Stream	Approx. RM	Date	Time	Survey Type	Water Temp.	Length in Meters	Width in Meters	GPS COORDINATES Northing	GPS COORDINATES Westing	Fish Species: Rainbow Trout number	Rainbow Trout size range	Other Fish Number	Other Fish Size Range	Notes
Ruby Creek	near mouth	7/8/2011	10:48	E-fish	8.8 C	75	2	47.449672	-120.653751	10	2" to 5"			Missed one fish
	0.4	7/8/2011	11:57	E-fish	9.0 C	75	1.5	47.443253	-120.646332	6	3" to 6"			
Camas Creek		7/8/2011	14:12	E-fish	11.1 C	100	2.5	47.478054	-120.618994	13	3" to 8"			Missed one fish (2")
		8/16/2011	15:06	Snorkel	12.3 C	80	1.5	47.475376	-120.612631			No fish		Flow is very low (< .2 cfs)
Hansel Creek		8/16/2011	14:00	Snorkel	11.7 C	100	2	47.470819	-120.660293			1	8"	Fish was not identified; Very high gradient, poor habitat.
		7/8/2011	12:39	E-Fish	8.2 C	25	2	47.469017	-120.673134			No fish		Very high gradient, poor habitat.
Mill Creek		8/16/2011	16:31	E-Fish	13.3 C	15	2	47.511841	-120.633923	2	4"			Extremely brush; very difficult to E-fish
		8/16/2011	15:51	E-Fish	11.8 C	35	2	47.513753	-120.673844			No fish		Very high gradient; likely above ending range of fish
Total										31	2" to 8"			

MILL CREEK
1994 STREAM SURVEY REPORT

SURVEYORS: K. Grantier and M. Rickel (observers)
K. Bartosiak (recorder)

SURVEY DATES: November 08 - November 15, 1994.

SURVEY DISTANCE: 2.3 miles.

LOCATION:

COUNTY: Chelan

FOREST: Wenatchee

DISTRICT: Leavenworth

TRIBUTARY TO: Peshastin creek

MOUTH LOCATION: T23N R18E SWSE of section 6

DRAINAGE: Peshastin creek

Fish Production Unit: Lower Peshastin

U.S.G.S. QUADS: Leavenworth, WA (064) and Blewett, WA (075)

WATERSHED:

NFS WATERSHED NUMBER: 17, 02, 00, 11, 13, A

WATERSHED AREA: 3,394 acres

STREAM ORDER: 2

STREAM CLASS: I (due to domestic use - irrigation diversion)

STREAM LENGTH: 4.1 river miles

DISCHARGE: 1.277 cfs recorded on November 15, 1994 at the mouth as part of the stream survey.

FISHERIES:

FISH OBSERVED: Rainbow trout (resident) sampled on November 16, 1994 by electroshocking.

TEMPERATURE: Minimum = 35^{O}F
Maximum = 37^{O}F

EXECUTIVE SUMMARY

The Mill Creek watershed was one of the many areas burned in the summer fires of 1994. A stream survey was conducted to gather important baseline habitat data and for input to watershed analysis. The Hankin and Reeves stream inventory protocol (taken from the Region 6-Stream Inventory Handbook Level I & II, Version 7.05 1994) was used to collect current habitat data and riparian vegetation status. Approximately 2.3 miles of Mill Creek was surveyed from November 08 - 15, 1994.

The 3,394 acre watershed of Mill Creek is bordered on the west side by Wedge Mountain, the Stuart Range, and the Alpine Lakes Wilderness boundary. It is bordered on the east by Highway 97 and Peshastin Creek. This is a spring fed, Class I (due to irrigation diversion), Order 2 stream. The mouth is located at the confluence with Peshastin creek in T23N R18E SWSE of section 6.

Only one (1) reach was identified in the survey. Reach 1 is characterized by a primarily moderately confined channel within a moderate V-shaped valley form surrounded by 30-60 percent Swauk sandstone and Bedrock side slopes. It has a low sinuosity (value of 1.1) and an average gradient of 12 percent. Forest Service road 7300 parallels the stream on the south side and then crosses the stream at the end of Reach 1. Six (6) intermittent tributaries were found to enter the reach. Historic uses of this area were primarily timber production and harvest. Recent use is timber production, irrigation diversion, and some recreation.

