



Upper Columbia Basin Network Integrated Water Quality Annual Report 2014

Nez Perce National Historical Park (NEPE)

Natural Resource Report NPS/UCBN/NRR—2015/1022



ON THE COVER

Lapwai Creek, September 2014, Nez Perce National Historical Park- Spalding Site
Photograph courtesy of the National Park Service

Upper Columbia Basin Network Integrated Water Quality Annual Report 2014

Nez Perce National Historical Park (NEPE)

Natural Resource Report NPS/UCBN/NRR—2015/1022

Eric N. Starkey

Aquatic Biologist
Upper Columbia Basin Network Inventory and Monitoring Program
National Park Service
105 E. 2nd St.
Suite #7
Moscow, ID 83843

September 2015

U.S. Department of the Interior
National Park Service
Natural Resource Stewardship and Science
Fort Collins, Colorado

The National Park Service, Natural Resource Stewardship and Science office in Fort Collins, Colorado, publishes a range of reports that address natural resource topics. These reports are of interest and applicability to a broad audience in the National Park Service and others in natural resource management, including scientists, conservation and environmental constituencies, and the public.

The Natural Resource Report Series is used to disseminate comprehensive information and analysis about natural resources and related topics concerning lands managed by the National Park Service. The series supports the advancement of science, informed decision-making, and the achievement of the National Park Service mission. The series also provides a forum for presenting more lengthy results that may not be accepted by publications with page limitations.

All manuscripts in the series receive the appropriate level of peer review to ensure that the information is scientifically credible, technically accurate, appropriately written for the intended audience, and designed and published in a professional manner.

Data in this report were collected and analyzed using methods based on established, peer-reviewed protocols and were analyzed and interpreted within the guidelines of the protocols.

Views, statements, findings, conclusions, recommendations, and data in this report do not necessarily reflect views and policies of the National Park Service, U.S. Department of the Interior. Mention of trade names or commercial products does not constitute endorsement or recommendation for use by the U.S. Government.

This report is available in digital format from the Upper Columbia Basin Network website (<http://science.nature.nps.gov/im/units/ucbn/>), and the Natural Resource Publications Management website (<http://www.nature.nps.gov/publications/nrpm/>). To receive this report in a format optimized for screen readers, please email irma@nps.gov.

Please cite this publication as:

Starkey, E. N. 2015. Upper Columbia Basin Network integrated water quality annual report 2014: Nez Perce National Historical Park (NEPE). Natural Resource Report NPS/UCBN/NRR—2015/1022. National Park Service, Fort Collins, Colorado.

Contents

	Page
Figures.....	iv
Tables.....	v
Appendices.....	vi
Executive Summary	vii
Acknowledgments.....	ix
Introduction and Background.....	1
Objectives.....	2
Study Area	5
Jim Ford Creek- Nez Perce National Historical Park (NEPE), Weippe Prairie	5
Lapwai Creek- Nez Perce National Historical Park (NEPE), Spalding	9
Methods.....	11
Water Chemistry.....	11
Quality Assurance/Quality Control (QA/QC):	11
Discharge.....	12
Macroinvertebrates.....	12
Results.....	13
Jim Ford Creek-Weippe Prairie.....	13
Water Chemistry.....	13
Macroinvertebrates	25
Lapwai Creek- Spalding.....	27
Water Chemistry:.....	27
Macroinvertebrates	38
Literature Cited	41

Figures

	Page
Figure 1. Jim Ford Creek looking downstream towards water quality monitoring station #01.....	5
Figure 2. Nez Perce National Historical Park regional map (NPS 1997).	6
Figure 3. Water quality monitoring location in Jim Ford Creek 2014.	7
Figure 4. Water quality monitoring location in Lapwai Creek 2014 (Station 02). Note the change in stream channel from 2008 and 2011.....	8
Figure 5. Lapwai Creek looking downstream from water quality monitoring station #02.	10
Figure 6. June 2014 cross section survey of Jim Ford Creek, box plot of specific conductance and plot of 95% family-wise confidence level.....	14
Figure 7. September 2014 cross section survey of Jim Ford Creek, box plot of specific conductance and plot of 95% family-wise confidence level.....	14
Figure 8. Jim Ford Creek, water quality monitoring results box-plot 2009-2014.	16
Figure 9. Daily maximum and mean water temperature in Jim Ford Creek, NEPE, 2014.	18
Figure 10. Corrected daily mean specific conductance in Jim Ford Creek, NEPE, 2014.....	19
Figure 11. Corrected daily minimum dissolved oxygen and daily maximum temperature in Jim Ford Creek, NEPE, 2014.....	21
Figure 12. Corrected daily maximum, minimum, and median pH in Jim Ford Creek, NEPE, 2014.....	22
Figure 13. Raw daily mean turbidity in Jim Ford Creek, NEPE, 2014.....	24
Figure 14. June 2014 cross section survey of Lapwai Creek, box-plot of specific conductance and plot of 95% family-wise confidence level.....	28
Figure 15. October 2014 cross section survey of Lapwai Creek, box-plot of specific conductance and plot of 95% family-wise confidence level.....	28
Figure 16. Lapwai Creek, water quality monitoring results box-plot 2008-2014.....	30
Figure 17. Daily maximum and mean water temperature in Lapwai Creek, NEPE, 2014.	32
Figure 18. Corrected daily mean specific conductance in Lapwai Creek, NEPE, 2014.....	33
Figure 19. Corrected daily minimum dissolved oxygen and daily maximum temperature in Lapwai Creek, NEPE, 2014.	34
Figure 20. Corrected daily maximum, minimum and median pH in Lapwai Creek, NEPE, 2014.....	35
Figure 21. Corrected daily mean turbidity in Lapwai Creek, NEPE, 2014.....	37

Tables

	Page
Table 1. Vital sign summary table for water chemistry in Jim Ford Creek June-November, 2014.....	15
Table 2. Vital sign summary table for water chemistry in Jim Ford Creek June-October, 2011.....	15
Table 3. Water temperature summary table for Jim Ford Creek 2009-2014.....	17
Table 4. Data grade/rating for water temperature each deployment period June-November 2014 in Jim Ford Creek, NEPE.....	18
Table 5. Data grade/rating for specific conductance each deployment period June-November 2014 in Jim Ford Creek, NEPE.....	19
Table 6. Data grade/rating for dissolved oxygen each deployment period June-November 2014 in Jim Ford Creek, NEPE.....	21
Table 7. Data grade/rating for pH each deployment period June-November 2014 in Jim Ford Creek, NEPE.	23
Table 8. Data grade/rating for turbidity each deployment period June-November 2014 in Jim Ford Creek, NEPE.....	24
Table 9. Vital sign summary table for benthic macroinvertebrates in Jim Ford Creek, 2014.....	26
Table 10. Vital sign summary table for water chemistry in Lapwai Creek, June-November, 2014.....	29
Table 11. Vital sign summary table for water chemistry in Lapwai Creek, June-November, 2011.....	29
Table 12. Water temperature summary table for Lapwai Creek 2008-2014.....	31
Table 13. Data grade/rating for water temperature each deployment period June-November 2014 in Lapwai Creek, NEPE.	32
Table 14. Data grade/rating for specific conductance each deployment period June-November 2014 in Lapwai Creek, NEPE.	33
Table 15. Data grade/rating for dissolved oxygen each deployment period June-November 2014 in Lapwai Creek, NEPE.	34
Table 16. Data grade/rating for pH each deployment period June-November 2014 in Lapwai Creek, NEPE.	36
Table 17. Data grade/rating for turbidity each deployment period June-November 2014 in Lapwai Creek, NEPE.	37
Table 18. Vital sign summary table for benthic macroinvertebrates in Lapwai Creek, 2014.....	39

Appendices

	Page
Appendix A. 2014 Water Quality Monitoring Locations	45
Appendix B. NEPE Hydrologic Unit Code Boundaries	47
Appendix C. Sample Locations for Water Quality Monitoring at NEPE.....	49
Appendix D. Quality Control (QC) Indicators.....	51
Appendix E. Corrections History.....	53
Appendix F. Macroinvertebrate Metrics.....	63
Appendix G. Macroinvertebrate Taxa List	67

Executive Summary

The mission of the National Park Service is “to conserve unimpaired the natural and cultural resources and values of the national park system for the enjoyment of this and future generations” (NPS 1999). To uphold this goal, the Director of the NPS approved the Natural Resource Challenge to encourage national parks to focus on the preservation of the nation’s natural heritage through science, natural resource inventories, and expanded resource monitoring (NPS 1999). Through the Challenge, 270 parks in the national park system were organized into 32 inventory and monitoring networks. The Upper Columbia Basin Network (UCBN) is comprised of 8 national park sites located in Idaho, Montana, Oregon, and Washington.

The UCBN has identified 14 priority park vital signs, indicators of ecosystem health, which represent a broad suite of ecological phenomena operating across multiple temporal and spatial scales. The intent of the network is to monitor a balanced and integrated “package” of vital signs that meets the needs of current park management, but will also be able to accommodate unanticipated environmental conditions in the future. Water quality is a particularly high priority vital sign for six of the nine UCBN parks. The UCBN contains more than 34 rivers, streams, ponds, and reservoirs. Unlike many National Parks that are large and often encompass entire watersheds, most UCBN parks and water bodies are small and embedded in large watersheds with diverse land use.

This annual report details the status of key indicators of water quality obtained from monitoring in Nez Perce National Historical Park (NEPE). Monitoring occurred in two units of NEPE, Spalding and Weippie Prairie. Lapwai Creek flows through the Spalding unit and Jim Ford Creek flows through the Weippe Prairie unit. Lapwai and Jim Ford Creeks were previously sampled by the UCBN in 2011 (see Starkey 2012). Data from the 2014 field sampling effort was collected following methods detailed in the UCBN integrated water quality monitoring protocol (Starkey et al. 2008). The UCBN Integrated Water Quality Monitoring Protocol was formally peer-reviewed and approved for implementation in August 2009. This protocol can be found on the UCBN website at: <http://science.nature.nps.gov/im/units/ucbn/publications.cfm?tab=3>. Benthic macroinvertebrates were collected by the United States Forest Service- PACFISH/INFISH Biological Opinion (PIBO) according to their peer reviewed protocol during the UCBN’s monitoring of stream channel characteristics and riparian condition in 2014. The UCBN’s peer reviewed stream channel characteristics and riparian condition protocols can also be found on the UCBN’s website listed above.

Water chemistry and macroinvertebrate results indicate that Jim Ford and Lapwai Creeks are in fair condition, with the primary concerns being elevated water temperatures, low dissolved oxygen, and pH levels occasionally above established thresholds. The status of water quality for Jim Ford and Lapwai Creeks relative to state regulatory thresholds is given in the summary tables on the following page. UCBN water quality monitoring is conducted on a 3 year rotating panel. As a result, conditions in both Jim Ford and Lapwai Creek will be re-evaluated in 2017.

Note that several of the appendices in this report are primarily intended for UCBN internal reference. In addition, some appendices serve as hard copies of quality assurance/quality control procedures performed during data processing.

Jim Ford Creek Water Chemistry Summary 2014

Measure	Current Condition (June-November, 2014)	State DEQ Thresholds ^a	% Exceedance ^b
Temperature (*MDMT, **MDAT)	* MDMT= 24.16 °C ** MDAT= 22.77 °C	<22 °C ^e **MDAT<19 °C	7% ^e
			30%
Specific conductance (mean)	95.6 µS/cm	N/A	N/A
Dissolved oxygen (mean daily min)	5.34 mg/l	> 6.0 mg/l	30%
pH (mean daily max)	7.58 pH Units	9.0 pH Units, Max	0%
pH (mean daily min)	7.13 pH Units	6.5 pH Units, Min	0%
Turbidity (mean daily max)	-- ^c	< 50 NTU over background (instantaneous) < 25 for 10 consecutive days	Insufficient data

Lapwai Creek Water Chemistry Summary 2014

Measure	Current Condition (June-November, 2014)	State DEQ Thresholds ^a	% Exceedance ^b
Temperature (*MDMT, **MDAT)	* MDMT= 26.59 °C ** MDAT= 22.81 °C	<22 °C ^e **MDAT<19 °C	13% ^e
			32%
Specific conductance (mean)	214.39 µS/cm	N/A	N/A
Dissolved oxygen (mean daily min)	8.13 mg/L	> 6.0 mg/L	0%
pH (mean daily max)	8.6 pH Units	9.0 pH Units, Max	2%
pH (mean daily min)	7.7 pH Units	6.5 pH Units, Min	0%
Turbidity (mean daily max)	22.5 NTU ^d	< 50 NTU over background (instantaneous) < 25 for 10 consecutive days	Insufficient data

*MDMT – Maximum Daily Maximum Temperature, **MDAT – Maximum Daily Average Temperature,

^a Criteria for cold water life designation, ^b Proportion of samples above water quality standard, ^c Poor data quality precludes reporting, see Jim Ford Creek turbidity section below for more details ^d Mean daily max based on 2 months of data due to poor data quality, ^e Previously (2011) reported the threshold as MDMT<22 °C; however, instantaneous values should be < 22 °C.

0-5% exceedance	
5-25% exceedance	
>25% exceedance	

Acknowledgments

Funding for this project was provided through the National Park Service Natural Resource Challenge and the Servicewide Inventory and Monitoring Program. The UCBN would also like to thank NEPE staff for their assistance in the field and for the review of this report.

Introduction and Background

Water resources have been identified as a high priority vital sign for the Upper Columbia Basin Network (UCBN). These resources are used by many riparian, migratory, and terrestrial organisms in the Network, and have intrinsic value as places of natural beauty and recreation (Garrett et al. 2007). Reflecting this priority, the Water Resources Division (WRD) of the NPS provides a separate source of funding each fiscal year to the UCBN to accomplish water quality monitoring. In June 2014 the UCBN began its second year of integrated water quality monitoring in Jim Ford Creek and its third year in Lapwai Creek at Nez Perce National Historical Park (NEPE).

Water resources in the semi-arid West have been strongly affected by human activity, and many UCBN streams and rivers are listed by states as impaired for one or more parameters. Most UCBN water bodies and many aquatic resources such as migratory fish are strongly influenced by activities in the larger watersheds outside park boundaries. Understanding the current status of freshwater ecosystems will help guide management and restoration efforts, and provide insight into ecosystem change in a landscape with a shifting climate and dynamic human influences.

During the process of prioritizing vital signs to monitor in UCBN parks in 2005, water quality was identified as a high priority vital sign (Garrett et al. 2007). When asked what aspects of water quality were important to monitor, resource managers identified the sampling of macroinvertebrate assemblages within UCBN water bodies as the top water quality monitoring priority. Secondary priorities included baseline sampling of water chemistry parameters, characterization of channel morphology, and information on water quantity. Channel morphology and riparian vegetation are addressed in separate monitoring protocols which were also implemented at NEPE in 2014.

The objectives of the UCBN Integrated Water Quality Monitoring Protocol are documenting the aquatic macroinvertebrate assemblage composition and baseline water chemistry parameters. Aquatic macroinvertebrate assemblages have strong effects on freshwater ecosystem processes and represent an important trophic linkage between primary producers and fishes. Measures of macroinvertebrate assemblage composition and structure have been frequently used as water quality indicators because these assemblages integrate the effects of point and non-point source pollutants over spatial-temporal scales and can be used to answer many management questions. Also, macroinvertebrates are more cost-effective to sample than other biota or many water chemistry parameters.

Water chemistry and temperature have strong effects on aquatic biota. Consequently, direct and indirect human alteration of stream water quality is associated with altered biotic communities and ecosystem processes. Because of the direct relationship between water chemistry and biota, water chemistry is typically a central component of any water quality monitoring program. More recently, monitoring of stream water temperatures has increased in the Pacific Northwest, because of concerns over cold-water fish habitat (primarily salmonid fishes), the recognized influence of land- and water-use on stream temperature regime, and the need for baseline temperature information to monitor the effects of climate change. National Park Service (NPS) Water Resource Division (WRD) has identified a suite of four “core water quality parameters”: temperature, specific conductance, pH, and dissolved oxygen, which are critical to understanding baseline conditions in aquatic habitats. The

UCBN added turbidity as a parameter to measure because turbidity is listed as a source of impairment in several UCBN park streams.

Well-articulated desired future condition statements have not yet been developed for water quality in UCBN parks. However, the mission statements for the NPS as a whole and for the individual parks clearly state the intent “to conserve unimpaired the natural and cultural resources and values of the national park system for the enjoyment of this and future generations” (NPS 1999). Water quality is a particularly important resource with nationally recognized merit. It is assumed that desired future conditions for all UCBN parks will include clean streams, rivers, and lakes free of human health concerns that provide visitors with recreational and scenic experiences. Monitoring macroinvertebrate assemblage composition and structure, and core water quality parameters will directly measure the water characteristics most important to park mission, visitor experience, and desired future conditions.

Objectives

The overarching programmatic goal of the UCBN integrated water quality monitoring program is to obtain information that will aid in informed management decisions pertaining to improved water quality within UCBN parks. Park managers have committed to improving the water quality of impaired waters by adopting the NPS Government Performance Results Act (GPRA) goal (Ia4) that streams and rivers managed by NPS will meet State and Federal water quality standards (NPS 2000).

Given this goal, it should be noted that in 2012 Jim Ford Creek was listed as a category 4A water for temperature, sedimentation/siltation, fecal coliform, and nutrient eutrophication. A category 4A means that it has a pollution problem, but has total maximum daily loads (TMDL) being actively implemented to remedy issues. In addition, in 1998 Lapwai Creek was on the 303(d) list for pollution problems related to: bacteria, flow alteration, habitat alteration, nutrients, sediment, dissolved oxygen and temperature. Since that time it has been listed as a category 3 stream meaning that it is considered an unassessed water (see study area description below for more information).

Given the lack of available data on water quality in UCBN parks, the following fundamental questions drive much of the UCBN’s inquiry into water quality:

- Are the core water quality parameters of streams in the UCBN with established Total Maximum Daily Loads (TMDLs) selected for sampling improving over time?
- What is the status and long-term trend of core water quality parameters (temperature, pH, conductivity, dissolved oxygen, and turbidity) in UCBN streams selected for sampling?
- What is the status and long term trend in aquatic macroinvertebrate abundance and assemblage composition in selected UCBN streams?
- Do aquatic macroinvertebrate assemblages sampled within UCBN streams indicate polluted or otherwise impaired water quality?
- Do aquatic macroinvertebrate assemblages sampled within UCBN streams indicate “pristine” or “reference” conditions according to regional criteria established by the (Environmental Protection Agency (EPA) and the states of Idaho, Oregon, Montana, and Washington?

In light of these questions and the broader goals outlined above, water quality monitoring in the UCBN addresses the following specific measurable monitoring objectives:

- Determine status and long term trend in key water quality parameters for selected streams within UCBN park units.
- Determine status and trend in aquatic macroinvertebrate abundance, assemblage composition, and functional feeding group composition in wadeable streams within the UCBN.

Study Area

Jim Ford Creek- Nez Perce National Historical Park (NEPE), Weippe Prairie

The segment of Jim Ford Creek within the park is in the lower Clearwater River drainage in Hydrologic Unit Code (HUC 6)170603060401 (United States Geologic Survey [USGS]), Upper Jim Ford Creek subwatershed, in Clearwater County, Idaho (Figures 1-3, Appendices A and B). The Weippe Prairie watershed is approximately 142 square km (54 square miles) and consists of several land cover types (Erixson et al. 2010). According to Erixson, et al. 2010, Weippe's watershed is primarily tree dominated vegetation (*Abies grandis*, *Pseudotsuga menziesii*, *Pinus ponderosa*) (67.9%), with smaller land cover components consisting of herbaceous vegetation (6.3%), shrub-dominated vegetation (6.4%), and agriculture (6.3%).

Designated beneficial uses for Jim Ford Creek include: cold water communities and primary contact recreation (ID Admin Code 2014, 58.01.02.120.08 (through 3/29/12)). The primary threats to water resources in Weippe Prairie are: point and non-point discharge from upstream sources, agriculture, logging, grazing, recreation, and historic landuse (Garrett et al. 2007; ID DEQ, Nez Perce Tribe EPA 2000). In 2012, Jim Ford Creek was listed as a category 4A impaired water for temperature, sedimentation/siltation, fecal coliform, and nutrient eutrophication (ID DEQ 2014). The category 4A designation means that it has a pollution problem, but has total maximum daily loads (TMDL) being actively implemented to reduce pollution. The current TMDLs can be found in Idaho Department of Environmental Quality (ID DEQ), Nez Perce Tribe EPA 2000. Additional information about Jim Ford Creek can be found in Jim Ford Creek Water Quality Monitoring Report 2003-2004 (Clark 2005) and Natural Resource Condition Assessment: Nez Perce National Historical Park (Erixson et al. 2010).

