Technical Report Overview

Teck Coal Limited
Sparwood Administration Office
P.O. Box 1777
609 Douglas Fir Road
Sparwood, BC Canada V0B 2G0

+1 250 425 3331 Tel
+1 250 425 3330 Fax
www.teck.com

Report: Evaluation of selenium sensitivity of spotted sandpipers breeding in the Elk River watershed of southeastern British Columbia

Overview: This report presents the results of field observations undertaken in 2013-2014 of nesting spotted sandpipers in the Elk River watershed. The main objective of the study was to determine if there is an association between sandpiper egg hatchability and selenium concentrations.

This report was prepared for Teck by Minnow Environmental Inc.

For More Information
If you have questions regarding this report, please:

- Phone toll-free to 1.855.806.6854
- Email **feedbackteckcoal@teck.com**

Future studies will be made available at **teck.com/elkvalley**

Evaluation of selenium sensitivity of spotted sandpipers breeding in the Elk River watershed of southeastern British Columbia

Prepared For:
Teck Resources Limited
Sparwood, BC

Prepared By:
Minnow Environmental Inc.
Georgetown, ON

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Evaluation of Selenium Sensitivity of Spotted Sandpipers Breeding in the Elk River Watershed of Southeastern British Columbia

Report Prepared for:

Teck Resources Limited

Report Prepared by:

Minnow Environmental Inc.

Shari Weech, Ph.D., RPBio
Project Manager

Patti Orr, M.Sc.
Senior Reviewer

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1.0 INTRODUCTION

1.1 Background

Teck Resources Limited (Teck) operates five, open pit, steelmaking coal mines in the Elk River watershed, which are the Fording River Operations (FRO), Greenhills Operations (GHO), Line Creek Operations (LCO), Elkview Operations (EVO), and Coal Mountain Operations (CMO) (Figure 1.1). Aquatic habitats of the Elk River watershed are predominantly lotic (flowing), characterized by cold, well-oxygenated water and coarse bottom substrates. Lentic areas, which range from oxbows to wetlands, ponds, and small lakes, are sparsely distributed and represent a small proportion of the aquatic habitat (Interior Reforestation 2008).

Numerous studies have been conducted in the Elk River watershed to measure selenium concentrations in water and aquatic biota, and/or to evaluate potential effects (Harding and Paton 2003; Harding et al. 2005; Minnow 2004, 2005, 2006, 2014; Minnow and PLA 2006, 2012; Minnow et al. 2007 and 2011; SciWrite 2007; etc.). For evaluation of potential selenium-related effects on birds, spotted sandpipers (*Actitis macularius*) were selected as an appropriate sentinel species because they are ubiquitous in the watershed, they feed primarily on aquatic invertebrates, they have a predictable clutch size (almost always four eggs), and they nest close to water making their nests relatively easy to find and monitor (Reed et al. 2013). One difficulty associated with using spotted sandpipers for reproductive monitoring is the fact that their young are precocious, meaning they are able to leave the nest almost immediately post-hatch. Thus, to ensure that hatching success is properly documented, routine monitoring of nests is required; particularly if the anticipated hatch date is uncertain. Two ways to effectively estimate hatch date are: finding a nest with an incomplete clutch, thereby knowing the date the final egg is laid, and assuming an average incubation period of 21 days (Reed et al. 2013); or collecting and opening an egg for examination of developmental status relative to the estimated incubation period. Since egg collections are required for the evaluation of selenium effects on bird reproduction, the latter method is most effective (especially since the likelihood of finding nests with an incomplete clutch of eggs decreases as the breeding season progresses).

Potential effects of selenium on spotted sandpipers within the Elk River watershed were previously evaluated by Harding and Paton (2003), with the findings later published in Harding et al. (2005). In the Harding and Paton study, a total of 40 spotted sandpiper eggs were collected; 14 from areas classified as reference (although some were located downstream of mines) and 26 from areas classified as mine-exposed. Mean [± standard

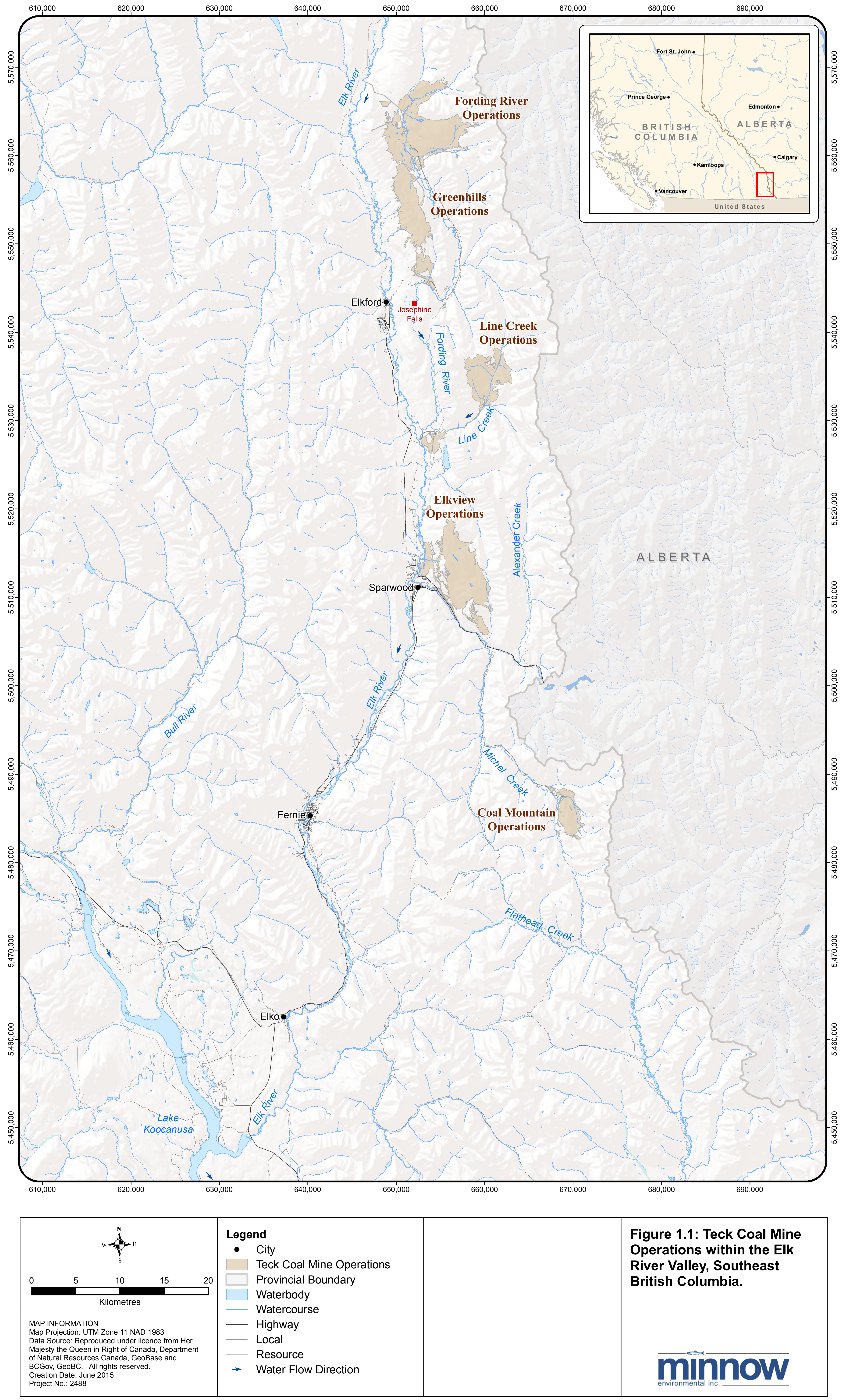

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Figure 1.1: Teck Coal Mine Operations within the Elk River Valley, Southeast British Columbia.

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error (SE)] egg selenium concentrations were estimated to be 3.8 (± 0.19) and 7.3 (± 0.43) µg/g dry weight in reference and mine-exposed areas, respectively. Mean clutch size was similar between groups (4.0 in the reference group versus 3.8 in the mine-exposed group), while hatching success was significantly lower in the mine-exposed group (75% compared to 92%; $p<0.01$). However, there is uncertainty in the reported results due to a number of technical issues associated with the Harding and Paton study. These include:

- Misclassification of reference nests. Some nests included in the reference group were situated in mine-exposed areas [i.e., seven nests on the Elk River north of Elkford (downstream of GHO) and 10 nests on upper Michel Creek (downstream of CMO)].
- No nests were documented as being depredated which is very unusual for spotted sandpipers (Maxson and Oring 1978; Oring et al. 1983) and other species of birds, in general (Sloan et al. 1998). Harding et al. (2005) documented a mean hatching success of 75% in mine-exposed areas and 92% in reference areas, which is high compared to the literature for spotted sandpipers (e.g., average = 51% over 8 years, range = 34-80% annually for an undisturbed population in north-central Minnesota; Oring et al. 1983). As a result, it is suspected that nests were not monitored in sufficient detail to determine whether successful hatching occurred (i.e., all nests found empty were assumed to have hatched completely), leading to uncertainty around the estimates of hatching success.
- Sometimes more than one egg was collected from the same clutch (i.e., 7 eggs from among 3 nests on Upper Michel Creek, 19 eggs from among 9 nests on Lower Michel Creek and 7 eggs from among 6 nests on the Fording River), and as such, samples were not statistically independent in the comparison of mean egg selenium concentrations between reference and mine-exposed areas.
- Percent moisture was not measured in eggs collected during the study. Rather concentrations of selenium in eggs were converted from wet weight to dry weight using an assumed value of 70% moisture, as published for other bird species (Ohlendorf and Hothem 1995, Ohlendorf et al. 1986). Given that percent moisture can vary considerably among eggs (i.e., eggs lose moisture during development and after abandonment; Weech et al. 2012; Bicudo et al. 2010); reported dry weight selenium concentrations are uncertain, which is very important in data interpretation.
- Nests for which all eggs were assumed not to hatch may simply have been abandoned before hatching (e.g., disturbances were noted in the mine-exposed

area). Harding et al. (2005) acknowledged that the nests on lower Michel Creek may have been abandoned, but chose to include them in the assessment of potential selenium-related effects, thereby increasing uncertainty in the results.

- The study was conducted over one year and as such, could not account for potential inter-annual variability.

Presently, the Harding et al. (2005) study is the one study being cited by the British Columbia Ministry of Environment (BCMOE) as supporting information to suggest sandpipers are particularly sensitive to the effects of selenium (Beatty and Russo 2014). To further evaluate the relative sensitivity of spotted sandpipers to selenium and address uncertainties associated with Harding et al. (2005), the following study was undertaken and designed to minimize or overcome technical issues and uncertainties associated with previous work.

1.2 Study Objectives

The main objectives of the current spotted sandpiper study were to:

1) Determine if there is an association between sandpiper egg hatchability and selenium concentrations;

2) Define the egg selenium concentration that causes a 10% reduction in hatching success of spotted sandpiper eggs, if possible (i.e., an EC10); and

3) Assess the degree to which disturbances or other factors may affect sandpiper egg hatchability.

1.3 General Study Approach

The study involved field observations of nesting spotted sandpipers over two years to evaluate hatching success (i.e., determine the number and viability of eggs laid in each nest), and measure selenium concentrations in randomly collected eggs and eggs that did not hatch or were abandoned. Benthic invertebrate samples were also collected for analysis of selenium concentrations in areas where sandpipers were observed nesting and feeding to evaluate dietary exposure levels.

Because sandpiper chicks are precocious and leave the nest soon after hatching, it was not usually possible to examine chicks for potential physical deformities. However, it is generally accepted that embryo mortality is a more sensitive endpoint for reproductive effects of selenium on birds than embryo or chick deformities (Adams et al. 2003; Fairbrother et al. 1999, 2000; USDOI 1998; Skorupa and Ohlendorf 1991). Given that it is uncommon for complete nest failure to occur as a result of selenium toxicity (e.g., the incidence of total nest failure due to selenium embryotoxicity was less than 3% each year at Kesterson Reservoir for black-necked stilts; Ohlendorf et al. 1989; Ohlendorf and Hothem 1995); all potential causes of nest and egg failure (e.g., depredation, abandonment, flooding by high water, infertility) were documented to the extent possible, to ensure that eggs that failed to hatch for known reasons were not included in the evaluation.

2.0 METHODS

2.1 Sample Locations and Study Timing

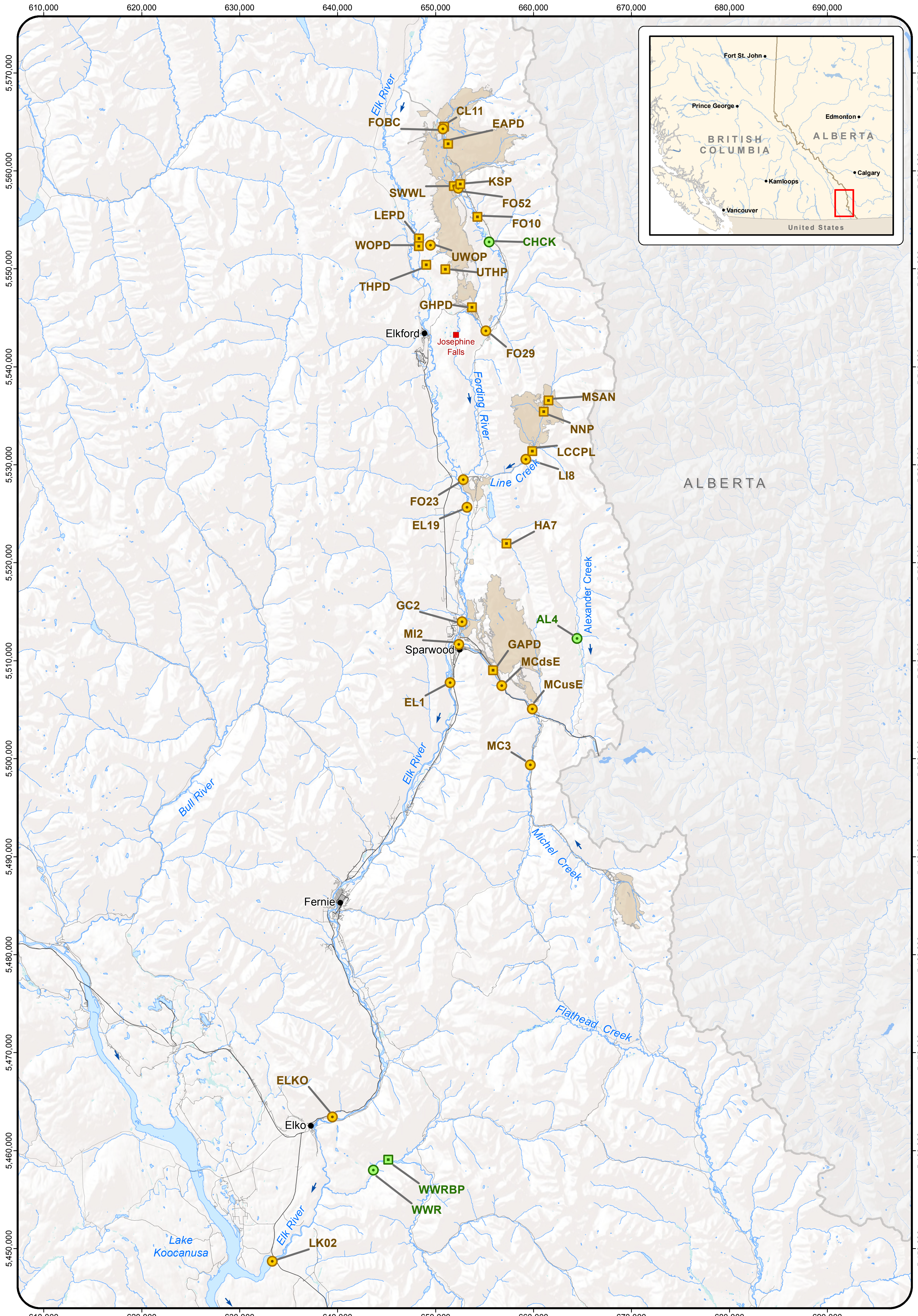
Spotted sandpiper monitoring locations (study areas) were selected to encompass a range of potential egg selenium concentrations throughout the Elk River watershed, and included both lentic and lotic habitats (Figure 2.1). Lentic habitats were often situated in close proximity to lotic habitats (e.g., settling ponds discharging to creeks/rivers) resulting in birds using both types of habitat. Disturbances (e.g., grazing cattle, mine-related activity, railway activity, recreational user access, etc.) were also observed to varying degrees among the study areas and were documented.

In 2013 and 2014, field investigations were initiated in mid-June and concluded in early August when the fate of all nests being monitored had been determined (e.g., hatched, depredated or abandoned). Heavy flooding occurred in mid-late June 2013 (Figure 2.2), resulting in the destruction of almost all nests initiated prior to the flood (a couple nests located near settling ponds were spared). However, most birds re-nested by the end of June.

2.2 Field Observations and Assessment of Hatching Success

Each spotted sandpiper nest found during the study was marked using a handheld Global Positioning System (GPS) receiver and a small pile of rocks, with the latter being located approximately 2 to 3 m from the nest to minimize depredation by attentive predators. Photographs of the nest and eggs were taken to document nest habitat/cover and egg positioning within the nest.

Nests were observed throughout the incubation period, and any nests lost to predators, abandonment, adverse weather/high water, or other forms of destruction (i.e., trampled by elk, damaged by machinery associated with flood mitigation work) were documented. Based on the developmental status of the egg collected when the nest was first found (see Section 2.3), the approximate hatch date was projected (based on an average incubation period of 21 days; Reed et al. 2013), thereby avoiding disturbing the nest on a routine/daily basis and minimizing the potential for nest abandonment related to monitoring. Nests were re-visited at least once during the incubation period, and again two to three days prior to the expected hatch date, at which point the eggs were examined for pipping. If pipping was not evident, the nest was re-checked in two days for hatching or pipping. Once pipping was noted, the nest was visited daily until the eggs hatched. Nests were documented as being depredated if all eggs disappeared or broken shells were found in the nest prior to the



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Legend

Sandpiper Sampling Locations

- Exposed Lentic
- Exposed Lotic
- Reference Lentic
- Reference Lotic

- Teck Coal Mine Operations
- Provincial Boundary
- Waterbody
- Watercourse
- Highway
- Local
- Resource
- Water Flow Direction
- City

Figure 2.1: Spotted Sandpiper Sampling Locations, 2013 & 2014

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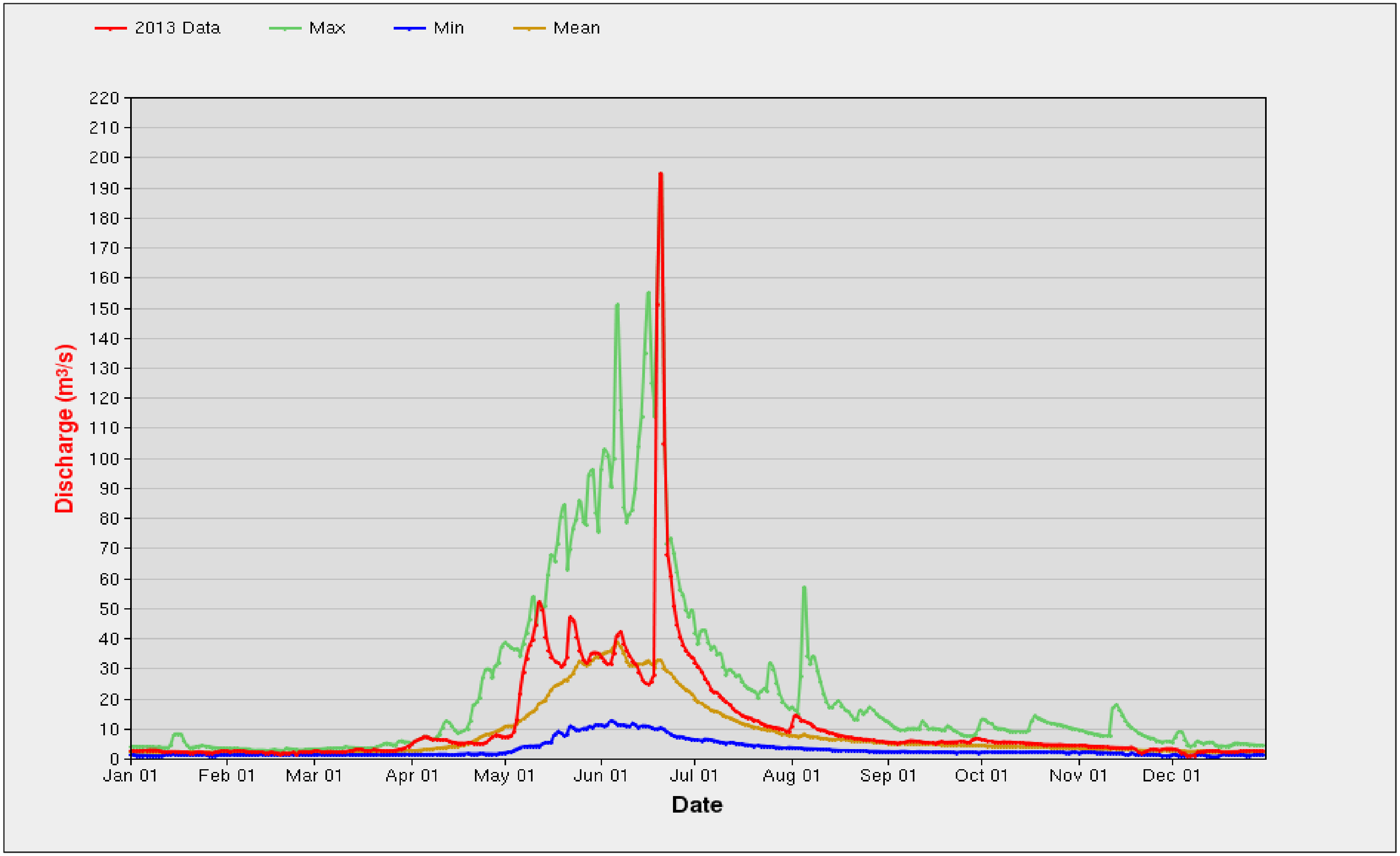

Figure 2.2: Daily discharge for the Water Survey of Canada monitoring station at the mouth of the Fording River (08NK018) in 2013 relative to historical maximum, minimum and mean daily values (1970 - 2014). Discharge was at a historical maximum on June 21st in 2013 (2013 series overlaps with maximum on chart during flood).

projected hatch date. Nests were considered abandoned if no adults were observed over two consecutive visits, and eggs were wet and/or cold to the touch prior to the projected hatch date. Nests were considered to have hatched if eggs were found pipping, hatching, and/or young were observed in the nest or in the vicinity of the nest with an adult on the projected hatch date.

2.3 Egg Collection

If a full clutch (i.e., four eggs) was present at the time of nest discovery, a single egg was randomly collected for chemical analysis. If a nest was found when the clutch was not yet complete (i.e., only one to three eggs present), the nest was re-visited one to two weeks later for egg collection. If a clutch of eggs was abandoned (i.e., cold to the touch, wet, no adult observed over two consecutive visits), all eggs were collected. Any eggs remaining in the nest two days after other eggs had hatched were assumed dead or infertile and were also collected.

Collected eggs were labelled with a unique sample identification code (on the shell) using a non-toxic permanent marker (Sharpie®), and stored/transported in a waterproof (Pelican™) case in the field. Each egg was cleaned of any external debris using a dry cloth or deionized water (as necessary). Egg contents were emptied into sterile weigh boats, photographed, weighed (using a digital balance), and examined for developmental status (e.g., unfertilized, early, mid or late development, abandoned/dead; developmental stage estimated based on Skorupa and Ackerman 2009) and any visible abnormalities. Eggs that were incubated to term, but did not hatch and showed no evidence of development were considered to be infertile. Contents were transferred to pre-weighed, sterile cryovials and stored frozen pending shipment to the University of Missouri's Research Reactor Center (MURR) in Columbia, Missouri, for analysis (see Section 2.6).

Despite the potential for within-clutch variability in egg selenium concentrations (Weech et al. 2012; Minnow 2014), only a single egg was collected from each active nest to minimize sampling influence on the assessment of hatchability. This is considered a statistically valid sampling approach and has been used for similar studies (Ohlendorf et al. 1989, Weech et al. 2012).

2.4 Benthic Invertebrate Sampling

To estimate dietary selenium exposure concentrations of nesting females, a composite benthic invertebrate tissue sample was collected from each area where sandpipers were found nesting and feeding during July 8 - 13, 2013 and July 2 – 11, 2014. In some cases (e.g., Line Creek Contingency Ponds – LCCPL, Clode Pond – CL11, Eagle Pond - EAPD), both lentic and lotic habitats were located in close proximity to nesting sites. In these instances, separate composite benthic invertebrate samples were collected from each habitat. Benthic invertebrate tissue samples were collected by the kick-and-sweep method, using a net with a triangular aperture measuring 35 cm per side and a mesh with 400 µm openings. This involved the field technician moving along the edges of the water body, disturbing the substrate with his or her feet to dislodge benthic organisms and debris into the net. Sampling intentionally focussed on the shallow edges of wetted areas, as these are the locations where sandpipers feed. After sampling was complete, the net was rinsed with water to move all debris and invertebrates to the collection cup at the bottom of the net. The collection cup was then removed, contents poured into a white plastic bin, and invertebrates picked free of debris. A minimum of approximately 2 g of invertebrates was collected for each sample to ensure adequate biomass for analysis. Benthic invertebrates contributing to the tissue sample were identified to the lowest practical level that could be confidently determined in the field without the aid of a microscope (i.e., Order or Family). The relative percentage of each group of invertebrates in the sample (on a biomass basis) was recorded. The composite sample of invertebrates was then placed into a sterile, labelled cryovial with as much water removed as possible. Samples were stored in a cooler with ice packs until they were transferred to a freezer later in the day.

2.5 Water Sampling

Teck has an extensive water quality monitoring program in the Elk River watershed, however, not all areas included in the spotted sandpiper study are part of routine monitoring. Therefore, as part of the current study, water samples were collected at spotted sandpiper monitoring locations that are not routinely sampled by Teck (e.g., Wigwam River, Upper Alexander Creek). Water samples were collected at the same time as benthic invertebrate samples. Samples were analyzed for total and dissolved organic carbon (TOC, DOC), total selenium and metals, anions (including nitrate, nitrite and sulphate), ammonia, total Kjeldahl nitrogen (TKN), and total phosphorus.

2.6 Laboratory Analyses

Water samples were sent to ALS Environmental (Burnaby, BC) for analysis. Frozen tissue samples (i.e., sandpiper eggs and benthic invertebrates) were sent to MURR (Columbia, MO) for freeze-drying and analysis of selenium and metals by high-resolution inductively coupled plasma mass spectrometry (ICP-MS). A chain of custody (COC) was included with all samples during shipment. Overall, the quality of the data collected for this project was considered acceptable to serve the project objectives (Appendix A).

2.7 Data Analysis

Plots were created to visually examine potential relationships between percent hatch and selenium concentrations. The relationship between hatching success and selenium concentrations was then tested using logistic regression (data from both study years combined). Only nests incubated to term were included in the analysis (i.e., depredated and abandoned nests were excluded because nest failure was not due to selenium). If more than one egg was sampled from a particular nest, the geometric mean selenium concentration was used. The proportion of nests having less than 100% hatching success and selenium concentrations greater than 12 µg/g dw was also compared to the proportion of nests having less than 100% hatching success and egg selenium concentrations less than 12 µg/g dw using a chi-squared test (12 µg/g dw corresponds to the low end of the range that is generally accepted to represent the threshold for selenium effects to birds; Adams et al. 2003; Ohlendorf 2003; Ohlendorf and Heinz 2011). Lastly, the potential relationship between selenium concentrations in benthic invertebrates (diet) and eggs was evaluated using linear regression (on $\log_{10}$-transformed data). For nests located beside lentic areas with nearby lotic habitat where a benthic invertebrate sample was collected from each area (e.g., the Line Creek Contingency Ponds – LCCPL and Line Creek beside the ponds – LIDSL and LC8), the average of the two invertebrate samples was used in the regression. The geometric mean selenium concentration of the first egg sampled from all nests within in each study area in each year was used in the comparison relative to benthic invertebrates sampled in the same year and within the same area.

In addition to the above, mean (± range) egg selenium concentrations were calculated and presented graphically for nests within each study area (i.e., inter-clutch variability in selenium), for individual clutches of eggs (i.e., intra-clutch variability in selenium), and for nests in areas sampled before and after the flood in 2013. The geometric mean was used in all instances where mean selenium concentrations were presented.

3.0 RESULTS

3.1 Nest Success

One or more spotted sandpiper nests were found in over 30 study areas throughout the Elk River watershed in 2013 and 2014 (Figure 2.1; Table 3.1; Appendix B - Tables B.1 and B.2). In 2013, 24 of 26 nests found within the first few days of sampling were subsequently destroyed by a record flood event that began on June 20th. However, birds started to re-nest shortly after waters began to recede (i.e., as early as one week after the start of flooding) (Appendix B - Table B.1).

A total of 84 nests in 2013 and 127 nests in 2014 were monitored to completion (Table 3.2; Appendix B - Tables B.3 and B.4; excludes nests destroyed by the flood event in 2013). In both years, slightly more than half of the nests were incubated to term/hatch (51-56%), approximately one-third were depredated (30-32%) and 11-13% were abandoned (Table 3.2). A few nests were inundated by rising water levels, while others (one or two per year) were trampled by wildlife or damaged by machinery associated with flood mitigation work (Table 3.2).

Of the 350 eggs incubated to term/hatch over the two year study, only 17 (4.9%) did not hatch, and thus were collected, examined for developmental status (see Appendix C for photographs of egg contents) and analyzed for selenium (Table 3.2). Of these 17 eggs, two eggs remained in each of two nests in 2013, where it appeared that asynchronous hatching may have occurred (i.e., one egg was missing from the nest, and an adult with a very young chick was observed in the vicinity of the nest). Alternatively, depredation of a single egg may have led to abandonment of the remaining eggs very close to hatching. In either case, the remaining eggs were not pipping, and did not hatch after being left in the nest for an additional two days (where they were not being attended by an adult). All other eggs that did not hatch over the course of the study appeared to be infertile (i.e., no obvious development) or perished during development for unknown reasons (Table 3.2). Other than nests that were depredated or abandoned, no clutches experienced complete nest failure (Appendix B - Tables B.1 and B.2).

Clutch size of spotted sandpipers is almost always 4 eggs (Reed et al. 2013; Oring et al. 1983), and the results of the current study show no exception. In 2013 and 2014, 96% and 95% of nests surviving through to incubation contained 4 eggs respectively (Appendix B - Tables B.1 and B.2).

Table 3.1: Spotted sandpiper monitoring areas in 2013 and 2014.

Reference vs Exposed	Area ID	Area Description	UTMs (Zone 11U)		Lentic vs Lotic	Number of nests found in 2013 (post-flood)	Number of nests found in 2014	Additional Details
Reference	AL4	Alexander Creek	664465	5512241	Lotic	1	0	Cows observed grazing in the area where nests were found. Few SPSA using this area.
Reference	CHCK	Chauncey Creek	655365	5552762	Lotic	1	1	Limited habitat very close to Fording River. SPSA feeding in both Fording River and CHCK and thus are not truly reference.
Reference	WWR	Wigwam River	643664	5457977	Lotic	6	17	Numerous SPSA and ample nesting habitat. Occasional disturbance by recreational users.
Reference	WWRBP	Wigwam River Beaver Ponds	645156	5459084	Lentic	1	2	Located close to WWR. SPSA observed foraging in beaver ponds and WWR.
Exposed	CL11	Clode Settling Ponds	650850	5564507	Lentic	3	3	Mine Settling Ponds. SPSA observed foraging in Fording River in addition to settling pond.
Exposed	EAPD	Eagle Settling Ponds	651264	5562752	Lentic	n/s	4	Mine Settling Ponds. SPSA observed foraging in Fording River in addition to settling pond.
Exposed	EL1	Elk River at Sparwood	651382	5507425	Lotic	5	8	Numerous SPSA and ample nesting habitat.
Exposed	EL19	Elk River d/s Fording	653227	5525791	Lotic	6	7	Numerous SPSA and ample nesting habitat.
Exposed	ELKO	Elk River u/s Elko Reservoir	639472	5463404	Lotic	12	3	High density of SPSA using this area. Regular disturbance by passing trains. Substantial depredation.
Exposed	FO10	Fording River Oxbow	654260	5555314	Lentic	n/s	3	Oxbow of the Fording River that became more of a side channel following the flood in 2013.
Exposed	FO23	Fording River d/s Line Creek	652837	5528446	Lotic	3	5	Moderate nesting habitat in this area. Lower density of SPSA compared to areas on Michel Creek and the Elk River.
Exposed	FO29	Fording River at highway bridge	655139	5543645	Lotic	2	2	Limited habitat with regular disturbance by trains and vehicles. A few SPSA will nest on gravel bars near bridges in this area.
Exposed	FO52	Fording River near Kilmarnock	652339	5558208	Lotic	5	7	Numerous SPSA and ample nesting habitat. SPSA may feed in Kilmarnock as well as Fording.
Exposed	FOBC	Fording River beside Clode Pond	650770	5564267	Lotic	0	2	Moderate nesting habitat. Substantial depredation. SPSA nesting in this area observed feeding in Clode Settling Pond.
Exposed	GAPD	Gatehouse Settling Pond	655924	5508941	Lentic	3	3	Mine Settling Pond. SPSA observed foraging in Michel Creek more routinely than settling pond.
Exposed	GHPD	Greenhills Settling Pond	653492	5546118	Lentic	3	3	Mine Settling Pond. SPSA likely forage solely on settling pond. Heavy equipment regularly operating in the area during the study.
Exposed	GC2	Goddard Creek	652723	5513938	Lotic	n/s	1	Small channel with limited habitat feeding into the Elk River. SPSA likely forage on Elk River.
Exposed	HA7	Harmer Settling Pond	657082	5522136	Lentic	2	2	Mine Settling Pond. SPSA likely forage solely on settling pond.
Exposed	KSP	Kilmarnock Settling Pond	652511	5558655	Lentic	2	7	Mine Settling Pond. SPSA observed foraging in seep on the opposite side of the berm from the settling pond as well as in the Fording River.
Exposed	LCCPL	Line Creek Contingency Ponds	659872	5531386	Lentic	2	1	Mine Settling Ponds. SPSA observed foraging in Line Creek in addition to settling ponds.
Exposed	LEPD	Leask Settling Ponds	648311	5553114	Lentic	n/s	2	Mine Settling Ponds. SPSA likely forage solely on settling pond.
Exposed	LI8	Line Creek above canyon	659259	5530553	Lotic	1	0	Moderate nesting habitat. SPSA in this area appear to forage in LCCPL in addition to Line Creek.
Exposed	LK02	Mouth of Elk on Koocanusa	633348	5448727	Lotic	6	7	Numerous SPSA and ample nesting habitat. Occasional disturbance by recreational users.
Exposed	MC3	Upper Michel Creek	659695	5499349	Lotic	n/s	6	Numerous SPSA and ample nesting habitat. Area includes numerous locations along Michel Creek upstream of Alexander.
Exposed	MCdsE	Michel Creek d/s Erickson	656762	5507432	Lotic	n/s	2	Area with moderate habitat. Few SPSA observed in area.
Exposed	MCusE	Michel Creek u/s Erickson	659890	5505051	Lotic	n/s	1	Small area with limited habitat. Few SPSA observed in area.
Exposed	MI2	Michel Creek in Sparwood	652819	5511618	Lotic	15	20	Numerous SPSA and ample nesting habitat. Occasional disturbance by recreational users.
Exposed	MSAN	MSA North Settling Ponds	661517	5536578	Lentic	2	0	Mine Settling Ponds. SPSA observed foraging in Line Creek in addition to settling ponds.
Exposed	NNP	NoName Settling Pond	661020	5535421	Lentic	1	2	Mine Settling Pond. SPSA likely forage solely on settling pond.
Exposed	SWWL	Swift Settling Pond	651839	5558449	Lentic	n/s	1	Mine Settling Pond. SPSA likely forage solely on settling pond.
Exposed	THPD	Thompson Settling Pond	649067	5550413	Lentic	3	2	Mine Settling Pond. SPSA likely forage solely on settling pond.
Exposed	UTHP	Upper Thompson Settling Pond	650978	5549967	Lentic	n/s	1	Mine Settling Pond. SPSA likely forage solely on settling pond.
Exposed	UWOP	Upper Wolfram Creek	649497	8552476	Lotic	n/s	1	Recently logged area with one nesting pair of SPSA in 2014.
Exposed	WOPD	Wolfram Settling Pond	648271	5552309	Lentic	n/s	1	Mine Settling Pond. SPSA likely forage solely on settling pond.

n/s - area not surveyed in 2013

Table 3.2: Summary of spotted sandpiper nesting results from 2013 and 2014 relative to published data for a reference population (Oring et al. 1983).

	Nest and Egg Outcomes	This Study		Oring et al. 1983[a]
		2013	**2014**	**Total from 1976 to 1981**
Nest Data	Total nests found	84	127	212
	Nests incubated to hatch	43 (51%)	71 (56%)	51%
	Depredated nests	27 (32%)	38 (30%)	34%
	Abandoned nests	11 (13%)	14 (11%)	nc
	Nests inundated by water	2 (2.4%)[c]	2 (1.6%)	nc
	Nests trampled by wildlife	0	2 (1.6%)	nc
	Nests destroyed by machinery	1 (1.2%)	0	nc
Egg Data	Eggs incubated full term	131	219	387
	Eggs incubated full term that did not hatch	9 (6.9%)	8 (3.7%)	32 (8.3%)
	Eggs incubated full term that appeared abandoned due to asynchronous hatch or late depredation of a single egg followed by abandonment	4 (3.1%)	0	8 (2.1%)[b]
	Eggs incubated full term that had no development (appeared infertile)	3 (2.3%)	6 (2.7%)	8 (2.1%)
	Eggs incubated full term that had some development but died for unknown reasons	2 (1.5%)	2 (0.9%)	16 (4.1%)

[a] Oring, L.W., D.B. Lank, and S.J. Maxson. 1983. Population studies of the polyandrous spotted sandpiper. Auk 100:272-285.

[b] These eggs were pipping, but did not hatch.

[c] Only includes nests monitored after the flood event in 2013.

nc - not calculable from raw data presented in Oring et al. 1983.

3.2 Selenium Concentrations in Eggs

In 2013, 120 eggs were collected for chemical analysis. Of these, 11 were from nests initiated early in June that were subsequently destroyed by flooding (i.e., CHCK-1, ELKO-1 to ELKO-5 and MI2-1 to MI2-5; Appendix B - Table B.3). Most of the remaining eggs were those randomly collected at the time the nest was found (68), as well as abandoned eggs (32), and eggs that were incubated to term but did not hatch (9). In 2014, 141 eggs were collected, of which 116 were submitted for chemical analysis (Appendix B - Table B.4). As in 2013, most of the eggs analyzed were those randomly collected at the time the nest was found (86), whereas 22 were from abandoned nests and 8 were incubated to term but did not hatch. Moisture content in eggs ranged from 60% to 90%, and averaged 75% (Appendix B - Tables B.5 and B.6).

Selenium concentrations measured in spotted sandpiper eggs collected during the two-year study ranged from 1.9 µg/g dry weight (dw) at the Wigwam River reference area (WWR) to 32 µg/g dw near the Line Creek Contingency Ponds (LCCPL) (Appendix B - Tables B.3 to B.6). The highest selenium concentrations were associated with nests located near mine works such as settling ponds (Figure 3.1; Appendix B - Tables B.3 and B.4). Variability in selenium concentrations among nests at a particular study area, and within individual clutches, also tended to be highest in areas close to settling ponds (Figures 3.1 and 3.2).

Selenium concentrations were measured in 11 eggs collected before the flood in June 2013 [five each from the Elk River upstream of Elko Reservoir (ELKO) and Michel Creek in Sparwood (MI2), and a single egg from Chauncey Creek (CHCK)]. Eggs collected from the same areas before and after the flood showed close agreement in selenium concentrations (Figure 3.3), suggesting the flood did not substantially change spotted sandpiper exposure to selenium within a given area in 2013.

No significant relationship was found between selenium concentrations in eggs and hatching success (p=0.398; Figure 3.4; Table 3.3). In addition, nests with egg selenium concentrations above 12 µg/g dw were no more likely to contain eggs that failed to hatch than were nests with egg selenium concentrations below 12 µg/g dw (p=0.556). Excluding eggs that were infertile or nests that were potentially abandoned as a result of asynchronous hatching or depredation of a single egg close to hatching (Section 3.1), all but four of the remaining 101 nests (96%) incubated to term over the two year study had 100% hatching success. Of the four eggs that failed to hatch for uncertain reasons, three had selenium concentrations above 12 µg/g dw [i.e., HA7-2-2 in 2013 (16.3 µg/g dw), FO52-1-1 in 2013 (16.5 µg/g dw), and FO10-1-2 in 2014 (13.6 µg/g dw) (Appendix B - Tables B.3 and B.4)].

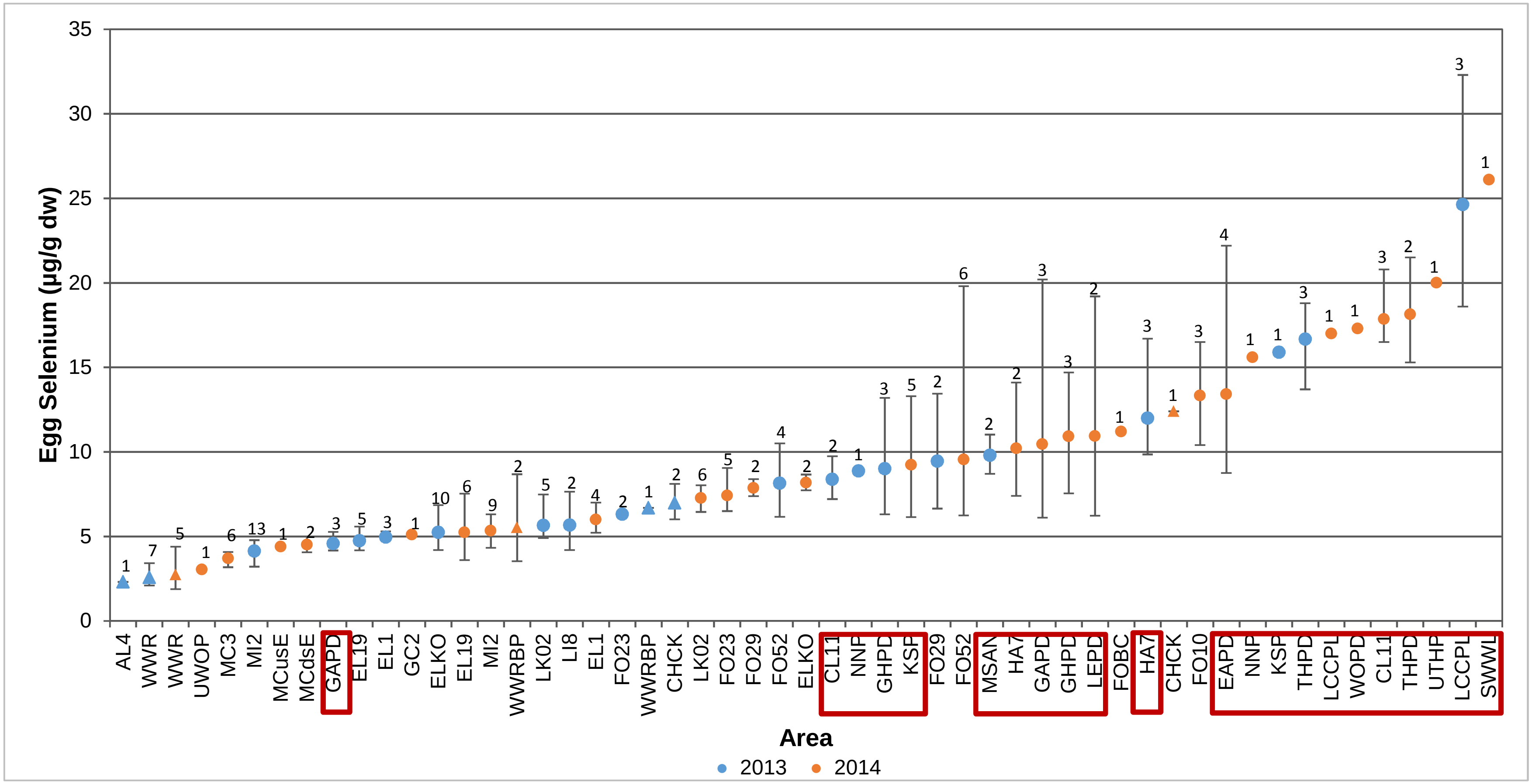

Figure 3.1: Geometric mean (± range) of selenium concentrations in sandpiper eggs from each sampling area. In cases where more than one egg was sampled from an individual nest, the first egg randomly collected from that clutch was used in calculations. The total number of nests sampled per area is shown above each data point. Areas outlined in red are associated with mine settling ponds. Triangle symbols represent reference areas, circles represent mine-exposed areas.

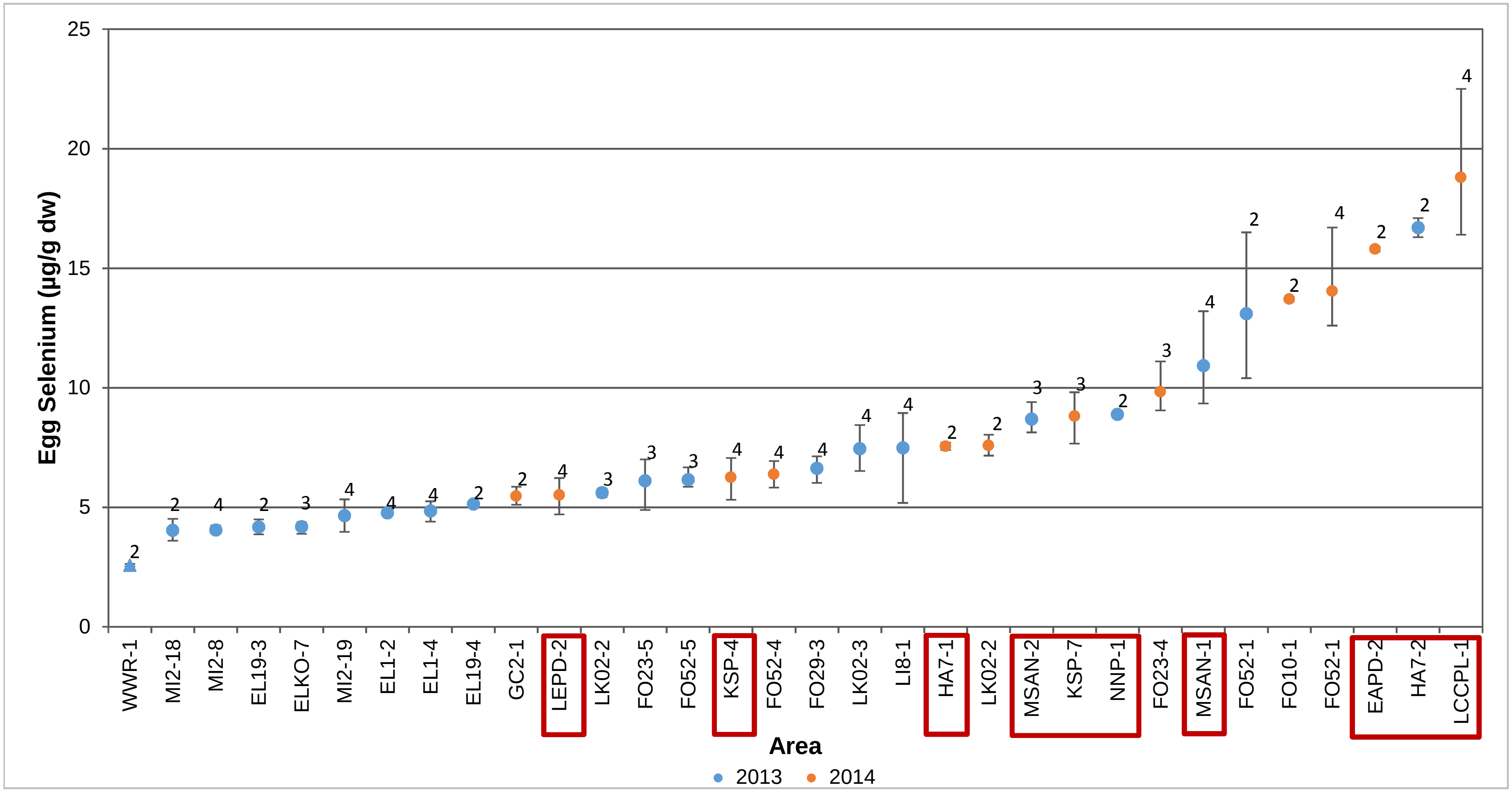

Figure 3.2: Geometric mean (± range) of selenium concentrations in spotted sandpiper eggs collected from the same nest (i.e., intra-clutch variability in selenium). The total number of eggs sampled per clutch is shown above each data point. Nests outlined in red are associated with mine settling ponds. Triangle symbols represent reference areas, circles represent mine-exposed areas.

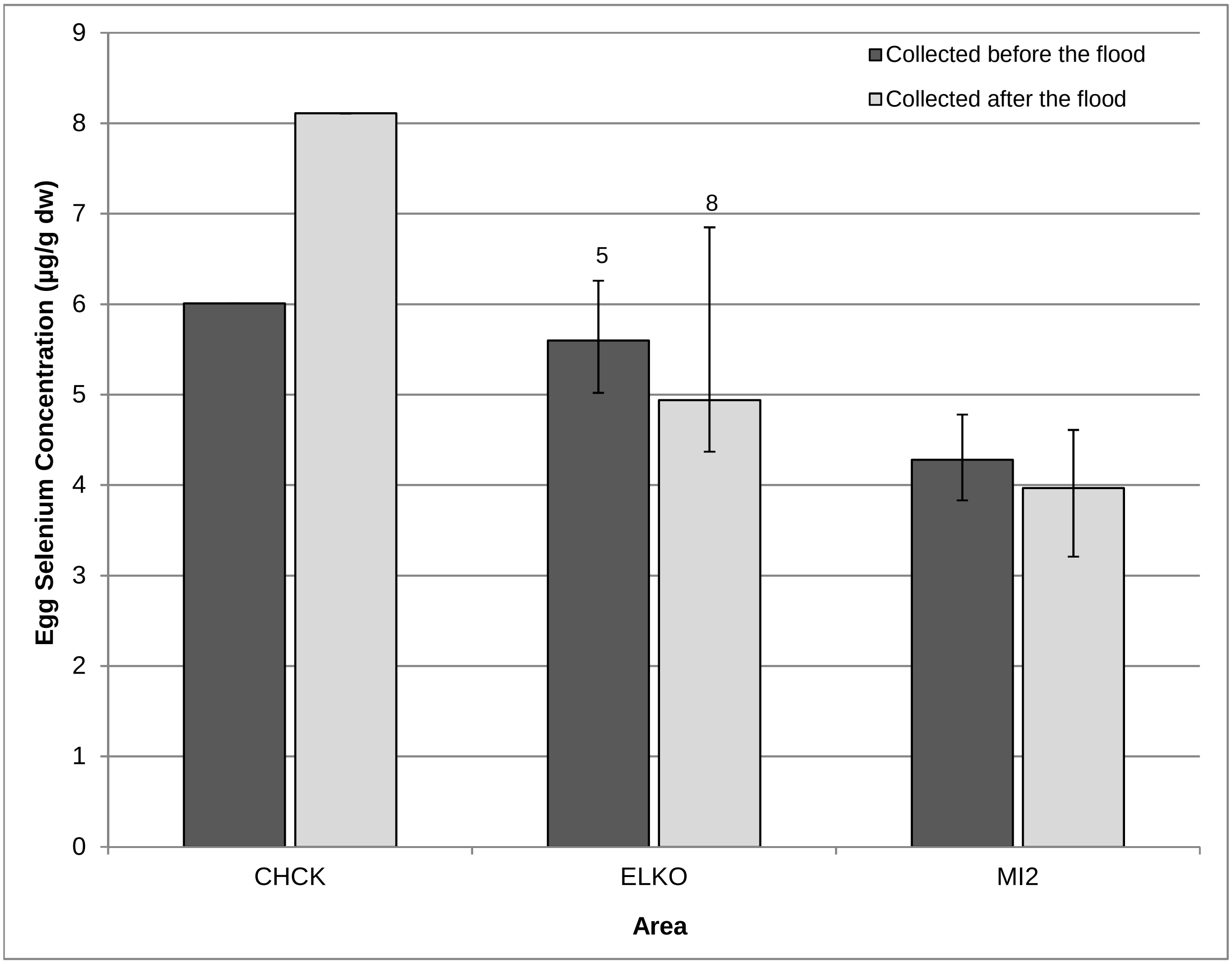

Figure 3.3: Geometric mean ± range of selenium concentrations in eggs collected from areas sampled before and after the flood in June 2013. Means were calculated using the first egg randomly sampled from each nest (total number of nests in each area is indicated above each bar).

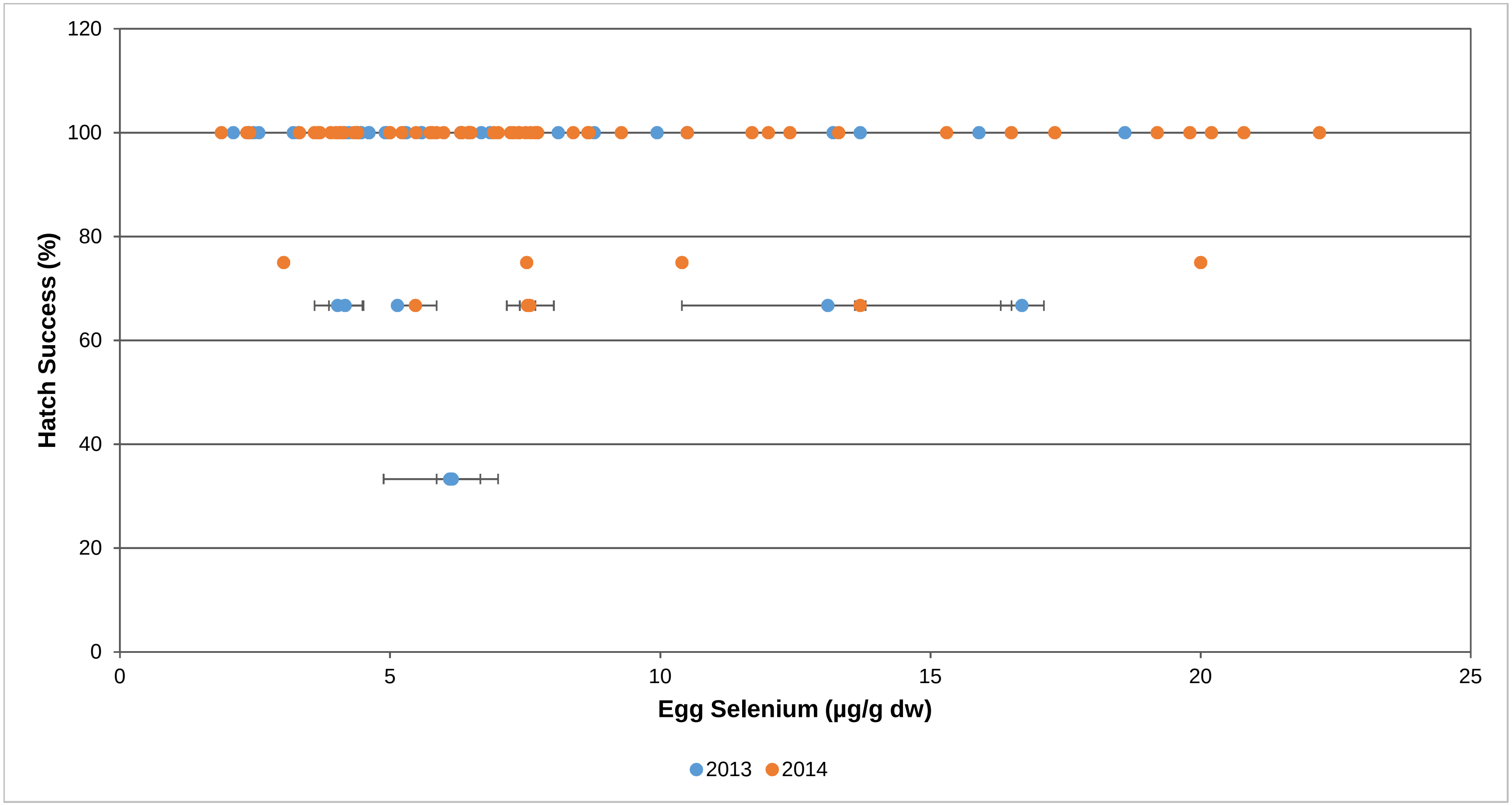

Figure 3.4: Hatchability of spotted sandpiper nests that were incubated to term relative to selenium concentrations measured in eggs collected from each nest, 2013-2014. Geometric mean (± range) of egg selenium concentrations is provided for nests where more than one egg was analyzed.

Table 3.3: Logistic regression results for hatching success versus egg selenium concentrations, 2013 and 2014.

Parameter	Estimate	Standard Error	Z	p-Value	95% Confidence Interval	
					Lower	Upper
Constant	-2.18	0.535	-4.073	0	-3.229	-1.131
Egg Selenium (µg/g dw)	0.047	0.054	0.867	0.386	-0.059	0.152

Overall Model Fit	
Log-Likelihood of Constant Only Model	-43.216
Log-Likelihood of Full Model	-42.859
Chi-Square	0.713
df	1
p-value	0.398

The partially developed embryo in the fourth egg (UWOP-1 from 2014) had a selenium concentration of 3.03 µg/g dw, which is within the range typically reported for bird eggs collected in reference areas (i.e., <5 µg/g dw for individual eggs or <3 µg/g dw for mean concentrations; Skorupa and Ohlendorf 1991; USDOI 1998). Overall, the data obtained during this study indicate very low potential for selenium-related reproductive effects on spotted sandpipers nesting in the Elk River watershed. The lack of effects also meant it was not possible to define the egg selenium concentration that causes a 10% reduction in hatching success (one of the original objectives of the study).