Riparian vegetation seems to be in relatively fair shape, even after the 1994 summer fires. Most of the area burned to the stream edge (in the surveyed portion) was primarily low to moderate intensity with isolated spots of high intensity burn. Dominant successional stage was sapling/pole and subdominant was small tree. The most common species present were Alder species, Dogwood species, Western red cedar, Fir species, and Equisetum species.

No fish were actually seen while surveying habitat units, but resident Rainbow trout (one to seven inches long) were identified after sampling two areas by electroshocking. An unidentified amphibian (frog) species was found but not captured while conducting electroshocking.

Mill Creek's number of large woody debris per mile and number of pools per mile are below the Forest Plan Standards and Guidelines. Temperature was well within the Forest Plan Standards. Sediment levels exceed the allowable amount stated by the Forest Plan.

BASIN SUMMARY

INTRODUCTION

Mill Creek was surveyed to collect baseline habitat data and for information to input on watershed analysis due to the summer of 1994 forest fires. The Hankin and Reeves stream inventory protocol was used. The survey was conducted from November 08 through November 15, 1994 beginning at the confluence of Mill Creek and Peshastin Creek in T23N R18E SWSE of section 6. The survey ended at Forest Service road 7300, where it crosses the stream at T23N R17E SESE of section 2. Approximately 2.3 miles out of the 4.1 mile long stream was surveyed.

WATERSHED and GEOLOGY

Mill Creek's 3,394 acre watershed is bordered on the west by the Stuart range and Alpine Lakes Wilderness boundary. The east side is bordered by Highway 97 and Peshastin Creek. Originating at it's springfed headwaters in the western part of the watershed, Mill Creek flows to the east to it's confluence with Peshastin Creek. Valley form is moderately V-shaped with 30-60 percent side slopes of bedrock and erodable Swauk sandstone. Channel confinement varies from unconfined in lower elevations to moderately confined in the upper portion of the reach. Short isolated sections of confined channel segments exist as well in the upper portions of the reach. Average gradient throughout Reach 1 is 12 percent. This is an Order 2 and Class I stream. It is Class I due only to domestic use which is an irrigation diversion structure located approximately 1/8 mile upstream from the mouth. Reach 1 begins at the confluence with Peshastin Creek in T23N R18E SWSE of section 6 (elevation of 1,360 feet) and ends after the culvert on Forest Service road 7300 in T23N R17E SESE of section 2 (elevation 2,380 feet). Six (6) tributaries were identified to enter Reach 1.

FLOW REGIME

Discharge from Mill creek was measured by the stream survey crew on November 15, 1994. It was sampled at the mouth (in NSO1, MR1) and determined to be 1.277 cubic feet per second (cfs). Refer to the field data form for all velocity and depth readings. The Chelan County

Conservation District also measured Mill creek's LOW flow (in 1993) to be less than 1 cubic feet per second.

WATER QUALITY

No information is available on Mill Creek for the following water quality criteria: fecal Coliform, dissoved oxygen, pH, tubidity (NTU), and toxic, radioative, or deleterious material concentrations. There is a possible concern about fecal coliform levels from a pasture on the rightbank approximately 40 feet upslope. Sediment loading to the stream could be a concern due to an irrigation diversion (elevation 1,420 feet) on the left bank, two clear cut units on the right bank, and some right bank/slope failure erosion. Twentyfive (25) of the 31 measured units in the survey are EMBEDDED, indicating high levels of sediment loading.

RIPARIAN VEGETATION

Floodplain vegetation in Zone 1 (100 feet from edge of stream on both banks) was identified by species and successional class. Three successional classes were represented adjacent to the stream. Sapling/pole class occurred in 47 percent of measured units. Dominant and subdominant species within this class were Alder species and Western red cedar. Small tree class occurred in 43 percent of measured units. Representing this class were dominant Fir species and subdominant Western red cedar. Shrub/seedling class existed in 10 percent of measured units and was composed of dominant Alder species and subdominant Dogwood species. Other prominant riparian species observed were Horsetail and Willow species. It was difficult to determine species and amount of ground cover of forbs and grasses due to snow cover. In this watershed a population of **Cipripedium** fasciculatum exists, it is listed in the state as Threatened. Also, a population of **Delphinium viridescens** exists which is state listed as endangered. In many habitat units the fire burned to the stream edge. Most of the area burned at low to moderate intensity, leaving much of the shrub cover intact. There were a few isolated areas of high intensity burn to the water's edge resulting in burned woody debris in and near the channel. For locations and intensity of the burn to the water's edge within Reach 1, refer to Table 1 and field comments. Canopy cover within the reach was rated at approximately 50-75 percent. Stream surface was shaded by overhanging shrubs and trees. Past harvest and recent fire have affected stream canopy cover in some areas within this reach.

