Hem Creek
2009 Field Investigations

State of Idaho
Department of Environmental Quality

June 2012

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Acknowledgments

This report is the result of the collaborative efforts of Don Essig, Jason Fales, Jason Pappani, Mark Shumar, and Daniel Stewart.

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1. Background

The Hem Creek field investigations were prompted by the United States Environmental Protection Agency's (EPA's) action in February 2009 to disapprove Idaho's removal of the Hem Creek assessment unit (AU) from Idaho's 2008 Clean Water Act Section 303(d) list as water-quality impaired for temperature (EPA 2009a). Attachment B to enclosure 3 of EPA's February 2009 action letter was a desktop shade analysis for Hem Creek. The Idaho Department of Environmental Quality (DEQ), in a prior informal review (December 2008), had found problems with some of the data used by EPA in their analysis. This field investigation report is DEQ's response to EPA's February 2009 action.

The Hem Creek AU (17060307CL007_02b) is part of water body unit C-7 (French Creek–source to mouth) in the upper North Fork Clearwater River subbasin (hydraulic unit code 17060307) in north central Idaho (Figure 1). The Hem Creek watershed is about 4,750 acres in size and is a second-order tributary of Sylvan Creek, which flows into French Creek. The Hem Creek watershed is entirely public land managed by the United States Forest Service (USFS), Clearwater National Forest.

Hem Creek was first listed for temperature impairment on Idaho's 2002 §303(d) list. The reason given for the listing was that Hem Creek was federally protected bull trout water, and USFS temperature data indicated exceedance of federal criteria. In fact, Hem Creek is not identified in the federal rule for Idaho as water protected for bull trout, so the basis for the listing was in error. Thus DEQ proposed removing the temperature listing for Hem Creek in the draft 2008 §303(d) list. We noted instead exceedance of salmonid spawning criteria, but dismissed them as natural based on DEQ's 2003 *Upper North Fork Clearwater River Subbasin Assessment and Total Maximum Daily Loads*. The rationale was the absence of tree removal within Idaho's 75-foot streamside protection zone (SPZ), stream temperatures colder than any other watershed in the upper North Fork Clearwater River subbasin, and excellent health of the aquatic community including a strong cutthroat trout population. Idaho's cumulative watershed effects (CWE) process was used to evaluate stream shade.

EPA raised concerns about the proposed delisting of Hem Creek in a February 20, 2008, letter to DEQ received during public comment on Idaho's draft 2008 Integrated Report. EPA stated that from their review of 1998 and 2004 aerial photography "it is clear that harvest management has been going on in this watershed during the past several years" and asserted that a more detailed analysis was needed, consistent with DEQ's natural background procedure's manual. EPA also objected to DEQ's mention of CWE. DEQ responded to EPA's comments, disagreeing with EPA's concerns, and proceeded with delisting.

In 2008, DEQ and EPA corresponded informally regarding EPA's pending action on Idaho's 2008 §303(d) list and final disposition of Hem Creek. In October 2008, DEQ learned that EPA had performed a geographic information system (GIS)-based shade analysis.

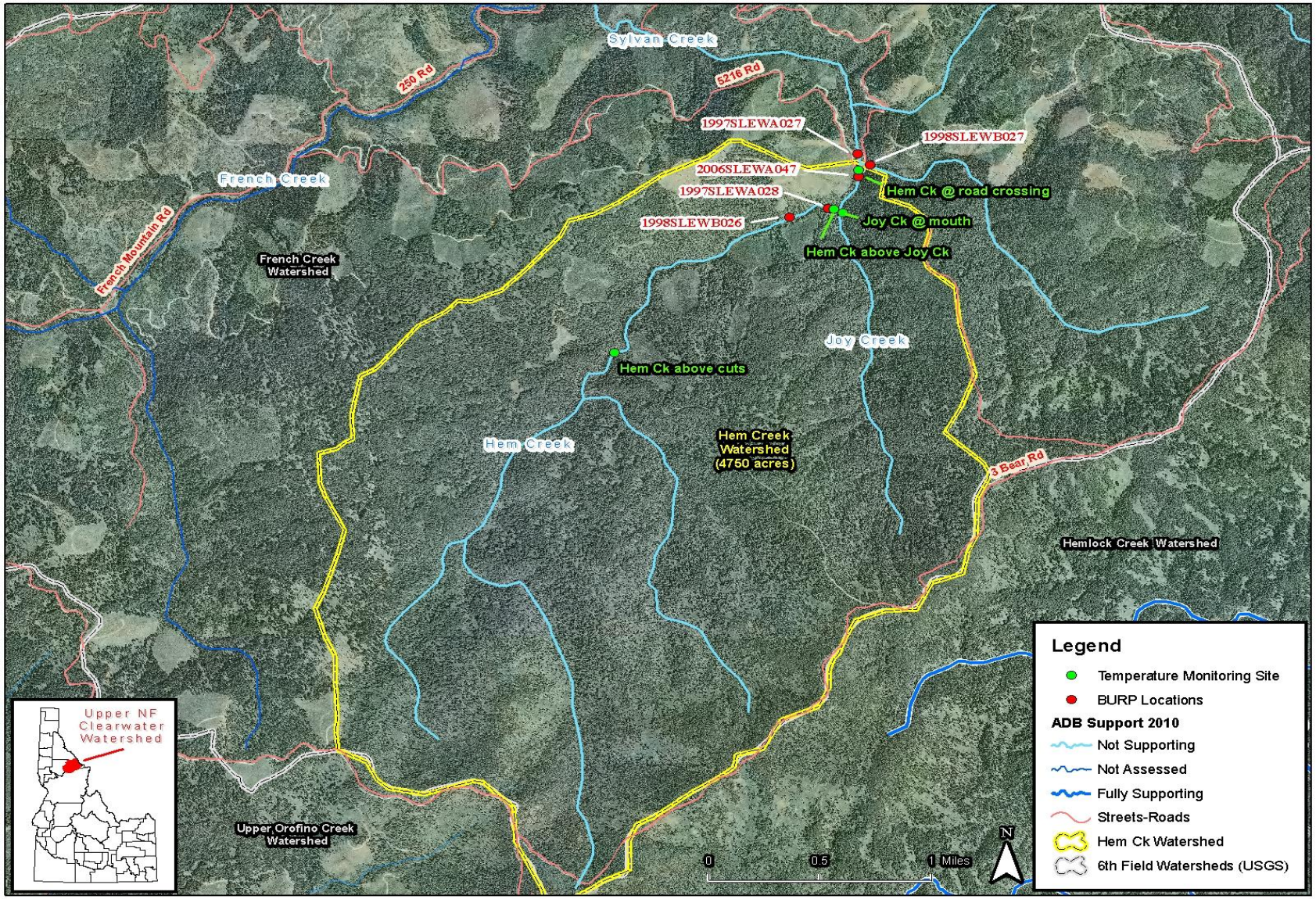

Figure 1. Monitoring locations in Hem Creek watershed.