3.3 Selenium Concentrations in Benthic Invertebrates

Selenium concentrations in composite benthic invertebrate samples ranged from 3.4 µg/g dw in the Chauncey Creek (CHCK) reference area in 2013 to 55 µg/g dw in Gatehouse settling pond (GAPD) in 2014 (Table 3.4). Invertebrates collected from lentic environments (e.g., mine settling ponds) were higher in selenium than those collected from lotic environments, and were also consistently higher than the lowest suggested dietary threshold for reproductive impairment in birds (~5 µg/g dw; Ohlendorf 2003) (Table 3.4; Appendix B - Tables B.7 to B.10).

Selenium concentrations in spotted sandpiper eggs were positively correlated with those in composite benthic invertebrate samples collected in the same area (Figure 3.5; $p<0.0001$, $r=0.609$). Areas where birds were observed feeding in both lentic and lotic habitats near their nests resulted in greater scatter of data points, because selenium concentrations in eggs represented variable amounts of feeding in both types of habitat (Figure 3.6). Consumption of other types of prey (e.g., terrestrial insects), and variability in selenium concentrations among the different invertebrate taxa in the composite samples would also add to the observed variability. Regardless, the significant relationship between spotted sandpiper eggs and composite benthic invertebrate samples indicated that egg selenium concentrations represented the areas from which they were collected.

On a biomass basis, craneflies (Tipulidae), case-making caddisflies (Limnephilidae) and midges (Chironomidae) were most common in samples collected from lentic habitats whereas mayflies (e.g., Baetidae, Ephemerellidae, Heptagenaiidae) and stoneflies (e.g., Perlidae, Perlodidae, Chloroperlidae) were most common in samples collected from lotic habitats (Appendix B - Tables B.9 and B.10).

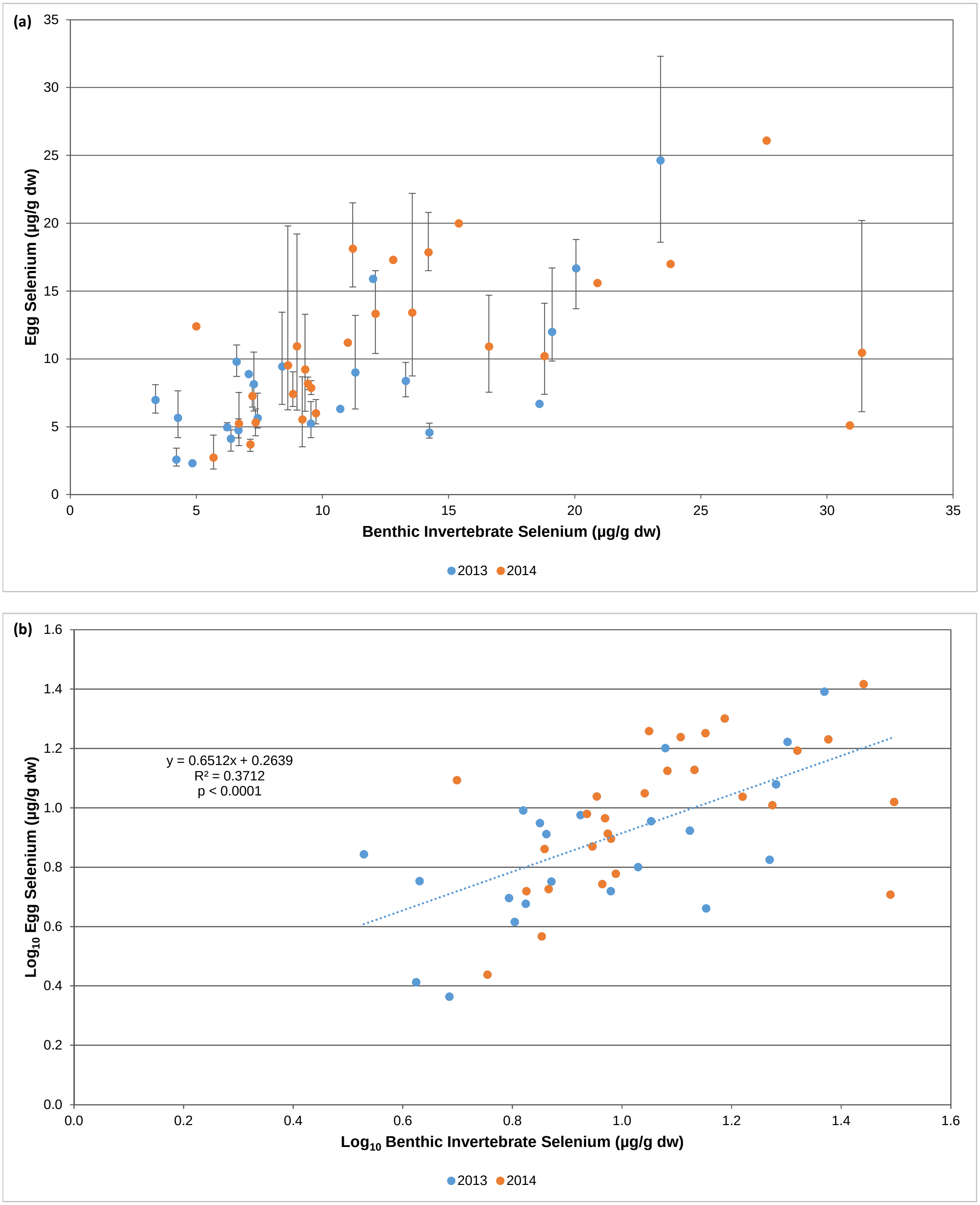

Figure 3.5: (a) Geometric mean (± range) of selenium concentrations in spotted sandpiper nests versus selenium concentrations in composite benthic invertebrate samples at each sampling area. (b) Same relationship using log-transformed data. In cases where more than one egg was sampled from an individual nest, the first egg randomly collected from that clutch was used in the calculation of the mean.

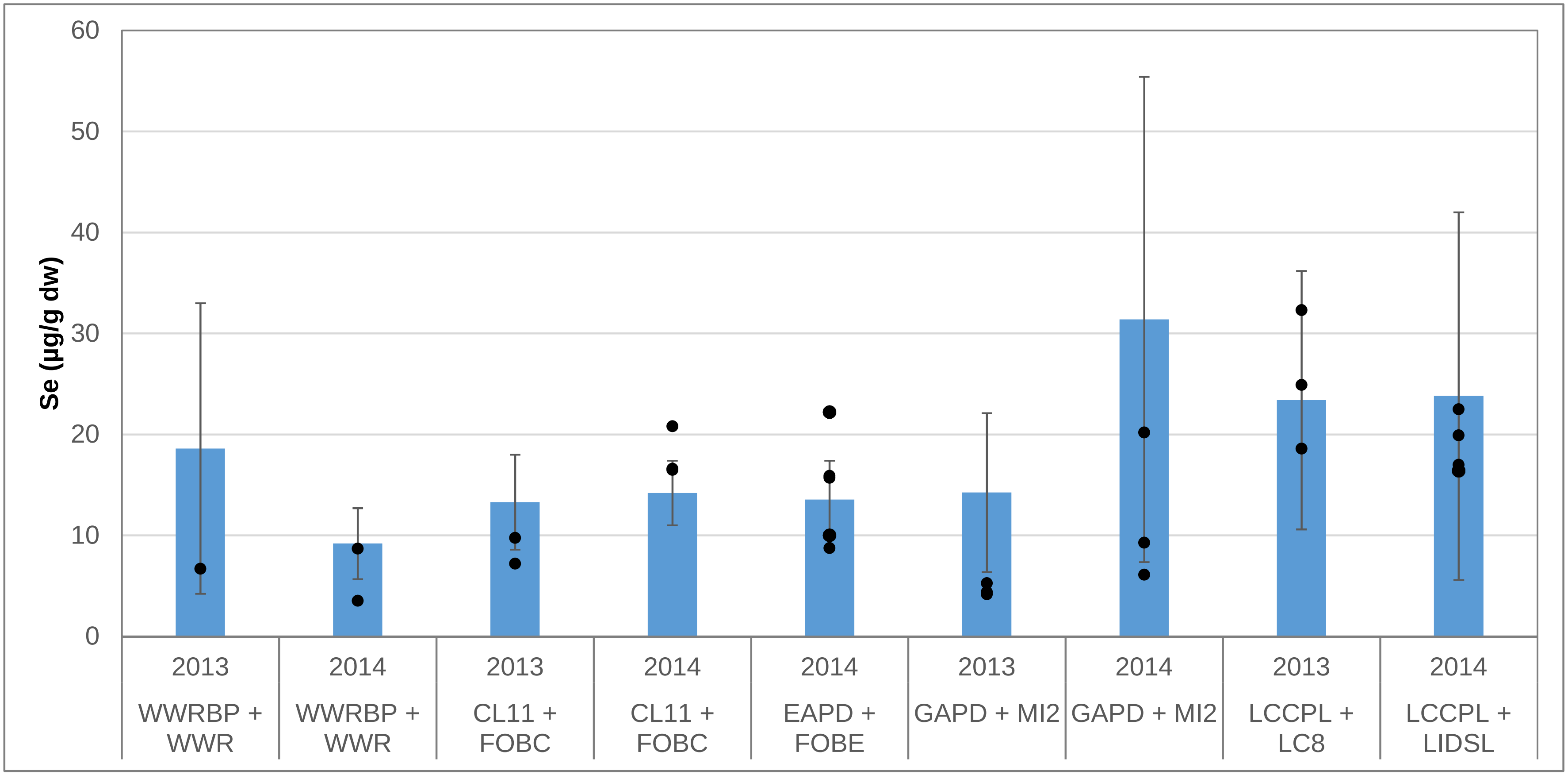

Figure 3.6: Selenium concentrations in spotted sandpiper eggs collected from areas containing both lentic and lotic habitats relative to composite benthic invertebrate samples from each type of habitat in the same area. Black dots represent individual eggs collected from nests associated with the lentic area. Blue bars represent the average (± range) selenium concentrations in the benthic invertebrate samples from the lentic and lotic habitats. Egg selenium concentrations near the top of the range bars are more closely related to benthic invertebrates collected from the lentic area. Eggs near the bottom of the range bars are more closely related to benthic invertebrates collected from the lotic area. Eggs near the middle represent a mix of feeding in both areas.

4.0 DISCUSSION

The previous study of spotted sandpiper hatching success in the Elk River watershed (Harding and Paton 2003, Harding et al. 2005) suggested that selenium-related effects may occur at concentrations below 7.3 µg/g dw in eggs. However, several constraints associated with the study (described in Section 1.1) resulted in uncertainties regarding the conclusions. As a result, this study addressed technical issues and limitations associated with previous work. Specifically:

- Nests having a much wider range of selenium concentrations in eggs were monitored, such that a relationship between hatching success and selenium concentrations could be explored for potential development of an effect threshold;
- The study was conducted over a period of two years to address potential year-to-year variability that may affect hatching success (e.g., disturbances related to flooding or construction in the first year that were not present in the second year);
- One egg was collected from each nest, allowing for accurate prediction of hatching dates and measurement of the selenium concentration associated with each nest;
- Percent moisture was measured in all eggs rather than estimated (average = 75%, range = 60% – 90%, compared to 70% used by Harding et al. 2005), providing accurate dry weight selenium concentrations;
- Nests were monitored regularly such that the cause of failure could be accurately documented; nests that were abandoned, depredated or lost for reasons unrelated to selenium were not included in statistical analyses; and
- Nests were not grouped into reference and mine-exposed categories for analysis (selenium concentrations in some mine-exposed areas were often within the range of reference areas, and would have biased comparisons if grouped accordingly);

By addressing limitations and uncertainties associated with the Harding et al. (2005) study, the current study found no selenium-related effects on spotted sandpiper egg hatchability. Rather, general population characteristics (e.g., percent nest success, clutch size and egg hatchability) were nearly identical to those observed by Oring et al. (1983) in a multi-year population study of spotted sandpipers in an undisturbed area of Minnesota (Table 3.2).

Over the two years of study, only 17 of 350 eggs incubated to completion did not hatch (4.9%). A little over half (9) of these eggs appeared to be infertile, with no obvious signs of development. Although it is difficult to prove infertility over early embryonic death, the suspected infertility rate observed in this study (2.6%) was very similar to that observed by Oring et al. (1983) (2.1%). Infertility is typically not associated with selenium exposure in birds (Heinz et al. 1987; Heinz et al. 1989; Heinz and Hoffman 1996, 1998; Smith et al. 1988; Stanley et al. 1996; Stanley et al. 2012). The comparability of egg infertility data obtained in the current study with that of Oring et al. (1983) and the lack of relationship between egg selenium concentrations and hatchability (regardless of inclusion of infertile eggs), suggests that spotted sandpipers are not particularly sensitive to selenium, and the existing threshold for selenium effects to birds of 12 µg/g dw (Adams et al. 2003; Ohlendorf 2003; Ohlendorf and Heinz 2011) should be protective of spotted sandpipers.

In the current study, 13% of nests found in 2013 and 11% of nests found in 2014 were concluded to be abandoned (Table 3.2). A similar proportion of nests (12%) where all eggs failed to hatch was found in the study conducted by Harding et al. (2005). These proportions are higher than the desertion rates observed by Oring et al. (1983) for spotted sandpipers (3.7% of total eggs laid from 1976 – 1981) and by Johnson and Walters (2008) in a multi-year study of western sandpipers (4% of nests from 2000 – 2005). Higher nest abandonment in the Elk River watershed studies may be attributable to a variety of disturbances (e.g., mine/industrial activities, recreational users, trains, cattle, other wildlife). Harding et al. (2005) suggested that industrial activity and highway work near Michel Creek in Sparwood may have contributed to complete nest failure in this area (i.e., 5 of 29 nests, representing 100% of mine-exposed nests where all eggs failed to hatch). Heavy recreational use of lower Michel Creek was also noted in 2013 and 2014. Collection of eggs for selenium analysis may also have contributed to nest abandonment. Experimental removal of eggs from nests of other bird species has been linked to nest abandonment in some instances (Sealy 1992; Mitchell and Robertson 1993).

With the exception of nests that were abandoned, no instances of complete nest failure (i.e., all eggs failed to hatch) were observed in 2013 or 2014. In contrast, Harding et al. (2005) indicated that 5 of 29 nests in lower Michel Creek experienced complete nest failure, which is very high compared to effects expected from selenium exposure. For example, even though mean egg selenium concentrations for black-necked stilts (*Himantopus mexicanus*) at Kesterson Reservoir in 1983, 1984, and 1985 were 28.2, 24.8, and 35.5 µg/g dw (with maximum concentrations of 58, 64, and 100 µg/g dw) and 55 of 624 eggs failed to hatch due to embryotoxicity, the incidence of total nest failure due to selenium embryotoxicity was less than 3% each year (Ohlendorf et al. 1989; Ohlendorf and Hothem 1995). This provides further information to support that the nests that failed to hatch on lower Michel Creek may have been abandoned.

In the current study and the study by Oring et al. (1983), depredation accounted for a loss of about one third of all nests/eggs (Table 3.2). In the study by Harding and Paton (2003), no nests were documented as being depredated, which is extremely unusual, and suggests that nests were not monitored in sufficient detail to determine if successful hatching occurred (i.e., all nests found empty were simply assumed to have hatched completely). Nevertheless, the comparability of depredation rates between the current study and that of Oring et al. (1983) indicates that spotted sandpiper nests in the Elk River watershed are no more or less prone to depredation than in undisturbed areas.

The highest selenium concentrations in spotted sandpiper eggs were found in nests located near mine settling ponds. These areas tend to be closest to mine operations and are lentic in nature, where the longer hydraulic retention times can promote greater selenium uptake and transfer through dietary pathways (Lillebo et al. 1988, Canton and Van Derveer 1997, Lemly 1999, Orr et al. 2006). Selenium concentrations were also elevated in one of the reference areas far removed from active mine operations – the Wigwam River beaver ponds (WWRBP; Figure 3.1). The WWRBP area is fed by water that appears to originate as a groundwater seep. While selenium concentrations in water at the WWRBP are slightly higher than in the Wigwam River itself (e.g., 0.0013 mg/L versus 0.00016 mg/L in 2013), they are substantially lower than at most mine-exposed areas (Appendix B - Tables B.11 and B.12; Windward et al. 2014), and are also lower than the BCMOE guideline for protection of aquatic life (0.002 mg/L). Despite this, in 2013, the selenium concentration measured in invertebrates from the WWRBP area was 33 µg/g dw which was the second highest observed among all study areas (Table 3.4). While the lentic nature of the area likely contributed to the higher selenium concentrations observed, the types of organisms included in the samples (in this case, oligochaetes) may have further influenced results. Malloy et al. (1999) noted that organisms dwelling within the sediment exhibited much higher selenium concentrations than taxa that were more epi-benthic. In 2014, the benthic invertebrate tissue sample was composed of Limnephilidae (an epi-benthic caddisfly) rather than oligochaetes (sediment-dwelling worms), and selenium concentrations were much lower (12.7 µg/g dw).

Spotted sandpipers are dietary generalists (i.e., not specializing on a certain type of prey; Reed et al. 2013). Composite and single-family benthic invertebrate samples collected to date show a range of dietary selenium concentrations within and among water bodies in the Elk River watershed (Minnow 2015). Consequently, the amount of selenium consumed on a daily basis may vary considerably, especially if feeding territories include both high- and low-selenium water bodies. Even within water bodies, dietary levels may vary based on heterogeneity of habitat and/or among selected prey items (i.e., specific invertebrate taxa consumed). As a result, in areas where sandpipers have access to prey items that vary widely in selenium concentrations, both inter- and intra-clutch variability in egg selenium concentrations tended to be greater. For example, selenium concentrations in nests located near the Line Creek Contingency Ponds (LCCPL) ranged from 17.0 to 24.6 µg/g dw, and within a single abandoned clutch collected in 2014, ranged from 16.4 to 22.5 µg/g dw (Figures 3.1 and 3.2). The contingency ponds are located directly beside Line Creek, separated by only a raised berm. Within the contingency ponds themselves, invertebrate selenium concentrations ranged from 36 to 42 µg/g dw, whereas invertebrates collected from Line Creek beside (LIDSL, LC8) and just downstream of the ponds (LI8) ranged from 4.3 to 10.6 µg/g dw (Figure 3.6; Table 3.4).

Female birds transfer selenium from their current diet into eggs, with the amount of selenium deposited being proportional to that of the diet (DeVink et al. 2008; Heinz 1993; Heinz et al. 1990). Therefore, selenium concentrations measured in spotted sandpiper eggs in the Elk River watershed vary within and among clutches depending on the amount of time the female spends feeding in areas with high versus low dietary selenium concentrations (as in the vicinity of the Line Creek Contingency Ponds). High inter- and intra-clutch variability in selenium concentrations would also be expected in other areas where dietary selenium can vary considerably during egg-laying (e.g., Gatehouse, Clode and Eagle Ponds; Figure 3.6). Conversely, where there is little variability in dietary selenium concentrations, inter- and intra-clutch selenium variability tends to be low (e.g., areas along the Wigwam River, Michel Creek, and the Elk River that are far removed from lentic areas/settling ponds).

Despite selenium concentrations in potential benthic invertebrate prey items exceeding the lowest suggested dietary threshold for reproductive impairment in birds (~5 µg/g dw; Ohlendorf 2003) in almost all study areas (Table 3.4), there was no evidence of selenium-related effects on spotted sandpiper reproduction. In fact, selenium concentrations in all spotted sandpiper eggs collected from lotic areas within the Elk River watershed were below the 12 µg/g dw threshold for sensitive bird species. Considering the vast majority of spotted sandpiper nesting habitat in the Elk River watershed is lotic in nature, the potential for population-level effects would be very low at present selenium exposure levels.

Results presented herein confirm that technical issues, uncertainties, and constraints associated with the Harding et al. (2005) study, lead to premature conclusions regarding the relative sensitivity of spotted sandpipers to selenium. If spotted sandpipers were particularly sensitive to selenium, as suggested by Harding et al. (2005), effects should have been observed in the current study, where 31 nests were found with egg selenium concentrations greater than 12 µg/g dw, compared to only one nest found by Harding et al. (2005). While the lack of observed effects over the much greater range of egg selenium concentrations measured in the current study did not allow for development of an adverse effect threshold, the data suggest that the generally accepted threshold of 12-15 µg/g dw selenium in eggs provides an adequate level of protection for spotted sandpipers.

5.0 RECOMMENDATIONS

Based on the results of this study, future monitoring of selenium concentrations in spotted sandpiper eggs is not recommended. The necessity of collecting eggs for the purposes of monitoring is inherently more damaging to the population than the potential for effects related to selenium. Also, as demonstrated in this multi-year study and data collected during previous sampling programs (Minnow 2014), concentrations of selenium in most spotted sandpiper eggs (including all eggs collected from lotic areas, which comprise the vast majority of spotted sandpiper nesting habitat in the Elk River watershed) are well below the lowest potential adverse effect threshold of 12 µg/g dw in the Elk River watershed.

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APPENDIX A

DATA QUALITY ASSESSMENT

APPENDIX A: DATA QUALITY ASSESSMENT

A1.0 INTRODUCTION

A Data Quality Assessment (DQA) was conducted on data collected as part of the Elk Valley Spotted Sandpipers monitoring program. The objective of the DQA is to define the overall quality of the data presented in the report, and, by extension, the confidence with which the data can be used to derive conclusions.

A1.1 Background

A variety of factors can influence the chemical and biological measurements made in an environmental study and thus affect the accuracy and/or precision of the data. Inconsistencies in sampling or laboratory methods, use of instruments that are inadequately calibrated or which cannot measure to the desired level of accuracy or precision, and contamination of samples in the field or laboratory are just some of the potential factors that can lead to the reporting of data that do not accurately reflect actual environmental conditions. Depending on the magnitude of the problem, inaccuracy or imprecision have the potential to affect the reliability of any conclusions made from the data. Therefore, it is important to ensure that monitoring programs incorporate appropriate steps to control the non-natural sources of data variability (i.e., minimize the variability that does not reflect natural spatial and temporal variability in the environment) and thus assure the quality of the data.

Data quality as a concept is meaningful only when it relates to the intended use of the data. That is, one must know the context in which the data will be interpreted in order to establish a relevant basis for judging whether or not the data set is adequate. DQA involves comparison of actual field and laboratory measurement performance to data quality objectives (DQOs) established for a particular study, such as evaluation of method detection limits, blank sample data, data precision (based on field and laboratory duplicate samples), and data accuracy (based on matrix spike recoveries and/or analysis of standards or certified reference materials).

DQOs were established at the outset of the field program that reflect reasonable and achievable performance expectations (Table A.1). Programs involving a large amount of samples and analytes usually have some results that exceed the DQOs. This is particularly so for multi-element scans (e.g., ICP scans for metals) since the analytical conditions are not necessarily optimal for every element included in the scan. Generally, scan results may be considered acceptable if no more than 20% of the analytes fail to meet the DQO. Overall, the intent of comparing data to DQOs was not to reject any measurement that did not meet the DQO, but to ensure any questionable data received

Table A.1: Data quality objectives for samples collected during the spotted sandpiper program.

Quality Control Measure	Quality Control Sample Type	Study Component	
		Water Quality	**Tissue Chemistry**
Method Detection Limits (MDL)	Comparison of actual MDL versus target MDL	MDL for each parameter should be at least as low as applicable guidelines, ideally ≤1/10th guideline value[a]	NA
Blank Analysis	Laboratory Blank	≤two-times the laboratory MDL	NA
Laboratory Precision	Laboratory Duplicates	≤25% RPD[b]	≤30% RPD[b]
	Sub-Sampling Precision	NA	NA
Accuracy	Recovery of Matrix Spikes	75-125%	70-130%
	Recovery of Certified Reference Material, QC Standards	85-115%	70-130%

[a] or below predictions, if applicable and no guideline exists for the substance.
[b] RPD - Relative Percent Difference.
NA - Not Applicable.

more scrutiny to determine what effect, if any, this had on interpretation of results within the context of this project.

A1.2 Types of Quality Control Samples

Several types of quality control (QC) samples were assessed as part of laboratory analysis. These samples, and a description of each, include the following:

- **Laboratory Blanks** are samples of de-ionized water and/or appropriate reagent(s) that are handled and analyzed the same way as regular samples. These samples will reflect any contamination of samples occurring in the laboratory (laboratory or method blanks). Concentrations of analytes should not be detectable, although a DQO of twice the method detection limit allows for slight “noise” around the detection limit.

- **Laboratory Duplicates** are replicate sub-samples created in the laboratory from randomly selected field samples which are sub-sampled and then analyzed independently using identical analytical methods. The laboratory duplicate sample results reflect any variability introduced during laboratory sample handling and analysis and thus provide a measure of laboratory precision.

- **Matrix Spike Recovery Samples** are created in the laboratory by adding a known amount/concentration of a given analyte (or mixture of analytes) to a randomly selected test sample previously divided to create two sub-samples. The spiked and regular sub-samples are then analyzed in an identical manner. The spike recovery represents the difference between the measured spike amount (total amount in spiked sample minus amount in original sample) relative to the known spike amount (as a percentage). The analysis of spiked samples provides an indication of the accuracy of analytical results.

- **Certified Reference Materials** are samples containing known chemical concentrations that are processed and analyzed along with batches of environmental samples. The sample results are then compared to target results to provide a measure of analytical accuracy. The results are reported as the percent of the known amount that was recovered in the analysis.

A2.0 WATER CHEMISTRY

Water chemistry samples were analyzed by ALS Environmental (Burnaby, BC).

A2.1 Method Detection Limits

Achieved MDLs for water chemistry samples were at or below the target concentrations, with the exception of bromide, fluoride, nitrite, cadmium, copper, silver, vanadium, and zinc (Table A.2). Despite not meeting the DQO, MDLs for all but cadmium were below applicable guideline levels, meaning that the concentrations could be reliably interpreted relative to guidelines. With respect to cadmium, concentrations were below the MDL for a few samples collected from reference areas in 2013 and 2014, but were otherwise above the MDL (Appendix Tables B.11 and B.12) allowing for data interpretation, as necessary.

A2.2 Data Precision

A2.2.1 Laboratory Blank Samples

Analyte concentrations were below the MDL for all laboratory blank samples, indicating no inadvertent contamination of samples within the laboratory during analysis (Table A.3).

A2.2.2 Laboratory Duplicate Samples

Close agreement was achieved between all laboratory duplicate samples, with a minor exception for the total suspended solids replicate from 2013. Overall, duplicate results indicated excellent analytical precision (Table A.4).

A2.2.3 Laboratory Matrix Spike Samples

Analyte recoveries for matrix spike samples all met the target DQO (Table A.5).

A2.3 Data Accuracy

Reference material recoveries were all reported within the target range (Table A.6), indicating excellent analytical accuracy associated with the analysis of water chemistry samples.

Table A.2: Laboratory method detection limits (MDLs) relative to targets and to water quality guidelines. Grey highlighted values indicate method detection limit more than 0.1 x lowest guideline (i.e., MDL failed to meet the target), bold and italicized values indicate method detection limit above guideline.

Analyte		Units	BCWQG[a]		Method Detection Limit		
			30-d Chronic	Maximum	Target	Achieved (2013)	Achieved (2014)
Non-metals	Hardness (as $CaCO_3$)	mg/L	-	-	0.50	0.50	0.50
	Total Suspended Solids	mg/L	-	-	-	3	3
	Ammonia (as N)	mg/L	0.298[b]	1.55[b]	0.0298	0.005	0.005
	Bromide (Br)	mg/L	-	0.050[c]	0.005	0.050	0.050 - 1.0
	Chloride (Cl)	mg/L	150	600	15.0	0.50 - 5.0	0.50 - 10
	Fluoride (F)	mg/L	-	0.51[d]	0.051	0.02 - 0.20	0.020 - 0.40
	Total Kjeldahl Nitrogen	mg/L	-	-	-	0.050	0.050
	Nitrate (as N)	mg/L	3	32.8	0.3	0.0050 - 0.050	0.0050 - 0.10
	Nitrite (as N)	mg/L	0.02	0.06	0.002	0.0010 - 0.010	0.0010 - 0.020
	Phosphorus (P)	mg/L	-	-	-	0.0020	0.0020
	Sulfate (SO_4)	mg/L	-	100	10	0.50 - 5.0	0.50 - 10
	Dissolved Organic Carbon	mg/L	-	-	-	0.50	0.50
	Total Organic Carbon	mg/L	-	-	-	0.50	0.50
Total metals	Aluminum (Al)	mg/L	0.053	0.13	0.005	0.0030	0.0030
	Antimony (Sb)	mg/L	-	0.02[c]	0.002	0.00010	0.00010
	Arsenic (As)	mg/L	-	0.005	0.0005	0.00010	0.00010
	Barium (Ba)	mg/L	1	5[c]	0.1	0.000050	0.000050
	Beryllium (Be)	mg/L	-	0.0053[c]	0.00053	0.00010	0.00010
	Bismuth (Bi)	mg/L	-	-	-	0.00050	0.00050
	Boron (B)	mg/L	-	1.2	0.12	0.010	0.010
	Cadmium (Cd)	mg/L	-	0.0000057[c,d]	0.00000057	***0.000010***	***0.000010***
	Calcium (Ca)	mg/L	-	-	-	0.050	0.050
	Chromium (Cr)	mg/L	-	0.001[c]	0.0001	0.00010	0.00010
	Cobalt (Co)	mg/L	0.004	0.11	0.0004	0.00010	0.00010
	Copper (Cu)	mg/L	0.002[d]	0.0032[d]	0.0002	0.00050	0.00050
	Iron (Fe)	mg/L	-	1	0.1	0.010	0.010
	Lead (Pb)	mg/L	0.00354[d]	0.00596[d]	0.0003	0.000050	0.000050
	Lithium (Li)	mg/L	0.014[c]	0.870	0.0014	0.00050	0.00050
	Magnesium (Mg)	mg/L	-	-	-	0.10	0.10
	Manganese (Mn)	mg/L	0.66	0.68	0.066	0.000050	0.000050
	Mercury (Hg)	mg/L	-	-	-	0.000010	0.000010
	Molybdenum (Mo)	mg/L	1	2	0.1	0.000050	0.000050
	Nickel (Ni)	mg/L	-	0.025[c,d]	0.0025	0.00050	0.00050
	Phosphorus (P)	mg/L	-	-	-	0.050	0.050
	Potassium (K)	mg/L	-	373 - 432[c,e]	37.3 - 43.2	0.10	0.10
	Selenium (Se)	mg/L	-	0.002	0.0002	0.00010	0.00010
	Silicon (Si)	mg/L	-	-	-	0.050	0.050
	Silver (Ag)	mg/L	0.00005[d]	0.00010[d]	0.000005	0.000010	0.000010
	Sodium (Na)	mg/L	-	-	-	0.050	0.050
	Strontium (Sr)	mg/L	-	-	-	0.00020	0.00020
	Thallium (Tl)	mg/L	0.0008[c]	-	0.00003	0.000010	0.000010
	Tin (Sn)	mg/L	-	-	-	0.00010	0.00010
	Titanium (Ti)	mg/L	-	2/4.6[c,f]	0.2/0.46	0.010	0.010
	Uranium (U)	mg/L	-	3[c]	0.3	0.000010	0.000010
	Vanadium (V)	mg/L	-	0.006[c]	0.0006	0.0010	0.0010
	Zinc (Zn)	mg/L	0.0075[d]	0.033[d]	0.00075	0.0030	0.0030

[a] BC MOE (British Columbia Ministry of Environment). 2006. British Columbia Approved Water Quality Guidelines (Criteria).
[b] Based on lowest guideline using highest temperature and pH.
[c] Working guideline.
[d] Based on lowest guideline using lowest hardness.
[e] Guideline based on threshold for Daphnia magna immobilization. Used lowest level in range.
[f] Guidelines based on median threshold level of *Scenedesmus/Daphnia.* Used lowest level between given threshold levels.

Table A.3: Laboratory method blank results associated with analysis of water samples. Highlighted data did not meet the data quality objective of ≤ 2x the method detection limit.

	Analyte	Units	Study Year																				
			2013											2014									
Non-metals	Total Suspended Solids	mg/L	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0				<3.0	<3.0	<3.0	<3.0						
	Ammonia (as N)	mg/L	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050			<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	Bromide (Br)	mg/L	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050				
	Chloride (Cl)	mg/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50				
	Fluoride (F)	mg/L	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020				
	Total Kjeldahl Nitrogen	mg/L	<0.050	<0.050	<0.050	<0.050								<0.050	<0.050	<0.050	<0.050						
	Nitrate (as N)	mg/L	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050				
	Nitrite (as N)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010				
	Phosphorus (P)	mg/L	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020					
	Sulfate (SO_4)	mg/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50				
	Dissolved Organic Carbon	mg/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50						<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50			
	Total Organic Carbon	mg/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50					<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	
Totals Metals	Aluminum (Al)	mg/L	<0.0030	<0.0030										<0.0030	<0.0030								
	Antimony (Sb)	mg/L	<0.00010	<0.00010										<0.00010	<0.00010								
	Arsenic (As)	mg/L	<0.00010	<0.00010										<0.00010	<0.00010								
	Barium (Ba)	mg/L	<0.000050	<0.000050										<0.000050	<0.000050								
	Beryllium (Be)	mg/L	<0.00010	<0.00010										<0.00010	<0.00010								
	Bismuth (Bi)	mg/L	<0.00050	<0.00050										<0.00050	<0.00050								
	Boron (B)	mg/L	<0.010	<0.010										<0.010	<0.010								
	Cadmium (Cd)	mg/L	<0.000010	<0.000010										<0.000010	<0.000010								
	Calcium (Ca)	mg/L	<0.050	<0.050										<0.050	<0.050								
	Chromium (Cr)	mg/L	<0.00010	<0.00010										<0.00010	<0.00010								
	Cobalt (Co)	mg/L	<0.00010	<0.00010										<0.00010	<0.00010								
	Copper (Cu)	mg/L	<0.00050	<0.00050										<0.00050	<0.00050								
	Iron (Fe)	mg/L	<0.010	<0.010										<0.010	<0.010								
	Lead (Pb)	mg/L	<0.000050	<0.000050										<0.000050	<0.000050								
	Lithium (Li)	mg/L	<0.00050	<0.00050										<0.00050	<0.00050								
	Magnesium (Mg)	mg/L	<0.050	<0.050										<0.050	<0.050								
	Manganese (Mn)	mg/L	<0.000050	<0.000050										<0.000050	<0.000050								
	Mercury (Hg)	mg/L	<0.000010	<0.000010										<0.000010									
	Molybdenum (Mo)	mg/L	<0.000050	<0.000050										<0.000050	<0.000050								
	Nickel (Ni)	mg/L	<0.00050	<0.00050										<0.00050	<0.00050								
	Phosphorus (P)	mg/L	<0.050	<0.050										<0.050	<0.050								
	Potassium (K)	mg/L	<0.10	<0.10										<0.10	<0.10								
	Selenium (Se)	mg/L	<0.00010	<0.00010										<0.00010	<0.00010								
	Silicon (Si)	mg/L	<0.050	<0.050										<0.050	<0.050								
	Silver (Ag)	mg/L	<0.000010	<0.000010										<0.000010	<0.000010								
	Sodium (Na)	mg/L	<0.050	<0.050										<0.050	<0.050								
	Strontium (Sr)	mg/L	<0.00020	<0.00020										<0.00020	<0.00020								
	Thallium (Tl)	mg/L	<0.000010	<0.000010										<0.000010	<0.000010								
	Tin (Sn)	mg/L	<0.00010	<0.00010										<0.00010	<0.00010								
	Titanium (Ti)	mg/L	<0.010	<0.010										<0.010	<0.010								
	Uranium (U)	mg/L	<0.000010	<0.000010										<0.000010	<0.000010								
	Vanadium (V)	mg/L	<0.0010	<0.0010										<0.0010	<0.0010								
	Zinc (Zn)	mg/L	<0.0030	<0.0030										<0.0030	<0.0030								

Table A.4: Laboratory duplicate results for water samples. Highlighted values did not meet the data quality objective of ≤ 25% relative percent difference (RPD).

Analyte		Year	Units	Replicate 1	Replicate 2	RPD[a] (%)
Physical Tests	Total Suspended Solids	2013	mg/L	4.9	3.6	31%
		2014	mg/L	<3.0	3.0	0%
Nutrients	Total Kjeldahl Nitrogen	2013	mg/L	0.062	0.064	3%
Organic / Inorganic Carbon	Dissolved Organic Carbon	2014	mg/L	1.88	1.87	1%
			mg/L	<0.5	<0.5	0%
			mg/L	0.81	0.88	8%
			mg/L	2.45	2.45	0%
	Total Organic Carbon	2014	mg/L	0.86	0.86	0%
			mg/L	<0.5	<0.5	0%
			mg/L	0.8	0.77	4%
			mg/L	3.34	3.12	7%
Total Metals	Aluminum (Al)	2014	mg/L	0.0924	0.0925	0%
	Antimony (Sb)		mg/L	<0.0001	<0.0001	0%
	Arsenic (As)		mg/L	0.0003	0.00027	11%
	Barium (Ba)		mg/L	0.068	0.0674	1%
	Beryllium (Be)		mg/L	<0.0001	<0.0001	0%
	Bismuth (Bi)		mg/L	<0.0005	<0.0005	0%
	Boron (B)		mg/L	<0.01	<0.01	0%
	Cadmium (Cd)		mg/L	0.000018	0.00002	11%
	Calcium (Ca)		mg/L	45.2	45.5	1%
	Chromium (Cr)		mg/L	0.00034	0.00035	3%
	Cobalt (Co)		mg/L	<0.0001	<0.0001	0%
	Copper (Cu)		mg/L	<0.0005	<0.0005	0%
	Iron (Fe)		mg/L	0.095	0.096	1%
	Lead (Pb)		mg/L	0.000093	0.000079	16%
	Lithium (Li)		mg/L	0.00417	0.00414	1%
	Magnesium (Mg)		mg/L	12.6	12.7	1%
	Manganese (Mn)		mg/L	0.00556	0.00565	2%
	Mercury (Hg)	2013	mg/L	<0.00001	<0.00001	0%
	Molybdenum (Mo)	2014	mg/L	0.000987	0.000954	3%
	Nickel (Ni)		mg/L	0.00050	<0.00050	0%
	Phosphorus (P)		mg/L	<0.050	<0.050	0%
	Potassium (K)		mg/L	0.54	0.55	2%
	Selenium (Se)		mg/L	0.00427	0.00424	1%
	Silicon (Si)		mg/L	2.07	2.08	0%
	Silver (Ag)		mg/L	<0.000010	<0.000010	0%
	Sodium (Na)		mg/L	1.41	1.4	1%
	Strontium (Sr)		mg/L	0.138	0.139	1%
	Thallium (Tl)		mg/L	10.1	10.1	0%
	Thallium (Tl)		mg/L	<0.00001	<0.00001	0%
	Tin (Sn)		mg/L	<0.00010	<0.00010	0%
	Titanium (Ti)		mg/L	<0.010	<0.010	0%
	Uranium (U)		mg/L	0.000711	0.000697	2%
	Vanadium (V)		mg/L	<0.0010	<0.0010	0%
	Zinc (Zn)		mg/L	<0.0030	<0.0030	0%

[a] The method detection limit (MDL) value was used in instances where values less than the MDL were reported.

Table A.5: Laboratory matrix spike recoveries for water samples. Highlighted values did not meet the data quality objective of 75 - 125% recovery.

		Sample Year	2013											2014					
	Analyte	Units	ALS Job No. L1331369							ALS Job No. L1332094				ALS Job No. L1487296					
Non-metals	Ammonia (as N)	mg/L	103	96	95					95	96	94		93	95	89	98	97	
	Bromide (Br)	mg/L	101	93	89					88	87			104	103	103	103	103	
	Chloride (Cl)	mg/L	100	91	87	93				91	88	87	101	102	102	102			
	Fluoride (F)	mg/L	107	96	91	102				94	90			110	108	110	97		
	Total Kjeldahl Nitrogen	mg/L	102	113						100	103			95	91	100	97		
	Nitrate (as N)	mg/L	100	91	87	94				88	87	98		103	102	102	102	101	
	Nitrite (as N)	mg/L	100	90	85	93				88	85	98		104	103	103	103	101	
	Phosphorus (P)	mg/L	77	78	87	86	98	103	100	98	98	97	97	92	100	N/A	101	88	
	Sulfate (SO_4)	mg/L	100	91	86	93				91	87	85	90	103	102	102	102	N/A	
	Dissolved Organic Carbon	mg/L	102							102				N/A	110	106	103	105	N/A
	Total Organic Carbon	mg/L	110							119	82	109		N/A	104	106	100	98	107
Totals Metals	Aluminum (Al)	mg/L	97											94					
	Antimony (Sb)	mg/L	105											105					
	Arsenic (As)	mg/L	104											101					
	Barium (Ba)	mg/L	N/A											N/A					
	Beryllium (Be)	mg/L	94											94					
	Bismuth (Bi)	mg/L	94											94					
	Boron (B)	mg/L	100											97					
	Cadmium (Cd)	mg/L	100											99					
	Calcium (Ca)	mg/L	99											N/A					
	Chromium (Cr)	mg/L	95											96					
	Cobalt (Co)	mg/L	97											93					
	Copper (Cu)	mg/L	96											91					
	Iron (Fe)	mg/L	97											91					
	Lead (Pb)	mg/L	94											92					
	Lithium (Li)	mg/L	99											93					
	Magnesium (Mg)	mg/L	99											N/A					
	Manganese (Mn)	mg/L	97											95					
	Mercury (Hg)	mg/L	90	79						91				102					
	Molybdenum (Mo)	mg/L	106											100					
	Nickel (Ni)	mg/L	96											N/A					
	Phosphorus (P)	mg/L												96					
	Potassium (K)	mg/L	105											102					
	Selenium (Se)	mg/L	98											N/A					
	Silicon (Si)	mg/L	98											93					
	Silver (Ag)	mg/L	89											100					
	Sodium (Na)	mg/L	N/A											N/A					
	Strontium (Sr)	mg/L	98											N/A					
	Thallium (Tl)	mg/L	95											94					
	Tin (Sn)	mg/L	104											100					
	Titanium (Ti)	mg/L	104											108					
	Uranium (U)	mg/L	97											N/A					
	Vanadium (V)	mg/L	99											100					
	Zinc (Zn)	mg/L	97											90					

N/A - Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Table A.6: Laboratory recoveries of of Quality Control (QC) standards (Certified Reference Material, CRM; Laboratory Control Sample, LCS) for water samples. Highlighted values did not meet the data quality objective of 85-115% recovery

		Sample Year	2013												2014											
	Analyte	Units	ALS Job No. L1331369							ALS Job No. L1332094					ALS Job No. L1487296											
Non-metals	Total Suspended Solids	mg/L	88	89	89	101	89			88	100	107	95		98	98	102	106								
	Ammonia (as N)	mg/L	102	100	96	96				106	87	101	95	95	102	102	98	96	103	104	102	99	97	97		
	Phosphorus (P)	mg/L	98	96	96	97	100	96	98	93	96	97	96		104	105	92	95	96							
	Bromide (Br)	mg/L	104	103						104	102				107	107										
	Chloride (Cl)	mg/L	102	102						102	102				104	104										
	Fluoride (F)	mg/L	109	108						108	108				108	110										
	Nitrate (as N)	mg/L	102	102						103	102				103	104										
	Nitrite (as N)	mg/L	102	102						102	101				105	105										
	Sulfate (SO_4)	mg/L	102	102						102	102				104	104										
	Total Kjeldahl Nitrogen	mg/L	101	113						110	107				95	93	100	98								
	Total Organic Carbon	mg/L	96	95	96	96				111	115	113	112		102	99	98	100	96	97	98	96	97	96	98	93
	Dissolved Organic Carbon	mg/L	96	92	94					96	92	94			102	101	97	98	104	101	101					
Totals Metals	Aluminum (Al)	mg/L	103							100					95	104										
	Antimony (Sb)	mg/L	103							101					101	108										
	Arsenic (As)	mg/L	100							101					94	104										
	Barium (Ba)	mg/L	107							101					90	105										
	Beryllium (Be)	mg/L	101							97					92	107										
	Bismuth (Bi)	mg/L	107							100					94	106										
	Boron (B)	mg/L	95							87					86	101										
	Cadmium (Cd)	mg/L	103							101					94	102										
	Calcium (Ca)	mg/L	99							101					99	102										
	Chromium (Cr)	mg/L	101							102					95	103										
	Cobalt (Co)	mg/L	99							99					93	102										
	Copper (Cu)	mg/L	100							99					92	103										
	Iron (Fe)	mg/L	97							97					94	99										
	Lead (Pb)	mg/L	106							100					92	106										
	Lithium (Li)	mg/L	103							98					94	105										
	Magnesium (Mg)	mg/L	99							103					98	104										
	Manganese (Mn)	mg/L	102							99					94	105										
	Mercury (Hg)	mg/L	98	96						100					92											
	Molybdenum (Mo)	mg/L	102							100					89	104										
	Nickel (Ni)	mg/L	94							100					94	100										
	Phosphorus (P)	mg/L	100							100					93	101										
	Potassium (K)	mg/L	106							100					94	99										
	Selenium (Se)	mg/L	101							100					95	102										
	Silicon (Si)	mg/L	100							102					97	100										
	Silver (Ag)	mg/L	102							100					97	109										
	Sodium (Na)	mg/L	104							101					93	103										
	Strontium (Sr)	mg/L	101							98					91	104										
	Sulfur (S)	mg/L	105							101					103	105										
	Thallium (Tl)	mg/L	108							100					93	106										
	Tin (Sn)	mg/L	101							99					96	104										
	Titanium (Ti)	mg/L	110							99					91	100										
	Uranium (U)	mg/L	109							101					92	108										
	Vanadium (V)	mg/L	100							101					96	106										
	Zinc (Zn)	mg/L	101							100					91	99										

A3.0 BENTHIC INVERTEBRATE SAMPLES

Benthic invertebrate tissue samples were analyzed by University of Missouri-Columbia Research Reactor Center (MURR) (Columbia, MO).

A3.1 Method Detection Limits

Method detection limits for elements measured in benthic invertebrate samples were variable (Table A.7), but were sufficiently low to produce detectable results for all analytes expect rhenium in 2013 (Appendix Tables B.7 and B.8). This did not affect the interpretation of results, as selenium was the primary element of concern in this study.

A3.2 Data Accuracy

Accuracy of elemental concentration data was determined by analyzing certified reference materials (NIST SRM 1577 bovine liver and NRC CRM DOLT-4 dogfish liver) and comparing achieved values to a DQO recovery of 70 – 130% of the certified value (Table A.8). Some elements listed on the certificates of analysis are lower-confidence values or unconfirmed results presented for informational purposes, rather than certified values (i.e., the value may not necessarily be correct, and may be subject to significant statistical error). These values were also provided for comparison purposes, but were not used to judge acceptability of data.

Only two metals were recovered at concentrations slightly outside of the acceptable range in one of the two certified reference materials (i.e., chromium in all NIST 1577 samples; and one minor under-recovery for lead in one of four DOLT-4 samples from 2014; Table A.8). The high-resolution ICP-MS multi-element method used by MURR is not optimized for all elements reported, so it is expected and reasonable for a few analytes to fail the DQO. Notably, the certified reference material recoveries were within the DQO for all selenium analyses. The results indicate acceptable analytical accuracy associated with analysis of benthic invertebrate tissue samples.

A3.3 Laboratory Duplicate Samples

Replicate digests of benthic invertebrate samples EL1, THPD, FOBE, LIDSL, and MC3 were prepared for analysis of laboratory precision. Most elements met the DQO, and in most cases the relative percent difference was only slightly outside of the range of the DQO (Table A.9). The majority of analyses that exceeded the DQO were from a single sample (EL1), suggesting that sample heterogeneity may have played a role in the observed variability, particularly if homogenization was not complete (i.e., crushing and

Table A.6: Laboratory recoveries of of Quality Control (QC) standards (Certified Reference Material, CRM; Laboratory Control Sample, LCS) for water samples. Highlighted values did not meet the data quality objective of 85-115% recovery

		Sample Year	2013												2014											
	Analyte	Units	ALS Job No. L1331369							ALS Job No. L1332094					ALS Job No. L1487296											
Non-metals	Total Suspended Solids	mg/L	88	89	89	101	89			88	100	107	95		98	98	102	106								
	Ammonia (as N)	mg/L	102	100	96	96				106	87	101	95	95	102	102	98	96	103	104	102	99	97	97		
	Phosphorus (P)	mg/L	98	96	96	97	100	96	98	93	96	97	96		104	105	92	95	96							
	Bromide (Br)	mg/L	104	103						104	102				107	107										
	Chloride (Cl)	mg/L	102	102						102	102				104	104										
	Fluoride (F)	mg/L	109	108						108	108				108	110										
	Nitrate (as N)	mg/L	102	102						103	102				103	104										
	Nitrite (as N)	mg/L	102	102						102	101				105	105										
	Sulfate (SO_4)	mg/L	102	102						102	102				104	104										
	Total Kjeldahl Nitrogen	mg/L	101	113						110	107				95	93	100	98								
	Total Organic Carbon	mg/L	96	95	96	96				111	115	113	112		102	99	98	100	96	97	98	96	97	96	98	93
	Dissolved Organic Carbon	mg/L	96	92	94					96	92	94			102	101	97	98	104	101	101					
Totals Metals	Aluminum (Al)	mg/L	103							100					95	104										
	Antimony (Sb)	mg/L	103							101					101	108										
	Arsenic (As)	mg/L	100							101					94	104										
	Barium (Ba)	mg/L	107							101					90	105										
	Beryllium (Be)	mg/L	101							97					92	107										
	Bismuth (Bi)	mg/L	107							100					94	106										
	Boron (B)	mg/L	95							87					86	101										
	Cadmium (Cd)	mg/L	103							101					94	102										
	Calcium (Ca)	mg/L	99							101					99	102										
	Chromium (Cr)	mg/L	101							102					95	103										
	Cobalt (Co)	mg/L	99							99					93	102										
	Copper (Cu)	mg/L	100							99					92	103										
	Iron (Fe)	mg/L	97							97					94	99										
	Lead (Pb)	mg/L	106							100					92	106										
	Lithium (Li)	mg/L	103							98					94	105										
	Magnesium (Mg)	mg/L	99							103					98	104										
	Manganese (Mn)	mg/L	102							99					94	105										
	Mercury (Hg)	mg/L	98	96						100					92											
	Molybdenum (Mo)	mg/L	102							100					89	104										
	Nickel (Ni)	mg/L	94							100					94	100										
	Phosphorus (P)	mg/L	100							100					93	101										
	Potassium (K)	mg/L	106							100					94	99										
	Selenium (Se)	mg/L	101							100					95	102										
	Silicon (Si)	mg/L	100							102					97	100										
	Silver (Ag)	mg/L	102							100					97	109										
	Sodium (Na)	mg/L	104							101					93	103										
	Strontium (Sr)	mg/L	101							98					91	104										
	Sulfur (S)	mg/L	105							101					103	105										
	Thallium (Tl)	mg/L	108							100					93	106										
	Tin (Sn)	mg/L	101							99					96	104										
	Titanium (Ti)	mg/L	110							99					91	100										
	Uranium (U)	mg/L	109							101					92	108										
	Vanadium (V)	mg/L	100							101					96	106										
	Zinc (Zn)	mg/L	101							100					91	99										

Table A.7: Laboratory method detection limits (MDLs) associated with chemical analysis of benthic invertebrate tissue samples.

Analyte	Units	Method Detection Limit	
		2013	2014
Aluminum (Al)	µg/g dw	0.0039 - 0.015	0.0036 - 0.0064
Antimony (Sb)	µg/g dw	0.00045 - 0.001	0.00023 - 0.00052
Arsenic (As)	µg/g dw	0.0042 - 0.0087	0.0047 - 0.0073
Barium (Ba)	µg/g dw	0.0006 - 0.0012	0.00065 - 0.00078
Beryllium (Be)	µg/g dw	0.0017 - 0.0027	0.0024 - 0.0047
Bismuth (Bi)	µg/g dw	0.000037 - 0.000067	0.000042 - 0.000095
Boron (B)	µg/g dw	0.078 - 0.13	0.095 - 0.26
Cadmium (Cd)	µg/g dw	0.0014 - 0.0021	0.0007 - 0.00097
Calcium (Ca)	µg/g dw	0.56 - 1.4	0.86 - 1.1
Cesium (Cs)	µg/g dw	0.0001 - 0.00026	0.000057 - 0.00011
Chromium (Cr)	µg/g dw	0.0018 - 0.0068	0.0028 - 0.0038
Cobalt (Co)	µg/g dw	0.00035 - 0.00097	0.00046 - 0.00087
Copper (Cu)	µg/g dw	0.0011 - 0.0016	0.0011 - 0.002
Gallium (Ga)	µg/g dw	0.00042 - 0.0017	0.00052 - 0.00064
Iron (Fe)	µg/g dw	0.036 - 0.083	0.035 - 0.21
Lead (Pb)	µg/g dw	0.00012 - 0.0003	0.00025 - 0.00041
Lithium (Li)	µg/g dw	0.002 - 0.0052	0.0033 - 0.0084
Magnesium (Mg)	µg/g dw	0.039 - 0.089	0.039 - 0.062
Manganese (Mn)	µg/g dw	0.0038 - 0.0079	0.0039 - 0.005
Molybdenum (Mo)	µg/g dw	0.00095 - 0.0019	0.00052 - 0.00083
Nickel (Ni)	µg/g dw	0.0043 - 0.006	0.0012 - 0.0028
Phosphorus (P)	µg/g dw	3.6 - 8.1	3.2 - 4.1
Potassium (K)	µg/g dw	1.1 - 4.7	0.59 - 0.73
Rhenium (Re)	µg/g dw	0.00019 - 0.00027	0.000052 - 0.000096
Rubidium (Rb)	µg/g dw	0.0007 - 0.0017	0.00043 - 0.0012
Selenium (Se)	µg/g dw	0.048 - 0.11	0.047 - 0.069
Silver (Ag)	µg/g dw	0.00037 - 0.00061	0.00033 - 0.00051
Sodium (Na)	µg/g dw	0.074 - 0.34	0.072 - 0.13
Strontium (Sr)	µg/g dw	0.00027 - 0.00042	0.00012 - 0.00037
Thallium (Tl)	µg/g dw	0.000052 - 0.000079	0.000069 - 0.000094
Thorium (Th)	µg/g dw	0.000050 - 0.000086	0.000033 - 0.000051
Tin (Sn)	µg/g dw	0.00073 - 0.0017	0.0005 - 0.00077
Titanium (Ti)	µg/g dw	0.0057 - 0.03	0.0054 - 0.0092
Uranium (U)	µg/g dw	0.000036 - 0.00019	0.00015 - 0.00022
Vanadium (V)	µg/g dw	0.00036 - 0.00064	0.00026 - 0.00091
Yttrium (Y)	µg/g dw	0.00017 - 0.00037	0.000081 - 0.00014
Zinc (Zn)	µg/g dw	0.0018 - 0.0089	0.0034 - 0.0045
Zirconium (Zr)	µg/g dw	0.00034 - 0.0011	0.00036 - 0.00058

Table A.8: Laboratory analyses of certified reference materials associated with benthic invertebrate tissue samples. Highlighted values did not achieve the data quality objective of recovery between 70% and 130% of certified values.