FISHERIES and INVERTEBRATES

Resident rainbow trout are known to exist in Mill creek. Electroshocking sampling was conducted on 2 separate 300 foot segments within Reach 1 on November 16, 1994. A total of 15 Rainbow trout were identified in the first shocking station and a total of 17 Rainbow trout were identified in station 2. Some invertebrates were also shocked and caught. These included 1 frog (unidentified species), leeches, and possible stonefly or caddisfly nymphs (unidentified). Refer to field notes for further descriptions. Also during stream habitat survey, unidentified invertebrate larve (possibly caddisfly or stonefly) were noticed on rocks within some riffles.

HISTORIC and RECENT USES

The primary use of this area in the past was for timber production and harvest. Milled lumber is deposited in the channel. Old stumps (some are greater than 40 inches at diameter breast height) were seen along the banks, indicative of past logging to the edge of the stream. Clear cut units extend to the stream edge in various locations. Remnants of an old dam are on the sides of the channel approximately 330 feet upstream from the mouth. The stream flows freely but appears it could be dammed again at this site. An old road bed (perhaps from past logging) is intermittently apparent on the left bank throughout most of the reach.

Native Americans may have used the area for hunting, gathering, and camping. Evidence (rusted cans and a lantern) of old campsites/dumpsites were discovered during the survey. These sites are perhaps remanants of logging or hunting campers.

Currently, a residence is located on the left bank approximately 300 feet upstream from the mouth. On the right bank across from the home there is a small pasture (approximately one acre) 40 feet upslope from the creek. There is also a maintained and used irrigation diversion located on the left bank approximately 770 feet upstream of the mouth (elevation 1420 feet).

Forest Service road 7300 (Mountain Home road) runs parallel and south of the stream for the length of Reach 1. Other unimproved Forest Service roads run through the watershed (north and south of the stream).

RECREATION

Recreation opportunities are not developed in this area. Backpacking/camping are available for those not needing facilities. Hiking on unimproved roads or just bushwacking it are also options. Photography, nature study, and hunting are also great choices for the area. Forest Service road 7300 (Mountain Home road) is an improved road popular for sightseeing from a vehicle and also leads to other areas rich with recreational opprotunity.

OTHER CONSIDERATIONS

The summer fires of 1994 did not leave this area untouched. Part of Mill creek was burned by the Rat creek fire. Much of the area surveyed had low to moderate intensity burn to the stream's edge and isolated areas of high intensity to the stream. Refer to Table 1 for burn locations to stream edge within Reach 1.

REACH SUMMARY

Approximately 2.3 miles of Mill creek was surveyed from the mouth (T23N R18E SWSE of section 6) to the crossing at Forest Service road 7300 (T23N R17E SESE of section 2). Elevation

at the start of Reach 1 was 1,360 feet and 2,380 feet at the end, an elevation gain of 1,020 feet. The survey was conducted between November 08 and November 15, 1994. Heavy fall rains and snow accumulation were experienced during the survey. This may have caused intermittent tributaries to be flowing and therefore counted. With snow cover it was sometimes difficult to identify ground cover and bank substrate. **Average gradient** throughout the reach was 12 percent and it had low **sinuosity** (1.1 value). **Valley form** is moderately V-shaped with steep 30-60 percent side slopes composed of bedrock and highly erodable Swauk sandstone. Channel confinement varies from unconfined in the lower portion to moderately confined in the upper portion of Reach 1. Throughout the moderately confined section there occurred isolated areas of confinement.

Mainstream **temperatures** during the survey varied between 35-37^{o}F, well within the Forest Plan Standards and Guidelines to support salmonids. Six (6) **tributaries** enter the reach. Tributaries one through five were estimated to contribute 1-5 percent flow and Tributary six was estimated to contribute 15-20 percent flow. Three (3) **side channels** were identified during the survey, comprising 0.4 percent of the total habitat. Mill creek runs through 3 culverts (considered **special cases**) and creates 1 falls. The last culvert (C3) occurs as the end point of Reach 1 on Forest Service road 7300. This road runs parallel to the south of the stream and crosses it, thus ending the reach. An old road bed is intermittently noticeable along the left bank through most of the surveyed portion. **Right bank erosion** (slope failures and headcut banks) was ocularly estimated, totaling 270 feet in the reach. **Sediment levels** exceed the Forest Plan Standards, proven by 25 out of the 31 measured units determined EMBEDDED.

