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Bull Trout and Pacific Lamprey Occupancy in the Imnaha River Subbasin

FY 2016 Final Report

Paul M. Sankovich and Timothy A. Whitesel

U.S. Fish and Wildlife Service
Columbia River Fish and Wildlife Conservation Office
Vancouver, WA 98683

On the cover: *Big Sheep Creek in the Imnaha River Subbasin. Photograph by Jason Lampel (FWS).*

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authored by

Paul M. Sankovich[1]

and

Timothy A. Whitesel[2]

U.S. Fish and Wildlife Service
Columbia River Fish and Wildlife Conservation Office

[1] 3502 Highway 30
La Grande, OR 97850

[2] 1211 SE Cardinal Court, Suite 100
Vancouver, WA 98683

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2016 FINAL REPORT

Paul M. Sankovich[1] and Timothy A. Whitesel[2]

U.S. Fish and Wildlife Service
Columbia River Fish and Wildlife Conservation Office

[1] *3502 Highway 30*
La Grande, OR 97850

[2] *1211 SE Cardinal Court, Suite 100*
Vancouver, WA 98683

Abstract

Abstract ─ The goal of the U.S. Fish and Wildlife Service's studies in the Imnaha River subbasin is to provide information that can be used to inform Bull Trout *Salvelinus confluentus* recovery and Pacific Lamprey *Entosphenus tridentatus* conservation efforts. In 2016, we collected environmental DNA (eDNA) samples in the Imnaha River subbasin to determine if Bull Trout eDNA would be detected in a stream known to support a local Bull Trout population (Big Sheep Creek) and two streams where Bull Trout occupancy was unknown (Horse Creek and the South Fork Big Sheep Creek upstream from a culvert), or if Bull Trout eDNA would be detected in a stream where Bull Trout were known to be absent (Skookum Creek). We also collected eDNA samples at the mouths of the Imnaha River and Horse, Lightning, and Cow creeks, which are the largest tributaries in the lower Imnaha River, to test for the presence of Pacific Lamprey eDNA. All of the sites sampled in Big Sheep Creek, and none of the sites sampled in Skookum Creek tested positive for Bull Trout eDNA, providing limited evidence eDNA techniques may yield accurate results. No Bull Trout eDNA was detected at the sampling sites in Horse Creek, suggesting it may not support a local Bull Trout population. Bull Trout eDNA was detected just upstream from a culvert near the mouth of the South Fork Big Sheep Creek. Efforts should be taken in the future to determine if a local Bull Trout population actually exists upstream from that culvert. No Pacific Lamprey eDNA was detected at any of the sampling sites analyzed for Pacific Lamprey eDNA. Thus, while Pacific Lamprey are occasionally captured in a rotary screw trap in the Imnaha River near its mouth, it appears they do not inhabit the Imnaha River subbasin continuously or extensively.

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Introduction

Bull Trout *Salvelinus confluentus* were listed as a threatened species under the Endangered Species Act (ESA) in coterminous United States in 1999. The U.S. Fish and Wildlife Service (FWS) issued a final Recovery Plan for Bull Trout in 2015 (U.S. Fish and Wildlife Service 2015). The ultimate goal of the FWS' Bull Trout recovery strategy is to "manage threats and ensure sufficient distribution and abundance to improve the status of Bull Trout throughout their extant range in the coterminous United States so that protection under the ESA is no longer necessary" (FWS 2015). Knowledge of where local populations of Bull Trout occur is critical to planning and implementing recovery efforts for this federally-listed species.

In 2008-2009, the FWS' Columbia River Fish and Wildlife Conservation Office (CRFWCO) conducted an analyses to identify habitat patches in the Imnaha River Subbasin having a relatively high probability of being able to support Bull Trout spawning and early rearing (FWS 2008), and sampled in a portion of those patches to determine if they were occupied by Bull Trout local populations. The patch analyses indicated there were 23 Bull Trout patches (Figure 1). CRFWCO personnel sampled in 10 of those patches, five of which were determined to be occupied by local Bull Trout populations (Imnaha River and Lick, Big Sheep, Little Sheep, and McCully creeks), and five of which were determined to be unoccupied (Skookum, Gumboot, Owl, Carrol, and West Fork Carrol creeks). Prior to 2016, the 13 remaining patches had not been sampled.