Analyte	Units	Year	Certified Reference Material						
			Certified Value	Informational Value	Measured	Value within Certified or Informational Range?	% Recovery Relative to Certified Value	% Recovery Relative to Informational Value	Reference Material
Aluminum (Al)	µg/g dw	2013	-	1.2 (0.7 - 1.7)	6.9	No	-	571%	05B SRM 1577
			-	1.2 (0.7 - 1.7)	4.4	No	-	363%	07A SRM 1577
			-	200	58	-	-	29%	06A CRM DOLT-4
		2014	-	1.2 (0.7 - 1.7)	1.1	Yes	-	92%	07B SRM 1577
			-	1.2 (0.7 - 1.7)	1.5	Yes	-	125%	01B SRM 1577
			-	200	86	-	-	43%	08B CRM DOLT-4
			-	200	52	-	-	26%	02B CRM DOLT-4
Antimony (Sb)	µg/g dw	2013	-	0.009 (0.004 - 0.014)	0.009	Yes	-	95%	05B SRM 1577
			-	0.009 (0.004 - 0.014)	0.006	Yes	-	69%	07A SRM 1577
			-	-	0.009	-	-	-	06A CRM DOLT-4
		2014	-	0.009 (0.004 - 0.014)	0.006	Yes	-	67%	07B SRM 1577
			-	0.009 (0.004 - 0.014)	0.007	Yes	-	78%	01B SRM 1577
			-	-	0.010	-	-		08B CRM DOLT-4
			-	-	0.012	-	-	-	02B CRM DOLT-4
Arsenic (As)	µg/g dw	2013	0.055 (0.050 - 0.060)	0.054 (0.048 - 0.060)	0.054	Yes	99%	101%	05B SRM 1577
			0.055 (0.050 - 0.060)	0.054 (0.048 - 0.060)	0.057	Yes	104%	106%	07A SRM 1577
			9.66 (9.04 - 10.28)	-	8.37	No	87%	-	06A CRM DOLT-4
		2014	0.055 (0.050 - 0.060)	0.054 (0.048 - 0.060)	0.058	Yes	106%	108%	07B SRM 1577
			0.055 (0.050 - 0.060)	0.054 (0.048 - 0.060)	0.056	Yes	102%	104%	01B SRM 1577
			9.66 (9.04 - 10.28)	-	8.34	No	86%	-	08B CRM DOLT-4
			9.66 (9.04 - 10.28)	-	8.79	No	91%	-	02B CRM DOLT-4
Cadmium (Cd)	µg/g dw	2013	0.27 (0.23 - 0.31)	0.283 (0.26 - 0.306)	0.289	Yes	107%	102%	05B SRM 1577
			0.27 (0.23 - 0.31)	0.283 (0.26 - 0.306)	0.270	Yes	100%	95%	07A SRM 1577
			24.3 (23.5 - 25.1)	-	21.5	No	88%	-	06A CRM DOLT-4
		2014	0.27 (0.23 - 0.31)	0.283 (0.26 - 0.306)	0.283	Yes	105%	100%	07B SRM 1577
			0.27 (0.23 - 0.31)	0.283 (0.26 - 0.306)	0.287	Yes	106%	101%	01B SRM 1577
			24.3 (23.5 - 25.1)	-	21.2	No	87%	-	08B CRM DOLT-4
			24.3 (23.5 - 25.1)	-	22.2	No	91%	-	02B CRM DOLT-4
Calcium (Ca)	µg/g dw	2013	124 (118 - 130)	121 (107 - 135)	159	Yes	128%	131%	05B SRM 1577
			124 (118 - 130)	121 (107 - 135)	117	Yes	94%	97%	07A SRM 1577
			-	680	656	-	-	96%	06A CRM DOLT-4
		2014	124 (118 - 130)	121 (107 - 135)	116	Yes	94%	96%	07B SRM 1577
			124 (118 - 130)	121 (107 - 135)	131	Yes	106%	108%	01B SRM 1577
			-	680	657	-	-	97%	08B CRM DOLT-4
			-	680	664	-	-	98%	02B CRM DOLT-4
Cesium (Cs)	µg/g dw	2013	-	0.015 (0.011 - 0.019)	0.012	Yes	-	81%	05B SRM 1577
			-	0.015 (0.011 - 0.019)	0.012	Yes	-	83%	07A SRM 1577
			-	-	0.100	-	-	-	06A CRM DOLT-4
		2014	-	0.015 (0.011 - 0.019)	0.012	Yes	-	83%	07B SRM 1577
			-	0.015 (0.011 - 0.019)	0.012	Yes	-	80%	01B SRM 1577
			-	-	0.098	-	-	-	08B CRM DOLT-4
			-	-	0.097	-	-	-	02B CRM DOLT-4
Chromium (Cr)	µg/g dw	2013	0.088 (0.076 - 0.10)	0.11 (0.06 - 0.16)	0.13	Yes	147%	117%	05B SRM 1577
			0.088 (0.076 - 0.10)	0.11 (0.06 - 0.16)	0.14	Yes	164%	131%	07A SRM 1577
			-	1.4	1.11	-	-	79%	06A CRM DOLT-4
		2014	0.088 (0.076 - 0.10)	0.11 (0.06 - 0.16)	0.13	Yes	150%	120%	07B SRM 1577
			0.088 (0.076 - 0.10)	0.11 (0.06 - 0.16)	0.15	Yes	170%	136%	01B SRM 1577
			-	1.4	1.17	-	-	84%	08B CRM DOLT-4
			-	1.4	1.17	-	-	84%	02B CRM DOLT-4
Cobalt (Co)	µg/g dw	2013	-	0.22 (0.18 - 0.26)	0.24	Yes	-	110%	05B SRM 1577
			-	0.22 (0.18 - 0.26)	0.22	Yes	-	112%	07A SRM 1577
			-	0.25	0.22	-	-	88%	06A CRM DOLT-4
		2014	-	0.22 (0.18 - 0.26)	0.23	Yes	-	105%	07B SRM 1577
			-	0.22 (0.18 - 0.26)	0.26	Yes	-	117%	01B SRM 1577
			-	0.25	0.21	-	-	83%	08B CRM DOLT-4
			-	0.25	0.22	-	-	86%	02B CRM DOLT-4
Copper (Cu)	µg/g dw	2013	193 (183 - 203)	190 (180 - 200)	168	No	87%	88%	05B SRM 1577
			193 (183 - 203)	190 (180 - 200)	154	No	80%	81%	07A SRM 1577
			31.2 (30.1 - 32.3)	-	27	No	87%	-	06A CRM DOLT-4
		2014	193 (183 - 203)	190 (180 - 200)	165	No	85%	87%	07B SRM 1577
			193 (183 - 203)	190 (180 - 200)	188	Yes	97%	99%	01B SRM 1577
			31.2 (30.1 - 32.3)	-	26.3	No	84%	-	08B CRM DOLT-4
			31.2 (30.1 - 32.3)	-	29.6	No	95%	-	02B CRM DOLT-4
Iron (Fe)	µg/g dw	2013	268 (260 - 276)	263 (241 - 285)	249	Yes	93%	95%	05B SRM 1577
			268 (260 - 276)	263 (241 - 285)	242	Yes	90%	92%	07A SRM 1577
			1,833 (1,758 - 1,908)	-	1680	No	92%	-	06A CRM DOLT-4
		2014	268 (260 - 276)	263 (241 - 285)	253	Yes	94%	96%	07B SRM 1577
			268 (260 - 276)	263 (241 - 285)	280	Yes	104%	106%	01B SRM 1577
			1,833 (1,758 - 1,908)	-	1,670	No	91%	-	08B CRM DOLT-4
			1,833 (1,758 - 1,908)	-	1,780	Yes	97%	-	02B CRM DOLT-4
Lead (Pb)	µg/g dw	2013	0.34 (0.26 - 0.42)	0.34 (0.30 - 0.38)	0.35	Yes	104%	104%	05B SRM 1577
			0.34 (0.26 - 0.42)	0.34 (0.30 - 0.38)	0.29	Yes	85%	85%	07A SRM 1577
			0.16 (0.12 - 0.20)	-	0.12	Yes	73%	-	06A CRM DOLT-4
		2014	0.34 (0.26 - 0.42)	0.34 (0.30 - 0.38)	0.31	Yes	91%	91%	07B SRM 1577
			0.34 (0.26 - 0.42)	0.34 (0.30 - 0.38)	0.36	Yes	107%	107%	01B SRM 1577
			0.16 (0.12 - 0.20)	-	0.11	No	69%	-	08B CRM DOLT-4
			0.16 (0.12 - 0.20)	-	0.16	Yes	99%	-	02B CRM DOLT-4

Table A.8: Laboratory analyses of certified reference materials associated with benthic invertebrate tissue samples. Highlighted values did not achieve the data quality objective of recovery between 70% and 130% of certified values.

Analyte	Units	Year	Certified Reference Material						
			Certified Value	Informational Value	Measured	Value within Certified or Informational Range?	% Recovery Relative to Certified Value	% Recovery Relative to Informational Value	Reference Material
			604 (595 - 613)	608 (577 - 639)	556	No	92%	91%	05B SRM 1577
		2013	604 (595 - 613)	608 (577 - 639)	558	No	92%	92%	07A SRM 1577
			-	1,500	1,250	-	-	83%	06A CRM DOLT-4
Magnesium (Mg)	µg/g dw		604 (595 - 613)	608 (577 - 639)	597	Yes	99%	98%	07B SRM 1577
		2014	604 (595 - 613)	608 (577 - 639)	655	No	108%	108%	01B SRM 1577
			-	1,500	1,290	-	-	86%	08B CRM DOLT-4
			-	1,500	1,390	-	-	93%	02B CRM DOLT-4
			10.3 (9.3 - 11.3)	10.2 (9.5 - 10.9)	10.1	Yes	98%	99%	05B SRM 1577
		2013	10.3 (9.3 - 11.3)	10.2 (9.5 - 10.9)	9.7	Yes	94%	95%	07A SRM 1577
			-	-	9.3	-	-	-	06A CRM DOLT-4
Manganese (Mn)	µg/g dw		10.3 (9.3 - 11.3)	10.2 (9.5 - 10.9)	9.9	Yes	96%	97%	07B SRM 1577
		2014	10.3 (9.3 - 11.3)	10.2 (9.5 - 10.9)	10.7	Yes	104%	105%	01B SRM 1577
			-	-	9.1	-	-	-	08B CRM DOLT-4
			-	-	9.5	-	-	-	02B CRM DOLT-4
			-	3.2 (2.8 - 3.6)	3.6	Yes	-	113%	05B SRM 1577
		2013	-	3.2 (2.8 - 3.6)	3.5	Yes	-	109%	07A SRM 1577
			-	1.0	1.1	-	-	106%	06A CRM DOLT-4
Molybdenum (Mo)	µg/g dw		-	3.2 (2.8 - 3.6)	3.6	Yes	-	111%	07B SRM 1577
		2014	-	3.2 (2.8 - 3.6)	3.7	No	-	114%	01B SRM 1577
			-	1.0	1.04	-	-	104%	08B CRM DOLT-4
			-	1.0	1.06	-	-	106%	02B CRM DOLT-4
			-	0.18 (0.10 - 0.26)	0.07	No	-	38%	05B SRM 1577
		2013	-	0.18 (0.10 - 0.26)	0.03	No	-	18%	07A SRM 1577
			0.97 (0.86 - 1.08)	-	0.77	No	79%	-	06A CRM DOLT-4
Nickel (Ni)	µg/g dw		-	0.18 (0.10 - 0.26)	0.04	No	-	22%	07B SRM 1577
		2014	-	0.18 (0.10 - 0.26)	0.04	No	-	21%	01B SRM 1577
			0.97 (0.86 - 1.08)	-	0.86	Yes	89%	-	08B CRM DOLT-4
			0.97 (0.86 - 1.08)	-	1.00	Yes	103%	-	02B CRM DOLT-4
			-	11,200 (10,100 - 12,300)	11,100	Yes	-	99%	05B SRM 1577
		2013	-	11,200 (10,100 - 12,300)	10,500	Yes	-	94%	07A SRM 1577
			-	-	11,300	-	-	-	06A CRM DOLT-4
Phosphorus (P)	µg/g dw		-	11,200 (10,100 - 12,300)	12,100	Yes	-	108%	07B SRM 1577
		2014	-	11,200 (10,100 - 12,300)	12,700	No	-	113%	01B SRM 1577
			-	-	12,200	-	-	-	08B CRM DOLT-4
			-	-	12,900	-	-	-	02B CRM DOLT-4
			9,700 (9,100 - 10,300)	9,700 (9,100 - 10,300)	10,800	No	111%	111%	05B SRM 1577
		2013	9,700 (9,100 - 10,300)	9,700 (9,100 - 10,300)	10,200	Yes	105%	105%	07A SRM 1577
			-	9,800	9,970	-	-	102%	06A CRM DOLT-4
Potassium (K)	µg/g dw		9,700 (9,100 - 10,300)	9,700 (9,100 - 10,300)	10,800	No	111%	111%	07B SRM 1577
		2014	9,700 (9,100 - 10,300)	9,700 (9,100 - 10,300)	11,300	No	116%	116%	01B SRM 1577
			-	9,800	9,570	-	-	98%	08B CRM DOLT-4
			-	9,800	10,200	-	-	104%	02B CRM DOLT-4
			18.3 (17.3 - 19.3)	18.2 (16.9 - 19.5)	19.1	Yes	104%	105%	05B SRM 1577
		2013	18.3 (17.3 - 19.3)	18.2 (16.9 - 19.5)	18.0	Yes	98%	99%	07A SRM 1577
			-	-	3.3	-	-	-	06A CRM DOLT-4
Rubidium (Rb)	µg/g dw		18.3 (17.3 - 19.3)	18.2 (16.9 - 19.5)	18.6	Yes	102%	102%	07B SRM 1577
		2014	18.3 (17.3 - 19.3)	18.2 (16.9 - 19.5)	19.0	Yes	104%	104%	01B SRM 1577
			-	-	3.2	-	-	-	08B CRM DOLT-4
			-	-	3.19	-	-	-	02B CRM DOLT-4
			1.1 (1.0 - 1.2)	1.09 (1.02 - 1.16)	1.09	Yes	99%	100%	05B SRM 1577
		2013	1.1 (1.0 - 1.2)	1.09 (1.02 - 1.16)	1.04	Yes	95%	95%	07A SRM 1577
			8.30 (6.96 - 9.64)	-	7.57	Yes	91%	-	06A CRM DOLT-4
Selenium (Se)	µg/g dw		1.1 (1.0 - 1.2)	1.09 (1.02 - 1.16)	1.00	Yes	91%	91%	07B SRM 1577
		2014	1.1 (1.0 - 1.2)	1.09 (1.02 - 1.16)	1.18	Yes	107%	108%	01B SRM 1577
			8.30 (6.96 - 9.64)	-	7.60	Yes	92%	-	08B CRM DOLT-4
			8.30 (6.96 - 9.64)	-	8.24	Yes	99%	-	02B CRM DOLT-4
			-	0.062 (0.051 - 0.073)	0.157	No	-	253%	05B SRM 1577
		2013	-	0.062 (0.051 - 0.073)	0.053	Yes	-	85%	07A SRM 1577
			0.93 (0.86 - 1.00)	-	0.810	No	87%	-	06A CRM DOLT-4
Silver (Ag)	µg/g dw		-	0.062 (0.051 - 0.073)	0.055	Yes	-	89%	07B SRM 1577
		2014	-	0.062 (0.051 - 0.073)	0.058	Yes	-	93%	01B SRM 1577
			0.93 (0.86 - 1.00)	-	0.801	No	86%	-	08B CRM DOLT-4
			0.93 (0.86 - 1.00)	-	0.818	No	88%	-	02B CRM DOLT-4
			2,430 (2,300 - 2,560)	2,390 (2,230 - 2,550)	2,180	No	90%	91%	05B SRM 1577
		2013	2,430 (2,300 - 2,560)	2,390 (2,230 - 2,550)	2,380	Yes	98%	100%	07A SRM 1577
			-	6,800	5,980	-	-	88%	06A CRM DOLT-4
Sodium (Na)	µg/g dw		2,430 (2,300 - 2,560)	2,390 (2,230 - 2,550)	2,300	Yes	95%	96%	07B SRM 1577
		2014	2,430 (2,300 - 2,560)	2,390 (2,230 - 2,550)	2,550	Yes	105%	107%	01B SRM 1577
			-	6,800	6,150	-	-	90%	08B CRM DOLT-4
			-	6,800	6,810	-		100%	02B CRM DOLT-4
			-	0.16 (0.13 - 0.19)	0.17	Yes	-	104%	05B SRM 1577
		2013	-	0.16 (0.13 - 0.19)	0.23	No	-	143%	07A SRM 1577
			-	5.5	5.36	-	-	97%	06A CRM DOLT-4
Strontium (Sr)	µg/g dw		-	0.16 (0.13 - 0.19)	0.14	Yes	-	88%	07B SRM 1577
		2014	-	0.16 (0.13 - 0.19)	0.15	Yes	-	91%	01B SRM 1577
			-	5.5	5.14	-	-	93%	08B CRM DOLT-4
			-	5.5	5.17	-	-	94%	02B CRM DOLT-4

Table A.8: Laboratory analyses of certified reference materials associated with benthic invertebrate tissue samples. Highlighted values did not achieve the data quality objective of recovery between 70% and 130% of certified values.

Analyte	Units	Year	Certified Reference Material						
			Certified Value	Informational Value	Measured	Value within Certified or Informational Range?	% Recovery Relative to Certified Value	% Recovery Relative to Informational Value	Reference Material
Tin (Sn)	µg/g dw	2013	-	0.016 (0.012 - 0.020)	0.015	Yes	-	94%	05B SRM 1577
			-	0.016 (0.012 - 0.020)	0.009	No	-	54%	07A SRM 1577
			-	0.17	0.144	-	-	85%	06A CRM DOLT-4
		2014	-	0.016 (0.012 - 0.020)	0.019	Yes	-	121%	07B SRM 1577
			-	0.016 (0.012 - 0.020)	0.008	No	-	53%	01B SRM 1577
			-	0.17	0.146	-	-	86%	08B CRM DOLT-4
			-	0.17	0.158	-	-	93%	02B CRM DOLT-4
Vanadium (V)	µg/g dw	2013	-	0.058 (0.052 - 0.064)	0.065	No	-	111%	05B SRM 1577
			-	0.058 (0.052 - 0.064)	0.077	No	-	133%	07A SRM 1577
			-	0.6	0.49	-	-	82%	06A CRM DOLT-4
		2014	-	0.058 (0.052 - 0.064)	0.060	Yes	-	104%	07B SRM 1577
			-	0.058 (0.052 - 0.064)	0.065	No	-	112%	01B SRM 1577
			-	0.6	0.56	-	-	94%	08B CRM DOLT-4
			-	0.6	0.47	-	-	79%	02B CRM DOLT-4
Zinc (Zn)	µg/g dw	2013	130 (117 - 143)	131 (123 - 139)	124	Yes	95%	95%	05B SRM 1577
			130 (117 - 143)	131 (123 - 139)	111	No	85%	85%	07A SRM 1577
			116 (110 - 122)	-	98	No	84%	-	06A CRM DOLT-4
		2014	130 (117 - 143)	131 (123 - 139)	121	Yes	93%	92%	07B SRM 1577
			130 (117 - 143)	131 (123 - 139)	133	Yes	102%	102%	01B SRM 1577
			116 (110 - 122)	-	101	No	87%	-	08B CRM DOLT-4
			116 (110 - 122)	-	110	Yes	95%	-	02B CRM DOLT-4

Table A.9: Laboratory duplicate results for benthic invertebrate tissue samples. Highlighted values did not meet the data quality objective of ≤ 30% relative percent difference (RPD).

Analyte	Units	2013						2014								
		EL1 Rep 1	EL1 Rep 2	RPD (%)	THPD Rep 1	THPD Rep 2	RPD (%)	FOBE Rep 1	FOBE Rep 2	RPD (%)	LIDSL Rep 1	LIDSL Rep 2	RPD (%)	MC3 Rep 1	MC3 Rep 2	RPD (%)
Aluminum (Al)	µg/g dw	1,140	1,890	50%	1,280	1,670	26%	1,850	1,570	16%	831	755	10%	2,070	2,260	9%
Antimony (Sb)	µg/g dw	0.0159	0.0324	68%	0.0215	0.0261	19%	0.0261	0.0339	26%	0.0184	0.0184	0%	0.0376	0.038	1%
Arsenic (As)	µg/g dw	0.961	1.04	8%	1.32	1.42	7%	1.33	1.49	11%	1.49	1.53	3%	1.98	1.96	1%
Barium (Ba)	µg/g dw	24.8	30.1	19%	94.4	103	9%	22	25.5	15%	12.3	12.2	1%	74.9	92.4	21%
Beryllium (Be)	µg/g dw	0.0524	0.0818	44%	0.0335	0.0492	38%	0.052	0.0621	18%	0.0238	0.0253	6%	0.0578	0.0769	28%
Bismuth (Bi)	µg/g dw	0.0115	0.0126	9%	0.00655	0.00793	19%	0.00803	0.00756	6%	0.00552	0.00591	7%	0.0103	0.011	7%
Boron (B)	µg/g dw	2.34	3.15	30%	2.52	2.75	9%	3.02	2.52	18%	1.85	1.57	16%	4.25	4.69	10%
Cadmium (Cd)	µg/g dw	5.48	5.14	6%	1.95	2.07	6%	4.1	4.21	3%	8.23	8.25	0%	8.67	9.05	4%
Calcium (Ca)	µg/g dw	8,130	8,830	8%	44,400	47,000	6%	8,180	11,200	31%	6,300	5,390	16%	3,150	3,320	5%
Cesium (Cs)	µg/g dw	0.17	0.248	37%	0.171	0.223	26%	0.233	0.207	12%	0.126	0.12	5%	0.204	0.224	9%
Chromium (Cr)	µg/g dw	2.43	3.57	38%	1.6	2.03	24%	2.73	2.69	1%	1.38	1.32	4%	3.08	3.28	6%
Cobalt (Co)	µg/g dw	4.12	4.12	0%	4	4.46	11%	6.34	6.48	2%	4.83	4.82	0%	7.56	7.49	1%
Copper (Cu)	µg/g dw	21.7	19.5	11%	26.9	28.1	4%	19.9	21.6	8%	19.9	19.6	2%	19.3	19.5	1%
Gallium (Ga)	µg/g dw	0.421	0.657	44%	0.381	0.513	30%	0.493	0.468	5%	0.249	0.236	5%	0.613	0.657	7%
Iron (Fe)	µg/g dw	1,220	1,450	17%	835	960	14%	892	1,150	25%	539	522	3%	1,330	1,350	1%
Lead (Pb)	µg/g dw	0.723	0.89	21%	0.432	0.51	17%	0.53	0.653	21%	0.348	0.333	4%	0.82	0.937	13%
Lithium (Li)	µg/g dw	1.17	1.49	24%	2.08	2.27	9%	1.99	1.92	4%	0.969	0.984	2%	1.39	1.47	6%
Magnesium (Mg)	µg/g dw	2,380	2,510	5%	1,890	1,990	5%	2,640	2,960	11%	2,070	2,090	1%	1,700	1,740	2%
Manganese (Mn)	µg/g dw	207	224	8%	62.8	78.3	22%	62.1	76.2	20%	35.3	35.9	2%	207	220	6%
Molybdenum (Mo)	µg/g dw	0.498	0.564	12%	0.431	0.474	10%	0.398	0.436	9%	0.327	0.319	2%	0.482	0.498	3%
Nickel (Ni)	µg/g dw	4.73	5.14	8%	7.72	8.73	12%	6.69	7.02	5%	7.89	7.88	0%	9.73	10	3%
Phosphorus (P)	µg/g dw	8,310	8,130	2%	7,980	8,380	5%	11,700	12,600	7%	11,100	11,200	1%	9,190	9,130	1%
Potassium (K)	µg/g dw	6,990	7,620	9%	9,430	9,820	4%	10,500	10,300	2%	9,810	9,820	0%	10,600	10,700	1%
Rhenium (Re)	µg/g dw	0.00108	0.00076	35%	0.00023	0.00026	12%	0.000167	0.000214	25%	0.000158	0.000196	21%	0.000382	0.00036	6%
Rubidium (Rb)	µg/g dw	5.22	6.72	25%	7.24	8	10%	6.82	6.33	7%	5.84	5.82	0%	6.55	6.83	4%
Selenium (Se)	µg/g dw	6.44	6	7%	18.9	21.2	11%	9.98	9.43	6%	5.56	5.63	1%	7.08	7.19	2%
Silver (Ag)	µg/g dw	0.124	0.12	3%	0.317	0.322	2%	0.115	0.128	11%	0.0378	0.0383	1%	0.124	0.129	4%
Sodium (Na)	µg/g dw	3,870	3,950	2%	4,700	4,660	1%	4,280	4,080	5%	3,620	3,720	3%	3,770	3,790	1%
Strontium (Sr)	µg/g dw	12.1	14.1	15%	110	115	4%	10	12.2	20%	8.37	7.56	10%	7.56	8.29	9%
Thallium (Tl)	µg/g dw	0.0778	0.091	16%	0.0929	0.102	9%	0.0668	0.0655	2%	0.0879	0.0866	1%	0.112	0.12	7%
Thorium (Th)	µg/g dw	0.309	0.438	35%	0.169	0.218	25%	0.249	0.247	1%	0.131	0.135	3%	0.335	0.324	3%
Tin (Sn)	µg/g dw	0.0398	0.0619	43%	0.0349	0.0497	35%	0.0504	0.045	11%	0.0314	0.0283	10%	0.0555	0.0606	9%
Titanium (Ti)	µg/g dw	5.67	12.7	77%	8.3	12.4	40%	11.5	11.5	0%	7.12	5.74	21%	15.5	16.9	9%
Uranium (U)	µg/g dw	0.124	0.165	28%	0.166	0.185	11%	0.109	0.13	18%	0.0963	0.0873	10%	0.175	0.195	11%
Vanadium (V)	µg/g dw	4.36	6.31	37%	3.43	4.34	23%	4.92	5.2	6%	2.21	2.05	8%	6.96	7.45	7%
Yttrium (Y)	µg/g dw	1.75	2.13	20%	0.506	0.6	17%	0.743	0.94	23%	0.44	0.413	6%	1.89	1.98	5%
Zinc (Zn)	µg/g dw	300	257	15%	78.3	89.6	13%	273	294	7%	493	492	0%	383	391	2%
Zirconium (Zr)	µg/g dw	0.871	1.33	42%	0.577	0.714	21%	0.73	0.77	5%	0.43	0.389	10%	0.981	1.04	6%

mixing with pre-cleaned plastic lab spatulas and glass stir rods may not have produced a homogeneous powder). Despite this, selenium was one of the elements that consistently met the DQO across all samples. As such, laboratory precision associated with analysis of benthic invertebrate samples was considered good.

A3.4 Laboratory Matrix Spike Samples

Analyte recoveries for matrix spike samples varied. Many of the analytes could not be included in the analysis, or could not be recovered because the spike concentrations were less than 50% of the average original concentration measured in the replicates. Analytes that were measured were generally within the DQO, except for antimony (in all five samples), beryllium (in two of five samples), strontium, vanadium, and zirconium (in one of five samples each) (Table A.10). None of these were considered elements of concern in this study. As such, the results of laboratory matrix spike analyses indicated acceptable accuracy for the purposes of this study.

Table A.10: Laboratory matrix spike recoveries associated with benthic invertebrate tissue samples. Highlighted values did not meet the data quality objective of 70 - 130% recovery.

Analyte	Units	Matrix Spike (% Recovery)				
		2013			2014	
		Plant-B	THPD	EL1	FOBE-B	LIDSL-B
Aluminum (Al)	µg/g dw	†	†	†	†	†
Antimony (Sb)	µg/g dw	44%	55%	37%	59%	63%
Arsenic (As)	µg/g dw	107%	94%	91%	105%	103%
Barium (Ba)	µg/g dw	†	†	†	†	†
Beryllium (Be)	µg/g dw	69%	67%	70%	102%	99%
Bismuth (Bi)	µg/g dw	89%	84%	88%	104%	103%
Boron (B)	µg/g dw	76%	73%	79%	98%	94%
Cadmium (Cd)	µg/g dw	97%	90%	91%	110%	†
Calcium (Ca)	µg/g dw	*	*	*	*	*
Cesium (Cs)	µg/g dw	*	*	*	*	*
Chromium (Cr)	µg/g dw	106%	95%	124%	117%	109%
Cobalt (Co)	µg/g dw	108%	98%	90%	†	99%
Copper (Cu)	µg/g dw	†	†	†	†	†
Gallium (Ga)	µg/g dw	*	*	*	*	*
Iron (Fe)	µg/g dw	†	†	†	†	†
Lead (Pb)	µg/g dw	99%	90%	99%	108%	108%
Lithium (Li)	µg/g dw	80%	80%	89%	108%	106%
Magnesium (Mg)	µg/g dw	†	†	†	†	†
Manganese (Mn)	µg/g dw	†	†	†	†	†
Molybdenum (Mo)	µg/g dw	104%	103%	101%	104%	103%
Nickel (Ni)	µg/g dw	130%	†	108%	†	†
Phosphorus (P)	µg/g dw	†	†	†	†	†
Potassium (K)	µg/g dw	*	*	*	*	*
Rhenium (Re)	µg/g dw	97%	97%	99%	117%	111%
Rubidium (Rb)	µg/g dw	*	*	*	*	*
Selenium (Se)	µg/g dw	†	†	90%	†	†
Silver (Ag)	µg/g dw	91%	88%	91%	94%	84%
Sodium (Na)	µg/g dw	†	†	†	†	†
Strontium (Sr)	µg/g dw	183%	†	†	†	†
Thallium (Tl)	µg/g dw	94%	93%	96%	110%	108%
Thorium (Th)	µg/g dw	102%	100%	103%	117%	114%
Tin (Sn)	µg/g dw	*	*	*	*	*
Titanium (Ti)	µg/g dw	93%	†	†	†	†
Uranium (U)	µg/g dw	101%	100%	100%	112%	112%
Vanadium (V)	µg/g dw	128%	104%	139%	†	122%
Yttrium (Y)	µg/g dw	*	*	*	*	*
Zinc (Zn)	µg/g dw	†	†	†	†	†
Zirconium (Zr)	µg/g dw	113%	107%	108%	111%	69%

* Not spiked. (The element was not included in the multi-element spike solution.)
† Spike too small. (The concentration of the element spiked into sample was less than 50% of the average concentration measured in the replicates.)

A4.0 SPOTTED SANDPIPER EGG SAMPLES

Spotted sandpiper egg samples were analyzed by MURR (Columbia, MO).

A4.1 Method Detection Limits

Similar to benthic invertebrates, MDLs for elements measured in spotted sandpiper egg samples were variable (Table A.11), but were sufficiently low that quantified concentrations were reported for most analytes (exceptions being boron, beryllium, bismuth, cadmium, rhenium, antimony, tin, thorium, uranium, and zirconium in some samples; Appendix Tables B.5 and B.6). None of these analytes were considered elements of concern in this study, so the lack of quantifiable results does not affect data analysis or interpretation.

A4.2 Data Accuracy

The accuracy of elemental concentration data reported for egg samples was determined by analyzing certified reference materials (NIST SRM 1577 bovine liver and NRC CRM DOLT-4 dogfish liver) and comparing achieved values to a recovery of 70 – 130% of the certified value (Table A.12). As discussed in Section A3.2, "information values" were not used to judge acceptability of data. Only one element was recovered at concentrations slightly outside of the acceptable range in one of the two certified reference materials (i.e., chromium in NIST 1577; Table A.12). Selenium met the DQO in all certified reference material analyses. The results indicate excellent analytical accuracy associated with analysis of spotted sandpiper egg samples.

A4.3 Laboratory Duplicate Samples

Replicate digests of spotted sandpiper egg samples (n = 18) were prepared for analysis of laboratory precision, and most elements, including selenium, met the DQO in all samples (Table A.13). As such, laboratory precision associated with analysis of spotted sandpiper egg samples was considered good.

A4.4 Laboratory Matrix Spike Samples

Several analytes could not be recovered because the spike concentrations were less than 50% of the average original concentration measured in the replicates. With the exception of zirconium (in nine of 12 samples) and aluminum (in one of 12 samples), all matrix spikes recoveries achieved the DQO (Table A.14).

Table A.11: Laboratory method detection limits (MDLs) associated with chemical analysis of spotted sandpiper egg samples.

Analyte	Units	Method Detection Limit	
		2013	2014
Aluminum (Al)	µg/g dw	0.0015 - 0.0072	0.0024 - 0.028
Antimony (Sb)	µg/g dw	0.0003 - 0.0007	0.0002 - 0.0006
Arsenic (As)	µg/g dw	0.002 - 0.004	0.004 - 0.009
Barium (Ba)	µg/g dw	0 - 0.0008	0.0012 - 0.0047
Beryllium (Be)	µg/g dw	0.0016 - 0.0028	0.0021 - 0.0049
Bismuth (Bi)	µg/g dw	0 - 0.0001	0.00003 - 0.0001
Boron (B)	µg/g dw	0.028 - 0.27	0.06 - 0.12
Cadmium (Cd)	µg/g dw	0.0006 - 0.0014	0.0006 - 0.0014
Calcium (Ca)	µg/g dw	0.88 - 1.5	0.77 - 1.3
Cesium (Cs)	µg/g dw	0.00005 - 0.00015	0.00006 - 0.00015
Chromium (Cr)	µg/g dw	0.0019 - 0.0047	0.0014 - 0.0028
Cobalt (Co)	µg/g dw	0.0002 - 0.0004	0.0005 - 0.0032
Copper (Cu)	µg/g dw	0.0007 - 0.0058	0.0009 - 0.0027
Gallium (Ga)	µg/g dw	0.0004 - 0.0008	0.001 - 0.002
Iron (Fe)	µg/g dw	0.024 - 0.045	0.027 - 0.047
Lead (Pb)	µg/g dw	0 - 0.0003	0.0001 - 0.0024
Lithium (Li)	µg/g dw	0.001 - 0.003	0.003 - 0.009
Magnesium (Mg)	µg/g dw	0.026 - 0.095	0.027 - 0.081
Manganese (Mn)	µg/g dw	0.0023 - 0.008	0.0036 - 0.0094
Molybdenum (Mo)	µg/g dw	0.0007 - 0.0011	0.0003 - 0.0015
Nickel (Ni)	µg/g dw	0.0006 - 0.0025	0.0017 - 0.0044
Phosphorus (P)	µg/g dw	3.5 - 7.2	2.1 - 6.4
Potassium (K)	µg/g dw	0.79 - 1.5	0.87 - 1.3
Rhenium (Re)	µg/g dw	0 - 0.0003	0.0001 - 0.0002
Rubidium (Rb)	µg/g dw	0.0003 - 0.0015	0.0007 - 0.0014
Selenium (Se)	µg/g dw	0.031 - 0.089	0.038 - 0.1
Silver (Ag)	µg/g dw	0.0004 - 0.0007	0.0004 - 0.0007
Sodium (Na)	µg/g dw	0.07 - 0.17	0.03 - 0.14
Strontium (Sr)	µg/g dw	0.0002 - 0.0003	0.0002 - 0.0009
Thallium (Tl)	µg/g dw	0 - 0.00005	0.00002 - 0.00010
Thorium (Th)	µg/g dw	0 - 0.0001	0.00005 - 0.0003
Tin (Sn)	µg/g dw	0.0003 - 0.001	0.0003 - 0.0007
Titanium (Ti)	µg/g dw	0.005 - 0.01	0.005 - 0.01
Uranium (U)	µg/g dw	0.00003 - 0.00010	0.00003 - 0.0028
Vanadium (V)	µg/g dw	0.0003 - 0.0006	0.0001 - 0.0005
Yttrium (Y)	µg/g dw	0.0001 - 0.0002	0.0001 - 0.0002
Zinc (Zn)	µg/g dw	0.0024 - 0.0079	0.0042 - 0.014
Zirconium (Zr)	µg/g dw	0.0003 - 0.001	0.0002 - 0.0009

Table A.12: Laboratory analyses of certified reference materials associated with spotted sandpiper egg samples. Highlighted values did not achieve the data quality objective of recovery between 70% and 130% of certified values.

Analyte	Units	Year	Certified Reference Material						
			Certified Value	Informational Value	Measured	Value within Certified or Informational Range?	% Recovery Relative to Certified Value	% Recovery Relative to Informational Value	Reference Material
Aluminum (Al)	µg/g dw	2013	-	1.2 (0.7 - 1.7)	1.2	Yes	-	98%	Bovine Liver (SRM)
			-	1.2 (0.7 - 1.7)	1.1	Yes	-	91%	Bovine Liver (SRM)
			-	1.2 (0.7 - 1.7)	1.3	Yes	-	106%	Bovine Liver (SRM)
			-	1.2 (0.7 - 1.7)	1.3	Yes	-	108%	Bovine Liver (SRM)(D12B)
			-	200	60.9	-	-	30%	DOLT (SRM)
			-	200	92.1	-	-	46%	DOLT (SRM)
			-	200	71.6	-	-	36%	DOLT-4 (SRM)-1
			-	200	53.4	-	-	27%	DOLT-4 (SRM)-2
		2014	-	1.2 (0.7 - 1.7)	1.3	Yes	-	111%	17B SRM 1577
			-	1.2 (0.7 - 1.7)	1.2	Yes	-	100%	19B SRM 1577
			-	1.2 (0.7 - 1.7)	1.3	Yes	-	108%	21B SRM 1577
			-	200	52	-	-	26%	18B CRM DOLT-4
			-	200	88	-	-	44%	20B CRM DOLT-4
			-	200	72	-	-	36%	22B CRM DOLT-4
Antimony (Sb)	µg/g dw	2013	-	0.009 (0.004 - 0.014)	0.007	Yes	-	80%	Bovine Liver (SRM)
			-	0.009 (0.004 - 0.014)	0.006	Yes	-	72%	Bovine Liver (SRM)
			-	0.009 (0.004 - 0.014)	0.005	Yes	-	57%	Bovine Liver (SRM)
			-	0.009 (0.004 - 0.014)	0.007	Yes	-	73%	Bovine Liver (SRM)(D12B)
			-	-	0.009	-	-	-	DOLT (SRM)
			-	-	0.010	-	-	-	DOLT (SRM)
			-	-	0.013	-	-	-	DOLT-4 (SRM)-1
			-	-	0.014	-	-	-	DOLT-4 (SRM)-2
		2014	-	0.009 (0.004 - 0.014)	0.007	Yes	-	83%	17B SRM 1577
			-	0.009 (0.004 - 0.014)	0.006	Yes	-	69%	19B SRM 1577
			-	0.009 (0.004 - 0.014)	0.007	Yes	-	72%	21B SRM 1577
			-	-	0.010	-	-	-	18B CRM DOLT-4
			-	-	0.011	-	-	-	20B CRM DOLT-4
			-	-	0.015	-	-	-	22B CRM DOLT-4
Arsenic (As)	µg/g dw	2013	0.055 (0.050 - 0.060)	0.054 (0.048 - 0.060)	0.055	Yes	100%	102%	Bovine Liver (SRM)
			0.055 (0.050 - 0.060)	0.054 (0.048 - 0.060)	0.047	No	85%	86%	Bovine Liver (SRM)
			0.055 (0.050 - 0.060)	0.054 (0.048 - 0.060)	0.048	Yes	86%	88%	Bovine Liver (SRM)
			0.055 (0.050 - 0.060)	0.054 (0.048 - 0.060)	0.057	Yes	103%	105%	Bovine Liver (SRM)(D12B)
			9.66 (9.04 - 10.28)	-	8.31	No	86%	-	DOLT (SRM)
			9.66 (9.04 - 10.28)	-	7.83	No	81%	-	DOLT (SRM)
			9.66 (9.04 - 10.28)	-	8.03	No	83%	-	DOLT-4 (SRM)-1
			9.66 (9.04 - 10.28)	-	8.33	No	86%	-	DOLT-4 (SRM)-2
		2014	0.055 (0.050 - 0.060)	0.054 (0.048 - 0.060)	0.047	No	85%	87%	17B SRM 1577
			0.055 (0.050 - 0.060)	0.054 (0.048 - 0.060)	0.052	Yes	95%	96%	19B SRM 1577
			0.055 (0.050 - 0.060)	0.054 (0.048 - 0.060)	0.052	Yes	95%	97%	21B SRM 1577
			9.66 (9.04 - 10.28)	-	8.30	No	86%	-	18B CRM DOLT-4
			9.66 (9.04 - 10.28)	-	8.58	No	89%	-	20B CRM DOLT-4
			9.66 (9.04 - 10.28)	-	8.30	No	86%	-	22B CRM DOLT-4
Cadmium (Cd)	µg/g dw	2013	0.27 (0.23 - 0.31)	0.283 (0.26 - 0.306)	0.280	Yes	104%	99%	Bovine Liver (SRM)
			0.27 (0.23 - 0.31)	0.283 (0.26 - 0.306)	0.273	Yes	101%	96%	Bovine Liver (SRM)
			0.27 (0.23 - 0.31)	0.283 (0.26 - 0.306)	0.276	Yes	102%	98%	Bovine Liver (SRM)
			0.27 (0.23 - 0.31)	0.283 (0.26 - 0.306)	0.291	Yes	108%	103%	Bovine Liver (SRM)(D12B)
			24.3 (23.5 - 25.1)	-	21.8	No	90%	-	DOLT (SRM)
			24.3 (23.5 - 25.1)	-	20.9	No	86%	-	DOLT (SRM)
			24.3 (23.5 - 25.1)	-	21.1	No	87%	-	DOLT-4 (SRM)-1
			24.3 (23.5 - 25.1)	-	21.7	No	89%	-	DOLT-4 (SRM)-2
		2014	0.27 (0.23 - 0.31)	0.283 (0.26 - 0.306)	0.296	Yes	110%	105%	17B SRM 1577
			0.27 (0.23 - 0.31)	0.283 (0.26 - 0.306)	0.298	Yes	110%	105%	19B SRM 1577
			0.27 (0.23 - 0.31)	0.283 (0.26 - 0.306)	0.289	Yes	107%	102%	21B SRM 1577
			24.3 (23.5 - 25.1)	-	22.1	No	91%	-	18B CRM DOLT-4
			24.3 (23.5 - 25.1)	-	22.4	No	92%	-	20B CRM DOLT-4
			24.3 (23.5 - 25.1)	-	22.5	No	93%	-	22B CRM DOLT-4
Calcium (Ca)	µg/g dw	2013	124 (118 - 130)	121 (107 - 135)	118	Yes	95%	98%	Bovine Liver (SRM)
			124 (118 - 130)	121 (107 - 135)	122	Yes	98%	101%	Bovine Liver (SRM)
			124 (118 - 130)	121 (107 - 135)	117	Yes	94%	97%	Bovine Liver (SRM)
			124 (118 - 130)	121 (107 - 135)	122	Yes	98%	101%	Bovine Liver (SRM)(D12B)
			-	680	668	-	-	98%	DOLT (SRM)
			-	680	744	-	-	109%	DOLT (SRM)
			-	680	660	-	-	97%	DOLT-4 (SRM)-1
			-	680	686	-	-	101%	DOLT-4 (SRM)-2
		2014	124 (118 - 130)	121 (107 - 135)	121	Yes	98%	100%	17B SRM 1577
			124 (118 - 130)	121 (107 - 135)	121	Yes	98%	100%	19B SRM 1577
			124 (118 - 130)	121 (107 - 135)	122	Yes	98%	101%	21B SRM 1577
			-	680	645	-	-	95%	18B CRM DOLT-4
			-	680	648	-	-	95%	20B CRM DOLT-4
			-	680	650	-	-	96%	22B CRM DOLT-4
Cesium (Cs)	µg/g dw	2013	-	0.015 (0.011 - 0.019)	0.012	Yes	-	80%	Bovine Liver (SRM)
			-	0.015 (0.011 - 0.019)	0.012	Yes	-	81%	Bovine Liver (SRM)
			-	0.015 (0.011 - 0.019)	0.012	Yes	-	82%	Bovine Liver (SRM)
			-	0.015 (0.011 - 0.019)	0.013	Yes	-	86%	Bovine Liver (SRM)(D12B)
			-	-	0.101	-	-	-	DOLT (SRM)
			-	-	0.099	-	-	-	DOLT (SRM)
			-	-	0.099	-	-	-	DOLT-4 (SRM)-1
			-	-	0.099	-	-	-	DOLT-4 (SRM)-2
		2014	-	0.015 (0.011 - 0.019)	0.012	Yes	-	81%	17B SRM 1577
			-	0.015 (0.011 - 0.019)	0.012	Yes	-	81%	19B SRM 1577
			-	0.015 (0.011 - 0.019)	0.012	Yes	-	79%	21B SRM 1577
			-	-	0.097	-	-	-	18B CRM DOLT-4
			-	-	0.100	-	-	-	20B CRM DOLT-4
			-	-	0.101	-	-	-	22B CRM DOLT-4
Chromium (Cr)	µg/g dw	2013	0.088 (0.076 - 0.10)	0.11 (0.06 - 0.16)	0.16	Yes	182%	145%	Bovine Liver (SRM)
			0.088 (0.076 - 0.10)	0.11 (0.06 - 0.16)	0.12	Yes	134%	107%	Bovine Liver (SRM)
			0.088 (0.076 - 0.10)	0.11 (0.06 - 0.16)	0.12	Yes	131%	105%	Bovine Liver (SRM)
			0.088 (0.076 - 0.10)	0.11 (0.06 - 0.16)	0.10	Yes	116%	93%	Bovine Liver (SRM)(D12B)
			-	1.4	1.2	-	-	86%	DOLT (SRM)
			-	1.4	1.2	-	-	84%	DOLT (SRM)
			-	1.4	1.2	-	-	85%	DOLT-4 (SRM)-1
			-	1.4	1.1	-	-	81%	DOLT-4 (SRM)-2
		2014	0.088 (0.076 - 0.10)	0.11 (0.06 - 0.16)	0.12	Yes	135%	108%	17B SRM 1577
			0.088 (0.076 - 0.10)	0.11 (0.06 - 0.16)	0.11	Yes	122%	97%	19B SRM 1577
			0.088 (0.076 - 0.10)	0.11 (0.06 - 0.16)	0.09	Yes	101%	81%	21B SRM 1577
			-	1.4	1.1	-	-	80%	18B CRM DOLT-4
			-	1.4	1.4	-	-	101%	20B CRM DOLT-4
			-	1.4	1.2	-	-	87%	22B CRM DOLT-4

Table A.12: Laboratory analyses of certified reference materials associated with spotted sandpiper egg samples. Highlighted values did not achieve the data quality objective of recovery between 70% and 130% of certified values.

			Certified Reference Material						
						Value within	% Recovery	% Recovery	
Cobalt (Co)	µg/g dw	2013	-	0.22 (0.18 - 0.26)	0.24	Yes	-	107%	Bovine Liver (SRM)
			-	0.22 (0.18 - 0.26)	0.24	Yes	-	109%	Bovine Liver (SRM)
			-	0.22 (0.18 - 0.26)	0.24	Yes	-	109%	Bovine Liver (SRM)
			-	0.22 (0.18 - 0.26)	0.24	Yes	-	110%	Bovine Liver (SRM)(D12B)
			-	0.25	0.21	-	-	85%	DOLT (SRM)
			-	0.25	0.22	-	-	87%	DOLT (SRM)
			-	0.25	0.22	-	-	90%	DOLT-4 (SRM)-1
			-	0.25	0.21	-	-	83%	DOLT-4 (SRM)-2
		2014	-	0.22 (0.18 - 0.26)	0.24	Yes	-	110%	17B SRM 1577
			-	0.22 (0.18 - 0.26)	0.24	Yes	-	110%	19B SRM 1577
			-	0.22 (0.18 - 0.26)	0.24	Yes	-	108%	21B SRM 1577
			-	0.25	0.21	-	-	83%	18B CRM DOLT-4
			-	0.25	0.21	-	-	84%	20B CRM DOLT-4
			-	0.25	0.22	-	-	87%	22B CRM DOLT-4
Copper (Cu)	µg/g dw	2013	193 (183 - 203)	190 (180 - 200)	175	No	91%	92%	Bovine Liver (SRM)
			193 (183 - 203)	190 (180 - 200)	171	No	89%	90%	Bovine Liver (SRM)
			193 (183 - 203)	190 (180 - 200)	178	No	92%	94%	Bovine Liver (SRM)
			193 (183 - 203)	190 (180 - 200)	184	Yes	95%	97%	Bovine Liver (SRM)(D12B)
			31.2 (30.1 - 32.3)	-	29	No	94%	-	DOLT (SRM)
			31.2 (30.1 - 32.3)	-	27	No	88%	-	DOLT (SRM)
			31.2 (30.1 - 32.3)	-	28	No	91%	-	DOLT-4 (SRM)-1
			31.2 (30.1 - 32.3)	-	29	No	93%	-	DOLT-4 (SRM)-2
		2014	193 (183 - 203)	190 (180 - 200)	177	No	92%	93%	17B SRM 1577
			193 (183 - 203)	190 (180 - 200)	183	Yes	95%	96%	19B SRM 1577
			193 (183 - 203)	190 (180 - 200)	180	Yes	93%	95%	21B SRM 1577
			31.2 (30.1 - 32.3)	-	28.7	No	92%	-	18B CRM DOLT-4
			31.2 (30.1 - 32.3)	-	28.7	No	92%	-	20B CRM DOLT-4
			31.2 (30.1 - 32.3)	-	29.5	No	95%	-	22B CRM DOLT-4
Iron (Fe)	µg/g dw	2013	268 (260 - 276)	263 (241 - 285)	265	Yes	99%	101%	Bovine Liver (SRM)
			268 (260 - 276)	263 (241 - 285)	261	Yes	97%	99%	Bovine Liver (SRM)
			268 (260 - 276)	263 (241 - 285)	268	Yes	100%	102%	Bovine Liver (SRM)
			268 (260 - 276)	263 (241 - 285)	270	Yes	101%	103%	Bovine Liver (SRM)(D12B)
			1,833 (1,758 - 1,908)	-	1,810	Yes	99%	-	DOLT (SRM)
			1,833 (1,758 - 1,908)	-	1,710	No	93%	-	DOLT (SRM)
			1,833 (1,758 - 1,908)	-	1,880	Yes	103%	-	DOLT-4 (SRM)-1
			1,833 (1,758 - 1,908)	-	1,740	No	95%	-	DOLT-4 (SRM)-2
		2014	268 (260 - 276)	263 (241 - 285)	259	Yes	97%	98%	17B SRM 1577
			268 (260 - 276)	263 (241 - 285)	264	Yes	99%	100%	19B SRM 1577
			268 (260 - 276)	263 (241 - 285)	262	Yes	98%	100%	21B SRM 1577
			1,833 (1,758 - 1,908)	-	1,740	No	95%	-	18B CRM DOLT-4
			1,833 (1,758 - 1,908)	-	1,710	No	93%	-	20B CRM DOLT-4
			1,833 (1,758 - 1,908)	-	1,790	Yes	98%	-	22B CRM DOLT-4
Lead (Pb)	µg/g dw	2013	0.34 (0.26 - 0.42)	0.34 (0.30 - 0.38)	0.36	Yes	91%	91%	Bovine Liver (SRM)
			0.34 (0.26 - 0.42)	0.34 (0.30 - 0.38)	0.35	Yes	103%	103%	Bovine Liver (SRM)
			0.34 (0.26 - 0.42)	0.34 (0.30 - 0.38)	0.33	Yes	97%	97%	Bovine Liver (SRM)
			0.34 (0.26 - 0.42)	0.34 (0.30 - 0.38)	0.34	Yes	100%	100%	Bovine Liver (SRM)(D12B)
			0.16 (0.12 - 0.20)	-	0.13	Yes	82%	-	DOLT (SRM)
			0.16 (0.12 - 0.20)	-	0.12	Yes	76%	-	DOLT (SRM)
			0.16 (0.12 - 0.20)	-	0.15	Yes	95%	-	DOLT-4 (SRM)-1
			0.16 (0.12 - 0.20)	-	0.14	Yes	89%	-	DOLT-4 (SRM)-2
		2014	0.34 (0.26 - 0.42)	0.34 (0.30 - 0.38)	0.33	Yes	98%	98%	17B SRM 1577
			0.34 (0.26 - 0.42)	0.34 (0.30 - 0.38)	0.35	Yes	104%	104%	19B SRM 1577
			0.34 (0.26 - 0.42)	0.34 (0.30 - 0.38)	0.35	Yes	103%	103%	21B SRM 1577
			0.16 (0.12 - 0.20)	-	0.12	Yes	76%	-	18B CRM DOLT-4
			0.16 (0.12 - 0.20)	-	0.13	Yes	82%	-	20B CRM DOLT-4
			0.16 (0.12 - 0.20)	-	0.14	Yes	86%	-	22B CRM DOLT-4
Magnesium (Mg)	µg/g dw	2013	604 (595 - 613)	608 (577 - 639)	587	Yes	97%	97%	Bovine Liver (SRM)
			604 (595 - 613)	608 (577 - 639)	597	Yes	99%	98%	Bovine Liver (SRM)
			604 (595 - 613)	608 (577 - 639)	636	Yes	105%	105%	Bovine Liver (SRM)
			604 (595 - 613)	608 (577 - 639)	644	No	107%	106%	Bovine Liver (SRM)(D12B)
			-	1,500	1,390	-	-	93%	DOLT (SRM)
			-	1,500	1,280	-	-	85%	DOLT (SRM)
			-	1,500	1,370	-	-	91%	DOLT-4 (SRM)-1
			-	1,500	1,380	-	-	92%	DOLT-4 (SRM)-2
		2014	604 (595 - 613)	608 (577 - 639)	620	Yes	103%	102%	17B SRM 1577
			604 (595 - 613)	608 (577 - 639)	630	Yes	104%	104%	19B SRM 1577
			604 (595 - 613)	608 (577 - 639)	612	Yes	101%	101%	21B SRM 1577
			-	1,500	1,390	-	-	93%	18B CRM DOLT-4
			-	1,500	1,380	-	-	92%	20B CRM DOLT-4
			-	1,500	1,380	-	-	92%	22B CRM DOLT-4
Manganese (Mn)	µg/g dw	2013	10.3 (9.3 - 11.3)	10.2 (9.5 - 10.9)	10.2	Yes	99%	100%	Bovine Liver (SRM)
			10.3 (9.3 - 11.3)	10.2 (9.5 - 10.9)	10.3	Yes	100%	101%	Bovine Liver (SRM)
			10.3 (9.3 - 11.3)	10.2 (9.5 - 10.9)	10.4	Yes	101%	102%	Bovine Liver (SRM)
			10.3 (9.3 - 11.3)	10.2 (9.5 - 10.9)	10.3	Yes	100%	101%	Bovine Liver (SRM)(D12B)
			-	-	9.8	-	-	-	DOLT (SRM)
			-	-	9.6	-	-	-	DOLT (SRM)
			-	-	10.2	-	-	-	DOLT-4 (SRM)-1
			-	-	9.3	-	-	-	DOLT-4 (SRM)-2
		2014	10.3 (9.3 - 11.3)	10.2 (9.5 - 10.9)	9.8	Yes	95%	96%	17B SRM 1577
			10.3 (9.3 - 11.3)	10.2 (9.5 - 10.9)	10.2	Yes	99%	100%	19B SRM 1577
			10.3 (9.3 - 11.3)	10.2 (9.5 - 10.9)	10.0	Yes	97%	98%	21B SRM 1577
			-	-	8.8	-	-	-	18B CRM DOLT-4
			-	-	9.1	-	-	-	20B CRM DOLT-4
			-	-	9.7	-	-	-	22B CRM DOLT-4
Molybdenum (Mo)	µg/g dw	2013	-	3.2 (2.8 - 3.6)	3.6	Yes	-	112%	Bovine Liver (SRM)
			-	3.2 (2.8 - 3.6)	3.6	Yes	-	113%	Bovine Liver (SRM)
			-	3.2 (2.8 - 3.6)	3.6	Yes	-	111%	Bovine Liver (SRM)
			-	3.2 (2.8 - 3.6)	3.6	Yes	-	113%	Bovine Liver (SRM)(D12B)
			-	1.0	1.0	-	-	103%	DOLT (SRM)
			-	1.0	1.1	-	-	106%	DOLT (SRM)
			-	1.0	1.0	-	-	104%	DOLT-4 (SRM)-1
			-	1.0	1.1	-	-	106%	DOLT-4 (SRM)-2
		2014	-	3.2 (2.8 - 3.6)	3.6	Yes	-	112%	17B SRM 1577
			-	3.2 (2.8 - 3.6)	3.7	No	-	115%	19B SRM 1577
			-	3.2 (2.8 - 3.6)	3.6	Yes	-	112%	21B SRM 1577
			-	1.0	1.0	-	-	104%	18B CRM DOLT-4
			-	1.0	1.1	-	-	107%	20B CRM DOLT-4
			-	1.0	1.1	-	-	107%	22B CRM DOLT-4

Table A.12: Laboratory analyses of certified reference materials associated with spotted sandpiper egg samples. Highlighted values did not achieve the data quality objective of recovery between 70% and 130% of certified values.