Dominant **streambed substrate** was gravel and subdominant was sand. **Bank ground cover** was rated as 51-75 percent with dominant **bank substrate** of sand and subdominant as cobble. Total **effective fish cover** was rated at 21-40 percent. Available cover was dominant overhanging vegetation and subdominant woody material. **Canopy cover** was rated approximately 50-75 percent. Reach 1 is dominated by **riffle habitat making up 94.7 percent** of total habitat in the reach. **Pools** make up only **3.9 percent**, but the riffles contain many plunge pools. Due to the small size of this system, plunge pools are considered to contribute to total available pool habitat for resident fish species. **Glides** are **1.0 percent** and **side channels make up 0.4 percent** of total available habitat.

There are 36 **primary pools** and 75 **plunge pools** in Reach 1. These pools were most often created by brush/log jams, boulders, or bedrock. All of the plunge pools were less than three feet deep, but due to the size of this system they provide valuable pool habitat. A total of 108 pools were identified in the reach surveyed of Mill Creek. When **primary** pools and **plunge** pools are **combined** there are **47 pools per mile**. This calculates to **1 pool every 10.7 bank full channel widths (BFCW) or every 112 feet**. If **plunge pools are NOT added** to the calculation, there are **15.8 pools per mile**; 1 pool every 73 BFCW or every 768 feet.

Large woody debris (LWD) totals 109 pieces (sizes: large, small, and brush) in Reach 1. This is calculated to **47.4 pieces per mile** (large, small, and brush) in Reach 1. EAST side size criteria were used to quantify woody debris. Using these size classes 47.4 pieces per mile breaks down to 5.7 Large pieces per mile, 12.7 small pieces per mile, and 29 brush pieces per mile. Not all the

pieces counted were active, some were potential (suspended 1-5 feet above stream). There were 32 total POTENTIAL pieces (large, small, and brush) counted in Reach 1.

The Forest Plan Standards and Guidelines require greater than or equal to 100 pieces large woody debris per mile. To **compare stream survey large woody debris with the Forest Plan requirement, ONLY** small and large size classes can be counted for the TOTAL large woody debris per mile. Reach 1 contained 49 pieces TOTAL small and large (active and potential) woody debris. This results in **21.3 pieces of LWD per mile**. When potential woody debris is excluded, the result is 14 pieces ACTIVE LWD per mile.

Reach 1 large woody debris per mile is extremely short of the Forest Plan requirement. Future recruitment of woody debris to this reach is expected due to fire killed trees along the stream falling into the stream.

METHODS

The Hankin and Reeves stream inventory protocol was followed from the Region 6, Version 7.05, Stream Inventory Handbook (Level I and II). A few of the survey's methods are not the same as the Forest Plan Standards and Guidelines. The following are the protocol for the Region 6 Stream Inventory Handbook:

Woody Debris (WD): Woody debris during the survey was counted by the EAST side criteria. The Forest Plan Standards are the same as the WEST side criteria for counting woody debris. WEST side forest classification: brush (12 inches x 25 feet), small (24 inches x 50 feet), large (36 inches x 50 feet) and only small and large classes are calculated in pieces of large woody debris per mile. EAST side forest classification: brush (6 inches x 20 feet), small (12 inches x 35 feet), large (20 inches x 35 feet) and all size classes are counted in pieces of large woody debris per mile (USDA, 1994). The division between east side and west side forests are based on the Timber, Fish, and Wildlife Division. In order to compare stream survey pieces of large woody debris per mile to the Forest Plan Standards, ONLY the small and large classes (excluding brush) were calculated into TOTAL large woody debris per mile. All woody debris counted in survey was NOT active (in water). A total of 34 pieces (large, small, and brush size) were potential (suspended one to five feet above the stream). These potential pieces (ONLY small and large size) were included in calculating TOTAL WOODY DEBRIS PER MILE for comparison with the Forest Plan Standards and Guidelines.