The Hydrolab was deployed approximately 200 m downstream of the bridge (Larson or Prairie Road) over Jim Ford Creek (Figure 1, Figure 3 and Appendix A). This location was chosen primarily due to adequate water depth during late summer months. The macroinvertebrate sample reaches along Jim Ford Creek coincide with the stream channel characteristics and riparian condition monitoring reaches (see Appendix C for GPS waypoint).



Figure 1. Jim Ford Creek looking downstream towards water quality monitoring station #01. Just beyond the hawthorn tree on right bank

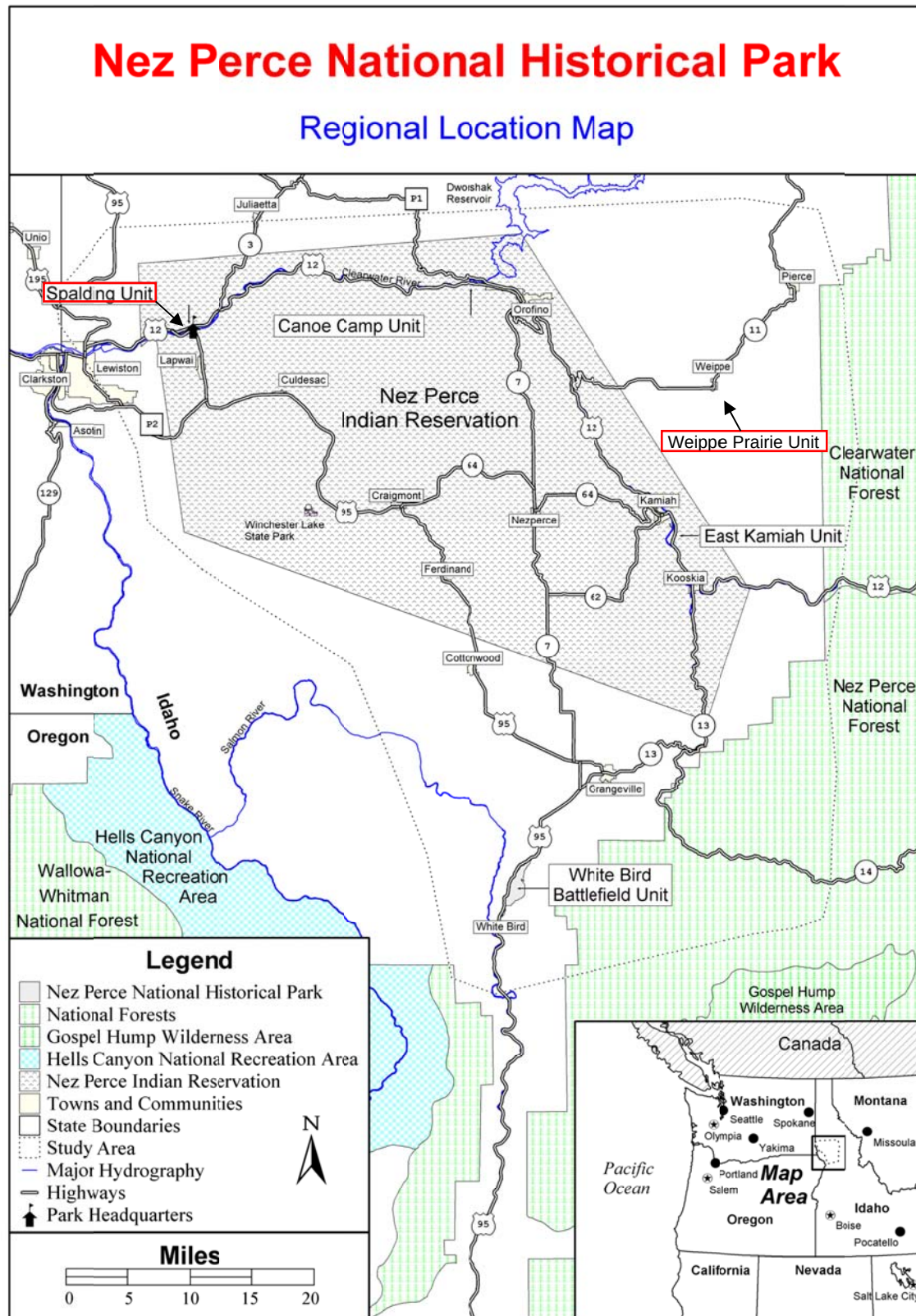


Figure 2. Nez Perce National Historical Park regional map (NPS 1997). Note that monitoring occurred in both the Spalding and Weippe Prairie Units.



NEPE- Water Quality Monitoring 2014



Figure 3. Water quality monitoring location in Jim Ford Creek 2014.



NEPE- Water Quality Monitoring 2014



Figure 4. Water quality monitoring location in Lapwai Creek 2014 (Station 02). Note the change in stream channel from 2008 and 2011.

Lapwai Creek- Nez Perce National Historical Park (NEPE), Spalding

Lapwai Creek is in the lower Clearwater River drainage in Hydrologic Unit Code (HUC 6) 170603061304 (United States Geologic Survey [USGS]), Lower Lapwai Creek subwatershed, in Nez Perce County, Idaho (Figures 2, 4 and Appendices A and B). The Spalding watershed is approximately 305 square km (118 square miles) and consists of several land cover types (Erixson et al. 2010). According to Erixson, et al. 2010, Spalding's watershed consists of the following land cover types: agriculture (52.9%), shrub dominated vegetation (20.4%), herbaceous vegetation (12.6%) and developed areas (i.e., City of Lewiston) (9.7%). For a description of each landcover type see Erixson et al. 2010.

Designated beneficial uses for Lapwai Creek (from Sweetwater Creek to mouth) include: cold water biota and primary contact recreation (Idaho Admin Code 2014, 58.01.02.120.08 (through 3/29/12)). Threats to water resources in NEPE have been listed as: point and non-point discharge from upstream sources, agriculture, logging, grazing, recreation, highway runoff and urbanization. (Garrett et al. 2007). In 1998, Lapwai Creek was on the 303(d) list for pollution problems related to: (bacteria, flow alteration, habitat alteration, nutrients, sediment, dissolved oxygen and temperature. In 2012, Lapwai Creek was listed as a category 3 (unassessed) water by the state of Idaho meaning that it had not been assessed or had insufficient data to determine if water quality standards were attained (ID DEQ 2014). The 2012 integrated report also lists Lapwai Creek as a Tribal water meaning that Idaho DEQ does not make 303(d) listing judgments or lead the development of TMDLs. Development of TMDLs depends on the Environmental Protection Agency (EPA) and the Tribe. In effect, the reason Lapwai Creek (Sweetwater Creek to Mouth) is listed as a category 3 stream is due to its "tribal water" designation (ID DEQ 2011 and ID DEQ 2014). Additional information on Lapwai Creek can be found in the Lapwai Creek Aquatic Assessment (Cichosz et al. 2001), the Lapwai Creek Watershed Ecological Restoration Strategy (Richardson et al. 2009), UCBN Integrated Water Quality Annual Reports 2008 and 2011 NEPE (Starkey 2009, and Starkey 2012) and the Natural Resource Condition Assessment: Nez Perce National Historical Park (Erixson et al. 2010).

Between 2011 and 2014, the stream channel shifted to the west thereby reducing the amount of water flowing over the deployment location used in 2008 and 2011 (Station #01). As a result, a new deployment station (#02) was established along the left bank approximately 200 m downstream from the railroad bridge (Figures 4 and 5, Appendix A). This location was chosen due to logistical considerations, adequate water depth, and to avoid placement of equipment near creek access points. The best access to the site is by parking in front of the "Green House" offices and walking to the North along the mowed trail. Monitoring station #02 is just downstream of the power poles.

The macroinvertebrate sample reach on Lapwai Creek coincides with the stream channel characteristics and riparian condition monitoring reach (see Appendix C for GPS waypoint).



Figure 5. Lapwai Creek looking downstream from water quality monitoring station #02.

Methods

Water Chemistry

Continuous water quality monitors (HACH, MS5 Hydrolabs) were deployed from June 16th to November 7th in Jim Ford Creek, and from June 18th to November 3rd in Lapwai Creek at index sites to estimate the status, variability, and long-term trends in core parameters. The core parameters measured were water temperature, dissolved oxygen, pH, specific conductance, and turbidity. These core parameters were measured hourly and the instrument serviced monthly throughout the deployment period. Each monitor was deployed in a location that was representative of conditions in the park, logistically feasible to access, and relatively secure from vandalism and high flows. A cross-section survey was conducted to aid in the determination of Hydrolab site selection. For more information on the UCBN water chemistry sampling design see Starkey et al. (2008). A gap in Jim Ford Creek monitoring occurred from August 5th to August 20th when Hydrolab #064 was sent to the Hach Company for repair of the dissolved oxygen sensor. A gap in monitoring also occurred on Lapwai Creek between August 6th and August 20th when Hydrolab #054 was also sent to the Hach Company for repair of the dissolved oxygen sensor.

During the years the UCBN is not conducting the full suite of monitoring, temperature loggers (HOBO, Pro v2) are deployed in both Jim Ford and Lapwai Creeks. Additional water temperature monitoring occurred in both streams in 2009, 2010, 2012 and 2013.

Quality Assurance/Quality Control (QA/QC):

Quality assurance and quality control for multiprobe data collection are covered in detail in SOP #12 (Starkey et al. 2008). Basic procedures adhere to the guidelines established in Part B lite (Irwin 2008); the National Coastal Assessment Quality Assurance Project Plan 2001-2004 (U.S. EPA 2001); the Laboratory Methods Manual-Estuaries, Volume 1: Biological and Physical Analyses (U.S. EPA 1995); and Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers (Barbour et al. 1999).

General quality assurance and quality control methods for UCBN water quality multiprobe calibration and data downloads include the following:

- Representative multiprobe sample locations are determined by using a cross-section and stream segment survey. Each site is re-assessed for representativeness at the start and end each sample year.
- The UCBN follows pre-established maximum acceptable differences for field instrument calibration and QC checks. If the multiprobe readings are outside of the maximum acceptable differences, the multiprobe is removed for non-routine maintenance.
- When calibrating the multiprobe, values of known standard solutions are measured pre and post calibration, to help determine if the instrument's measurements have "drifted." In addition, repeated measures of these solutions are used to determine the repeatability of multiprobe measures.

- All multiprobe data is visually checked for outliers and QC issues immediately following the download of data. QC issues indicated by the data may include: wiper parking, defective sensors, power supply problems, and other anomalies affecting data quality.
- Quantitative and qualitative terms that describe how accurate data need to be in order to meet project objectives are discussed in detail in SOP #12 Starkey et al. 2008 and Appendix D in this report. NPS WRD lists the following data quality objectives as necessary for water chemistry data: target population, representativeness, completeness, data comparability, measurement sensitivity and detection limits, measurement precision as repeatability, and measurement systematic error/bias.

More detailed QA/QC for water quality multiprobes is contained in SOP #6 and 12, Starkey et al. 2008.

Discharge

Water discharge was determined by data available from a United States Geological Survey (USGS) real time gauging site. For Lapwai Creek, the closest gage is near the town of Lapwai, ID, #13342450. This data was used to aid in the interpretation of continuous water chemistry data collected June – November 2014. No USGS gauging station exists on Jim Ford Creek.

Macroinvertebrates

On both Jim Ford and Lapwai Creeks, macroinvertebrates were collected at designated sample reaches (3 on Jim Ford Creek, 1 on Lapwai Creek) by the United States Forest Service-PACFISH/INFISH Biological Opinion (PIBO) Effectiveness Monitoring Program during the assessment of stream channel characteristics. This assessment was completed as part of the UCBNs stream channel characteristics monitoring protocol. Macroinvertebrates were collected from 8 fast water habitats (riffles, runs) in each sample reach. These 8 samples were combined for a single composite sample per reach. For more information on the PIBO macroinvertebrate sampling design see Heitke et al. (2008).

Results

Jim Ford Creek-Weippe Prairie

Water Chemistry

Cross Section Survey:

A cross section survey was conducted at the proposed multiprobe deployment location to evaluate if the site was reasonably representative of stream conditions throughout the park. As suggested by the water resource division the UCBN judges overall representativeness primarily on the basis of specific conductance (Starkey et al. 2008).

The 2014 deployment location provided adequate water depth throughout the field season, was easily accessible, and was away from heavily trafficked access points. There are limited other deployment locations along the creek due to frequent visitor use and lack of pools.

A one way analysis of variance (ANOVA) test was conducted to evaluate representativeness (R v3.1.2). Results of the ANOVA showed that there was a significant difference for specific conductance among the transects and the deployment location in June $F(4,41)=19.14$, $p < 0.05$ and in September $F(4,42)= 5151$, $p < 0.05$.

To determine where the difference in representativeness occurred, a post hoc Tukey's test was conducted (R v3.1.2). Relative to specific conductance, results of the Tukey's test for the cross section conducted in June indicates that the deployment location was significantly different from transects 1, 2, 3, and 4 (Figure 6). Results of the Tukey's test for the cross section conducted in September indicated that the deployment location was significantly different from transects 2, 3, and 4 (Figure 7).

While both cross section surveys indicate the monitoring station may not have been the most representative of conditions downstream, both physical and hydrological factors limit the utility of these surveys. During the September survey, surface flow had ceased and each cross section transect was within a distinct isolated pool of varying depth. Specific conductance may have varied between pools due to differential rates of evaporation between pools. The second factor influencing the utility of this data was that during each cross section survey the substrate (very fine clay particles) was disturbed and remained suspended during the survey. Given that the monitoring location was within the largest and deepest pool in the park, it represents the best/only location suitable for permanent deployment. If a cross section was completed during periods of persistent surface flow (difficult due to water depth) the results would likely indicate that the deployment location is representative of conditions throughout the park.

In the future, this location will likely remain the best option for long term deployment of the water quality monitor. In addition, cross section surveys should continue because they offer interesting insight into stream flow and water quality dynamics that might not otherwise be apparent.

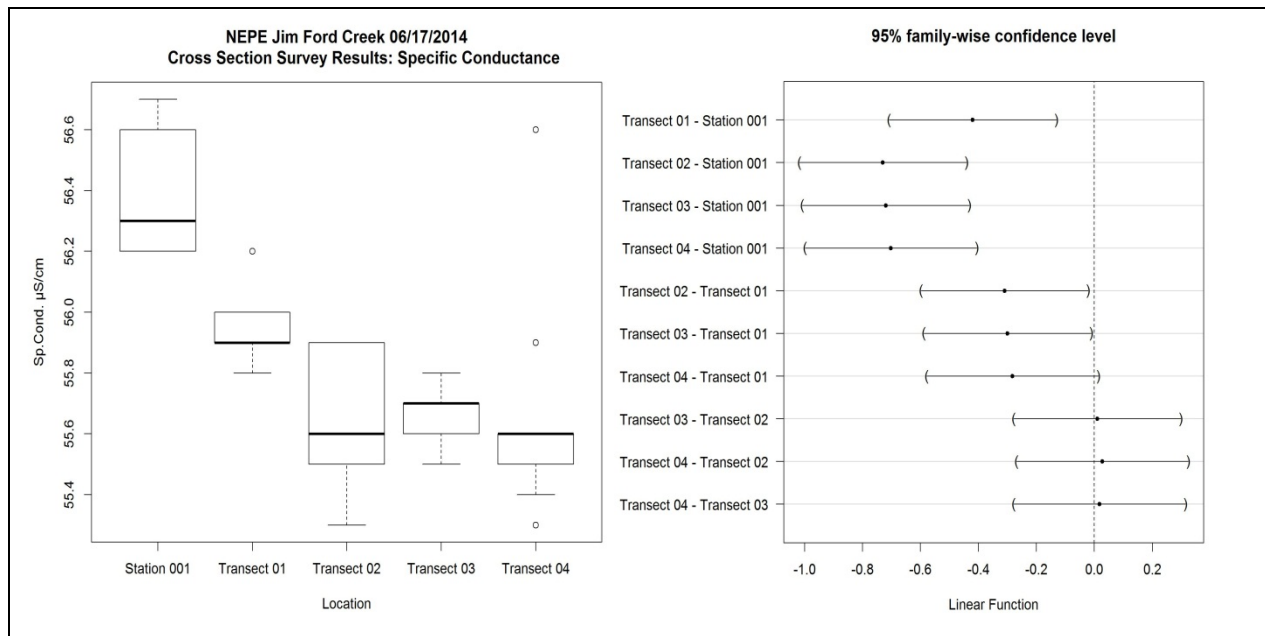


Figure 6. June 2014 cross section survey of Jim Ford Creek, box plot of specific conductance and plot of 95% family-wise confidence level.

Note that “Station 01” is the location of multiprobe deployment and transects progress downstream (1-4).

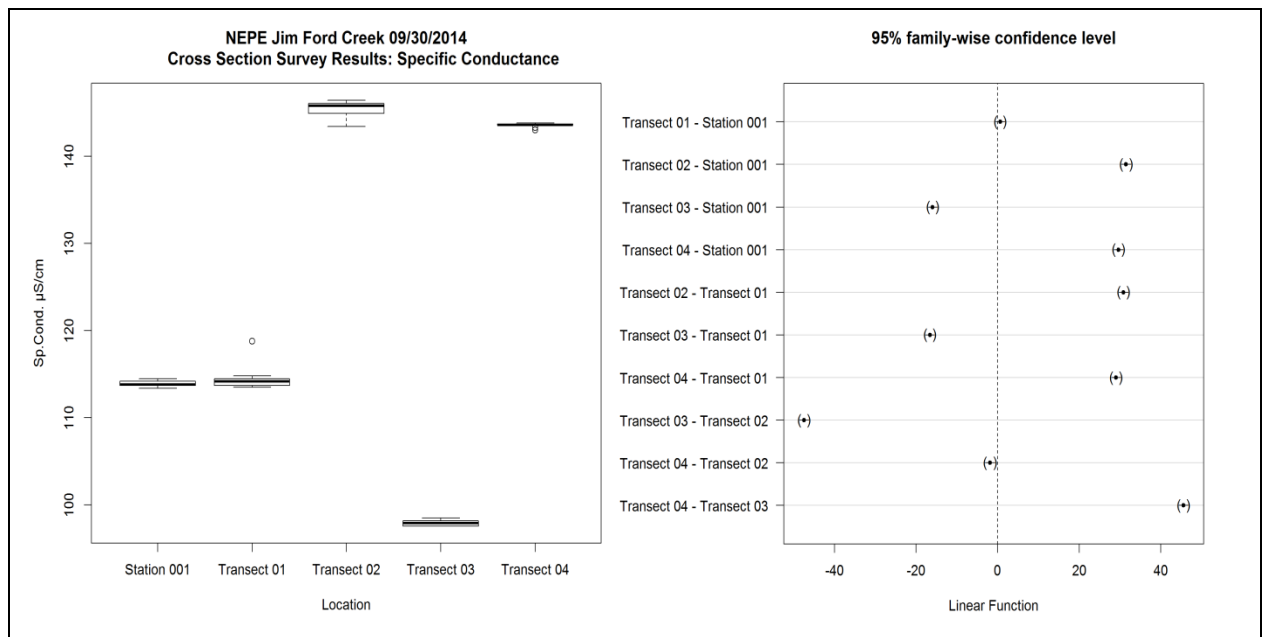


Figure 7. September 2014 cross section survey of Jim Ford Creek, box plot of specific conductance and plot of 95% family-wise confidence level.

Note that “Station 01” is the location of multiprobe deployment and transects progress downstream (1-4).

Status:

Condition of core water quality parameters (2014) along with the corresponding Idaho DEQ regulatory threshold are given in Table 1. For comparison, the condition of core water quality parameters as observed in 2011 are given in Table 2 and Figure 8. The primary concern is elevated water temperatures and their effect on native fish and other cold water biota. Each parameter is discussed in further detail below.

Table 1. Vital sign summary table for water chemistry in Jim Ford Creek June-November, 2014.

Jim Ford Creek Water Chemistry Summary 2014			
Measure	Current Condition (June-November, 2014)	State DEQ Thresholds ^a	% Exceedance ^b
Temperature (*MDMT, **MDAT)	* MDMT= 24.16 °C ** MDAT= 22.77 °C	<22 °C ^d **MDAT<19 °C	7% ^d
			30%
Specific conductance (mean)	95.6 µS/cm	N/A	N/A
Dissolved oxygen (mean daily min)	5.34 mg/l	> 6.0 mg/l	30%
pH (mean daily max)	7.58 pH Units	9.0 pH Units, Max	0%
pH (mean daily min)	7.13 pH Units	6.5 pH Units, Min	0%
Turbidity (mean daily max)	-- ^c	< 50 NTU over background (instantaneous) < 25 for 10 consecutive days	Insufficient data

*MDMT – Maximum Daily Maximum Temperature, **MDAT – Maximum Daily Average Temperature,

^a Mix of TMDLs and criteria for cold water life designation ^b Proportion of samples above water quality standard ^c Poor data quality precludes reporting, see turbidity section below for more details ^d Previously (2011) reported the threshold as MDMT<22 °C; however, instantaneous values should be < 22 °C.