			Certified Reference Material						
						Value within	% Recovery	% Recovery	
Nickel (Ni)	µg/g dw	2013	-	0.18 (0.10 - 0.26)	0.03	No	-	19%	Bovine Liver (SRM)
			-	0.18 (0.10 - 0.26)	0.03	No	-	19%	Bovine Liver (SRM)
			-	0.18 (0.10 - 0.26)	0.04	No	-	21%	Bovine Liver (SRM)
			-	0.18 (0.10 - 0.26)	0.04	No	-	20%	Bovine Liver (SRM)(D12B)
			0.97 (0.86 - 1.08)	-	0.78	No	80%	-	DOLT (SRM)
			0.97 (0.86 - 1.08)	-	0.80	No	83%	-	DOLT (SRM)
			0.97 (0.86 - 1.08)	-	0.87	Yes	90%	-	DOLT-4 (SRM)-1
			0.97 (0.86 - 1.08)	-	0.84	No	86%	-	DOLT-4 (SRM)-2
		2014	-	0.18 (0.10 - 0.26)	0.04	No	-	20%	17B SRM 1577
			-	0.18 (0.10 - 0.26)	0.03	No	-	19%	19B SRM 1577
			-	0.18 (0.10 - 0.26)	0.03	No	-	15%	21B SRM 1577
			0.97 (0.86 - 1.08)	-	0.91	Yes	93%	-	18B CRM DOLT-4
			0.97 (0.86 - 1.08)	-	1.04	Yes	107%	-	20B CRM DOLT-4
			0.97 (0.86 - 1.08)	-	0.84	No	87%	-	22B CRM DOLT-4
Phosphorus (P)	µg/g dw	2013	-	11,200 (10,100 - 12,300)	10,400	Yes	-	93%	Bovine Liver (SRM)
			-	11,200 (10,100 - 12,300)	11,100	Yes	-	99%	Bovine Liver (SRM)
			-	11,200 (10,100 - 12,300)	11,200	Yes	-	100%	Bovine Liver (SRM)
			-	11,200 (10,100 - 12,300)	11,400	Yes	-	102%	Bovine Liver (SRM)(D12B)
			-	-	11,800	-	-	-	DOLT (SRM)
			-	-	11,100	-	-	-	DOLT (SRM)
			-	-	11,500	-	-	-	DOLT-4 (SRM)-1
			-	-	11,800	-	-	-	DOLT-4 (SRM)-2
		2014	-	11,200 (10,100 - 12,300)	11,900	Yes	-	106%	17B SRM 1577
			-	11,200 (10,100 - 12,300)	11,900	Yes	-	106%	19B SRM 1577
			-	11,200 (10,100 - 12,300)	11,500	Yes	-	103%	21B SRM 1577
			-	-	12,600	-	-	-	18B CRM DOLT-4
			-	-	12,400	-	-	-	20B CRM DOLT-4
			-	-	12,200	-	-	-	22B CRM DOLT-4
Potassium (K)	µg/g dw	2013	9,700 (9,100 - 10,300)	9,700 (9,100 - 10,300)	10,200	Yes	105%	105%	Bovine Liver (SRM)
			9,700 (9,100 - 10,300)	9,700 (9,100 - 10,300)	10,900	No	112%	112%	Bovine Liver (SRM)
			9,700 (9,100 - 10,300)	9,700 (9,100 - 10,300)	11,500	No	119%	119%	Bovine Liver (SRM)
			9,700 (9,100 - 10,300)	9,700 (9,100 - 10,300)	11,500	No	119%	119%	Bovine Liver (SRM)(D12B)
			-	9800	9,520	-	-	97%	DOLT (SRM)
			-	9800	9,740	-	-	99%	DOLT (SRM)
			-	9800	10,000	-	-	102%	DOLT-4 (SRM)-1
			-	9800	10,200	-	-	104%	DOLT-4 (SRM)-2
		2014	9,700 (9,100 - 10,300)	9,700 (9,100 - 10,300)	10,900	No	112%	112%	17B SRM 1577
			9,700 (9,100 - 10,300)	9,700 (9,100 - 10,300)	11,100	No	114%	114%	19B SRM 1577
			9,700 (9,100 - 10,300)	9,700 (9,100 - 10,300)	10,500	No	108%	108%	21B SRM 1577
			-	9800	9,440	-	-	96%	18B CRM DOLT-4
			-	9800	9,880	-	-	101%	20B CRM DOLT-4
			-	9,800	9,940	-	-	101%	22B CRM DOLT-4
Rubidium (Rb)	µg/g dw	2013	18.3 (17.3 - 19.3)	18.2 (16.9 - 19.5)	18.4	Yes	101%	101%	Bovine Liver (SRM)
			18.3 (17.3 - 19.3)	18.2 (16.9 - 19.5)	18.7	Yes	102%	103%	Bovine Liver (SRM)
			18.3 (17.3 - 19.3)	18.2 (16.9 - 19.5)	19.2	Yes	105%	105%	Bovine Liver (SRM)
			18.3 (17.3 - 19.3)	18.2 (16.9 - 19.5)	18.9	Yes	103%	104%	Bovine Liver (SRM)(D12B)
			-	-	3.1	-	-	-	DOLT (SRM)
			-	-	3.2	-	-	-	DOLT (SRM)
			-	-	3.1	-	-	-	DOLT-4 (SRM)-1
			-	-	3.1	-	-	-	DOLT-4 (SRM)-2
		2014	18.3 (17.3 - 19.3)	18.2 (16.9 - 19.5)	18.3	Yes	100%	101%	17B SRM 1577
			18.3 (17.3 - 19.3)	18.2 (16.9 - 19.5)	18.6	Yes	102%	102%	19B SRM 1577
			18.3 (17.3 - 19.3)	18.2 (16.9 - 19.5)	18.6	Yes	102%	102%	21B SRM 1577
			-	-	3.1	-	-	-	18B CRM DOLT-4
			-	-	3.1	-	-	-	20B CRM DOLT-4
			-	-	3.2	-	-	-	22B CRM DOLT-4
Selenium (Se)	µg/g dw	2013	1.1 (1.0 - 1.2)	1.09 (1.02 - 1.16)	1.04	Yes	95%	95%	Bovine Liver (SRM)
			1.1 (1.0 - 1.2)	1.09 (1.02 - 1.16)	0.99	No	90%	91%	Bovine Liver (SRM)
			1.1 (1.0 - 1.2)	1.09 (1.02 - 1.16)	0.97	No	88%	89%	Bovine Liver (SRM)
			1.1 (1.0 - 1.2)	1.09 (1.02 - 1.16)	0.96	No	88%	88%	Bovine Liver (SRM)(D12B)
			8.30 (6.96 - 9.64)	-	7.84	Yes	94%	-	DOLT (SRM)
			8.30 (6.96 - 9.64)	-	7.07	Yes	85%	-	DOLT (SRM)
			8.30 (6.96 - 9.64)	-	7.40	Yes	89%	-	DOLT-4 (SRM)-1
			8.30 (6.96 - 9.64)	-	7.69	Yes	93%	-	DOLT-4 (SRM)-2
		2014	1.1 (1.0 - 1.2)	1.09 (1.02 - 1.16)	1.09	Yes	99%	100%	17B SRM 1577
			1.1 (1.0 - 1.2)	1.09 (1.02 - 1.16)	1.03	Yes	94%	94%	19B SRM 1577
			1.1 (1.0 - 1.2)	1.09 (1.02 - 1.16)	1.10	Yes	100%	101%	21B SRM 1577
			8.30 (6.96 - 9.64)	-	7.43	Yes	90%	-	18B CRM DOLT-4
			8.30 (6.96 - 9.64)	-	7.79	Yes	94%	-	20B CRM DOLT-4
			8.30 (6.96 - 9.64)	-	7.36	Yes	89%	-	22B CRM DOLT-4
Silver (Ag)	µg/g dw	2013	-	0.062 (0.051 - 0.073)	0.055	Yes	-	89%	Bovine Liver (SRM)
			-	0.062 (0.051 - 0.073)	0.054	Yes	-	86%	Bovine Liver (SRM)
			-	0.062 (0.051 - 0.073)	0.055	Yes	-	89%	Bovine Liver (SRM)
			-	0.062 (0.051 - 0.073)	0.056	Yes	-	90%	Bovine Liver (SRM)(D12B)
			0.93 (0.86 - 1.00)	-	0.837	No	90%	-	DOLT (SRM)
			0.93 (0.86 - 1.00)	-	0.805	No	87%	-	DOLT (SRM)
			0.93 (0.86 - 1.00)	-	0.802	No	86%	-	DOLT-4 (SRM)-1
			0.93 (0.86 - 1.00)	-	0.816	No	88%	-	DOLT-4 (SRM)-2
		2014	-	0.062 (0.051 - 0.073)	0.054	Yes	-	87%	17B SRM 1577
			-	0.062 (0.051 - 0.073)	0.060	Yes	-	97%	19B SRM 1577
			-	0.062 (0.051 - 0.073)	0.056	Yes	-	90%	21B SRM 1577
			0.93 (0.86 - 1.00)	-	0.83	No	89%	-	18B CRM DOLT-4
			0.93 (0.86 - 1.00)	-	0.83	No	89%	-	20B CRM DOLT-4
			0.93 (0.86 - 1.00)	-	0.85	No	91%	-	22B CRM DOLT-4
Sodium (Na)	µg/g dw	2013	2,430 (2,300 - 2,560)	2,390 (2,230 - 2,550)	2,100	No	86%	88%	Bovine Liver (SRM)
			2,430 (2,300 - 2,560)	2,390 (2,230 - 2,550)	2,330	Yes	96%	97%	Bovine Liver (SRM)
			2,430 (2,300 - 2,560)	2,390 (2,230 - 2,550)	2,480	Yes	102%	104%	Bovine Liver (SRM)
			2,430 (2,300 - 2,560)	2,390 (2,230 - 2,550)	2,300	Yes	95%	96%	Bovine Liver (SRM)(D12B)
			-	6,800	6,710	-	-	99%	DOLT (SRM)
			-	6,800	6,260	-	-	92%	DOLT (SRM)
			-	6,800	6,560	-	-	96%	DOLT-4 (SRM)-1
			-	6,800	6,640	-	-	98%	DOLT-4 (SRM)-2
		2014	2,430 (2,300 - 2,560)	2,390 (2,230 - 2,550)	2,590	No	107%	108%	17B SRM 1577
			2,430 (2,300 - 2,560)	2,390 (2,230 - 2,550)	2,370	Yes	98%	99%	19B SRM 1577
			2,430 (2,300 - 2,560)	2,390 (2,230 - 2,550)	2,370	Yes	98%	99%	21B SRM 1577
			-	6,800	7,160	-	-	105%	18B CRM DOLT-4
			-	6,800	6,620	-	-	97%	20B CRM DOLT-4
			-	6,800	6,710	-	-	99%	22B CRM DOLT-4

Table A.12: Laboratory analyses of certified reference materials associated with spotted sandpiper egg samples. Highlighted values did not achieve the data quality objective of recovery between 70% and 130% of certified values.

			Certified Reference Material						
						Value within	% Recovery	% Recovery	
Strontium (Sr)	µg/g dw	2013	-	0.16 (0.13 - 0.19)	0.15	Yes	-	91%	Bovine Liver (SRM)
			-	0.16 (0.13 - 0.19)	0.15	Yes	-	92%	Bovine Liver (SRM)
			-	0.16 (0.13 - 0.19)	0.14	Yes	-	89%	Bovine Liver (SRM)
			-	0.16 (0.13 - 0.19)	0.15	Yes	-	92%	Bovine Liver (SRM)(D12B)
			-	5.5	5.16	-	-	94%	DOLT (SRM)
			-	5.5	5.57	-	-	101%	DOLT (SRM)
			-	5.5	5.13	-	-	93%	DOLT-4 (SRM)-1
			-	5.5	5.22	-	-	95%	DOLT-4 (SRM)-2
		2014	-	0.16 (0.13 - 0.19)	0.14	Yes	-	89%	17B SRM 1577
			-	0.16 (0.13 - 0.19)	0.14	Yes	-	89%	19B SRM 1577
			-	0.16 (0.13 - 0.19)	0.18	Yes	-	112%	21B SRM 1577
			-	5.5	4.8	-	-	87%	18B CRM DOLT-4
			-	5.5	5.0	-	-	91%	20B CRM DOLT-4
			-	5.5	5.2	-	-	95%	22B CRM DOLT-4
Tin (Sn)	µg/g dw	2013	-	0.016 (0.012 - 0.020)	0.013	Yes	-	80%	Bovine Liver (SRM)
			-	0.016 (0.012 - 0.020)	0.009	No	-	59%	Bovine Liver (SRM)
			-	0.016 (0.012 - 0.020)	0.009	No	-	56%	Bovine Liver (SRM)
			-	0.016 (0.012 - 0.020)	0.012	Yes	-	73%	Bovine Liver (SRM)(D12B)
			-	0.17	0.15	-	-	85%	DOLT (SRM)
			-	0.17	0.15	-	-	89%	DOLT (SRM)
			-	0.17	0.14	-	-	85%	DOLT-4 (SRM)-1
			-	0.17	0.14	-	-	80%	DOLT-4 (SRM)-2
		2014	-	0.016 (0.012 - 0.020)	0.010	No	-	64%	17B SRM 1577
			-	0.016 (0.012 - 0.020)	0.010	No	-	64%	19B SRM 1577
			-	0.016 (0.012 - 0.020)	0.012	Yes	-	76%	21B SRM 1577
			-	0.17	0.16	-	-	96%	18B CRM DOLT-4
			-	0.17	0.17	-	-	101%	20B CRM DOLT-4
			-	0.17	0.15	-	-	86%	22B CRM DOLT-4
Vanadium (V)	µg/g dw	2013	-	0.058 (0.052 - 0.064)	0.059	Yes	-	101%	Bovine Liver (SRM)
			-	0.058 (0.052 - 0.064)	0.059	Yes	-	102%	Bovine Liver (SRM)
			-	0.058 (0.052 - 0.064)	0.059	Yes	-	101%	Bovine Liver (SRM)
			-	0.058 (0.052 - 0.064)	0.062	Yes	-	106%	Bovine Liver (SRM)(D12B)
			-	0.6	0.5	-	-	84%	DOLT (SRM)
			-	0.6	0.6	-	-	100%	DOLT (SRM)
			-	0.6	0.6	-	-	93%	DOLT-4 (SRM)-1
			-	0.6	0.5	-	-	76%	DOLT-4 (SRM)-2
		2014	-	0.058 (0.052 - 0.064)	0.059	Yes	-	102%	17B SRM 1577
			-	0.058 (0.052 - 0.064)	0.058	Yes	-	100%	19B SRM 1577
			-	0.058 (0.052 - 0.064)	0.059	Yes	-	101%	21B SRM 1577
			-	0.6	0.4	-	-	75%	18B CRM DOLT-4
			-	0.6	0.5	-	-	82%	20B CRM DOLT-4
			-	0.6	0.5	-	-	89%	22B CRM DOLT-4
Zinc (Zn)	µg/g dw	2013	130 (117 - 143)	131 (123 - 139)	115	No	88%	88%	Bovine Liver (SRM)
			130 (117 - 143)	131 (123 - 139)	116	No	89%	89%	Bovine Liver (SRM)
			130 (117 - 143)	131 (123 - 139)	116	No	89%	89%	Bovine Liver (SRM)
			130 (117 - 143)	131 (123 - 139)	119	Yes	92%	91%	Bovine Liver (SRM)(D12B)
			116 (110 - 122)	-	102	No	88%	-	DOLT (SRM)
			116 (110 - 122)	-	96	No	83%	-	DOLT (SRM)
			116 (110 - 122)	-	98	No	85%	-	DOLT-4 (SRM)-1
			116 (110 - 122)	-	100	No	86%	-	DOLT-4 (SRM)-2
		2014	130 (117 - 143)	131 (123 - 139)	122	Yes	94%	93%	17B SRM 1577
			130 (117 - 143)	131 (123 - 139)	125	Yes	96%	95%	19B SRM 1577
			130 (117 - 143)	131 (123 - 139)	124	Yes	95%	95%	21B SRM 1577
			116 (110 - 122)	-	102	No	88%	-	18B CRM DOLT-4
			116 (110 - 122)	-	105	No	91%	-	20B CRM DOLT-4
			116 (110 - 122)	-	104	No	90%	-	22B CRM DOLT-4

Table A.13: Laboratory duplicate results for spotted sandpiper eggs. Highlighted values did not meet the data quality objective of ≤ 30% relative percent difference (RPD).

Analyte	Units	2013															2014		
		LK02-6 (Rep 1)	LK02-6 (Rep 2)	RPD (%)	LK02-3 (Rep 1)	LK02-3 (Rep 2)	RPD (%)	NNP-1 (Rep-1)	NNP-1 (Rep 2)	RPD (%)	HA7-1 (Rep 1)	HA7-1 (Rep 2)	RPD (%)	GHPD-1 (Rep 1)	GHPD-1 (Rep 2)	RPD (%)	CL11-2 (Rep 1)	CL11-2 (Rep 2)	RPD (%)
Aluminum (Al)	µg/g dw	2.1	0.399	136%	0.329	0.182	58%	0.238	0.0883	92%	0.176	0.255	37%	0.144	0.243	51%	0.14	0.14	0%
Antimony (Sb)	µg/g dw	0.00073	0.00045	47%	0.00036	0.00048	29%	0.00061	0.00057	7%	0.00046	0.00041	11%	0.00041	0.00038	8%	0.0005	0.00058	15%
Arsenic (As)	µg/g dw	0.0127	0.0163	25%	0.025	0.022	13%	0.0114	0.0114	0%	0.0238	0.0197	19%	0.014	0.0124	12%	0.0131	0.0105	22%
Barium (Ba)	µg/g dw	7.14	6.84	4%	3.59	3.64	1%	4.61	4.66	1%	4	3.91	2%	4.99	5.05	1%	5.69	6.15	8%
Beryllium (Be)	µg/g dw	0.0018	0.0022	20%	0.0017	0.0019	11%	0.0027	0.0022	20%	0.0028	0.0025	11%	0.0022	0.002	10%	0.0023	0.0027	16%
Bismuth (Bi)	µg/g dw	0.000031	0.000037	18%	0.000043	0.00004	7%	0.000024	0.000019	23%	0.000023	0.000023	0%	0.0002	0.00074	115%	0.00006	0.00007	15%
Boron (B)	µg/g dw	0.17	0.2	16%	0.16	0.18	12%	0.12	0.104	14%	0.147	0.099	39%	0.26	0.24	8%	0.11	0.12	9%
Cadmium (Cd)	µg/g dw	0.00204	0.00164	22%	0.00217	0.00201	8%	0.00134	0.00238	56%	0.00265	0.00307	15%	0.00149	0.00085	55%	0.00323	0.00283	13%
Calcium (Ca)	µg/g dw	2820	2690	5%	2640	2630	0%	2950	2920	1%	3850	3700	4%	2900	3090	6%	2300	2380	3%
Cesium (Cs)	µg/g dw	0.00106	0.00113	6%	0.00092	0.00086	7%	0.0056	0.00537	4%	0.00219	0.00225	3%	0.0046	0.00514	11%	0.00272	0.0029	6%
Chromium (Cr)	µg/g dw	0.0791	0.0773	2%	0.158	0.0786	67%	0.0911	0.106	15%	0.0572	0.0868	41%	0.101	0.129	24%	0.0667	0.0616	8%
Cobalt (Co)	µg/g dw	0.096	0.0933	3%	0.115	0.12	4%	0.181	0.18	1%	0.126	0.123	2%	0.172	0.168	2%	0.2	0.197	2%
Copper (Cu)	µg/g dw	3.47	3.44	1%	4.21	4.18	1%	3.46	3.59	4%	3.54	3.82	8%	3.2	3.23	1%	3.4	3.63	7%
Gallium (Ga)	µg/g dw	0.006	0.00534	12%	0.00512	0.00549	7%	0.00739	0.00692	7%	0.00673	0.00703	4%	0.00607	0.00619	2%	0.004	0.0032	22%
Iron (Fe)	µg/g dw	106	103	3%	67.4	68	1%	99.6	98.6	1%	124	123	1%	108	106	2%	88.3	90.6	3%
Lead (Pb)	µg/g dw	0.011	0.0111	1%	0.0149	0.0129	14%	0.00745	0.00734	1%	0.00702	0.0061	14%	0.00692	0.00663	4%	0.004	0.00372	7%
Lithium (Li)	µg/g dw	0.0359	0.0434	19%	0.0457	0.0412	10%	0.0892	0.0874	2%	0.0322	0.0367	13%	0.0636	0.0635	0%	0.113	0.111	2%
Magnesium (Mg)	µg/g dw	306	304	1%	364	359	1%	318	316	1%	365	365	0%	418	410	2%	391	400	2%
Manganese (Mn)	µg/g dw	1.7	1.62	5%	1.3	1.34	3%	1.89	1.86	2%	2.67	2.56	4%	1.07	1.05	2%	1.64	1.71	4%
Molybdenum (Mo)	µg/g dw	0.1	0.0958	4%	0.189	0.188	1%	0.127	0.129	2%	0.113	0.108	5%	0.0831	0.0826	1%	0.11	0.116	5%
Nickel (Ni)	µg/g dw	0.013	0.0102	24%	0.016	0.0075	72%	0.0126	0.0116	8%	0.0139	0.0142	2%	0.0132	0.0138	4%	0.0138	0.0136	1%
Phosphorus (P)	µg/g dw	8460	8210	3%	8000	8300	4%	8810	9500	8%	9450	9270	2%	8440	8610	2%	7820	8150	4%
Potassium (K)	µg/g dw	4880	4920	1%	5610	5570	1%	5370	5320	1%	5230	5480	5%	5510	5590	1%	5820	5980	3%
Rhenium (Re)	µg/g dw	0.00064	0.0006	6%	0.00148	0.00136	8%	0.00033	0.00027	20%	0.00057	0.00047	19%	0.00029	0.00027	7%	0.00044	0.00049	11%
Rubidium (Rb)	µg/g dw	0.763	0.756	1%	0.996	0.985	1%	1.57	1.58	1%	1.42	1.47	3%	4.21	4.23	0%	2.57	2.61	2%
Selenium (Se)	µg/g dw	5.15	4.85	6%	7.32	7.48	2%	8.38	9.6	14%	9.3	10.4	11%	8.35	9.21	10%	16	16.9	5%
Silver (Ag)	µg/g dw	0.00692	0.00624	10%	0.00683	0.00677	1%	0.00494	0.0047	5%	0.0298	0.0282	6%	0.00353	0.00327	8%	0.00566	0.00649	14%
Sodium (Na)	µg/g dw	5020	5200	4%	6400	6180	3%	5460	5410	1%	5370	5480	2%	5450	5570	2%	5170	5110	1%
Strontium (Sr)	µg/g dw	3.75	3.6	4%	2.49	2.49	0%	2.13	2.14	0%	2.64	2.61	1%	2.69	2.78	3%	1.73	1.82	5%
Thallium (Tl)	µg/g dw	0.0275	0.0277	1%	0.0566	0.0553	2%	0.0242	0.0258	6%	0.0538	0.0538	0%	0.0626	0.0633	1%	0.0563	0.0577	2%
Thorium (Th)	µg/g dw	0.000092	0.00011	18%	0.00012	0.00012	0%	0.000075	0.00006	22%	0.000074	0.000072	3%	0.000095	0.000089	7%	0.000065	0.000075	14%
Tin (Sn)	µg/g dw	0.00087	0.00096	10%	0.00077	0.00083	8%	0.00038	0.00069	58%	0.00039	0.00035	11%	0.00072	0.00067	7%	0.0006	0.00069	14%
Titanium (Ti)	µg/g dw	0.0533	0.0405	27%	0.0476	0.0485	2%	0.0477	0.0344	32%	0.0487	0.0526	8%	0.0558	0.048	15%	0.074	0.067	10%
Uranium (U)	µg/g dw	0.000235	0.000184	24%	0.00009	0.000081	11%	0.000503	0.000438	14%	0.000074	0.000056	28%	0.000093	0.000087	7%	0.00077	0.00089	14%
Vanadium (V)	µg/g dw	0.00352	0.00258	31%	0.0117	0.00425	93%	0.004	0.0032	22%	0.00217	0.00197	10%	0.00352	0.00483	31%	0.00161	0.0012	29%
Yttrium (Y)	µg/g dw	0.00099	0.00084	16%	0.00058	0.00053	9%	0.00028	0.00031	10%	0.0004	0.00061	42%	0.00017	0.00016	6%	0.00031	0.00032	3%
Zinc (Zn)	µg/g dw	45.8	43.5	5%	36.6	39.4	7%	42.3	46.6	10%	50.9	50.6	1%	39.3	40.2	2%	36	38	5%
Zirconium (Zr)	µg/g dw	0.0046	0.00418	10%	0.00639	0.00177	113%	0.00195	0.00113	53%	0.00535	0.00447	18%	0.00126	0.0025	66%	0.00186	0.00081	79%

Table A.13: Laboratory duplicate results for spotted sandpiper eggs. Highlighted values did not meet the data quality objective of ≤ 30% relative percent difference (RPD).

Analyte	Units	2014																	
		EL1-6 (Rep 1)	EL1-6 (Rep 2)	RPD (%)	ELKO-2 (Rep 1)	ELKO-2 (Rep 2)	RPD (%)	FO29-2 (Rep 1)	FO29-2 (Rep 2)	RPD (%)	FO52-2 (Rep 1)	FO52-2 (Rep 2)	RPD (%)	GAPD-1 (Rep 1)	GAPD-1 (Rep 2)	RPD (%)	HA7-1-2 (Rep 1)	HA7-1-2 (Rep 2)	RPD (%)
Aluminum (Al)	µg/g dw	0.431	0.431	0%	0.177	0.177	0%	0.101	0.101	0%	0.076	0.076	0%	0.152	0.152	0%	0.145	0.145	0%
Antimony (Sb)	µg/g dw	0.00133	0.00127	5%	0.00034	0.00136	120%	0.00159	0.00135	16%	0.00076	0.00107	34%	0.00056	0.00037	41%	0.00027	0.00027	0%
Arsenic (As)	µg/g dw	0.0276	0.0306	10%	0.0082	0.0093	13%	0.0251	0.0265	5%	0.0208	0.0215	3%	0.0176	0.0165	6%	0.0212	0.0186	13%
Barium (Ba)	µg/g dw	5.62	6.12	9%	3.71	3.94	6%	10.3	10.4	1%	13.9	13.3	4%	4.32	4.44	3%	3.1	3.09	0%
Beryllium (Be)	µg/g dw	0.003	0.0035	15%	0.0033	0.0034	3%	0.0029	0.0033	13%	0.0032	0.0034	6%	0.0028	0.0025	11%	0.0029	0.0029	0%
Bismuth (Bi)	µg/g dw	0.000418	0.000702	51%	0.00337	0.000036	196%	0.00003	0.00006	67%	0.000053	0.000034	44%	0.000099	0.000089	11%	0.0001	0.0001	0%
Boron (B)	µg/g dw	0.117	0.12	3%	0.1	0.1	0%	0.112	0.1	11%	0.123	0.17	32%	0.142	0.173	20%	0.122	0.157	25%
Cadmium (Cd)	µg/g dw	0.00129	0.00103	22%	0.00188	0.00224	17%	0.00281	0.00287	2%	0.00186	0.00221	17%	0.0048	0.0057	17%	0.0021	0.0029	32%
Calcium (Ca)	µg/g dw	3380	3510	4%	2670	2860	7%	2660	2710	2%	2530	2460	3%	2700	2850	5%	2790	2730	2%
Cesium (Cs)	µg/g dw	0.00182	0.00163	11%	0.000993	0.000943	5%	0.000907	0.000744	20%	0.00211	0.00207	2%	0.00216	0.00201	7%	0.0027	0.00295	9%
Chromium (Cr)	µg/g dw	0.093	0.12	25%	0.0623	0.0677	8%	0.0635	0.0825	26%	0.0627	0.062	1%	0.0578	0.0856	39%	0.0627	0.0627	0%
Cobalt (Co)	µg/g dw	0.136	0.134	1%	0.0762	0.0782	3%	0.101	0.106	5%	0.173	0.164	5%	0.178	0.188	5%	0.109	0.106	3%
Copper (Cu)	µg/g dw	3.14	3.22	3%	3.46	3.27	6%	3.76	3.79	1%	3.88	4.16	7%	3.53	3.71	5%	4.17	4.2	1%
Gallium (Ga)	µg/g dw	0.0046	0.0042	9%	0.0035	0.0042	18%	0.004	0.0048	18%	0.0044	0.0038	15%	0.0031	0.0053	52%	0.004	0.0031	25%
Iron (Fe)	µg/g dw	77.4	78.5	1%	70.9	75.1	6%	97.2	100	3%	83.9	80.9	4%	93.8	97.4	4%	78.7	78.1	1%
Lead (Pb)	µg/g dw	0.0109	0.0111	2%	0.0108	0.0118	9%	0.00659	0.00657	0%	0.00559	0.00481	15%	0.0178	0.0176	1%	0.0039	0.004	3%
Lithium (Li)	µg/g dw	0.0446	0.0444	0%	0.0756	0.0741	2%	0.0979	0.0964	2%	0.0924	0.0858	7%	0.189	0.204	8%	0.0925	0.0894	3%
Magnesium (Mg)	µg/g dw	409	437	7%	368	382	4%	330	331	0%	404	412	2%	327	345	5%	495	501	1%
Manganese (Mn)	µg/g dw	1.78	1.79	1%	1.44	1.51	5%	1.42	1.45	2%	1.63	1.57	4%	1.06	1.13	6%	1.32	1.3	2%
Molybdenum (Mo)	µg/g dw	0.202	0.202	0%	0.0804	0.0858	6%	0.128	0.133	4%	0.128	0.123	4%	0.141	0.143	1%	0.0942	0.0948	1%
Nickel (Ni)	µg/g dw	0.0367	0.0337	9%	0.0108	0.012	11%	0.0129	0.0129	0%	0.0138	0.0125	10%	0.0127	0.0134	5%	0.0107	0.0123	14%
Phosphorus (P)	µg/g dw	9310	9300	0%	8520	9210	8%	9190	9050	2%	8360	8320	0%	8740	9310	6%	7690	7670	0%
Potassium (K)	µg/g dw	6150	6330	3%	5550	5510	1%	5380	5470	2%	5910	5990	1%	5560	6160	10%	5950	5960	0%
Rhenium (Re)	µg/g dw	0.00073	0.00073	0%	0.00023	0.0004	54%	0.00095	0.00083	13%	0.00132	0.00112	16%	0.00073	0.00069	6%	0.00064	0.0006	6%
Rubidium (Rb)	µg/g dw	0.884	0.922	4%	1.06	1.03	3%	1.48	1.5	1%	1.23	1.2	2%	1.26	1.33	5%	2.2	2.22	1%
Selenium (Se)	µg/g dw	6.87	7.12	4%	7.8	7.66	2%	8.38	8.39	0%	8.93	9.14	2%	19.3	21	8%	7.41	7.97	7%
Silver (Ag)	µg/g dw	0.0064	0.00646	1%	0.00655	0.00711	8%	0.0222	0.0212	5%	0.0165	0.0161	2%	0.0059	0.00637	8%	0.0257	0.026	1%
Sodium (Na)	µg/g dw	6340	6490	2%	6460	6320	2%	5830	5880	1%	6450	6560	2%	6040	6380	5%	6240	6270	0%
Strontium (Sr)	µg/g dw	3.92	4.27	9%	3.03	3.15	4%	1.5	1.55	3%	1.56	1.51	3%	2.14	2.22	4%	1.66	1.68	1%
Thallium (Tl)	µg/g dw	0.0535	0.0576	7%	0.0233	0.0231	1%	0.04	0.0403	1%	0.0286	0.0273	5%	0.0542	0.056	3%	0.0606	0.062	2%
Thorium (Th)	µg/g dw	0.000051	0.000059	15%	0.000065	0.000058	11%	0.00005	0.000056	11%	0.000054	0.000058	7%	0.00024	0.00022	9%	0.00025	0.00025	0%
Tin (Sn)	µg/g dw	0.00387	0.00228	52%	0.00035	0.00036	3%	0.00198	0.00048	122%	0.00034	0.00036	6%	0.00055	0.00049	12%	0.00057	0.00057	0%
Titanium (Ti)	µg/g dw	0.0697	0.082	16%	0.075	0.066	13%	0.065	0.07	7%	0.076	0.065	16%	0.0536	0.0558	4%	0.0735	0.0589	22%
Uranium (U)	µg/g dw	0.00023	0.00026	12%	0.00025	0.00026	4%	0.00022	0.00035	46%	0.00024	0.00026	8%	0.0026	0.0024	8%	0.0027	0.0027	0%
Vanadium (V)	µg/g dw	0.00343	0.00327	5%	0.00298	0.00242	21%	0.00218	0.00315	36%	0.0022	0.00213	3%	0.0019	0.00171	11%	0.00164	0.00164	0%
Yttrium (Y)	µg/g dw	0.00051	0.00051	0%	0.00042	0.00042	0%	0.00021	0.00021	0%	0.00055	0.00055	0%	0.00039	0.00039	0%	0.00057	0.00057	0%
Zinc (Zn)	µg/g dw	45.1	43.3	4%	40	42.7	7%	44.3	43.4	2%	43.3	41	5%	50.1	52.4	4%	39.5	39.9	1%
Zirconium (Zr)	µg/g dw	0.00618	0.00598	3%	0.00175	0.00121	36%	0.00093	0.00084	10%	0.0141	0.00067	182%	0.00099	0.00111	11%	0.00161	0.00084	63%

Table A.13: Laboratory duplicate results for spotted sandpiper eggs. Highlighted values did not meet the data quality objective of ≤ 30% relative percent difference (RPD).

Analyte	Units	2014																		
		KSP-7 (Rep 1)	KSP-7 (Rep 2)	RPD (%)	LEPD-2-2 (Rep 1)	LEPD-2-2 (Rep 2)	RPD (%)	MC3-1 (Rep 1)	MC3-1 (Rep 2)	RPD (%)	MI2-13 (Rep 1)	MI2-13 (Rep 2)	RPD (%)	MI2-8 (Rep 1)	MI2-8 (Rep 2)	RPD (%)	WWR-4 (Rep 1)	WWR-4 (Rep 2)	WWR-4 (Rep 3)	RPD (%)
Aluminum (Al)	µg/g dw	0.078	0.078	0%	0.148	0.148	0%	0.437	0.437	0%	0.108	0.108	0%	0.0895	0.0895	0%	0.0971	0.0971	0.102	3%
Antimony (Sb)	µg/g dw	0.00038	0.00055	37%	0.00028	0.00072	88%	0.00064	0.0004	46%	0.00037	0.00055	39%	0.00041	0.00042	2%	0.00041	0.00035	0.00042	10%
Arsenic (As)	µg/g dw	0.0095	0.0124	26%	0.0112	0.0142	24%	0.0243	0.0227	7%	0.0107	0.013	19%	0.0197	0.0158	22%	0.0167	0.0199	0.0214	12%
Barium (Ba)	µg/g dw	8.03	8.11	1%	4.59	4.68	2%	15	15.3	2%	9.47	9.31	2%	6.14	6.64	8%	6.24	6.54	6.19	3%
Beryllium (Be)	µg/g dw	0.0026	0.0028	7%	0.003	0.0026	14%	0.004	0.0046	14%	0.0042	0.0043	2%	0.0047	0.0048	2%	0.0047	0.0041	0.0048	8%
Bismuth (Bi)	µg/g dw	0.000091	0.0001	9%	0.00011	0.000093	17%	0.000073	0.000046	45%	0.000078	0.000043	58%	0.000047	0.000048	2%	0.000047	0.00004	0.000048	10%
Boron (B)	µg/g dw	0.064	0.07	9%	0.19	0.227	18%	0.095	0.11	15%	0.1	0.1	0%	0.14	0.12	15%	0.11	0.112	0.14	14%
Cadmium (Cd)	µg/g dw	0.0032	0.0035	9%	0.0013	0.0012	8%	0.00372	0.0041	10%	0.0023	0.0017	30%	0.0018	0.0028	43%	0.0011	0.00094	0.0014	20%
Calcium (Ca)	µg/g dw	2670	2660	0%	3730	4010	7%	2500	2510	0%	2610	2600	0%	2950	3080	4%	2710	2730	2680	1%
Cesium (Cs)	µg/g dw	0.00162	0.00185	13%	0.00125	0.00124	1%	0.00141	0.00155	9%	0.00153	0.00169	10%	0.00228	0.00224	2%	0.000778	0.00104	0.000917	14%
Chromium (Cr)	µg/g dw	0.066	0.0724	9%	0.0615	0.0745	19%	0.0632	0.0843	29%	0.063	0.0639	1%	0.066	0.0875	28%	0.0633	0.0618	0.0678	5%
Cobalt (Co)	µg/g dw	0.197	0.191	3%	0.0836	0.0824	1%	0.196	0.188	4%	0.173	0.165	5%	0.205	0.207	1%	0.142	0.145	0.141	1%
Copper (Cu)	µg/g dw	2.49	2.6	4%	4.64	4.33	7%	2.49	2.54	2%	3	3.12	4%	4.13	4.16	1%	3.52	3.53	3.46	1%
Gallium (Ga)	µg/g dw	0.0049	0.0037	28%	0.0046	0.0047	2%	0.0047	0.0043	9%	0.0045	0.0037	20%	0.0059	0.0045	27%	0.007	0.0051	0.0048	21%
Iron (Fe)	µg/g dw	92.9	90.5	3%	122	119	2%	118	119	1%	90.1	88.6	2%	95.6	101	5%	128	131	128	1%
Lead (Pb)	µg/g dw	0.0053	0.0057	7%	0.004	0.0041	2%	0.00815	0.00889	9%	0.0231	0.022	5%	0.0177	0.0201	13%	0.0124	0.0124	0.012	2%
Lithium (Li)	µg/g dw	0.0558	0.0622	11%	0.113	0.118	4%	0.0272	0.0294	8%	0.0443	0.0444	0%	0.0519	0.0465	11%	0.0295	0.0336	0.0352	9%
Magnesium (Mg)	µg/g dw	308	332	8%	411	419	2%	330	339	3%	317	316	0%	301	310	3%	334	332	331	0%
Manganese (Mn)	µg/g dw	2.04	2.07	1%	3.01	3.1	3%	2.09	2.11	1%	1.57	1.55	1%	1.94	2.08	7%	1.86	1.91	1.85	2%
Molybdenum (Mo)	µg/g dw	0.0863	0.0869	1%	0.149	0.154	3%	0.109	0.111	2%	0.103	0.106	3%	0.122	0.121	1%	0.111	0.109	0.109	1%
Nickel (Ni)	µg/g dw	0.0121	0.0121	0%	0.0146	0.0145	1%	0.0094	0.0093	1%	0.0089	0.0097	9%	0.0111	0.0135	20%	0.0095	0.0066	0.0071	20%
Phosphorus (P)	µg/g dw	9840	9570	3%	9130	9380	3%	9180	8920	3%	8830	8990	2%	9320	9750	5%	8830	9210	9080	2%
Potassium (K)	µg/g dw	4460	5240	16%	6210	6180	0%	5530	5480	1%	6060	5870	3%	5470	5160	6%	5860	5850	5910	1%
Rhenium (Re)	µg/g dw	0.0004	0.00035	13%	0.00126	0.00126	0%	0.00063	0.00051	21%	0.00047	0.00045	4%	0.00037	0.00034	8%	0.0002	0.00018	0.00016	11%
Rubidium (Rb)	µg/g dw	0.951	1.1	15%	0.994	0.975	2%	1.08	1.11	3%	1.29	1.27	2%	1.54	1.46	5%	0.963	0.973	0.969	1%
Selenium (Se)	µg/g dw	8.45	9.72	14%	5.28	5.43	3%	3.72	3.67	1%	5.65	5.9	4%	4.9	4.76	3%	2.23	2.6	2.38	8%
Silver (Ag)	µg/g dw	0.00584	0.00565	3%	0.0139	0.0142	2%	0.0128	0.013	2%	0.00965	0.00909	6%	0.0166	0.0181	9%	0.00533	0.00557	0.00576	4%
Sodium (Na)	µg/g dw	3870	4550	16%	6800	6700	1%	5370	5480	2%	5350	5410	1%	5580	5270	6%	5950	5880	6050	1%
Strontium (Sr)	µg/g dw	1.78	1.83	3%	2.63	2.85	8%	4.11	4.26	4%	4.68	4.61	2%	3.12	3.24	4%	2.38	2.43	2.34	2%
Thallium (Tl)	µg/g dw	0.0243	0.0258	6%	0.0277	0.0288	4%	0.0586	0.0607	4%	0.0401	0.0403	0%	0.0453	0.0449	1%	0.0109	0.0116	0.0117	4%
Thorium (Th)	µg/g dw	0.00022	0.00025	13%	0.00026	0.00023	12%	0.0002	0.00024	18%	0.00022	0.00022	0%	0.00024	0.00025	4%	0.00024	0.00021	0.00024	8%
Tin (Sn)	µg/g dw	0.00051	0.00056	9%	0.00059	0.00051	15%	0.00046	0.00054	16%	0.0005	0.00051	2%	0.00055	0.00056	2%	0.00055	0.00047	0.00056	9%
Titanium (Ti)	µg/g dw	0.0515	0.0588	13%	0.0735	0.0581	23%	0.0488	0.0584	18%	0.0539	0.0664	21%	0.0646	0.0545	17%	0.0703	0.0593	0.065	8%
Uranium (U)	µg/g dw	0.0024	0.0027	12%	0.0028	0.0025	11%	0.000162	0.000123	27%	0.0001	0.000103	3%	0.000144	0.000184	24%	0.000079	0.000045	0.000057	29%
Vanadium (V)	µg/g dw	0.00104	0.00115	10%	0.0015	0.00225	40%	0.00307	0.00437	35%	0.00224	0.0025	11%	0.00137	0.00169	21%	0.00111	0.00121	0.00145	14%
Yttrium (Y)	µg/g dw	0.00073	0.00073	0%	0.00119	0.00119	0%	0.00098	0.00098	0%	0.00062	0.00062	0%	0.00118	0.00118	0%	0.00118	0.00118	0.00093	13%
Zinc (Zn)	µg/g dw	45.7	44.4	3%	40.4	40.9	1%	47.1	46.6	1%	41.1	40.9	0%	38.4	40	4%	46.3	47.9	45.7	2%
Zirconium (Zr)	µg/g dw	0.00095	0.00073	26%	0.00199	0.00152	27%	0.00331	0.00196	51%	0.00117	0.00089	27%	0.00329	0.00327	1%	0.00497	0.00149	0.00168	72%

Table A.14: Laboratory matrix spike recoveries associated with spotted sandpiper egg samples. Highlighted values did not meet the data quality objective of 70 - 130% recovery.

Analyte	Units	Matrix Spike (% Recovery)											
		2013						2014					
		LK02-6	LK02-3	GHPD-1 (Rep 1)	HA7-1	HA7-2	NNP-1	EL1-6	FO29-2	GAPD-1	KSP-7	MC3-1	MI2-8
Aluminum (Al)	µg/g dw	66%	98%	97%	98%	97%	97%	§	§	§	§	§	§
Antimony (Sb)	µg/g dw	94%	93%	92%	93%	88%	91%	95%	98%	96%	96%	95%	97%
Arsenic (As)	µg/g dw	96%	94%	95%	94%	91%	92%	98%	102%	102%	101%	99%	100%
Barium (Ba)	µg/g dw	†	100%	107%	105%	110%	96%	†	†	102%	†	†	†
Beryllium (Be)	µg/g dw	76%	80%	88%	84%	82%	84%	92%	95%	97%	101%	99%	98%
Bismuth (Bi)	µg/g dw	102%	103%	96%	95%	91%	93%	96%	100%	102%	103%	99%	103%
Boron (B)	µg/g dw	84%	88%	92%	90%	95%	92%	88%	94%	93%	95%	94%	93%
Cadmium (Cd)	µg/g dw	96%	94%	93%	94%	89%	93%	94%	98%	98%	97%	96%	98%
Calcium (Ca)	µg/g dw	*	*	*	*	*	*	*	*	*	*	*	*
Cesium (Cs)	µg/g dw	*	*	*	*	*	*	*	*	*	*	*	*
Chromium (Cr)	µg/g dw	97%	96%	97%	96%	94%	95%	93%	96%	96%	97%	96%	96%
Cobalt (Co)	µg/g dw	97%	96%	96%	96%	94%	95%	93%	97%	95%	97%	95%	95%
Copper (Cu)	µg/g dw	93%	95%	83%	85%	86%	85%	92%	97%	93%	93%	95%	92%
Gallium (Ga)	µg/g dw	*	*	*	*	*	*	*	*	*	*	*	*
Iron (Fe)	µg/g dw	†	†	†	†	†	†	†	†	†	†	†	†
Lead (Pb)	µg/g dw	106%	107%	100%	100%	97%	97%	99%	102%	105%	104%	101%	105%
Lithium (Li)	µg/g dw	87%	91%	97%	92%	101%	92%	97%	104%	103%	107%	101%	104%
Magnesium (Mg)	µg/g dw	†	†	†	†	†	†	†	†	†	†	†	†
Manganese (Mn)	µg/g dw	101%	99%	100%	98%	98%	96%	95%	95%	99%	99%	101%	100%
Molybdenum (Mo)	µg/g dw	101%	99%	100%	102%	100%	101%	99%	101%	101%	100%	99%	100%
Nickel (Ni)	µg/g dw	93%	93%	93%	92%	89%	91%	92%	95%	93%	94%	94%	94%
Phosphorus (P)	µg/g dw	†	†	†	†	†	†	†	†	†	†	†	†
Potassium (K)	µg/g dw	*	*	*	*	*	*	*	*	*	*	*	*
Rhenium (Re)	µg/g dw	103%	105%	104%	103%	106%	99%	107%	109%	109%	108%	106%	109%
Rubidium (Rb)	µg/g dw	*	*	*	*	*	*	*	*	*	*	*	*
Selenium (Se)	µg/g dw	96%	†	†	†	†	†	†	†	†	†	95%	108%
Silver (Ag)	µg/g dw	96%	95%	93%	93%	89%	93%	89%	96%	74%	94%	95%	96%
Sodium (Na)	µg/g dw	†	†	†	†	†	†	†	†	†	†	†	†
Strontium (Sr)	µg/g dw	105%	100%	99%	105%	104%	103%	92%	97%	97%	101%	105%	102%
Thallium (Tl)	µg/g dw	107%	109%	102%	101%	99%	97%	100%	103%	104%	104%	102%	107%
Thorium (Th)	µg/g dw	107%	104%	102%	99%	96%	97%	100%	107%	106%	106%	101%	108%
Tin (Sn)	µg/g dw	*	*	*	*	*	*	*	*	*	*	*	*
Titanium (Ti)	µg/g dw	100%	99%	98%	99%	94%	99%	97%	99%	96%	97%	99%	98%
Uranium (U)	µg/g dw	110%	109%	103%	102%	103%	100%	106%	111%	106%	106%	102%	108%
Vanadium (V)	µg/g dw	101%	101%	98%	99%	97%	99%	97%	98%	99%	99%	98%	99%
Yttrium (Y)	µg/g dw	*	*	*	*	*	*	*	*	*	*	*	*
Zinc (Zn)	µg/g dw	†	†	†	†	†	†	†	†	†	†	†	†
Zirconium (Zr)	µg/g dw	73%	69%	45%	59%	71%	61%	78%	43%	41%	27%	40%	33%

* Not spiked. (The element was not included in the multi-element spike solution.)
† Spike too small. (The concentration of the element spiked into sample was less than 50% of the average concentration measured in the replicates.)
§ Only one unspiked replicate was used for this element because the second replicate was digested in a vessel with known, significantly high background levels of this element. Thus the standard deviation of the replicates could not be accurately determined.

A5.0 DATA QUALITY STATEMENT

Overall, the quality of the data collected for this project was considered acceptable to serve the project objectives.

APPENDIX B

DETAILED FIELD AND ANALYTICAL DATA

SPOTTED SANDPIPER EGGS AND NESTS

Table B.1: Status of spotted sandpiper nests monitored post-flood in 2013.

Reference vs Exposed	Area ID	Area	UTMs (Zone 11U)		Nest ID	# of Eggs in Nest	Potential Hatch Date	Fate or Actual Hatch Date	Hatch Success	Selenium (µg/g dw)[c]
			Easting	Northing						
Reference	AL4	Alexander Creek	664465	5512241	AL4-1	4	20-Jul-13	depredated	0	2.31
Reference	CHCK	Chauncey Creek	655365	5552762	CHCK-2	4	25-Jul-13	25-Jul-13	3/3	8.11
Reference	WWR	Wigwam River	643660	5458276	WWR-2	4	16-Jul-13	depredated	0	2.75
Reference	WWR	Wigwam River	643664	5457977	WWR-3	4	05-Jul-13	07-Jul-13	3/3	2.47
Reference	WWR	Wigwam River	643676	5458140	WWR-4	5	16-Jul-13	15-Jul-13	4/4	2.38
Reference	WWR	Wigwam River (Beaver Pond)	645156	5459084	WWR-5	4	10-Jul-13	10-Jul-13	3/3	6.69
Reference	WWR	Wigwam River	646291	5458934	WWR-6	4	05-Jul-13	09-Jul-13	3/3	2.10
Reference	WWR	Wigwam River	645470	5459052	WWR-7	4	24-Jul-13	depredated	0	3.42
Reference	WWR	Wigwam River	645449	5459027	WWR-8	4	22-Jul-13	21-Jul-13	3/3	2.57
Exposed	CL11	Clode Settling Ponds	650850	5564507	CL11-1	4	23-Jul-13	possibly depredated[a]	0	9.75
Exposed	CL11	Clode Settling Ponds	650805	5564232	CL11-2	4	20-Jul-13	possibly depredated[a]	0	7.21
Exposed	CL11	Clode Settling Ponds	650887	5564189	CL11-3	1	?	abandoned	0	NA
Exposed	EL1	Elk River at Sparwood	651477	5507788	EL1-1	3	?	20-Jul-13	3/3	NA
Exposed	EL1	Elk River at Sparwood	651499	5507726	EL1-2	4	27-Jul-13	abandoned	0	4.64
Exposed	EL1	Elk River at Sparwood	651539	5507575	EL1-3	4	30-Jul-13	30-Jul-13	3/3	5.30
Exposed	EL1	Elk River at Sparwood	651403	5507566	EL1-4	4	25-Jul-13	abandoned	0	4.65
Exposed	EL1	Elk River at Sparwood	651382	5507425	EL1-5	1	?	depredated	0	NA
Exposed	EL19	Elk River d/s Fording	653227	5525791	EL19-3	4	25-Jul-13	25-Jul-13	2/3	3.87
Exposed	EL19	Elk River d/s Fording	653152	5525679	EL19-4	4	23-Jul-13	20-Jul-13	2/3	5.12
Exposed	EL19	Elk River d/s Fording	653195	5525565	EL19-5	4	21-Jul-13	19-Jul-13	3/3	5.58
Exposed	EL19	Elk River d/s Fording	653292	5525506	EL19-6	1	?	depredated	0	NA
Exposed	EL19	Elk River d/s Fording	653210	5525641	EL19-7	4	22-Jul-13	22-Jul-13	3/3	4.39
Exposed	EL19	Elk River d/s Fording	653198	5525727	EL19-8	4	20-Jul-13	20-Jul-13	3/3	4.61
Exposed	ELKO	Elk River u/s Elko Reservoir	639444	5463217	ELKO-6	4	17-Jul-13	depredated	0	NA
Exposed	ELKO	Elk River u/s Elko Reservoir	639454	5463266	ELKO-7	4	15-Jul-13	depredated then abandoned	0	4.37
Exposed	ELKO	Elk River u/s Elko Reservoir	639450	5463283	ELKO-8	4	17-Jul-13	depredated	0	NA
Exposed	ELKO	Elk River u/s Elko Reservoir	639469	5463334	ELKO-9	4	19-Jul-13	19-Jul-13	3/3	4.94
Exposed	ELKO	Elk River u/s Elko Reservoir	639435	5463434	ELKO-10	4	26-Jul-13	depredated	0	NA
Exposed	ELKO	Elk River u/s Elko Reservoir	639435	5463434	ELKO-11	4	20-Jul-13	20-Jul-13	3/3	4.46
Exposed	ELKO	Elk River u/s Elko Reservoir	639425	5463410	ELKO-12	4	22-Jul-13	depredated	0	NA
Exposed	ELKO	Elk River u/s Elko Reservoir	639419	5463383	ELKO-13	4	23-Jul-13	depredated	0	NA
Exposed	ELKO	Elk River u/s Elko Reservoir	639472	5463404	ELKO-14	4	15-Jul-13	depredated	0	NA
Exposed	ELKO	Elk River u/s Elko Reservoir	639564	5463584	ELKO-15	4	17-Jul-13	17-Jul-13	3/3	4.46
Exposed	ELKO	Elk River u/s Elko Reservoir	639555	5463569	ELKO-16	4	26-Jul-13	depredated	0	NA
Exposed	ELKO	Elk River u/s Elko Reservoir	639528	5463541	ELKO-17	4	28-Jul-13	27-Jul-13	3/3	6.85
Exposed	FO23	Fording River d/s Line Creek	652837	5528446	FO23-5	4	20-Jul-13	~19-Jul-13[b]	1/3	7.00
Exposed	FO23	Fording River d/s Line Creek	652678	5527923	FO23-6	4	20-Jul-13	20-Jul-13	3/3	6.45
Exposed	FO23	Fording River d/s Line Creek	652831	5528440	FO23-7	4	21-Jul-13	25-Jul-13	4/4	NA
Exposed	FO29	Fording River at hwy bridge	655139	5543645	FO29-3	4	18-Jul-13	abandoned	0	6.33
Exposed	FO29	Fording River at hwy bridge	655158	5543700	FO29-4	4	27-Jul-13	destroyed by machinery	0	NA
Exposed	FO52	Fording River near Kilmarnock	652339	5558208	FO52-1	4	24-Jul-13	22-Jul-13	2/3	10.4
Exposed	FO52	Fording River near Kilmarnock	652464	5558020	FO52-2	4	17-Jul-13	possibly depredated[a]	0	6.87
Exposed	FO52	Fording River near Kilmarnock	652503	5557932	FO52-3	4	20-Jul-13	20-Jul-13	3/3	10.5
Exposed	FO52	Fording River near Kilmarnock	652322	5558306	FO52-4	4	30-Jul-13	~31-Jul-13	3/3	9.94
Exposed	FO52	Fording River near Kilmarnock	651834	5559642	FO52-5	4	05-Aug-13	~3-Aug-13[b]	1/3	5.95
Exposed	GAPD	Gatehouse Settling Pond	655867	5509021	GAPD-1	4	08-Jul-13	08-Jul-13	3/3	4.17
Exposed	GAPD	Gatehouse Settling Pond	655769	5509145	GAPD-2	4	18-Jul-13	19-Jul-13	3/3	5.27
Exposed	GAPD	Gatehouse Settling Pond	655924	5508941	GAPD-3	4	20-Jul-13	19-Jul-13	3/3	4.39
Exposed	GHPD	Greenhills Settling Pond	653492	5546118	GHPD-1	4	15-Jul-13	14-Jul-13	3/3	8.78
Exposed	GHPD	Greenhills Settling Pond	653768	5545986	GHPD-2	4	21-Jul-13	22-Jul-13	2/2	6.31
Exposed	GHPD	Greenhills Settling Pond	653707	5546077	GHPD-3	4	19-Jul-13	20-Jul-13	3/3	13.2
Exposed	HA7	Harmer Settling Pond	657082	5522136	HA7-2	4	03-Jul-13	02-Jul-13	2/3	17.1
Exposed	HA7	Harmer Settling Pond	657204	5521962	HA7-3	4	19-Jul-13	22-Jul-13	3/3	10.5
Exposed	KSP	Kilmarnock Settling Pond	652406	5558695	KSP-1	4	-	17-Jul-13	4/4	NA
Exposed	KSP	Kilmarnock Settling Pond	652511	5558655	KSP-2	4	28-Jul-13	28-Jul-13	3/3	15.9
Exposed	LCCPL	Line Creek Contingency Ponds	659872	5531386	LCCPL-2	4	29-Jul-13	depredated	0	32.3
Exposed	LCCPL	Line Creek Contingency Ponds	659831	5531340	LCCPL-3	4	19-Jul-13	19-Jul-13	3/3	18.6
Exposed	LI8	Line Creek above Canyon	659259	5530553	LI8-4	4	20-Jul-13	depredated	0	4.20
Exposed	LK02	Mouth of Elk on Koocanusa	633348	5448727	LK02-1	4	17-Jul-13	19-Jul-13	3/3	4.91
Exposed	LK02	Mouth of Elk on Koocanusa	633509	5448713	LK02-2	3	27-Jul-13	inundated by rising lake level	0	5.78
Exposed	LK02	Mouth of Elk on Koocanusa	633334	5448685	LK02-3	4	02-Aug-13	abandoned	0	7.40
Exposed	LK02	Mouth of Elk on Koocanusa	633420	5448876	LK02-4	2	?	depredated	0	NA
Exposed	LK02	Mouth of Elk on Koocanusa	633766	5449082	LK02-5	4	21-Jul-13	21-Jul-13	3/3	5.58
Exposed	LK02	Mouth of Elk on Koocanusa	633281	5448707	LK02-6	1	?	abandoned	0	5.00
Exposed	MI2	Michel Creek in Sparwood	652819	5511618	MI2-6	4	17-Jul-13	depredated	0	NA
Exposed	MI2	Michel Creek in Sparwood	652973	5511691	MI2-7	4	17-Jul-13	17-Jul-13	3/3	3.30
Exposed	MI2	Michel Creek in Sparwood	653315	5511567	MI2-8	4	18-Jul-13	abandoned	0	4.23
Exposed	MI2	Michel Creek in Sparwood	653004	5511666	MI2-9	4	18-Jul-13	depredated	0	NA
Exposed	MI2	Michel Creek in Sparwood	653730	5511230	MI2-10	4	17-Jul-13	19-Jul-13	3/3	3.21
Exposed	MI2	Michel Creek in Sparwood	653384	5511596	MI2-11	4	17-Jul-13	depredated	0	NA
Exposed	MI2	Michel Creek in Sparwood	651970	5511777	MI2-12	4	21-Jul-13	depredated	0	NA
Exposed	MI2	Michel Creek in Sparwood	652295	5511711	MI2-13	4	23-Jul-13	depredated	0	NA
Exposed	MI2	Michel Creek in Sparwood	652323	5511659	MI2-14	4	17-Jul-13	17-Jul-13	3/3	4.61
Exposed	MI2	Michel Creek in Sparwood	652384	5511637	MI2-15	4	23-Jul-13	possibly depredated[a]	0	4.47
Exposed	MI2	Michel Creek in Sparwood	652948	5511659	MI2-16	4	18-Jul-13	19-Jul-13	3/3	4.24
Exposed	MI2	Michel Creek in Sparwood	653204	5511588	MI2-17	3	-	-	-	NA
Exposed	MI2	Michel Creek in Sparwood	652659	5511636	MI2-18	4	18-Jul-13	19-Jul-13	2/3	3.60
Exposed	MI2	Michel Creek in Sparwood	653451	5511411	MI2-19	4	30-Jul-13	abandoned	0	4.36
Exposed	MI2	Michel Creek in Sparwood	652124	5511767	MI2-20	4	30-Jul-13	abandoned	0	NA
Exposed	MSAN	MSA-North Settling Ponds	661517	5536578	MSAN-1	4	18-Jul-13	abandoned	0	13.2
Exposed	MSAN	MSA-North Settling Ponds	661517	5536580	MSAN-2	3	-	flooded	0	8.58
Exposed	NNP	NoName Settling Pond	661020	5535421	NNP-1	2	?	abandoned	0	8.99
Exposed	THPD	Thompson Settling Pond	649083	5550441	THPD-1	4	06-Jul-13	10-Jul-13	3/3	13.7
Exposed	THPD	Thompson Settling Pond	649028	5550422	THPD-2	4	01-Jul-13	depredated	0	18.8
Exposed	THPD	Thompson Settling Pond	649072	5550310	THPD-3	4	24-Jul-13	possibly depredated[a]	0	18.0

[a] no evidence of chicks in area, but may have moved out of area very quickly after hatching.
[b] suspect asynchronous hatch resulting in partial abandonment of remaining clutch.
[c] Selenium concentration in first egg randomly collected from nest.
NA - Not analyzed

Table B.2: Status of spotted sandpiper nests monitored in 2014.