Pools: Pools were considered a unit only if they were longer than wide. **Plunge pools** were counted if they extended the total or near total width of the stream but were too short to be considered a unit. In this survey number of plunge pools were recorded and were considered primary pools in determining the TOTAL number of pools per mile. The stream survey protocol requires plunge pools to be greater than

or equal to 3 feet deep. None of the plunge pools in this system were 3 feet or greater deep. However, they were recorded because due to the small size of this creek plunge pools provide important habitat for resident fish species.

Side channels were identified as a separate habitat unit only if they were separated from the main channel by vegetation of sapling/pole size class or larger and were thought to provide fish habitat during low flows. Measurements taken at side channels include: length, width, maximum depth, substrate, and woody debris count.

Temperature of the mainstream were taken 3 times daily (morning, noon, and afternoon) with a hand held Farenheit thermometer.

Measurement of sedimentation in the stream was by an ocular estimate of **EMBEDDEDNESS** on measured units only. The unit was considered embedded if greater than or equal to 35 percent of the substrate (gravel, cobble, boulders) is covered or surrounded by fine sediment (USDA, 1994).

Units were measured with a hip chain string box for length and width. Depth was measured with a measuring stick (5 feet long). Bank full width and depth was taken on measured riffles. On 1 riffle, bank full width and depth could not be taken due to the small length and meandering of the unit (NSO42, MR21). Another measured riffle (NSO74, MR37) was also too short and meandering, but we took a bank full width and depth at NSO78, R39 to substitute in for MR37.

The stream inventory protocol emphasizes having only 1 observer for 1 reach to obtain consistent estimates throughout the reach. This had to be deviated from due to the original observer's concern for self saftey. Rifle hunting for Elk and Deer were going in this area at the same time of the survey. Therefore, the original observer was replaced by another observer for the remainder of the survey. Observers changed at NSO17, MR9 on November 11, 1994.
At NSO28, P11 measured pool frequency was increased from the original every 2 to every 3 pools to be measured.

CONCLUSION

Forest Plan Standards and Guidelines

The following are the Region 6, Wenatchee National Forest, Forest Plan Standards and Guidelines concerning woody debris, pools, temperature, and sediment and how the stream survey data compares:

Woody Debris: The Forest Plan requires a minimum of greater than or equal to 100 pieces of woody debris per mile of the following distribution: 80 percent of greater than or equal to 12 inches minimum diameter of small class woody debris and the remaining 20 percent of greater than or equal to 20 inches minimum diameter of large class woody debris. A 50 feet minimum length for both small and large size classes is required. The size requirements in the Forest Plan happen to be the same as the WEST side woody debris classification criteria.

From the Region 6 Stream Inventory Handbook protocol we needed to use the EAST side woody debris classification criteria. Forest plan woody debris requirements are compared with stream survey woody debris data by including ONLY the small and large size classes (excluding brush size) in calculating large woody debris per mile. The **stream survey large woody debris per mile totals 21.3 pieces per mile**

(includes active and potential wood). This is very much below Forest Plan Standards.

Primary pools are defined as occupying greater than or equal to 50 percent of the low flow channel width and having a depth of greater than or equal to 36 inches. In this small creek, primary and plunge pools were not equal to 36 inches deep, but provide the habitat to support the resident fish species. The Forest Plan also requires streams with a greater than or equal to 3 percent gradient maintain at least 1 primary pool every 3 bank full channel widths (BFCW). Considering the small size of this stream, pools and plunge pools were combined to calculate pools per mile. There are **47 TOTAL pools per mile (primary and plunge)**. Therefore, **one (1) pool occurs every 112 feet or every 10.7 BFCW**. To meet the Forest Plan Standards, there **needs** to be one (1) pool occurring every 31.5 feet or every 10.5 BFCW. The number of pools per mile falls below the Forest Plan Standards and Guidelines.

Sediments - fines must be maintained at less than 20 percent fines (which is less than or equal to 1 millimeter) as the weighted average in spawining habitat (pool tail-outs and glides). Survey data shows that 25 out of 31 measured units were embedded, indicating that this portion of Mill creek is exceeding the Forest Plan Standards.

The Forest Plan Standards allow a maximum daily **temperature** of 61^{O}F. Daily mainstream temperatures in Reach 1 varied from 35^{O}F to 37^{O}F. These temperatures are well within the Forest Plan Standards.

REFERENCES

Hindes, Robert. June 30, 1994. Wenatchee River Watershed Ranking Project. Chelan County Conservation District. (Unpublished document) Report on file at Leavenworth Ranger District. Wenatchee National Forest. pp. 151.

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