It appeared throughout 2008 that EPA and DEQ were making judgments based on desktop shade analysis. After receiving EPA-proposed disapproval of the Hem Creek delisting for temperature impairment in spring 2009, DEQ decided additional field investigations were needed to verify unclear facts or facts in dispute based on aerial photos and GIS layers used in EPA's shade analysis. The facts in dispute included (a) the extent of lost shade from past timber harvest, (b) presence of a road in the streamside management zone, and (c) infringement of timber harvest units on riparian buffers.

On September 23, 2009, Don Essig, Jason Pappani, and Daniel Stewart, DEQ, visited Hem Creek to gather and verify information about the effect of historic forest operations in the drainage on stream shade and thus water temperatures. EPA's action to keep Hem Creek listed for temperature in Idaho's 2008 Integrated Report was finalized on October 13, 2009, before this report could be completed (EPA 2009b). This field investigation report will support DEQ's pursuit of temperature impairment delisting in the 2012 Integrated Report on the basis of natural conditions.

2. Purpose of September 2009 Field Visit

The purpose of the September 2009 field visit was to identify any logging activity that may have occurred adjacent to the stream or in the riparian area. Specifically, we looked for evidence of riparian roads and measured height and girth (diameter at breast height [DBH]) of riparian trees, distance from streambank to clear-cut margins, and height of tree regeneration in the clear-cuts. In part, we were verifying the data and assumptions made by EPA in the GIS shade analysis they had conducted (enclosure 3 to February 4, 2009, EPA approval/disapproval letter of Idaho's 2008 §303(d) list).

Based on our knowledge of Hem Creek and forest practices in Idaho, we were concerned about three pieces of information EPA used in their analysis that appeared to be inaccurate:

1. EPA asserted, based on a GIS stream layer that Hem Creek actually passed through one of the timber harvest units (cut 2 in Figure 2).
2. EPA asserted that there was an old riparian road along a portion of lower Hem Creek.
3. In predicting lost shade due to past timber harvest, EPA used tree height of only 5 feet, growing back after clear-cutting in some units, 13 years after harvest.

During the September field visit, we also retrieved HOBO temperature loggers that were installed at the beginning of summer 2009 (Table 1) by Jason Fales and Daniel Stewart. Figure 1 shows the temperature monitoring locations as well as locations of three past DEQ Beneficial Use Reconnaissance Program (BURP) biomonitoring sites in the Hem Creek watershed. Appendix A provides a photo log of the September 2009 field visit. This field visit was in addition to earlier field work by Mark Shumar to ground-truth his existing shade estimates made from interpretation of aerial imagery. The potential natural vegetation (PNV) work is reported in Appendix B.

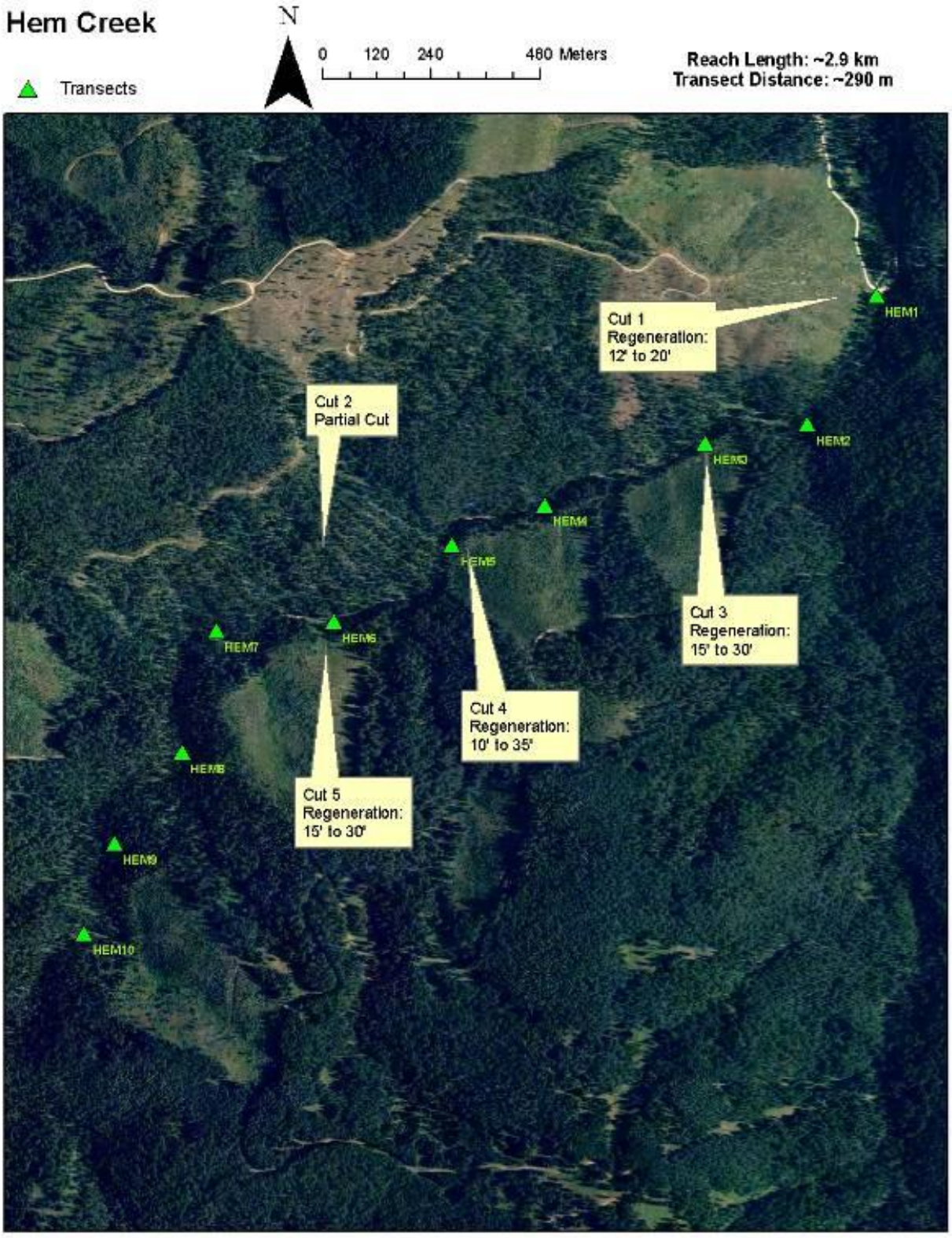

Figure 2. Hem Creek riparian assessment transects.

Table 1. Temperature logger locations in summer 2009.

No.	Site Name	Date Placed	Latitude	Longitude
1	Hem Creek above cutting units[a]	7-9-2009	46° 30' 48.2"	-115° 37' 30.1"
2	Hem Creek above Joy Creek[a]	6-26-2009	46° 31' 26.3"	-115° 36' 13.6"
3	Joy Creek at mouth	6-26-2009	46° 31' 25.3"	-115° 36' 12.8"
4	Hem Creek above Forest Service Road 5216 near mouth	6-26-2009	46° 31' 35.9"	-115° 36' 06.3"

a. Duplicate loggers were placed at these two locations. All loggers were recovered September 23, 2009.