0-5% exceedance	5-25% exceedance	>25% exceedance
-----------------	------------------	-----------------

Table 2. Vital sign summary table for water chemistry in Jim Ford Creek June-October, 2011.

Jim Ford Creek Water Chemistry Summary 2011			
Measure	Current Condition (June-October, 2011)	State DEQ Thresholds ^a	% Exceedance ^b
Temperature (*MDMT, **MDAT)	* MDMT= 22.26 °C ** MDAT= 21.68 °C	<22 °C ^d **MDAT<19 °C	1% ^d
			42%
Specific conductance (mean)	108.7 µS/cm	N/A	N/A
Dissolved oxygen (mean daily min)	6.6 mg/l	> 6.0 mg/l	1 %
pH (mean daily max)	7.36 pH Units	9.0 pH Units, Max	0%
pH (mean daily min)	7.12 pH Units	6.5 pH Units, Min	0%
Turbidity (mean daily max)	-- ^c	< 50 NTU over background (instantaneous) < 25 for 10 consecutive days	Insufficient data

*MDMT – Maximum Daily Maximum Temperature, **MDAT – Maximum Daily Average Temperature,

^a Mix of TMDLs and criteria for cold water life designation ^b Proportion of samples above water quality standard ^c Poor data quality precludes reporting, see turbidity section below for more details ^d Previously (2011) reported the threshold as MDMT<22 °C; however, instantaneous values should be < 22 °C.

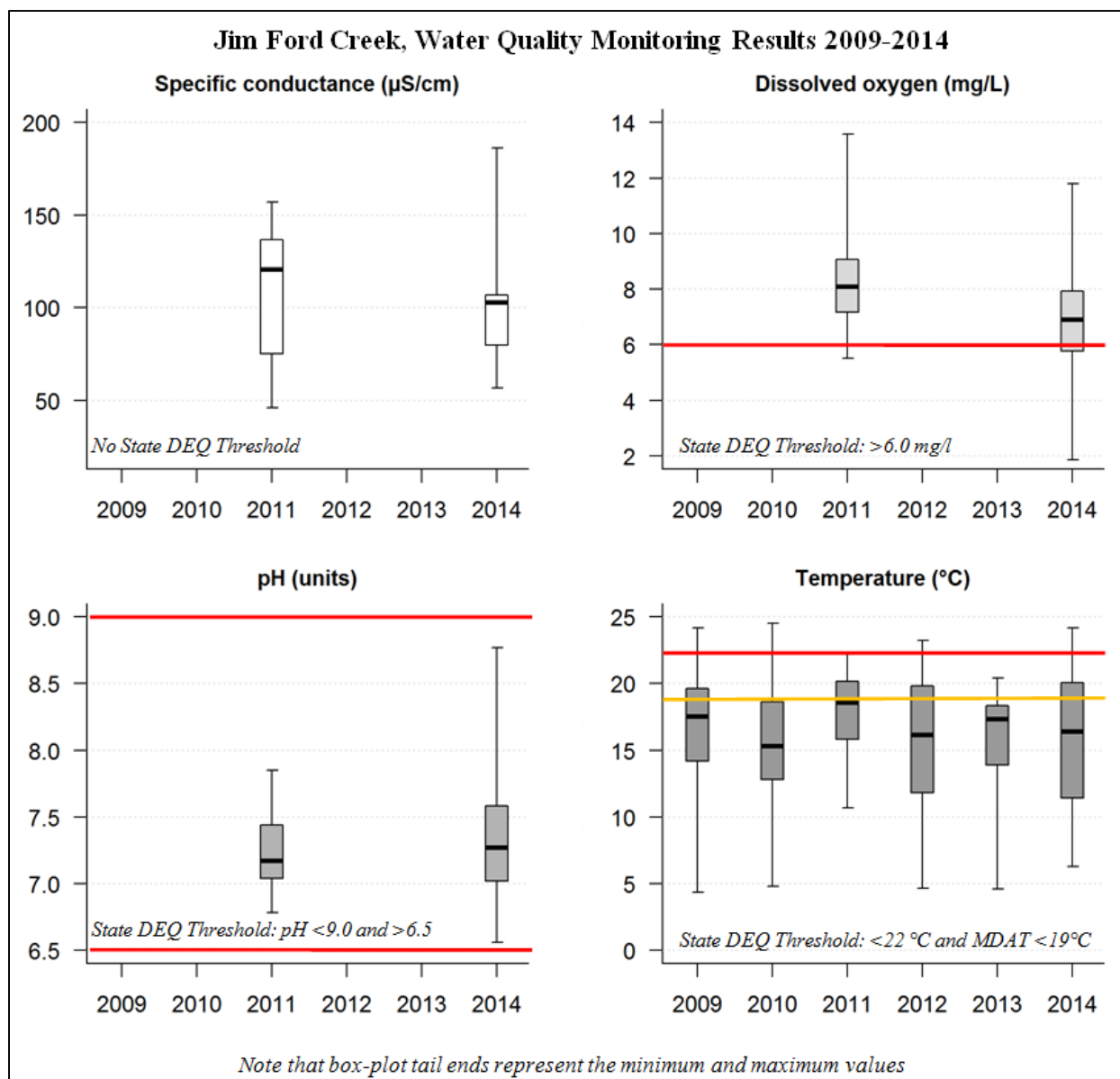


Figure 8. Jim Ford Creek, water quality monitoring results box-plot 2009-2014.

Temperature:

In 2014, water temperature exceeded 22.0 °C in 7% of observations and the maximum daily average temperature (MDAT) exceeded 19 °C in 30% of observations. Data from 2014 is consistent with that collected during water temperature monitoring 2009-2013 (Table 3). Our data reinforces basin-wide temperature concerns as discussed in the Jim Ford Creek Total Maximum Daily Load (TMDL) (ID DEQ, Nez Perce Tribe EPA 2000). Figure 9 shows the daily maximum and mean daily temperatures in Jim Ford Creek from June-November 2014. Table 4 lists the data rating/grade for each deployment period (monthly interval). These standard USGS ratings are based on the degree of sensor fouling and drift encountered during each deployment period (Wagner et al. 2006; Starkey et al. 2008).

Water temperatures are of particular interest in Jim Ford Creek, given that its designated use includes cold water communities. Implications of elevated water temperatures may include decreased salmonid recruitment, decreased salmonid health, and potential shifts in fish and benthic macroinvertebrate communities (Vannote and Sweeney 1980; McCullough 1999). It is also important to note that elevated water temperatures have the capacity to reduce the total concentration of dissolved oxygen (i.e., there is an inverse relationship between water temperature and dissolved oxygen; Figure 11), thereby impacting aquatic biota.

Maintaining water temperatures suitable for naturally occurring species in Jim Ford Creek will depend on stream flow regime, and riparian/stream channel conditions basin-wide. For this reason cooperation with other agencies, stakeholders, and adjacent landowners will be critical for improving water temperature.

Table 3. Water temperature summary table for Jim Ford Creek 2009-2014.

Monitoring Dates	State DEQ Threshold	% Exceedance	MDMT °C	MDAT °C
06/17/2014-11/07/2014*	>22 °C	7.2	24.16	22.77
	MDAT >19 °C	30.0		
06/01/2013-10/24/2013**	>22 °C	0.0	20.41	19.53
	MDAT >19 °C	10.3		
06/01/2012-10/26/2012**	>22 °C	0.8	23.26	21.79
	MDAT >19 °C	38.5		
06/18/2011-10/06/2011*	>22 °C	1.1	22.26	21.68
	MDAT >19 °C	41.8		
01/01/2010-10/08/2010**	>22 °C	0.6	24.53	22.76
	MDAT >19 °C	8.6		
05/29/2009-12/31/2009**	>22 °C	7.3	24.17	23.23
	MDAT >19 °C	22.1		

* Collected with Hydrolab, ** Collected with HOBO Pro v2.0 temperature logger, MDMT – Maximum Daily Maximum Temperature, MDAT – Maximum Daily Average Temperature

0-5% exceedance	5-25% exceedance	>25% exceedance
-----------------	------------------	-----------------

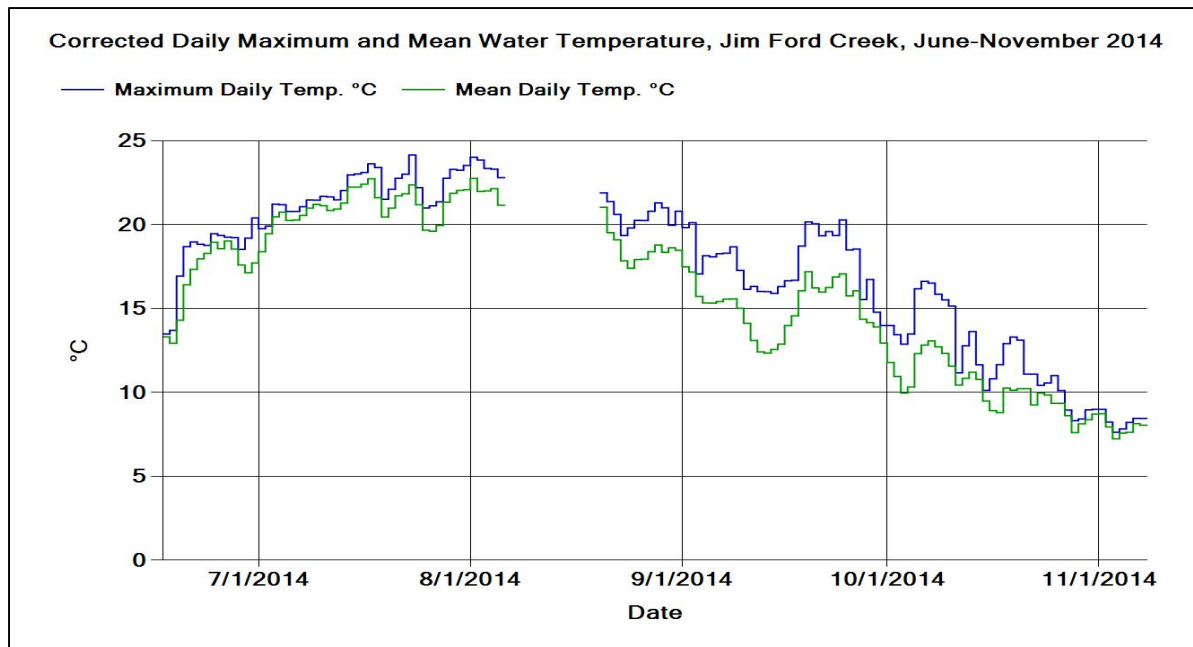


Figure 9. Daily maximum and mean water temperature in Jim Ford Creek, NEPE, 2014.

Table 4. Data grade/rating for water temperature each deployment period June–November 2014 in Jim Ford Creek, NEPE.

Temperature Data Grade/Rating	From UTC-07:00	To UTC-07:00
GOOD	06/17/2014 15:00	07/08/2014 10:00
FAIR	07/08/2014 16:00	08/05/2014 10:00
GOOD	08/20/2014 13:00	09/02/2014 10:00
GOOD	09/02/2014 15:00	09/30/2014 09:00
POOR	09/30/2014 17:00	11/07/2014 10:00

Specific Conductance:

Specific conductance ranged from 56.7 to 186.3 $\mu\text{S}/\text{cm}$, with an average specific conductance of 95.6 $\mu\text{S}/\text{cm}$. The steady increase in specific conductance shown in Figure 10 reflects the cessation of surface flow and subsequent drop in water level associated with evaporation throughout the summer. The spike and rapid decrease in early November corresponds to a rain event. Table 5 shows the data rating/grade for each deployment period (monthly interval). These standard USGS ratings are based on the degree of sensor fouling and drift encountered during each deployment period (Wagner et al. 2006; Starkey et al. 2008).

Corrections that have been applied to the specific conductance data are listed in Appendix E.

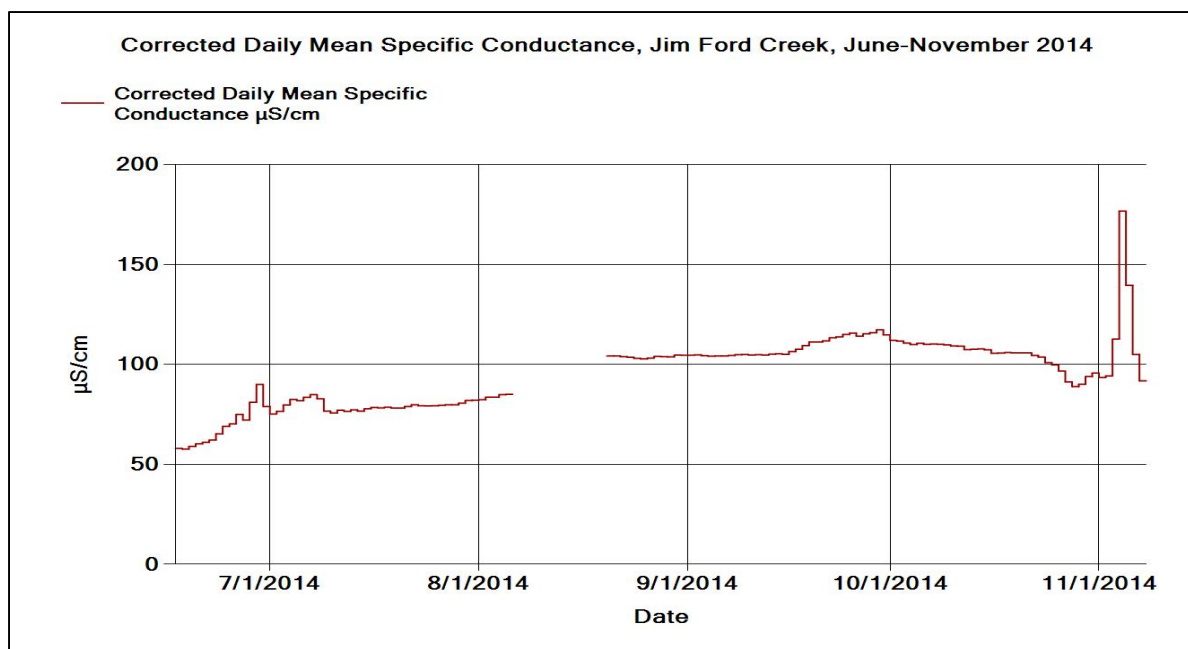


Figure 10. Corrected daily mean specific conductance in Jim Ford Creek, NEPE, 2014.

Table 5. Data grade/rating for specific conductance each deployment period June-November 2014 in Jim Ford Creek, NEPE.

Specific Conductance Data Grade/Rating	From UTC-07:00	To UTC-07:00
EXCELLENT	06/17/2014 15:00	07/08/2014 10:00
GOOD	07/08/2014 16:00	08/05/2014 10:00
EXCELLENT	08/20/2014 13:00	09/02/2014 10:00
EXCELLENT	09/02/2014 15:00	09/30/2014 09:00
EXCELLENT	09/30/2014 17:00	11/07/2014 10:00

Dissolved Oxygen:

Mean daily minimum dissolved oxygen was 5.34 mg/L and dipped below the regulatory threshold (6.0 mg/L) during 30% of observations. Dissolved oxygen was below the regulatory threshold with more regularity than in 2011, when only 1% of observations were below 6.0mg/l. In general, minimum dissolved oxygen levels corresponded to maximum water temperatures (Figure 11). However, qualitative observations indicate that in 2014 there was more aquatic vegetation (long-leaf pondweed- *Potamogeton nodosus*) at the deployment site. Decaying aquatic vegetation at high temperatures may have contributed to low dissolved oxygen levels.

Table 6 shows the data rating/grade for each deployment period (monthly interval). These standard USGS ratings are based on the degree of sensor fouling and drift encountered during each deployment period (Wagner et al. 2006; Starkey et al. 2008). Data grades of “poor” were generally due to heavy fouling. Corrections applied to the dissolved oxygen data are listed in Appendix E. The gap in the data (all parameters) in August was caused by the failure of the dissolved oxygen sensor during calibration on 8/5/2014. Following repair by the Hach Company, the instrument was re-deployed on 8/20/2014.

The nutrient and dissolved oxygen TMDL for Jim Ford Creek are combined due to the assumption that low dissolved oxygen levels are generally being driven by excess instream nutrients (nitrogen and phosphorous) (ID DEQ, Nez Perce Tribe EPA 2000). While the UCBN’s monitoring did not directly measure nutrients, the dissolved oxygen data suggests that eutrophication may play a role in depressing dissolved oxygen levels in the portion of Jim Ford Creek within the Weippie Prairie unit.

Frequent low dissolved oxygen levels in Jim Ford Creek pose a threat to native cold water aquatic biota, especially when coupled with elevated water temperatures.

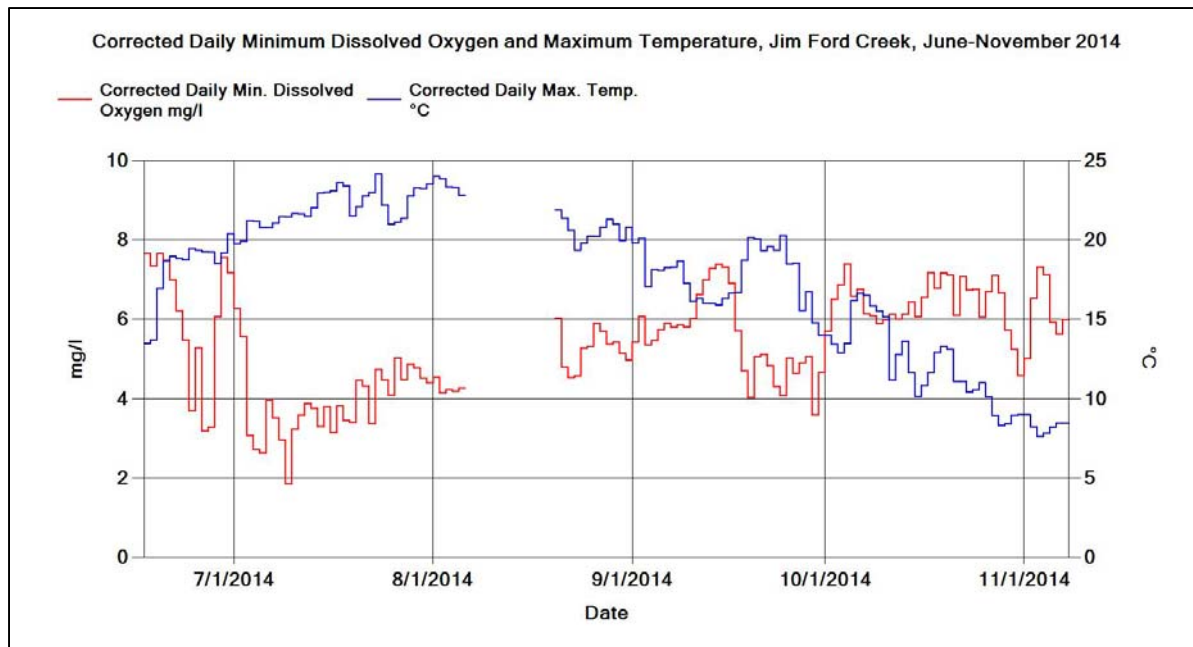


Figure 11. Corrected daily minimum dissolved oxygen and daily maximum temperature in Jim Ford Creek, NEPE, 2014.

Table 6. Data grade/rating for dissolved oxygen each deployment period June-November 2014 in Jim Ford Creek, NEPE.

Dissolved Oxygen Data Grade/Rating	From UTC-07:00	To UTC-07:00
POOR	06/17/2014 15:00	07/08/2014 10:00
GOOD	07/08/2014 16:00	08/05/2014 10:00
POOR	08/20/2014 13:00	09/02/2014 10:00
POOR	09/02/2014 15:00	09/30/2014 09:00
EXCELLENT	09/30/2014 17:00	11/07/2014 10:00

pH:

The minimum and maximum pH (6.6 and 8.8 respectively) were never outside the acceptable regulatory thresholds of 6.5-9.0 pH units and the median (7.3 pH units) was well within this range. Figure 12 shows the daily maximum, minimum, and median pH in Jim Ford Creek from June-November 2014. Table 7 shows the data rating/grade for each deployment period (monthly interval). These standard USGS ratings are based on the degree of sensor fouling and drift encountered during each deployment period (Wagner et al. 2006; Starkey et al. 2008). Data grades less than “excellent” were due to a combination of sensor fouling and drift. Corrections applied to the pH data are listed in Appendix E.

