BONNEVILLE POWER ADMINISTRATION

Satus Creek Watershed Restoration Project

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Satus Creek Watershed Restoration Project
Project No. 199603501

ANNUAL REPORT
Project Fiscal Year 2005

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Construction and Implementation Phase

Goal 1: Restore natural riparian and upland vegetation patterns

Project staff will replant appropriate indigenous vegetation in areas where its absence is having a deleterious affect on watershed processes. This included both woody and herbaceous species.

We will also use project expertise and resources to assure that present land management actions which influence vegetation (e.g. road construction, fire suppression, timber harvest, grazing,) has a positive influence on cultural and natural resources.

Task 1a-1: Revegetation

After completion of the Satus Creek side-channel construction project, staff revegetated the floodplain with bluebunch wheatgrass.

Project staff also planted 500 aspen in the section of Rentschler's Meadow that we had recently excluded from cattle grazing.

Task 1a-2: Enhance beaver habitat by propagating riparian hardwoods

The Yakama Nation Fuels Management department has a plan to implement prescribed burning in the Riparian areas within the Satus Creek Watershed for 2005, but this was delayed and will most likely occur in the 2006 year.

Prescribed burning will aid in the regeneration of aspen and cottonwood. Since the advent of fire suppression, aspen and cottonwood trees have become progressively less prevalent in riparian areas within the forested portion of the Satus Creek watershed. Riparian areas are increasingly dominated by conifers. Although conifers are important for large woody debris, project staff have recognized that beaver are more active and likely to build dams in riparian areas containing a healthy stand of aspen and cottonwood. Beaver dams have played a significant role in developing healthy and productive floodplains with healthy fish populations.

Project staff are also working closely with Bureau of Indian Affairs (BIA) timber sale officers to thin out some of the conifer tree species to allow riparian hardwoods to flourish. The Yakama Nation Forest Management Plan doesn't allow for commercial riparian harvest, a policy that has saved important riparian conifer stands, but careful management, including selective conifer thinning, is needed to mimic the role of fire in maintaining tree species diversity in riparian areas.

Objective 1b. Influence land management to enhance or restore natural vegetative patterns.

Task 1b-1: Continue the patrol and maintenance of range fences in the Satus Creek watershed

This task has been carried out in the course of performing other tasks. We hired a range rider in March of 2004 who has done an excellent job of keeping cattle out of the stream and mountain wetlands. He communicates with range lessees who cooperatively work with him to remove cattle that stray from their designated range unit into sensitive areas. Patrolling by

the range rider assures that grazing management objectives (exclusion from designated areas) are being met (Figure 1). The Range Rider also GPS's downed fence lines that need to be repaired.

Figure 1. Well-distributed grazing in managed pasture within Mule-Dry Creek sub-watershed.

During this year alone the Satus project has built or repaired 10 miles of fence within the Satus Watershed. Most of these fences protect mountain wetlands and riparian areas. Permittees have been cooperative and eager to work with YN and BIA staff to improve grazing management across the watershed. We will continue to refine the grazing strategies to better suit project resource management goals as well as those of the permittees.

The resources, both human and monetary, made available by this project have changed the course of grazing management in this area. With the help provided by the Satus project, individual permittees are now able to effect range improvements (e.g. water developments and fence maintenance) that would be otherwise unachievable.

Feral horses have been identified as a problem on the Satus watershed rangeland. The YN wildlife program has begun a wild horse project and has been effectively removing horses from the rangeland. Project staff have worked closely with YN Wildlife to reduce the horse herds. Project staff are also assisting in the development of an YN Wild Horse Management Plan.

Task 1b-2: Continue leasing grazing permits throughout the watershed

The Satus Watershed Project continues to hold grazing permits for non-use on approximately 140,000 acres within the Satus Creek watershed, about 1/3 of the total watershed area. This task has been an effective means to mitigate the potentially detrimental influence of livestock grazing throughout most of the Logy Creek and upper Satus Creek sub-watersheds. Our range rider is essential has been successfully keeping cattle out of our leased range areas.