3. Methods

From desktop analysis, we identified a 2.9 kilometer (km) reach of lower Hem Creek as the area in the watershed potentially affected by timber harvest. This reach extends from just above Forest Service Road 5216 crossing near the mouth of Hem Creek to a point above all historic cutting units. We divided the reach into 10 approximately equidistant sections and established Global Positioning System waypoints for transects in the middle of each section (Figure 2, green triangles). Figure 2 also identifies the five historic timber harvest units adjacent to lower Hem Creek.

We then went on site to investigate the effects that the cutting units and associated roads may have had on shading of Hem Creek. We walked the entire 2.9 km reach, up and then back down. At each transect, we measured height and DBH of the nearest tree at each bank (Table 2). If it was possible to see a cutting unit from the stream, we measured the horizontal and straight line (slope) distance to the edge of the clear-cut by using a rangefinder sited on the nearest uncut tree. Where clear-cuts were evident from the creek, we also walked into the clear-cut and measured the height of tree regeneration.

4. Findings

4.1 Integrity of Streamside Management Zone

At no point along the lower 2.9 km of Hem Creek does the creek enter or pass through a cutting unit. The smallest distance from streambank to cutting unit found was 73 feet. This distance is consistent with forest practices at the time of harvesting (mid-1990s), which is a 75-foot buffer width for each bank. We believe EPA's misimpression of harvest unit infringement on these buffers can be attributed to their use of GIS analysis coupled with the inaccurate location of Hem Creek in the 1:100,000 hydrography layer used. The location accuracy of GIS data did not support the detailed level of their analysis.

Table 2. Transect measurements.

Transect	Bank	Tree Ht (ft)	Tree DBH (in)	Horizontal Distance to clear cut (ft)	Comment
HEM1	RB	163	29	73	Engelmann spruce; no road found along stream; taken at road crossing; regeneration height in Cut- 12-20'
HEM2	LB	82	12	NA	White Fir
HEM2	RB	105	38	300	Western Red Cedar;
HEM3	LB	28	7	147	Engelmann spruce- small tree is not representative of what is along bank or within riparian corridor; regeneration height in clear cut- 15', 21', 24', 22', 30'
HEM3	RB	92	18	*	White Fir; unable to see clear cut from creek or riparian area
HEM4	LB	130	27	*	Engelmann spruce; 55.4' from wetted edge; cannot see cut from creek
HEM4	RB	59	14	NA	Western Red Cedar; 16' from wetted
HEM5	LB	134	33	123	Engelmann spruce; regeneration height in cut- 10', 24', 24', 36', 31'
HEM5	RB	54	13	NA	Engelman spruce,
HEM6	LB	102	19	*	Engelmann spruce; 5' from wetted edge; cannot see any evidence of logging through the trees, natural gap with saturated soil
HEM6	RB	106	20	*	Engelmann spruce; 10' from wetted edge; cannot see any evidence of logging through the trees
HEM7	LB	127	23	*	Engelmann spruce; 4' from wetted edge; cannot see any evidence of logging through the trees
HEM7	RB	66	19	NA	Western Red Cedar; 20' from wetted; saturated soil
HEM8	LB	120	20	NA	Engelman spruce
HEM8	RB	107	22	NA	Engelman spruce
HEM9	LB	94	25	*	Engelmann spruce; cannot see any evidence of logging through the trees
HEM9	RB	115	24	NA	Engelman spruce
HEM10	LB	73	12	*	White Fir; cannot see any evidence of logging through the trees
HEM10	RB	60	15	NA	Engelman spruce

Neither a road nor any evidence of a road constructed was seen in the riparian area of the lower 2.9 km of Hem Creek. A small, primitive one-unit camping site was found adjacent to Hem Creek on the south bank just upstream of Forest Service Road 5216. We do not know the source of misinformation regarding a riparian road along Hem Creek, but it may have been an inaccurate roads layer or misinterpretation of aerial photos or imagery.

Regeneration within the clear-cut units was robust with dense growth of trees and thick undergrowth of shrubs and forbs throughout the cuts. There was nearly complete cover of the ground and the canopy structure was already two-tiered, with a shrub layer of head height beneath a tree canopy of 12–35 feet. This growth is consistent with a date for the most recent harvest activity adjacent to Hem Creek of 1994, as reported by the USFS. As noted by EPA in its comparison of aerial photographs, a more recent second entry into a cutting unit spanned the Hem Creek and French Creek divide, but this cutting unit is too far removed from Hem Creek to affect stream shading.

We found minimal evidence of logging operations within the riparian zone. We counted 6 stumps adjacent to the right bank near transect HEM5; these stumps were not within a harvest unit and were likely removed as hazards to logging operations in the adjacent clear-cuts or because they were in the way of high-line cables used for log extraction. Since high-line logging was employed, harvest units along the creek were not skidded, and roads were absent, except for access roads along the upper boundaries of the units, far from the creek.

In walking the lower 2.9 km of Hem Creek, the clear-cut units were visible from only a few locations, and the partial cut (cut 2 in Figure 1) was never visible from the stream. During our field visit (10 a.m. to 4 p. m. on September 23, 2009), the stream surface was at times lit by sunshine, but this was almost entirely due to the sun shining down between the forest cover gaps caused by the stream channel itself, not due to any missing trees in the riparian zone or beyond.

In DEQ's view, EPA also inappropriately based their analysis on 300-foot INFISH management buffers that were not in effect at the time of harvest. Irrespective of buffer width, minimal departure is seen from potential stream shade 15 years after harvest (Appendix B).

4.2 2009 Water Temperature

All four temperature monitoring locations easily met Idaho's temperature criteria for cold water aquatic life of 22 °C for daily maximums and 19 °C for daily averages (Table 3). This was not true for salmonid spawning temperature criteria (Table 4). Applying a cutthroat trout spawning period of May 1 through July 31, all four sites exceeded Idaho's spawning and incubation criteria of 13 °C for daily maximums and 9 °C for daily averages. Note that Hem Creek above the lower 2.9 km reach and Joy Creek (sites 1 and 3) are unentered watersheds.

Table 3. Stream temperature summary, °C.

Site No.	MDMT	MWMT	MDAT	Days of Record	SS Days
1[a]	14.15	13.73	12.08	77	23
2[a]	16.03	15.57	13.00	90	36
3	13.91	13.44	12.17	90	36
4	15.56	15.06	12.90	90	36

Notes: maximum daily maximum temperature (MDMT); maximum weekly maximum temperature (MWMT); maximum daily average temperature (MDAT); salmonid spawning (SS)
a. The warmer of the two duplicates is shown; the duplicate were very close in temperature.

