reduce erosion and improve aquatic passage.

Deep Creek Road Stream Crossing Upgrade Project Photos

MP 3.3 Crossing Before – Five foot drop at the outlet created a fish barrier in Deep Creek.

MP 3.3 Crossing After-Fish barrier was eliminated opening up around

	
MP 3.3 Crossing During-Force account road crew was used to install the structure saving time and money as compared to running a contract and having contractor costs.	**MP 3.3 Crossing- After looking inside bottomless arch pipe showing natural bottom substrate to promote aquatic passage.**

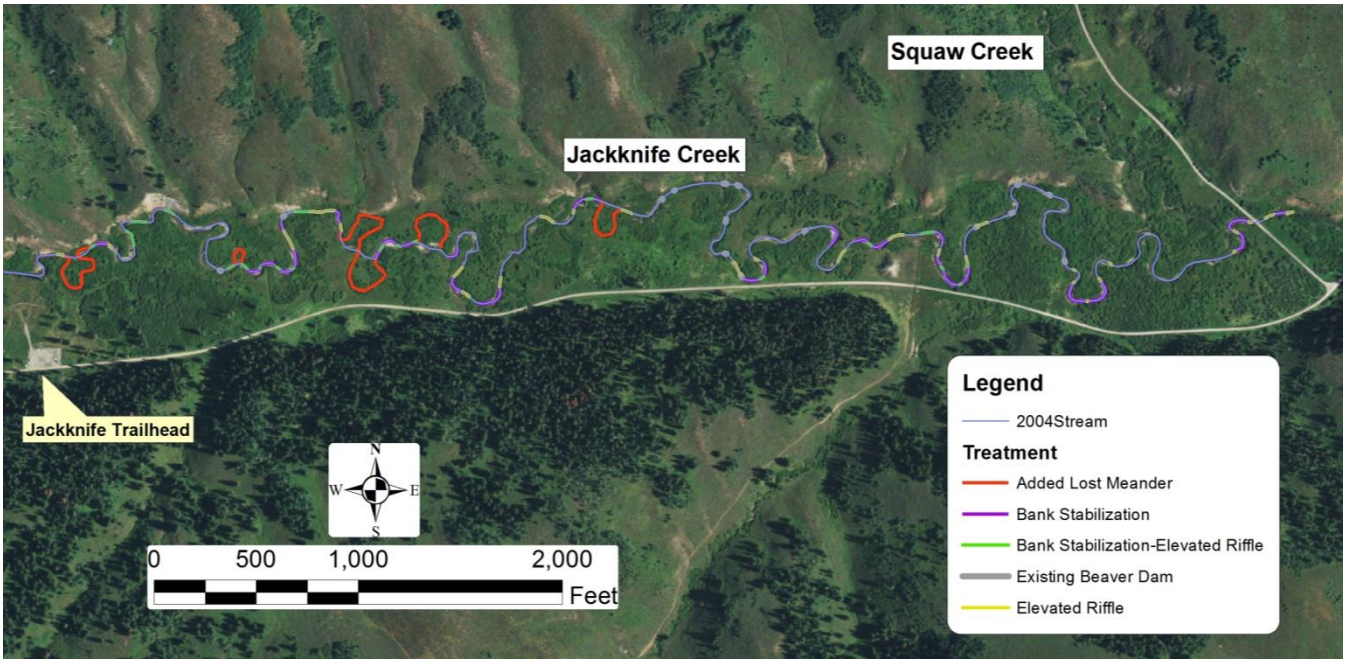
2014 - Jackknife Watershed Restoration Projects

Jackknife Stream Restoration

One of the last remaining projects on NFS lands included the stream restoration on the main stem of Jackknife Creek. This was a continuation of the extensive stream restoration that began in 2012 that focused on channel restoration and streambank stabilization of Jackknife Creek from the Jackknife trailhead bridge down to the Squaw Creek road bridge coving over 2.5 miles of stream.

The goal of the restoration was to increase channel function, stream stability, improve fish habitat, restore riparian function, and improve water quality. Restoration consisted of restoring channel stability via elevating the stream channel to historic levels, re-activating lost meander cutoff and stabilizing eroding stream banks. The instability was brought about by channel downcutting of 1-4 feet where nearly 3,000ft of channel length have been lost.