Task 1b-3: Reintegrate fire as a landscape process

The BIA Fuels Management Program has taken measures to develop a prescribed burn plan for 2005. The program has recently been contracted from BIA into the Yakama Nation Division of Natural Resources. This change is substantially improving our ability to bring this task to fruition.

The Yakama Nation Fuels Management has proposed six sites to be burned for 2005. Out of the six proposed sites, three are within the Satus Watershed, including approximately 3,368 acres of riparian area. If conditions permit, these prescribed burns will be implemented in November, 2005.

Goal 2: Reduce erosion.

Objective 2a: Restore natural erosion patterns critical to watershed function

Task 2a-1. Rehabilitate incised ephemeral and intermittent channels

Project staff have hand-placed a number of rock structures in the upper portion of Dry Creek called Starvation Flats to stabilize headcuts and prevent further channel incision. This area is heavily impacted by wild horse and cattle trails. Plans are being developed to build larger rock structures to be more effective in raising the channel elevation back to connect with its historic floodplain. This work is planned for 2006.

Project staff installed a number of straw bale structures in a mountain wetland within the Dry Creek sub-watershed known as Rentschler's Meadow. The Rentchler's Meadow Headcut project achieved its goal of filling in the plunge pool of a 3ft headcut. The project also keyed in several pieces of large woody debris upstream of the headcut and armored a cattle crossing upstream of the headcut. Project staff maintained an enclosure fence that will exclude cattle from about 2/3 of the entire meadow.

Task 2a-2: Reestablish access to floodplains.

At mile 32 of Satus Creek, just downstream of the SR97 crossing known as the High Bridge, the stream flows from a canyon onto a floodplain 3 miles long and up to 1000 ft wide (See Figure 2.) The present highway is above the floodplain in this reach, but an abandoned section of highway and several BPA transmission towers are within the floodplain. Gravel mining and stockpiling, armoring of the tower footings and other earthmoving have taken place over the years. Satus Creek is entrenched next to the hill slope on the left side of the floodplain, well below the old channels visible in undisturbed portions of the floodplain. Because of these and other changes to its channels and floodplains, Satus Creek is characterized by rapid runoff and long periods of low flow. During dry summers such as 2005, Satus Creek in the middle section of this floodplain goes completely dry. Despite the

risks imposed by high water temperatures and stranding, this reach is heavily used by spawning Middle Columbia River steelhead. Steelhead redds in this 3-mile floodplain reach are near their highest densities in all of Satus Creek.

The Yakama Nation reactivated the upstream portion of this floodplain by excavating notches in an abandoned road bed that currently restricts flood flow in 1/3 of the total possible area. This work entailed reopening sections of the channel that have been filled in by the abandoned road and other earthmoving activity.

The project placed a cross floodplain grade control structure constructed to lessen the likelihood of headcuts developing in the reactivated overflow channel. The keyways were excavated into the adjacent uplands, and large boulders were keyed into the bank. Keyway rocks were placed on top of the boulder at grade. Rocks in the channel were partially excavated into the channel bed, and left with no more than 12" of drop from the top of the boulder to the channel bed.

This project will (1) allow Satus Creek to slow down and dissipate energy over a wider cross-section, (2) promote infiltration of winter and spring flow for gradual release downstream, and (3) promote the growth of riparian vegetation. No work was done in the low-flow channel of Satus Creek itself.