Table 4. Salmonid spawning criteria exceedance summary.

Site No.	13 °C DMT		13 °C WMT[a]		9 °C DAT	
	No. of Days	Percent of SS	No. of Days	Percent of SS	No. of Days	Percent of SS
1[b]	7	8	11	12	20	22
2[b]	16	17	21	23	31	34
3	0	0	5	5	26	28
4	11	12	18	20	30	33

Notes: daily maximum temperature (DMT); weekly maximum temperature (WMT); daily average temperature (DAT); salmonid spawning (SS)
a. United States Environmental Protection Agency Region 10 recommended spawning criterion.
b. Calculated as number of observed days >criterion /92-day spawning period. Assumes all exceedances were captured in period of measurement. Seasonal trends in temperature indicate this is very likely.

4.3 General Observations

The Hem Creek channel is dominated by coarse substrate (cobbles and gravel) and is about 30% bedrock, mostly in the middle of the examined reach. Ample woody debris and frequent pools formed by substrate and large wood are present. A narrow floodplain lies along Hem Creek near its mouth, between transects 1 and 2. Above Joy Creek, the valley narrows, the channel steepens, and there are only pockets of floodplain with steep slopes coming down to the stream in most places. In this area, outcrops of bedrock become apparent. Between transects 6 and 7, the valley widens slightly, and a narrow floodplain is again evident.

A 75-foot SPZ on either bank is wider, often much wider, than the floodplain of Hem Creek in nearly the entire 2.9 km lower reach. As noted above, the valley is steep-sided outside of the minimal floodplain. Thus effective shade of the riparian forest is increased by topography.

Hem Creek experienced overbank flow in floodplain areas during high runoff in spring and early summer 2009. We found evidence of recent floodplain sediment deposits in places, but despite the high runoff, there was no evidence of mass-wasting, channel-widening, or overland delivery of sediment from adjacent hill slopes.

4.4 Hem Creek Existing and Potential Shade Summary

Independent of the September 2009 field investigation of riparian disturbance, but also prompted by EPA's pending §303(d) listing action, Mark Shumar conducted an analysis of PNV earlier in 2009. The results of this work are provided in Appendix B and summarized in Table 5.

Table 5. Summary of 2009 potential natural vegetation analysis of Hem Creek.

Reach	Channel Width (meter)	Cover Type	Target Shade	Existing Shade (2009)	Difference	Near Stream Disturbance
1	2	Subalpine	97	80	-17	No activity
2	3	Subalpine	96	80	-16	No activity
3	4	Upland	94	80	-14	No activity
4	6	Upland	90	70	-20	No activity
5	8	Upland	81	60	-21	Few old (1994) cuts
6	8	Breakland	55	60	+5	More old (1994) cuts
7	8	Breakland	55	50	-5	Road crossing campsite

The reaches are numbered from upstream to downstream. Length of each reach varies (Appendix B). Channel widths are the existing widths. As noted previously, no evidence of channel-widening was found in the September 2009 field investigations. In many places, the channel in the lower reaches was observed to be constrained by steep side slopes that dropped into the stream with no floodplain. Sections of the bedrock channel observed were wider than adjacent sections, perhaps because down-cutting is limited. The phenomenon of undisturbed channels wider than regional curves predict is one that DEQ has seen before in wetter portions of Idaho. Therefore, although wider in the lower reaches than regional curves suggest, existing widths were taken as natural.

The combination of channel width and cover type determines potential shade based on regional shade curves (Shumar and de Varona 2009). Existing shade is estimated from aerial imagery and field verified, where possible, with Solar Pathfinder observations. This verification was only possible in the lower three reaches due to limited access in the upper watershed because of the lack of roads. Existing shade estimates are binned by 10% increments, rounded down; that is, estimated shade of less than 10% is assigned an existing shade class of 0%, 10% to 19% is assigned 10%, and so on.

5. Shade Discussion

A deficit of shade (potential to existing) was identified in the upper four undisturbed reaches of Hem Creek, ranging nominally from 14% to 20%. A portion of this deficit may be an artifact of rounding down the existing shade. We also believe that the shade curves fail to account for sparser forest stands that can occur on saturated slopes or wet meadows at higher elevations. In any event, we do not take the indicated deficit of shade in the upper four reaches to be a departure from natural as there is no human activity than can account for it.

Reaches 6 and 7 are at a lower elevation where the cover type is breaklands. This cover type in combination with a wider channel results is lower natural shade. Reach 6 shows a small (+5%) surplus of shade. The surplus could be due to improved understory growth spurred by increased sunlight from upstream harvest units but most likely is not a real measurable difference. The small shade deficit (-5%) in reach 7, while possibly attributed to a break in riparian cover due to the Forest Service Road 5216 crossing and campsite, is also within the precision of measurement. This disturbance is also below all temperature measurements and thus cannot cause warmer temperatures at monitored locations.

While reach 5 has a significant shade deficit (-21%), it is similar to the undisturbed upper reaches. Although there was timber harvest that might account for this deficit, on our September 2009 site visit we found past timber harvest to be no closer than 73 feet to the stream and in only a few areas was past harvest evident from the stream as a visible break in the canopy (Appendix A, photos A-15 to A-17). Overall through reach 5, human disturbance of the riparian area was insignificant.

5.1 Biological Condition

Previously collected DEQ bioassessment data indicate very healthy aquatic communities (Appendix C), exceeding reference condition thresholds by a large margin. The fish population monitored by DEQ consisted entirely of cutthroat trout. Monitoring of fish populations by the Clearwater National Forest has shown Hem Creek to host strong populations of cutthroat trout (Appendix D).

6. Conclusions

The presence of timber management seen from aerial photographs or on the ground does not constitute a violation of water quality standards. Minor levels of disturbance in a watershed do not preclude natural conditions of temperature or other attributes of water quality. Nature, extent, proximity, and age of disturbance all matter.

While temperature data clearly show exceedance of Idaho's salmonid spawning criteria applied to a spawning period for cutthroat trout that extends from May 1 to July 31, there is not a human cause to explain this exceedance. There is not a riparian road. Hem Creek does not flow through any of the recovering harvest units, and those units are set well back from the channel, respecting harvest practice at the time (75-foot buffers). Vegetation regrowth within the 1994 harvest units has created a closed canopy with tree heights reaching 30 feet. Loss of stream shade, while not absent, is small and mainly attributable to human disturbance near the mouth at the Forest Service Road 5216 crossing.

The results of the PNV analysis and on-site investigation of riparian condition leads DEQ to conclude human-caused depression in riparian shade is far less than 1% and does not account for observed exceedance of numeric temperature criteria to protect salmonid spawning. The healthy macroinvertebrate community and robust cutthroat trout population indicates the stream's natural structural, functional, and taxonomic integrity are preserved. Together, this weight of evidence

leads DEQ to conclude that Hem Creek's exceedance of numeric temperature criteria is a natural condition and is not a violation of Idaho's water quality standards.