Restoration increased channel length and decrease stream gradient and decrease stream power leading to stability function stream system. Meander cutoffs were plugged with a mimicked debris jam consisting of trees, boulders, gravel/cobble and riparian vegetation. This re-elevated the channel 1-4 feet to historic meander elevation, improving the stream connection to the floodplain and decrease channel instability and bank erosion. Eroded meanders were stabilized using whole tree & willow clump revetments. This reduced bank erosion and decreased stream sedimentation improving water quality and fish habitat.



2014 Jackknife stream restoration reach covering 2.5 miles of stream utilizing various treatments to achieve project objectives.

The following photos are example of the treatments that were performed on the Jackknife Restoration Project. The first treatment example is the re-activation of lost meanders which were typically accompanied by elevating riffle upstream and downstream of the meander.

Pre-activation of a lost meander. Whole trees and exisiting riparian vegation was salavaged and utilize in the treatment.

During construction re-connection and re-activation of a lost meander.

Post construction of the lost meander re-activation.

The second series of photos are an example of bank stability treatments that utilized nearby whole willow clumps to re-build lost bank and promote long-term stability. This treatment was usually accompanied by elevating the riffles upstream and downstream to reduce shear stress and let the high flows access the floodplain.

Before the bank stabilization treatment was implemented. Raw 2-5foot tall eroding stream banks existed that lead to stream instability, reduced water quality and poor fish/aquatic habitat.

	**During bank stabilization where nearby whole willow clumps were installed along the outside stream bank to promote stability. This was typically accompanied by elevating the riffles upstream and downstream to reduce shear stress and let the high flows access the floodplain.**
	**Post construction showing the trenched whole willow clumps and cobble/gravel toe rock protecting the previous eroding bank.**

The following are another series of photos showing bank stabilization treatment upstream of the Squaw Creek road bridge. 5-15 feet of lost stream bank was re-built to direct flows through the center of the bridge. Whole willow clumps and cobble/gravel toe rock was used to stabilize the bank. A hardened riffle and a boulder cross vane was installed below the bank stabilization and above the bridge to help protect the bridge and elevate the 2-3 foot downcut stream bed.

	**Before construction that shows how the bank had eroded and direct flows against the road and bridge abutment.**
	**During construction where whole clump willows from nearby were relocated to form the new outside edge of the stream bank. About 5-15 feet of lost bank was re-established.**

	**During construction showing the boulder cross vane at the head of the hardened riffle that helps direct flow towards the center of the bridge.**
	**Completed bank stabilization and elevated riffle treatment above the Squaw Creek road bridge.**

The 2014 stream restoration restored 13,830 feet (2.6 miles) of stream adding 1,913 feet of stream in re-activation of lost meanders and critical yellowstone cutthroat trout habitat. The restoration elevated the downcut stream channel 1-3 feet reconnecting the floodplain and revitalizing the 75 acres of stream and neighboring riparian habitat. The 75 acres was calculated by a riparian valley length of 6,071ft and an average valley width of 540ft. This restoration will also increase the robustness of stream system to function naturally and potentially lessen the impacts of the projected climate changes.

Partner(s) and funding: The stream restoration component of the overall Jackknife Watershed Restoration effort was implemented through a participating agreement with Trout Unlimited. The cost of the stream restoration work that was performed by a local equipment contractor was about $52,000. Both TU and USFS provided in-kind totaling close to $10,000.

Jackknife Watershed Trail Improvement

Trail improvements have occurred on the 43 miles of trail in the Jackknife watershed which made up some of the essential projects that helped to change watershed condition class in the Jackknife Priority Watershed. The 2014 remaining trail project utilized the Northwest Youth Conservation (NYC) crew to relocate and improve conditions on the 458 trail from the Squaw Cr. corrals up to Bald Mtn. The trail originally followed the overly steep and problematic old fire dozer line. The crew with guidance from the district recreation staff completed 3 relocations totaling about 2,500 feet of brand new trail. The crew also reworked last year's relocation of trail 456 up Squaw Creek and improved the West Fork creek crossing and fixed three mud holes on the Squaw Creek ATV system trail. The crew also covered 3.5 miles of the main Jackknife Creek trail #448 to maintain and repair as needed, particularly along the 2 miles of relocations built in the past 2 years.

The beginning portion of the Squaw Creek Trail (458) that was re-routed to avoid steep problematic trail sections. The slash on the right hand side is the obliterated over steepened trail that was re-routed.

	
NYC Crew relocating a portion of the Squaw Creek Trail 458.	**A completed portion of the Squaw Creek Trail 458 by the NYC Crew.**

Partner(s) and funding: FS appropriated funds were utilized to secure an agreement with the NYC Crews to perform this years and previous years' work.