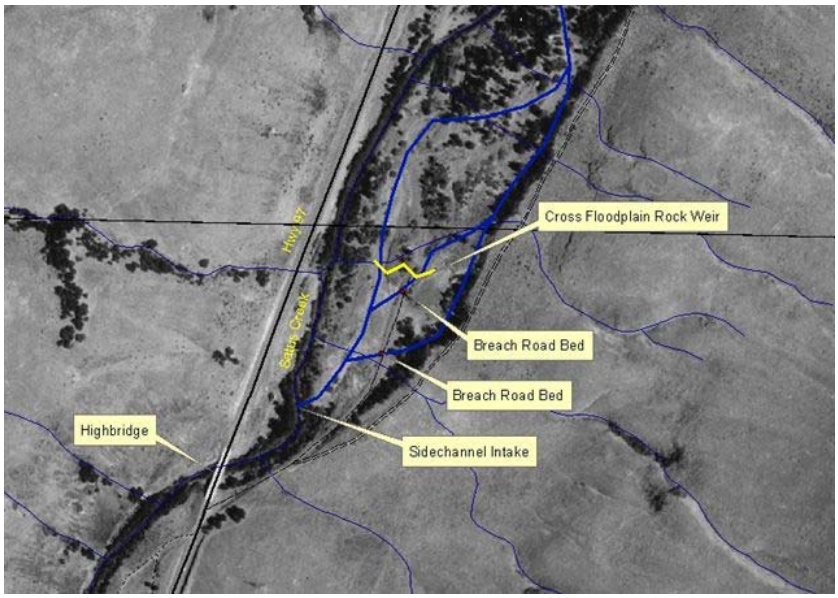

Figure 2. Location and brief description of floodplain reconnection project.

Task 2a-3: Improve road drainage.

The project continues to identify problem road drainages. In the 2005 fiscal year the project graveled approximately 1 mile of deteriorating road that drained toward Dry Creek. When funding permits, we intend to address more problem roads. Project staff are currently working with BIA Forestry and Tribal programs to improve road drainages.

Task 2a-4: Enhance beaver habitat by propagating riparian hardwoods

See task 1a-2 and 1b-3.

Objective 2b: Influence land management to restore natural erosion processes and patterns

Task 2b-1: Continue participating in land management planning processes.

Staff have worked with BIA Range Management to improve cattle grazing management. Also, we communicate with lessees to assist them in improving cattle management. Staff also work with BIA Forestry to develop sivilcultural prescriptions for riparian areas within proposed timber sales, and to ensure that roads impacting are improved as part of the sale preparation or shutdown process. Staff members work with other tribal programs to ensure that management decisions focus on all aspects of watershed improvement, and with landowners and tribal members to reach a consensus addressing both restoration goals and citizen needs.

Goal 3: Moderate flow regime

Natural stream channel geometry is shaped to a large degree by the flow regime. Hence, a change in the long term flow regime will elicit a response in the geometry of a stream. Findings of the Satus Creek Watershed Analysis suggest that modern land use, as well as other factors, have modified the flow regime of Satus Creek. The following objective and tasks endeavor to return both peak and base flows of Satus Creek and its tributaries to levels within the natural range of variability. Because of the interconnectedness of soil, water, and vegetation within a stream system many of tasks listed under Goal 3 are the same as those listed above.

Objective 3a. Slow the movement of water through the watershed.

Task 3a: The tasks listed under Goals 1 and 2 will also serve to slow the movement of water through the watershed, hence moderating the flow regime.

See tasks: 1a-1 through 2b-1.

Goal 4: Improve fish and wildlife habitat quality

Task 4a: As with Goal 3, the tasks listed under Goals 1 and 2 will also serve to improve fish and wildlife habitat throughout the watershed.

See tasks: 1a-1 through 2b-1.

Monitoring and Evaluation Phase

Goal 5: Monitor results

The Satus Creek watershed presents unique opportunities for both restoration and monitoring. Although commercial forestry and livestock management are major factors, most of the watershed is relatively immune to the type of development pressures faced in other areas of the Columbia Basin. Satus Creek is one of the largest streams east of the Cascade Crest that is not diverted for agriculture, and its location within the Yakima Subbasin is isolated from some of the negative mainstem impacts of the Yakima Irrigation Project. Because of these factors the Satus Creek steelhead population has long been recognized as a linchpin for Yakima Subbasin

steelhead as a whole. With respect to vegetation, streamflow, channel morphology, climate, and fish habitat/populations, the Satus Creek watershed is one of the most intensely monitored watersheds of its size in the western United States. This network gives the Satus Project the unique opportunity to precisely monitor changes to watershed function and anadromous fish habitat/populations at both the site and watershed scales. The information collected in the course of our monitoring program has been used extensively in both the Yakima Subbasin Plan and the Yakima Subbasin Salmon Recovery Plan.