The facts surrounding Hem Creek reinforce DEQ's view that Idaho's current salmonid spawning temperature criteria are inappropriate to many Idaho waters, overly protective, and should be revised upward so that future time and resources are not wasted on phantom impairments.

7. References

EPA (United States Environmental Protection Agency, Region 10). 2009a. *Partial Approval/Partial Disapproval of Idaho's 2008 303(d) List*. Letter from Mike Bussell, EPA Director of Water and Watersheds to Barry Burnell, DEQ Administrator of Water Quality Programs, February 4, 2009, with attachments.

EPA (United States Environmental Protection Agency, Region 10). 2009b. *Final Action Letter on Idaho's 2008 303(d) List*. Letter from Mike Bussell, EPA Director of Water and Watersheds to Barry Burnell, DEQ Administrator of Water Quality Programs, October 13, 2009, with attachments.

Shumar, M. and J. de Varona. 2009. *The Potential Natural Vegetation (PNV) Temperature Total Maximum Daily Load (TMDL) Procedures Manual*. Boise, ID: Idaho Department of Environmental Quality.

Appendix A—Photo Log

Photo A-1. Cut 1 as viewed from Forest Service Road 5216 (foreground). Hem Creek crossing is just out of view at bottom of picture.

Photo A-2. View up Hem Creek from Forest Service Road 5216 showing campsite. Creek flows from middle to lower right corner.

Photo A-3. View of Hem Creek looking upstream from transect 1. The creek in this area has some floodplain. Temperature logger 4 was located near this area.

Photo A-4. View toward cut 1 from Hem Creek just above transect 1.

Photo A-5. Hem Creek between transects 1 and 2.

Photo A-6. View upslope toward cut 1 from transect 2.

Photo A-7. Natural gap in forest canopy (no stumps) on south bank between transects 2 and 3.

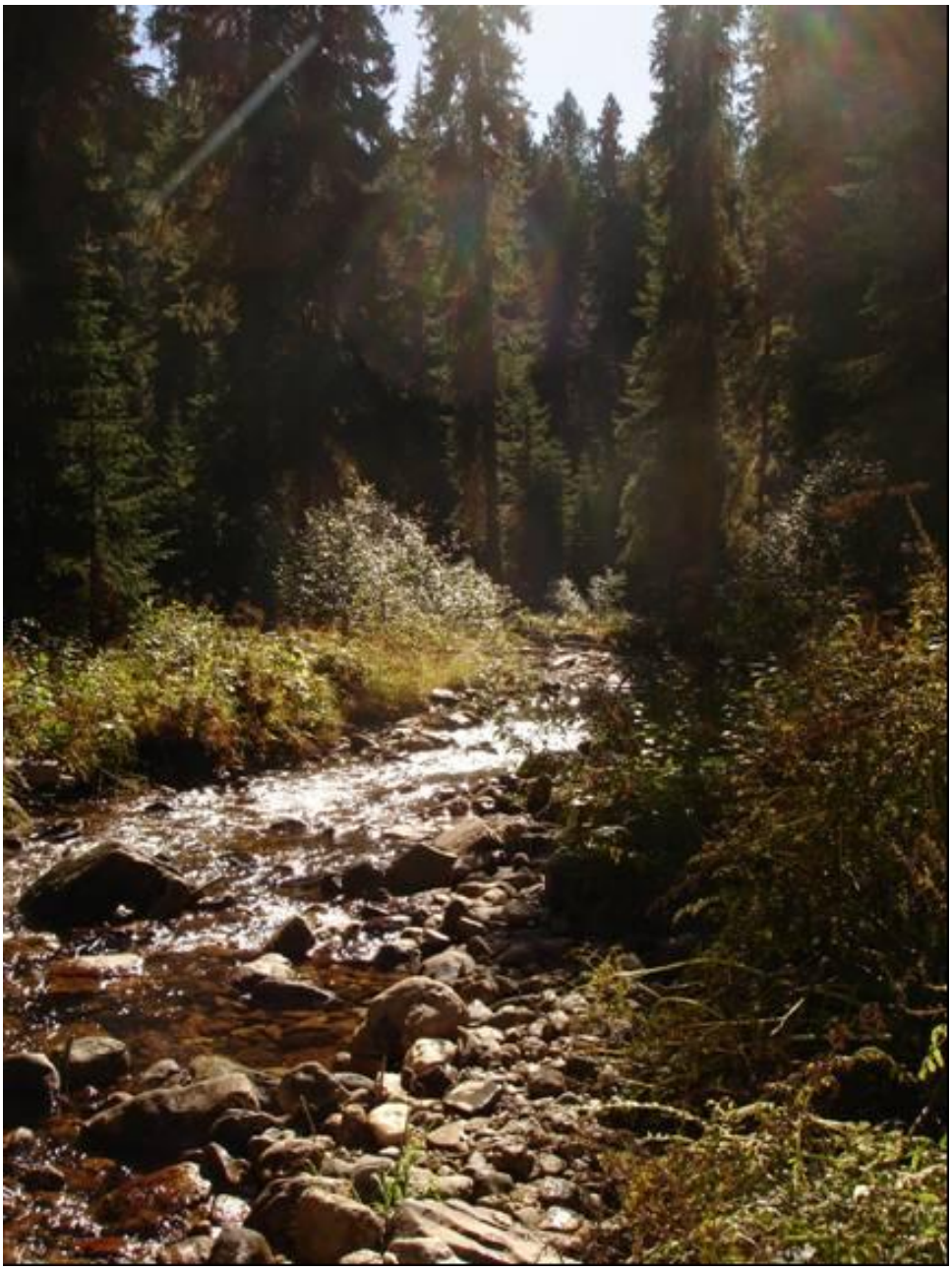

Photo A-8. View up Joy Creek from confluence with Hem Creek. Joy Creek is an un-entered, roadless watershed. Temperature logger 3 was located in this area.

Photo A-9. Hem Creek view upstream above Joy Creek confluence. Temperature logger 2 was located in the area. No cutting units are located in area. Sun was shining through gap in forest formed by Joy Creek.

Photo A-10. View up to cut 3 taken at transect 3. One of two natural gaps encountered, approximately 30 yards wide. No stumps were present.

Photo A-11. View up north bank taken from transect 3 toward cut 1, which was not visible from stream.

Photo A-12. View of south bank of Hem Creek at transect 4, looking toward cut 4.

Photo A-13. Pool formed by log just above transect 4. Abundant large woody debris created structure and habitat in the channel.

Photo A-14. Bedrock stream channel between transects 4 and 5; cut 4 is to the left but was not visible from stream.

Photo A-15. View down Hem Creek at transect 5. Cut 4 is to the right. No floodplain is present.

Photo A-16. View of south bank at transect 5, looking toward cut 4.

Photo A-17. View toward cut 2 from mouth of small tributary between transects 5 and 6. Cut was not visible.

Photo A-18. View downstream at transect 6, cut 5 on right. No floodplain is present. Hill slopes plunge down into stream.