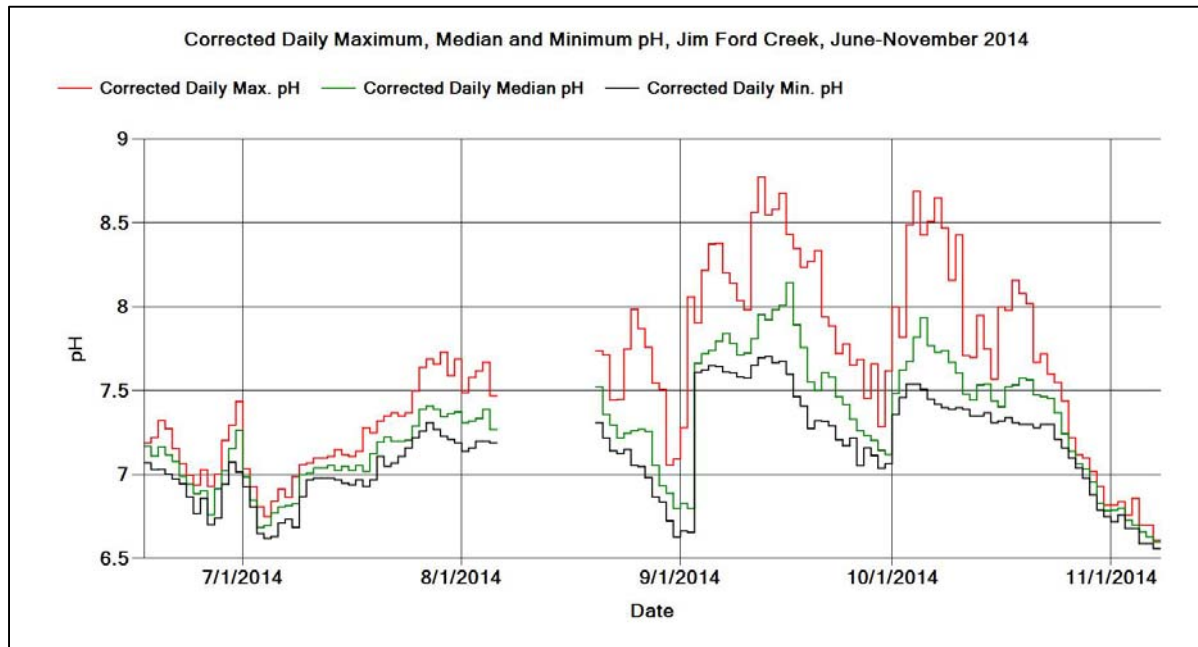


Figure 12. Corrected daily maximum, minimum, and median pH in Jim Ford Creek, NEPE, 2014.

Table 7. Data grade/rating for pH each deployment period June-November 2014 in Jim Ford Creek, NEPE.

pH Data Grade/Rating	From UTC-07:00	To UTC-07:00
GOOD	06/17/2014 15:00	07/08/2014 10:00
EXCELLENT	07/08/2014 16:00	08/05/2014 10:00
POOR	08/20/2014 13:00	09/02/2014 10:00
GOOD	09/02/2014 15:00	09/30/2014 09:00
EXCELLENT	09/30/2014 17:00	11/07/2014 10:00

Turbidity:

Prior to discussion about turbidity in Jim Ford Creek (Figure 13), it should be noted that conclusions based on this data are limited due to extremely poor/unusable data quality (Table 8). Sensor fouling due to sediment and sensor drift (possibly associated with the dissolved oxygen sensor failure) were the primary factors influencing data quality. It is important to note that the method detection limit (MDL) for this sensor was 0.2 NTU and the minimum level of quantitation (ML) was 0.64 NTU (Appendix D). Figure 13 shows the raw (uncorrected) daily mean turbidity in the Jim Ford Creek from June-November 2014. Raw values were graphed because the program used to manage the water quality data (AQUAIRUS) will only graph corrected data if it has a data grade better than “unusable” (i.e., Poor–Excellent). Corrections that were applied to turbidity data are listed in Appendix E.

Data indicates that mean daily turbidity ranged from <0.2 to 956 NTU. However, due to poor data quality and lack of historic data for this site the UCBN is unable to determine if conditions exceeded the state standard. Regulatory thresholds for turbidity state that it should be “< 50 NTU over background (instantaneous) and < 25 NTU for 10 consecutive days.” Although conclusions are limited based on the quality of data collected in 2014, it is likely that Jim Ford Creek does experience relatively high levels of turbidity in part due to historic/current land use and historic stream channel modifications.

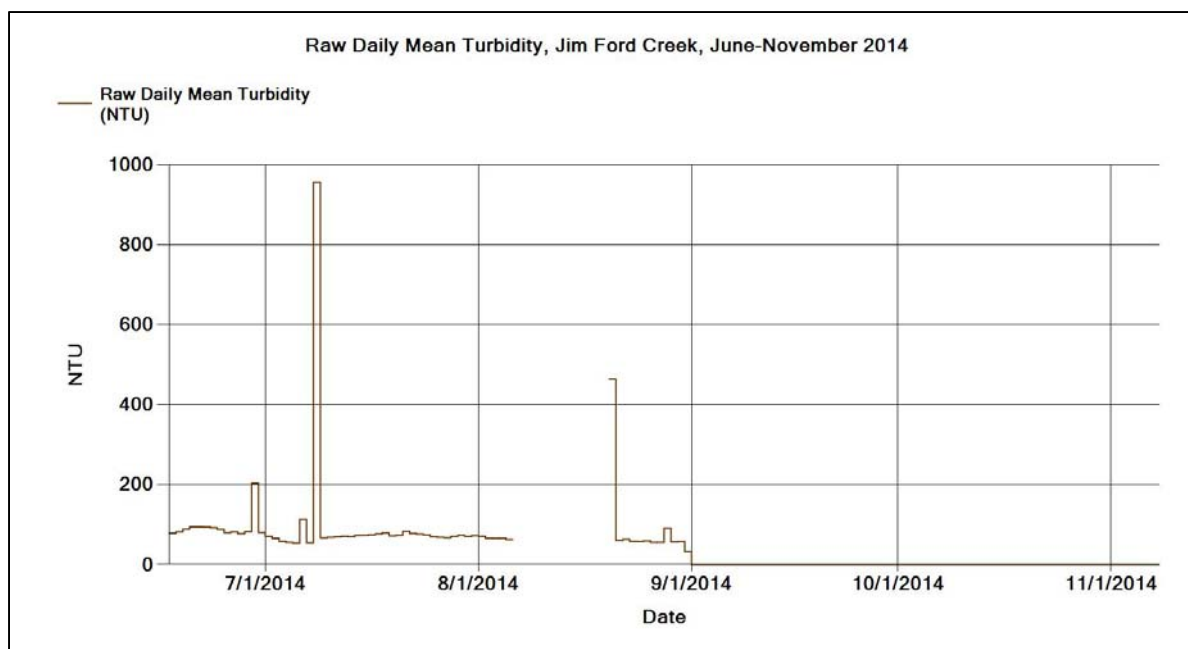


Figure 13. Raw daily mean turbidity in Jim Ford Creek, NEPE, 2014.

Table 8. Data grade/rating for turbidity each deployment period June-November 2014 in Jim Ford Creek, NEPE.

Turbidity Data Grade/Rating	From UTC-07:00	To UTC-07:00
UNUSABLE	06/17/2014 15:00	07/08/2014 10:00
UNUSABLE	07/08/2014 16:00	08/05/2014 10:00
UNUSABLE	08/20/2014 13:00	09/02/2014 10:00
UNUSABLE	09/02/2014 15:00	09/30/2014 09:00
UNUSABLE	09/30/2014 17:00	11/07/2014 10:00

Macroinvertebrates

Status:

The Hilsenhoff Biotic Index (HBI), which summarizes pollution tolerances of the macroinvertebrate taxa within the sample, indicated variability across sites in Jim Ford Creek. A single site had an HBI of 4.01 and indicated “possible slight organic pollution” and “very good” water quality (Hilsenhoff 1988). In contrast, two other sites had HBI values of 5.58 and 5.96 and indicated “fairly substantial [organic] pollution likely” and “substantial [organic] pollution likely.” Water quality for these two sites was categorized as “fair” to “fairly poor” (Hilsenhoff 1988). HBI values generally increase (HBI ranges from 0.0 to 10.0) as nutrient enrichment increases. While HBI is most sensitive to organic pollution, it may also respond to sediment loading, low dissolved oxygen and elevated water temperatures. Based on other observations, it seems likely that factors other than organic pollution may be influencing HBI values in Jim Ford Creek. The US Forest Service (USFS) community tolerance quotient was between 104 and 108 and indicates that Jim Ford Creek’s benthic macroinvertebrate community is severely impaired. Values of the USFS tolerance quotient range from 20 to just over 100, with lower values indicating better water quality. The observed to expected ratio (OE) for all three sample reaches was 0.12 with a condition rating of poor.

In a single sample reach, the maximum number of Ephemeroptera, Plecoptera, Trichoptera (EPT) taxa was 2; there were a maximum of 2 long lived taxa; and the dominate family was Chironomidae (non-biting midges). See Table 9 and Appendix F for additional summary metrics.

These data along with the tolerance indices listed above suggest that Jim Ford Creek is impaired. Observations in 2014 were consistent with those from monitoring in 2011. Causes of impairment may be tied to elevated water temperatures, lack of summer stream flow, or sedimentation.

Table 9. Vital sign summary table for benthic macroinvertebrates in Jim Ford Creek, 2014.

Note that the abbreviations are those found in the PIBO MS-Access database.

Jim Ford Creek Macroinvertebrate Summary August 2014				
PIBO Station		3115	3116	3118
Sample ID		153325	153318	153317
Richness*	RICH	3	14	6
Shannon's Diversity*	SHDIVER	0.53	1.87	0.68
Simpson's Diversity*	SIDIVER	0.27	0.80	0.41
Evenness*	Evenness	0.48	0.71	0.38
# of EPT Taxa*	EPTT	0	2	0
Dominant Family	DFAMILY	Chironomidae	Chironomidae	Chironomidae
Dominant Taxa	dtaxonomy	Chironominae	Orthoclaadiinae	Chironominae
Hilsenhoff Biotic Index*	tv1	5.58	4.01	5.96
# of Intolerant Taxa*	HBIINT1	0	0	0
# of Tolerant Taxa*	HBITOL1	0	2	1
USFS Community Tolerance Quotient (d)*	ctqd	108	104	107
# of shredder taxa*	sht	0	0	0
# of scraper taxa*	sct	0	1	0
# of collector-filterer taxa*	cft	0	2	1
# of collector-gatherer taxa*	cgt	2	9	3
# of predator taxa*	prt	1	2	1
# of clinger taxa*	clinger	0	0	0
Long-lived Taxa*	LLTaxa	0	2	1

Lapwai Creek- Spalding

Water Chemistry:

Cross Section Survey:

A cross section survey was conducted at the proposed multiprobe deployment location to evaluate if the site was reasonably representative of stream conditions throughout the park. As suggested by the water resource division the UCBN judges overall representativeness primarily on the basis of specific conductance (Starkey et al. 2008).

The 2014 deployment location (Station #02) provided adequate water depth throughout the field season, was easily accessible, and was away from heavily trafficked access points.

A one way analysis of variance (ANOVA) test was conducted to evaluate representativeness (R v3.1.2). Results of the ANOVA showed that there was a significant difference for specific conductance among the transects and the deployment location in June $F(4,42) = 25.76$, $p < 0.05$ and a significant difference in October $F(4,40) = 8.79$, $p < 0.05$.

To determine where the difference in representativeness occurred, a post hoc Tukey's test was conducted (R v3.1.2). Relative to specific conductance, results of the Tukey's test for the cross section survey conducted in June indicates that the deployment location was significantly different from transect 3 and 4 (Figure 14). Results of the Tukey's test for the cross section survey conducted in October indicates that the deployment location was significantly different from transect 4 (Figure 15).

It should be noted that transects 3 and 4 occurred at or just upstream of the two bridges within the park. Reasons for the difference between the deployment location and transects 3 and 4 appeared to be related to the influence of these bridges. During the cross section survey, specific conductance was notably different near these structures.

In summary, the deployment location was less representative of upstream conditions than desirable; however, there are currently no other suitable pools within the park for deployment. In addition, the deployment location is likely more representative of conditions downstream (i.e., away from the bridges). In the future, the UCBN may consider a cross section survey in the opposite direction (i.e., downstream of deployment location) to determine if this is a valid assumption.

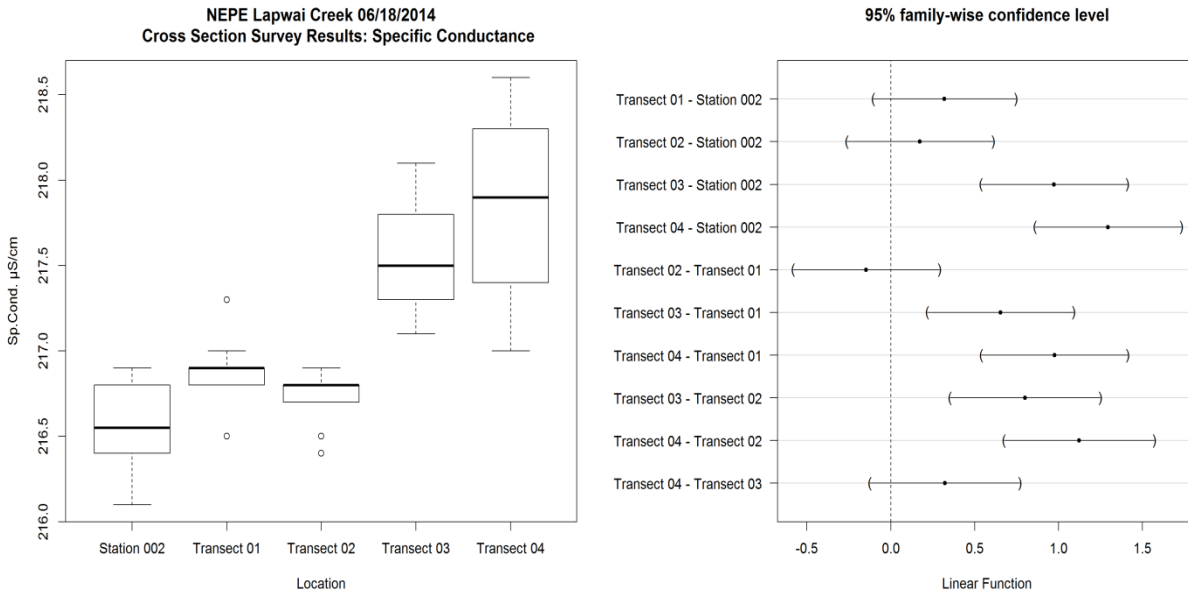


Figure 14. June 2014 cross section survey of Lapwai Creek, box-plot of specific conductance and plot of 95% family-wise confidence level. Note that “Station 02” is the location of multiprobe deployment and the transects progress upstream (1-4).

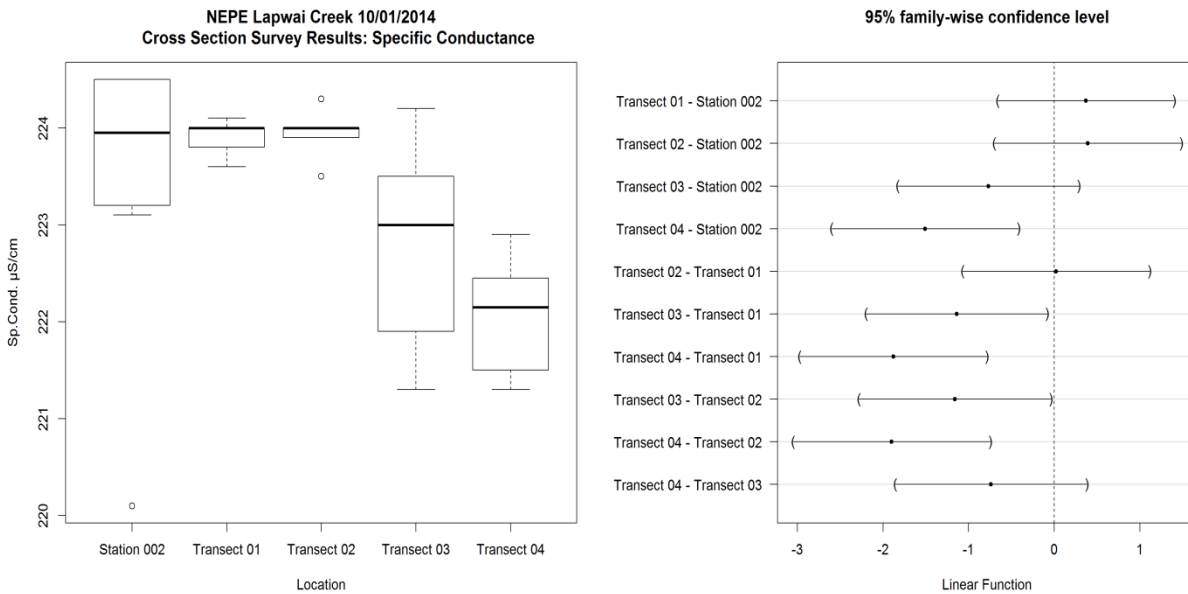


Figure 15. October 2014 cross section survey of Lapwai Creek, box-plot of specific conductance and plot of 95% family-wise confidence level. Note that “Station 02” is the location of multiprobe deployment and the transects progress upstream (1-4).

Status:

Condition of core water quality parameters (2014) along with the corresponding Idaho DEQ regulatory threshold are given in Table 10 and Figure 16. For comparison, the condition of core water quality parameters as observed in 2011 are given in Table 11. As in Jim Ford Creek, the primary concern in Lapwai Creek is elevated water temperature and its effect on native salmonids. In addition, Lapwai Creek occasionally exceeded the upper pH criteria which may have a detrimental effect on native aquatic biota.

Table 10. Vital sign summary table for water chemistry in Lapwai Creek, June-November, 2014.

Lapwai Creek Water Chemistry Summary 2014			
Measure	Current Condition (June-November, 2014)	State DEQ Thresholds ^a	% Exceedance ^b
Temperature (*MDMT, **MDAT)	* MDMT= 26.59 °C ** MDAT= 22.81 °C	<22 °C ^d **MDAT<19 °C	13% ^d
			32%
Specific conductance (mean)	214.39 µS/cm	N/A	N/A
Dissolved oxygen (mean daily min)	8.13 mg/L	> 6.0 mg/L	0%
pH (mean daily max)	8.6 pH Units	9.0 pH Units, Max	2%
pH (mean daily min)	7.7 pH Units	6.5 pH Units, Min	0%
Turbidity (mean daily max)	22.5 NTU ^c	< 50 NTU over background (instantaneous) < 25 for 10 consecutive days	Insufficient data

*MDMT – Maximum Daily Maximum Temperature, **MDAT – Maximum Daily Average Temperature, ^aCriteria for cold water life designation, ^bProportion of samples above water quality standard, ^cMean daily max based on 2 months of data due to poor data quality, ^dPreviously (2008 and 2011) reported the threshold as MDMT<22 °C; however, instantaneous values should be < 22 °C.