Objective 5a: Monitor anadromous fish populations and habitat

Task 5a-1. Annual spawning ground surveys

We conducted spawning ground surveys in the Satus Creek watershed between March and the beginning of June in 2005. The mainstem of Satus (from the impassible falls at RM (river mile) 44 to Rd. # 23 at RM 15.4), Logy Creek, Dry Creek, Kusshi Creek, Wilson Charley Creek, Shinando Creek, Bull Creek, and Mule Dry Creek are surveyed using a three-pass protocol. Because Satus Creek steelhead have a protracted spawning season, surveys are spread over a three month period from March 1 to the beginning of June.

In 2005, we managed to complete all three passes on the mainstem Satus, Dry, and Logy Creeks. Conditions were unsually good for surveys (i.e., clear water, good visibility) on all three passes. In the entire watershed we documented 111 redds in 2005 (table 1). We observed 83 redds (74 percent observed in total watershed) in the mainstem of Satus Creek. Of the tributaries, only Logy and Dry Creeks had redds deposited by steelhead. Logy Creek accounted for 22 redds and Dry Creek had 6. Low flows resulting from little snowpack and precipitation in 2005 delayed entry into Dry Creek and apparently prevented steelhead from moving into other tributaries. Steelhead began spawning downstream and moved higher in the watershed after precipitation events.

Table 1. Redd count data for all three passes conducted in the Satus Creek watershed in 2005

				1st Pass					2nd Pass			3rd Pass			
Stream	**From**	**To**	**Miles**	**3/7**	**3/9**	**3/14**	**3/23**	**3/25**	**4/11**	**4/13**	**4/22**	**5/11**	**5/12**	**5/23**	**Total**
SATUS	Falls	Wood Bridge	4.2	0					1			8			
	Wood Bridge	County Line	4.4	1					1			5			
	County Line	High Bridge	4						7			2			
	High Bridge	Holwegner	4.8	0					11			0			
	Holwegner	2nd X-ing	3.9	4					3			6			
	2nd X-ing	1st Xing Gaging	3.5		10					2			6		
	1st X-ing Gaging	Station	2.8		5					4			0		
	Station	Rd 23	4.3		5					2			0		
total			**31.9**	**5**	**20**				**23**	**8**		**21**	**6**	**0**	**83**
LOGY	Falls	Spring Cr	3												
	Spring Cr	S. C. Ford	1.5			1					2			1	
	S. C. Ford	3rd Xing	6			3					1				
	3rd Xing	Mouth	0.5			14					0			0	
			1.5												
			1.5												
total			**14**		**0**	**18**			**0**	**0**	**3**	**0**	**0**	**1**	**22**
DRY	South Fk	Saddle	3.6												
	Saddle	S-Turn	2.75				0								
	S-Turn	Elbow Xing	3				0								
	Elbow Xing Seattle	Seattle Creek	4.25				0								
	Creek	Rd 75 bend	5.25				0								
	Rd 75 bend Power Line	Power Line Ford	6.25				0								
	Ford	SR 97	1.75					1							
	SR 97	Mouth	1					2				3			
total			**27.85**		**0**			**3**	**0**	**0**		**3**	**0**	**0**	**6**
											Season Total				**111**

Task 5a-2. Repeat fish habitat surveys at 5-year intervals.