Photo A-19. View of cut 5 through natural gap near transect 6.

Photo A-20. View of north bank at transect 6, looking toward cut 2.

Photo A-21. View of south bank, looking toward cut 5 at transect 6.

Photo A-22. View upstream at transect 6.

Photo A-23. View down Hem Creek at transect 7. Stream has a small floodplain. Cut 2 is to the left, and cut 5 is to the right; neither are visible from stream.

Photo A-24. View downstream at transect 8. No cuts are nearby. Sunshine is due to stream aspect and time of day.

Photo A-25. View downstream at transect 9. Uppermost cut on south side of stream is off to the right but not visible from stream. Sunshine is due to stream aspect aligning with sun.

Photo A-26. View upstream at transect 9.

Photo A-27. View downstream from transect 10.

Photo A-28. View upstream at transect 10. Temperature monitoring location 1 (Hem Creek above cuts) was a short distance upstream. At this point, the channel gradient has slackened; valley has opened up a bit; and a floodplain is again present. All past timber harvest activity is downstream from this location.

Appendix B—Potential Natural Vegetation Shade Analysis

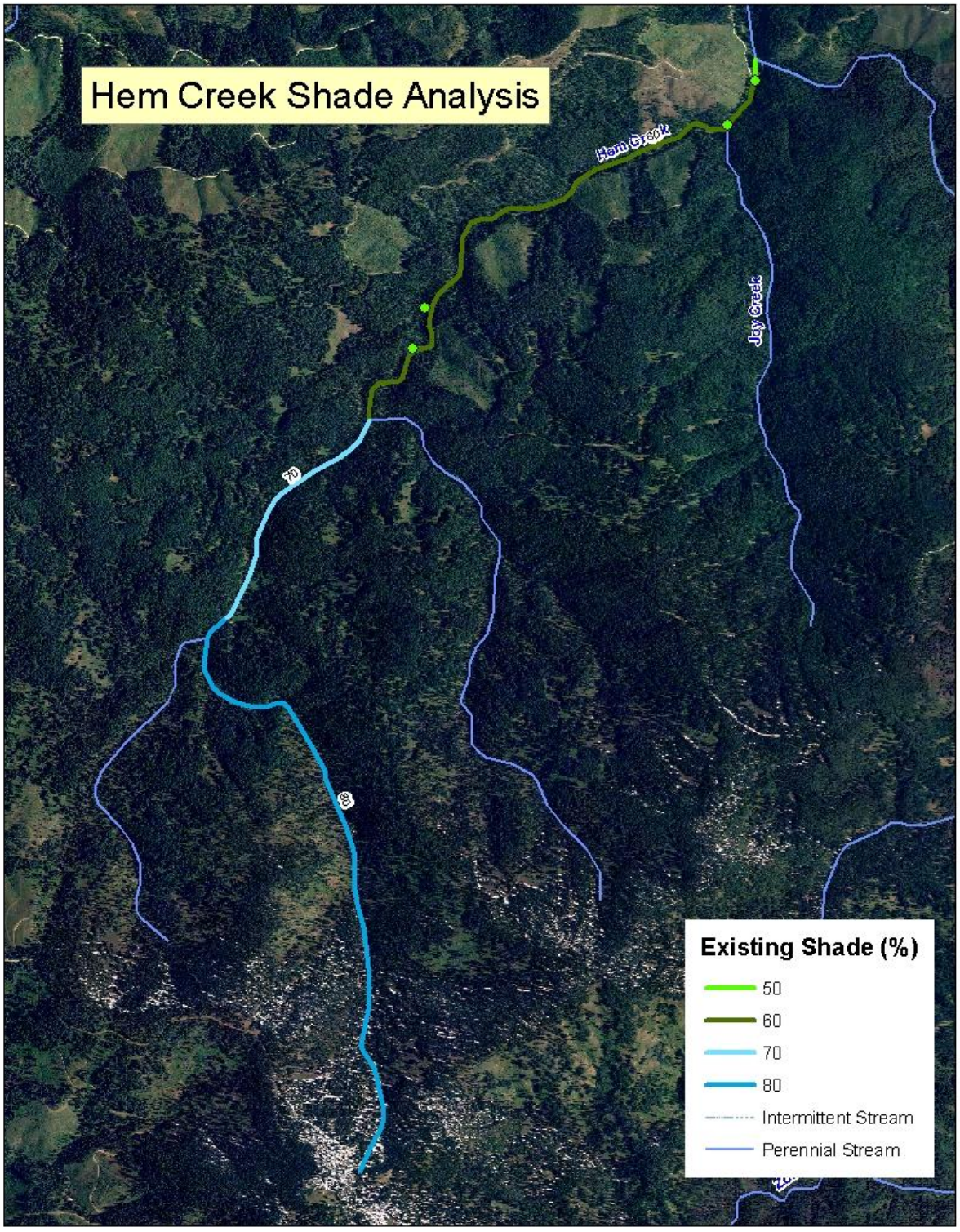

Figure B-1. Existing shade analysis for Hem Creek.