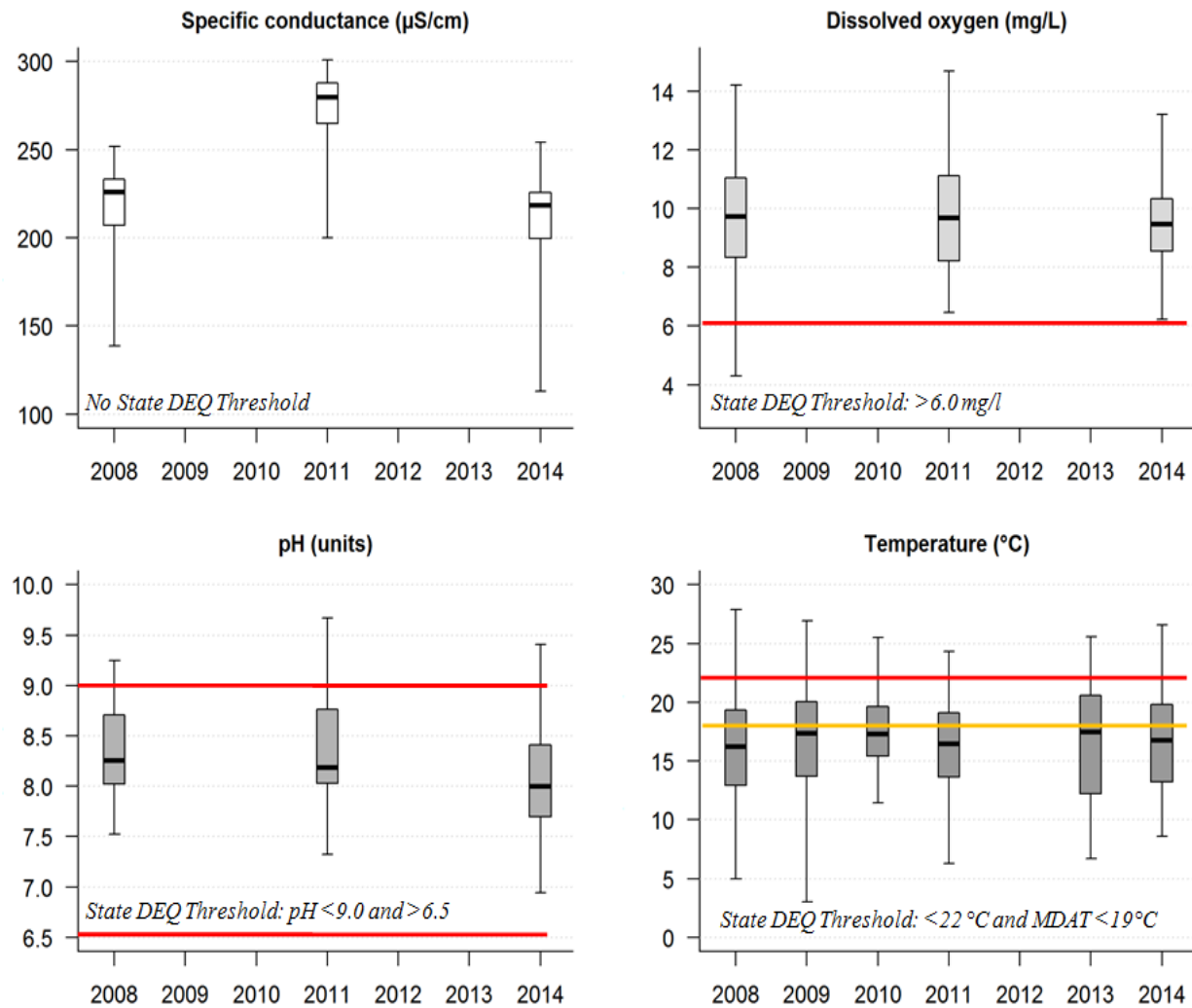
0-5% exceedance	5-25% exceedance	>25% exceedance
-----------------	------------------	-----------------

Table 11. Vital sign summary table for water chemistry in Lapwai Creek, June-November, 2011.

Lapwai Creek Water Chemistry Summary 2011			
Measure	Current Condition (June-November, 2011)	State DEQ Thresholds ^a	% Exceedance ^b
Temperature (*MDMT, **MDAT)	* MDMT= 24.31 °C ** MDAT= 21.04 °C	<22 °C ^d **MDAT<19 °C	6% ^d
			17%
Specific conductance (mean)	273.19 µS/cm	N/A	N/A
Dissolved oxygen (mean daily min)	8.24 mg/L	> 6.0 mg/L	0%
pH (mean daily max)	9.0 pH Units	9.0 pH Units, Max	14%
pH (mean daily min)	7.9 pH Units	6.5 pH Units, Min	0%
Turbidity (mean daily max)	104 NTU ^c	< 50 NTU over background (instantaneous) < 25 for 10 consecutive days	Insufficient data

*MDMT – Maximum Daily Maximum Temperature, **MDAT – Maximum Daily Average Temperature, ^aCriteria for cold water life designation, ^bProportion of samples above water quality standard ^cMean daily max based on 2 months of data due to poor data quality, ^dPreviously (2008 and 2011) reported the threshold as MDMT<22 °C; however, instantaneous values should be < 22 °C.

Lapwai Creek, Water Quality Monitoring Results 2008-2014



Note that box-plot tail ends represent the minimum and maximum values

Figure 16. Lapwai Creek, water quality monitoring results box-plot 2008-2014.

Temperature:

In 2014, water temperature exceeded 22.0 °C in 13% of observations and the maximum daily average temperature (MDAT) exceeded 19 °C in 32% of observations. Data from 2014 is consistent with that collected during water temperature monitoring 2008-2013 (Figure 16 and Table 12). Our data reinforces basin-wide temperature concerns as mentioned in the 1998 303(d) list, Lapwai Creek Aquatic Assessment (Cichosz et al. 2001), and Lapwai Creek Watershed Ecological Restoration Strategy (Richardson et al. 2009). Figure 17 shows the daily maximum and mean daily temperatures in Lapwai Creek from June-November 2014. Table 13 lists the data rating/grade for each deployment period (monthly interval). These standard USGS ratings are based on the degree of sensor fouling and drift encountered during each deployment period (Wagner et al. 2006; Starkey et al. 2008).

Water temperatures are of particular interest in Lapwai Creek, given that its designated use includes cold water biota and that it provides habitat for the following anadromous fish species: steelhead (*Oncorhynchus mykiss*), chinook salmon (*Oncorhynchus tshawytscha*), coho salmon (*Oncorhynchus kisutch*), and lamprey (*Lamprreta tridentate*) (Richardson et al. 2009). Implications of elevated water temperatures may include decreased salmonid recruitment, decreased salmonid health, and potential shifts in fish and benthic macroinvertebrate communities (Vannote and Sweeney 1980; McCullough 1999). It is also important to note that elevated water temperatures have the capacity to reduce the total concentration of dissolved oxygen (i.e., there is an inverse relationship between water temperature and dissolved oxygen; Figure 19), thereby impacting aquatic biota.

Maintaining water temperatures suitable for naturally occurring species in Lapwai Creek will depend on stream flow regime, and riparian/stream channel conditions basin-wide. For this reason cooperation with other agencies, stakeholders, and adjacent landowners will be critical for improving water temperature.

Table 12. Water temperature summary table for Lapwai Creek 2008-2014.

Monitoring Dates	State DEQ Threshold	% Exceedance	MDMT °C	MDAT °C
06/16/2008-11/01/2008*	>22 °C	12.1	27.88	22.95
	MDAT >19 °C	31.8		
06/01/2009-12/31/2009**	>22 °C	9.2	26.97	23.30
	MDAT >19 °C	21.6		
01/01/2010-10/07/2010**	>22 °C	10.0	25.53	21.75
	MDAT >19 °C	31.2		
06/01/2011-10/07/2011**	>22 °C	5.7	24.31	21.04
	MDAT >19 °C	17.1		
07/30/2013-10/25/2013**	>22 °C	13.7	25.60	22.79
	MDAT >19 °C	51.7		
06/01/2014-11/03/2014**	>22 °C	14.0	26.50	22.74
	MDAT >19 °C	38.3		

* Collected with Hydrolab, **Collected with HOBO Pro v2.0 temperature logger, MDMT – Maximum Daily Maximum Temperature, MDAT – Maximum Daily Average Temperature

0-5% exceedance 5-25% exceedance >25% exceedance

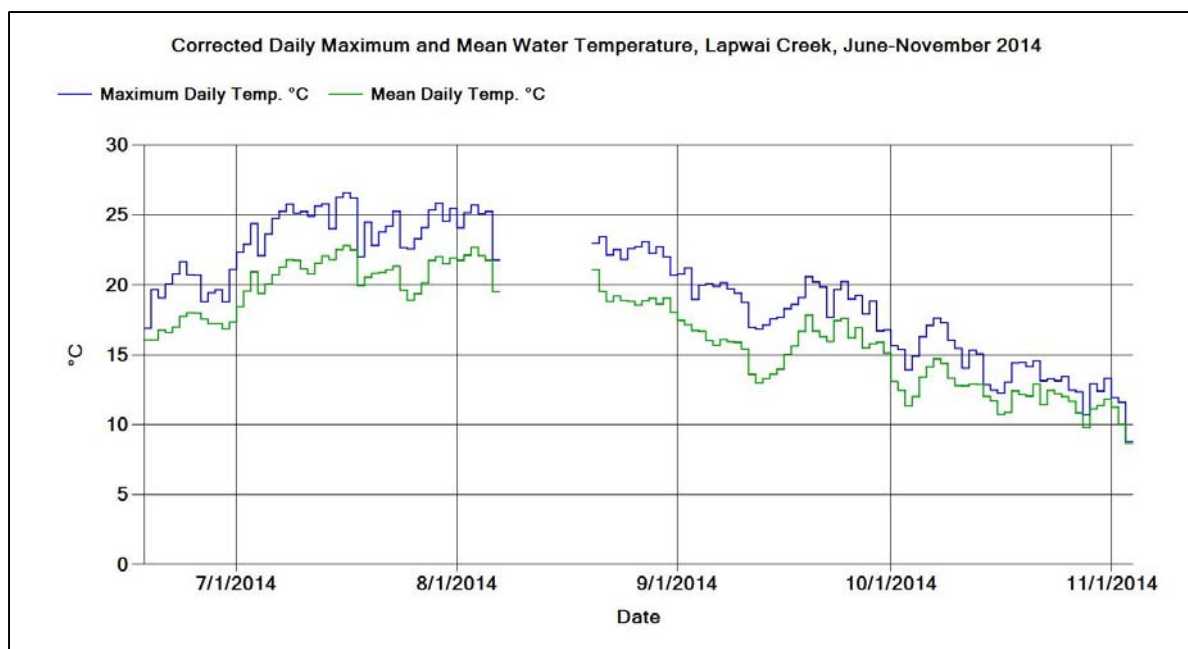


Figure 17. Daily maximum and mean water temperature in Lapwai Creek, NEPE, 2014.

Table 13. Data grade/rating for water temperature each deployment period June-November 2014 in Lapwai Creek, NEPE.

Temperature Data Grade/Rating	From UTC-07:00	To UTC-07:00
GOOD	06/18/2014 15:00	07/09/2014 09:00
EXCELLENT	07/09/2014 13:00	08/06/2014 08:00
EXCELLENT	08/20/2014 15:00	09/04/2014 08:00
GOOD	09/04/2014 13:00	10/01/2014 08:00
EXCELLENT	10/01/2014 18:00	11/03/2014 09:00

Specific Conductance:

Specific conductance ranged from 113.0 to 254.4 $\mu\text{S}/\text{cm}$, with an average specific conductance of 214.39 $\mu\text{S}/\text{cm}$ (Figure 18). Table 14 shows the data rating/grade for each deployment period (monthly interval). These standard USGS ratings are based on the degree of sensor fouling and drift encountered during each deployment period (Wagner et al. 2006; Starkey et al. 2008). Specific conductance data grades less than “excellent” were due to a mix of sensor drift and fouling. Corrections that have been applied to the specific conductance data are listed in Appendix E.

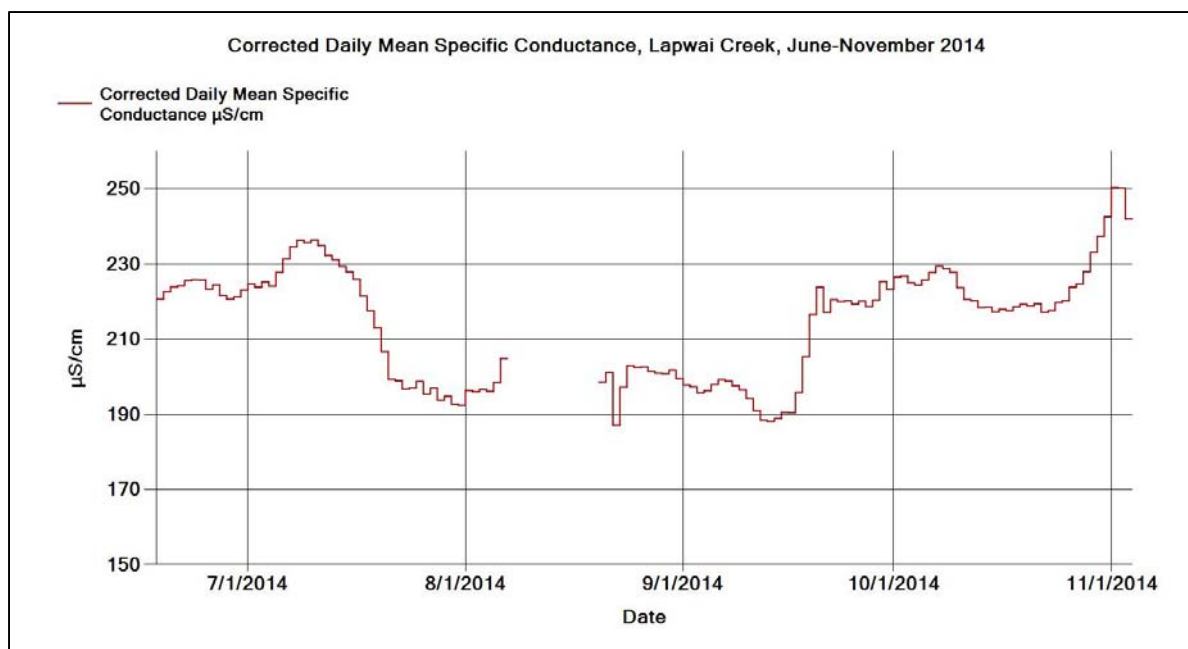


Figure 18. Corrected daily mean specific conductance in Lapwai Creek, NEPE, 2014.

Table 14. Data grade/rating for specific conductance each deployment period June-November 2014 in Lapwai Creek, NEPE.

Specific Conductance Data Grade/Rating	From UTC-07:00	To UTC-07:00
EXCELLENT	06/18/2014 15:00	07/09/2014 09:00
GOOD	07/09/2014 13:00	08/06/2014 08:00
EXCELLENT	08/20/2014 15:00	09/04/2014 08:00
GOOD	09/04/2014 13:00	10/01/2014 08:00
FAIR	10/01/2014 18:00	11/03/2014 09:00

Dissolved Oxygen:

Mean daily minimum dissolved oxygen was 8.13 mg/l and was never below the regulatory threshold (6.0 mg/l). Dissolved oxygen levels were similar to those observed in both 2011 and 2008. Figure 19 shows the daily minimum dissolved oxygen and maximum temperatures in Lapwai Creek from June-November 2014. Table 15 shows the data rating/grade for each deployment period (monthly interval). These standard USGS ratings are based on the degree of sensor fouling and drift encountered during each deployment period (Wagner et al. 2006; Starkey et al. 2008). Data grades less than “excellent” were due to a mix of sensor drift and fouling. Corrections that have been applied to the dissolved oxygen data are listed in Appendix E. The gap in the data (all parameters) in August was caused by the failure of the dissolved oxygen sensor during calibration on 8/6/2014. Following repair by the Hach Company, the instrument was re-deployed on 8/20/2014.

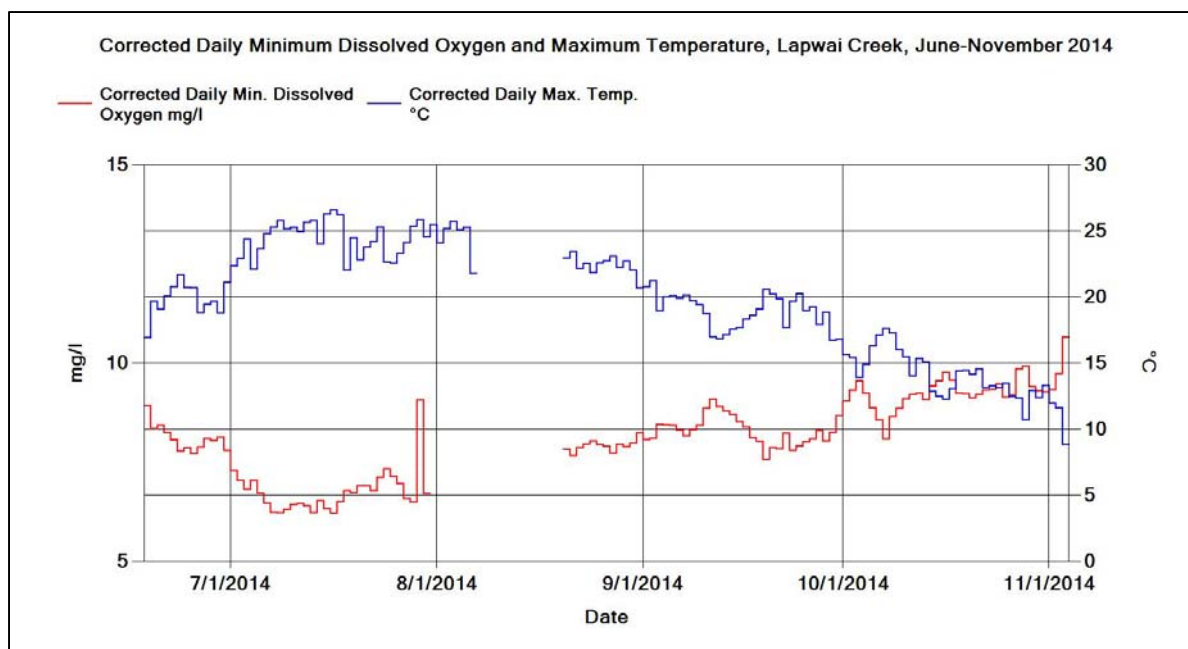


Figure 19. Corrected daily minimum dissolved oxygen and daily maximum temperature in Lapwai Creek, NEPE, 2014.

Table 15. Data grade/rating for dissolved oxygen each deployment period June-November 2014 in Lapwai Creek, NEPE.

Dissolved Oxygen Data Grade/Rating	From UTC-07:00	To UTC-07:00
GOOD	06/18/2014 15:00	07/09/2014 09:00
GOOD	07/09/2014 13:00	08/06/2014 08:00
EXCELLENT	08/20/2014 15:00	09/04/2014 08:00
EXCELLENT	09/04/2014 13:00	10/01/2014 08:00
GOOD	10/01/2014 18:00	11/03/2014 09:00

pH:

The minimum and maximum pH was 6.94 and 9.41 pH units respectively. pH exceeded the upper threshold of 9.0 pH units in 2% of observations. It should be noted that in 2011, pH exceeded the upper pH criteria (9.0 pH units) in 14% of observations. No observations fell below the lower pH threshold (6.5 pH units). Figure 20 shows the daily maximum, minimum, and median pH in Lapwai Creek from June-November 2014. Table 16 shows the data rating/grade for each deployment period (monthly interval). These standard USGS ratings are based on the degree of sensor fouling and drift encountered during each deployment period (Wagner et al. 2006; Starkey et al. 2008). Data grades less than “excellent” were due to a combination of sensor fouling and sensor drift. Corrections that have been applied to the pH data are listed in Appendix E.

Elevated pH may be cause for concern as it may indicate pollution from an upstream source. With 3 years of monitoring data, it appears that pH exceedances have held steady and have not increased. Subsequent monitoring of pH in future years will help definitively determine how pH is trending (up, down or stable).

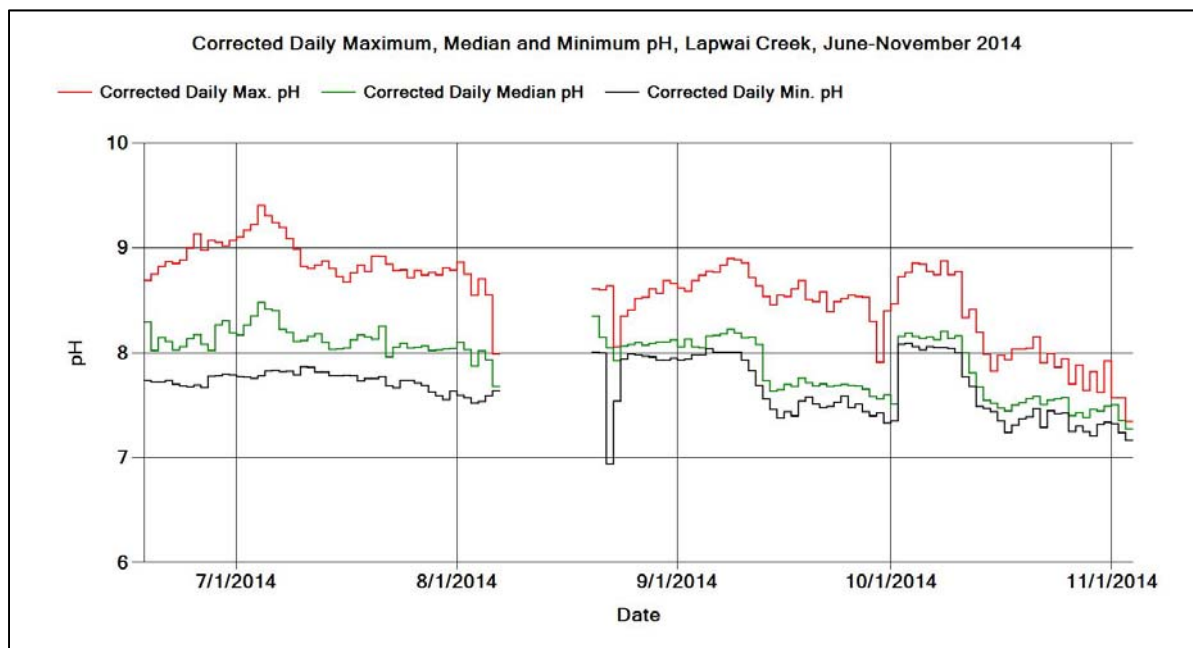


Figure 20. Corrected daily maximum, minimum and median pH in Lapwai Creek, NEPE, 2014.