Reference vs Exposed	Area ID	Area Description	UTMs (Zone 11U)		Nest ID	# of Eggs in Nest	Potential Hatch Date	Fate or Actual Hatch Date	Hatch Success	Selenium (µg/g dw)[b]
			Easting	Northing						
Reference	CHCK	Chauncey Creek	655363	5552767	CHCK-1	4	8-Jul-14	7-Jul-14	3/3	12.4
Reference	WWR	Wigwam River	643611	5458230	WWR-1	4	23-Jun-14	depredated	0	NA
Reference	WWR	Wigwam River	643659	5458280	WWR-2	4	unknown	abandoned when found	0	NA
Reference	WWR	Wigwam River	643667	5458286	WWR-3	3	unknown	depredated	0	NA
Reference	WWR	Wigwam River	643671	5458152	WWR-4	4	4-Jul-14	5-Jul-14	3/3	2.40
Reference	WWR	Wigwam River	645275	5459062	WWR-5	4	29-Jul-14	28-Jun-14	3/3	4.39
Reference	WWR	Wigwam River	645330	5459027	WWR-6	3	unknown	depredated	0	NA
Reference	WWR	Wigwam River	646283	5458941	WWR-7	4	4-Jul-14	3-Jul-14	3/3	2.35
Reference	WWR	Wigwam River	643681	5457951	WWR-8	4	5-Jul-14	5-Jul-14	3/3	1.88
Reference	WWR	Wigwam River	643678	5457997	WWR-9	4	29-Jun-14	29-Jun-14	3/3	3.32
Reference	WWR	Wigwam River	645417	5459060	WWR-10	4	12-Jul-14	abandoned	0	NA
Reference	WWR	Wigwam River	645310	5459078	WWR-11	4	18-Jul-14	depredated	0	NA
Reference	WWR	Wigwam River	646125	5458940	WWR-12	1	unknown	depredated	0	NA
Reference	WWR	Wigwam River	645861	5458918	WWR-13	4	21-Jul-14	depredated	0	NA
Reference	WWR	Wigwam River	643639	5458256	WWR-14	2	unknown	abandoned	0	NA
Reference	WWR	Wigwam River	643620	5458224	WWR-15	4	26-Jul-14	depredated then abandoned	0	NA
Reference	WWR	Wigwam River	645362	5459052	WWR-16	4	20-Jul-14	depredated	0	NA
Reference	WWR	Wigwam River	645240	5459021	WWR-17	4	21-Jul-14	depredated	0	NA
Reference	WWRBP	Wigwam Beaver Pond	645157	5459084	WWRBP-1	4	29-Jul-14	29-Jun-14	3/3	8.68
Reference	WWRBP	Wigwam Beaver Pond	645241	5459097	WWRBP-2	4	5-Jul-14	depredated	0	3.53
Exposed	CL11	Clode Settling Ponds	651005	5564348	CL11-1	4	16-Jul-14	depredated	0	16.6
Exposed	CL11	Clode Settling Ponds	650881	5564223	CL11-2	4	11-Jul-14	depredated	0	16.5
Exposed	CL11	Clode Settling Ponds	650937	5564324	CL11-3	4	23-Jul-14	22-Jul-14	3/3	20.8
Exposed	EAPD	Eagle Settling Ponds	651276	5562677	EAPD-1	4	9-Jul-14	nest attacked; 2 pipped eggs cold on ground; adult feathers on ground; one egg missing	0	8.75
Exposed	EAPD	Eagle Settling Ponds	651258	5562752	EAPD-2	2	unknown	abandoned when found	0	15.9
Exposed	EAPD	Eagle Settling Ponds	651264	5562752	EAPD-3	4	30-Jun-14	2-Jul-14	3/3	10.5
Exposed	EAPD	Eagle Settling Ponds	651230	5562835	EAPD-4	4	15-Jul-14	14-Jul-14	3/3	22.2
Exposed	EL1	Elk River d/s Michel	651554	5507528	EL1-1		unknown	depredated	0	NA
Exposed	EL1	Elk River d/s Michel	651562	5507290	EL1-2		unknown	depredated	0	NA
Exposed	EL1	Elk River d/s Michel	651443	5507067	EL1-3	4	1-Jul-14	1-Jul-14	3/3	6.46
Exposed	EL1	Elk River d/s Michel	651429	5507311	EL1-4	4	9-Jul-14	9-Jul-14	3/3	5.48
Exposed	EL1	Elk River d/s Michel	651417	5507447	EL1-5	4	30-Jun-14	depredated	0	NA
Exposed	EL1	Elk River d/s Michel	651600	5507400	EL1-6	4	7-Jul-14	6-Jul-14	3/3	7.00
Exposed	EL1	Elk River d/s Michel	651561	5507202	EL1-7	4	22-Jul-14	nest destroyed (stepped on by elk)	0	NA
Exposed	EL1	Elk River d/s Michel	651548	5507647	EL1-8	4	25-Jul-14	24-Jul-14	3/3	5.22
Exposed	EL19	Elk River d/s Fording	653170	5525743	EL19-1	4	6-Jul-14	5-Jul-14	3/3	4.13
Exposed	EL19	Elk River d/s Fording	653534	5525390	EL19-2	4	4-Jul-14	5-Jul-14	3/3	7.29
Exposed	EL19	Elk River d/s Fording	653319	5525439	EL19-3	4	10-Jul-14	10-Jul-14	3/3	3.60
Exposed	EL19	Elk River d/s Fording	653194	5525744	EL19-4	4	1-Jul-14	30-Jun-14	3/3	4.00
Exposed	EL19	Elk River d/s Fording	653192	5525554	EL19-5	4	14-Jul-14	depredated	0	NA
Exposed	EL19	Elk River d/s Fording	653556	5525039	EL19-6	4	12-Jul-14	11-Jul-14	3/3	6.33
Exposed	EL19	Elk River d/s Fording	653565	5525006	EL19-7	4	6-Jul-14	6-Jul-14	3/4	7.53
Exposed	ELKO	Elk River u/s Elko Reservoir	639403	5463376	ELKO-1	4	6-Jul-14	4-Jul-14	3/3	8.66
Exposed	ELKO	Elk River u/s Elko Reservoir	639431	5463424	ELKO-2	4	17-Jul-14	15-Jul-14	3/3	7.73
Exposed	ELKO	Elk River u/s Elko Reservoir	639555	5463561	ELKO-3	4	16-Jul-14	depredated	0	NA
Exposed	FO10	Fording River Oxbow	654260	5555314	FO10-1	4	28-Jun-14	29-Jun-14	2/3	13.8
Exposed	FO10	Fording River Oxbow	654161	5555330	FO10-2	4	11-Jul-14	11-Jul-14	3/3	16.5
Exposed	FO10	Fording River Oxbow	654187	5555121	FO10-3	4	1-Jul-14	2-Jul-14	3/4	10.4
Exposed	FO23	Fording River d/s Line Creek	652658	5528044	FO23-1	4	5-Jul-14	5-Jul-14	3/3	6.92
Exposed	FO23	Fording River d/s Line Creek	652805	5528297	FO23-2	4	14-Jul-14	13-Jul-14	3/3	6.50
Exposed	FO23	Fording River d/s Line Creek	652431	5558501	FO23-3	4	17-Jul-14	16-Jul-14	3/3	7.60
Exposed	FO23	Fording River d/s Line Creek	652879	5528449	FO23-4	4	27-Jul-14	nest destroyed	0	9.05
Exposed	FO23	Fording River d/s Line Creek	652664	5528144	FO23-5	4	10-Jul-14	10-Jul-14	3/3	7.23
Exposed	FO29	Fording River at hwy bridge	655090	5543580	FO29-1	4	26-Jun-14	26-Jun-14	3/3	7.38
Exposed	FO29	Fording River at hwy bridge	655123	5543665	FO29-2	4	12-Jul-14	12-Jul-14	3/3	8.39
Exposed	FO52	Fording River near Kilmarnock	652306	5558453	FO52-1	4	5-Jul-14	abandoned	0	13.4
Exposed	FO52	Fording River near Kilmarnock	652266	5558507	FO52-2	4	15-Jul-14	abandoned	0	9.04
Exposed	FO52	Fording River near Kilmarnock	651824	5559389	FO52-3	4	16-Jul-14	15-Jul-14	3/3	19.8
Exposed	FO52	Fording River near Kilmarnock	652340	5558263	FO52-4	4	unknown	abandoned when found	0	6.54
Exposed	FO52	Fording River near Kilmarnock	652372	5558170	FO52-5	4	17-Jul-14	depredated	0	7.70
Exposed	FO52	Fording River near Kilmarnock	652468	5557998	FO52-6	3	unknown	depredated	0	NA
Exposed	FO52	Fording River near Kilmarnock	652357	5558255	FO52-7	4	18-Jul-14	depredated	0	6.24
Exposed	FOBC	Fording beside Clode Pond	650770	5564267	FOBC-1	4	13-Jul-14	possibly depredated[a]	0	11.2
Exposed	FOBC	Fording beside Clode Pond	650752	5564402	FOBC-2	4	unknown	depredated	0	NA
Exposed	GAPD	Gatehouse Settling Pond	655793	5509117	GAPD-1	4	20-Jun-14	26-Jun-14	3/3	20.2
Exposed	GAPD	Gatehouse Settling Pond	655778	5509189	GAPD-2	4	3-Jul-14	depredated	0	6.11
Exposed	GAPD	Gatehouse Settling Pond	655882	5509081	GAPD-3	4	21-Jun-14	25-Jun-14	3/3	9.28
Exposed	GC2	Goddard Creek	652723	5513938	GC2-1	4	6-Jul-14	7-Jul-14	2/3	5.10
Exposed	GHPD	Greenhills Settling Pond	653484	5546116	GHPD-1	4	10-Jul-14	possibly depredated[a]	0	14.7
Exposed	GHPD	Greenhills Settling Pond	653766	5546056	GHPD-2	4	10-Jul-14	depredated	0	7.55
Exposed	GHPD	Greenhills Settling Pond	653443	5546083	GHPD-3	4	20-Jul-14	19-Jul-14	3/3	11.7
Exposed	HA7	Harmer Settling Pond	657214	5521984	HA7-1	4	6-Jul-14	9-Jul-14	2/3	7.40
Exposed	HA7	Harmer Settling Pond	657024	5522122	HA7-2	4	13-Jul-14	depredated	0	14.1
Exposed	KSP	Kilmarnock Settling Ponds	652418	5558689	KSP-1	4	30-Jun-14	29-Jun-14	3/3	7.51
Exposed	KSP	Kilmarnock Settling Ponds	652361	5558738	KSP-2	3	unknown	8-Jul-14	3/3	NA
Exposed	KSP	Kilmarnock Settling Ponds	652485	5558555	KSP-3	4	9-Jul-14	9-Jul-14	3/3	13.3
Exposed	KSP	Kilmarnock Settling Ponds	652413	5558486	KSP-4	4	5-Jul-14	abandoned	0	6.14
Exposed	KSP	Kilmarnock Settling Ponds	652481	5558663	KSP-5	4	9-Jul-14	8-Jul-14	3/3	12.0
Exposed	KSP	Kilmarnock Settling Ponds	652517	5558611	KSP-6	4	30-Jun-14	1-Jul-14	4/4	NA
Exposed	KSP	Kilmarnock Settling Ponds	652432	5558505	KSP-7	4	18-Jul-14	depredated then abandoned	0	9.09
Exposed	LCCPL	Line Creek Contingency Ponds	659831	5531348	LCCPL-1	4	12-Jul-14	abandoned ~5 days after egg collection	0	17.0
Exposed	LEPD	Leask Settling Pond	648311	5553114	LEPD-1	4	5-Jul-14	30-Jun-14	3/3	19.2
Exposed	LEPD	Leask Settling Pond	648201	5552927	LEPD-2	4	7-Jul-14	1 egg cold and outside nest; nest abandoned	0	6.22
Exposed	LK02	Mouth of Elk on Koocanusa	633504	5448751	LK02-1	4	30-Jun-14	depredated	0	NA
Exposed	LK02	Mouth of Elk on Koocanusa	633423	5448708	LK02-2	4	29-Jun-14	27-Jun-14	2/3	8.03
Exposed	LK02	Mouth of Elk on Koocanusa	633368	5448773	LK02-3	4	1-Jul-14	30-Jun-14	3/3	6.47
Exposed	LK02	Mouth of Elk on Koocanusa	633353	5448755	LK02-4	4	2-Jul-14	30-Jun-14	3/3	7.68
Exposed	LK02	Mouth of Elk on Koocanusa	633296	5448607	LK02-5	4	16-Jul-14	14-Jul-14	3/3	7.73
Exposed	LK02	Mouth of Elk on Koocanusa	633269	5448433	LK02-6	4	18-Jul-14	16-Jul-14	3/3	7.39
Exposed	LK02	Mouth of Elk on Koocanusa	633375	5448659	LK02-7	4	16-Jul-14	14-Jul-14	3/3	6.45
Exposed	MC3	Upper Michel Creek	660291	5502089	MC3-1	4	15-Jul-14	depredated	0	3.70
Exposed	MC3	Upper Michel Creek	659752	5499824	MC3-2	4	15-Jul-14	abandoned; only 2 eggs left on July 5	0	3.18
Exposed	MC3	Upper Michel Creek	659508	5497383	MC3-3	4	19-Jul-14	18-Jul-14	3/3	3.66
Exposed	MC3	Upper Michel Creek	659695	5499349	MC3-4	4	20-Jul-14	19-Jul-14	3/3	3.90

Table B.2: Status of spotted sandpiper nests monitored in 2014.

Reference vs Exposed	Area ID	Area Description	UTMs (Zone 11U)		Nest ID	# of Eggs in Nest	Potential Hatch Date	Fate or Actual Hatch Date	Hatch Success	Selenium (µg/g dw)[b]
			Easting	Northing						
Exposed	MC3	Upper Michel Creek	659741	5499390	MC3-5	4	5-Jul-14	5-Jul-14	3/3	4.08
Exposed	MC3	Upper Michel Creek	659741	5499769	MC3-6	4	8-Jul-14	8-Jul-14	3/3	3.70
Exposed	MCdsE	Michel Creek d/s Erickson	659757	5505105	MCdsE-1	4	3-Jul-14	2-Jul-14	3/3	4.06
Exposed	MCdsE	Michel Creek d/s Erickson	656762	5507432	MCdsE-2	4	1-Jul-14	30-Jun-14	3/3	4.99
Exposed	MCusE	Michel Creek u/s Erickson	659890	5505051	MCusE-1	4	18-Jul-14	16-Jul-14	3/3	4.39
Exposed	MI2	Michel Creek in Sparwood	652942	5511660	MI2-1	3	9-Jul-14	depredated	0	NA
Exposed	MI2	Michel Creek in Sparwood	652998	5511682	MI2-2	4	3-Jul-14	washed out by high water	0	NA
Exposed	MI2	Michel Creek in Sparwood	653032	5511711	MI2-3	4	5-Jul-14	washed out by high water	0	NA
Exposed	MI2	Michel Creek in Sparwood	653886	5511072	MI2-4	4	4-Jul-14	abandoned during high water	0	NA
Exposed	MI2	Michel Creek in Sparwood	653293	5511692	MI2-5	3	9-Jul-14	abandoned (eggs knocked out of nest)	0	NA
Exposed	MI2	Michel Creek in Sparwood	653299	5511637	MI2-6	4	28-Jun-14	28-Jun-14	3/3	NA
Exposed	MI2	Michel Creek in Sparwood	653105	5511630	MI2-7	4	28-Jun-14	28-Jun-14	3/3	5.00
Exposed	MI2	Michel Creek in Sparwood	653050	5511672	MI2-8	4	16-Jul-14	15-Jul-14	3/3	NA
Exposed	MI2	Michel Creek in Sparwood	653071	5511637	MI2-9	4	11-Jul-14	11-Jul-14	3/3	4.33
Exposed	MI2	Michel Creek in Sparwood	652963	5511659	MI2-10	4	25-Jun-14	25-Jun-14	4/4	NA
Exposed	MI2	Michel Creek in Sparwood	652110	5511750	MI2-11	4	14-Jul-14	depredated	0	4.94
Exposed	MI2	Michel Creek in Sparwood	652416	5511636	MI2-12	4	14-Jul-14	depredated	0	NA
Exposed	MI2	Michel Creek in Sparwood	652355	5511646	MI2-13	4	14-Jul-14	13-Jul-14	3/3	5.78
Exposed	MI2	Michel Creek in Sparwood	652132	5511762	MI2-14	4	7-Jul-14	6-Jul-14	3/3	5.74
Exposed	MI2	Michel Creek in Sparwood	651984	5511776	MI2-15	4	14-Jul-14	14-Jul-14	3/3	5.99
Exposed	MI2	Michel Creek in Sparwood	652804	5511604	MI2-16	4	16-Jul-14	16-Jul-14	3/3	4.40
Exposed	MI2	Michel Creek in Sparwood	652292	5511701	MI2-17	4	17-Jul-14	16-Jul-14	3/3	6.31
Exposed	MI2	Michel Creek in Sparwood	653821	5511076	MI2-18	4	14-Jul-14	abandoned	0	NA
Exposed	MI2	Michel Creek in Sparwood	653781	5511188	MI2-19	4	16-Jul-14	15-Jul-14	3/3	5.86
Exposed	MI2	Michel Creek in Sparwood	653867	5511072	MI2-20	4	18-Jul-14	depredated	0	NA
Exposed	NNP	NoName Settling Pond	661046	5535465	NNP-1	4	16-Jul-14	depredated	0	15.6
Exposed	NNP	NoName Settling Pond	660999	5535393	NNP-2	1	unknown	depredated	0	NA
Exposed	SWWL	Swift Settling Pond	651839	5558449	SWWL-1	4	9-Jul-14	depredated	0	26.1
Exposed	THPD	Thompson Settling Pond	649067	5550413	THPD-1	4	3-Jul-14	29-Jun-14	3/3	15.3
Exposed	THPD	Thompson Settling Pond	649012	5550502	THPD-2	4	12-Jul-14	depredated	0	21.5
Exposed	UTHP	Upper Thompson Settling Pond	650978	5549967	UTHP-1	4	27-Jun-14	27-Jun-14	3/4	20.0
Exposed	UWOP	Upper Wolfram Creek	649497	8552476	UWOP-1	4	8-Jul-14	~12-Jul-14	3/4	3.03
Exposed	WOPD	Wolfram Settling Pond	648271	5552309	WOPD-1	4	5-Jul-14	3-Jul-14	3/3	17.3

[a] no evidence of chicks in area, but may have moved out of area very quickly after hatching
[b] Selenium concentration in first egg randomly collected from nest
NA - Not analyzed

Table B.3: Details related to spotted sandpiper eggs collected in 2013.

Reference vs Exposed	Area ID	Area	UTMs (Zone 11U)		Sample ID	Nest ID	Weight of Egg without Shell (g)	Collection Date	Egg Status	Selenium (µg/g dw)
			Easting	Northing						
Reference	AL4	Alexander Creek	664465	5512241	AL4-1	AL4-1	8.360	5-Jul-13	early development	2.31
Reference	CHCK	Chauncey Creek	655480	5552709	CHCK-1	CHCK-1	7.881	18-Jun-13	mid development	6.01
Reference	CHCK	Chauncey Creek	655365	5552762	CHCK-2	CHCK-2	8.522	08-Jul-13	very early development	8.11
Reference	WWR	Wigwam River	643659	5458275	WWR-1	WWR-1	7.685	01-Jul-13	no development	2.52
Reference	WWR	Wigwam River	643659	5458275	WWR-1-2	WWR-1	8.115	01-Jul-13	no development	2.63
Reference	WWR	Wigwam River	643660	5458276	WWR-2	WWR-2	8.135	1-Jul-13	early development	2.75
Reference	WWR	Wigwam River	643664	5457977	WWR-3	WWR-3	6.790	1-Jul-13	late development	2.47
Reference	WWR	Wigwam River	643676	5458140	WWR-4	WWR-4	8.460	1-Jul-13	early development	2.38
Reference	WWR	Wigwam River (Beaver Pond)	645156	5459084	WWR-5	WWR-5	7.530	1-Jul-13	mid development	6.69
Reference	WWR	Wigwam River	646291	5458934	WWR-6	WWR-6	7.165	1-Jul-13	late development	2.10
Reference	WWR	Wigwam River	645470	5459052	WWR-7	WWR-7	7.789	07-Jul-13	fertile	3.42
Reference	WWR	Wigwam River	645449	5459027	WWR-8	WWR-8	7.488	07-Jul-13	early development	2.57
Exposed	CL11	Clode Pond area	650850	5564507	CL11-1	CL11-1	8.096	4-Jul-13	no development	9.75
Exposed	CL11	Clode Pond area	650805	5564232	CL11-2	CL11-2	8.185	4-Jul-13	early development	7.21
Exposed	EL1	Elk River at Sparwood	651499	5507726	EL1-2	EL1-2	7.791	08-Jul-13	no development	4.64
Exposed	EL1	Elk River at Sparwood	651499	5507726	EL1-2-2	EL1-2	7.836	21-Jul-13	early development	4.84
Exposed	EL1	Elk River at Sparwood	651499	5507726	EL1-2-3	EL1-2	7.846	21-Jul-13	early development	4.74
Exposed	EL1	Elk River at Sparwood	651499	5507726	EL1-2-4	EL1-2	8.085	21-Jul-13	early development	4.83
Exposed	EL1	Elk River at Sparwood	651539	5507575	EL1-3	EL1-3	8.327	12-Jul-13	no development	5.30
Exposed	EL1	Elk River at Sparwood	651403	5507566	EL1-4	EL1-4	7.939	08-Jul-13	fertile	4.65
Exposed	EL1	Elk River at Sparwood	651403	5507566	EL1-4-2	EL1-4	7.811	21-Jul-13	early development	5.14
Exposed	EL1	Elk River at Sparwood	651403	5507566	EL1-4-3	EL1-4	7.238	21-Jul-13	early development	5.25
Exposed	EL1	Elk River at Sparwood	651403	5507566	EL1-4-4	EL1-4	7.814	21-Jul-13	early development	4.40
Exposed	EL19	Elk River d/s Fording	653227	5525791	EL19-3	EL19-3	7.828	06-Jul-13	no development	3.87
Exposed	EL19	Elk River d/s Fording	653227	5525791	EL19-3-2	EL19-3	6.732	26-Jul-13	infertile	4.49
Exposed	EL19	Elk River d/s Fording	653152	5525679	EL19-4	EL19-4	8.457	06-Jul-13	fertile-very early development	5.12
Exposed	EL19	Elk River d/s Fording	653152	5525679	EL19-4-2	EL19-4	7.163	21-Jul-13	infertile	5.15
Exposed	EL19	Elk River d/s Fording	653195	5525565	EL19-5	EL19-5	8.893	06-Jul-13	early development	5.58
Exposed	EL19	Elk River d/s Fording	653210	5525641	EL19-7	EL19-7	7.436	06-Jul-13	very early development	4.39
Exposed	EL19	Elk River d/s Fording	653198	5525727	EL19-8	EL19-8	7.700	17-Jul-13	very late (alive)	4.61
Exposed	ELKO	Elko Reservoir	639448	5463464	ELKO-1	ELKO-1	7.430	18-Jun-13	very early development	6.26
Exposed	ELKO	Elko Reservoir	639436	5463411	ELKO-2	ELKO-2	7.562	18-Jun-13	early development	5.91
Exposed	ELKO	Elko Reservoir	639422	5463456	ELKO-3	ELKO-3	7.283	18-Jun-13	mid development	5.33
Exposed	ELKO	Elko Reservoir	639408	5463439	ELKO-4	ELKO-4	7.295	18-Jun-13	mid development	5.02
Exposed	ELKO	Elko Reservoir	639395	5463425	ELKO-5	ELKO-5	6.943	18-Jun-13	mid development	5.55
Exposed	ELKO	Elko Reservoir	639454	5463266	ELKO-7	ELKO-7	8.125	28-Jun-13	early development	4.37
Exposed	ELKO	Elko Reservoir	639454	5463266	ELKO-7-2	ELKO-7	7.658	13-Jul-13	early-mid development	4.32
Exposed	ELKO	Elko Reservoir	639454	5463266	ELKO-7-3	ELKO-7	7.629	13-Jul-13	early-mid development	3.89
Exposed	ELKO	Elko Reservoir	639469	5463334	ELKO-9	ELKO-9	6.886	01-Jul-13	fertile	4.94
Exposed	ELKO	Elko Reservoir	639435	5463434	ELKO-11	ELKO-11	8.548	5-Jul-13	early development	4.46
Exposed	ELKO	Elko Reservoir	639564	5463584	ELKO-15	ELKO-15	8.031	07-Jul-13	mid development	4.46
Exposed	ELKO	Elko Reservoir	639528	5463541	ELKO-17	ELKO-17	8.509	16-Jul-13	early-mid development	6.85
Exposed	FO23	Fording at Elk	652837	5528446	FO23-5	FO23-5	8.428	06-Jul-13	early-mid development	7.00
Exposed	FO23	Fording at Elk	652837	5528446	FO23-5-2	FO23-5	7.181	21-Jul-13	very late - rotten	6.66
Exposed	FO23	Fording at Elk	652837	5528446	FO23-5-3	FO23-5	7.768	21-Jul-13	very late (recently alive)	4.88
Exposed	FO23	Fording at Elk	652678	5527923	FO23-6	FO23-6	8.007	16-Jul-13	late development	6.45
Exposed	FO29	Fording River at hwy bridge	655139	5543645	FO29-3	FO29-3	8.220	30-Jun-13	fertile	6.33
Exposed	FO29	Fording River at hwy bridge	655139	5543645	FO29-3-2	FO29-3	8.361	15-Jul-13	fertile - rotten	7.13
Exposed	FO29	Fording River at hwy bridge	655139	5543645	FO29-3-3	FO29-3	8.971	15-Jul-13	fertile - rotten	6.02
Exposed	FO29	Fording River at hwy bridge	655139	5543645	FO29-3-4	FO29-3	8.610	15-Jul-13	fertile - rotten	7.10
Exposed	FO52	Fording d/s Kilmarnock	652339	5558208	FO52-1	FO52-1	9.155	09-Jul-13	early development	10.4
Exposed	FO52	Fording d/s Kilmarnock	652339	5558208	FO52-1-2	FO52-1	7.195	23-Jul-13	early development (rotten)	16.5
Exposed	FO52	Fording d/s Kilmarnock	652464	5558020	FO52-2	FO52-2	8.164	09-Jul-13	early-mid development	6.87
Exposed	FO52	Fording d/s Kilmarnock	652503	5557932	FO52-3	FO52-3	7.493	09-Jul-13	early-mid development	10.5
Exposed	FO52	Fording d/s Kilmarnock	652322	5558306	FO52-4	FO52-4	9.288	17-Jul-13	early development	9.94
Exposed	FO52	Fording u/s Kilmarnock	651834	5559642	FO52-5	FO52-5	7.520	17-Jul-13	no development	5.95
Exposed	FO52	Fording u/s Kilmarnock	651834	5559642	FO52-5-2	FO52-5	6.820	06-Aug-13	late development	6.67
Exposed	FO52	Fording u/s Kilmarnock	651834	5559642	FO52-5-3	FO52-5	7.112	06-Aug-13	late development	5.86
Exposed	GAPD	Gatehouse Pond	655867	5509021	GAPD-1	GAPD-1	7.153	29-Jun-13	mid development	4.17
Exposed	GAPD	Gatehouse Pond	655769	5509145	GAPD-2	GAPD-2	8.032	29-Jun-13	no development	5.27
Exposed	GAPD	Gatehouse Pond	655924	5508941	GAPD-3	GAPD-3	7.983	4-Jul-13	early development	4.39
Exposed	GHPD	Greenhills Settling Pond	653492	5546118	GHPD-1	GHPD-1	8.180	26-Jun-13	early development	8.78
Exposed	GHPD	Greenhills Settling Pond	653768	5545986	GHPD-2	GHPD-2	7.619	2-Jul-13	no development	6.31
Exposed	GHPD	Greenhills Settling Pond	653707	5546077	GHPD-3	GHPD-3	7.074	11-Jul-13	mid development	13.2
Exposed	HA7	Harmer Pond	657228	5521975	HA7-1	HA7-1	7.531	18-Jun-13	mid development	9.85
Exposed	HA7	Harmer Pond	657082	5522136	HA7-2	HA7-2	6.962	29-Jun-13	very late (alive)	17.1
Exposed	HA7	Harmer Pond	657082	5522136	HA7-2-2	HA7-2	6.253	3-Jul-13	dead - mid-late development	16.3
Exposed	HA7	Harmer Pond	657204	5521962	HA7-3	HA7-3	9.094	3-Jul-13	very early development	10.5
Exposed	KSP	Kilmarnock Settling Pond	652511	5558655	KSP-2	KSP-2	7.020	17-Jul-13	early-mid development	15.9
Exposed	LCCPL	Line Creek Lower Cont. Ponds	659964	5531586	LCCPL-1	LCCPL-1	6.090	19-Jun-13	late development	24.9
Exposed	LCCPL	Line Creek Lower Cont. Ponds	659872	5531386	LCCPL-2	LCCPL-2	8.287	10-Jul-13	no development	32.3
Exposed	LCCPL	Line Creek Lower Cont. Ponds	659831	5531340	LCCPL-3	LCCPL-3	8.002	10-Jul-13	mid development	18.6
Exposed	LI8	Line Creek above Canyon	659218	5530522	LI8-1	LI8-1	7.850	19-Jun-13	fertile	5.18
Exposed	LI8	Line Creek above Canyon	659218	5530522	LI8-1-2	LI8-1	8.460	27-Jun-13	no development	7.78
Exposed	LI8	Line Creek above Canyon	659218	5530522	LI8-1-3	LI8-1	8.715	27-Jun-13	fertile	8.94
Exposed	LI8	Line Creek above Canyon	659218	5530522	LI8-1-4	LI8-1	9.015	27-Jun-13	fertile	8.69
Exposed	LI8	Line Creek above Canyon	659259	5530553	LI8-4	LI8-4	8.848	3-Jul-13	very early development	4.20
Exposed	LK02	Mouth of Elk on Koocanusa	633348	5448727	LK02-1	LK02-1	8.283	1-Jul-13	early development	4.91
Exposed	LK02	Mouth of Elk on Koocanusa	633509	5448713	LK02-2	LK02-2	8.470	07-Jul-13	no development	5.78
Exposed	LK02	Mouth of Elk on Koocanusa	633509	5448713	LK02-2-2	LK02-2	8.315	07-Jul-13	no development	5.42
Exposed	LK02	Mouth of Elk on Koocanusa	633509	5448713	LK02-2-3	LK02-2	8.135	07-Jul-13	no development	5.64
Exposed	LK02	Mouth of Elk on Koocanusa	633334	5448685	LK02-3	LK02-3	8.622	16-Jul-13	very early development	7.40
Exposed	LK02	Mouth of Elk on Koocanusa	633334	5448685	LK02-3-2	LK02-3	8.464	18-Jul-13	very early development	7.58
Exposed	LK02	Mouth of Elk on Koocanusa	633334	5448685	LK02-3-3	LK02-3	8.602	18-Jul-13	no development - infertile	6.52
Exposed	LK02	Mouth of Elk on Koocanusa	633334	5448685	LK02-3-4	LK02-3	8.683	18-Jul-13	very early development	8.44
Exposed	LK02	Mouth of Elk on Koocanusa	633766	5449082	LK02-5	LK02-5	8.460	09-Jul-13	early-mid development	5.58
Exposed	LK02	Mouth of Elk on Koocanusa	633281	5448707	LK02-6	LK02-6	7.884	16-Jul-13	no development	5.00
Exposed	MI2	Michel Creek in Sparwood	651565	5511804	MI2-1	MI2-1	8.562	19-Jun-13	mid-late development	4.32
Exposed	MI2	Michel Creek in Sparwood	652030	5511784	MI2-2	MI2-2	8.297	19-Jun-13	mid development	3.83
Exposed	MI2	Michel Creek in Sparwood	652031	5511709	MI2-3	MI2-3	7.171	19-Jun-13	mid-late development	4.54
Exposed	MI2	Michel Creek in Sparwood	652983	5511666	MI2-4	MI2-4	7.709	19-Jun-13	fertile	4.00
Exposed	MI2	Michel Creek in Sparwood	652660	5511634	MI2-5	MI2-5	7.785	19-Jun-13	no development	4.78
Exposed	MI2	Michel Creek in Sparwood	652973	5511691	MI2-7	MI2-7	8.074	29-Jun-13	no development	3.30
Exposed	MI2	Michel Creek in Sparwood	653315	5511567	MI2-8	MI2-8	8.090	29-Jun-13	no development	4.23
Exposed	MI2	Michel Creek in Sparwood	653315	5511567	MI2-8-2	MI2-8	8.611	12-Jul-13	no development	4.11
Exposed	MI2	Michel Creek in Sparwood	653315	5511567	MI2-8-3	MI2-8	8.300	12-Jul-13	no development	3.91
Exposed	MI2	Michel Creek in Sparwood	653315	5511567	MI2-8-4	MI2-8	8.492	12-Jul-13	no development	3.96
Exposed	MI2	Michel Creek in Sparwood	653730	5511230	MI2-10	MI2-10	8.911	29-Jun-13	no development	3.21
Exposed	MI2	Michel Creek in Sparwood	652323	5511659	MI2-14	MI2-14	8.229	4-Jul-13	early-mid development	4.61
Exposed	MI2	Michel Creek in Sparwood	652384	5511637	MI2-15	MI2-15	8.000	4-Jul-13	early development	4.47

Table B.3: Details related to spotted sandpiper eggs collected in 2013.

Reference vs Exposed	Area ID	Area	UTMs (Zone 11U)		Sample ID	Nest ID	Weight of Egg without Shell (g)	Collection Date	Egg Status	Selenium (µg/g dw)
			Easting	Northing						
Exposed	MI2	Michel Creek in Sparwood	652948	5511659	MI2-16	MI2-16	7.891	12-Jul-13	mid-late development	4.24
Exposed	MI2	Michel Creek in Sparwood	652659	5511636	MI2-18	MI2-18	7.642	12-Jul-13	mid-late development	3.60
Exposed	MI2	Michel Creek in Sparwood	652659	5511636	MI2-18-2	MI2-18	6.876	20-Jul-13	infertile	4.51
Exposed	MI2	Michel Creek in Sparwood	653451	5511411	MI2-19	MI2-19	8.277	12-Jul-13	fertile	4.36
Exposed	MI2	Michel Creek in Sparwood	653451	5511411	MI2-19-2	MI2-19	8.281	20-Jul-13	no development	5.04
Exposed	MI2	Michel Creek in Sparwood	653451	5511411	MI2-19-3	MI2-19	8.382	20-Jul-13	no development	3.97
Exposed	MI2	Michel Creek in Sparwood	653451	5511411	MI2-19-4	MI2-19	8.464	20-Jul-13	fertile	5.33
Exposed	MP1	Fording River - Multiplate	651220	5562484	MP1-1	MP1-1	7.272	18-Jun-13	no development	6.32
Exposed	MSAN	MSA-North Pond	661517	5536578	MSAN-1	MSAN-1	7.944	10-Jul-13	mid development	13.2
Exposed	MSAN	MSA-North Pond	661517	5536578	MSAN-1-2	MSAN-1	7.482	21-Jul-13	mid development - rotten	9.34
Exposed	MSAN	MSA-North Pond	661517	5536578	MSAN-1-3	MSAN-1	7.893	21-Jul-13	mid development - rotten	9.95
Exposed	MSAN	MSA-North Pond	661517	5536578	MSAN-1-4	MSAN-1	8.624	21-Jul-13	mid development - rotten	11.6
Exposed	MSAN	MSA-North Pond	661517	5536580	MSAN-2	MSAN-2	7.478	10-Jul-13	no development - rotten	8.58
Exposed	MSAN	MSA-North Pond	661517	5536580	MSAN-2-2	MSAN-2	7.536	10-Jul-13	no development - rotten	9.40
Exposed	MSAN	MSA-North Pond	661517	5536580	MSAN-2-3	MSAN-2	7.921	10-Jul-13	no development - rotten	8.13
Exposed	NNP	NoName Pond	661020	5535421	NNP-1	NNP-1	8.016	10-Jul-13	no development	8.99
Exposed	NNP	NoName Pond	661020	5535421	NNP-1-2	NNP-1	7.065	10-Jul-13	no development	8.78
Exposed	THPD	Thompson Settling Pond	649083	5550441	THPD-1	THPD-1	8.162	18-Jun-13	no development	13.7
Exposed	THPD	Thompson Settling Pond	649028	5550422	THPD-2	THPD-2	7.754	26-Jun-13	mid-late development	18.8
Exposed	THPD	Thompson Settling Pond	649072	5550310	THPD-3	THPD-3	7.970	06-Jul-13	fertile	18.0

Table B.4: Details related to spotted sandpiper eggs collected in 2014.

Reference vs Exposed	Area ID	Area	UTMs (Zone 11U)		Sample ID	Nest ID	Weight (g)	Date Sampled	Egg Status	Selenium (μg/g dw)
			Easting	Northing						
Reference	CHCK	Chauncey Creek	655363	5552767	CHCK-1	CHCK-1	8.630	26-Jun-14	mid development	12.4
Reference	WWR	Wigwam River	643611	5458230	WWR-1	WWR-1	8.185	17-Jun-14	mid-late development	NA
Reference	WWR	Wigwam River	643659	5458280	WWR-2	WWR-2	7.990	17-Jun-14	no development	NA
Reference	WWR	Wigwam River	643671	5458152	WWR-4	WWR-4	7.853	17-Jun-14	very early development	2.40
Reference	WWR	Wigwam River	645275	5459062	WWR-5	WWR-5	8.420	17-Jun-14	mid development	4.39
Reference	WWR	Wigwam River	646283	5458941	WWR-7	WWR-7	7.964	17-Jun-14	early development	2.35
Reference	WWR	Wigwam River	643681	5457951	WWR-8	WWR-8	8.330	23-Jun-14	early-mid development	1.88
Reference	WWR	Wigwam River	643678	5457997	WWR-9	WWR-9	7.269	23-Jun-14	mid-late development	3.32
Reference	WWR	Wigwam River	645417	5459060	WWR-10	WWR-10	7.405	23-Jun-14	no development	NA
Reference	WWR	Wigwam River	645310	5459078	WWR-11	WWR-11	8.386	29-Jun-14	fertile	NA
Reference	WWR	Wigwam River	645861	5458918	WWR-13	WWR-13	8.585	03-Jul-14	fertile	NA
Reference	WWR	Wigwam River	643620	5458224	WWR-15	WWR-15	8.333	09-Jul-14	very early development	NA
Reference	WWR	Wigwam River	643620	5458224	WWR-15-2	WWR-15	8.086	24-Jul-14	mid development	NA
Reference	WWR	Wigwam River	643620	5458224	WWR-15-3	WWR-15	8.208	24-Jul-14	mid development	NA
Reference	WWR	Wigwam River	645362	5459052	WWR-16	WWR-16	7.505	04-Jul-14	early development	NA
Reference	WWR	Wigwam River	645240	5459021	WWR-17	WWR-17	8.382	04-Jul-14	early development	NA
Reference	WWRBP	Wigwam River (Beaver Pond)	645157	5459084	WWRBP-1	WWRBP-1	7.689	23-Jun-14	mid-late development	8.68
Reference	WWRBP	Wigwam River (Beaver Pond)	645241	5459097	WWRBP-2	WWRBP-2	8.104	23-Jun-14	early development	3.53
Exposed	CL11	Clode Pond	651005	5564348	CL11-1	CL11-1	7.307	28-Jun-14	fertile	16.6
Exposed	CL11	Clode Pond	650881	5564223	CL11-2	CL11-2	8.385	28-Jun-14	early-mid development	16.5
Exposed	CL11	Clode Pond	650937	5564324	CL11-3	CL11-3	8.597	07-Jul-14	early development	20.8
Exposed	EAPD	Eagle Ponds	651276	5562677	EAPD-1	EAPD-1	8.809	02-Jun-14	no development	8.75
Exposed	EAPD	Eagle Ponds	651258	5562752	EAPD-2-1	EAPD-2	8.077	29-Jun-14	no development	15.9
Exposed	EAPD	Eagle Ponds	651258	5562752	EAPD-2-2	EAPD-2	8.074	29-Jun-14	no development	15.7
Exposed	EAPD	Eagle Ponds	651264	5562752	EAPD-3	EAPD-3	7.634	28-Jun-14	very late development	10.5
Exposed	EAPD	Eagle Ponds	651230	5562835	EAPD-4	EAPD-4	8.385	28-Jun-14	very early development	22.2
Exposed	EL1	Elk River d/s Michel	651443	5507067	EL1-3	EL1-3	7.862	20-Jun-14	mid development	6.46
Exposed	EL1	Elk River d/s Michel	651429	5507311	EL1-4	EL1-4	8.100	20-Jun-14	no development	5.48
Exposed	EL1	Elk River d/s Michel	651417	5507447	EL1-5	EL1-5	7.395	22-Jun-14	mid development	NA
Exposed	EL1	Elk River d/s Michel	651600	5507400	EL1-6	EL1-6	7.255	27-Jun-14	mid development	7.00
Exposed	EL1	Elk River d/s Michel	651561	5507202	EL1-7	EL1-7	8.573	06-Jul-14	early development	NA
Exposed	EL1	Elk River d/s Michel	651548	5507647	EL1-8	EL1-8	8.150	08-Jul-14	very early development	5.22
Exposed	EL19	Elk River d/s Fording	653170	5525743	EL19-1	EL19-1	8.136	18-Jun-14	very early development	4.13
Exposed	EL19	Elk River d/s Fording	653534	5525390	EL19-2	EL19-2	9.540	18-Jun-14	early development	7.29
Exposed	EL19	Elk River d/s Fording	653319	5525439	EL19-3	EL19-3	8.555	25-Jun-14	early development	3.60
Exposed	EL19	Elk River d/s Fording	653194	5525744	EL19-4	EL19-4	8.156	18-Jun-14	early-mid development	4.00
Exposed	EL19	Elk River d/s Fording	653192	5525554	EL19-5	EL19-5	8.275	25-Jun-14	no development	NA
Exposed	EL19	Elk River d/s Fording	653556	5525039	EL19-6	EL19-6	8.572	04-Jul-14	mid development	6.33
Exposed	EL19	Elk River d/s Fording	653565	5525006	EL19-7	EL19-7	3.237	07-Jul-14	no development, very tiny, infertile?	7.53
Exposed	ELKO	Elko Reservoir	639403	5463376	ELKO-1	ELKO-1	8.295	22-Jun-14	early development	8.66
Exposed	ELKO	Elko Reservoir	639431	5463424	ELKO-2	ELKO-2	9.295	01-Jul-14	very early development	7.73
Exposed	ELKO	Elko Reservoir	639555	5463561	ELKO-3	ELKO-3	7.857	27-Jun-14	no development	NA
Exposed	FO10	Fording River Oxbow	654260	5555314	FO10-1	FO10-1	7.048	26-Jun-14	late development	13.8
Exposed	FO10	Fording River Oxbow	654260	5555314	FO10-1-2	FO10-1	6.854	30-Jun-14	very early development, dead in nest	13.6
Exposed	FO10	Fording River Oxbow	654161	5555330	FO10-2	FO10-2	8.495	26-Jun-14	early development	16.5
Exposed	FO10	Fording River Oxbow	654187	5555121	FO10-3	FO10-3	6.933	02-Jul-14	no development, infertile?	10.4
Exposed	FO23	Fording River d/s Line Creek	652658	5528044	FO23-1	FO23-1	8.973	18-Jun-14	very early development	6.92
Exposed	FO23	Fording River d/s Line Creek	652805	5528297	FO23-2	FO23-2	-	25-Jun-14	no development	6.50
Exposed	FO23	Fording River d/s Line Creek	652431	5558501	FO23-3	FO23-3	8.304	28-Jun-14	no development	7.60
Exposed	FO23	Fording River d/s Line Creek	652879	5528449	FO23-4	FO23-4	8.323	09-Jul-14	fertile	9.05
Exposed	FO23	Fording River d/s Line Creek	652879	5528449	FO23-4-2	FO23-4	7.617	26-Jul-14	late development	11.1
Exposed	FO23	Fording River d/s Line Creek	652879	5528449	FO23-4-3	FO23-4	7.750	26-Jul-14	late development	9.44
Exposed	FO23	Fording River d/s Line Creek	652664	5528144	FO23-5	FO23-5	8.244	05-Jul-14	mid-late development	7.23
Exposed	FO29	Fording at road bridge	655090	5543580	FO29-1	FO29-1	8.286	21-Jun-14	mid-late development	7.38
Exposed	FO29	Fording at road bridge	655123	5543665	FO29-2	FO29-2	8.881	23-Jun-14	no development	8.39
Exposed	FO52	Fording at Kilmarnock	652306	5558453	FO52-1	FO52-1	7.560	20-Jun-14	early development	13.4
Exposed	FO52	Fording at Kilmarnock	652306	5558453	FO52-1-2	FO52-1	7.064	07-Jul-14	early development	13.8
Exposed	FO52	Fording at Kilmarnock	652306	5558453	FO52-1-3	FO52-1	7.187	07-Jul-14	early development	16.7
Exposed	FO52	Fording at Kilmarnock	652306	5558453	FO52-1-4	FO52-1	6.835	07-Jul-14	early development	12.6
Exposed	FO52	Fording at Kilmarnock	652266	5558507	FO52-2	FO52-2	7.916	28-Jun-14	very early development	9.04
Exposed	FO52	Fording at Kilmarnock	651824	5559389	FO52-3	FO52-3	-	28-Jun-14	fertile	19.8
Exposed	FO52	Fording at Kilmarnock	652340	5558263	FO52-4	FO52-4	7.753	30-Jun-14	fertile	6.54
Exposed	FO52	Fording at Kilmarnock	652340	5558263	FO52-4-2	FO52-4	7.920	30-Jun-14	fertile	6.25
Exposed	FO52	Fording at Kilmarnock	652340	5558263	FO52-4-3	FO52-4	7.004	30-Jun-14	fertile	5.82
Exposed	FO52	Fording at Kilmarnock	652340	5558263	FO52-4-4	FO52-4	7.761	30-Jun-14	fertile	6.93
Exposed	FO52	Fording at Kilmarnock	652372	5558170	FO52-5	FO52-5	8.691	30-Jun-14	early development	7.7
Exposed	FO52	Fording at Kilmarnock	652357	5558255	FO52-7	FO52-7	6.687	30-Jun-14	fertile	6.24
Exposed	FOBC	Fording beside Clode Pond	650770	5564267	FOBC-1	FOBC-1	8.225	24-Jun-14	no development	11.2
Exposed	GAPD	Gatehouse Pond	655793	5509117	GAPD-1	GAPD-1	8.164	03-Jun-14	very early development	20.2
Exposed	GAPD	Gatehouse Pond	655778	5509189	GAPD-2	GAPD-2	8.134	17-Jun-14	early development	6.11
Exposed	GAPD	Gatehouse Pond	655882	5509081	GAPD-3	GAPD-3	7.894	17-Jun-14	late development	9.28
Exposed	GC2	Goddard Creek	652723	5513938	GC2-1	GC2-1	8.069	17-Jun-14	fertile	5.10
Exposed	GC2	Goddard Creek	652723	5513938	GC2-1-2	GC2-1	6.088	07-Jul-14	no development, infertile?	5.86
Exposed	GHPD	Greenhills Settling Pond	653484	5546116	GHPD-1	GHPD-1	8.514	21-Jun-14	no development	14.7
Exposed	GHPD	Greenhills Settling Pond	653766	5546056	GHPD-2	GHPD-2	6.272	21-Jun-14	fertile	7.55
Exposed	GHPD	Greenhills Settling Pond	653443	5546083	GHPD-3	GHPD-3	8.169	04-Jul-14	early development	11.7
Exposed	HA7	Harmer Pond	657214	5521984	HA7-1	HA7-1	8.462	17-Jun-14	no development	7.40
Exposed	HA7	Harmer Pond	657214	5521984	HA7-1-2	HA7-1	7.910	10-Jul-14	no development, infertile?	7.69
Exposed	HA7	Harmer Pond	657024	5522122	HA7-2	HA7-2	8.677	26-Jun-14	very early development	14.1
Exposed	KSP	Kilmarnock Settling Pond	652418	5558689	KSP-1	KSP-1	7.639	20-Jun-14	mid development	7.51
Exposed	KSP	Kilmarnock Settling Pond	652485	5558555	KSP-3	KSP-3	8.734	20-Jun-14	fertile	13.3
Exposed	KSP	Kilmarnock Settling Pond	652413	5558486	KSP-4	KSP-4	8.330	20-Jun-14	early development	6.14
Exposed	KSP	Kilmarnock Settling Pond	652413	5558486	KSP-4-2	KSP-4	7.828	30-Jun-14	early development	5.31
Exposed	KSP	Kilmarnock Settling Pond	652413	5558486	KSP-4-3	KSP-4	7.474	30-Jun-14	very early development	7.06
Exposed	KSP	Kilmarnock Settling Pond	652413	5558486	KSP-4-4	KSP-4	8.062	30-Jun-14	early development	6.63
Exposed	KSP	Kilmarnock Settling Pond	652481	5558663	KSP-5	KSP-5	8.615	28-Jun-14	mid development	12.0
Exposed	KSP	Kilmarnock Settling Pond	652432	5558505	KSP-7	KSP-7	6.895	30-Jun-14	fertile	9.09
Exposed	KSP	Kilmarnock Settling Pond	652432	5558505	KSP-7-2	KSP-7	6.789	21-Jul-14	early development	7.66
Exposed	KSP	Kilmarnock Settling Pond	652432	5558505	KSP-7-3	KSP-7	6.636	21-Jul-14	mid development	9.81
Exposed	LCCPL	Line Creek Contingency Ponds	659831	5531348	LCCPL-1	LCCPL-1	8.195	27-Jun-14	early development	17.0
Exposed	LCCPL	Line Creek Contingency Ponds	659831	5531348	LCCPL-1-2	LCCPL-1	8.004	10-Jul-14	mid development	22.5
Exposed	LCCPL	Line Creek Contingency Ponds	659831	5531348	LCCPL-1-3	LCCPL-1	7.635	10-Jul-14	mid development	19.9
Exposed	LCCPL	Line Creek Contingency Ponds	659831	5531348	LCCPL-1-4	LCCPL-1	8.027	10-Jul-14	mid development	16.4
Exposed	LEPD	Leask Settling Pond	648311	5553114	LEPD-1	LEPD-1	7.870	21-Jun-14	early development	19.2
Exposed	LEPD	Leask Settling Pond	648201	5552927	LEPD-2	LEPD-2	7.416	21-Jun-14	early development	6.22
Exposed	LEPD	Leask Settling Pond	648201	5552927	LEPD-2-2	LEPD-2	6.680	02-Jul-14	mid-late development	5.36
Exposed	LEPD	Leask Settling Pond	648201	5552927	LEPD-2-3	LEPD-2	6.483	02-Jul-14	no obvious development	5.87
Exposed	LEPD	Leask Settling Pond	648201	5552927	LEPD-2-4	LEPD-2	6.425	02-Jul-14	late development	4.70

Table B.4: Details related to spotted sandpiper eggs collected in 2014.

Reference vs Exposed	Area ID	Area	UTMs (Zone 11U)		Sample ID	Nest ID	Weight (g)	Date Sampled	Egg Status	Selenium (µg/g dw)
			Easting	Northing						
Exposed	LK02	Mouth of Elk River	633504	5448751	LK02-1	LK02-1	7.195	15-Jun-14	early development	NA
Exposed	LK02	Mouth of Elk River	633423	5448708	LK02-2	LK02-2	7.004	22-Jun-14	mid development	8.03
Exposed	LK02	Mouth of Elk River	633423	5448708	LK02-2-2	LK02-2	6.610	27-Jun-14	no development, infertile?	7.16
Exposed	LK02	Mouth of Elk River	633368	5448773	LK02-3	LK02-3	7.695	22-Jun-14	mid development	6.47
Exposed	LK02	Mouth of Elk River	633353	5448755	LK02-4	LK02-4	8.314	22-Jun-14	mid development	7.68
Exposed	LK02	Mouth of Elk River	633296	5448607	LK02-5	LK02-5	7.345	27-Jun-14	early development	7.73
Exposed	LK02	Mouth of Elk River	633269	5448433	LK02-6	LK02-6	8.740	04-Jul-14	early development	7.39
Exposed	LK02	Mouth of Elk River	633375	5448659	LK02-7	LK02-7	7.295	04-Jul-14	early-mid development	6.45
Exposed	MC3	Upper Michel Creek	660291	5502089	MC3-1	MC3-1	9.208	26-Jun-14	no development	3.70
Exposed	MC3	Upper Michel Creek	659752	5499824	MC3-2	MC3-2	7.879	26-Jun-14	fertile	3.18
Exposed	MC3	Upper Michel Creek	659508	5497383	MC3-3	MC3-3	8.254	02-Jul-14	very early development	3.66
Exposed	MC3	Upper Michel Creek	659695	5499349	MC3-4	MC3-4	7.952	02-Jul-14	very early development	3.90
Exposed	MC3	Upper Michel Creek	659741	5499390	MC3-5	MC3-5	7.904	02-Jul-14	very late development	4.08
Exposed	MC3	Upper Michel Creek	659741	5499769	MC3-6	MC3-6	6.594	05-Jul-14	late development	3.70
Exposed	MCdsE	Michel Creek d/s Erickson	659757	5505105	MCdsE-1	MCdsE-1	8.290	17-Jun-14	early development	4.06
Exposed	MCdsE	Michel Creek d/s Erickson	656762	5507432	MCdsE-2	MCdsE-2	7.704	18-Jun-14	early-mid development	4.99
Exposed	MCusE	Michel Creek u/s Erickson	659890	5505051	MCusE-1	MCusE-1	8.157	04-Jul-14	early development	4.39
Exposed	MI2	Michel Creek u/s Elk River	652942	5511660	MI2-1	MI2-1	8.446	20-Jun-14	fertile	NA
Exposed	MI2	Michel Creek u/s Elk River	652998	5511682	MI2-2	MI2-2	8.368	16-Jun-14	very early development	NA
Exposed	MI2	Michel Creek u/s Elk River	653032	5511711	MI2-3	MI2-3	7.870	16-Jun-14	no development	NA
Exposed	MI2	Michel Creek u/s Elk River	653886	5511072	MI2-4	MI2-4	7.442	16-Jun-14	very early development	NA
Exposed	MI2	Michel Creek u/s Elk River	653293	5511692	MI2-5	MI2-5	8.152	20-Jun-14	no development	NA
Exposed	MI2	Michel Creek u/s Elk River	653299	5511637	MI2-6	MI2-6	7.030	20-Jun-14	mid development	NA
Exposed	MI2	Michel Creek u/s Elk River	653105	5511630	MI2-7	MI2-7	7.367	25-Jun-14	late development	5.00
Exposed	MI2	Michel Creek u/s Elk River	653050	5511672	MI2-8	MI2-8	7.669	28-Jun-14	fertile	NA
Exposed	MI2	Michel Creek u/s Elk River	653071	5511637	MI2-9	MI2-9	7.636	25-Jun-14	early development	4.33
Exposed	MI2	Michel Creek u/s Elk River	652110	5511750	MI2-11	MI2-11	8.579	25-Jun-14	no development	4.94
Exposed	MI2	Michel Creek u/s Elk River	652416	5511636	MI2-12	MI2-12	8.532	25-Jun-14	no development	NA
Exposed	MI2	Michel Creek u/s Elk River	652355	5511646	MI2-13	MI2-13	8.678	25-Jun-14	no development	5.78
Exposed	MI2	Michel Creek u/s Elk River	652132	5511762	MI2-14	MI2-14	7.381	25-Jun-14	mid development	5.74
Exposed	MI2	Michel Creek u/s Elk River	651984	5511776	MI2-15	MI2-15	7.833	25-Jun-14	no development	5.99
Exposed	MI2	Michel Creek u/s Elk River	652804	5511604	MI2-16	MI2-16	8.477	28-Jun-14	fertile	4.40
Exposed	MI2	Michel Creek u/s Elk River	652292	5511701	MI2-17	MI2-17	8.199	01-Jul-14	early development	6.31
Exposed	MI2	Michel Creek u/s Elk River	653821	5511076	MI2-18	MI2-18	7.611	01-Jul-14	early development	NA
Exposed	MI2	Michel Creek u/s Elk River	653781	5511188	MI2-19	MI2-19	8.491	01-Jul-14	early development	5.86
Exposed	MI2	Michel Creek u/s Elk River	653867	5511072	MI2-20	MI2-20	8.366	02-Jul-14	early development	NA
Exposed	NNP	NoName Pond	661046	5535465	NNP-1	NNP-1	8.026	27-Jun-14	fertile	15.6
Exposed	SWWL	Swift Wetland	651839	5558449	SWWL-1	SWWL-1	8.300	20-Jun-14	fertile	26.1
Exposed	THPD	Thompson Settling Pond	649067	5550413	THPD-1	THPD-1	8.135	21-Jun-14	early-mid development	15.3
Exposed	THPD	Thompson Settling Pond	649012	5550502	THPD-2	THPD-2	9.583	28-Jun-14	early development	21.5
Exposed	UTHP	Upper Thompson Pond	650978	5549967	UTHP-1	UTHP-1	7.305	27-Jun-14	no obvious development	20.0
Exposed	UWOP	Upper Wolfram	649497	8552476	UWOP-1	UWOP-1	4.498	14-Jul-14	mid development	3.03
Exposed	WOPD	Wolfram Settling Pond	648271	5552309	WOPD-1	WOPD-1	7.175	26-Jun-14	mid development	17.3

NA - Not analyzed

Table B.5: Metal concentrations in spotted sandpiper eggs collected in 2013.