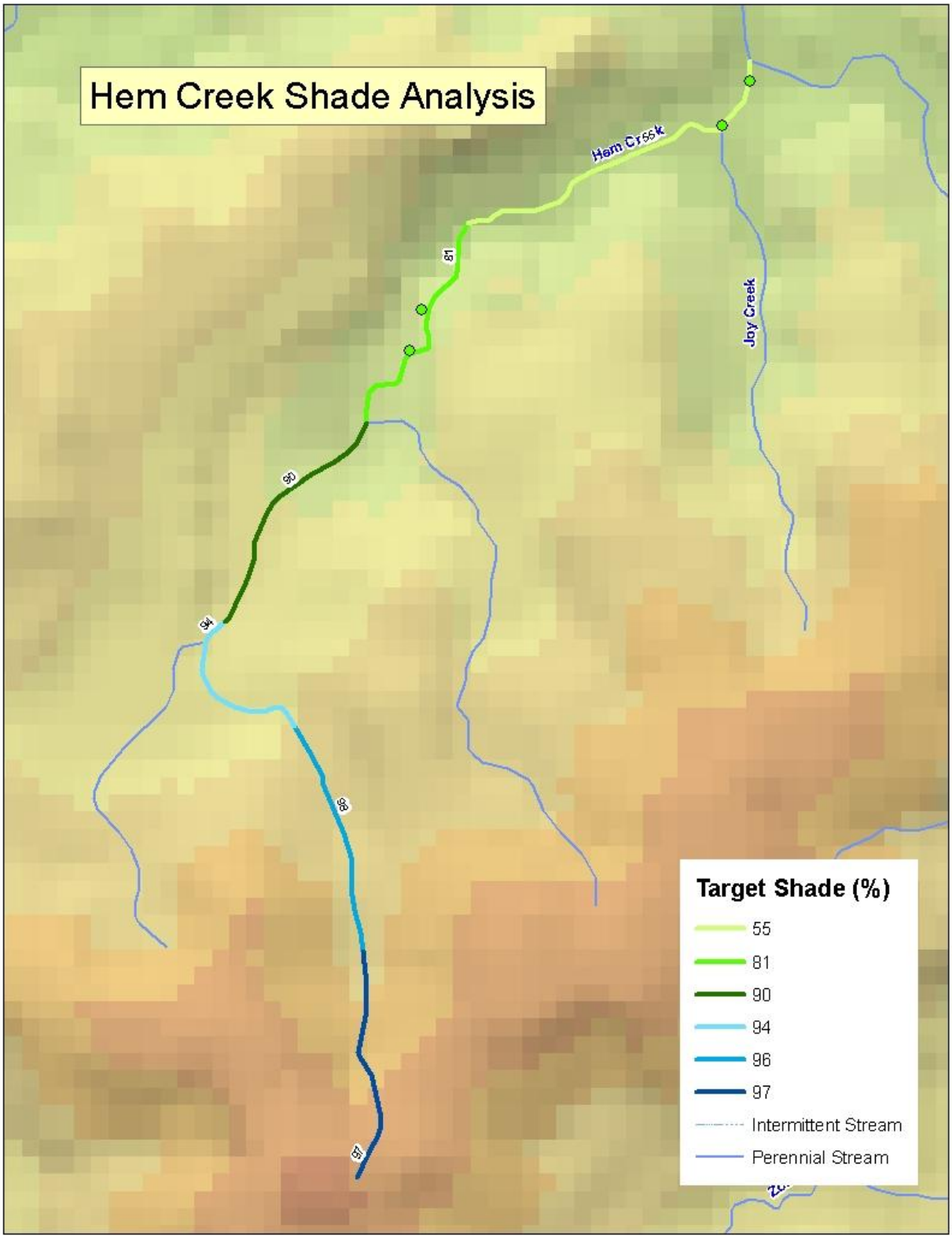

Figure B-2. Target shade analysis for Hem Creek.

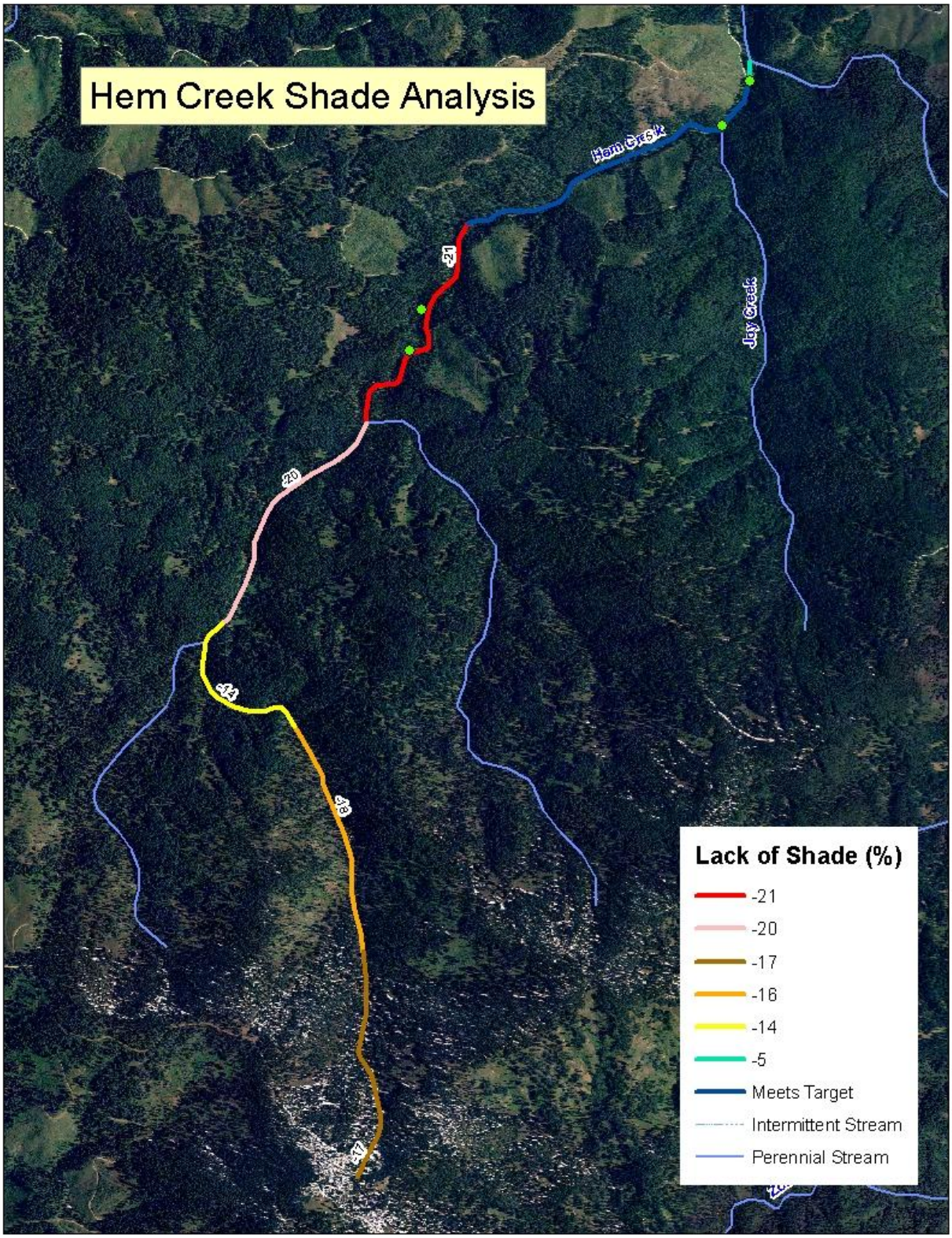

Figure B-3. Lack-of-shade analysis for Hem Creek.

Table B-1. Solar load analysis for Hem Creek.

Reach No.	Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m^2/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m^2/day)	Potential Load Minus Existing load (kWh/m^2/day)
1	1,240	0.8	1.10	0.97	0.165	-0.930
2	1,240	0.8	1.10	0.96	0.220	-0.880
3	940	0.8	1.10	0.94	0.330	-0.770
4	1,330	0.7	1.65	0.90	0.550	-1.100
5	1,320	0.6	2.20	0.81	1.045	-1.155
6	1,820	0.6	2.20	0.55	2.475	0.275
7	80	0.5	2.75	0.55	2.475	-0.275

Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m^2)	Existing Summer Load (kWh/day)	Natural Segment Area (m^2)	Potential Summer Load (kWh/day)	Potential Load Minus Existing Load (kWh/day)	Lack of Shade (%)	Hem Creek
2	2	2,480	2,728	2,480	409.2	-2,318.8	-17	Subalpine
3	3	3,720	4,092	3,720	818.4	-3,273.6	-16	—
4	4	3,760	4,136	3,760	1,240.8	-2,895.2	-14	Upland
6	6	7,980	13,167	7,980	4,389.0	-8,778.0	-20	—
8	8	10,560	23,232	10,560	11,035.2	-12,196.8	-21	—
8	8	14,560	32,032	14,560	36,036.0	4004.0	0	Breakland
8	8	640	1,760	640	1,584.0	-176.0	-5	—
	Total	**43,700**	**81,147**	**43,700**	**55,513**	**-25,634**	**-13**	—

Notes: kilowatt hour per square meter per day (kWh/m^2/day); meter (m); square meter (m^2)

Appendix C—Summary of DEQ's Biological Monitoring and Assessment Results for Hem Creek

Table C-1. Hem Creek stream fish index.