Table 16. Data grade/rating for pH each deployment period June-November 2014 in Lapwai Creek, NEPE.

pH Data Grade/Rating	From UTC-07:00	To UTC-07:00
FAIR	06/18/2014 15:00	07/09/2014 09:00
GOOD	07/09/2014 13:00	08/06/2014 08:00
EXCELLENT	08/20/2014 15:00	09/04/2014 08:00
EXCELLENT	09/04/2014 13:00	10/01/2014 08:00
GOOD	10/01/2014 18:00	11/03/2014 09:00

Turbidity:

Prior to discussion about turbidity in Lapwai Creek, it should be noted that conclusions based on this data are limited due to marginal data quality (Figure 21, Table 17). A combination of sensor fouling and drift influenced data quality. It is important to note that the method detection limit (MDL) for this sensor was 0.2 NTU and the minimum level of quantitation (ML) was 0.64 NTU (Appendix D). Figure 21 shows the daily mean turbidity in Lapwai Creek from June-November 2014. Corrections that have been applied to turbidity data are listed in Appendix E. Data indicates that turbidity ranged from <0.2 to 126.5 NTU. However, field observations and stream discharge indicated that peak turbidity likely occurred while the instrument was out of the water for repair of the dissolved oxygen sensor (8/6-8/20).

Due to poor data quality and lack of historic data for this site the UCBN is unable to determine if conditions exceeded state criteria. Regulatory thresholds for turbidity state that it should be “< 50 NTU over background (instantaneous) and < 25 NTU for 10 consecutive days.” Although conclusions are limited based on the quality of data collected in 2014 it is likely that Lapwai Creek does experience pulses of turbidity due to upstream agricultural activity and road work.

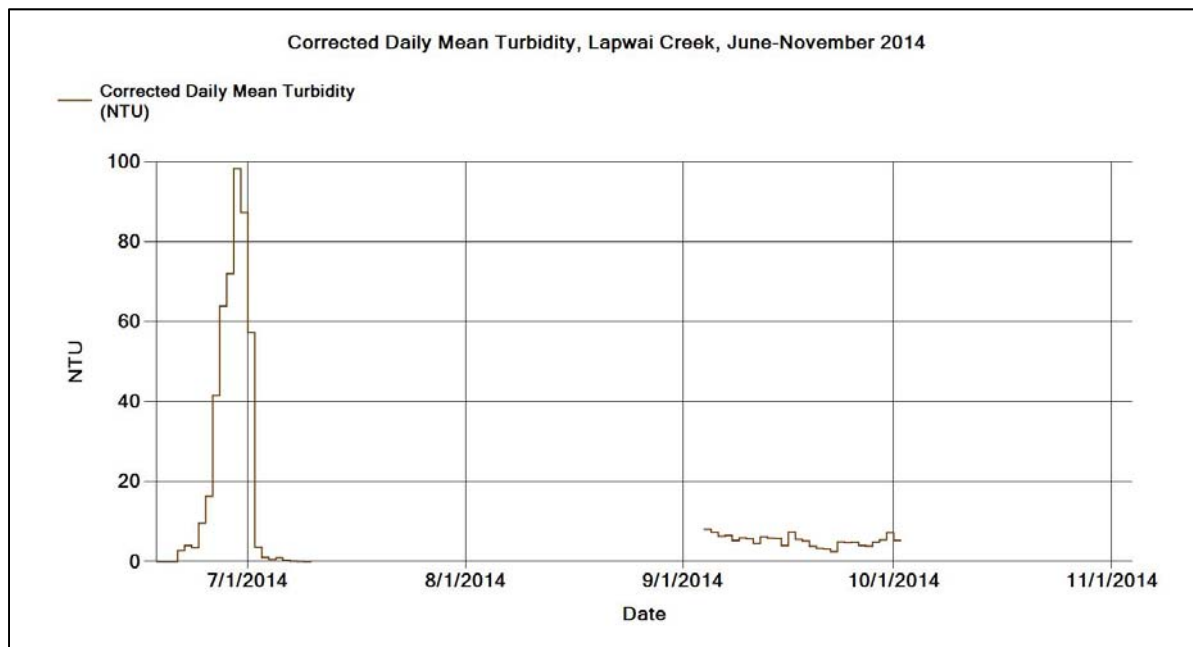


Figure 21. Corrected daily mean turbidity in Lapwai Creek, NEPE, 2014.

Table 17. Data grade/rating for turbidity each deployment period June-November 2014 in Lapwai Creek, NEPE.

Turbidity Data Grade/Rating	From UTC-07:00	To UTC-07:00
POOR	06/18/2014 15:00	07/09/2014 09:00
UNUSABLE	07/09/2014 13:00	08/06/2014 08:00
UNUSABLE	08/20/2014 15:00	09/04/2014 08:00
EXCELLENT	09/04/2014 13:00	10/01/2014 08:00
UNUSABLE	10/01/2014 18:00	11/03/2014 09:00

Macroinvertebrates

Status:

The Hilsenhoff Biotic Index (HBI), which summarizes pollution tolerances of the macroinvertebrate taxa within the sample, indicates that in Lapwai Creek “organic pollution [was] unlikely” and that water quality was “excellent” (HBI= 3.70) (Hilsenhoff 1988). This was substantially different from the 2011 HBI (5.17), which indicated that fairly substantial organic pollution was likely and that water quality was fair. HBI values generally increase (HBI ranges from 0.0 to 10.0) as nutrient enrichment increases. While HBI is most sensitive to organic pollution, it may also respond to sediment loading, low dissolved oxygen and elevated water temperatures. The US Forest Service (USFS) community tolerance quotient was 86 and indicates that Lapwai Creek is impaired. Values of the USFS tolerance quotient range from 20 to just over 100, with lower values indicating better water quality. The observed to expected ratio (OE) for this sample reach was 0.35 and indicated that Lapwai Creek was in “poor” condition. However, due to physiographic and climatic conditions at the sample location the model had to extrapolate rather than interpolate predictor variables. As a result the condition rating should be interpreted with caution. The number of Ephemeroptera, Plecoptera, Trichoptera (EPT) taxa was 8; there were 2 long lived taxa; and the dominate family was Baetidae (small minnow mayflies).

These data suggest that Lapwai Creek was in slightly better condition than in 2011, yet has room for improvement. Causes of impairment may be tied to elevated water temperatures, and pH. Stream channel characteristics monitoring did not point to any single physical factor (substrate size, bank stability, bank erosion, etc.) that could have resulted in improvements to the benthic assemblages since 2011. See Table 23 and Appendix F for additional summary metrics.

Table 18. Vital sign summary table for benthic macroinvertebrates in Lapwai Creek, 2014.

Note that the abbreviations are those found in the PIBO MS-Access database.

Lapwai Creek Macroinvertebrate Summary June 2014		
PIBO Station		3114
Sample ID		153324
Richness*	RICH	16
Shannon's Diversity*	SHDIVER	1.70
Simpson's Diversity*	SIDIVER	0.75
Evenness*	Evenness	0.61
# of EPT Taxa*	EPTT	8
Dominant Family	DFAMILY	Baetidae
Dominant Taxa	dtaxonomy	Baetis
Hilsenhoff Biotic Index*	tv1	3.70
# of Intolerant Taxa*	HBIINT1	3
# of Tolerant Taxa*	HBITOL1	0
USFS Community Tolerance Quotient (d)*	ctqd	86
# of shredder taxa*	sht	0
# of scraper taxa*	sct	1
# of collector-filterer taxa*	cft	3
# of collector-gatherer taxa*	cgt	7
# of predator taxa*	prt	3
# of clinger taxa*	clinger	5
Long-lived Taxa*	LLTaxa	2

Literature Cited

- Barbour, M. T., J. Gerritsen, B. D. Snyder, and J. B. Stribling. 1999. Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates and Fish, Second Edition. EPA 841-B-99-002. U.S. Environmental Protection Agency.
- Cichosz, T., A. Davidson, C. Rabe, and D. Saul. 2001. Lapwai Creek aquatic assessment. Center for Environmental Education. Washington State University. Pullman, WA. (http://www.nezperceswcd.org/Portals/2/DocumentLibrary/Publications/Lapwai_Aquatic_Assessment.pdf). Accessed 27 January 2014.
- Clark, K. 2005. Jim Ford Creek water quality monitoring report 2003-2004. Technical Results Summary KPC-JF-05. Idaho Association of Soil Conservation Districts. Moscow, ID.
- Erixson J. A., J. Bell, and D. Hinson. 2010. Natural resource condition assessment: Nez Perce National Historic Park. Natural Resource Technical Report NPS/UCBN/NRTR—2010/333. National Park Service, Fort Collins, CO.
- Garrett, L. K., T. J. Rodhouse, G. H. Dicus, C. C. Caudill, and M. R. Shardlow. 2007. Vitals Signs Monitoring Plan, Upper Columbia Basin Network. Natural Resource Report NPS/PWR/UCBN/NRR—2007/002. National Park Service, Fort Collins, CO.
- Heitke, J. D., E. J. Archer, D. D. Dugaw, B. A. Bouwes, E. A. Archer, R. C. Henderson, J. L. Kershner. 2008. Effectiveness monitoring for streams and riparian areas: sampling protocol for stream channel attributes. PACFISH/INFISH- Biological Opinion Effectiveness Monitoring Program (PIBO-EM). Logan, UT. (<http://www.fs.fed.us/biology/fishecology/emp>). Accessed 27 January 2014.
- Hilsenhoff, W. L. 1988. Rapid field assessment of organic pollution with a family-level biotic index. *Journal of the North American Benthological Society*, 7:65–68.
- Idaho Administrative Code. 2014. Idaho administrative code-Department of Environmental Quality, IDAPA 58.01.02 water quality standards. Idaho Department of Environmental Quality, Boise, ID. (<http://adminrules.idaho.gov/rules/current/58/0102.pdf>). Accessed 27 January 2014.
- Idaho Department of Environmental Quality (ID DEQ). 2011. Idaho Department of Environmental Quality Final 2010 Integrated Report. ID DEQ. Boise, ID.
- Idaho Department of Environmental Quality (ID DEQ). 2014. Idaho's 2012 integrated report. ID DEQ. Boise, ID.

- Idaho Department of Environmental Quality (ID DEQ), and Nez Perce Tribe Environmental Protection Agency (EPA). 2000. Jim Ford Creek Total Maximum Daily Load Watershed Management Plan. (http://www.deq.idaho.gov/media/454495-water_data_reports_surface_water_tmdls_jim_ford_creek_jim_ford_entire.pdf). Accessed 27 January 2014.
- Irwin, R. J. 2008. Draft Part B lite QA/QC review checklist for aquatic vital sign monitoring protocols and SOPs, National Park Service, Water Resources Division. Fort Collins, CO. (<http://www.nature.nps.gov/water/vitalsigns/assets/docs/PartBLite.pdf>). Accessed 27 January 2014.
- McCullough, D. A. 1999. A review and synthesis of effects of alterations to the water temperature regime on freshwater life stages of salmonids, with special reference to chinook salmon. EPA 910-R-99-010. U.S. Environmental Protection Agency, Washington, DC.
- National Park Service (NPS) 1997. Baseline water quality data inventory and analysis: Nez Perce National Historical Park. NPS/NRWRD/NRTR-97/114. Fort Collins, CO.
- National Park Service (NPS). 1999. Natural resource challenge: the National Park Service's action plan for preserving natural resources. US Department of the Interior National Park Service, Washington D.C.
- National Park Service (NPS). 2000. Strategic plan FY 2001-2005. NPS D-1383. US Department of the Interior National Park Service, Washington D.C.
- Richardson, S., L. Rasmussen, and C. Chandler. 2009. Lapwai Creek watershed ecological restoration strategy. Nez Perce Tribe and Nez Perce Soil and Water Conservation District, Lapwai, ID. (http://www.nezperceswcd.org/Portals/2/ISRP/2009_Lapwai_Creek_Ecological_Restoration_Strategy.pdf). Accessed 27 January 2014.
- Starkey, E. N. 2009. Upper Columbia Basin Network integrated water quality annual report 2008: Nez Perce National Historical Park (NEPE) and Whitman Mission National historic Site (WHMI). Natural Resource Technical Report NPS/UCBN/NRTR—2009/214. National Park Service, Fort Collins, CO. (<http://irmafiles.nps.gov/reference/holding/153796>). Accessed 27 January 2014.
- Starkey, E. N. 2012. Upper Columbia Basin Network integrated water quality annual report 2011: Nez Perce National Historical Park (NEPE). Natural Resource Technical Report NPS/UCBN/NRTR—2012/571. National Park Service, Fort Collins, CO. (<http://irmafiles.nps.gov/reference/holding/447878>). Accessed 27 January 2014.
- Starkey, E. N., L. K. Garrett, T. J. Rodhouse, G. H. Dicus, and R. K. Steinhorst. 2008. Upper Columbia Basin Network integrated water quality monitoring protocol: Narrative version 1.0. Natural Resource Report NPS/UCBN/NRR—2008/026. National Park Service, Fort Collins, CO. (<https://irma.nps.gov/App/Reference/Profile/662633>). Accessed 27 January 2014.

- United States EPA. 2001. Environmental Monitoring and Assessment Program (EMAP): National Coastal Assessment Quality Assurance Project Plan 2001-2004. United States Environmental Protection Agency, Office of Research and Development, National Health and Environmental Effects Research Laboratory, Gulf Ecology Division, Gulf Breeze, FL.EPA/620/R-01/002.
- United States EPA. 1995. Environmental Monitoring and Assessment Program (EMAP): Laboratory Methods Manual-Estuaries, Volume 1: Biological and Physical Analyses. U.S. Environmental Protection Agency, Office of Research and Development , Narragansett, RI. EPA/620/R-95/008.
- Vannote, R. L., and B. W. Sweeney. 1980. Geographic analysis of thermal equilibria: a conceptual model for evaluating the effect of natural and modified thermal regimes on aquatic insect communities. *The American Naturalist* **115**: 667–695.
- Wagner, R. J., R. W. Boulger Jr., C. J. Oblinger, and B. A. Smith. 2006. Guidelines and Standard procedures for continuous water-quality monitors: station operation, record computation, and data reporting: U.S. Geological Survey Techniques and Methods 1–D3, 51.

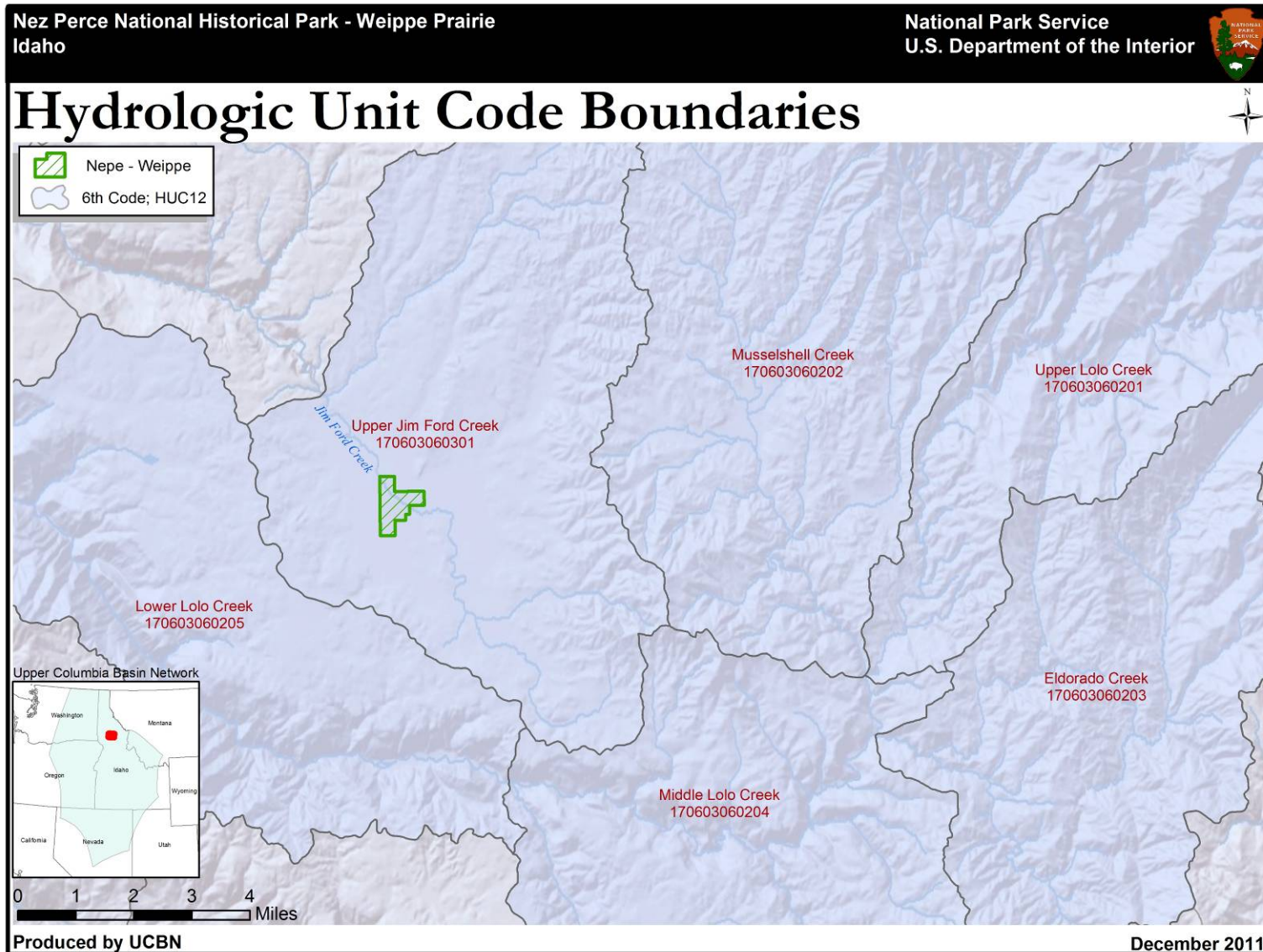
Appendix A. 2014 Water Quality Monitoring Locations



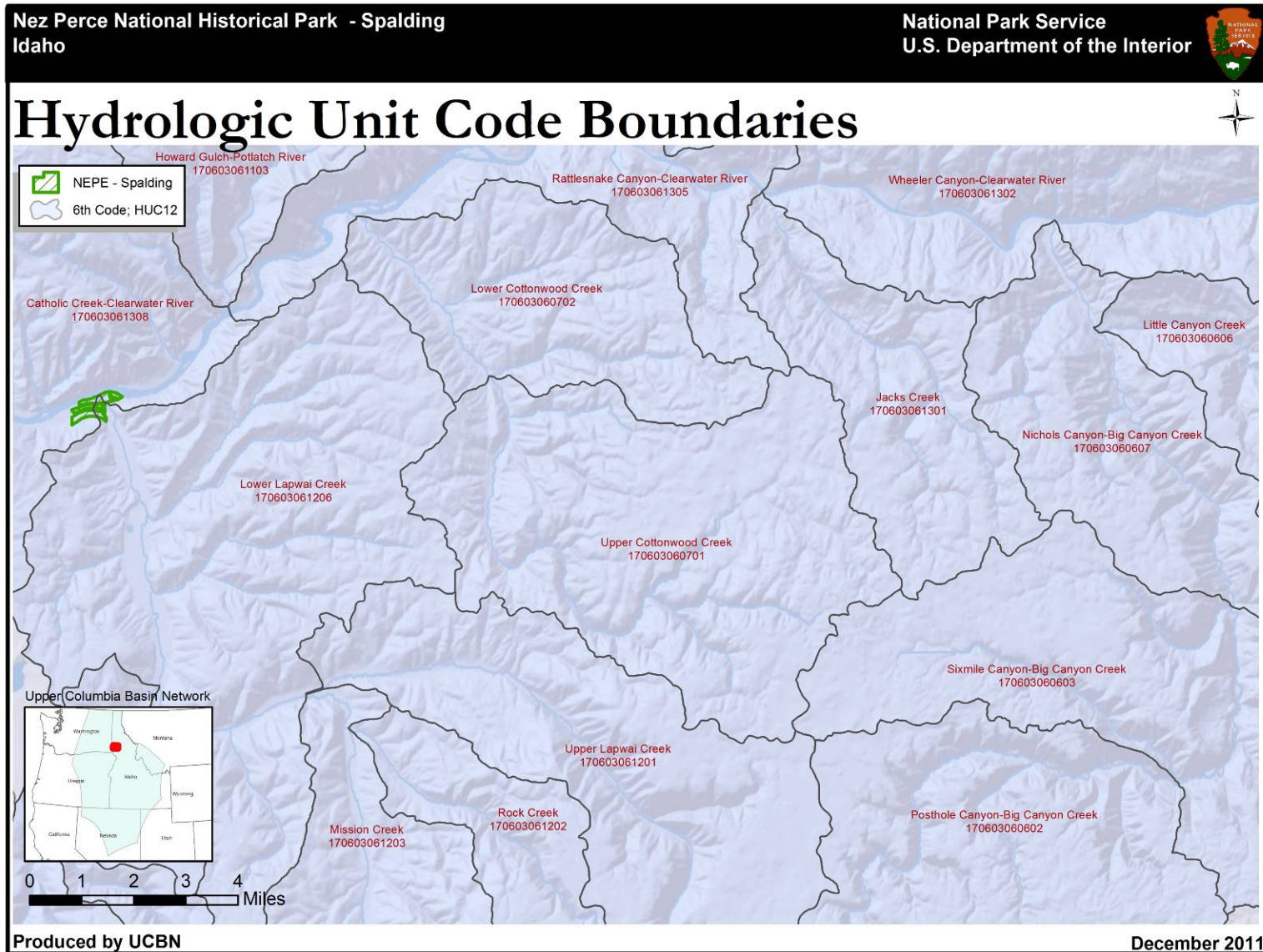
Appendix A. 2014 Water Quality Monitoring Locations (continued)



Appendix B. NEPE Hydrologic Unit Code Boundaries



Appendix B. NEPE Hydrologic Unit Code Boundaries (continued)



Appendix C. Sample Locations for Water Quality Monitoring at NEPE

Park	Stream	Monitoring Type	Station #	Lat.	Long.	Y	X
NEPE	Jim Ford Creek	Water Chemistry	001	46.35429603	-115.91867957	5133980.86	583193.94
NEPE	Lapwai Creek	Water Chemistry	002	46.45001602	-116.819499204	5144065.16	513862.85
NEPE	Jim Ford Creek	Macroinvertebrates	3115	46.36121748	-115.926842	5134742	582554
NEPE	Jim Ford Creek	Macroinvertebrates	3116	46.35968941	-115.9251301	5134574	582688
NEPE	Jim Ford Creek	Macroinvertebrates	3118	46.35689017	-115.9222344	5134266	582915
NEPE	Lapwai Creek	Macroinvertebrates	3114	46.45051829	-116.8179127	5144121	513984

Note that X and Y have been projected in WGS84, UTM Zone 11. These locations were recorded by the field crew with a handheld GPS unit.