The U.S. Forest Service (USFS) Rocky Mountain Research Station (RMRS) is currently implementing "The Rangewide Bull Trout eDNA Mapping Project" (http://www.fs.fed.us/rm/boise/AWAE/projects/BullTrout_eDNA.html). The project's goal is to identify all occupied Bull Trout natal areas in the coterminous United States. RMRS researchers have developed a Climate Shield habitat occupancy model that predicts the probability of juvenile Bull Ttrout presence in all potential natal areas (Isaak et al. 2015). To complete the project, the RMRS researchers require biologists throughout the Pacific Northwest to assist them by collecting environmental DNA (eDNA; e.g., McKelvey et al. 2016; Wilcox et al. 2016) samples in each of the potential natal areas. No RMRS funding is available to support eDNA sample collection, but funding is available to cost-share the analyses of the samples. The opportunity also exists to test for the presence of eDNA from species other than Bull Trout, but without cost-sharing.

Pacific Lamprey *Entosphenus tridendata* are a conservation concern for the FWS and are known to occur in the Imnaha River Subbasin through their infrequent capture in a rotary screw trap in the lower Imnaha River. Beyond the observations of Pacific Lamprey at the screw trap, virtually nothing is known about Pacific Lamprey in the Imnaha River Subbasin. Pacific Lamprey is among the species for which researchers have developed an eDNA assay.

To assist with Bull Trout recovery and Pacific Lamprey conservation efforts, our objectives in 2016 were to collect eDNA samples from three of the Bull Trout patches identified by the FWS in 2008, and from the mouths of the Imnaha River and three tributaries to the lower Imnaha River. The three patches we selected included one that was known to be occupied by a Bull Trout local population, one that was known to be unoccupied, and one for which Bull Trout