BURPID	Stream	Ecoregion	Date Sampled	HUC	SFI	% Cold	Score	Reference Benchmark[a]
1997SLEWA028	Hem Creek	Northern Rockies	8/7/1997	17060307	82.7	100	3	81
1998SLEWB026	Hem Creek	Northern Rockies	8/5/1998	17060307	99.5	100	3	81
2006SLEWA047	Hem Creek	Northern Rockies	8/10/2006	17060307	81.7	100	3	81

Notes: Beneficial Use Reconnaissance Program identification (BURPID); hydrologic unit code (HUC); stream fish index (SFI)
a. This is the median for reference sites used in developing the index. The 75th percentile was 91, and the 90th percentile 97.

Table C-2. Hem Creek stream macroinvertebrate index.

BURPID	Stream	Ecoregion	Date Sampled	HUC	Total Abundance	Total Taxa	SMI	Score	Reference Benchmark[a]
1997SLEWA028	Hem Creek	Northern Rockies	8/7/1997	17060307	580	38	79.9	3	65
1998SLEWB026	Hem Creek	Northern Rockies	8/5/1998	17060307	405	33	79.3	3	65
2006SLEWA047	Hem Creek	Northern Rockies	8/10/2006	17060307	525	45	76.0	3	65

Notes: Beneficial Use Reconnaissance Program identification (BURPID); hydrologic unit code (HUC); stream macroinvertebrate index (SMI)
a. This is the 25th percentile for reference sites used in developing the index. The median was 70, and the 75th percentile was 79.

Table C-3. Hem Creek stream habitat index.

BURPID	Stream	Ecoregion	Date Sampled	HUC	SHI	Score	Reference Benchmark[a]
1997SLEWA028	Hem Creek	Northern Rockies	8/7/1997	17060307	77	3	66
1998SLEWB026	Hem Creek	Northern Rockies	8/5/1998	17060307	74	3	66
2006SLEWA047	Hem Creek	Northern Rockies	8/10/2006	17060307	78	3	66

Notes: Beneficial Use Reconnaissance Program identification (BURPID); hydrologic unit code (HUC); stream habitat index (SHI)
a. This is the 25th percentile of reference sites used in developing the index.

More detail on development of Idaho's small stream biological indices can be found in the following reference:

Grafe, C.S., ed. *Idaho Stream Ecological Assessment Framework: An Integrated Approach*. Boise, ID: Idaho Department of Environmental Quality.

This document is available online at: *http://www.deq.idaho.gov/media/457010-wbag_02_entire.pdf*

Appendix D—Information on Strength of Cutthroat Population in Hem Creek

E-mail from Pat Murphy, Clearwater National Forest to Cynthia Barrett, DEQ, Lewiston Regional Office, April 9, 2009:

Regarding the fish population status in Hem Creek, we have noted on several occasions that we considered the westslope cutthroat trout population strong. This is based on the following information:

First, during our input to the Columbia River Basin assessment (CRB) in 1995 we were asked to evaluate the existing fish populations for specific drainages. In drainages we had fish population data, we based our strong versus depress designations for westslope cutthroat trout on information provided in Rieman and Apperson (1989); the document noted that in their status and analysis of westslope cutthroat trout populations in Idaho they assumed densities of 1-10 fish (age 2 or older fish) per 100 m2 were strong populations. At the time, I discuss this information with Bruce Rieman and we agreed that for the CRB effort westslope cutthroat trout densities of >2 fish (age 2 or older)/100 m2 would be appropriate to designate a strong population.

Now for Hem Creek, we conducted an in-house fish population survey (snorkeling) at three locations (two - Hem Creek, 1 Joy Creek) in 1994. The densities of westslope cutthroat trout (>2 fish (age 2 or older)/100 m2) ranged from 7.5-20.9 at the two Hem Creek sites and 3.2 at the Joy Creek site.

In 1997, the Sylvan Creek drainage had a habitat survey conducted via contractor, Clearwater BioStudies, Inc. The contract also called for fish population surveys (snorkeling) in Hem Creek as well as in several tributaries. The information was summarized in Clearwater BioStudies, Inc. (1998); I believe DEQ has a copy at its Lewiston Office. The densities of westslope cutthroat trout (>2 fish (age 2 or older)/100 m2) ranged from 2.0-5.9 in Hem Creek, 2.4-3.6 in West Fork Hem Creek, 11.6 at one site in East Fork Hem Creek, and 2.2 at the lower site in Joy Creek. For comparison, the parent drainage, Sylvan Creek, had densities that ranged from 2.4-8.6.

Two of the 1994 Hem Creek sites were repeated in 1997. While the number were lower than what the Forest observed in 1994, the stream flows were substantially higher in 1997 versus 1994. Based on data from the Lochsa River and assuming the stream flows within the North Fork Clearwater River drainage were similar to the Lochsa River, the summer stream flows in 1994 were very low (30% of average) and very high in 1997 (168% of average). Although the data is standardized by 100 m2, our densities in 1994 were most likely higher than average stream flow conditions as the larger fish were bunched together in the pool/run habitat. Likewise, the densities in 1997 were most likely lower due to higher stream flows which spread the fish out and created additional habitats for rearing.

So, based on the two fish population surveys we have considered the westslope cutthroat trout population strong in the Hem Creek. Could the drainage support higher densities or is the drainage at carrying capacity are two good questions that folks can speculate upon. In any case, the available data supports our opinion that Hem Creek is most likely in the middle tier of the streams designated with strong populations of westslope cutthroat trout in the North Fork Clearwater River drainage (see attachment, north_fork_cutt_dens.xls).

Citations:

Rieman, B.E. and K.A. Apperson. 1989. Status and analysis of salmonid fisheries. Westslope cutthroat trout synopsis and analysis of fishery information. Idaho Department of Fish and Game Project F-73-R-11, Subproject II, Job No. 1. Idaho Department of Fish Game, Boise, Idaho.

Clearwater BioStudies, Inc. 1998. Habitat conditions and salmonid abundance in selected streams within the Orogrande Creek drainage, North Fork Ranger District, summer 1997. Contract report no. 53-0276-7-88, prepared for U.S.D.A. Forest Service, Clearwater National Forest, Orofino, Idaho.

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