Sample ID	Reference vs Exposed	Moisture	Ag	Al	As	B	Ba	Be	Bi	Ca	Cd	Co	Cr	Cs
		%	µg/g dw	µg/g dw	µg/g dw	µg/g dw	µg/g dw	µg/g dw	µg/g dw	µg/g dw	µg/g dw	µg/g dw	µg/g dw	µg/g dw
AL4-1	Reference	73.8%	0.0111	0.100	0.0239	<0.23	8.45	<0.0020	<0.000098	2,840	0.00135	0.164	0.0610	0.00289
CHCK-1	Reference	72.6%	0.0143	0.151	0.0148	0.117	5.67	<0.0024	<0.000023	2,990	0.000950	0.139	0.0685	0.00221
CHCK-2	Reference	74.5%	0.00782	0.326	0.0186	0.142	17.4	<0.0028	<0.000025	2,670	0.00135	0.266	0.0982	0.00581
WWR-1	Reference	73.7%	0.00511	0.0773	0.0172	0.109	4.34	<0.0023	0.000102	2,880	0.00129	0.0972	0.107	0.00110
WWR-1-2	Reference	73.3%	0.00465	0.0868	0.0160	0.174	7.73	<0.0026	0.0000550	2,850	0.00150	0.0955	0.122	0.00124
WWR-2	Reference	72.7%	0.00597	0.0930	0.0342	0.141	15.1	<0.0026	0.000178	2,550	<0.00079	0.139	0.105	0.00206
WWR-3	Reference	68.8%	0.00541	20.9	0.0192	<0.13	14.5	<0.0024	0.000306	11,000	0.00310	0.137	0.169	0.00205
WWR-4	Reference	74.6%	0.00751	2.68	0.0165	0.0700	7.14	<0.0025	<0.000019	2,610	0.00121	0.0922	0.0793	0.00165
WWR-5	Reference	68.1%	0.00618	0.107	0.0404	0.0730	12.2	<0.0021	0.000247	3,140	0.00108	0.103	0.0632	0.00178
WWR-6	Reference	73.5%	0.00257	0.608	0.0233	<0.14	9.92	<0.0027	0.0000780	4,360	<0.0013	0.120	0.0916	0.00213
WWR-7	Reference	73.7%	0.0107	0.215	0.0373	<0.18	23.4	<0.0019	<0.000034	2,750	<0.00070	0.243	0.0715	0.00296
WWR-8	Reference	73.1%	0.00671	0.0652	0.0441	<0.23	9.85	<0.0020	<0.00010	2,950	0.000980	0.101	0.0801	0.00178
CL11-1	Exposed	73.3%	0.00990	5.28	0.0113	<0.23	8.94	<0.0020	<0.000099	2,860	0.00171	0.269	0.0850	0.00212
CL11-2	Exposed	73.4%	0.0149	0.104	0.0131	<0.24	4.08	<0.0020	<0.00010	2,460	0.00150	0.194	0.0698	0.00273
EL1-2	Exposed	72.5%	0.0178	0.138	0.0220	0.0950	8.46	<0.0023	<0.000020	2,780	0.00223	0.189	0.109	0.00118
EL1-2-2	Exposed	71.7%	0.0102	0.200	0.0174	<0.17	4.12	<0.0018	<0.000032	2,500	0.00264	0.182	0.0607	0.00129
EL1-2-3	Exposed	71.8%	0.0112	0.213	0.0174	<0.18	3.31	<0.0019	<0.000035	2,630	0.00288	0.186	0.0819	0.00153
EL1-2-4	Exposed	71.8%	0.0126	0.106	0.0208	<0.22	5.88	<0.0019	<0.000093	2,720	0.00238	0.205	0.145	0.00122
EL1-3	Exposed	74.2%	0.0150	0.146	0.0337	<0.19	5.23	<0.0020	0.0000500	3,000	0.00171	0.113	0.162	0.00121
EL1-4	Exposed	72.8%	0.00848	23.6	0.0140	0.0730	6.67	<0.0026	<0.000023	2,680	0.00136	0.236	0.0889	0.00102
EL1-4-2	Exposed	73.2%	0.0126	0.149	0.0275	<0.18	10.5	<0.0020	<0.000035	3,120	0.00266	0.269	0.155	0.00130
EL1-4-3	Exposed	73.6%	0.0118	0.132	0.0161	<0.18	4.83	<0.0019	<0.000034	2,840	0.000960	0.248	0.141	0.00124
EL1-4-4	Exposed	73.2%	0.0146	0.281	0.0197	<0.19	5.77	<0.0020	<0.000039	3,240	0.00142	0.279	0.150	0.00137
EL19-3	Exposed	72.6%	0.00958	3.72	0.00710	<0.22	3.66	<0.0019	0.00117	2,870	0.00156	0.129	0.0699	0.00147
EL19-3-2	Exposed	67.0%	0.00951	0.0947	0.0110	0.122	4.55	<0.0021	<0.000019	2,940	0.00105	0.143	0.110	0.00184
EL19-4	Exposed	74.1%	0.0131	42.3	0.0173	<0.22	6.87	<0.0019	<0.000094	2,810	0.00299	0.217	0.0848	0.00179
EL19-4-2	Exposed	72.5%	0.00975	0.464	0.0220	<0.19	2.72	<0.0020	<0.000028	3,170	0.00168	0.154	0.144	0.00183
EL19-5	Exposed	74.7%	0.00988	0.924	0.0164	<0.21	8.58	<0.0017	<0.000088	2,620	0.00233	0.229	0.0806	0.00188
EL19-7	Exposed	75.7%	0.00961	0.0618	0.0135	<0.23	9.19	<0.0020	<0.00010	2,820	0.00119	0.156	0.0957	0.000962
EL19-8	Exposed	66.6%	0.0108	1.01	0.0175	<0.12	9.08	<0.0024	0.000458	17,200	0.00180	0.265	0.206	0.00173
ELKO-1	Exposed	74.4%	0.0123	0.185	0.00930	0.0620	9.06	<0.0025	<0.000024	2,610	0.00228	0.207	0.101	0.00116
ELKO-11	Exposed	74.3%	0.00667	0.165	0.00940	<0.24	2.84	<0.0020	<0.00010	2,450	0.00126	0.250	0.0774	0.000909
ELKO-15	Exposed	71.0%	0.00822	0.144	0.00650	<0.19	3.97	<0.0020	0	3,380	0.000810	0.122	0.0856	0.000730
ELKO-17	Exposed	74.0%	0.0126	0.110	0.0145	<0.24	5.33	<0.0021	0.000130	2,460	0.00112	0.194	0.149	0.00122
ELKO-2	Exposed	74.1%	0.00950	0.142	0.0121	0.0770	9.63	<0.0026	<0.000024	2,660	0.00213	0.105	0.0665	0.00128
ELKO-3	Exposed	73.6%	0.00702	1.28	0.0119	<0.11	4.22	<0.0021	<0.000029	3,300	0.00190	0.188	0.0879	0.00114
ELKO-4	Exposed	74.5%	0.0105	0.292	0.0108	0.0780	6.02	<0.0027	0	2,990	0.00111	0.157	0.0933	0.000730
ELKO-5	Exposed	75.0%	0.00904	1.12	0.0150	<0.11	8.43	<0.0021	0.0000940	2,790	0.00250	0.120	0.176	0.000979
ELKO-7	Exposed	74.7%	0.00612	0.109	0.00540	0.0480	5.74	<0.0025	<0.000022	2,920	0.00119	0.164	0.0765	0.000647
ELKO-7-2	Exposed	87.5%	0.00472	51.4	0.00560	<0.13	3.33	<0.0025	0.000199	2,640	0.00240	0.0897	0.107	0.000751
ELKO-7-3	Exposed	72.3%	0.00601	0.200	0.00490	<0.21	1.24	<0.0023	<0.000039	2,840	0.00126	0.106	0.0712	0.000410
ELKO-9	Exposed	73.7%	0.00541	0.0806	0.00790	<0.22	2.12	<0.0019	0.0000960	3,690	0.000850	0.0679	0.112	0.000518
FO23-5	Exposed	73.5%	0.0123	0.402	0.0148	<0.22	9.06	<0.0018	<0.000093	2,780	0.00130	0.219	0.0954	0.00333
FO23-5-2	Exposed	75.5%	0.0166	3.60	0.0178	<0.14	13.0	<0.0026	0.000147	8,240	0.00240	0.232	0.118	0.00311
FO23-5-3	Exposed	74.8%	0.0159	0.665	0.0163	<0.12	8.42	<0.0022	0.000242	10,500	0.00130	0.270	0.152	0.00354
FO23-6	Exposed	75.1%	0.0296	1.04	0.0297	<0.13	9.00	<0.0026	<0.000035	11,000	<0.0013	0.303	0.0932	0.00282
FO29-3	Exposed	72.8%	0.0198	0.061	0.0159	0.167	5.53	<0.0026	<0.000021	2,560	0.00171	0.108	0.125	0.00133
FO29-3-2	Exposed	72.3%	0.0253	0.252	0.0161	<0.17	18.6	<0.0018	0.0000400	2,950	0.00199	0.144	0.0928	0.00158
FO29-3-3	Exposed	74.4%	0.0239	0.500	0.0145	<0.19	21.0	<0.0020	0.0000350	2,890	0.00122	0.161	0.0751	0.00164
FO29-3-4	Exposed	74.1%	0.0202	0.242	0.0197	<0.21	11.3	<0.0018	<0.000089	2,700	<0.00073	0.120	0.147	0.00189
FO52-1	Exposed	75.0%	0.0141	0.157	0.0153	0.331	8.49	<0.0026	<0.000023	2,440	0.00388	0.172	0.0774	0.00268
FO52-1-2	Exposed	71.0%	0.0102	0.584	0.0181	0.173	6.27	<0.0027	0	2,910	0.00398	0.188	0.0594	0.00239
FO52-2	Exposed	71.7%	0.0189	0.138	0.0147	0.0800	8.22	<0.0021	<0.000019	3,590	0.00184	0.232	0.0798	0.00342
FO52-3	Exposed	72.0%	0.0222	0.171	0.0116	0.0670	15.4	<0.0026	<0.000023	3,410	0.00204	0.253	0.0830	0.00210
FO52-4	Exposed	74.6%	0.0124	13.6	0.0115	<0.19	4.23	<0.0020	0.000197	2,890	0.00408	0.280	0.0773	0.00302
FO52-5	Exposed	74.0%	0.0227	0.253	0.0164	<0.20	8.30	<0.0021	<0.000036	3,340	0.00244	0.239	0.0920	0.00246
FO52-5-2	Exposed	78.1%	0.0117	0.473	0.0158	0.260	4.97	<0.0026	0.000118	12,700	<0.0013	0.166	0.174	0.00456
FO52-5-3	Exposed	76.7%	0.0122	2.26	0.0186	<0.13	6.83	<0.0025	0.0000840	10,700	0.00140	0.145	0.105	0.00587
GAPD-1	Exposed	70.5%	0.0109	0.116	0.0187	0.0590	11.9	<0.0027	<0.000021	3,650	0.00197	0.210	0.116	0.00197
GAPD-2	Exposed	73.5%	0.0137	0.0827	0.0247	0.0960	12.3	<0.0024	<0.000022	2,850	0.00250	0.396	0.114	0.00217
GAPD-3	Exposed	72.6%	0.00853	0.160	0.0176	<0.24	5.44	<0.0020	<0.00010	2,670	0.00191	0.150	0.0866	0.00170
GHPD-1	Exposed	73.6%	0.00340	0.1935	0.0132	<0.25	5.02	<0.0021	0.000470	2,995	0.00117	0.170	0.115	0.00487
GHPD-2	Exposed	73.0%	0.00413	0.0949	0.0132	<0.24	5.03	<0.0021	<0.00010	3,110	0.00131	0.152	0.111	0.00297
GHPD-3	Exposed	77.4%	0.00632	1.56	0.00830	<0.13	3.07	<0.0024	0.000146	4,640	0.00260	0.123	0.263	0.00365
HA7-1	Exposed	72.4%	0.0290	0.216	0.0218	0.123	3.96	<0.0027	<0.000023	3,775	0.00286	0.125	0.0720	0.00222
HA7-2	Exposed	75.7%	0.0163	1.01	0.0157	<0.14	6.64	<0.0026	0.000158	16,000	0.00160	0.135	0.130	0.00173
HA7-2-2	Exposed	72.8%	0.0154	0.663	0.0112	<0.13	3.74	<0.0026	0.0000570	7,740	<0.0013	0.119	0.0953	0.00162
HA7-3	Exposed	75.0%	0.0245	0.176	0.0220	<0.23	9.12	<0.0020	<0.00010	2,430	0.00275	0.132	0.123	0.00339
KSP-2	Exposed	72.7%	0.00743	0.259	0.00860	0.190	3.43	<0.0018	<0.000032	3,210	0.00437	0.210	0.0819	0.00275
LCCPL-1	Exposed	73.5%	0.00555	0.534	0.00980	<0.12	5.31	<0.0023	0.000102	5,740	0.00200	0.180	0.102	0.00196
LCCPL-2	Exposed	73.7%	0.00616	0.169	0.0169	0.0890	6.58	<0.0026	<0.000022	2,590	0.00227	0.298	0.0906	0.00223
LCCPL-3	Exposed	75.1%	0.00759	1.73	0.0201	<0.11	6.48	<0.0021	0.0000910	3,720	0.00280	0.209	0.100	0.00238
LI8-1	Exposed	75.3%	0.0280	0.118	0.0184	<0.23	6.10	<0.0020	0.000383	2,990	0.00235	0.159	0.105	0.00172
LI8-1-2	Exposed	74.7%	0.0214	0.147	0.0234	0.0820	15.5	<0.0026	<0.000023	3,090	0.00457	0.203	0.0989	0.00278
LI8-1-3	Exposed	74.2%	0.0218	0.118	0.0149	0.127	9.38	<0.0022	<0.000020	2,910	0.00291	0.179	0.0738	0.00151
LI8-1-4	Exposed	74.7%	0.0240	14.4	0.0202	0.218	12.1	<0.0023	<0.000021	3,060	0.00291	0.169	0.0600	0.00192
LI8-4	Exposed	75.4%	0.0193	0.0718	0.0215	<0.25	16.0	<0.0021	<0.00011	3,010	0.00342	0.241	0.0963	0.00263
LK02-1	Exposed	74.0%	0.00524	0.176	0.00860	<0.22	2.85	<0.0019	<0.000096	2,940	0.00132	0.143	0.129	0.000875
LK02-2	Exposed	72.9%	0.00600	0.214	0.0309	<0.18	7.60	<0.0019	0	2,680	0.00114	0.130	0.0635	0.00183
LK02-2-2	Exposed	72.4%	0.00687	3.08	0.0271	0.113	2.94	<0.0024	0.000125	2,700	<0.00074	0.106	0.0877	0.00143
LK02-2-3	Exposed	72.7%	0.00487	0.449	0.0203	0.101	6.52	<0.0023	0.000154	2,460	0.00126	0.115	0.0737	0.00152
LK02-3	Exposed	74.4%	0.00680	0.256	0.0235	<0.17	3.62	<0.0018	<0.000042	2,635	0.00209	0.118	0.118	0.000890
LK02-3-2	Exposed	74.3%	0.00586	0.199	0.0308	<0.17	5.05	<0.0018	<0.000032	2,450	0.000970	0.138	0.149	0.00117
LK02-3-3	Exposed	74.3%	0.00645	0.237	0.0290	<0.19	7.54	<0.0020	0.0000600	2,470	0.00167	0.147	0.0952	0.00115
LK02-3-4	Exposed	74.4%	0.00716	0.193	0.0278	<0.17	3.97	<0.0018	<0.000034	2,090	<0.00068	0.109	0.0647	0.00130
LK02-5	Exposed	72.7%	0.00348	0.134	0.00680	0.109	1.33	<0.0027	0.000298	1,820	<0.00083	0.0824	0.0615	0.00122
LK02-6	Exposed	72.2%	0.00658	1.25	0.0145	<0.19	6.99	<0.0020	<0.000034	2,755	0.00184	0.0947	0.0782	0.00110
MI2-1	Exposed	72.8%	0.0112	1.20	0.0141	<0.14	9.64	<0.0026	0.0000840	4,250	0.00150	0.160	0.0714	0.00203
MI2-10	Exposed	74.5%	0.0134	0.0759	0.0102	0.156	9.03	<0.0026	0.0000560	2,710	0.00198	0.395	0.0997	0.00117
MI2-14	Exposed	74.1%	0.0100	0.160	0.00990	<0.23	6.43	<0.0019	<0.000097	2,560	0.00114	0.181	0.100	0.00148
MI2-15	Exposed	74.3%	0.0103	0.690	0.0133	<0.25	8.03	<0.0021	<0.00011	2,620	0.00206	0.364	0.0620	0.00192
MI2-16	Exposed	87.1%	0.0148	3.66	0.0146	<0.15	9.55	<0.0028	0.000159	7,330	0.00350	0.248	0.0753	0.00180
MI2-18	Exposed	87.4%	0.0126	0.365	0.0138	<0.12	6.64	<0.0024	0.000263	6,420	0.00250	0.195	0.143	0.00245
MI2-18-2	Exposed	70.6%	0.0121	0.302	0.0180	<0.18	7.11	<0.0019	<0.000033	3,110	0.00206	0.176	0.0648	0.00248
MI2-19	Exposed	74.3%	0.00894	5.10	0.00830	<0.16	3.82	<0.0017	<0.000031	3,290	0.00187	0.196	0.0753	0.00163
MI2-19-2	Exposed	73.4%	0.0104	0.276	0.0214	<0.19	15.9	<0.0020	<0.000034	2,920	0.00427	0.199	0.153	0.00225
MI2-19-3	Exposed	73.0%	0.00900	0.343	0.0132	<0.22	9.14	<0.0023	0.000249	3,050	0.00369	0.246	0.0510	0.00204
MI2-19-4	Exposed	73.6%	0.00971	0.239	0.0260	<0.16	14.0	<0.0016	0.0000720	2,890	0.00411	0.233	0.146	0.00233
MI2-2	Exposed	74.5%	0.0192	0.325	0.00810	<0.25	8.48	<0.0022	<0.00011	2,820	<0.00090	0.0901	0.0799	0.00216
MI2-3	Exposed	72.4%	0.0136	2.47	0.0113	<0.13	5.35	<0.0026	0.0000910	4,330	0.00150	0.184	0.121	0.00226
MI2-4	Exposed	72.1%	0.0120	0.128	0.0238	<0.20	12.7	<0.0017	0.000106	3,090	0.00252	0.249	0.125	0.00188
MI2-5	Exposed	74.1%	0.0128	0.125	0.0235	<0.24	10.8	<0.0020	0.000150	2,890	0.00253	0.124	0.0927	0.00251
MI2-7	Exposed	73.6%	0.0176	0.0981	0.0160	0.325	18.9	<0.0024	0.000115	3,370	0.00530	0.359	0.0951	0.00119
MI2-8	Exposed	72.7%	0.0147	0.0655	0.0137	0.208	7.37	<0.0026	<0.000022	2,810	0.00324	0.256	0.100	0.00156
MI2-8-2	Exposed	72.5%	0.0147	1.01	0.0141	<0.20	14.7	<0.0021	<0.000037	2,450	0.00335	0.364	0.0904	0.00190
MI2-8-3	Exposed	72.0%	0.0139	0.197	0.0180	<0.17	11.8	<0.0018	<0.000030	2,720	0.00286	0.318	0.152	0.00161
MI2-8-4	Exposed	73.6%	0.0156	0.313	0.0118	<0.18	19.1	<0.0019	0.0000360	2,700	0.00521	0.336	0.089	0.00166
MP1-1	Exposed	72.7%	0.0145	0.124	0.0183	0.0900	10.3	<0.0026	0.000113	3,100	0.00239	0.185	0.0953	0.00233
MSAN-1	Exposed	74.1%	0.00214	0.153	0.00960	0.130	4.37	<0.0027	<0.000024	2,720	<0.00082	0.148	0.0605	0.00691
MSAN-1-2	Exposed	74.0%	0.00305	4.96	0.0117	<0.21	11.7	<0.0022	<0.000038	2,980	0.00122	0.223	0.0671	0.00685
MSAN-1-3	Exposed	74.6%	0.00502	0.295	0.00940	<0.20	16.4	<0.0022	<0.000037	3,270	0.00156	0.219	0.0648	0.00699
MSAN-1-4	Exposed	74.6%	0.00565	0.239	0.0103	<0.19	19.5	<0.0020	<0.000034	2,430	0.00124	0.232	0.0623	0.00720
MSAN-2	Exposed	74.0%	0.00790	0.364	0.0164	0.111	21.6	<0.0023	0.0000220	2,720	0.00149	0.276	0.115	0.00351
MSAN-2-2	Exposed	73.5%	0.0120	0.128	0.00900	0.0860	3.70	<0.0027	<0.000024	2,560	<0.00082	0.171	0.0672	0.00224
MSAN-2-3	Exposed	73.1%	0.00701	0.714	0.00950	0.120	19.4	<0.0025	<0.000022	4,300	0.00131	0.267	0.0959	0.00515
NNP-1	Exposed	73.4%	0.00482	0.163	0.0114	0.112	4.64	<0.0025	<0.000022	2,935	0.00186	0.181	0.0986	0.00549
NNP-1-2	Exposed	73.5%	0.00453	0.180	0.0111	0.157	4.24	<0.0027	0.0000910	3,190	0.00298	0.147	0.0645	0.00566
THPD-1	Exposed	73.2%	0.0114	0.112	0.0102	0.183	8.32	<0.0027	<0.000022	3,060	0.00115	0.200	0.0826	0.00165
THPD-2	Exposed	72.1%	0.00718	0.808	0.00910	<0.12	1.86	<0.0023	0.0000540	7,890	<0.0012	0.113	0.0772	0.00153
THPD-3	Exposed	73.4%	0.0108	0.126	0.0124	<0.22	3.50	<0.0019	0.000245	3,480	0.00156	0.283	0.0716	0.00145

Table B.5: Metal concentrations in spotted sandpiper eggs collected in 2013.

Sample ID	Reference vs Exposed	Cu µg/g dw	Fe µg/g dw	Ga µg/g dw	K µg/g dw	Li µg/g dw	Mg µg/g dw	Mn µg/g dw	Mo µg/g dw	Na µg/g dw	Ni µg/g dw	P µg/g dw	Pb µg/g dw	Rb µg/g dw
AL4-1	Reference	2.97	99.9	0.00628	5,250	0.0261	373	2.52	0.0915	6,060	0.0100	8,200	0.00750	1.71
CHCK-1	Reference	3.15	112	0.00609	5,580	0.112	386	1.76	0.0833	5,230	0.0132	8,760	0.00734	1.73
CHCK-2	Reference	3.27	107	0.00792	5,880	0.0963	349	1.96	0.141	5,330	0.0149	9,160	0.00990	1.62
WWR-1	Reference	3.39	84.1	0.00762	5,670	0.0209	319	3.26	0.0935	4,990	0.00980	9,220	0.0120	1.18
WWR-1-2	Reference	3.51	79.6	0.00611	5,910	0.0198	362	3.22	0.0660	4,980	0.00980	8,550	0.0161	1.22
WWR-2	Reference	2.55	88.7	0.00648	5,290	0.0519	318	1.83	0.104	5,730	0.00910	8,580	0.0131	1.54
WWR-3	Reference	3.64	134	0.0129	8,100	0.0520	656	2.48	0.0971	7,010	0.0778	11,100	0.0598	1.29
WWR-4	Reference	3.62	87.8	0.00621	7,320	0.0345	329	2.08	0.0797	6,070	0.00850	8,020	0.00833	1.68
WWR-5	Reference	3.22	61.4	0.00543	4,320	0.0316	326	1.75	0.111	3,880	0.0100	7,700	0.0120	1.48
WWR-6	Reference	3.06	96.9	0.00721	5,660	0.0192	485	2.23	0.0928	5,800	0.0219	9,170	0.0196	0.877
WWR-7	Reference	3.73	124	0.00544	5,640	0.0224	316	1.51	0.127	5,020	0.00697	8,460	0.0124	2.49
WWR-8	Reference	3.32	90.9	0.00551	5,160	0.0237	335	1.52	0.133	5,120	0.00800	8,550	0.0114	1.26
CL11-1	Exposed	2.83	99.5	0.00712	5,950	0.148	348	2.12	0.124	5,200	0.0120	8,850	0.00739	1.40
CL11-2	Exposed	3.47	90.2	0.00545	6,470	0.268	362	2.25	0.0984	5,410	0.00840	7,700	0.0114	2.23
EL1-2	Exposed	3.38	107	0.00656	5,250	0.0348	318	1.63	0.0988	4,870	0.00900	8,570	0.0131	1.20
EL1-2-2	Exposed	3.89	77.8	0.00534	5,910	0.0303	328	1.60	0.0765	5,030	0.00760	7,270	0.00621	1.36
EL1-2-3	Exposed	4.03	90.7	0.00497	6,110	0.0198	313	1.70	0.0880	5,450	0.00734	8,170	0.0102	1.48
EL1-2-4	Exposed	3.58	95.1	0.00567	5,950	0.0262	342	1.65	0.0884	5,510	0.00990	8,650	0.0100	1.29
EL1-3	Exposed	3.45	141	0.00612	4,580	0.0726	328	1.54	0.144	5,030	0.0103	9,050	0.0196	1.36
EL1-4	Exposed	3.26	83.7	0.0113	4,580	0.0687	321	1.51	0.107	5,200	0.0219	8,940	0.00628	1.16
EL1-4-2	Exposed	3.88	116	0.00507	5,620	0.045	363	1.79	0.139	5,480	0.00752	8,580	0.00880	1.31
EL1-4-3	Exposed	3.82	94.0	0.00526	6,000	0.130	388	1.67	0.0958	5,710	0.00758	8,110	0.00564	1.47
EL1-4-4	Exposed	3.70	108	0.00715	4,670	0.0622	378	1.87	0.110	5,680	0.00846	9,080	0.00925	1.34
EL19-3	Exposed	3.35	84.0	0.00574	5,240	0.0342	376	1.53	0.0789	4,820	0.0387	9,210	0.0780	1.01
EL19-3-2	Exposed	3.23	92.6	0.00676	5,150	0.0482	368	1.38	0.0613	4,540	0.00810	9,460	0.00713	0.979
EL19-4	Exposed	3.31	101	0.0147	5,600	0.0524	370	1.40	0.102	5,790	0.0491	8,870	0.0153	1.24
EL19-4-2	Exposed	3.84	81.7	0.00511	5,650	0.0372	387	1.33	0.107	6,090	0.0103	7,290	0.00701	1.19
EL19-5	Exposed	3.76	102	0.00512	5,940	0.172	327	2.21	0.0880	6,550	0.0106	8,570	0.0161	1.38
EL19-7	Exposed	3.24	106	0.00616	5,910	0.0550	365	1.79	0.0971	6,440	0.00970	9,020	0.00665	1.07
EL19-8	Exposed	4.27	117	0.0113	7,470	0.0832	715	1.85	0.125	7,330	0.0602	12,500	0.270	1.88
ELKO-1	Exposed	3.52	111	0.00596	5,840	0.230	299	2.57	0.107	5,850	0.0104	9,000	0.00949	1.08
ELKO-11	Exposed	3.36	86.5	0.00535	5,970	0.0785	357	0.763	0.0727	5,570	0.00890	7,800	0.00924	1.03
ELKO-15	Exposed	3.17	91.5	0.00614	5,890	0.0293	340	1.77	0.0954	5,560	0.00694	9,680	0.00800	0.909
ELKO-17	Exposed	4.30	95.7	0.00459	6,410	0.0757	424	1.46	0.107	6,230	0.00840	7,370	0.00652	1.38
ELKO-2	Exposed	3.83	87.3	0.00603	5,510	0.0388	343	2.19	0.116	6,110	0.0101	8,070	0.105	1.12
ELKO-3	Exposed	3.55	102	0.00728	6,500	0.0260	401	1.08	0.118	5,400	0.0248	9,160	0.0469	1.84
ELKO-4	Exposed	3.52	96.8	0.00665	5,960	0.0973	313	3.16	0.0852	6,170	0.00960	9,500	0.0780	1.15
ELKO-5	Exposed	3.23	93.3	0.00726	6,370	0.0654	322	2.24	0.108	5,970	0.0432	9,280	0.0840	1.52
ELKO-7	Exposed	3.37	106	0.00745	5,230	0.0273	362	1.09	0.0727	5,530	0.00700	9,230	0.00792	1.19
ELKO-7-2	Exposed	3.88	83.5	0.0192	6,240	0.0353	409	1.39	0.0893	5,870	0.0539	8,030	0.0327	0.987
ELKO-7-3	Exposed	3.37	78.5	0.00578	4,910	0.0187	336	1.19	0.132	5,060	0.00769	8,870	0.00536	0.989
ELKO-9	Exposed	3.75	91.7	0.00647	5,350	0.103	364	1.73	0.0816	5,440	0.00930	10,200	2.74	0.641
FO23-5	Exposed	4.15	93.5	0.00546	6,100	0.143	373	1.38	0.101	5,390	0.00970	7,950	0.00919	2.07
FO23-5-2	Exposed	4.52	118	0.00803	6,640	0.113	526	1.79	0.130	5,760	0.0290	9,340	0.0218	2.24
FO23-5-3	Exposed	4.02	116	0.00881	7,110	0.147	605	2.10	0.143	6,080	0.0529	10,700	0.0232	2.25
FO23-6	Exposed	3.56	127	0.00822	6,990	0.0884	643	1.98	0.0957	6,650	0.0352	10,100	0.0123	2.00
FO29-3	Exposed	3.44	104	0.00644	5,620	0.0413	288	1.59	0.129	4,870	0.00960	8,620	0.00540	1.65
FO29-3-2	Exposed	3.62	93.0	0.00564	5,410	0.0562	337	1.42	0.110	5,290	0.0172	8,150	0.00563	1.69
FO29-3-3	Exposed	3.52	98.7	0.00674	5,760	0.110	315	1.42	0.104	5,800	0.00945	8,290	0.00667	1.86
FO29-3-4	Exposed	3.68	91.1	0.00541	6,190	0.0793	347	1.38	0.113	6,210	0.0125	7,990	0.00471	1.63
FO52-1	Exposed	3.20	97.2	0.00613	5,610	0.264	300	1.01	0.105	6,340	0.0119	7,890	0.00598	1.81
FO52-1-2	Exposed	3.71	110	0.00556	6,410	0.138	358	0.837	0.102	7,610	0.0159	7,300	0.00600	1.61
FO52-2	Exposed	4.11	86.9	0.00618	7,040	0.138	393	1.63	0.0954	6,610	0.0117	7,790	0.00786	2.25
FO52-3	Exposed	3.43	127	0.00682	4,260	0.146	330	1.81	0.140	4,160	0.0116	9,690	0.00871	1.09
FO52-4	Exposed	3.32	119	0.00895	5,750	0.110	343	1.31	0.094	7,010	0.0263	8,290	0.00516	1.80
FO52-5	Exposed	2.80	122	0.00790	3,850	0.253	358	3.12	0.140	3,630	0.0124	10,700	0.0106	1.35
FO52-5-2	Exposed	4.10	120	0.00868	7,910	0.296	828	2.46	0.160	8,350	0.0468	10,600	0.0141	2.51
FO52-5-3	Exposed	3.22	98.3	0.00836	7,500	0.255	668	3.12	0.134	7,600	0.0382	10,000	0.0318	2.48
GAPD-1	Exposed	2.99	104	0.00737	7,170	0.0833	399	1.63	0.114	7,160	0.0127	9,350	0.0180	1.24
GAPD-2	Exposed	3.71	116	0.00650	5,790	0.0520	313	1.57	0.120	5,070	0.0100	8,720	0.0202	2.29
GAPD-3	Exposed	3.28	122	0.00512	5,100	0.0172	296	1.18	0.138	5,450	0.0190	8,660	0.0264	1.17
GHPD-1	Exposed	3.22	107	0.00613	5,550	0.06355	414	1.06	0.0829	5,510	0.0135	8,525	0.00678	4.22
GHPD-2	Exposed	3.91	94.3	0.00548	5,670	0.0502	336	2.07	0.107	5,190	0.0116	8,750	0.00700	2.68
GHPD-3	Exposed	3.47	122	0.00704	6,510	0.0222	438	1.80	0.141	5,740	0.0906	8,930	0.0174	2.75
HA7-1	Exposed	3.68	124	0.00688	5,355	0.0345	365	2.62	0.111	5,425	0.0141	9,360	0.00656	1.45
HA7-2	Exposed	4.08	110	0.00972	8,050	0.0356	774	3.47	0.155	7,440	0.0504	11,700	0.0105	2.10
HA7-2-2	Exposed	4.30	115	0.00807	7,110	0.0328	472	3.89	0.174	6,720	0.0283	9,320	0.0101	1.73
HA7-3	Exposed	3.52	145	0.00571	6,370	0.0557	373	2.74	0.0923	6,140	0.00870	8,690	0.00989	1.91
KSP-2	Exposed	3.51	110	0.00597	5,350	0.0905	336	2.16	0.125	5,650	0.0175	9,160	0.00440	1.80
LCCPL-1	Exposed	2.99	92.1	0.00694	6,700	0.0458	456	1.79	0.103	6,080	0.122	9,820	0.00366	1.84
LCCPL-2	Exposed	4.16	124	0.00649	5,630	0.0630	299	2.29	0.0942	6,080	0.0101	8,380	0.00410	2.05
LCCPL-3	Exposed	4.09	130	0.00801	5,550	0.0945	402	1.33	0.109	5,720	0.0156	9,450	0.00903	2.03
LI8-1	Exposed	3.37	99.6	0.00539	5,780	0.0479	321	1.58	0.115	6,760	0.0113	8,670	0.00608	2.20
LI8-1-2	Exposed	3.40	113	0.00698	5,660	0.0621	312	1.38	0.112	5,770	0.0123	8,980	0.00765	2.21
LI8-1-3	Exposed	2.97	103	0.00603	5,690	0.0422	317	1.26	0.108	5,960	0.00960	8,500	0.00556	2.05
LI8-1-4	Exposed	3.28	109	0.0104	5,420	0.0568	333	1.32	0.117	6,040	0.0191	8,580	0.00650	2.00
LI8-4	Exposed	3.67	120	0.00536	6,210	0.100	343	1.35	0.114	6,880	0.0132	8,170	0.00755	2.58
LK02-1	Exposed	3.74	121	0.00547	5,250	0.0336	303	1.62	0.131	6,820	0.00740	9,040	0.00710	1.02
LK02-2	Exposed	3.56	114	0.00575	5,600	0.0730	324	1.64	0.124	4,990	0.00805	8,020	0.0100	1.52
LK02-2-2	Exposed	3.35	94.4	0.00580	4,940	0.0317	260	1.61	0.149	4,400	0.0115	8,590	0.00918	1.62
LK02-2-3	Exposed	3.19	86.9	0.00570	5,570	0.0705	300	1.91	0.106	5,010	0.0160	7,740	0.0111	1.57
LK02-3	Exposed	4.20	67.7	0.00531	5,590	0.0435	362	1.32	0.189	6,290	0.0118	8,150	0.0139	0.991
LK02-3-2	Exposed	3.85	80.8	0.00484	5,620	0.0407	365	1.12	0.182	5,950	0.00844	7,790	0.0132	1.00
LK02-3-3	Exposed	3.73	99.0	0.00558	5,780	0.135	325	1.84	0.159	5,950	0.0117	8,130	0.0166	1.04
LK02-3-4	Exposed	5.01	62.2	0.00353	6,210	0.0437	356	0.994	0.116	6,670	0.00682	6,060	0.00903	1.23
LK02-5	Exposed	3.56	65.8	0.00356	5,370	0.0370	301	1.34	0.0708	5,540	0.00790	5,220	0.00512	1.13
LK02-6	Exposed	3.46	105	0.00567	4,900	0.0397	305	1.66	0.0979	5,110	0.0116	8,335	0.0111	0.760
MI2-1	Exposed	4.19	90.5	0.00688	7,020	0.0528	471	1.27	0.0958	6,480	0.0183	8,600	0.00977	2.07
MI2-10	Exposed	2.96	134	0.00723	4,700	0.0374	333	1.13	0.114	4,700	0.00680	9,180	0.0222	1.18
MI2-14	Exposed	3.29	92.1	0.00481	6,270	0.0562	358	1.52	0.0795	6,080	0.00830	8,000	0.0258	1.51
MI2-15	Exposed	3.57	126	0.00573	5,960	0.0679	390	1.24	0.0899	6,580	0.00880	8,000	0.0202	1.34
MI2-16	Exposed	3.39	121	0.00864	7,130	0.0786	599	1.70	0.154	7,050	0.0277	10,300	0.0459	1.90
MI2-18	Exposed	4.04	114	0.00856	7,260	0.0764	468	1.92	0.0962	5,840	0.0365	9,860	0.0910	1.94
MI2-18-2	Exposed	4.98	111	0.00434	6,510	0.0526	357	1.23	0.0823	5,520	0.00772	7,210	0.0185	1.78
MI2-19	Exposed	3.24	129	0.00713	5,180	0.0443	335	1.94	0.0774	5,790	0.0142	9,180	0.0139	1.24
MI2-19-2	Exposed	3.33	127	0.00521	5,480	0.0750	316	1.85	0.0884	6,100	0.00892	8,570	0.0247	1.53
MI2-19-3	Exposed	3.38	135	0.00618	5,330	0.0551	357	1.76	0.0811	5,510	0.00795	9,080	0.0170	1.41
MI2-19-4	Exposed	3.45	121	0.00572	5,360	0.0613	345	1.53	0.0820	5,770	0.00934	8,300	0.0199	1.47
MI2-2	Exposed	2.96	96.1	0.00583	5,830	0.0530	355	1.35	0.0774	5,790	0.00870	8,420	0.00798	1.55
MI2-3	Exposed	4.34	94.4	0.00775	6,220	0.0510	416	2.17	0.111	6,010	0.0214	9,070	0.0106	2.26
MI2-4	Exposed	3.27	94.8	0.00605	4,770	0.0363	364	1.96	0.0997	4,760	0.0108	9,560	0.00885	1.61
MI2-5	Exposed	3.49	103	0.00496	5,700	0.0541	311	2.59	0.112	4,270	0.0122	8,730	0.00931	1.79
MI2-7	Exposed	3.20	121	0.00730	4,500	0.0271	321	1.57	0.109	4,310	0.00900	9,600	0.101	1.36
MI2-8	Exposed	2.92	129	0.00634	4,790	0.0327	303	2.44	0.100	4,630	0.00950	9,080	0.0141	1.30
MI2-8-2	Exposed	3.73	121	0.00616	5,030	0.0594	317	1.71	0.0851	4,620	0.123	8,530	0.0324	1.32
MI2-8-3	Exposed	3.37	131	0.00601	4,990	0.0302	343	2.15	0.0865	4,700	0.00896	8,680	0.0157	1.21
MI2-8-4	Exposed	3.78	137	0.00454	4,740	0.0490	323	1.83	0.0835	4,630	0.00760	9,450	0.0421	1.18
MP1-1	Exposed	2.84	111	0.00724	5,020	0.139	303	2.30	0.129	4,220	0.0109	10,300	0.0289	1.34
MSAN-1	Exposed	3.80	65.2	0.00408	6,520	0.0774	378	1.16	0.138	6,230	0.0118	5,970	0.00703	1.75
MSAN-1-2	Exposed	3.40	96.2	0.00659	6,070	0.0774	377	1.52	0.136	6,020	0.0171	7,390	0.00850	1.52
MSAN-1-3	Exposed	3.60	92.5	0.00509	6,070	0.155	419	1.47	0.122	6,200	0.0110	7,990	0.00950	1.57
MSAN-1-4	Exposed	3.32	92.2	0.00465	6,280	0.240	360	1.21	0.118	6,110	0.00726	7,440	0.0106	1.74
MSAN-2	Exposed	2.84	104	0.00611	4,470	0.110	347	1.90	0.138	4,290	0.0276	8,660	0.00887	1.24
MSAN-2-2	Exposed	3.56	108	0.00520	5,630	0.0898	365	1.41	0.0625	5,590	0.0103	7,620	0.00711	1.57
MSAN-2-3	Exposed	2.85	97.1	0.00675	5,490	0.104	393	1.61	0.126	4,860	0.0173	8,330	0.00877	1.62
NNP-1	Exposed	3.53	99.1	0.00716	5,345	0.0883	317	1.88	0.128	5,435	0.0121	9,155	0.00740	1.58
NNP-1-2	Exposed	3.63	94.4	0.0071	5,060	0.0691	322	2.16	0.135	5,020	0.0107	9,070	0.00755	1.44
THPD-1	Exposed	3.63	139	0.00660	5,150	0.0798	367	2.16	0.131	5,190	0.0199	9,130	0.00500	1.15
THPD-2	Exposed	3.71	88.6	0.00849	6,750	0.0303	497	1.79	0.101	5,930	0.0369	10,300	0.0121	1.38
THPD-3	Exposed	3.51	121	0.00493	5,110	0.0546	338	1.80	0.123	5,470	0.0118	8,970	0.00302	2.82

Table B.5: Metal concentrations in spotted sandpiper eggs collected in 2013.

Sample ID	Reference vs Exposed	Re	Sb	Se	Sn	Sr	Th	Ti	Tl	U	V	Y	Zn	Zr
		µg/g dw	µg/g dw	µg/g dw	µg/g dw	µg/g dw	µg/g dw	µg/g dw	µg/g dw	µg/g dw	µg/g dw	µg/g dw	µg/g dw	µg/g dw
AL4-1	Reference	0.000340	<0.00036	2.31	<0.00064	2.95	<0.000085	0.0491	0.0306	<0.000083	0.00207	0.000530	36.1	0.00156
CHCK-1	Reference	0.000360	<0.00039	6.01	<0.00033	1.94	<0.000072	0.0405	0.0300	0.0000750	0.00259	0.000320	44.7	0.00116
CHCK-2	Reference	0.000290	<0.00047	8.11	<0.00040	3.14	<0.000079	0.0516	0.0210	0.000170	0.00404	0.000640	42.4	0.00260
WWR-1	Reference	0.000330	<0.00039	2.52	<0.00033	2.33	<0.000073	0.0443	0.0167	<0.000053	0.00280	0.000540	38.1	0.00130
WWR-1-2	Reference	0.000240	<0.00043	2.63	<0.00037	3.16	<0.000085	0.0538	0.0143	0.0000680	0.00328	0.000790	40.6	<0.00094
WWR-2	Reference	0.000610	0.000630	2.75	<0.00037	5.32	<0.000074	0.0483	0.0330	0.0000900	0.00348	0.000500	39.1	0.00114
WWR-3	Reference	0.000570	0.00406	2.47	0.00295	5.92	<0.000062	0.0946	0.0251	0.0000890	0.00437	0.00526	51.0	0.000330
WWR-4	Reference	<0.00017	<0.00041	2.38	<0.00035	2.44	<0.000060	0.0555	0.0139	<0.000055	0.00241	0.00108	38.1	0.00164
WWR-5	Reference	0.00074	0.000890	6.69	<0.00030	3.58	<0.000078	0.0432	0.0129	0.000370	0.00177	0.000430	36.3	<0.00077
WWR-6	Reference	<0.000310	<0.00067	2.10	<0.00071	2.73	<0.000068	0.0729	0.0242	0.000055	0.00355	0.00108	42.2	0.000370
WWR-7	Reference	0.00055	0.000840	3.42	<0.00083	2.82	<0.00010	0.0486	0.0279	0.000130	0.00221	0.000730	45.9	0.000660
WWR-8	Reference	0.00114	<0.00037	2.57	<0.00065	1.60	<0.000087	0.0449	0.0345	0.000147	0.00233	0.000630	40.7	0.000750
CL11-1	Exposed	0.000500	0.000660	9.75	<0.00065	2.35	<0.000086	0.0410	0.0215	0.000157	0.00407	0.00193	42.6	0.00558
CL11-2	Exposed	0.000350	0.000630	7.21	<0.00066	1.56	<0.000088	0.0485	0.0290	0.000128	0.00317	<0.00016	39.7	0.00478
EL1-2	Exposed	0.000990	0.000440	4.64	<0.00032	4.08	<0.000064	0.0507	0.0338	0.000123	0.00377	0.000810	48.1	0.00187
EL1-2-2	Exposed	0.000390	<0.00038	4.84	<0.00082	3.41	<0.000095	0.0529	0.0288	0.0000490	0.00159	0.000180	37.7	<0.00054
EL1-2-3	Exposed	0.000470	<0.00041	4.74	<0.00087	3.12	<0.00010	0.0473	0.0319	<0.000044	0.00244	0.000280	38.5	<0.00057
EL1-2-4	Exposed	0.000570	<0.00034	4.83	<0.00061	3.72	<0.000081	0.0411	0.0281	<0.000079	0.00726	0.000470	44.6	0.000850
EL1-3	Exposed	0.000940	<0.00041	5.30	<0.00089	3.33	<0.000097	0.0446	0.0483	0.000173	0.0133	0.000710	42.9	0.00220
EL1-4	Exposed	0.000480	<0.00044	4.65	<0.00037	3.24	<0.000074	0.0479	0.0257	0.000115	0.00321	0.00734	46.0	0.0125
EL1-4-2	Exposed	0.000570	<0.00041	5.14	<0.00087	3.56	<0.00010	0.0605	0.0388	0.000160	0.0123	0.000300	51.5	0.00289
EL1-4-3	Exposed	0.000200	<0.00039	5.25	<0.00084	3.14	<0.00010	0.0569	0.0291	<0.000043	0.0116	0.000230	42.7	0.00112
EL1-4-4	Exposed	<0.00021	<0.00042	4.40	<0.00089	3.71	<0.00012	0.0516	0.0264	0.000102	0.0121	0.000420	46.6	0.00264
EL19-3	Exposed	0.000370	0.00772	3.87	0.00276	3.56	0.000166	0.0418	0.0159	0.000138	0.00305	0.000640	67.0	0.00418
EL19-3-2	Exposed	0.000180	<0.00035	4.49	<0.00030	4.28	<0.000059	0.0513	0.0164	0.000123	0.00308	0.000220	60.0	0.00369
EL19-4	Exposed	0.00101	<0.00035	5.12	0.00102	2.44	<0.000082	0.0611	0.0256	<0.000080	0.00277	0.00825	46.7	0.0221
EL19-4-2	Exposed	0.000750	<0.00042	5.15	<0.00089	1.86	<0.000084	0.0501	0.0273	0.0000800	0.0118	0.000560	34.7	0.0143
EL19-5	Exposed	0.00114	<0.00032	5.58	<0.00058	3.58	<0.000076	0.0533	0.0275	0.000140	0.00259	0.00104	41.2	0.00286
EL19-7	Exposed	0.000890	<0.00037	4.39	<0.00066	3.43	<0.000087	0.0501	0.0165	0.000157	0.00291	0.000230	45.3	0.00176
EL19-8	Exposed	0.000540	0.00355	4.61	0.00197	12.9	<0.000061	0.0911	0.0404	0.000190	0.00566	0.000940	51.0	0.000330
ELKO-1	Exposed	0.000570	<0.00041	6.26	<0.00035	3.74	<0.000076	0.0400	0.0179	0.0000710	0.00406	0.000560	49.6	0.00999
ELKO-11	Exposed	<0.00027	<0.00037	4.46	<0.00066	2.59	<0.000087	0.0473	0.0168	<0.000085	0.00246	0.000160	40.8	0.000900
ELKO-15	Exposed	0	<0.00042	4.46	<0.00090	3.48	0	0.0437	0.0140	<0.000045	0.00270	0.000240	50.4	0.000850
ELKO-17	Exposed	<0.00028	<0.00038	6.85	<0.00068	2.71	<0.00009	0.0607	0.0246	<0.000088	0.00848	0.000220	38.1	<0.00062
ELKO-2	Exposed	0.000540	<0.00043	5.91	<0.00037	2.70	<0.000076	0.0586	0.0208	0.000113	0.00303	0.000590	43.2	<0.00093
ELKO-3	Exposed	0.000320	<0.00053	5.33	<0.00056	2.87	<0.000053	0.0615	0.0286	0.000176	0.00428	0.000840	46.6	0.000290
ELKO-4	Exposed	0	<0.00045	5.02	<0.00038	3.14	0	0.0487	0.0150	0.000124	0.00298	0.000340	49.1	<0.00097
ELKO-5	Exposed	0.000320	0.00149	5.55	0.00140	3.42	<0.000055	0.0821	0.0235	0.000203	0.00486	0.00106	52.2	0.000290
ELKO-7	Exposed	<0.00020	<0.00041	4.37	<0.00036	3.44	<0.000070	0.0380	0.00973	0.0000620	0.00312	0.000210	53.6	0.00111
ELKO-7-2	Exposed	<0.00029	0.00124	4.32	0.00284	2.97	<0.000064	0.0792	0.00959	0.000141	0.00413	0.0108	41.7	0.000340
ELKO-7-3	Exposed	<0.00021	<0.00047	3.89	<0.0010	2.05	<0.00012	0.0453	0.00704	<0.000051	0.00290	0.000230	38.2	0.00256
ELKO-9	Exposed	<0.00025	<0.00035	4.94	<0.00063	3.59	<0.000083	0.0423	0.0133	<0.000081	0.00409	0.000360	54.7	0.00131
FO23-5	Exposed	0.000590	<0.00034	7.00	<0.00061	2.68	<0.000081	0.0592	0.0342	0.000104	0.00265	0.000240	41.6	0.00266
FO23-5-2	Exposed	0.000660	0.00219	6.66	0.00123	5.93	<0.000066	0.0656	0.0438	0.000226	0.00431	0.000570	50.5	0.000350
FO23-5-3	Exposed	0.000660	0.00153	4.88	0.00123	6.45	<0.000056	0.0784	0.0454	0.000131	0.00463	0.000570	50.8	0.000300
FO23-6	Exposed	0.00131	0.000710	6.45	<0.00068	5.75	<0.000065	0.0783	0.0444	0.000165	0.00342	0.000890	46.2	0.000350
FO29-3	Exposed	0.000620	<0.00043	6.33	0.000570	1.17	<0.000065	0.0440	0.0227	0.0000930	0.00382	0.000380	38.7	0.000980
FO29-3-2	Exposed	0.000420	0.000810	7.13	<0.00078	2.38	<0.000090	0.0516	0.0210	0.000121	0.00335	0.000570	41.0	0.00155
FO29-3-3	Exposed	0.000330	0.000720	6.02	<0.00091	2.30	<0.00010	0.0635	0.0212	0.000111	0.00373	0.000870	40.7	0.00214
FO29-3-4	Exposed	0.000680	0.000490	7.10	<0.00058	1.87	<0.000077	0.0560	0.0235	<0.000075	0.00931	0.000410	35.9	<0.00053
FO52-1	Exposed	0.000760	<0.00043	10.4	<0.00037	1.94	<0.000073	0.0441	0.0441	0.0000650	0.00365	0.000510	40.9	0.00189
FO52-1-2	Exposed	0	0.000590	16.5	<0.00039	1.90	0	0.0613	0.0470	<0.000061	0.00351	0.000360	37.0	<0.00097
FO52-2	Exposed	0.000420	0.000390	6.87	<0.00030	2.83	<0.000060	0.0632	0.0428	0.0000530	0.00407	0.000150	35.7	<0.00077
FO52-3	Exposed	0.000510	<0.00043	10.5	<0.00037	2.48	<0.000073	0.0505	0.0293	0.0000990	0.00390	0.00105	48.1	0.00125
FO52-4	Exposed	<0.00019	0.00217	9.94	<0.00089	1.31	<0.00010	0.0684	0.0489	0.0000520	0.00368	0.00489	44.9	0.00989
FO52-5	Exposed	0.000300	<0.00043	5.95	<0.00093	2.98	<0.00011	0.0828	0.0263	0.000134	0.00290	0.000440	68.5	0.00226
FO52-5-2	Exposed	0.000300	<0.00065	6.67	0.00129	6.31	<0.000066	0.0944	0.0399	0.000150	0.00534	0.00103	52.0	0.000360
FO52-5-3	Exposed	0.000370	0.000780	5.86	0.000790	5.68	<0.000063	0.0728	0.0357	0.000108	0.00444	0.000660	49.1	0.000340
GAPD-1	Exposed	0.000260	<0.00044	4.17	<0.00038	8.80	<0.000067	0.0425	0.0539	0.000221	0.00584	0.00101	44.1	0.00105
GAPD-2	Exposed	0.000250	<0.00039	5.27	<0.00034	2.83	<0.000069	0.0480	0.0479	<0.000054	0.00373	0.000440	46.1	<0.00085
GAPD-3	Exposed	0.000690	0.000550	4.39	<0.00066	2.54	<0.000087	0.0448	0.0470	0.000153	0.00263	0.000880	39.0	0.00347
GHPD-1	Exposed	<0.00028	<0.00040	8.78	<0.00070	2.74	<0.000092	0.0519	0.0630	<0.000090	0.00418	<0.00017	39.8	0.00188
GHPD-2	Exposed	0.000340	<0.00038	6.31	<0.00068	2.38	<0.000090	0.0440	0.0344	<0.000088	0.00386	0.000250	49.9	0.00197
GHPD-3	Exposed	0.000540	<0.00061	13.2	0.000760	2.48	<0.000062	0.0652	0.0395	0.000131	0.00364	0.000530	43.4	0.000340
HA7-1	Exposed	0.000520	<0.00044	9.85	<0.00037	2.63	<0.000073	0.0507	0.0538	0.0000650	0.00207	0.000505	50.8	0.00491
HA7-2	Exposed	<0.00030	<0.00066	17.1	<0.00070	5.21	<0.000067	0.0874	0.0444	0.0000520	0.00472	0.000730	51.5	0.000360
HA7-2-2	Exposed	<0.00030	0.00104	16.3	<0.00069	2.64	0.000149	0.0750	0.0453	0.0000890	0.00395	0.000580	47.8	0.000350
HA7-3	Exposed	0.00103	0.000410	10.5	<0.00066	2.53	<0.000087	0.0541	0.0660	0.000100	0.00431	0.000440	41.9	0.00246
KSP-2	Exposed	0.000230	0.000510	15.9	<0.00083	1.07	<0.000095	0.0543	0.0468	0.000136	0.00351	0.000520	45.3	0.00267
LCCPL-1	Exposed	<0.00026	0.000590	24.9	<0.00060	4.36	<0.000057	0.0795	0.0335	0.0000510	0.00318	0.000260	57.9	0.000310
LCCPL-2	Exposed	0.000330	<0.00042	32.3	<0.00036	2.56	<0.000071	0.0499	0.0317	0.0000820	0.00291	0.000180	44.7	0.00130
LCCPL-3	Exposed	0.000320	0.000580	18.6	0.000550	3.65	<0.000053	0.0489	0.0701	0.0000830	0.00338	0.000700	51.8	0.000280
LI8-1	Exposed	0.000680	0.000420	5.18	<0.00065	2.65	<0.000086	0.0480	0.0691	0.000171	0.00313	0.000320	43.6	0.00396
LI8-1-2	Exposed	0.000340	<0.00043	7.78	<0.00037	4.26	<0.000073	0.0518	0.0484	0.000160	0.00262	0.000360	53.7	0.00108
LI8-1-3	Exposed	0.000390	0.000400	8.94	<0.00032	3.47	<0.000062	0.0568	0.0424	0.000156	0.00233	0.000190	45.0	<0.0008
LI8-1-4	Exposed	0.000420	0.000510	8.69	<0.00033	4.28	0.000145	0.0807	0.0428	0.000170	0.00313	0.00307	47.9	0.0509
LI8-4	Exposed	0.000380	0.000440	4.20	<0.00069	3.62	<0.000092	0.0478	0.0688	<0.000090	0.00342	0.000270	45.8	0.00198
LK02-1	Exposed	0.000300	<0.00035	4.91	<0.00063	2.00	<0.000083	0.0449	0.0111	<0.000081	0.00470	0.000240	45.6	0.00155
LK02-2	Exposed	0.00100	<0.00041	5.78	<0.00087	2.78	0	0.0460	0.0510	0.000125	0.00344	0.000360	43.2	<0.00057
LK02-2-2	Exposed	0.000850	<0.00040	5.42	<0.00035	2.07	<0.000068	0.0487	0.0388	0.000126	0.00356	0.000850	38.5	0.00463
LK02-2-3	Exposed	0.00103	0.000510	5.64	0.000370	3.19	<0.000065	0.0702	0.0344	0.000114	0.00458	0.000580	34.7	0.00103
LK02-3	Exposed	0.00142	0.000420	7.40	<0.00080	2.49	<0.00012	0.0481	0.0560	0.0000855	0.00798	0.000555	38.0	0.00408
LK02-3-2	Exposed	0.00130	0.000590	7.58	<0.00082	2.60	<0.000095	0.0488	0.0414	0.000158	0.0108	0.000670	40.8	0.00138
LK02-3-3	Exposed	0.00143	0.00461	6.52	<0.00089	3.23	<0.000088	0.0418	0.0427	0.000164	0.00394	0.000630	46.9	0.00173
LK02-3-4	Exposed	0.000900	<0.00037	8.44	<0.00080	2.48	<0.00010	0.0588	0.0810	0.000127	0.00375	0.000410	28.4	0.000580
LK02-5	Exposed	<0.00021	<0.00045	5.58	<0.00039	1.24	<0.000076	0.0625	0.0193	<0.000061	0.00213	<0.00015	24.8	0.00145
LK02-6	Exposed	0.000620	0.000590	5.00	0.000915	3.68	<0.00010	0.0469	0.0276	0.000210	0.00305	0.000915	44.7	0.00439
MI2-1	Exposed	0.000830	0.000690	4.32	<0.00070	4.48	0.000102	0.0852	0.0464	0.0000870	0.00339	0.000900	42.6	0.000360
MI2-10	Exposed	0.000260	<0.00042	3.21	<0.00036	3.47	<0.000073	0.0482	0.0265	0.0000740	0.00274	0.000570	55.4	<0.00091
MI2-14	Exposed	0.000310	<0.00036	4.61	<0.00064	3.02	<0.000085	0.0479	0.0323	<0.000083	0.00304	0.000320	41.2	0.000920
MI2-15	Exposed	<0.00029	<0.00040	4.47	<0.00071	3.57	0.000100	0.0649	0.0363	<0.000091	0.00324	0.000680	37.8	0.00202
MI2-16	Exposed	0.000380	0.00210	4.24	0.00123	6.68	<0.000071	0.0870	0.0461	0.0000970	0.00726	0.00129	50.1	0.000380
MI2-18	Exposed	<0.00027	<0.00059	3.60	0.00132	5.69	<0.00006	0.0865	0.0452	0.0000960	0.00320	0.000600	50.1	0.000320
MI2-18-2	Exposed	0.000210	<0.00040	4.51	<0.00085	3.31	<0.000098	0.0480	0.0512	0.0000470	0.00339	0.000490	41.9	0.00165
MI2-19	Exposed	0.000340	0.00123	4.36	<0.00078	2.83	<0.000091	0.0496	0.0358	<0.000039	0.00282	0.00205	45.6	0.00315
MI2-19-2	Exposed	0.00124	<0.00042	5.04	<0.00091	3.45	<0.00010	0.0359	0.0692	0.0000720	0.0136	0.000610	42.6	0.00246
MI2-19-3	Exposed	0.000770	<0.00048	3.97	<0.0010	3.27	<0.000094	0.0524	0.0481	0.000275	0.00274	0.000700	45.7	0.0100
MI2-19-4	Exposed	0.00110	0.000360	5.33	<0.00074	3.40	<0.00010	0.0451	0.0567	0.0000780	0.0110	0.000860	42.9	0.00396
MI2-2	Exposed	<0.00029	<0.00040	3.83	<0.00071	3.45	<0.000094	0.0499	0.0233	<0.000092	0.00336	0.000500	44.4	0.00258
MI2-3	Exposed	0.000380	0.000710	4.54	<0.00068	4.29	<0.000065	0.0676	0.0598	0.0000410	0.00393	0.00180	41.7	0.000350
MI2-4	Exposed	0.000540	0.000460	4.00	<0.00055	3.55	<0.000073	0.0432	0.0435	0.000104	0.00421	0.000510	42.7	0.00206
MI2-5	Exposed	0.000560	<0.00037	4.78	<0.00066	2.95	<0.000088	0.0445	0.0460	0.000102	0.00377	0.000380	42.6	0.000880
MI2-7	Exposed	0.000590	<0.00039	3.30	<0.00034	4.32	<0.000072	0.0411	0.0430	0.000221	0.00295	0.000670	55.8	0.00190
MI2-8	Exposed	0.000350	<0.00043	4.23	<0.00037	3.12	<0.000071	0.0462	0.0398	<0.000058	0.00302	0.000910	47.0	0.00842
MI2-8-2	Exposed	0.000360	<0.00044	4.11	<0.0010	3.44	<0.00011	0.0487	0.0453	<0.000048	0.00291	0.00106	51.3	0.00112
MI2-8-3	Exposed	0.000340	<0.00038	3.91	<0.00082	3.32	<0.000089	0.0464	0.0418	0.0000450	0.0118	0.000600	48.1	0.00128
MI2-8-4	Exposed	0.000370	<0.00039	3.96	<0.00085	4.02	<0.000097	0.0457	0.0450	0.000100	0.00373	0.00133	55.3	0.00395
MP1-1	Exposed	0.000270	0.000560	6.32	<0.00037	6.09	<0.000066	0.0465	0.0247	<0.000058	0.00230	0.000630	51.0	0.00112
MSAN-1	Exposed	0.000290	0.000500	13.2	<0.00038	2.05	<0.000075	0.0676	0.0196	0.000104	0.00274	0.000310	24.5	0.00221
MSAN-1-2	Exposed	<0.00021	0.00121	9.34	0.00104	2.90	0.000150	0.827	0.0234	0.000300	0.0122	0.00103	34.6	0.00778
MSAN-1-3	Exposed	<0.00020	0.000560	9.95	<0.0010	3.29	<0.00011	0.0654	0.0264	0.000133	0.00255	0.000560	38.5	0.00216
MSAN-1-4	Exposed	<0.00019	<0.00041	11.6	<0.00089	2.98	<0.00010	0.0435	0.0247	0.000100	0.00249	0.000600	37.8	0.00211
MSAN-2	Exposed	0.000280	0.000710	8.58	<0.00033	3.14	<0.000065	0.0585	0.0190	0.00226	0.00525	0.000590	37.3	0.00274
MSAN-2-2	Exposed	0.000330	<0.00044	9.40	<0.00038	1.76	<0.000075	0.0494	0.0213	0.000157	0.00277	0.000220	37.8	0.00101
MSAN-2-3	Exposed	0.000220	0.000430	8.13	<0.00036	4.42	<0.000071	0.0667	0.0196	0.00112	0.00540	0.000620	37.3	0.00433
NNP-1	Exposed	0.000300	0.000590	8.99	0.000535	2.14	<0.000068	0.0411	0.0250	0.000471	0.00360	0.000295	44.5	0.00154
NNP-1-2	Exposed	<0.00021	<0.00044	8.78	<0.00038	2.19	<0.000075	0.0542	0.0250	0.000470	0.00256	0.000380	40.4	0.00296
THPD-1	Exposed	0.000460	<0.00044	13.7	<0.00038	4.49	<0.000070	0.0501	0.0402	0.0000980	0.00217	0.000480	47.7	<0.00096
THPD-2	Exposed	0.000380	0.00143	18.8	0.000660	8.70	<0.000059	0.0640	0.0465	0.000130	0.00304	0.000580	39.2	0.000320
THPD-3	Exposed	<0.00025	<0.00035	18.0	<0.00062	4.10	<0.000082	0.0466	0.0569	<0.000080	0.00284	0.000190	42.8	0.00217

Table B.6: Metal concentrations in spotted sandpiper eggs collected in 2014.