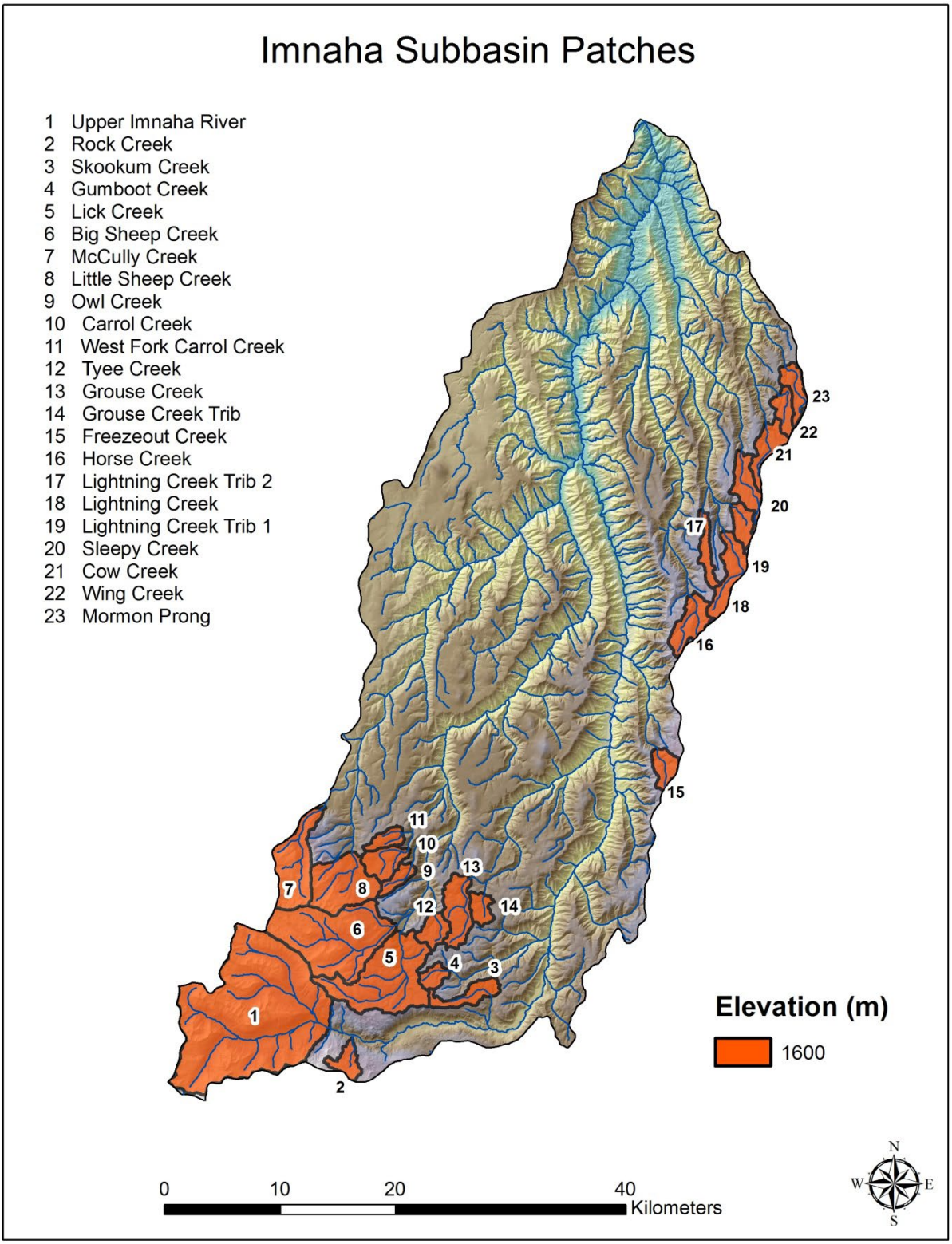

Figure 1. Location of Bull Trout patches in the Imnaha River Subbasin.

occupancy was unknown. The latter patch coincided with a natal area identified by the Climate Shield habitat occupancy model and was known to support steelhead *Onchorhynchus mykiss* spawning (i.e., was a good candidate to support Pacific Lamprey, since Pacific Lamprey spawning habitat is similar to that of steelhead [e.g., Goodman and Reid 2012]). This approach allowed us to 1) continue the patch occupancy work begun in 2008, 2) assist the RMRS researchers in meeting their goal, 3) begin acquiring information on Pacific Lamprey distribution in the Imnaha River Subbasin, and 4) provide information useful in assessing how the results from eDNA sampling compare to those from other sampling techniques (e.g., electrofishing) for Bull Trout.

Study Area

The Imnaha River Subbasin encompasses an area of approximately 2,202 km^2. Its headwaters drain the east slope of the Wallowa Mountains in northeastern Oregon (Figure 1). The North Fork, Middle Fork, and South Fork Imnaha rivers originate at elevations ranging from 2,495 m to 2,604 m and converge to form the Imnaha River, which flows for approximately 117 km before entering the Snake River at an elevation of 288 m. Native fishes present in the Imnaha River Subbasin include Chinook Salmon *O. tshawytscha*, Steehead and Rainbow Trout *O. mykiss*, Bull Trout, Mountain Whitefish *Prosopium Willliamsoni*, Pacific and Western Brook Lamprey *Lampetra richardsonii*, and various sucker and sculpin species.

Methods

During 20-23 September 2016, we collected eDNA samples from patches in Horse, Skookum, and Big Sheep creeks, and near the mouths of Horse, Lightning, and Cow creeks and the Imnaha River (Figure 2; Table 1). It was not known whether a Bull Trout local population occupied Horse Creek. RMRS biologists had identified 10 sites (spaced 1000 m apart, following their protocol) from which to collect eDNA samples in Horse Creek (Appendix Figure 1). We collected samples at only three of those sites (Figure 2; Table 1) because the remaining sites were either dry or lacked sufficient flow to support Bull Trout. In Skookum Creek, which was not identified as a potential Bull Trout natal area by the RMRS biologists but was identified as a patch in the FWS' 2008 analysis and was determined through electrofishing in 2009 to be unoccupied by Bull Trout, we collected eDNA samples at four sites from the downstream end of the patch into its upper reaches (Figure 2; Table 1). The FWS and RMRS analyses both indicated Big Sheep Creek held the potential to support a Bull Trout local population, and an electrofishing occupancy survey in 2009 demonstrated a Bull Trout local population was, in fact, present. We collected eDNA samples at five sites in Big Sheep Creek that coincided with RMRS eDNA sampling sites (Figure 2; Table 1; Appendix Figure 2). We also collected an eDNA sample from South Fork Big Sheep Creek at a site just upstream from a culvert that was approximately 240 m upstream from the mouth of South Fork Big Sheep Creek (Figure 2; Table 1). Downstream from the culvert, South Fork Big Sheep Creek was known to be occupied by Bull Trout, but whether Bull Trout occurred upstream from the culvert was unknown.