We collected data on habitat quality in the upper reaches and tributaries of Logy Creek to provide insight on proper stream function, large woody debris loading, and sediment transport to the lower reaches of Logy Creek and Satus Creek, which are productive steelhead spawning and juvenile rearing reaches. We used the TFW (timber, fish, and wildlife) protocol with some modifications to assess pool to riffle ratios and large woody debris densities in four 1500 foot study reaches. Sites were located in the following areas: Section Corner Creek, Yatama Creek, North Fork of Logy Creek, and South Fork of Logy Creek. Timber sales are planned in this area in the near future possibly causing changes in stream function. This information will likely be used in riparian harvest, road construction, and other forest management decisions. GPS was used to inventory and map large woody debris pieces for future monitoring. We also conducted Wolman pebble counts to classify substrate and assess fine sediment levels. We are still processing this data at this time.

Task 5a-3. Smolt Trapping.

We monitored the steelhead out-migration in Satus Creek through the use of a five foot rotary screw trap manufactured by E.G. Solutions. The trap was deployed at river km 2 of Satus Creek, at the Satus Creek Wildlife Refuge. For the 2005 season, the trap was in place and operating between November 15, 2004 and June 6, 2005. The trap was operated continuously in all but the highest flows. The stream channel configuration has changed, so that our trap could not sample the out-migration less efficiently than in prior years. During the period of operation, the trap was checked daily in the mornings including holidays and weekends.

All Juvenile steelhead were anesthetized in MS-222 before being handled. They were then enumerated, measured and weighed. We inserted PIT tags into a sub-sample of the captured steelhead that measured greater than 100 mm to evaluate survival and migration timing. Scales were collected from 100 individuals of varying sizes to use in conjunction with PIT tag data to assess survival by year class. We collected fin clips from 100 steelhead smolts for use in DNA studies as well. After handling we released steelhead juveniles 100 meters downstream. Physical data (water temperature, air temperature, and percent cloud cover) were recorded.

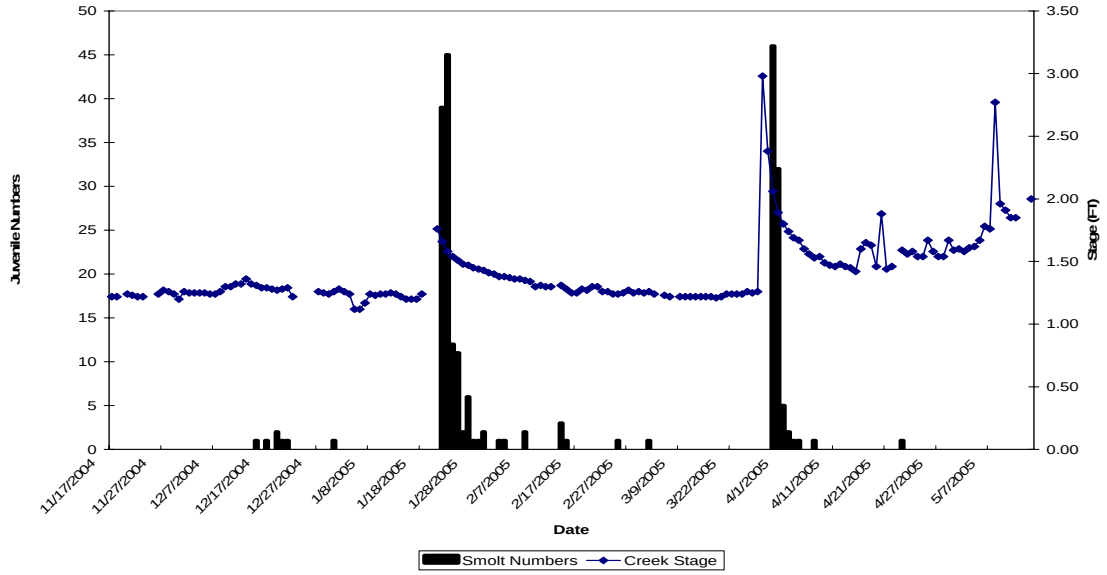

Figure 3. Daily steelhead captures compared with staff gage measurements in Satus Creek during the 2004-2005 out-migration season.