Sample ID	Reference vs Exposed	Moisture %	Ag µg/g dw	Al µg/g dw	As µg/g dw	B µg/g dw	Ba µg/g dw	Be µg/g dw	Bi µg/g dw	Ca µg/g dw	Cd µg/g dw	Co µg/g dw	Cr µg/g dw	Cs µg/g dw	Cu µg/g dw
CHCK-1	Reference	90%	0.0147	0.407	0.0201	<0.10	4.6	<0.0023	0.000284	2,950	0.00174	0.195	0.124	0.00246	3.24
WWR-4	Reference	75%	0.00555	0.0996	0.0193	0.121	6.32	<0.0045	<0.000045	2,707	0.0011	0.143	0.0643	0.000912	3.50
WWR-5	Reference	84%	0.00694	0.228	0.0215	0.13	11.7	<0.0045	0.000198	2,950	0.0015	0.131	0.07	0.00233	3.32
WWR-7	Reference	74%	0.0047	0.209	0.0174	0.16	11.1	<0.0047	0.000068	2,830	0.0014	0.143	0.0642	0.00208	3.18
WWR-8	Reference	81%	0.00361	0.206	0.0185	0.18	6.1	<0.0046	0.000277	2,750	0.0014	0.172	0.0606	0.000701	2.88
WWR-9	Reference	88%	0.0107	0.202	0.0403	0.12	11.4	<0.0047	0.000463	12,200	0.0012	0.121	0.0677	0.00181	3.86
WWRBP-1	Reference	83%	0.00497	0.252	0.0205	0.13	8.52	<0.0048	0.000818	7,420	0.0023	0.0932	0.0828	0.00154	4.21
WWRBP-2	Reference	80%	0.00773	0.122	0.0292	<0.11	16.4	<0.0048	0.000125	3,320	<0.0011	0.111	0.0651	0.00261	3.46
CL11-1	Exposed	74%	0.0103	0.168	0.0139	<0.099	11.6	<0.0022	<0.000057	3,050	0.0025	0.279	0.0797	0.00426	2.99
CL11-2	Exposed	74%	0.00608	0.14	0.0118	<0.12	5.92	<0.0025	<0.000065	2,340	0.00303	0.199	0.0642	0.00281	3.52
CL11-3	Exposed	75%	0.00927	0.313	0.0109	<0.12	11.5	<0.0026	<0.000067	2,620	0.00133	0.22	0.0695	0.00378	3.9
EAPD-1	Exposed	74%	0.0108	0.0778	0.0138	<0.096	3.74	<0.0021	0.000148	3,000	0.00134	0.224	0.0569	0.0023	3.5
EAPD-2-1	Exposed	74%	0.00696	0.859	0.013	<0.11	1.95	<0.0025	0.00013	2,880	0.00241	0.185	0.0534	0.00119	3.93
EAPD-2-2	Exposed	73%	0.00737	0.118	0.0147	<0.10	4.87	<0.0023	0.000082	2,960	0.00278	0.288	0.0717	0.00136	3.58
EAPD-3	Exposed	81%	0.00928	0.227	0.0106	<0.12	6.83	<0.0026	0.000246	9,610	0.00157	0.201	0.0643	0.0022	4.23
EAPD-4	Exposed	74%	0.00605	0.11	0.0115	<0.12	7.4	<0.0026	0.000105	2,460	0.00275	0.26	0.0754	0.00154	3.57
EL1-3	Exposed	81%	0.0071	0.234	0.024	<0.11	10.2	<0.0025	0.000156	4,230	0.00286	0.171	0.078	0.00143	3.52
EL1-4	Exposed	73%	0.00947	0.108	0.0177	<0.10	6.75	<0.0022	<0.000057	2,560	0.00292	0.234	0.0792	0.00199	3.55
EL1-6	Exposed	84%	0.00643	0.431	0.0291	0.119	5.87	<0.0033	0.000560	3,445	0.00116	0.135	0.107	0.00173	3.18
EL1-8	Exposed	73%	0.00836	0.348	0.0127	0.11	6.8	<0.0032	0.000054	2,720	0.00271	0.382	0.084	0.00152	3.61
EL19-1	Exposed	74%	0.00648	0.156	0.0229	0.13	8.1	<0.0033	0.000142	2,770	0.00127	0.135	0.0751	0.00216	4.12
EL19-2	Exposed	74%	0.00947	0.156	0.0221	<0.096	4.92	<0.0031	0.00005	2,570	0.00254	0.115	0.086	0.00129	3.66
EL19-3	Exposed	75%	0.00319	0.241	0.0241	<0.10	3.1	<0.0034	0.00016	2,650	0.0024	0.114	0.0923	0.00127	3.73
EL19-4	Exposed	80%	0.0048	0.209	0.0296	<0.10	9.76	<0.0034	0.000256	3,060	0.00155	0.14	0.0865	0.00126	3.44
EL19-6	Exposed	81%	0.0127	0.312	0.0282	0.13	8.21	<0.0034	0.000111	4,980	0.00197	0.139	0.0833	0.000978	3.24
EL19-7	Exposed	60%	0.00599	0.23	0.0277	0.107	1.79	<0.0031	<0.000031	3,010	0.00336	0.0921	0.122	0.00136	3.17
ELKO-1	Exposed	82%	0.0113	0.323	0.0162	<0.10	6.18	<0.0034	0.000316	2,950	0.0024	0.101	2.24	0.00103	2.88
ELKO-2	Exposed	74%	0.00683	0.177	0.0088	<0.10	3.83	<0.0034	0.00170	2,765	0.00206	0.0772	0.0650	0.000968	3.37
FO10-1	Exposed	77%	0.0136	0.303	0.0221	0.14	11.9	<0.0029	0.000226	11,700	0.00229	0.236	0.0808	0.00177	4.06
FO10-1-2	Exposed	70%	0.0116	0.187	0.0179	0.13	9.62	<0.0031	0.000045	3,070	0.00187	0.175	0.0696	0.00129	4.24
FO10-2	Exposed	74%	0.00827	0.176	0.0145	0.12	8.89	<0.0033	0.000097	2,490	0.00156	0.205	0.0615	0.0017	4.21
FO10-3	Exposed	71%	0.0147	0.201	0.0271	0.1	3.53	<0.0033	0.000072	2,800	0.00395	0.137	0.0826	0.00124	4.2
FO23-1	Exposed	75%	0.00887	0.205	0.0295	0.142	4.92	<0.0031	0.000039	2,710	0.00087	0.13	0.0739	0.00162	3.32
FO23-2	Exposed		0.0163	0.175	0.0259	0.106	9.85	<0.0031	0.000074	3,210	0.00126	0.222	0.0811	0.00121	3.09
FO23-3	Exposed	74%	0.0164	0.172	0.0243	0.12	7.03	<0.0033	<0.000034	2,890	0.00144	0.212	0.066	0.00213	3.27
FO23-4	Exposed	74%	0.00895	0.178	0.0133	0.098	3.89	<0.0030	0.000034	2,460	0.00162	0.104	0.0707	0.0018	3.19
FO23-4-2	Exposed	87%	0.00878	0.26	0.0117	0.116	8.97	<0.0030	0.000083	10,200	0.00287	0.128	0.0775	0.00232	3.59
FO23-4-3	Exposed	86%	0.00868	0.177	0.0111	0.11	5.36	<0.0032	0.000135	9,610	0.00225	0.109	0.0689	0.0027	3.58
FO23-5	Exposed	79%	0.0172	0.179	0.0249	0.11	8.29	<0.0032	0.000339	4,890	0.00288	0.14	0.0751	0.00242	4.25
FO29-1	Exposed	82%	0.0333	0.231	0.0202	0.18	17.8	<0.0034	0.000394	9,000	0.00193	0.13	0.149	0.0015	3.73
FO29-2	Exposed	75%	0.0217	0.101	0.0258	0.11	10.4	<0.0031	0.000045	2,685	0.00284	0.104	0.0730	0.000826	3.78
FO52-1	Exposed	73%	0.0124	0.128	0.0218	0.12	2.77	<0.0032	<0.000033	2,360	0.00225	0.102	0.0774	0.00183	3.45
FO52-1-2	Exposed	73%	0.0158	0.437	0.018	0.15	15.3	<0.0033	0.000049	2,660	0.00199	0.122	0.0746	0.00204	4.17
FO52-1-3	Exposed	74%	0.0142	0.163	0.0234	0.14	6.24	<0.0034	0.000041	2,470	0.00248	0.115	0.104	0.00202	4.67
FO52-1-4	Exposed	74%	0.0177	0.167	0.0165	0.128	23.4	<0.0031	0.000038	2,970	0.00279	0.119	0.069	0.00228	4.13
FO52-2	Exposed	75%	0.0163	0.076	0.0212	0.147	13.6	<0.0033	0.000044	2,495	0.00204	0.169	0.0624	0.00209	4.02
FO52-3	Exposed	66%	0.0119	2.22	0.0089	0.193	7.6	<0.0031	0.000053	2,940	0.00388	0.133	0.0744	0.00174	4.53
FO52-4	Exposed	73%	0.0253	0.0581	0.028	0.16	3.38	<0.0033	0.000172	2,610	0.00272	0.146	0.0769	0.00102	3.65
FO52-4-2	Exposed	75%	0.0263	0.10	0.0251	0.18	10.5	<0.0034	0.000061	2,440	0.00212	0.192	0.0578	0.00132	3.58
FO52-4-3	Exposed	74%	0.0238	0.0897	0.0269	0.16	11	<0.0034	0.00244	2,550	0.00234	0.204	0.0644	0.00158	3.95
FO52-4-4	Exposed	74%	0.0246	0.0679	0.0259	0.14	7.14	<0.0036	0.000162	2,410	0.00204	0.178	0.0616	0.00142	4
FO52-5	Exposed	75%	0.0219	0.0722	0.0246	0.1	9.22	<0.0033	<0.000033	2,620	0.00256	0.221	0.0636	0.00221	2.97
FO52-7	Exposed	76%	0.013	0.122	0.0166	0.12	9.22	<0.0034	<0.000035	2,360	0.00258	0.188	0.0662	0.0021	3.65
FOBC-1	Exposed	73%	0.0156	0.102	0.0125	0.108	4.17	<0.0032	0.000033	2,880	0.00359	0.121	0.0708	0.00245	3.39
GAPD-1	Exposed	74%	0.00614	0.152	0.0171	0.158	4.38	<0.0027	<0.000094	2,775	0.0053	0.183	0.0717	0.00209	3.62
GAPD-2	Exposed	70%	0.0111	0.139	0.0158	0.108	9.78	<0.0027	0.000208	2,460	0.0031	0.0955	0.0816	0.0012	3.3
GAPD-3	Exposed	73%	0.0068	0.345	0.0231	0.155	7.22	<0.0030	0.00025	5,170	0.0024	0.168	0.0959	0.00358	4.06
GC2-1	Exposed	74%	0.0136	0.121	0.0222	0.076	7.67	<0.0030	<0.00011	3,150	0.0028	0.164	0.0762	0.00138	2.6
GC2-1-2	Exposed		0.0109	0.282	0.0274	0.123	3.79	<0.0029	<0.0001	2,820	0.0018	0.118	0.0811	0.00143	3.57
GHPD-1	Exposed	75%	0.00709	0.139	0.0164	<0.074	7.71	<0.0030	<0.00011	3,060	0.0018	0.244	0.08	0.00404	4.16
GHPD-2	Exposed	73%	0.00781	0.156	0.0057	0.077	4.4	<0.0028	<0.000097	3,210	0.002	0.0771	0.0856	0.00196	3.88
GHPD-3	Exposed	74%	0.00521	0.194	0.0136	0.105	4.72	<0.0028	<0.000099	2,670	<0.0013	0.149	0.107	0.00368	3.32
HA7-1	Exposed	74%	0.0256	0.181	0.018	<0.072	4.34	<0.0029	<0.0001	2,430	0.0038	0.126	0.0676	0.00218	3.28
HA7-1-2	Exposed	72%	0.0259	0.145	0.0199	0.140	3.10	<0.0029	<0.0001	2,760	0.0025	0.108	0.0627	0.00283	4.19
HA7-2	Exposed	76%	0.00935	0.145	0.0133	0.085	6.51	<0.0027	<0.000096	2,710	0.0021	0.168	0.0669	0.00176	3.36
KSP-1	Exposed	70%	0.00936	0.207	0.0058	0.15	5.05	<0.0028	<0.0001	3,800	0.0025	0.112	0.0768	0.00099	3.75
KSP-3	Exposed	74%	0.0127	0.192	0.0088	0.141	5.27	<0.0029	<0.0001	2,850	0.0028	0.226	0.0632	0.00118	3.27
KSP-4	Exposed	72%	0.0123	0.166	<0.0046	0.25	8.01	<0.0028	0.00077	2,870	0.0021	0.0917	0.0738	0.00116	3.76
KSP-4-2	Exposed	74%	0.0107	0.127	<0.0047	0.153	3.51	<0.0029	<0.0001	2,810	0.0029	0.0908	0.064	0.00143	4.19
KSP-4-3	Exposed	74%	0.0074	0.131	0.0085	0.276	7.5	<0.0031	<0.00011	2,490	<0.0014	0.08	0.0744	0.00156	3.75
KSP-4-4	Exposed	74%	0.00972	0.207	0.0077	0.185	8.91	<0.0026	<0.000092	2,750	0.0016	0.0761	0.0656	0.00124	3.81
KSP-5	Exposed	79%	0.00767	0.211	0.0076	0.181	3.95	<0.0027	<0.000097	2,730	0.004	0.0823	0.0718	0.00103	3.85
KSP-7	Exposed	72%	0.00575	0.078	0.0110	<0.067	8.07	<0.0027	<0.0001	2,665	0.0034	0.194	0.0692	0.00174	2.55
KSP-7-2	Exposed	70%	0.00594	0.099	0.0084	0.114	5.2	<0.0030	<0.0001	2,890	0.0039	0.14	0.0652	0.00167	3.49
KSP-7-3	Exposed	81%	0.00551	0.188	0.0086	0.128	6.27	<0.0028	0.000502	3,220	0.0047	0.157	0.115	0.00238	3.13
LCCPL-1	Exposed	74%	0.00748	0.06	0.0199	0.114	5.06	<0.0027	<0.000095	2,670	0.002	0.224	0.0655	0.00217	4.16
LCCPL-1-2	Exposed	74%	0.00834	0.064	0.0175	0.121	4.69	<0.0028	<0.000098	2,800	0.0031	0.273	0.0697	0.00274	4.17
LCCPL-1-3	Exposed	72%	0.00938	0.083	0.0164	<0.073	2.18	<0.0030	<0.0001	2,970	0.0027	0.112	0.0701	0.00162	4.28
LCCPL-1-4	Exposed	81%	0.00656	0.255	0.016	0.107	4.26	<0.0030	0.00015	3,110	0.0027	0.158	0.0681	0.00207	4.37
LEPD-1	Exposed	79%	0.00919	0.157	0.0171	0.125	13.9	<0.0029	<0.0001	2,810	0.0041	0.249	0.0947	0.00259	3.51
LEPD-2	Exposed	74%	0.0157	0.126	0.0119	0.289	7.25	<0.0030	<0.0001	2,380	<0.0013	0.102	0.0563	0.00114	4.59
LEPD-2-2	Exposed	74%	0.0141	0.148	0.0127	0.209	4.64	<0.0028	<0.00010	3,870	<0.0013	0.0830	0.0680	0.00125	4.49
LEPD-2-3	Exposed	74%	0.0185	0.364	0.0117	0.124	8.79	<0.0028	<0.000098	2,490	0.0013	0.124	0.0776	0.00125	4.75
LEPD-2-4	Exposed	79%	0.0137	0.2	0.0092	0.304	4.21	<0.0027	0.000191	6,800	0.0019	0.0815	0.0867	0.00108	4.12
LK02-2	Exposed	90%	0.0193	0.123	0.0106	0.093	10.5	<0.0026	0.000389	11,400	0.0021	0.189	0.0629	0.0016	4.7
LK02-2-2	Exposed	71%	0.012	0.483	0.008	0.092	3.26	<0.0028	<0.000097	3,680	0.0014	0.0844	0.0685	0.00112	4.56
LK02-3	Exposed	79%	0.00894	0.127	0.0103	0.082	15.4	<0.0029	0.00025	3,860	0.0016	0.179	0.0721	0.00152	3.17
LK02-4	Exposed	82%	0.00917	0.221	0.0377	0.179	9.78	<0.0028	0.000119	4,240	<0.0012	0.118	0.091	0.00287	3.82
LK02-5	Exposed	74%	0.0101	0.212	0.011	0.112	4.22	<0.0030	<0.00011	3,560	<0.0013	0.113	0.0652	0.00127	4.9
LK02-6	Exposed	80%	0.011	0.1	0.0115	0.069	3.02	<0.0025	0.000094	2,830	<0.0011	0.112	0.0742	0.00211	3.82
LK02-7	Exposed	79%	0.0149	0.212	0.0101	<0.11	8.83	<0.0047	0.000097	2,790	<0.0011	0.133	0.08	0.00184	3.86
MC3-1	Exposed	75%	0.0129	0.437	0.0235	<0.10	15.2	<0.0043	0.000060	2,505	0.00391	0.192	0.0738	0.00148	2.52
MC3-2	Exposed	73%	0.00911	0.208	0.0266	<0.11	5.21	<0.0047	0.000057	2,940	0.0025	0.181	0.0664	0.00113	2.65
MC3-3	Exposed	74%	0.0239	0.343	0.0237	<0.10	12.9	<0.0044	0.000051	2,680	0.0028	0.229	0.0618	0.00202	2.75
MC3-4	Exposed	72%	0.0243	0.408	0.0297	<0.11	10.2	<0.0044	<0.000044	2,550	0.0038	0.215	0.0758	0.00177	3.2
MC3-5	Exposed	84%	0.0153	1.04	0.0315	<0.094	10.5	<0.0039	0.000454	11,500	0.0034	0.171	0.11	0.00246	3.4
MC3-6	Exposed	83%	0.0184	0.783	0.0303	<0.11	22.3	<0.0048	0.000627	8,410	0.0071	0.21	0.132	0.0016	3.77
MCdsE-1	Exposed	75%	0.00832	0.217	0.017	<0.11	4.74	<0.0044	<0.000044	2,290	0.002	0.166	0.107	0.00188	3.29
MCdsE-2	Exposed	82%	0.0129	0.483	0.0179	0.12	6.34	<0.0042	0.000178	2,830	0.00242	0.106	0.109	0.00104	3.32
MCusE-1	Exposed	81%	0.0201	0.41	0.0203	<0.11	20.2	<0.0047	0.00029	3,120	0.0031	0.238	0.079	0.00147	4.13
MI2-6-2014	Exposed	81%	0.00737	0.289	0.0187	0.14	10.2	<0.0048	0.000916	4,700	0.0029	0.146	0.0654	0.00227	3.52
MI2-7	Exposed	80%	0.0108	0.217	0.019	<0.11	10.5	<0.0047	0.000197	12,800	0.002	0.183	0.0595	0.00178	3.97
MI2-9	Exposed	74%	0.0145	0.071	0.0219	0.13	8.74	<0.0047	<0.000047	2,570	0.0025	0.17	0.0745	0.00198	3.1
MI2-11	Exposed		0.0102	0.122	0.0153	0.11	10.9	<0.0043	<0.000043	2,880	0.0023	0.245	0.0676	0.00125	3.12
MI2-13	Exposed	75%	0.00937	0.108	0.0119	<0.10	9.39	<0.0043	0.000061	2,605	0.0020	0.169	0.0635	0.00161	3.06
MI2-14	Exposed	83%	0.0112	0.37	0.0217	0.13	17	<0.0044	0.000543	2,680	0.0019	0.269	0.102	0.00248	3.54
MI2-15	Exposed	73%	0.0132	0.132	0.0182	<0.11	12.9	<0.0047	0.00016	2,730	0.0034	0.255	0.0522	0.00111	3.24
MI2-16	Exposed	73%	0.013	0.123	0.0173	0.11	5.4	<0.0043	0.000075	3,070	0.0027	0.348	0.0585	0.00154	3.42
MI2-17	Exposed	74%	0.00475	0.68	0.0172	<0.11	8.53	<0.0045	0.000075	2,930	0.0035	0.17	0.0705	0.0016	3.58
MI2-19	Exposed	74%	0.0108	0.494	0.0111	<0.11	11.2	<0.0046	<0.000046	2,460	0.0038	0.326	0.105	0.00168	3.85
NNP-1	Exposed	74%	0.00617	0.25	0.0118	<0.11	15	<0.0045	<0.000045	2,680	<0.0010	0.364	0.0748	0.00405	3.4
SWWL-1	Exposed	74%	0.0117	0.0738	0.0079	<0.097	3.53	<0.0040	<0.000040	2,710	0.00151	0.143	0.0662	0.00202	3.61
THPD-1	Exposed	78%	0.00496	0.186	0.0124	0.12	5.99	<0.0047	0.000225	3,580	<0.0011	0.156	0.0751	0.00248	4.05
THPD-2	Exposed	80%	0.00439	0.219	0.0075	<0.092	3.09	<0.0039	0.000132	2,520	0.00118	0.118	0.0792	0.0018	4.67
UTHP-1	Exposed	72%	0.0182	0.118	0.0129	0.15	13.2	<0.0047	<0.000047	6,260	0.0019	0.224	0.0759	0.00272	4.21
UWOP-1	Exposed	78%	0.00933	1.08	0.0201	<0.12	4.06	<0.0049	0.000176	4,620	0.0025	0.0806	0.0799	0.000617	4.56
WOPD-1	Exposed	81%	0.0118	0.491	0.0154	0.1	14.1	<0.0042	0.000116	4,310	0.00273	0.235	0.0728	0.00187	3.51

Table B.6: Metal concentrations in spotted sandpiper eggs collected in 2014.

Sample ID	Reference vs Exposed	Fe	Ga	K	Li	Mg	Mn	Mo	Na	Ni	P	Pb	Rb	Re	Sb
		µg/g dw	µg/g dw	µg/g dw	µg/g dw	µg/g dw	µg/g dw	µg/g dw	µg/g dw	µg/g dw	µg/g dw	µg/g dw	µg/g dw	µg/g dw	µg/g dw
CHCK-1	Reference	118	0.0064	5,840	0.156	400	1.65	0.085	5,440	0.0189	9,390	3.16	1.47	0.0003	0.00361
WWR-4	Reference	129	0.0056	5,873	0.0328	332	1.87	0.110	5,960	0.0077	9,040	0.0123	0.968	0.00018	<0.00039
WWR-5	Reference	90.3	0.0051	5,490	0.0429	391	2.4	0.126	5,960	0.0096	9,530	0.0384	1.5	0.00049	0.0012
WWR-7	Reference	96.9	0.0045	5,500	0.0663	411	3.08	0.0924	5,550	0.0856	9,030	0.015	0.868	0.00034	<0.00041
WWR-8	Reference	113	0.0048	5,780	0.131	414	1.92	0.0805	5,640	0.0112	9,450	0.0119	0.785	<0.00012	0.00043
WWR-9	Reference	152	0.0057	6,870	0.0622	623	1.99	0.144	7,320	0.0342	11,700	0.0348	1.19	0.00226	0.00056
WWRBP-1	Reference	114	0.0042	6,310	0.0531	514	2.27	0.159	6,820	0.037	10,800	0.0261	1.38	0.00066	0.00055
WWRBP-2	Reference	84	0.0048	5,710	0.0291	401	1.87	0.111	6,520	0.0126	9,780	0.018	1.8	0.00026	0.00071
CL11-1	Exposed	116	0.0055	5,200	0.252	378	2.5	0.123	5,850	0.0262	9,020	0.00804	1.74	0.00044	<0.00047
CL11-2	Exposed	89.5	0.0036	5,900	0.112	396	1.68	0.113	5,140	0.0137	7,985	0.00386	2.59	0.00047	<0.00054
CL11-3	Exposed	96.7	0.0046	5,330	0.332	387	1.5	0.116	6,200	0.022	8,290	0.00645	2.22	0.00045	0.00063
EAPD-1	Exposed	126	0.006	4,950	0.0575	386	1.72	0.0903	4,810	0.0137	9,710	0.00684	2.01	0.00021	<0.00046
EAPD-2-1	Exposed	100	0.006	4,870	0.034	347	1.41	0.17	4,460	0.0142	9,490	0.00501	1.33	0.00038	<0.00053
EAPD-2-2	Exposed	105	0.0067	5,200	0.0346	387	1.58	0.135	4,410	0.012	9,980	0.0047	1.38	0.00031	<0.00048
EAPD-3	Exposed	111	0.0066	7,160	0.115	660	1.87	0.106	7,160	0.0337	11,300	0.0159	2.22	<0.00015	<0.00056
EAPD-4	Exposed	98.7	0.0057	6,230	0.0645	371	1.42	0.118	5,480	0.0123	8,580	0.0072	1.29	0.00049	<0.00056
EL1-3	Exposed	96.3	0.0058	5,380	0.0477	389	1.4	0.166	5,930	0.0203	10,300	0.0111	0.839	0.00105	<0.00054
EL1-4	Exposed	114	0.0049	5,340	0.0308	339	1.36	0.116	4,990	0.0146	9,350	0.0105	1.2	0.0006	0.00167
EL1-6	Exposed	78.0	0.0044	6,240	0.0445	423	1.79	0.202	6,415	0.0352	9,305	0.0110	0.903	0.00073	0.00130
EL1-8	Exposed	120	0.0055	5,610	0.0335	329	1.97	0.0999	6,000	0.0156	8,950	0.0124	1.72	0.00016	0.00047
EL19-1	Exposed	91.4	0.0056	5,790	0.134	350	2.21	0.0959	5,300	0.0098	9,330	0.00716	1.27	0.0011	<0.00034
EL19-2	Exposed	65.3	0.0049	5,870	0.16	369	1.51	0.117	5,840	0.0123	8,070	0.00502	0.943	0.00262	0.00051
EL19-3	Exposed	99.3	0.0064	5,350	0.0831	348	2.58	0.118	6,480	0.0161	9,060	0.00412	0.94	0.00091	<0.00035
EL19-4	Exposed	86.9	0.0052	5,350	0.0529	286	1.82	0.0997	6,120	0.0157	9,610	0.0094	0.979	0.00337	0.00058
EL19-6	Exposed	80.9	0.0049	6,170	0.0654	440	0.944	0.124	6,200	0.0191	10,000	0.00854	0.923	0.00229	0.00103
EL19-7	Exposed	105	0.0062	5,670	0.0331	331	3.09	0.148	5,160	0.0285	9,870	0.00406	1.02	0.00365	0.00061
ELKO-1	Exposed	97.8	0.0057	5,520	0.0508	382	2.12	0.182	6,760	1.06	9,160	0.0543	0.961	0.00041	0.0014
ELKO-2	Exposed	73.0	0.0039	5,530	0.0749	375	1.48	0.0831	6,390	0.0114	8,865	0.0113	1.05	0.00032	0.00085
FO10-1	Exposed	90.7	0.0053	6,330	0.0868	688	1.95	0.156	6,650	0.0514	11,200	0.00815	1.41	0.00109	0.00107
FO10-1-2	Exposed	95	0.0034	5,400	0.0831	455	1.24	0.114	6,030	0.0127	8,250	0.00657	1.28	0.00073	0.00085
FO10-2	Exposed	87.9	0.005	5,660	0.117	424	1.65	0.116	6,400	0.0168	8,020	0.00819	1.22	0.00042	0.00073
FO10-3	Exposed	122	0.0061	4,770	0.0473	338	2.54	0.143	4,830	0.0143	9,810	0.00553	1.34	0.00102	0.00151
FO23-1	Exposed	111	0.0054	5,010	0.0889	389	1.58	0.1	6,420	0.0161	9,470	0.00435	1.19	0.00255	0.00039
FO23-2	Exposed	118	0.0057	3,610	0.0936	342	1.01	0.128	3,880	0.0131	11,100	0.00902	0.88	0.00304	0.00059
FO23-3	Exposed	135	0.006	4,520	0.0668	373	1.86	0.104	5,090	0.0147	10,300	0.00851	1.13	0.00322	0.0005
FO23-4	Exposed	123	0.0042	5,370	0.0453	338	0.776	0.128	5,300	0.0092	9,300	0.00545	0.997	0.00056	0.00121
FO23-4-2	Exposed	137	0.0065	6,380	0.0941	566	1.1	0.119	6,540	0.0339	12,000	0.012	1.3	0.00051	0.00045
FO23-4-3	Exposed	135	0.0054	6,470	0.075	609	0.895	0.125	6,670	0.0326	10,500	0.00975	1.29	0.00073	0.00077
FO23-5	Exposed	127	0.0044	5,700	0.0893	452	0.698	0.148	5,870	0.026	9,670	0.0316	1.9	0.0013	0.00101
FO29-1	Exposed	75.5	0.0062	6,830	0.173	569	1.93	0.127	6,960	0.0646	11,000	0.0114	1.86	0.00101	0.00153
FO29-2	Exposed	98.6	0.0044	5,425	0.0972	331	1.44	0.131	5,855	0.0129	9,120	0.00658	1.49	0.00089	0.00147
FO52-1	Exposed	112	0.0039	5,940	0.0991	342	1.28	0.108	6,510	0.0186	7,950	0.00563	1.51	0.00118	0.00081
FO52-1-2	Exposed	102	0.0042	6,040	0.132	385	1.21	0.0993	6,650	0.0138	8,270	0.00771	1.27	0.00079	0.00064
FO52-1-3	Exposed	111	0.0037	6,100	0.102	374	1.23	0.102	6,920	0.0126	8,480	0.00758	1.43	0.001	0.00079
FO52-1-4	Exposed	118	0.0044	5,810	0.149	407	1.37	0.12	6,650	0.013	9,770	0.00847	1.22	0.00083	0.00051
FO52-2	Exposed	82.4	0.0041	5,950	0.0891	408	1.60	0.126	6,505	0.0132	8,340	0.00520	1.22	0.00122	0.00092
FO52-3	Exposed	110	0.0054	5,510	0.0751	350	3.19	0.111	3,840	0.0157	9,580	0.00675	1.36	0.00042	0.00085
FO52-4	Exposed	106	0.0053	5,640	0.0932	357	1.61	0.133	6,210	0.0101	9,220	0.007	1.1	0.00177	0.00094
FO52-4-2	Exposed	95.2	0.0054	5,750	0.118	376	1.35	0.0996	6,650	0.0096	9,120	0.0065	1.13	0.00139	0.0018
FO52-4-3	Exposed	105	0.0048	5,640	0.169	360	1.88	0.0972	6,230	0.0121	9,000	0.00832	1.17	0.00174	0.00094
FO52-4-4	Exposed	98.7	0.0043	6,210	0.0907	363	1.3	0.113	6,840	0.0175	8,660	0.00639	1.23	0.00119	0.0184
FO52-5	Exposed	106	0.0047	5,490	0.112	325	0.829	0.089	7,260	0.0098	9,040	0.00543	1.36	0.00105	0.00124
FO52-7	Exposed	86.5	0.0043	6,540	0.235	394	1.35	0.0882	7,480	0.0125	9,080	0.0072	1.17	0.00069	0.00064
FOBC-1	Exposed	114	0.0049	5,130	0.045	344	1.27	0.13	5,660	0.0195	9,380	0.00428	1.63	0.0006	0.00127
GAPD-1	Exposed	95.6	0.0042	5,860	0.197	336	1.10	0.142	6,210	0.0131	9,025	0.0177	1.30	0.00071	0.00047
GAPD-2	Exposed	93.7	0.0047	4,810	0.156	299	2.01	0.134	4,260	0.009	9,160	0.0109	1.02	0.00031	0.00041
GAPD-3	Exposed	106	0.0036	6,210	0.0758	473	1.66	0.156	6,420	0.0425	9,800	0.11	2.34	0.001	0.00123
GC2-1	Exposed	101	0.0058	4,200	0.245	353	2.28	0.109	4,890	0.0122	10,400	0.0085	0.863	0.00091	0.00081
GC2-1-2	Exposed	102	0.0039	5,070	0.156	334	2.33	0.174	6,090	0.0111	8,990	0.0048	1.16	0.00224	<0.00027
GHPD-1	Exposed	104	0.0038	5,700	0.0848	416	1.64	0.125	5,490	0.0161	8,980	0.0052	3.5	0.00042	<0.00028
GHPD-2	Exposed	113	0.0048	5,170	0.164	384	2.01	0.136	3,620	0.0138	10,700	0.0048	1.96	0.00045	<0.00025
GHPD-3	Exposed	103	0.0031	5,640	0.0818	400	1.04	0.096	6,020	0.0171	8,510	0.0056	2.46	0.00033	0.00028
HA7-1	Exposed	76.5	0.0049	4,890	0.0299	374	2.16	0.0916	4,860	0.0109	9,110	0.0062	1.83	0.00063	<0.00027
HA7-1-2	Exposed	78.4	0.0036	5,955	0.0910	498	1.31	0.0945	6,255	0.0115	7,680	0.0040	2.21	0.00062	<0.00027
HA7-2	Exposed	82.8	0.0041	6,030	0.0515	315	2.25	0.102	7,210	0.0097	9,160	0.0077	1.97	0.00014	0.00139
KSP-1	Exposed	91.8	0.0044	5,610	0.0779	442	1.79	0.129	5,320	0.0143	10,200	0.0088	1.05	0.00038	0.00059
KSP-3	Exposed	101	0.006	5,530	0.0527	349	2.32	0.1	5,390	0.0195	9,510	0.0122	1.46	<0.00014	0.00049
KSP-4	Exposed	83.8	0.0055	5,730	0.207	390	3.88	0.149	5,780	0.0106	9,730	0.014	1.38	0.00043	0.001
KSP-4-2	Exposed	75.1	0.005	6,050	0.188	343	3.91	0.158	6,110	0.0101	8,830	0.0028	1.57	0.00039	<0.00027
KSP-4-3	Exposed	74.4	0.0045	5,830	0.26	363	3.7	0.137	6,110	0.0148	8,880	0.0059	1.43	0.00091	<0.00028
KSP-4-4	Exposed	79.9	0.0047	5,690	0.279	388	3.63	0.127	6,100	0.0093	9,610	0.0069	1.32	0.00061	<0.00024
KSP-5	Exposed	92.5	0.0041	5,650	0.0679	390	1.34	0.11	6,140	0.0115	9,180	0.0044	1.2	0.0004	<0.00025
KSP-7	Exposed	91.7	0.0043	4,850	0.0590	320	2.06	0.0866	4,210	0.0121	9,705	0.0055	1.03	0.00038	0.00047
KSP-7-2	Exposed	95.7	0.0046	5,980	0.0475	388	1.67	0.0954	5,280	0.0155	7,900	0.0029	1.24	0.00033	<0.00027
KSP-7-3	Exposed	92.7	0.0043	5,780	0.087	396	1.89	0.0952	5,400	0.0502	8,720	0.0221	1.24	0.00044	0.00069
LCCPL-1	Exposed	95	0.0042	5,530	0.0581	350	0.881	0.0964	5,880	0.018	8,680	0.0047	2.21	0.00033	0.00027
LCCPL-1-2	Exposed	97	0.004	5,700	0.121	358	0.915	0.0967	5,790	0.0152	8,940	0.0064	2.45	0.00034	<0.00026
LCCPL-1-3	Exposed	91.5	0.0041	5,310	0.0352	371	0.879	0.108	6,000	0.0166	9,160	0.003	2.09	0.00057	0.00078
LCCPL-1-4	Exposed	101	0.005	5,870	0.0891	391	0.897	0.0997	5,930	0.0205	9,540	0.0142	2.27	0.00035	<0.00027
LEPD-1	Exposed	130	0.0044	5,970	0.258	390	1.83	0.116	5,990	0.017	9,180	0.0191	1.36	0.00026	0.00061
LEPD-2	Exposed	112	0.0047	6,240	0.18	368	3	0.146	6,770	0.0103	8,190	0.0046	1.03	0.00116	<0.00027
LEPD-2-2	Exposed	121	0.0047	6,195	0.116	415	3.06	0.152	6,750	0.0146	9,255	0.0041	0.985	0.00126	0.00050
LEPD-2-3	Exposed	110	0.0045	6,020	0.0929	364	2.84	0.142	6,450	0.0114	8,660	0.0067	1.04	0.00125	<0.00025
LEPD-2-4	Exposed	151	0.0059	6,410	0.106	469	4.23	0.163	6,190	0.028	10,800	0.0078	0.997	0.00139	0.00048
LK02-2	Exposed	106	0.0059	7,380	0.0586	636	3.07	0.106	6,530	0.0304	13,100	0.04	1	<0.00013	0.00118
LK02-2-2	Exposed	105	0.004	6,130	0.0405	442	2.1	0.0943	5,890	0.0087	9,320	0.0111	0.875	<0.00014	<0.00025
LK02-3	Exposed	93.3	0.0048	6,260	0.0941	477	2.37	0.103	6,420	0.0135	9,970	0.13	1.43	0.0003	0.00072
LK02-4	Exposed	97.9	0.0049	6,450	0.0625	478	1.93	0.131	6,330	0.0216	10,400	0.0192	1.6	0.00049	0.00044
LK02-5	Exposed	96.3	0.0044	5,920	0.0334	362	2.17	0.101	6,030	0.0107	9,360	0.0196	0.937	0.00019	<0.00027
LK02-6	Exposed	97	0.0034	6,280	0.0417	341	1.76	0.104	6,030	0.0092	9,160	0.0278	0.888	0.00037	0.00063
LK02-7	Exposed	116	0.0048	5,960	0.0929	331	2.64	0.091	5,230	0.0143	8,960	0.0126	1.3	0.00036	0.00079
MC3-1	Exposed	119	0.0045	5,505	0.0283	335	2.10	0.110	5,425	0.0094	9,050	0.00852	1.10	0.00057	0.00052
MC3-2	Exposed	105	0.0048	4,530	0.0236	310	1.71	0.116	4,050	0.0108	9,420	0.0102	1.05	0.00068	<0.00041
MC3-3	Exposed	82.4	0.0045	5,790	0.0333	373	2.67	0.116	6,220	0.011	8,130	0.00851	1.65	<0.00012	0.00089
MC3-4	Exposed	88.1	0.0038	5,280	0.0238	357	1.18	0.102	5,390	0.0113	8,630	0.00812	1.21	0.00118	0.00096
MC3-5	Exposed	104	0.0059	5,710	0.0236	634	2.01	0.129	7,100	0.0503	11,200	0.0184	1.59	0.0004	0.00117
MC3-6	Exposed	112	0.0043	6,220	0.0384	475	2.32	0.129	6,100	0.0409	10,800	0.0208	1.29	0.0006	0.00126
MCdsE-1	Exposed	76.6	0.0038	5,820	0.0457	307	2.6	0.106	5,910	0.0114	8,550	0.0135	1.77	0.00046	<0.00039
MCdsE-2	Exposed	89.6	0.004	5,470	0.0301	396	1.44	0.129	5,380	0.0304	9,000	0.0458	1.19	0.00107	0.00058
MCusE-1	Exposed	112	0.0044	5,560	0.0426	417	2.18	0.101	6,180	0.0146	9,140	0.0165	1.41	0.00053	<0.00041
MI2-6-2014	Exposed	86.3	0.0052	5,650	0.104	396	1.52	0.117	5,860	0.018	10,200	0.0169	1.32	0.00032	0.00111
MI2-7	Exposed	76.4	0.0062	7,710	0.0758	745	2.33	0.155	7,350	0.0381	12,200	0.0669	1.92	0.00019	0.00052
MI2-9	Exposed	101	0.0037	5,620	0.0481	336	1.66	0.0988	5,870	0.0091	8,580	0.0241	1.53	0.00069	<0.00041
MI2-11	Exposed	130	0.0052	4,430	0.0421	327	1.66	0.0984	4,770	0.0084	10,300	0.0287	0.979	0.00022	<0.00038
MI2-13	Exposed	89.4	0.0041	5,965	0.0444	317	1.56	0.105	5,380	0.0093	8,910	0.0226	1.28	0.00046	0.00046
MI2-14	Exposed	101	0.004	5,660	0.0467	388	1.52	0.136	5,800	0.0273	8,990	0.0497	1.52	0.00058	0.0009
MI2-15	Exposed	127	0.0046	4,900	0.0375	334	0.994	0.126	4,820	0.0085	9,430	0.0329	0.932	0.00056	0.00154
MI2-16	Exposed	106	0.0045	4,690	0.0297	329	1.39	0.0971	5,300	0.0092	9,750	0.0111	1.28	0.00036	<0.00037
MI2-17	Exposed	97.9	0.0046	5,400	0.0319	351	1.31	0.164	5,820	0.0122	8,890	0.018	1.06	0.00049	0.00039
MI2-19	Exposed	107	0.0045	6,560	0.0569	307	1.21	0.105	6,040	0.0095	8,340	0.0248	1.52	0.0005	<0.00040
NNP-1	Exposed	106	0.0044	5,170	0.111	373	1.68	0.141	5,310	0.0202	8,910	0.0145	1.96	0.00026	0.00065
SWWL-1	Exposed	116	0.0047	6,140	0.125	416	1.62	0.11	5,010	0.0177	9,130	0.00661	2.14	0.00033	0.0004
THPD-1	Exposed	118	0.0047	6,050	0.116	383	1.96	0.101	4,950	0.0177	9,250	0.0156	1.55	0.00052	0.00057
THPD-2	Exposed	93.9	0.0047	6,740	0.124	348	1.38	0.0884	5,820	0.0144	8,340	0.0135	2	0.00026	<0.00034
UTHP-1	Exposed	128	0.0043	5,280	0.206	440	1.57	0.113	5,540	0.0209	9,010	0.00748	1.87	0.0008	0.00049
UWOP-1	Exposed	93.7	0.004	6,690	0.065	351	1.9	0.279	7,210	0.0178	7,540	0.0214	0.805	0.00149	0.00098
WOPD-1	Exposed	107	0.006	5,920	0.0793	426	1.87	0.152	5,780	0.0308	10,000	0.514	1.04	0.00048	0.00097

Table B.6: Metal concentrations in spotted sandpiper eggs collected in 2014.

Sample ID	Reference vs Exposed	Se µg/g dw	Sn µg/g dw	Sr µg/g dw	Th µg/g dw	Ti µg/g dw	Tl µg/g dw	U µg/g dw	V µg/g dw	Y µg/g dw	Zn µg/g dw	Zr µg/g dw
CHCK-1	Reference	12.4	0.00184	2.24	<0.000063	0.071	0.0275	<0.00075	0.00571	0.0007	48.1	0.0083
WWR-4	Reference	2.40	<0.00053	2.38	<0.00023	0.0649	0.0114	0.000060	0.00126	0.00106	46.6	0.00271
WWR-5	Reference	4.39	0.00125	3.32	0.00079	0.0657	0.019	0.000137	0.00145	0.00147	46.3	0.00544
WWR-7	Reference	2.35	<0.00054	2.55	0.00026	0.069	0.0336	0.000078	0.00119	0.00091	47.5	0.00111
WWR-8	Reference	1.88	0.00084	3.2	<0.00023	0.0776	0.0095	0.000065	0.00093	0.00046	44.1	0.00438
WWR-9	Reference	3.32	0.00134	7.03	<0.00024	0.0945	0.0413	0.000174	0.00145	0.00113	46.6	0.0069
WWRBP-1	Reference	8.68	0.00069	6.28	<0.00024	0.0698	0.0214	0.000128	0.00174	0.00069	53.2	0.00833
WWRBP-2	Reference	3.53	<0.00056	3.71	<0.00024	0.0709	0.0234	0.000236	0.00106	0.00048	47.5	0.00359
CL11-1	Exposed	16.6	<0.00056	2.95	<0.000061	0.066	0.0368	<0.00072	0.00282	0.00071	51.6	0.0025
CL11-2	Exposed	16.5	<0.00065	1.78	<0.000070	0.071	0.0570	<0.00083	0.00141	0.00032	37	0.00134
CL11-3	Exposed	20.8	<0.00067	2.64	0.000231	0.077	0.0363	<0.00086	0.00226	0.00042	47.2	0.00231
EAPD-1	Exposed	8.75	<0.00054	3.58	0.000339	0.069	0.0394	<0.00070	0.00159	0.00021	47.3	0.00096
EAPD-2-1	Exposed	15.9	<0.00063	1.86	0.000978	0.066	0.0208	<0.00081	0.00215	0.00089	43.2	<0.00036
EAPD-2-2	Exposed	15.7	<0.00057	2.41	0.000118	0.061	0.0193	<0.00074	0.00213	0.00052	50.9	<0.00033
EAPD-3	Exposed	10.5	0.00144	6.15	0.000072	0.085	0.0409	<0.00086	0.00261	0.00057	61.2	<0.00038
EAPD-4	Exposed	22.2	<0.00067	2.47	0.000078	0.074	0.0227	<0.00086	0.00263	0.00053	47.3	<0.00038
EL1-3	Exposed	6.46	0.00106	6.11	0.000098	0.08	0.0438	<0.00083	0.0041	0.00144	53.2	0.0116
EL1-4	Exposed	5.48	<0.00057	3.01	<0.000061	0.054	0.0391	<0.00073	0.00142	0.00056	53	<0.00032
EL1-6	Exposed	7.00	0.00308	4.10	<0.000055	0.0759	0.0556	<0.00025	0.00335	0.00051	44.2	0.00608
EL1-8	Exposed	5.22	0.0016	3.54	<0.000056	0.069	0.021	<0.00025	0.00206	0.00048	51.5	0.0103
EL19-1	Exposed	4.13	0.00053	3.3	<0.000057	0.052	0.0342	<0.00025	0.00207	0.00086	49.4	0.00361
EL19-2	Exposed	7.29	<0.00033	3.15	<0.000053	0.067	0.0452	<0.00024	0.0027	0.00051	40	0.00289
EL19-3	Exposed	3.60	<0.00036	2.48	<0.000058	0.064	0.0214	<0.00026	0.00169	0.00082	43.3	0.0089
EL19-4	Exposed	4.00	0.00063	3.49	<0.000058	0.061	0.035	<0.00026	0.00257	0.00094	46.5	0.00577
EL19-6	Exposed	6.33	0.00088	4.16	<0.000059	0.085	0.0414	<0.00026	0.00312	0.00125	47.1	0.0141
EL19-7	Exposed	7.53	<0.00033	1.71	<0.000052	0.0644	0.042	<0.00023	0.00338	0.00048	51	0.00501
ELKO-1	Exposed	8.66	0.00295	3.14	<0.000058	0.076	0.0322	<0.00026	0.0183	0.00115	48.3	0.00694
ELKO-2	Exposed	7.73	<0.00036	3.09	0.000062	0.071	0.0232	<0.00026	0.00270	0.00042	41.4	0.00148
FO10-1	Exposed	13.8	0.00291	6.47	<0.000049	0.0867	0.0545	<0.00022	0.00359	0.00558	53.1	0.0828
FO10-1-2	Exposed	13.6	<0.00034	2.3	<0.000054	0.0704	0.0412	<0.00024	0.003	0.00067	44.3	0.0164
FO10-2	Exposed	16.5	<0.00036	1.79	0.000261	0.074	0.034	0.00032	0.00274	0.00033	42.7	0.00191
FO10-3	Exposed	10.4	<0.00035	1.2	0.000109	0.06	0.0626	<0.00025	0.00206	0.00028	41.9	0.00159
FO23-1	Exposed	6.92	<0.00034	2.12	0.000079	0.0654	0.039	<0.00024	0.00247	0.00042	45.1	0.00135
FO23-2	Exposed	6.5	0.00058	2.53	<0.000053	0.0585	0.0469	0.00036	0.00263	0.00045	57.6	0.0009
FO23-3	Exposed	7.6	<0.00036	3.39	<0.000057	0.055	0.037	<0.00025	0.00341	0.00039	48.1	0.0009
FO23-4	Exposed	9.05	<0.00032	2.7	<0.000051	0.059	0.0221	<0.00023	0.0014	0.0004	44.9	0.00124
FO23-4-2	Exposed	11.1	0.00082	11.6	<0.000052	0.087	0.0328	<0.00023	0.00247	0.00115	54.3	0.119
FO23-4-3	Exposed	9.44	0.00143	8.57	<0.000055	0.075	0.0326	<0.00025	0.00238	0.00271	49.6	0.0631
FO23-5	Exposed	7.23	0.00984	3.78	0.00008	0.066	0.0422	0.0003	0.0028	0.00121	52.7	0.0155
FO29-1	Exposed	7.38	0.00093	5.09	<0.000058	0.084	0.0572	<0.00026	0.00263	0.00068	51.6	0.01
FO29-2	Exposed	8.39	0.00123	1.53	<0.000053	0.068	0.0402	0.00029	0.00267	0.00021	43.9	0.00089
FO52-1	Exposed	13.4	<0.00035	0.963	<0.000055	0.067	0.0515	<0.00025	0.00217	0.00041	36.4	0.0178
FO52-1-2	Exposed	13.8	<0.00036	1.56	0.000085	0.072	0.0416	0.00031	0.0041	0.00094	44.2	0.00367
FO52-1-3	Exposed	16.7	<0.00037	1.19	<0.000058	0.076	0.0466	<0.00026	0.00438	0.00066	39.5	0.00441
FO52-1-4	Exposed	12.6	<0.00033	1.91	<0.000053	0.0663	0.0447	0.00028	0.00257	0.00084	51.7	0.00256
FO52-2	Exposed	9.04	<0.00035	1.54	<0.000056	0.071	0.0280	<0.00025	0.00217	0.00055	42.2	0.0074
FO52-3	Exposed	19.8	0.00049	1.78	0.000348	0.119	0.0311	0.00026	0.00672	0.00108	46.8	0.00455
FO52-4	Exposed	6.54	<0.00036	1.05	0.000504	0.067	0.0428	0.00044	0.00168	0.00032	40.8	0.00155
FO52-4-2	Exposed	6.25	<0.00036	1.64	0.000187	0.067	0.0378	0.00033	0.00222	0.00119	42.8	0.00072
FO52-4-3	Exposed	5.82	<0.00037	1.93	0.000177	0.07	0.0378	0.00038	0.00267	0.00148	43.9	0.00245
FO52-4-4	Exposed	6.93	<0.00039	1.39	<0.000062	0.068	0.0431	0.00029	0.00257	0.00041	42.3	0.00077
FO52-5	Exposed	7.7	<0.00035	2.49	<0.000056	0.083	0.0366	<0.00025	0.00222	0.00049	43.2	0.00059
FO52-7	Exposed	6.24	<0.00037	1.95	0.00007	0.062	0.0252	<0.00026	0.00354	0.00094	40.1	0.00127
FOBC-1	Exposed	11.2	<0.00034	1.44	<0.000054	0.06	0.0365	<0.00024	0.00186	0.00032	41	0.00049
GAPD-1	Exposed	20.2	<0.00052	2.18	<0.00023	0.0547	0.0551	<0.0025	0.00181	0.00039	51.3	0.00105
GAPD-2	Exposed	6.11	<0.00052	1.87	<0.00023	0.0465	0.0276	<0.0025	0.00392	0.00082	49	0.00736
GAPD-3	Exposed	9.28	0.00109	3.07	<0.00026	0.0643	0.0632	<0.0028	0.00223	0.00148	44.7	0.00774
GC2-1	Exposed	5.1	<0.00059	3.94	<0.00026	0.0457	0.0396	<0.0028	0.00221	0.00044	48.2	0.00261
GC2-1-2	Exposed	5.86	<0.00058	3.06	<0.00025	0.0611	0.0611	<0.0027	0.00268	0.00039	36.6	0.00254
GHPD-1	Exposed	14.7	<0.00059	2.63	<0.00026	0.0689	0.0395	<0.0028	0.00154	<0.00022	42.3	0.00223
GHPD-2	Exposed	7.55	<0.00054	2.26	<0.00024	0.0516	0.0217	<0.0026	0.00124	<0.00020	61.8	0.00156
GHPD-3	Exposed	11.7	<0.00055	1.98	<0.00024	0.0755	0.0253	<0.0026	0.0027	<0.00021	36.1	0.00316
HA7-1	Exposed	7.4	<0.00058	1.67	<0.00025	0.0538	0.0453	<0.0027	0.00158	0.00078	48.1	0.00206
HA7-1-2	Exposed	7.69	<0.00057	1.67	<0.00025	0.0662	0.0613	<0.0027	0.00164	0.00057	39.7	0.00123
HA7-2	Exposed	14.1	<0.00053	1.49	<0.00023	0.072	0.0334	<0.0025	0.00154	<0.00020	43.3	0.00083
KSP-1	Exposed	7.51	0.0014	1.6	<0.00024	0.0455	0.0217	<0.0026	0.00141	0.00077	50.5	0.00444
KSP-3	Exposed	13.3	<0.00056	1.48	0.00032	0.0498	0.0286	<0.0027	0.00094	0.00058	51.1	0.00141
KSP-4	Exposed	6.14	<0.00056	1.57	<0.00025	0.0601	0.0201	<0.0027	0.0013	0.00049	49.8	0.00333
KSP-4-2	Exposed	5.31	<0.00057	1.37	<0.00025	0.0702	0.0234	<0.0027	0.00143	0.00033	42.3	0.00184
KSP-4-3	Exposed	7.06	<0.00060	1.47	<0.00026	0.0631	0.0235	<0.0028	0.0017	0.00063	43.2	0.00092
KSP-4-4	Exposed	6.63	<0.00051	1.67	<0.00023	0.0574	0.0232	<0.0024	0.00203	0.00069	49.8	0.00076
KSP-5	Exposed	12	<0.00054	1.17	<0.00024	0.0749	0.0203	<0.0026	0.00171	0.00043	42.7	0.00642
KSP-7	Exposed	9.09	<0.00054	1.81	<0.00024	0.0552	0.0251	<0.0026	0.00110	0.00073	45.1	0.00084
KSP-7-2	Exposed	7.66	<0.00058	1.49	<0.00026	0.0598	0.0188	<0.0028	0.00117	0.00037	38.3	0.127
KSP-7-3	Exposed	9.81	0.00067	1.9	<0.00024	0.0657	0.0287	<0.0026	0.00192	0.0008	41	0.0207
LCCPL-1	Exposed	17	<0.00053	2.4	<0.00023	0.0592	0.0589	<0.0025	0.00152	0.00046	47.9	0.0106
LCCPL-1-2	Exposed	22.5	<0.00055	2.45	<0.00024	0.061	0.0684	<0.0026	0.0015	0.00073	48.4	0.00822
LCCPL-1-3	Exposed	19.9	<0.00058	2.38	<0.00026	0.0669	0.0611	<0.0028	0.00142	0.00048	42.1	0.00571
LCCPL-1-4	Exposed	16.4	<0.00058	2.65	<0.00026	0.0653	0.0632	<0.0028	0.00156	0.00051	47.9	0.00664
LEPD-1	Exposed	19.2	<0.00057	5.22	<0.00025	0.0719	0.044	<0.0027	0.00347	0.00125	45.4	0.00706
LEPD-2	Exposed	6.22	<0.00058	2.6	<0.00026	0.0643	0.0267	<0.0028	0.00196	0.00122	40.7	0.00266
LEPD-2-2	Exposed	5.36	<0.00055	2.74	<0.00025	0.0658	0.0283	<0.0027	0.00188	0.00119	40.7	0.00176
LEPD-2-3	Exposed	5.87	<0.00054	2.89	<0.00024	0.0673	0.0296	<0.0026	0.00286	0.00239	45.4	0.00245
LEPD-2-4	Exposed	4.7	0.00353	3.52	0.00033	0.0633	0.0289	<0.0025	0.00175	0.00148	44.2	0.0083
LK02-2	Exposed	8.03	0.00094	12.3	0.0003	0.0786	0.0334	<0.0025	0.00266	0.00268	63.1	0.0145
LK02-2-2	Exposed	7.16	<0.00054	3.24	0.00025	0.0693	0.0226	<0.0026	0.00259	0.00053	46.3	0.00117
LK02-3	Exposed	6.47	0.00087	5.8	<0.00025	0.065	0.0357	<0.0027	0.00522	0.00134	51.8	0.0048
LK02-4	Exposed	7.68	0.00085	6.28	<0.00024	0.0669	0.0269	<0.0026	0.00393	0.00057	50.8	0.00403
LK02-5	Exposed	7.73	<0.00058	3.14	<0.00026	0.0667	0.0205	<0.0028	0.00185	0.00056	40.5	<0.00052
LK02-6	Exposed	7.39	0.00069	2.05	<0.00021	0.06	0.0204	<0.0023	0.00137	0.00058	37.3	0.00235
LK02-7	Exposed	6.45	0.00135	3.58	<0.00024	0.0726	0.0209	0.000119	0.00179	0.00097	48.3	0.0233
MC3-1	Exposed	3.70	<0.00050	4.19	<0.00022	0.0536	0.0597	0.000143	0.00372	0.00098	46.9	0.00264
MC3-2	Exposed	3.18	<0.00054	2.62	<0.00024	0.0582	0.0357	0.000074	0.00147	0.00063	39.8	0.00606
MC3-3	Exposed	3.66	<0.00051	3.66	<0.00022	0.0812	0.0408	0.000062	0.00208	0.00074	44.4	0.00499
MC3-4	Exposed	3.9	0.00474	3.91	<0.00023	0.0613	0.0513	0.000292	0.00294	0.00052	41	0.00483
MC3-5	Exposed	4.08	0.00694	8.36	<0.00020	0.106	0.0641	0.000119	0.00345	0.00136	43.6	0.0132
MC3-6	Exposed	3.7	0.00379	10.4	<0.00024	0.0796	0.0624	0.000338	0.0041	0.00296	58.3	0.0128
MCdsE-1	Exposed	4.06	<0.00052	2.8	<0.00023	0.0667	0.0289	0.00016	0.00311	0.00083	41.4	0.0049
MCdsE-2	Exposed	4.99	0.00121	2.65	<0.00021	0.0626	0.0392	0.000096	0.00229	0.00077	44.1	0.00729
MCusE-1	Exposed	4.39	0.00156	4.16	<0.00024	0.0814	0.0292	0.000185	0.00252	0.00135	53.9	0.0107
MI2-6-2014	Exposed	4.87	0.00085	5.6	<0.00024	0.0646	0.0496	0.000119	0.00251	0.00131	48.4	0.00776
MI2-7	Exposed	5	0.00125	15.6	<0.00024	0.0815	0.0588	0.000153	0.00188	0.00273	57.4	0.0283
MI2-9	Exposed	4.33	<0.00055	3.6	<0.00024	0.0542	0.0505	0.000165	0.00204	0.00067	44.7	0.173
MI2-11	Exposed	4.94	<0.00051	4.33	<0.00022	0.0464	0.0328	0.000143	0.00134	0.00117	61	<0.00082
MI2-13	Exposed	5.78	<0.00051	4.65	<0.00022	0.0602	0.0402	0.000102	0.00237	0.00062	41.00	0.00103
MI2-14	Exposed	5.74	0.00132	4.12	<0.00023	0.0627	0.0669	0.000188	0.00398	0.0016	44	0.00501
MI2-15	Exposed	5.99	<0.00054	3.49	0.00062	0.045	0.0447	0.000238	0.00241	0.00106	47.6	0.00199
MI2-16	Exposed	4.4	<0.00050	3.17	0.00022	0.0688	0.0306	<0.000036	0.00126	0.00043	44.6	0.00088
MI2-17	Exposed	6.31	0.00058	4.33	0.00037	0.0808	0.041	0.000109	0.00229	0.00072	35.7	0.00163
MI2-19	Exposed	5.86	<0.00054	3.17	<0.00024	0.0675	0.0394	0.000097	0.00221	0.00092	42	0.00122
NNP-1	Exposed	15.6	<0.00052	2.69	<0.00023	0.0616	0.0377	0.00018	0.00258	0.00065	47.4	0.0256
SWWL-1	Exposed	26.1	<0.00047	1.21	<0.00021	0.056	0.052	0.000175	0.0018	0.00017	49.8	0.0105
THPD-1	Exposed	15.3	<0.00055	7.7	<0.00024	0.0552	0.0514	0.000133	0.00156	0.00045	44.1	0.0136
THPD-2	Exposed	21.5	0.00051	3.8	<0.00020	0.0678	0.0442	0.00006	0.00152	0.0002	40.2	0.00805
UTHP-1	Exposed	20	<0.00055	10.1	<0.00024	0.0651	0.0355	0.000407	0.00169	0.00044	46.7	0.00436
UWOP-1	Exposed	3.03	0.00191	3.89	<0.00025	0.0775	0.0312	0.000208	0.00364	0.00108	44.6	0.0095
WOPD-1	Exposed	17.3	0.00127	6.06	<0.00021	0.0908	0.0363	0.00032	0.00356	0.00163	56.1	0.007

BENTHIC INVERTEBRATE TISSUE

Table B.7: Metal concentrations in composite benthic invertebrate samples collected in July 2013.