Appendix D. Quality Control (QC) Indicators

QC data quality indicators for 2014 season at NEPE, Jim Ford Creek, Hydrolab #064, Station ID: NEPE #001

STORET Name	Units	Detection Range Description From Manufacture	Method Detection Limit (MDL)	Minimum Level of Quantitation (ML)	Alternative Measurement Sensitivity Plus (AMS+) Beginning of Season	Alternative Measurement Sensitivity Plus (AMS+) End of Season	Precision+ (RPD) Beginning of Season	Precision+ (RPD) End of Season
Temperature, water	deg C	-5 to 50°C	N/A	N/A	0.01	0.05	0	0.23
Specific Conductance	µS/cm	0 to 100,000 µS/cm	N/A	N/A	0.83	1.15	0.71	0
Dissolved Oxygen	mg/L	0-20 mg/L	N/A	N/A	0.05	1.37	0.25	3.45
pH	pH units	0-14 Units	N/A	N/A	0.05	0.13	0.42	0
Turbidity	NTU	0-3000 NTU	0.2	0.64	18.68		3.76	

Note that end of season AMS+ and Precision+ could not be calculated for turbidity due to sensor failure.

QC data quality indicators for 2014 season at NEPE, Lapwai Creek, Hydrolab #054, Station ID: NEPE #002

STORET Name	Units	Detection Range Description From Manufacture	Method Detection Limit (MDL)	Minimum Level of Quantitation (ML)	Alternative Measurement Sensitivity Plus (AMS+) Beginning of Season	Alternative Measurement Sensitivity Plus (AMS+) End of Season	Precision+ (RPD) Beginning of Season	Precision+ (RPD) End of Season
Temperature, water	deg C	-5 to 50°C	N/A	N/A	0.16	0.97	0.27	3.07
Specific Conductance	µS/cm	0 to 100,000 µS/cm	N/A	N/A	0.67	5.55	0.05	1.35
Dissolved Oxygen	mg/L	0-20 mg/L	N/A	N/A	0.04	0.37	0.17	1.58
pH	pH units	0-14 Units	N/A	N/A	0.03	0.31	0	1.34
Turbidity	NTU	0-3000 NTU	0.2	0.64	2.36	1.3	17.54	3.7

Appendix E. Corrections History

Correction history for Jim Ford Creek, NEPE 2014 temperature data.

Creator	Comment	From Time	To Time	Applied Time	Points Modified
EStarkey	Drift Correction with Calibration Drift value of 0.020°C and Fouling Drift value of 0.570°C	7/8/2014 16:00	8/5/2014 10:00	8/8/2014 13:13	667
EStarkey	Drift Correction with Calibration Drift value of -0.120°C and Fouling Drift value of 0.830°C	9/30/2014 17:00	11/7/2014 11:00	11/11/2014 14:53	906
EStarkey	Delete point(s) to shift from DST to ST	11/6/2014 1:00	11/6/2014 1:00	11/11/2014 14:54	1
EStarkey	Clock Drift Correction with start offset of -60.000 and end offset of -60.000 to shift from DST to St	11/6/2014 2:00	11/7/2014 11:00	11/11/2014 14:54	33

Correction history for Jim Ford Creek, NEPE 2014 specific conductance data.

Creator	Comment	From Time	To Time	Applied Time	Points Modified
EStarkey	Drift Correction with Calibration Drift value of 8.850µS/cm and Fouling Drift value of 6.000µS/cm	6/17/2014 15:00	7/8/2014 10:00	7/16/2014 9:06	500
EStarkey	Drift Correction with Calibration Drift value of -12.400µS/cm and Fouling Drift value of 1.000µS/cm	7/8/2014 16:00	8/5/2014 10:00	8/8/2014 13:19	667
EStarkey	Delete point(s)- due to outlier	7/15/2014 22:00	7/15/2014 22:00	8/8/2014 13:21	1
EStarkey	Delete point(s)- due to outlier	7/17/2014 12:00	7/17/2014 12:00	8/8/2014 13:22	1
EStarkey	Drift Correction with Calibration Drift value of -7.150µS/cm and Fouling Drift value of -0.200µS/cm	9/30/2014 17:00	11/7/2014 11:00	11/11/2014 14:58	906
EStarkey	Delete point(s) to adjust for DST to ST	11/2/2014 1:00	11/2/2014 1:00	11/11/2014 14:58	1
EStarkey	Clock Drift Correction with start offset of -60.000 and end offset of -60.000 DST to ST	11/2/2014 2:00	11/7/2014 11:00	11/11/2014 14:59	129

Appendix E. Corrections History (continued)

Correction history for Jim Ford Creek, NEPE 2014 dissolved oxygen data.

Creator	Comment	From Time	To Time	Applied Time	Points Modified
EStarkey	Drift Correction with Calibration Drift value of -0.410mg/l and Fouling Drift value of 1.890mg/l	6/17/2014 15:00	7/8/2014 10:00	7/16/2014 9:16	500
EStarkey	Delete point(s) due to outlier	6/22/2014 12:00	6/22/2014 12:00	7/16/2014 9:17	1
EStarkey	Delete point(s) due to outlier	6/24/2014 16:00	6/24/2014 16:00	7/16/2014 9:18	1
EStarkey	Delete point(s) due to outlier	6/27/2014 14:00	6/27/2014 14:00	7/16/2014 9:18	1
EStarkey	Delete point(s) due to outlier	6/26/2014 21:00	6/26/2014 21:00	7/16/2014 9:19	1
EStarkey	Delete point(s) due to outlier	7/3/2014 6:00	7/3/2014 6:00	7/16/2014 9:20	1
EStarkey	Drift Correction with Calibration Drift value of -0.270mg/l and Fouling Drift value of 1.090mg/l	8/20/2014 13:00	9/2/2014 10:00	9/5/2014 10:40	310
EStarkey	Drift Correction with Calibration Drift value of 0.130mg/l and Fouling Drift value of 0.740mg/l	9/2/2014 15:00	9/30/2014 9:00	10/8/2014 11:13	667
EStarkey	Delete point(s) to apply clock shift from DST to ST	11/2/2014 1:00	11/2/2014 1:00	11/11/2014 15:02	1
EStarkey	Clock Drift Correction with start offset of -60.000 and end offset of -60.000 DST to ST	11/2/2014 2:00	11/7/2014 11:00	11/11/2014 15:03	129

Correction history for Jim Ford Creek, NEPE 2014 pH data.

Creator	Comment	From Time	To Time	Applied Time	Points Modified
EStarkey	Drift Correction with Calibration Drift value of 0.216pH and Fouling Drift value of -0.190pH	6/17/2014 15:00	7/8/2014 10:00	7/16/2014 9:26	500
EStarkey	Drift Correction with Calibration Drift value of 0.141pH and Fouling Drift value of -0.860pH	8/20/2014 13:00	9/2/2014 10:00	9/5/2014 10:43	310
EStarkey	Drift Correction with Calibration Drift value of -0.324pH and Fouling Drift value of -0.080pH	9/2/2014 15:00	9/30/2014 9:00	10/8/2014 11:16	667
EStarkey	Delete point(s) to adjust for DST to ST	11/2/2014 1:00	11/2/2014 1:00	11/11/2014 15:06	1
EStarkey	Clock Drift Correction with start offset of -60.000 and end offset of -60.000 DST to ST	11/2/2014 2:00	11/7/2014 11:00	11/11/2014 15:07	129

Appendix E. Corrections History (continued)

Correction history for Jim Ford Creek, NEPE 2014 turbidity data.

Creator	Comment	From Time	To Time	Applied Time	Points Modified
EStarkey	Drift Correction with Calibration Drift value of 15.900NTU and Fouling Drift value of 0.000NTU	6/17/2014 15:00	7/8/2014 10:00	7/16/2014 9:30	500
EStarkey	Delete point(s)- due to outlier	6/29/2014 16:00	6/29/2014 16:00	7/16/2014 9:32	1
EStarkey	Delete point(s)- due to outlier	7/6/2014 15:00	7/6/2014 15:00	7/16/2014 9:32	1
EStarkey	Delete point(s)- due to outlier	6/25/2014 15:00	6/25/2014 15:00	7/16/2014 9:33	1
EStarkey	Delete Region- due to the optic being blocked or wiper parking. Sensor limit 0-3,000 NTU	7/8/2014 16:00	7/8/2014 21:00	8/8/2014 13:41	6
EStarkey	Delete point(s)	8/20/2014 14:00	8/20/2014 14:00	9/5/2014 10:48	1
EStarkey	Delete point(s)- due to outlier	8/28/2014 19:00	8/28/2014 19:00	9/5/2014 10:49	1
EStarkey	Delete Region- outliers appear to be caused by sensor failure.	8/31/2014 14:00	9/2/2014 10:00	9/5/2014 10:51	45
EStarkey	Delete point(s) to apply shift from DST to ST	11/2/2014 1:00	11/2/2014 1:00	11/11/2014 15:10	1
EStarkey	Clock Drift Correction with start offset of -60.000 and end offset of -60.000DST to ST	11/2/2014 2:00	11/7/2014 11:00	11/11/2014 15:10	129
EStarkey	Delete Region- due to outlier	8/20/2014 13:00	8/20/2014 13:00	1/15/2015 15:20	1

Correction history for Lapwai Creek, NEPE 2014 temperature data.

Creator	Comment	From Time	To Time	Applied Time	Points Modified
EStarkey	Delete point(s) to adjust time due to change from DST to ST	11/2/2014 1:00	11/2/2014 1:00	11/11/2014 13:39	1
EStarkey	Clock Drift Correction with start offset of -60.000 and end offset of -60.000 due to change from DST to ST	11/2/2014 2:00	11/3/2014 10:00	11/11/2014 13:39	32

Appendix E. Corrections History (continued)

Correction history for Lapwai Creek, NEPE 2014 specific conductance data.

Creator	Comment	From Time	To Time	Applied Time	Points Modified
EStarkey	Drift Correction with Calibration Drift value of 3.300µS/cm and Fouling Drift value of -1.800µS/cm	6/18/2014 15:00	7/9/2014 9:00	7/15/2014 12:08	499
EStarkey	Delete point(s)- due to outlier	8/4/2014 19:00	8/4/2014 19:00	8/8/2014 13:50	1
EStarkey	Drift Correction with Calibration Drift value of 2.350µS/cm and Fouling Drift value of -4.800µS/cm	7/9/2014 13:00	8/6/2014 8:00	8/8/2014 13:59	668
EStarkey	Delete Region-due to outlier	8/27/2014 3:00	8/27/2014 3:00	9/5/2014 12:58	1
EStarkey	Delete Region-due to outlier	9/19/2014 14:00	9/19/2014 14:00	10/8/2014 11:40	1
EStarkey	Delete Region-due to outlier	9/21/2014 22:00	9/21/2014 22:00	10/8/2014 11:40	1
EStarkey	Delete Region-due to outlier	9/24/2014 12:00	9/24/2014 12:00	10/8/2014 11:40	1
EStarkey	Delete Region-due to outlier	9/10/2014 11:00	9/10/2014 12:00	10/8/2014 11:43	2
EStarkey	Drift Correction with Calibration Drift value of -2.650µS/cm and Fouling Drift value of -8.100µS/cm	9/4/2014 13:00	10/1/2014 8:00	10/8/2014 11:43	644
EStarkey	Drift Correction with Calibration Drift value of -10.400µS/cm and Fouling Drift value of -21.500µS/cm	10/1/2014 18:00	11/3/2014 10:00	11/11/2014 13:25	784
EStarkey	Delete point(s) due to outlier	10/21/2014 13:00	10/21/2014 13:00	11/11/2014 13:27	1
EStarkey	Delete point(s) due to outlier	10/23/2014 14:00	10/23/2014 14:00	11/11/2014 13:28	1
EStarkey	Delete point(s)-due to outlier	10/25/2014 0:00	10/25/2014 0:00	11/11/2014 13:28	1
EStarkey	Delete point(s)- to adjust for DST end and ST start	11/2/2014 1:00	11/2/2014 1:00	11/11/2014 13:31	1
EStarkey	Clock Drift Correction with start offset of -60.000 and end offset of -60.000 due to DST end	11/2/2014 2:00	11/3/2014 10:00	11/11/2014 13:33	32

Appendix E. Corrections History (continued)

Correction history for Lapwai Creek, NEPE 2014 dissolved oxygen data.

Creator	Comment	From Time	To Time	Applied Time	Points Modified
EStarkey	Drift Correction with Calibration Drift value of - 0.760mg/l and Fouling Drift value of 0.420mg/l	6/18/2014 15:00	7/9/2014 9:00	7/15/2014 13:28	499
AQ_AUTO	Threshold correction with lower limit=2 mg/l	7/9/2014 13:00	Open	8/8/2014 14:07	225
EStarkey	Delete Region-due to outlier	8/23/2014 10:00	8/23/2014 10:00	9/5/2014 13:06	1
EStarkey	Delete Region-due to outlier	8/26/2014 5:00	8/26/2014 5:00	9/5/2014 13:07	1
EStarkey	Delete Region-due to outlier	8/25/2014 22:00	8/25/2014 22:00	9/5/2014 13:07	1
EStarkey	Drift Correction with Calibration Drift value of 0.100mg/l and Fouling Drift value of 0.230mg/l	10/1/2014 18:00	11/3/2014 10:00	11/11/2014 13:43	784
EStarkey	Delete point(s) to adjust from DST to ST	11/2/2014 1:00	11/2/2014 1:00	11/11/2014 13:44	1
EStarkey	Clock Drift Correction with start offset of -60.000 and end offset of -60.000 due to change from DST to ST	11/2/2014 2:00	11/3/2014 10:00	11/11/2014 13:45	32

Correction history for Lapwai Creek, NEPE 2014 pH data.

Creator	Comment	From Time	To Time	Applied Time	Points Modified
EStarkey	Drift Correction with Calibration Drift value of 0.498pH and Fouling Drift value of -0.010pH	6/18/2014 15:00	7/9/2014 9:00	7/15/2014 14:33	499
EStarkey	Drift Correction with Calibration Drift value of 0.140pH and Fouling Drift value of -0.230pH	7/9/2014 13:00	8/6/2014 8:00	8/8/2014 14:12	668
EStarkey	Drift Correction with Calibration Drift value of 0.070pH and Fouling Drift value of 0.250pH	10/1/2014 18:00	11/3/2014 10:00	11/11/2014 14:34	784
EStarkey	Delete point(s) to adjust from DST to ST	11/2/2014 1:00	11/2/2014 1:00	11/11/2014 14:35	1
EStarkey	Clock Drift Correction with start offset of - 60.000 and end offset of -60.000 to change from DST to ST	11/2/2014 2:00	11/3/2014 10:00	11/11/2014 14:36	32

Appendix E. Corrections History (continued)

Correction history for Lapwai Creek, NEPE 2014 turbidity data.

Creator	Comment	From Time	To Time	Applied Time	Points Modified
EStarkey	Delete point(s) due to outlier	6/19/2014 13:00	6/19/2014 13:00	7/15/2014 15:05	1
EStarkey	Delete point(s) due to outlier	6/19/2014 23:00	6/19/2014 23:00	7/15/2014 15:05	1
EStarkey	Delete point(s) due to outlier	6/20/2014 20:00	6/20/2014 20:00	7/15/2014 15:05	1
EStarkey	Delete point(s) due to outlier	6/22/2014 0:00	6/22/2014 0:00	7/15/2014 15:06	1
EStarkey	Delete point(s) due to outlier	6/21/2014 21:00	6/21/2014 21:00	7/15/2014 15:06	1
EStarkey	Delete point(s) due to outlier	6/21/2014 12:00	6/21/2014 12:00	7/15/2014 15:06	1
EStarkey	Delete point(s) due to outlier	6/25/2014 12:00	6/25/2014 12:00	7/15/2014 15:07	1
EStarkey	Delete point(s) due to outlier	6/27/2014 8:00	6/27/2014 8:00	7/15/2014 15:07	1
EStarkey	Delete point(s) due to outlier	6/27/2014 13:00	6/27/2014 13:00	7/15/2014 15:07	1
EStarkey	Delete point(s) due to outlier	6/27/2014 18:00	6/27/2014 18:00	7/15/2014 15:07	1
EStarkey	Delete point(s) due to outlier	6/28/2014 4:00	6/28/2014 4:00	7/15/2014 15:08	1
EStarkey	Delete point(s) due to outlier	6/28/2014 9:00	6/28/2014 9:00	7/15/2014 15:08	1
EStarkey	Delete point(s) due to outlier	6/28/2014 16:00	6/28/2014 16:00	7/15/2014 15:08	1
EStarkey	Delete point(s) due to outlier	6/28/2014 19:00	6/28/2014 19:00	7/15/2014 15:08	1
EStarkey	Delete point(s) due to outlier	6/29/2014 5:00	6/29/2014 5:00	7/15/2014 15:08	1
EStarkey	Delete point(s) due to outlier	6/28/2014 23:00	6/28/2014 23:00	7/15/2014 15:08	1
EStarkey	Delete point(s) due to outlier	6/29/2014 9:00	6/29/2014 9:00	7/15/2014 15:08	1
EStarkey	Delete point(s) due to outlier	7/4/2014 12:00	7/4/2014 12:00	7/15/2014 15:09	1
EStarkey	Delete point(s) due to outlier	7/5/2014 13:00	7/5/2014 13:00	7/15/2014 15:09	1
EStarkey	Delete point(s) due to outlier	7/6/2014 4:00	7/6/2014 4:00	7/15/2014 15:09	1
EStarkey	Delete point(s) due to outlier	7/7/2014 12:00	7/7/2014 12:00	7/15/2014 15:10	1
EStarkey	Delete point(s) due to outlier	7/8/2014 11:00	7/8/2014 11:00	7/15/2014 15:10	1
EStarkey	Delete point(s) due to outlier	7/9/2014 9:00	7/9/2014 9:00	7/15/2014 15:10	1
EStarkey	Delete point(s)- due to outlier	7/12/2014 22:00	7/12/2014 22:00	8/8/2014 14:16	1
EStarkey	Delete point(s)- due to outlier	7/24/2014 12:00	7/24/2014 12:00	8/8/2014 14:16	1

Appendix E. Corrections History (continued)