Results

We operated the Satus Creek rotary screw trap for a 179 day period. During that time the trap was operating efficiently (i.e., deployed and cone rotating for the entire 24 hour period) on 77 days (41% of the operating time). Steelhead juveniles were captured on 29 (16%) of the 179 operating days.

Between the dates of December 17th and April 24th, 224 steelhead smolts were captured (Table 2). The highest daily catch for the period of operation was 46 on March 30th. Peaks in daily catches were associated with spikes in discharge occurring at the end of January during a rain on snow event in the upper Satus Creek watershed and again at end of March (Figure 4). Very few fish were captured outside of the periods when discharge spikes were occurring. The current velocity at the trap location is relatively low and results in a slow rotation of the screw trap cone. Our redd count data, which is comparable and often higher than Toppenish Creek suggest that our catches at this location should be much higher than they are. Additionally, our attempts of a efficiency testing, which produced no recaptures indicate that better positioning or an altogether new location may be needed in order to use this trap to obtain an out-migration estimate. Higher flow conditions in a normal or above normal water year could improve catches as well.

Average size (length and weight) jumped during the month of April, possibly reflecting a migration of age 2 and 3 juveniles or higher growth rates during the spring months due to more optimal water temperatures.

We PIT tagged 162 steelhead smolts in 2005. Despite low catch efficiency, the ability to PIT tag out-migrants has greatly contributed to our understanding of steelhead out-migration from Satus Creek. We now have two seasons' data on PIT tag detections from Satus Creek out-migrants. In both 2003-04 and 2004-05, Satus Creek out-migrants survived better to Prosser Dam than out-migrants from Toppenish or Ahtanum Creek, and in the drought year of 2005, Satus Creek fish had a greater survival advantage.

Steelhead tagged in Satus Creek in the 2003-04 and 2004-05 seasons arrived earlier at Prosser Dam than Toppenish Creek or Ahtanum Creek fish. Both the survival (Table 2.2) and travel time data suggest that the downstream location of Satus Creek in the Yakima subbasin is advantageous for out-migration under present conditions.

Table 2. Monthly catch statistics for juvenile steelhead in the Satus Creek screw trap at RM 1 for the 2004-2005 season.

Statistic	Nov	Dec	Jan	Feb	March	April	May	June	Overall
Monthly Catch	0	7	119	9	79	11	0	0	225
% of total	0%	3%	53%	4%	35%	5%	0%	0%	100%
Max Fork Length	.	127	157	118	121	165	.	.	165
Min Fork Length	.	87	76	86	90	125	.	.	76
Mean Fork Length	.	106	115	101	110	150	.	.	117
Max Weight	.	14.3	37.6	13.6	17.6	41.6	.	.	41.6
Min Weight	.	5.4	4.6	6.6	7.4	19.8	.	.	4.6
Mean Weight	.	10.4	16.7	10.2	13.3	32.4	.	.	16.9
Mean Cond.Factor	.	0.866	0.960	10.167	0.959	0.943	.	.	0.944
Number tagged	.	1	73	3	74	11	.	.	162
% monthly catch tagged	.	14.3%	61.3%	33.3%	93.7%	100.0%	.	.	72.0%

Objective 5b. Monitor watershed processes

Task 5b-1. Monitor streamflow

Wading discharge measurements are taken weekly or bi-weekly depending on conditions. Our network of continuous recording stream gages were also maintained. The data are entered into the project database on the day of collection and is available for immediate use.

Task 5b-2. Monitor climate

The climate monitoring stations were maintained throughout this reporting period without incident. We expect to summarize the data and report on it in the 2006 year.

Task 5b-3. Temperature Monitoring.

In 2005 we deployed 11 Stowaway data loggers in the lower reaches of the Satus Creek watershed to assess the suitability of water temperature for salmonids including ESA listed steelhead and other cold water biota. Yakama Nation Fisheries have monitored water temperature in the Satus Creek basin since 1996. We intend to use this long term data to evaluate changes within the watershed that may affect water temperature (i.e., restoration projects, grazing practices, and timber harvest).