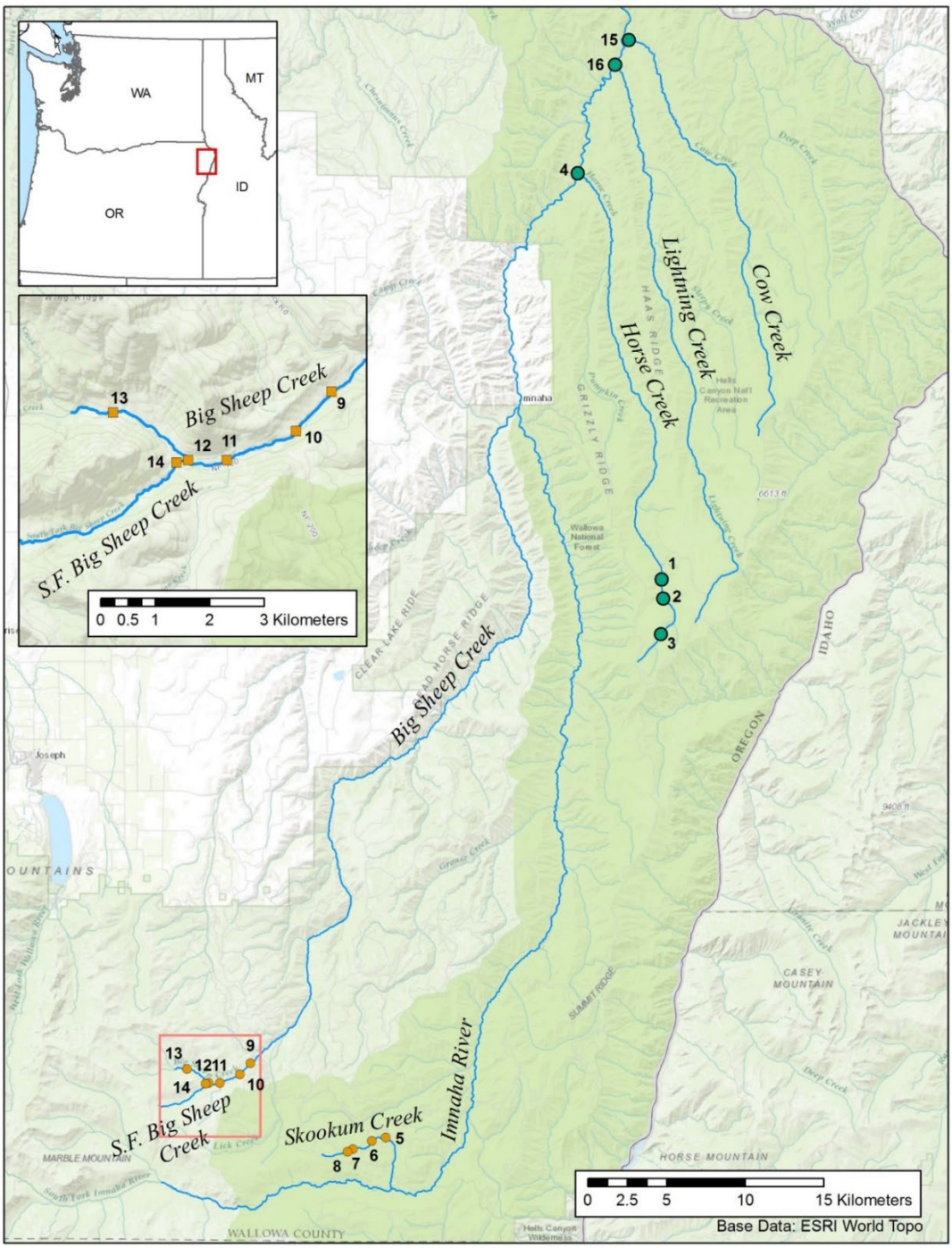

Figure 2. Environmental DNA sampling sites in the Imnaha River Subbasin in 2016. Samples from sites colored green were tested for Bull Trout and Pacific Lamprey DNA. Samples from sites colored orange were tested only for Bull Trout DNA. The sampling site for Pacific Lamprey eDNA at the mouth of the Imnaha River is not depicted.