Correction history for Lapwai Creek, NEPE 2014 turbidity data (continued)					
Creator	Comment	From Time	To Time	Applied Time	Points Modified
EStarkey	Drift Correction with Calibration Drift value of -1.200NTU and Fouling Drift value of 20.600NTU	8/20/2014 15:00	9/4/2014 8:00	9/5/2014 13:13	354
EStarkey	Delete Region-due to sensor limit being reached (3,000 NTU), possibly due to the optic being blocked by sediment.	8/22/2014 20:00	8/22/2014 22:00	9/5/2014 13:15	3
EStarkey	Delete Region-due to outlier	9/9/2014 23:00	9/9/2014 23:00	10/8/2014 11:58	1
EStarkey	Delete Region-due to outlier	9/12/2014 3:00	9/12/2014 3:00	10/8/2014 11:58	1
EStarkey	Delete Region-due to outlier	9/12/2014 6:00	9/12/2014 6:00	10/8/2014 11:58	1
EStarkey	Delete Region-due to outlier	9/12/2014 13:00	9/12/2014 13:00	10/8/2014 11:58	1
EStarkey	Delete Region-due to outlier	9/12/2014 16:00	9/12/2014 16:00	10/8/2014 11:58	1
EStarkey	Delete Region-due to outlier	9/12/2014 22:00	9/12/2014 22:00	10/8/2014 11:58	1
EStarkey	Delete Region-due to outlier	9/13/2014 4:00	9/13/2014 4:00	10/8/2014 11:58	1
EStarkey	Delete Region-due to outlier	9/13/2014 7:00	9/13/2014 7:00	10/8/2014 11:58	1
EStarkey	Delete Region-due to outlier	9/13/2014 9:00	9/13/2014 9:00	10/8/2014 11:58	1
EStarkey	Delete Region-due to outlier	9/15/2014 6:00	9/15/2014 6:00	10/8/2014 11:59	1
EStarkey	Delete Region-due to outlier	9/15/2014 8:00	9/15/2014 8:00	10/8/2014 11:59	1
EStarkey	Delete Region-due to outlier	9/15/2014 16:00	9/15/2014 16:00	10/8/2014 11:59	1
EStarkey	Delete Region-due to outlier	9/17/2014 0:00	9/17/2014 0:00	10/8/2014 11:59	1
EStarkey	Delete Region-due to outlier	9/17/2014 4:00	9/17/2014 4:00	10/8/2014 12:01	1
EStarkey	Delete Region-due to outlier	9/19/2014 19:00	9/19/2014 19:00	10/8/2014 12:01	1
EStarkey	Delete Region-due to outlier	9/20/2014 11:00	9/20/2014 11:00	10/8/2014 12:01	1
EStarkey	Delete Region-due to outlier	9/21/2014 16:00	9/21/2014 16:00	10/8/2014 12:01	1
EStarkey	Delete Region-due to outlier	9/28/2014 4:00	9/28/2014 4:00	10/8/2014 12:02	1
EStarkey	Delete Region-due to outlier	9/29/2014 4:00	9/29/2014 4:00	10/8/2014 12:02	1
EStarkey	Delete Region-due to outlier	9/29/2014 15:00	9/29/2014 16:00	10/8/2014 12:02	2
EStarkey	Delete Region-due to outlier	9/29/2014 13:00	9/29/2014 13:00	10/8/2014 12:02	1

Appendix E. Corrections History (continued)

Correction history for Lapwai Creek, NEPE 2014 turbidity data (continued)

Creator	Comment	From Time	To Time	Applied Time	Points Modified
EStarkey	Delete Region-due to outlier	9/30/2014 16:00	9/30/2014 16:00	10/8/2014 12:02	1
EStarkey	Delete Region-due to outlier	9/7/2014 13:00	9/7/2014 13:00	10/8/2014 13:21	1
EStarkey	Delete Region-due to outlier	9/14/2014 12:00	9/14/2014 12:00	10/8/2014 13:22	1
EStarkey	Delete Region-due to outlier	9/14/2014 23:00	9/14/2014 23:00	10/8/2014 13:22	1
EStarkey	Delete Region-due to outlier	9/22/2014 19:00	9/22/2014 19:00	10/8/2014 13:23	1
EStarkey	Delete Region-due to outlier	9/23/2014 2:00	9/23/2014 2:00	10/8/2014 13:23	1
EStarkey	Delete point(s) to apply clock drift DST to ST Clock Drift Correction with start offset of - 60.000 and end offset of -60.000 to change from DST to ST	11/2/2014 1:00	11/2/2014 1:00	11/11/2014 14:40	1
EStarkey		11/2/2014 2:00	11/3/2014 10:00	11/11/2014 14:41	32
EStarkey	Delete Region due to outlier	10/3/2014 21:00	10/3/2014 21:00	11/11/2014 14:42	1
EStarkey	Delete Region due to outlier	10/6/2014 7:00	10/6/2014 7:00	11/11/2014 14:43	1
EStarkey	Delete Region due to outlier	10/6/2014 10:00	10/6/2014 10:00	11/11/2014 14:43	1
EStarkey	Delete Region due to outlier	10/7/2014 7:00	10/7/2014 7:00	11/11/2014 14:43	1
EStarkey	Delete Region due to outlier	10/7/2014 16:00	10/7/2014 16:00	11/11/2014 14:43	1
EStarkey	Delete Region due to outlier	10/7/2014 20:00	10/7/2014 20:00	11/11/2014 14:43	1
EStarkey	Delete Region due to outlier	10/8/2014 14:00	10/8/2014 14:00	11/11/2014 14:43	1
EStarkey	Delete Region due to outlier	10/11/2014 7:00	10/11/2014 8:00	11/11/2014 14:44	2
EStarkey	Delete Region due to outlier	10/13/2014 7:00	10/13/2014 7:00	11/11/2014 14:44	1
EStarkey	Delete Region due to outlier	10/18/2014 5:00	10/18/2014 5:00	11/11/2014 14:44	1
EStarkey	Delete Region due to outlier	10/20/2014 22:00	10/20/2014 22:00	11/11/2014 14:44	1
EStarkey	Delete Region due to outlier	10/22/2014 23:00	10/22/2014 23:00	11/11/2014 14:45	1
EStarkey	Delete Region due to outlier	10/23/2014 2:00	10/23/2014 2:00	11/11/2014 14:45	1
EStarkey	Delete Region due to outlier	10/25/2014 14:00	10/25/2014 14:00	11/11/2014 14:45	1

Appendix E. Corrections History (continued)

Correction history for Lapwai Creek, NEPE 2014 turbidity data (continued).					
Creator	Comment	From Time	To Time	Applied Time	Points Modified
EStarkey	Delete Region due to outlier	10/26/2014 18:00	10/26/2014 18:00	11/11/2014 14:45	1
EStarkey	Delete Region due to outlier	10/27/2014 12:00	10/27/2014 12:00	11/11/2014 14:46	1
EStarkey	Delete Region due to outlier	10/28/2014 3:00	10/28/2014 3:00	11/11/2014 14:46	1
EStarkey	Delete Region due to outlier	10/30/2014 7:00	10/30/2014 7:00	11/11/2014 14:46	1
EStarkey	Delete Region due to outlier	10/31/2014 3:00	10/31/2014 3:00	11/11/2014 14:46	1
EStarkey	Delete Region due to outlier	10/31/2014 22:00	10/31/2014 22:00	11/11/2014 14:46	1
EStarkey	Delete Region due to outlier	11/2/2014 6:00	11/2/2014 6:00	11/11/2014 14:47	1
EStarkey	Delete point(s)- due to outlier	8/22/2014 23:00	8/22/2014 23:00	1/13/2015 11:09	1

Appendix F. Macroinvertebrate Metrics

NPS Upper Columbia Basin Benthos 2014 – NEPE
*Standardized to OTU and fixed count

SampleID	153325	153318	153317	153324
Station	PIBO:3115	PIBO:3116	PIBO:3118	PIBO:3114
ReachID	8223	8224	8225	8222
Waterbody	Jim Ford 1	Jim Ford 2	Jim Ford 4	Lapwai
County	Clearwater	Clearwater	Clearwater	Nez Perce
State	ID	ID	ID	ID
Latitude	46.36121748	46.35968941	46.35689017	46.45051829
Longitude	-115.926842	-115.9251301	-115.9222344	-116.8179127
Collection Date	8/13/2014	8/13/2014	8/12/2014	6/21/2014
Habitat Sampled	Targeted Riffle	Targeted Riffle	Targeted Riffle	Targeted Riffle
Collection Method	Surber Net	Surber Net	Surber Net	Surber Net
Field Notes	--	--	--	--
Lab Notes	--	--	--	--
Area sampled (m^2)	0.74	0.74	0.74	0.74
Field Split	100	100	100	100
Lab Split	25	100	100	12.5
Split Count	785	414	687	693
Fixed Count	300	300	300	300
Big Rare Count	2	0	0	5
Richness*	3	14	6	16
Abundance	4246	559	928	7499
Shannon's Diversity*	0.526347584	1.868305958	0.678339772	1.699867531
Simpson's Diversity*	0.267090301	0.799687848	0.413556299	0.746666667
Evenness*	0.479102218	0.707944438	0.378588635	0.613097614
# of EPT Taxa*	0	2	0	8
EPT Taxa Abundance	11	5	0	4991
Dominant Family	Chironomidae	Chironomidae	Chironomidae	Baetidae
Abundance of Dominant Family	3859	243	911	2900
Dominant Taxa	Chironominae	Orthoclaadiinae	Chironominae	Baetis
Abundance of Dominant Taxa	3589	147	678	2673
Hilsenhoff Biotic Index*	5.58	4.01	5.956666667	3.696666667
# of Intolerant Taxa*	0	0	0	3
Intolerant Taxa abundance	1	0	0	1872
# of Tolerant Taxa*	0	2	1	0
Tolerant Taxa abundance	5	35	3	0
USFS Community Tolerance Quotient (d)*	108	104	107	86
# of shredder taxa*	0	0	0	0
Shredder Abundance	0	0	0	0

Appendix F. Macroinvertebrate Metrics (continued)

NPS Upper Columbia Basin Benthos 2014 – NEPE
*Standardized to OTU and fixed count

SampleID	153325	153318	153317	153324
Station	PIBO:3115	PIBO:3116	PIBO:3118	PIBO:3114
ReachID	8223	8224	8225	8222
Waterbody	Jim Ford 1	Jim Ford 2	Jim Ford 4	Lapwai
County	Clearwater	Clearwater	Clearwater	Nez Perce
State	ID	ID	ID	ID
Latitude	46.36121748	46.35968941	46.35689017	46.45051829
Longitude	-115.926842	-115.9251301	-115.9222344	-116.8179127
Collection Date	8/13/2014	8/13/2014	8/12/2014	6/21/2014
Habitat Sampled	Targeted Riffle	Targeted Riffle	Targeted Riffle	Targeted Riffle
Collection Method	Surber Net	Surber Net	Surber Net	Surber Net
# of scraper taxa*	0	1	0	1
Scraper abundance	0	22	0	11
# of collector-filterer taxa*	0	2	1	3
Collector-filterer abundance	5	12	3	2207
# of collector-gatherer taxa*	2	9	3	7
Collector-gatherer abundance	4189	503	919	5107
# of predator taxa*	1	2	1	3
Predator abundance	7	23	7	164
# of clinger taxa*	0	0	0	5
Long-lived Taxa*	0	2	1	2
# of Ephemeroptera taxa*	0	2	0	5
Ephemeroptera abundance	11	5	0	2945
# of Plecoptera taxa*	0	0	0	1
Plecoptera abundance	0	0	0	88
# of Trichoptera taxa*	0	0	0	2
Trichoptera abundance	0	0	0	1958
# of Coleoptera taxa*	0	0	0	1
Coleoptera abundance	0	0	0	22
# of Elmidae Taxa*	0	0	0	1
Elmidae abundance	0	0	0	22
# of Megaloptera taxa*	0	0	0	0
Megaloptera abundance	0	0	0	0
# of Diptera taxa*	2	3	2	4
Diptera abundance	3859	251	912	2314
# of Chironomidae taxa*	2	2	2	3
Chironomidae abundance	3859	243	911	2065
# of Crustacea taxa*	0	3	1	0
Crustacea abundance	45	109	8	0

AppendixF. Macroinvertebrate Metrics (continued)

NPS Upper Columbia Basin Benthos 2014 – NEPE

*Standardized to OTU and fixed count

SampleID	153325	153318	153317	153324
Station	PIBO:3115	PIBO:3116	PIBO:3118	PIBO:3114
ReachID	8223	8224	8225	8222
Waterbody	Jim Ford 1	Jim Ford 2	Jim Ford 4	Lapwai
County	Clearwater	Clearwater	Clearwater	Nez Perce
State	ID	ID	ID	ID
Latitude	46.36121748	46.35968941	46.35689017	46.45051829
Longitude	-115.926842	-115.9251301	-115.9222344	-116.8179127
Collection Date	8/13/2014	8/13/2014	8/12/2014	6/21/2014
Habitat Sampled	Targeted Riffle	Targeted Riffle	Targeted Riffle	Targeted Riffle
Collection Method	Surber Net	Surber Net	Surber Net	Surber Net
# of Oligochaete taxa*	0	0	0	0
Oligochaete abundance	319	135	0	108
# of Mollusca taxa*	0	4	1	0
Mollusca abundance	5	39	3	0
# of Insect taxa*	2	6	3	13
Insect abundance	3877	276	915	7326
# of Non-insect taxa*	1	8	3	3
Non-insect abundance	369	284	14	173

Appendix G. Macroinvertebrate Taxa List

NPS Upper Columbia Basin Benthos 2014 – NEPE
Note that all samples were from targeted riffles and sampled using Surber nets.

Sample ID	Reach ID	Name	Sample Date	Lab Split	Field Split	Area	Code	Taxon	Split Count	Big Rare Count
153325	8223	Jim Ford 1	8/13/2014	25	100	0.74	387	Gomphus	0	1
153325	8223	Jim Ford 1	8/13/2014	25	100	0.74	1947	Crangonyctidae	8	1
153325	8223	Jim Ford 1	8/13/2014	25	100	0.74	647	Pisidium	1	0
153325	8223	Jim Ford 1	8/13/2014	25	100	0.74	184	Orthoclaadiinae	48	0
153325	8223	Jim Ford 1	8/13/2014	25	100	0.74	182	Chironominae	664	0
153325	8223	Jim Ford 1	8/13/2014	25	100	0.74	180	Chironomidae	2	0
153325	8223	Jim Ford 1	8/13/2014	25	100	0.74	19	Oligochaeta	59	0
153325	8223	Jim Ford 1	8/13/2014	25	100	0.74	261	Caenis	2	0
153325	8223	Jim Ford 1	8/13/2014	25	100	0.74	374	Coenagrionidae	1	0
153324	8222	Lapwai	6/21/2014	12.5	100	0.74	250	Baetis	247	2
153324	8222	Lapwai	6/21/2014	12.5	100	0.74	469	Skwala	8	1
153324	8222	Lapwai	6/21/2014	12.5	100	0.74	497	Cheumatopsyche	14	1
153324	8222	Lapwai	6/21/2014	12.5	100	0.74	280	Epeorus	0	1
153324	8222	Lapwai	6/21/2014	12.5	100	0.74	187	Tanypodinae	2	0
153324	8222	Lapwai	6/21/2014	12.5	100	0.74	135	Optioservus	1	0
153324	8222	Lapwai	6/21/2014	12.5	100	0.74	1076	Optioservus quadrimaculatus	1	0
153324	8222	Lapwai	6/21/2014	12.5	100	0.74	307	Tricorythodes	2	0
153324	8222	Lapwai	6/21/2014	12.5	100	0.74	495	Hydropsychidae	4	0
153324	8222	Lapwai	6/21/2014	12.5	100	0.74	834	Dipheter hageni	20	0
153324	8222	Lapwai	6/21/2014	12.5	100	0.74	182	Chironominae	42	0
153324	8222	Lapwai	6/21/2014	12.5	100	0.74	907	Acentrella	1	0
153324	8222	Lapwai	6/21/2014	12.5	100	0.74	655	Turbellaria	1	0
153324	8222	Lapwai	6/21/2014	12.5	100	0.74	932	Brachycentrus occidentalis	163	0
153324	8222	Lapwai	6/21/2014	12.5	100	0.74	184	Orthoclaadiinae	108	0
153324	8222	Lapwai	6/21/2014	12.5	100	0.74	67	Sperchon	4	0

Appendix G. Macroinvertebrate Taxa List (continued)

NPS Upper Columbia Basin Benthos 2014 – NEPE
Note that all samples were from targeted riffles and sampled using Surber nets.

Sample ID	Reach ID	Name	Sample Date	Lab Split	Field Split	Area	Code	Taxon	Split Count	Big Rare Count
153324	8222	Lapwai	6/21/2014	12.5	100	0.74	180	Chironomidae	39	0
153324	8222	Lapwai	6/21/2014	12.5	100	0.74	59	Hygrobatidae	1	0
153324	8222	Lapwai	6/21/2014	12.5	100	0.74	19	Oligochaeta	10	0
153324	8222	Lapwai	6/21/2014	12.5	100	0.74	287	Leptophlebiidae	1	0
153324	8222	Lapwai	6/21/2014	12.5	100	0.74	221	Simuliidae	6	0
153324	8222	Lapwai	6/21/2014	12.5	100	0.74	223	Simulium	17	0
153324	8222	Lapwai	6/21/2014	12.5	100	0.74	943	Serratella tibialis	1	0
153318	8224	Jim Ford 2	8/13/2014	100	100	0.74	610	Physa	2	0
153318	8224	Jim Ford 2	8/13/2014	100	100	0.74	854	Ferrissia rivularis	16	0
153318	8224	Jim Ford 2	8/13/2014	100	100	0.74	187	Tanypodinae	1	0
153318	8224	Jim Ford 2	8/13/2014	100	100	0.74	179	Ceratopogonidae	2	0
153318	8224	Jim Ford 2	8/13/2014	100	100	0.74	261	Caenis	3	0
153318	8224	Jim Ford 2	8/13/2014	100	100	0.74	364	Aeshnidae	2	0
153318	8224	Jim Ford 2	8/13/2014	100	100	0.74	651	Musculium	5	0
153318	8224	Jim Ford 2	8/13/2014	100	100	0.74	927	Lymnaea	6	0
153318	8224	Jim Ford 2	8/13/2014	100	100	0.74	184	Orthoclaadiinae	109	0
153318	8224	Jim Ford 2	8/13/2014	100	100	0.74	374	Coenagrionidae	12	0
153318	8224	Jim Ford 2	8/13/2014	100	100	0.74	182	Chironominae	67	0
153318	8224	Jim Ford 2	8/13/2014	100	100	0.74	82	Cambaridae	2	0
153318	8224	Jim Ford 2	8/13/2014	100	100	0.74	69	Amphipoda	29	0
153318	8224	Jim Ford 2	8/13/2014	100	100	0.74	180	Chironomidae	3	0
153318	8224	Jim Ford 2	8/13/2014	100	100	0.74	75	Hyalella	14	0
153318	8224	Jim Ford 2	8/13/2014	100	100	0.74	19	Oligochaeta	100	0
153318	8224	Jim Ford 2	8/13/2014	100	100	0.74	189	Culicidae	3	0
153318	8224	Jim Ford 2	8/13/2014	100	100	0.74	189	Culicidae	1	0

Appendix G. Macroinvertebrate Taxa List (continued)

NPS Upper Columbia Basin Benthos 2014 – NEPE
Note that all samples were from targeted riffles and sampled using Surber nets.

Sample ID	Reach ID	Name	Sample Date	Lab Split	Field Split	Area	Code	Taxon	Split Count	Big Rare Count
153318	8224	Jim Ford 2	8/13/2014	100	100	0.74	251	Callibaetis	1	0
153318	8224	Jim Ford 2	8/13/2014	100	100	0.74	71	Gammarus	36	0
153317	8225	Jim Ford 4	8/12/2014	100	100	0.74	179	Ceratopogonidae	1	0
153317	8225	Jim Ford 4	8/12/2014	100	100	0.74	182	Chironominae	251	0
153317	8225	Jim Ford 4	8/12/2014	100	100	0.74	71	Gammarus	6	0
153317	8225	Jim Ford 4	8/12/2014	100	100	0.74	58	Trombidiformes	2	0
153317	8225	Jim Ford 4	8/12/2014	100	100	0.74	182	Chironominae	251	0
153317	8225	Jim Ford 4	8/12/2014	100	100	0.74	184	Orthoclaadiinae	86	0
153317	8225	Jim Ford 4	8/12/2014	100	100	0.74	647	Pisidium	2	0
153317	8225	Jim Ford 4	8/12/2014	100	100	0.74	374	Coenagrionidae	2	0
153317	8225	Jim Ford 4	8/12/2014	100	100	0.74	184	Orthoclaadiinae	86	0

The Department of the Interior protects and manages the nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities.

NPS 429/129666, September 2015

National Park Service
U.S. Department of the Interior



Natural Resource Stewardship and Science

1201 Oakridge Drive, Suite 150
Fort Collins, CO 80525

www.nature.nps.gov

EXPERIENCE YOUR AMERICA TM