Temperature data loggers were placed in canisters and anchored with aircraft cable to trees, rootwads or other available permanent structures that could withstand high flow events. They were generally placed in pools or low flow channels that were less likely to dewater during the summer. We deployed the data loggers between 3-02-05 and 3-24-05 at sites located between river mile RM 3 and RM 34 (downstream from the confluence with Wilson Charley Creek). We also deployed data-loggers in both Dry Creek and Logy Creek near their confluence with Satus Creek. The units were in place and continuously recording water temperatures at 48 minute intervals until we retrieved them on 10-13-2005. One unit failed to record temperatures (downstream from Kusshi Creek) and one was stolen (downstream from Dry Creek). The other 10 data loggers recorded temperatures for the entire period.

Table 3. Descriptive statistics for water temperature at 10 locations in the Satus Creek watershed. Maximum weekly average temperatures are in bold text.

Location	Instantaneous Maximum	Instantaneous Minimum	Mean Daily Maximum	Mean Daily Average	Mean Daily Minimum	Maximum Daily Average	Maximum 7-Day Maximum	Maximum 7-Day Average
N. Satus Rd. (3.3)	22.4 ºC	7.2 ºC	17.3 ºC	16.0 ºC	14.7 ºC	20.7 ºC	21.9 ºC	**20.3 ºC**
Plank Rd (8.2)	24.3 ºC	6.4 ºC	18.0 ºC	17.1 ºC	16.3 ºC	23.0 ºC	23.7 ºC	**22.5 ºC**
1st Crossing (12.4)	27.5 ºC	4.7 ºC	18.9 ºC	15.9 ºC	13.2 ºC	22.6 ºC	26.7 ºC	**22.2 ºC**
Above Logy (16.7)	23.3 ºC	4.6 ºC	17.2 ºC	14.6 ºC	12.5 ºC	20.0 ºC	22.3 ºC	**18.8 ºC**
High Bridge (22.4)	24.9 ºC	2.5 ºC	16.0 ºC	13.4 ºC	11.2 ºC	21.2 ºC	24.3 ºC	**20.6 ºC**
4th Crossing (28.0)	23.6 ºC	2.4 ºC	16.0 ºC	13.6 ºC	11.3 ºC	20.5 ºC	22.9 ºC	**19.8 ºC**
County Line (32)	25.0 ºC	2.0 ºC	16.4 ºC	12.9 ºC	10.0 ºC	20.5 ºC	24.6 ºC	**19.5 ºC**
Wilson Charley (34)	25.0 ºC	1.7 ºC	15.9 ºC	12.1 ºC	9.4 ºC	19.3 ºC	24.4 ºC	**18.6 ºC**
Logy Mouth	23.8 ºC	4.0 ºC	16.4 ºC	14.4 ºC	12.3 ºC	21.0 ºC	23.2 ºC	**20.5 ºC**
Dry Mouth	21.8 ºC	6.4 ºC	17.0 ºC	15.1 ºC	13.4 ºC	18.9 ºC	21.4 ºC	**18.7 ºC**

Results

Mean daily averages in Satus Creek ranged from 12.1º C downstream from the mouth of Wilson Charley Creek to 17.1º C at Plank Rd. where the stream is straight and channelized (table 3). The instantaneous maximum of 27.5º C occurred at the 1st (i.e. lowermost) Hwy 97 crossing (RM 12.4) The maximum seven day average of the daily maximum (MWMT) and average (MWAT) water temperature were used as an index to evaluate suitability for salmonids and other cold water biota (figure 4) along the course of the stream. The thermal maximum of 24.1 º C was exceeded by MWMT at several sites from Wilson Charley at RM 34 to 1st crossing at RM 12.4. MWATs ranged from 18.6º C at Wilson Charley to 22.5º C at Plank Rd. During the summer there are several reaches that dewater followed downstream by areas of upwelling. These upwelling areas, as well as springs and tributary confluences (i.e., Dry Creek and Logy Creek) provide important rearing habitat for steelhead.