Horse, Lightning, and Cow creeks are the largest tributaries to the lower Imnaha River. We suspected that if Pacific Lamprey reared as larvae and spawned in the Imnaha River

Table 1. Coordinates (UTM WGS94; 11T), number, and name of sites from which eDNA samples were collected in the Imnaha River Subbasin.

Stream	Site number	Site name	Coordinates	
			Easting	Northing
Horse Creek	1	HC-301-1	521988	5033946
	2	HC-279-1	522084	5032714
	3	HC-243-2	521929	5030428
	4	HC-001	516637	5059795
Skookum Creek	5	SK-001	504397	4998395
	6	SK-002	503514	4998179
	7	SK-003	502301	4997644
	8	SK-004	501964	4997485
Big Sheep Creek	9	BS-78-2	495770	5003120
	11	BS-78-3	495114	5002400
	12	BS-80-1	493836	5001863
	13	BS-91-1	493130	5001863
	14	BS-93-1	491747	5002742
South Fork Big Sheep Creek	15	SFBS-73-2	492915	5001820
Cow Creek	16	CC-001	519896	5068270
Lightning Creek	17	LC-001	519006	5066683
Imnaha River	1	IR-001	518272	5073597

subbasin, they would be most likely to occupy the larger, lower tributaries. In addition, given Pacific Lamprey life history, we also suspected larvae would be present near tributary mouths. Thus, we collected one eDNA sample each near the mouths of Horse, Lightning, and Cow creeks and the mouth of the Imnaha River.

We collected the samples following an established protocol (Carim et al. 2015). The samples were stored in a freezer at -15.0ºC before shipment to the RMRS. The Big Sheep Creek, South Fork Big Sheep Creek, and Skookum Creek samples were analyzed for Bull Trout eDNA (Figure 2). The remaining samples were analyzed for both Bull Trout and Pacific Lamprey eDNA (Figure 2), with the exception of the sample collected at the mouth of the Immaha River, which was analyzed only for Pacific Lamprey eDNA.

Results

None of the four sites we sampled in Horse Creek tested positive for Bull Trout eDNA.

All of the sites we sampled in Big Sheep Creek and the single site we sampled just upstream from the culvert in South Fork Big Sheep Creek tested positive for Bull Trout eDNA. None of the four sites we sampled in Skookum Creek tested positive for Bull Trout eDNA. No Bull Trout or Pacific Lamprey eDNA was detected at the mouths of Cow, Lightning, or Horse creeks, and no Pacific Lamprey eDNA was detected at the mouth of the Imnaha River.

Discussion, Conclusions and Management Implications

Results from the eDNA analysis were consistent with those from previous electrofishing efforts. Bull Trout eDNA was detected at all of the sampling sites in Big Sheep Creek, which had been demonstrated through electrofishing to support a Bull Trout population. No Bull Trout eDNA was detected at any of the sampling sites in Skookum Creek, which had been demonstrated through electrofishing to be unoccupied.

Although the modeled probability of Bull Trout occupancy in Horse Creek was reasonably high (25-50%), most of the sampling sites were either dry or lacked sufficient flow to support Bull Trout. This, coupled with the eDNA results being consistent with previous electrofishing efforts and with the eDNA analysis indicating no Bull Trout eDNA was present at the three sites we sampled, indicates Horse Creek likely does not support a Bull Trout population.

Bull Trout were not previously known to exist upstream from the culvert near the mouth of South Fork Big Sheep Creek. Given Bull Trout eDNA was detected upstream from that culvert, efforts should be made to determine if Bull Trout are actually present upstream from the culvert, and, if so, where they are distributed in order to more fully inform management and monitoring efforts.

Pacific Lamprey are known to be present in the Imnaha River based on their capture, primarily as larvae, but also as macropthalmia and adults, in a screw trap approximately 6.3 km upstream from its mouth. From 2000 to 2017, the number of Pacific Lamprey, of all life stages, captured in the trap ranged from 0 to 1422 (Jim Harbeck, Nez Perce Tribe, personal communication). An average of 132 individuals were captured each year, but the median number was only 5. In all years except 2007 and 2008 (when n = 1422 and n = 828, respectively), fewer than 24 individuals were captured each year. Thus, it appears Pacific Lamprey abundance in the Imnaha River fluctuated widely between years, but usually was low. It is unclear why the samples we collected at the mouths of the Imnaha River and Cow, Lightning, and Horse creeks tested negative for Pacific Lamprey. It could be that those streams actually were not occupied by Pacific Lamprey, or that some or all of them were, but we did not collect samples high in enough in the drainages or close enough to larvae to detect Pacific Lamprey eDNA. Given the life history of Pacific Lamprey (i.e., they tend to be distributed throughout systems in which they occur) and the apparent tendency toward the absence or low abundance of Pacific Lamprey in the lower Imnaha River, we suspect Pacific Lamprey were, in fact, absent from the lower Imnaha River and the three tributaries we sampled. However, since we only sampled at the mouths of the main stem and those tributaries, we cannot entirely dismiss

the possibility that Pacific Lamprey were present farther upstream in some or all of those systems.

Acknowledgements

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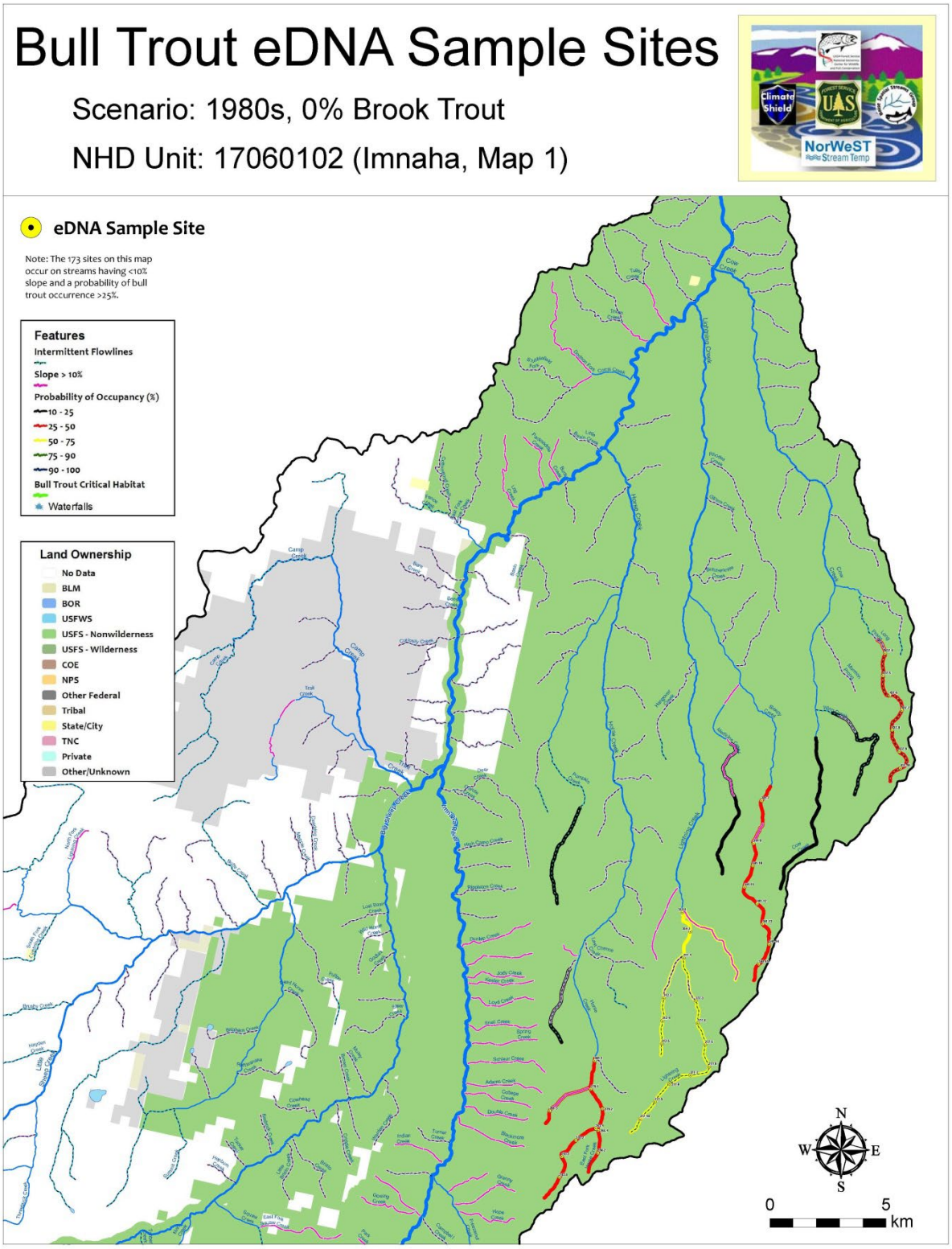
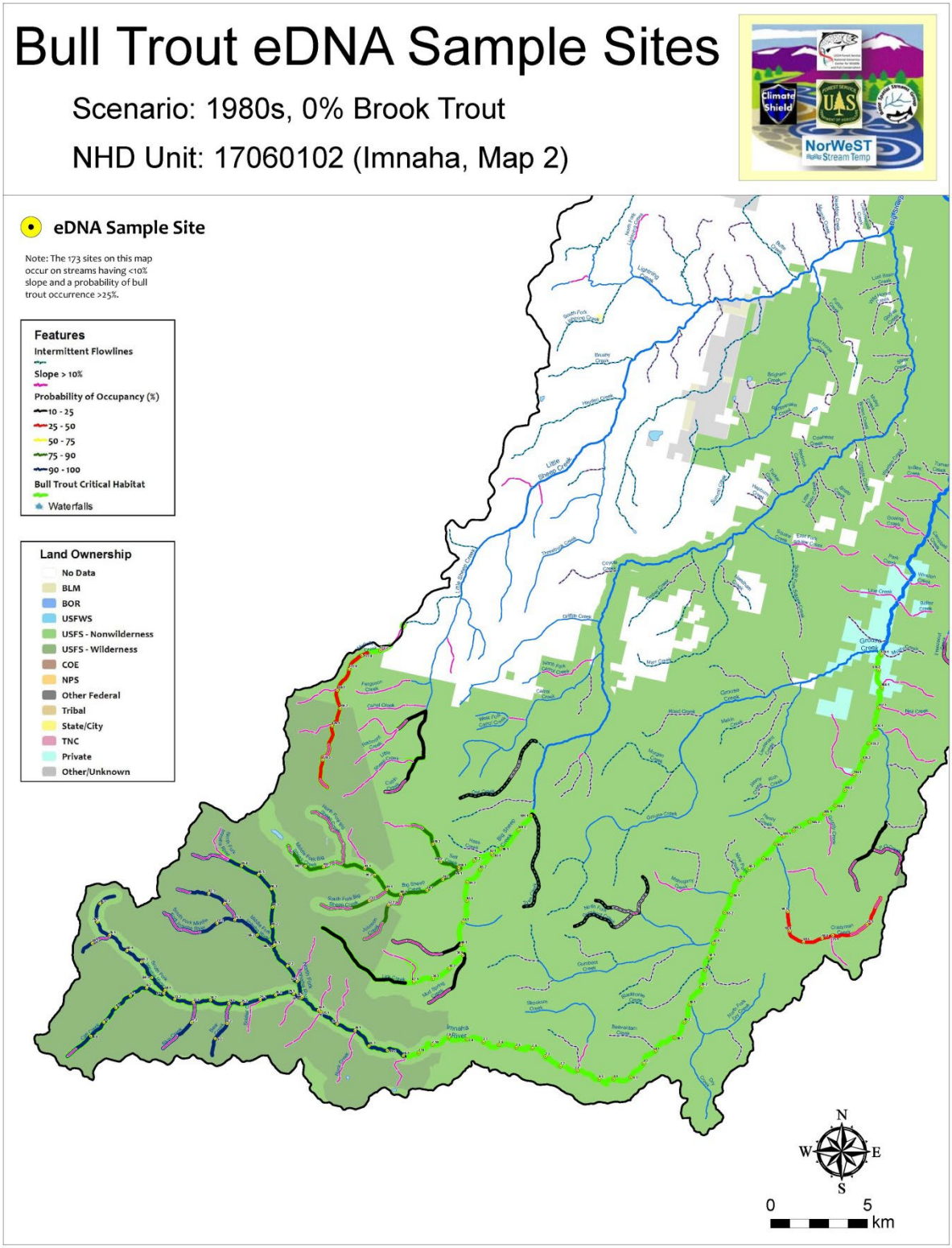
Appendix Figure 1. Environmental DNA sampling sites in the Horse Creek drainage.



Appendix Figure 2. Environmental DNA sampling sites in the Big Sheep Creek drainage.



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1211 SE Cardinal Court, Suite 100
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