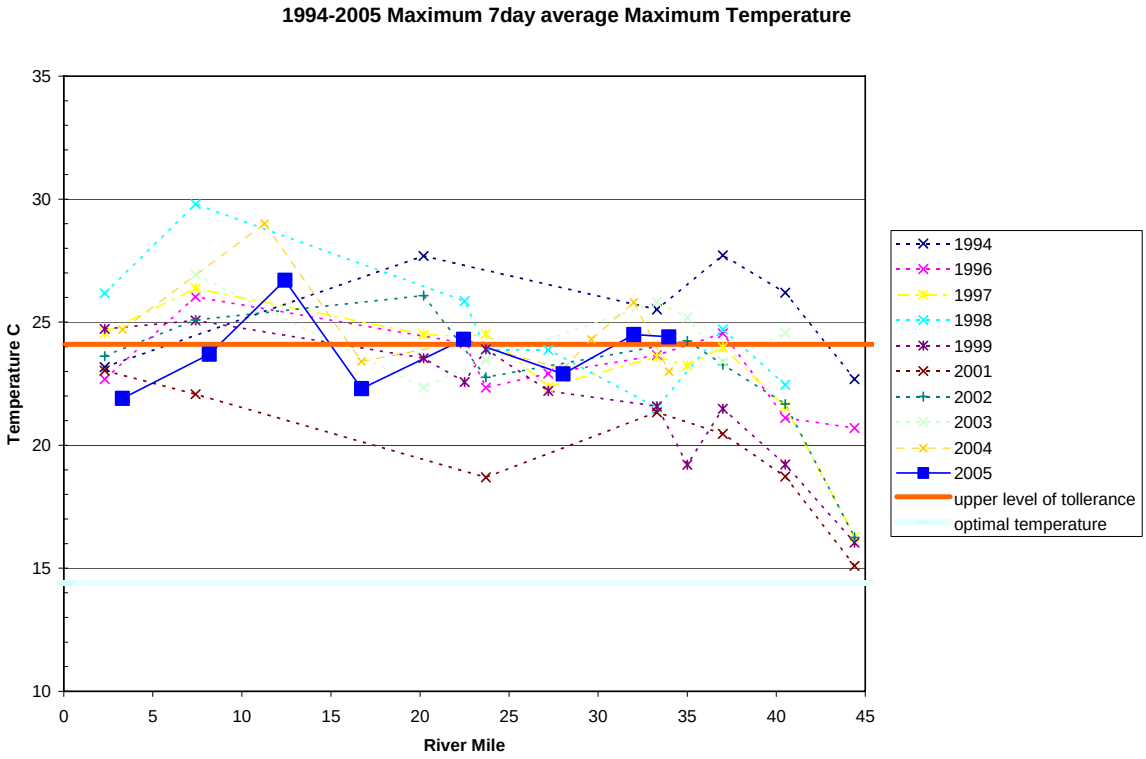

Figure 4. Maximum seven day maximum temperature by river mile in the Satus basin.

Objective 5c: Monitor restoration treatments

Task 5c-1. Monitor revegetation success

An extensive set of photo points were developed in the course of implementing rehabilitation treatments, and we continue to photographically monitor these locations. We have finished scanning all of the photos and slides accumulated during the life of this project, and moved completely too digital photography.

Task 5c-2. Evaluate effectiveness of sediment-trapping structures.

Numerous photo points were developed in the course of installing sediment retention structures (Figure 5). Project staff believe hand-placed rock structures are more effective sediment traps than straw bales. In the 2006 year the project plans to use only rock for sediment traps. The bale structures are effective in the short term, but the long-term stability of rocks more than compensates for greater installation difficulty, even if hand placement is the only option.

Figure 5. Sediment captured behind a bale structure on headwaters of Mule Creek.