Sample ID	Reference vs Exposed	Moisture %	As µg/g dw	B µg/g dw	Ba µg/g dw	Be µg/g dw	Bi µg/g dw	Mg µg/g dw	Al µg/g dw	Ca µg/g dw	Cd µg/g dw	Co µg/g dw	Cr µg/g dw	Cs µg/g dw
AL4	Reference	87.8	1.76	4.78	54.2	0.0766	0.0170	2,100	3,350	4,970	3.15	2.47	4.34	0.483
CHCK	Reference	85.5	1.59	1.60	26.8	0.0255	0.00504	2,200	925	8,060	1.31	1.06	1.58	0.114
WWR	Reference	88.2	1.91	1.48	37.6	0.0464	0.0203	1,860	1,250	4,670	1.83	2.88	1.71	0.212
WWR Beaver Pond	Reference	87.6	4.64	4.05	70.8	0.0402	0.0114	2,040	1,540	34,100	2.38	1.73	3.57	0.242
CL11	Exposed	89.7	1.68	6.52	343	0.124	0.0249	3,440	4,760	18,100	4.58	18.9	7.82	0.829
EL1	Exposed	85.9	1.00	2.75	27.5	0.0671	0.0121	2,445	1,515	8,480	5.31	4.12	3.00	0.209
EL19	Exposed	86.9	1.40	3.06	42.5	0.0640	0.0141	3,590	1,630	14,900	8.38	3.70	3.97	0.252
ELKO	Exposed	84.3	1.13	2.42	29.6	0.0530	0.0116	2,220	1,700	8,550	3.72	1.84	2.84	0.212
FO23	Exposed	80.1	2.25	7.66	98.2	0.160	0.0260	5,300	5,510	27,800	3.70	2.31	9.12	0.728
FO29	Exposed	84.6	1.02	2.31	35.7	0.0498	0.0120	2,280	1,540	6,560	7.55	6.99	2.73	0.216
FOBC	Exposed	86.4	2.03	2.30	32.3	0.0379	0.00835	2,760	1,650	11,800	3.65	5.02	2.92	0.253
FO52	Exposed	87.6	2.35	3.37	42.4	0.0571	0.0127	2,640	2,510	9,460	8.31	18.1	3.87	0.367
GAPD	Exposed	85.8	2.44	4.23	76.3	0.110	0.0613	1,930	3,090	8,500	4.98	3.53	4.90	0.419
GHPD	Exposed	87.2	1.14	2.01	90.4	0.0363	0.00558	2,190	1,310	73,900	0.729	0.661	1.55	0.177
HA7	Exposed	83.7	0.933	3.49	43.1	0.0573	0.0145	1,700	2,330	5,070	3.24	2.01	3.27	0.316
KSP	Exposed	86.3	1.32	4.51	137	0.0983	0.0266	2,700	2,810	6,810	6.45	18.6	4.68	0.450
LC8	Exposed	89.6	1.11	4.07	49.2	0.0736	0.0146	2,470	2,240	12,100	3.88	5.95	3.60	0.396
LCCPL	Exposed	85.7	1.71	5.87	69.6	0.103	0.0165	2,580	2,920	20,700	2.59	7.44	4.88	0.416
LI8	Exposed	84.5	1.24	0.71	11.7	0.0144	0.00461	1,810	412	6,280	3.63	2.39	0.792	0.0806
LK02	Exposed	86.8	2.00	4.73	63.5	0.0972	0.0259	3,610	3,760	15,700	7.75	3.81	6.08	0.512
MI2	Exposed	82.9	1.11	2.26	28.5	0.0462	0.0105	1,710	1,740	3,660	6.27	5.32	3.12	0.218
MSAN	Exposed	83.7	2.88	6.17	235	0.253	0.0447	1,700	4,800	9,600	12.8	44.4	9.44	0.862
NNP-Benthos	Exposed	82.0	0.444	2.53	34.0	0.0680	0.00841	1,590	1,600	4,060	1.66	2.17	2.65	0.211
NNP-Tadpole	Exposed	89.5	2.07	9.42	237	0.365	0.0630	2,070	5,960	10,200	1.25	7.10	12.2	0.923
THPD	Exposed	86.6	1.37	2.64	98.7	0.0414	0.00724	1,940	1,475	45,700	2.01	4.23	1.82	0.197

Table B.7: Metal concentrations in composite benthic invertebrate samples collected in July 2013.

Sample ID	Reference vs Exposed	Cu	Fe	Ga	K	Li	Mn	Na	Ni	P	Pb	Rb	Re	Sb
		µg/g dw	µg/g dw	µg/g dw	µg/g dw	µg/g dw	µg/g dw	µg/g dw	µg/g dw	µg/g dw	µg/g dw	µg/g dw	µg/g dw	µg/g dw
AL4	Reference	15.8	1,990	1.04	10,700	2.22	57.2	3,010	4.46	8,870	1.15	10.6	<0.00026	0.0265
CHCK	Reference	10.7	864	0.298	9,490	0.846	52.6	3,040	1.94	11,400	0.365	4.11	<0.00024	0.0108
WWR	Reference	17.8	1,380	0.501	8,260	1.21	74.8	2,630	1.94	7,480	1.19	5.48	<0.00024	0.0120
WWR Beaver Pond	Reference	14.0	1,160	0.512	8,100	1.20	21.3	3,120	1.07	7,580	1.16	6.60	0.00041	0.0147
CL11	Exposed	16.5	2,580	1.56	8,730	6.78	112	9,890	33.6	6,190	1.94	13.3	0.00049	0.0597
EL1	Exposed	20.6	1,335	0.539	7,305	1.33	216	3,910	4.94	8,220	0.807	5.97	0.00092	0.0242
EL19	Exposed	20.2	1,890	0.632	7,790	1.84	156	3,850	4.65	7,760	1.02	6.30	0.00067	0.0144
ELKO	Exposed	16.2	1,260	0.592	7,730	1.17	192	3,090	4.31	7,980	0.749	5.91	0.00063	0.0313
FO23	Exposed	10.8	5,240	1.85	7,670	3.46	247	2,200	7.27	6,100	2.10	12.7	0.00127	0.0299
FO29	Exposed	17.1	1,620	0.534	7,630	1.33	213	2,870	7.62	7,040	0.923	7.07	0.00064	0.0126
FOBC	Exposed	13.3	1,040	0.556	9,830	1.65	117	3,220	4.13	10,400	0.641	7.02	0.00026	0.0283
FO52	Exposed	15.5	1,840	0.794	8,550	1.95	162	2,730	13.1	9,070	1.08	9.16	0.00034	0.0312
GAPD	Exposed	17.5	5,210	1.06	8,200	2.39	151	4,840	11.1	5,160	4.16	7.16	0.00035	0.0222
GHPD	Exposed	44.0	426	0.367	9,250	1.38	37.1	4,660	3.83	8,710	0.401	9.03	0.00022	0.0288
HA7	Exposed	15.0	1,530	0.735	9,870	1.30	116	2,800	4.11	8,800	1.16	7.14	<0.00023	0.0160
KSP	Exposed	30.7	2,400	0.966	14,700	2.49	341	2,530	63.5	8,720	2.48	9.41	<0.00023	0.0269
LC8	Exposed	18.8	1,550	0.756	12,500	1.58	111	4,570	16.6	9,580	1.43	5.93	0.0004	0.0266
LCCPL	Exposed	16.9	1,740	0.983	8,550	2.44	196	4,380	14.1	7,010	1.44	6.78	0.00049	0.0384
LI8	Exposed	25.0	1,140	0.159	7,990	0.555	27.1	3,380	5.32	10,200	0.575	4.07	<0.00024	0.0132
LK02	Exposed	24.4	2,740	1.25	10,000	2.55	200	3,020	5.89	8,010	1.70	10.1	0.00067	0.0479
MI2	Exposed	18.1	1,550	0.572	7,560	0.891	136	3,190	10.5	7,880	3.89	6.85	0.00037	0.0464
MSAN	Exposed	22.3	3,620	1.84	8,440	2.82	141	3,640	38.1	5,480	4.11	14.9	0.00042	0.0245
NNP-Benthos	Exposed	12.4	658	0.583	7,960	1.06	32.7	3,760	4.72	7,150	0.594	3.82	0.00022	0.0221
NNP-Tadpole	Exposed	11.1	3,260	2.90	7,220	4.23	115	7,390	17.8	4,500	5.27	16.6	0.00185	0.0247
THPD	Exposed	27.5	898	0.447	9,625	2.18	70.6	4,680	8.23	8,180	0.471	7.62	0.000245	0.0238

Table B.7: Metal concentrations in composite benthic invertebrate samples collected in July 2013.

Sample ID	Reference vs Exposed	Se µg/g dw	Mo µg/g dw	Ag µg/g dw	Sn µg/g dw	Sr µg/g dw	Th µg/g dw	Ti µg/g dw	Tl µg/g dw	U µg/g dw	V µg/g dw	Y µg/g dw	Zn µg/g dw	Zr µg/g dw
AL4	Reference	4.84	0.505	0.0834	0.102	9.89	0.505	22.3	0.108	0.155	7.73	1.58	225	1.40
CHCK	Reference	3.38	0.380	0.0989	0.0242	10.2	0.147	3.71	0.0325	0.0711	2.74	0.562	203	0.382
WWR	Reference	4.21	0.361	0.0637	0.0415	4.85	0.512	9.33	0.0514	0.109	2.23	2.12	195	0.809
WWR Beaver Pond	Reference	33.0	0.539	0.0896	0.0580	46.6	0.268	12.8	0.0597	0.235	3.09	1.06	137	0.591
CL11	Exposed	18.0	2.81	0.174	0.139	26.1	0.749	26.1	0.220	0.461	15.5	2.28	211	3.24
EL1	Exposed	6.22	0.531	0.122	0.0509	13.1	0.374	9.19	0.0844	0.145	5.34	1.94	279	1.10
EL19	Exposed	6.67	0.669	0.143	0.0587	21.3	0.584	8.79	0.0909	0.247	6.89	2.04	351	1.39
ELKO	Exposed	9.54	0.499	0.099	0.0577	14.8	0.386	12.4	0.0704	0.136	5.13	1.96	183	1.16
FO23	Exposed	10.7	0.680	0.127	0.148	37.0	1.15	18.6	0.163	0.453	17.3	5.05	250	2.01
FO29	Exposed	8.40	0.445	0.0997	0.0431	9.23	0.373	6.07	0.0754	0.158	5.68	1.84	390	0.966
FOBC	Exposed	8.59	0.448	0.128	0.0506	14.1	0.322	11.6	0.0643	0.139	5.32	1.08	264	0.934
FO52	Exposed	7.28	0.528	0.124	0.0733	13.8	0.376	12.8	0.0955	0.175	8.17	1.44	503	1.23
GAPD	Exposed	22.1	0.702	0.147	0.0458	26.5	0.808	12.3	0.190	0.289	12.5	2.29	197	1.71
GHPD	Exposed	11.3	0.450	0.442	0.0362	90.4	0.165	8.26	0.0888	0.0942	3.42	0.451	48.8	0.822
HA7	Exposed	19.1	0.640	0.0859	0.0618	9.31	0.410	10.0	0.0745	0.156	7.29	1.31	179	1.10
KSP	Exposed	12.0	0.902	0.200	0.0897	16.2	0.853	11.1	0.135	0.688	10.9	2.88	343	3.22
LC8	Exposed	10.6	0.616	0.0533	0.0677	16.5	0.405	9.79	0.104	0.229	7.72	1.43	248	1.59
LCCPL	Exposed	36.2	1.50	0.101	0.0821	24.7	0.472	13.7	0.106	0.334	10.2	1.53	281	2.15
LI8	Exposed	4.27	0.315	0.0663	0.0166	9.64	0.114	4.06	0.0527	0.0499	1.41	0.39	324	0.324
LK02	Exposed	7.43	0.765	0.104	0.129	25.2	0.792	25.8	0.115	0.248	11.0	2.77	184	2.05
MI2	Exposed	6.37	0.698	0.134	0.370	7.37	0.295	11.1	0.0781	0.110	6.03	2.65	265	1.09
MSAN	Exposed	6.60	1.12	0.192	0.115	37.2	1.39	12.5	0.227	0.502	22.0	4.12	550	6.67
NNP-Benthos	Exposed	7.08	0.430	0.0318	0.0476	9.26	0.237	10.9	0.0644	0.0936	5.64	0.643	105	1.84
NNP-Tadpole	Exposed	6.76	1.73	0.124	0.147	53.1	1.69	27.7	0.314	0.632	31.0	4.45	133	15.0
THPD	Exposed	20.1	0.453	0.320	0.0423	113	0.194	10.4	0.0975	0.176	3.89	0.553	84.0	0.646

Table B.8: Metal concentrations in composite benthic invertebrate samples collected in July 2014.

Sample ID	Reference vs Exposed	Moisture %	Ag µg/g dw	Al µg/g dw	As µg/g dw	B µg/g dw	Ba µg/g dw	Be µg/g dw	Bi µg/g dw	Ca µg/g dw	Cd µg/g dw	Co µg/g dw	Cr µg/g dw	Cs µg/g dw
CHCK-B	Reference	81%	0.0930	808	2.34	1.90	27.8	0.0257	0.00430	4,750	3.54	1.57	1.62	0.102
WWR-B	Reference	83%	0.0553	2,120	2.11	3.16	25.9	0.0946	0.0258	5,410	1.10	2.38	2.70	0.274
WWRBP-B	Reference	87%	0.111	3,650	3.02	9.96	179	0.204	0.0406	18,300	0.763	2.81	7.53	0.491
CL11-B	Exposed	83%	0.130	2,590	2.40	4.60	81.6	0.0892	0.0128	9,160	3.02	18.7	3.85	0.391
EAPD-B	Exposed	81%	0.129	897	0.410	1.71	12.2	0.0290	0.00524	6,100	1.22	0.946	1.33	0.114
EL1-B	Exposed	80%	0.127	2,340	1.43	5.55	61.7	0.0904	0.0221	10,200	6.38	3.27	4.18	0.267
EL19-B	Exposed	82%	0.111	1,740	1.82	5.63	88.1	0.0716	0.0108	8,340	5.77	3.01	3.41	0.242
ELKO-B	Exposed	85%	0.112	2,860	1.33	4.73	42.5	0.101	0.0191	9,330	4.48	2.42	4.60	0.312
FO10-B	Exposed	83%	0.119	5,080	1.48	7.43	55.5	0.148	0.0280	11,400	1.97	2.52	7.91	0.554
FO23-B	Exposed	84%	0.111	2,660	1.38	5.60	48.9	0.0958	0.0149	8,670	5.52	2.71	4.28	0.351
FO29-B	Exposed	81%	0.0937	3,360	1.59	5.44	62.0	0.110	0.0138	7,560	6.18	2.99	5.42	0.329
FO52-B	Exposed	80%	0.0988	5,020	2.44	8.00	60.6	0.161	0.0232	16,900	17.7	7.23	7.78	0.640
FOBC-B	Exposed	87%	0.109	1,500	1.56	2.61	21.8	0.0435	0.00894	12,300	4.06	3.90	2.57	0.200
GAPD-B	Exposed	82%	0.163	6,420	4.66	11.1	94.1	0.254	0.0354	26,500	7.17	5.32	10.2	0.685
GC2-B	Exposed	78%	0.116	3,890	2.44	8.24	76.4	0.145	0.0209	14,000	2.45	3.17	6.03	0.430
GHPD-B	Exposed	77%	0.235	1,900	1.88	3.50	60.1	0.0608	0.0104	97,400	0.394	0.982	2.45	0.221
HA7-B	Exposed	81%	0.0634	4,580	2.87	7.80	44.4	0.163	0.0244	9,450	9.34	5.64	6.35	0.521
HOPD-B	Exposed	82%	0.110	2,480	2.15	4.75	77.4	0.099	0.0176	3,480	7.52	30.7	4.07	0.343
FOBE-B	Exposed	79%	0.122	1,710	1.41	2.77	23.8	0.0571	0.00780	9,690	4.16	6.41	2.71	0.220
KSP-B	Exposed	80%	0.0800	3,690	0.816	6.38	48.9	0.144	0.0194	5,720	4.77	3.80	5.70	0.471
KSPS-B	Exposed	78%	0.0569	3,850	0.999	7.67	40.6	0.156	0.0210	11,500	0.810	1.06	6.57	0.425
LCCPL-B	Exposed	80%	0.0693	1,770	1.17	4.16	45.8	0.0657	0.0107	10,400	1.69	4.42	2.84	0.212
LEPD-B	Exposed	79%	0.0702	4,330	1.24	6.99	122	0.165	0.0276	72,700	1.46	2.62	6.47	0.518
LIDSL-B	Exposed	80%	0.0381	793	1.51	1.71	12.3	0.0246	0.00572	5,845	8.24	4.83	1.35	0.123
LK02-B	Exposed	82%	0.0865	3,460	2.14	5.98	67.1	0.122	0.0295	11,900	6.29	3.98	5.06	0.392
MC3-B	Exposed	79%	0.127	2,165	1.97	4.47	83.7	0.0674	0.0107	3,235	8.86	7.53	3.18	0.214
MI2-B	Exposed	83%	0.116	4,760	1.80	7.04	71.0	0.151	0.0230	6,840	4.70	4.52	7.22	0.452
NNP-B	Exposed	77%	0.130	9,910	2.31	13.9	211	0.433	0.0506	11,000	3.35	11.0	14.5	0.955
SWWL-B	Exposed	84%	0.0877	2,700	2.52	4.53	52.2	0.0914	0.0217	15,400	6.75	2.43	4.33	0.346
THPD-B	Exposed	81%	0.0653	3,300	0.643	5.60	51.4	0.0977	0.0163	12,000	0.518	1.17	4.19	0.355
UTHP-B	Exposed	87%	0.288	10,900	2.64	13.9	209	0.349	0.0518	31,000	2.28	5.39	13.9	1.24
WOPD-B	Exposed	82%	0.0965	5,220	1.51	10.5	128	0.185	0.0314	40,900	1.14	6.41	6.67	0.583

Table B.8: Metal concentrations in composite benthic invertebrate samples collected in July 2014.

Sample ID	Reference vs Exposed	Cu µg/g dw	Fe µg/g dw	Ga µg/g dw	K µg/g dw	Li µg/g dw	Mg µg/g dw	Mn µg/g dw	Mo µg/g dw	Na µg/g dw	Ni µg/g dw	P µg/g dw	Pb µg/g dw	Rb µg/g dw
CHCK-B	Reference	10.7	558	0.279	9,750	0.820	1,830	60.7	0.414	2,830	1.85	10,100	0.368	4.61
WWR-B	Reference	16.7	1,650	0.707	10,500	2.52	2,480	67.3	0.631	8,200	2.87	8,860	7.23	5.81
WWRBP-B	Reference	20.5	3,030	1.27	21,100	3.46	4,060	334	0.926	4,600	5.23	7,780	3.07	10.4
CL11-B	Exposed	20.9	1,370	0.819	9,360	3.66	2,160	186	1.29	5,390	24.8	7,700	0.993	9.73
EAPD-B	Exposed	14.6	506	0.287	11,000	0.974	1,560	22.7	0.350	6,670	6.34	9,280	0.417	8.88
EL1-B	Exposed	28.9	1,920	0.725	10,100	2.02	3,140	239	0.543	3,480	6.04	10,500	1.48	6.47
EL19-B	Exposed	21.5	1,350	0.648	12,500	1.95	2,780	421	0.649	2,820	11.8	8,810	0.880	6.13
ELKO-B	Exposed	25.4	1,980	0.888	9,460	2.48	2,960	253	0.828	6,070	4.67	9,850	2.19	7.28
FO10-B	Exposed	15.5	3,260	1.48	9,500	4.40	4,110	183	0.618	5,900	10.9	8,490	1.95	9.54
FO23-B	Exposed	22.4	1,810	0.819	12,400	2.53	3,150	204	0.590	4,790	13.4	10,500	1.05	7.74
FO29-B	Exposed	13.8	2,340	1.01	10,800	2.69	2,790	137	0.482	3,140	7.53	9,480	1.14	8.58
FO52-B	Exposed	31.0	3,030	1.44	11,400	4.67	4,820	114	0.645	3,560	13.7	9,420	1.82	15.7
FOBC-B	Exposed	16.4	937	0.453	10,400	1.65	3,150	76.3	0.397	3,790	3.46	13,300	0.669	6.06
GAPD-B	Exposed	18.6	5,720	1.87	11,600	5.65	3,740	134	1.24	4,870	23.6	8,030	4.49	12.7
GC2-B	Exposed	18.3	2,560	1.17	12,200	3.39	3,450	611	0.833	5,440	9.73	9,240	1.55	7.99
GHPD-B	Exposed	55.9	888	0.530	9,350	1.83	2,940	24.4	0.790	4,720	5.54	11,500	1.89	7.91
HA7-B	Exposed	28.5	2,770	1.30	12,200	3.23	2,730	76.9	0.675	3,870	6.71	10,200	2.83	13.2
HOPD-B	Exposed	26.0	1,160	0.825	16,100	2.61	2,200	119	0.843	5,740	68.5	11,800	1.78	7.79
FOBE-B	Exposed	20.8	1,021	0.481	10,400	1.96	2,800	69.2	0.417	4,180	6.86	12,150	0.592	6.58
KSP-B	Exposed	21.4	1,970	1.11	12,800	3.37	2,260	98.2	0.572	4,740	24.4	9,840	2.56	6.87
KSPS-B	Exposed	15.2	2,840	1.17	10,800	4.30	4,080	122	0.665	4,220	8.29	8,850	4.43	6.78
LCCPL-B	Exposed	18.4	1,170	0.559	10,400	1.69	2,410	202	1.45	4,730	12.5	9,760	1.16	4.20
LEPD-B	Exposed	10.6	2,900	1.19	9,010	4.95	3,190	208	0.688	6,300	17.0	6,160	2.17	8.06
LIDSL-B	Exposed	19.8	531	0.243	9,815	0.977	2,080	35.6	0.323	3,670	7.89	11,150	0.341	5.83
LK02-B	Exposed	28.1	2,610	1.09	10,500	3.20	3,570	278	0.670	3,720	5.73	9,530	1.75	8.69
MC3-B	Exposed	19.4	1,340	0.635	10,650	1.43	1,720	214	0.490	3,780	9.87	9,160	0.879	6.69
MI2-B	Exposed	21.9	2,950	1.36	10,100	3.27	2,830	247	0.745	7,530	7.14	8,650	2.48	9.46
NNP-B	Exposed	17.2	2,660	3.35	9,790	6.17	2,370	198	1.62	2,790	34.2	6,840	5.21	16.2
SWWL-B	Exposed	24.4	1,430	0.808	13,500	2.94	2,890	255	0.721	3,870	35.0	10,900	9.87	7.93
THPD-B	Exposed	12.6	1,810	0.935	10,900	2.68	2,220	86.9	0.702	4,930	15.7	10,700	2.25	6.08
UTHP-B	Exposed	16.4	5,950	2.92	15,400	8.79	3,370	278	0.838	10,500	38.3	7,330	4.03	19.0
WOPD-B	Exposed	14.6	3,330	1.41	12,900	5.17	2,730	121	0.847	6,160	82.4	8,110	1.75	9.80

Table B.8: Metal concentrations in composite benthic invertebrate samples collected in July 2014.

Sample ID	Reference vs Exposed	Re µg/g dw	Sb µg/g dw	Se µg/g dw	Sn µg/g dw	Sr µg/g dw	Th µg/g dw	Ti µg/g dw	Tl µg/g dw	U µg/g dw	V µg/g dw	Y µg/g dw	Zn µg/g dw	Zr µg/g dw
CHCK-B	Reference	0.000160	0.0160	5.00	0.0337	6.54	0.150	5.48	0.0321	0.0974	2.50	0.509	194	0.425
WWR-B	Reference	0.000303	0.0190	5.68	0.686	6.31	0.593	18.9	0.0648	0.155	3.68	1.51	118	0.965
WWRBP-B	Reference	0.000839	0.0292	12.7	0.108	21.8	1.08	13.7	0.0747	1.04	7.27	4.11	203	3.00
CL11-B	Exposed	0.000552	0.0509	17.4	0.0771	14.2	0.375	15.3	0.122	0.251	8.09	1.18	182	1.72
EAPD-B	Exposed	0.000143	0.0248	17.4	0.0436	6.45	0.134	6.88	0.0644	0.164	2.80	0.451	72.5	0.552
EL1-B	Exposed	0.000631	0.0487	9.74	0.0682	18.1	0.413	16.4	0.0864	0.258	8.43	1.74	382	1.17
EL19-B	Exposed	0.000399	0.0359	6.69	0.0641	15.1	0.414	11.0	0.0637	0.460	6.50	1.59	378	1.25
ELKO-B	Exposed	0.000585	0.0528	9.42	0.135	19.9	0.551	21.5	0.101	0.194	8.57	2.52	235	1.54
FO10-B	Exposed	0.000519	0.0527	12.1	0.126	15.9	0.764	21.1	0.121	0.262	16.7	2.49	138	1.84
FO23-B	Exposed	0.000593	0.0391	8.83	0.0865	11.2	0.422	17.4	0.0847	0.243	7.97	1.36	375	1.24
FO29-B	Exposed	0.000316	0.0374	9.55	0.0957	12.4	0.498	17.6	0.0936	0.189	11.2	1.57	264	1.18
FO52-B	Exposed	0.000611	0.0531	8.63	0.116	19.5	0.772	27.2	0.132	0.286	15.6	2.46	527	2.14
FOBC-B	Exposed	0.000286	0.0275	11.0	0.0837	13.0	0.241	10.5	0.0630	0.113	4.80	0.770	257	0.773
GAPD-B	Exposed	0.000931	0.0728	55.4	0.139	38.6	1.02	23.4	0.291	0.554	23.7	3.26	252	3.23
GC2-B	Exposed	0.000746	0.0637	30.9	0.118	23.0	0.581	20.1	0.132	0.265	13.6	2.30	205	1.74
GHPD-B	Exposed	0.000320	0.0535	16.6	0.699	58.1	0.276	11.3	0.0891	0.155	5.54	0.723	55.4	1.34
HA7-B	Exposed	0.000536	0.0342	18.8	0.490	13.3	0.666	24.1	0.163	0.216	13.1	1.97	313	1.79
HOPD-B	Exposed	0.000378	0.0628	15.5	0.0845	11.4	0.394	18.1	0.105	0.757	8.64	1.13	418	3.23
FOBE-B	Exposed	0.0001905	0.0300	9.71	0.0477	11.1	0.248	11.5	0.0662	0.120	5.06	0.842	284	0.75
KSP-B	Exposed	0.000346	0.0565	9.31	0.423	12.9	0.617	22.5	0.130	0.288	12.4	1.80	144	2.32
KSPS-B	Exposed	0.000470	0.0694	8.51	0.585	13.5	0.698	20.1	0.103	0.416	13.7	2.45	80.5	1.99
LCCPL-B	Exposed	0.000747	0.0638	42.0	0.101	12.9	0.295	11.1	0.0861	0.281	6.01	0.763	288	1.20
LEPD-B	Exposed	0.000540	0.0269	8.99	0.114	250	0.740	13.3	0.158	0.248	14.2	2.01	79.2	2.08
LIDSL-B	Exposed	0.000177	0.0184	5.60	0.0299	7.97	0.133	6.43	0.0873	0.0918	2.13	0.427	493	0.410
LK02-B	Exposed	0.000426	0.0376	7.22	0.129	16.9	0.807	26.9	0.0919	0.198	8.90	2.52	192	1.72
MC3-B	Exposed	0.000371	0.0378	7.14	0.0581	7.93	0.330	16.2	0.116	0.185	7.21	1.94	387	1.011
MI2-B	Exposed	0.000780	0.0531	7.35	0.123	14.1	0.762	30.7	0.155	0.284	16.8	3.65	255	2.13
NNP-B	Exposed	0.00142	0.0617	20.9	0.0740	54.9	1.50	27.6	0.326	0.679	35.7	3.70	151	8.41
SWWL-B	Exposed	0.000367	0.0551	27.6	2.57	13.0	0.436	19.6	0.142	0.353	9.69	1.10	310	1.92
THPD-B	Exposed	0.000684	0.0320	11.2	0.604	19.9	0.436	19.1	0.0825	0.168	9.27	1.12	101	1.30
UTHP-B	Exposed	0.000972	0.0312	15.4	0.323	47.9	1.45	43.7	0.228	0.461	31.5	4.21	142	5.11
WOPD-B	Exposed	0.000441	0.0469	12.8	0.134	47.5	0.733	26.1	0.149	0.485	15.1	1.98	183	1.99

Table B.9: Benthic invertebrate sample composition and corresponding *in situ* water quality measures, July 2013.

Station	Coordinates	Taxa	Biomass (Fraction of Sample)	Field Measures: Temperature (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (%)	pH	Specific Conductance (µS/cm)
FO23	652766 5528336	Perlidae	60	8.83	10.25	88.5	8.54	479
		Oligochaeta	35					
		Heptageniidae	2					
		Baetidae	2					
		Other (blackfly, Polycentropodidae)	1					
MI2	652665 5511671	Ephemerellidae	20	10.78	10.04	90.7	8.60	324
		Perlidae	50					
		Drunella	20					
		Tipulidae	< 1					
		Rhyacophila	2					
		Perlodidae	5					
		Baetidae	3					
EL1	651485 5507705	Ephemerellidae	25	10.90	9.44	85.6	8.07	320
		Perlidae	30					
		Baetidae	15					
		Heptageniidae	15					
		Perlodidae	10					
		Oligochaeta	< 1					
		Chloroperlidae	5					
LK02	633259 5448677	Leptoceridae	2	11.22	10.76	98.2	8.24	298
		Drunella	25					
		Ephemerellidae	13					
		Perlodidae	15					
		Baetidae	40					
		Tipulidae	5					
EL19	653143 5525768	Heptageniidae	20	9.26	10.15	88.3	8.25	315
		Perlidae	25					
		Tipulidae	5					
		Baetidae	30					
		Chloroperlidae (Adult)	5					
		Drunella	10					
		other plecoptera	5					
ELKO	639440 5463495	Drunella	45	12.01	9.16	85.3	8.06	316
		Oligochaeta	10					
		Baetidae	15					
		Chloroperlidae	10					
		Heptageniidae	3					
		Perlidae	15					
		Lepidostoma	1					
		Rhyacophila	1					
WWR	645275 5458996	Drunella	30	12.45	10.34	97.3	7.59	158
		Perlidae	5					
		Perlodidae	12					
		Chloroperlidae	15					
		Baetidae	20					
		Heptageniidae	15					
		Limnephilidae	2					
		Tipulidae	1					
WWR (Beaver Pond)	645345 5459119	Amphipoda	15	11.22	8.89	81.4	7.11	301
		Oligochaeta	50					
		Leptoceridae	5					
		Tipulidae	10					
		Dytiscidae	10					
		Baetidae	10					
NNP (Benthos)	661061 5535576	Dytiscidae	70	15.96	x	x	8.08	478
		Chironomidae	10					
		Oligochaeta	20					
LCCPL	659817 5531572	Tipulidae	50	10.05	x	x	7.96	619
		Limnephilidae	35					
		Leptoceridae	5					
		Heptageniidae	2					
		Baetidae	2					
		Perlodidae / Chloroperlidae	1					
		Oligochaeta	5					
LC8 (d/s of culvert, u/s of LCCPL)	659871 5531615	Chironomidae	80	6.88	x	x	8.07	577
		Rhyacophila / Leptoceridae	15					
		Chloroperlidae	5					
MSAN	661463 5536414	Tipulidae	40	19.76	x	x	7.71	421
		Stratiomyidae	10					
		Leptoceridae	< 1					
		Baetidae	42					
		Limnephilidae	5					
		Other Diptera	< 1					
		Chironomidae	< 1					

Table B.9: Benthic invertebrate sample composition and corresponding *in situ* water quality measures, July 2013.

Station	Coordinates	Taxa	Biomass (Fraction of Sample)	Field Measures: Temperature (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (%)	pH	Specific Conductance (µS/cm)
LI8	659264 5530542	Perlidae	80	6.71	11.05	90.5	7.92	468
		Baetidae	< 0.5					
		Peltoperlidae / Ephemerellidae	10					
		Heptageniidae	10					
		Oligochaeta	< 0.5					
HA7	657032 5522138	Limnephilidae	67	9.71	10.68	94.7	8.15	509
		Baetidae	20					
		Chironomidae	5					
		Leptoceridae	5					
		Tipulidae	2					
		Chloroperlidae	< 1					
		Amphipoda	< 1					
GHPD	653679 5596063	Amphipoda	92	19.20	9.06	98.3	8.11	902
		Coenagrionidae	5					
		Limnephilidae	3					
CHCK	655382 5552743	Perlidae	60	9.34	10.27	89.7	8.34	200
		Heptageniidae	5					
		Ephemerellidae	15					
		Rhyacophila	5					
		Leptoceridae	5					
		Baetidae	10					
CL11	650971 5564050	Coenagrionidae	8	10.19	9.15	82.1	7.73	1120
		Pisidium	< 1					
		Ceratopogonidae	1					
		Chironomidae	1					
		Sialis	5					
		Baetidae	3					
		Oligochaeta	2					
		Tipulidae	65					
		Chrysops	15					
FOBC (Fording River beside Clode Pond)	650769 5564269	Ephemerellidae	25	8.99	9.99	86.5	8.20	358
		Heptageniidae	17					
		Chironomidae	2					
		Baetidae	15					
		Perlidae / Perlodidae	35					
		Oligochaeta	< 1					
		Rhyacophila	5					
		Lepidostoma	1					
KSP	652378 5558721	Oligochaeta	1	9.99	9.89	87.6	7.95	936
		Chironomidae	5					
		Limnephilidae	94					
FO52	652390 5558148	Heptageniidae	20	11.70	9.71	89.5	8.25	643
		Baetidae	10					
		Ephemerellidae	45					
		Perlidae	25					
		Chloroperlidae	< 1					
		Chironomidae	< 1					
GAPD	655838 5509080	Oligochaeta	20	9.97	9.06	80.6	7.93	1576
		Baetidae	2					
		Tipulidae	60					
		Amphipoda	< 1					
		Chironomidae	< 1					
		Maggot-Diptera	2					
		Limnephilidae	15					
		Coenagrionidae	< 1					
AL4	664507 5512244	Baetidae	50	5.05	11.17	87.7	8.56	218
		Limnephilidae	5					
		Ephemerellidae	33					
		Perlidae	2					
		Heptageniidae	10					
		Chironomidae	< 1					
FO29	655134 5543676	Drunella	55	9.56	10.10	89.0	8.11	516
		Perlidae	5					
		Heptageniidae	25					
		Baetidae	15					
		Rhyacophila	< 1					
		Chironomidae	< 1					
THPD	648956 5550412	Coenagrionidae	20	14.85	12.7	125.9	8.28	1126
		Amphipoda	50					
		Baetidae	28					
		Sialis	< 1					
		Limnephilidae	2					

x - Probe not functioning properly at time of sampling (DO membrane damaged).

Table B.10: Benthic invertebrate sample composition and corresponding *in-situ* water quality measures, July 2014.

Station	Coordinates	Taxa	Total Biomass (g)	Mass (g)	Biomass (Fraction of Sample)	Field Measures: Temperature (°C)	Field Measures: Dissolved Oxygen (mg/L)	Field Measures: Dissolved Oxygen (%)	Field Measures: pH	Field Measures: Specific Conductance (μS/cm)
CHCK	0655324 5552778	Baetidae	2.69	1.14	42%	5.54	11.73	93.3	8.50	190
		Chironomidae		0.15	5%					
		Chloroperlidae		0.15	6%					
		Heptageniidae		0.68	25%					
		Limnephilidae		0.30	11%					
		Perlidae / Perlodidae		0.27	10%					
CL11	0650925 5564364	Baetidae	3.69	1.65	45%	12.52	8.71	80.7	8.00	635
		Ceratopogonidae		0.13	4%					
		Chrysops		0.29	8%					
		Dytiscidae larvae		0.03	1%					
		Limnephilidae		0.18	5%					
		Lumbriculidae		0.16	4%					
		Tipulidae		1.26	34%					
EAPD	0651231 5562849	Baetidae	2.54	0.02	1%	18.29	5.26	54.5	7.98	2,201
		Chrysops		0.09	4%					
		Coenagrionidae		1.89	75%					
		Dytiscidae larvae		0.01	0%					
		Tipulidae		0.53	21%					
EL1	0651373 5507445	Baetidae	6.28	0.44	7%	10.21	x	x	8.30	288
		Ephemerellidae		2.19	35%					
		Limnephilidae		1.02	16%					
		Lumbriculidae		0.40	6%					
		Perlidae / Perlodidae		2.08	33%					
		Tipulidae		0.14	2%					
EL19	0653170 5525830	Baetidae	4.28	1.19	28%	9.41	x	x	8.25	294
		Ephemerellidae		0.66	15%					
		Heptageniidae		0.53	12%					
		Limnephilidae		1.72	40%					
		Perlidae / Perlodidae		0.18	4%					
ELKO	0639391 5463408	*Atherix*	2.93	0.10	3%	14.77	x	x	8.27	275
		Tipulidae		0.83	28%					
		Heptageniidae		0.08	3%					
		Drunella		0.29	10%					
		Ephemerellidae		1.00	34%					
		Lumbriculidae		0.01	0.2%					
		Baetidae		0.14	5%					
		Perlidae / Perlodidae		0.08	3%					
		Chloroperlidae		0.41	14%					
FO10	0654257 5555305	*Drunella*	5.54	0.25	5%	10.66	9.41	85.1	8.10	463
		Heptageniidae		0.04	0.7%					
		Lumbriculidae		0.28	5%					
		Perlidae / Perlodidae		1.86	34%					
		Rhyacophila		0.07	1.3%					
		Tipulidae		3.05	55%					
FO23	0652917 5528772	Baetidae	2.85	0.68	24%	8.63	x	x	8.30	454
		Limnephilidae		0.88	31%					
		Ephemerellidae		0.11	4%					
		Perlidae / Perlodidae		0.52	18%					
		Rhyacophila		0.08	3%					
		Tipulidae		0.59	21%					
FO29	0655151 5543673	Baetidae	5.00	0.51	10%	6.79	12.14	100.9	8.35	426
		Chironomidae		0.23	5%					
		Chloroperlidae		0.13	3%					
		Ephemerellidae		0.41	8%					
		Heptageniidae		2.74	55%					
		Limnephilidae		0.29	6%					
		Lumbriculidae		0.13	3%					
		Perlidae / Perlodidae		0.38	8%					
		Rhyacophila		0.14	3%					
		Tipulidae		0.04	1%					
FO52	0652439 5558086	Baetidae	4.97	4.97	100%	11.16	9.15	86	8.22	419
FOBC	0650752 5564402	Baetidae	4.01	2.25	56%	7.55	10.07	85.09	8.16	263
		Drunella		0.28	7%					
		Heptageniidae		0.51	13%					
		Perlidae / Perlodidae		0.93	23%					
		Rhyacophila		0.03	1%					
		Tipulidae		0.01	0.1%					
FOBE	0651252 5562680	Baetidae	5.98	3.33	56%	7.97	12.47	103.2	8.23	291
		Ephemerellidae		0.05	1%					
		Heptageniidae		0.84	14%					
		Perlidae		1.37	23%					
		Tipulidae		0.39	7%					
GAPD	0655814 5509138	Amphipoda	1.87	0.05	2%	15.98	x	x	8.26	1,477
		Anisoptera		0.11	6%					
		Coenagrionidae		0.06	3%					
		Limnephilidae		0.52	28%					
		Lumbriculidae		0.73	39%					
		Tipulidae		0.41	22%					
GC2	0652909 5514034	Baetidae	2.32	0.11	5%	15.92	x	x	8.14	763
		Chironomidae		0.17	7%					
		Dytiscidae larvae		0.16	7%					
		Limnephilidae		0.72	31%					
		Limnophora		0.05	2%					
		Lumbriculidae		0.38	16%					
		Tipulidae		0.74	32%					
GHPD	0653685 5546050	Amphipoda	2.98	2.98	100%	13.65	10.19	98.5	7.88	1,112

Table B.10: Benthic invertebrate sample composition and corresponding *in-situ* water quality measures, July 2014.

Station	Coordinates	Taxa	Total Biomass (g)	Mass (g)	Biomass (Fraction of Sample)	Field Measures				
						Temperature (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (%)	pH	Specific Conductance (µS/cm)
HA7	0657038 5522145	Baetidae	3.52	3.52	100%	10.70	x	x	7.63	485
HOPD	0661582 5536307	Baetidae	2.14	0.36	17%	5.96	12.02	95.5	7.56	562
		Chironomidae		0.22	10%					
		Chloroperlidae		0.03	1.2%					
		Dytiscidae larvae		0.33	15%					
		Limnephilidae		0.67	31%					
		Tipulidae		0.54	25%					
KSP	0652451 5558689	Chironomidae	3.06	2.30	75%	7.56	9.91	82.3	8.09	740
		Dytiscidae larvae		0.42	14%					
		Limnephilidae		0.18	6%					
		Nematoda		0.01	0.3%					
		Tipulidae		0.15	5%					
KSPS	0652386 5558479	Chironomidae	2.46	2.46	100%	6.52	8.53	72.5	7.73	866
LCCPL	0659810 5531658	Baetidae	3.46	0.13	4%	11.42	9.83	92	7.93	528
		Chloroperlidae / Perlodidae		0.09	3%					
		Limnephilidae		2.17	63%					
		Lumbriculidae		0.14	4%					
		Tipulidae		0.94	27%					
LEPD	0648257 5553043	Baetidae	4.38	0.11	3%	15.14	x	x	8.24	1,232
		Dytiscidae larvae		0.32	7%					
		Limnephilidae		0.27	6%					
		Rhyacophila		0.07	2%					
		Stratiomyidae		1.38	32%					
		Tipulidae		2.24	51%					
LIDSL	0659252 5530505	Baetidae	4.79	1.05	22%	6.46	11.62	94.7	8.28	439
		Chironomidae		1.01	21%					
		Ephemerellidae		0.71	15%					
		Heptageniidae		0.67	14%					
		Hydropsychidae		0.38	8%					
		Perlodidae		0.51	11%					
		Rhyacophila		0.43	9%					
		Tipulidae		0.05	0.9%					
LK02	0633255 5448663	Baetidae	2.32	0.93	40%	13.02	x	x	8.26	249
		Drunella		0.34	15%					
		Heptageniidae		0.25	11%					
		Limnephilidae + *Glossosoma* pupae		0.17	7%					
		Other Ephemerellidae		0.42	18%					
		Perlodidae		0.01	0.4%					
		Tipulidae		0.20	9%					
MC3	0659830 5500020	Baetidae	4.05	0.78	19%	8.83	x	x	8.49	220
		Ephemerellidae		1.17	29%					
		Heptageniidae		1.13	28%					
		Limnephilidae		0.66	16%					
		Tipulidae		0.32	8%					
MI2	0652585 5511637	Baetidae	4.00	0.31	8%	11.66	x	x	8.27	309
		Ephemerellidae		1.47	37%					
		Limnephilidae		0.23	6%					
		Perlidae / Perlodidae		0.11	3%					
		Tipulidae		1.88	47%					
NNP	0661057 5535573	Dytiscidae larvae	2.53	0.02	0.8%	14.71	8.52	84	8.36	417
		Limnephilidae		0.15	6%					
		Lumbriculidae		1.88	74%					
		Tipulidae		0.49	19%					
SWWL	0651843 5558479	Baetidae	2.20	0.48	22%	6.55	11.66	96	8.17	1,455
		Chironomidae		0.37	17%					
		Culicidae		0.16	7%					
		Dytiscidae larvae		0.04	2%					
		Perlodidae / Peltoperlidae		0.04	2%					
		Tipulidae		0.18	8%					
		Trichoptera		0.95	43%					
THPD	0649010 5550498	Chironomidae	2.90	1.03	36%	12.74	9.87	93.5	8.51	1,271
		Heptageniidae		0.01	0.3%					
		Limnephilidae		0.75	26%					
		Limnophora		0.03	1.0%					
		Rhyacophila		0.67	23%					
		Tipulidae		0.41	14%					
UTHP	0650958 5549870	Chironomidae	2.90	0.10	3%	8.20	10.78	90.4	8.39	1,162
		Chloroperlidae		0.02	0.7%					
		Limnephilidae		0.28	10%					
		Lumbriculidae		0.12	4%					
		Rhyacophila		0.25	9%					
		Tipulidae		2.13	73%					
WOPD	0648210 5552367	Chironomidae	2.87	0.12	4%	18.10	9.58	98.6	8.32	1,115
		Limnephilidae		1.09	38%					
		Nemouridae		0.01	0.2%					
		Rhyacophila		0.08	3%					
		Tipulidae		1.58	55%					
WWR	0645244 5459054	Baetidae	3.36	0.28	8%	9.00	x	x	7.97	263
		Ephemerellidae		0.69	21%					
		Heptageniidae		0.06	2%					
		Hexatoma		0.76	23%					
		Perlodidae		0.06	2%					
		Tipulidae		1.51	45%					
WWRBP	0645238 5459089	Limnephilidae	2.21	2.21	100%	10.67	x	x	7.96	302

x - Probe not functioning properly at time of sampling (DO membrane damaged).

WATER CHEMISTRY

Table B.11: Water chemistry at spotted sandpiper monitoring areas not routinely sampled by Teck, July 2013.

Analytes		Reference				Mine-Exposed						
	Units	AL4	CHCK	WWR	WWRBP	EL19	ELKO	FO23	FO29	FO52	FOBC	LK02
Physical Tests												
Hardness (as $CaCO_3$)	mg/L	139	124	102	189	219	205	303	320	416	224	190
Total Suspended Solids (TSS)	mg/L	<3.0	<3.0	4.7	<3.0	57.3	46.0	14.7	7.6	4.2	4.9	36.0
Anions and Nutrients												
Ammonia, Total (as N)	mg/L	0.0088	<0.0050	<0.0050	<0.0050	0.0072	<0.0050	<0.0050	<0.0050	0.0366	<0.0050	<0.0050
Bromide (Br)	mg/L	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.50	<0.050	<0.050
Chloride (Cl)	mg/L	<0.50	<0.50	<0.50	<0.50	0.91	1.40	1.10	1.02	<5.0	<0.50	1.20
Fluoride (F)	mg/L	0.182	0.187	0.075	0.529	0.192	0.184	0.221	0.202	<0.20	0.199	0.167
Nitrate (as N)	mg/L	0.0397	<0.0050	0.0054	0.127	2.25	1.51	7.68	9.67	12.6	4.93	1.25
Nitrite (as N)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	0.0033	0.0026	0.0104	0.0127	0.021	0.0045	0.0026
Total Kjeldahl Nitrogen (TKN)	mg/L	0.077	0.062	0.058	<0.050	0.169	0.259	0.195	0.206	<0.050	0.152	0.185
Total Phosphorus (P)	mg/L	0.0072	0.0037	0.0246	<0.0020	0.0732	0.0567	0.0197	0.0110	0.0065	0.0041	0.0552
Sulfate (SO_4)	mg/L	10.9	8.90	4.33	20.0	42.3	39.4	104	112	144	67.9	33.4
Organic / Inorganic Carbon												
Dissolved Organic Carbon (DOC)	mg/L	1.09	1.29	0.66	<0.50	1.54	1.51	1.68	1.47	1.42	1.19	1.34
Total Organic Carbon (TOC)	mg/L	1.48	1.62	0.59	<0.50	2.45	1.60	1.51	2.31	2.50	1.93	1.87
Total Metals												
Aluminum (Al)	mg/L	0.0241	0.0116	0.154	<0.0030	0.512	0.747	0.108	0.0689	0.0559	0.0271	0.950
Antimony (Sb)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	0.00013	0.00013	0.00020	0.00020	0.00048	<0.00010	0.00012
Arsenic (As)	mg/L	0.00016	0.00014	0.00041	0.00017	0.00053	0.00061	0.00021	0.00016	0.00017	0.00012	0.00066
Barium (Ba)	mg/L	0.0505	0.0489	0.0816	0.0795	0.0678	0.0744	0.0790	0.0832	0.0739	0.0535	0.0787
Beryllium (Be)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth (Bi)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	0.011	0.011	<0.010	0.012	<0.010	0.010
Cadmium (Cd)	mg/L	<0.000010	0.000010	0.000085	<0.000010	0.000088	0.000089	0.000085	0.000057	0.000234	0.000021	0.000086
Calcium (Ca)	mg/L	39.4	35.4	28.1	45.9	60.1	56.6	74.4	78.8	99.0	61.5	52.2
Chromium (Cr)	mg/L	0.00031	0.00022	0.00041	0.00051	0.00134	0.00154	0.00030	0.00026	0.00024	0.00019	0.00179
Cobalt (Co)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	0.00039	0.00040	0.00013	0.00013	0.00030	<0.00010	0.00042
Copper (Cu)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	0.00119	0.00129	<0.00050	<0.00050	<0.00050	<0.00050	0.00140
Iron (Fe)	mg/L	0.021	<0.010	0.181	<0.010	0.893	0.928	0.170	0.112	0.082	0.024	1.04
Lead (Pb)	mg/L	<0.000050	<0.000050	0.000168	<0.000050	0.000536	0.000590	0.000108	0.000099	0.000100	<0.000050	0.000610
Lithium (Li)	mg/L	0.00185	0.00169	0.00092	0.00448	0.00594	0.00564	0.0146	0.0144	0.0289	0.00440	0.00533
Magnesium (Mg)	mg/L	9.75	8.70	7.73	17.9	16.6	15.6	28.5	29.9	41.0	17.1	14.4
Manganese (Mn)	mg/L	0.00108	0.000841	0.00648	0.000181	0.0633	0.0437	0.0137	0.0108	0.0101	0.00492	0.0396
Mercury (Hg)	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L	0.000509	0.000481	0.000482	0.00129	0.00131	0.00120	0.00134	0.00120	0.00242	0.000740	0.00120
Nickel (Ni)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	0.00214	0.00199	0.00228	0.00213	0.00768	0.00067	0.00190
Phosphorus (P)	mg/L	<0.050	<0.050	<0.050	<0.050	0.084	0.072	<0.050	<0.050	<0.050	<0.050	0.066
Potassium (K)	mg/L	0.32	0.35	0.37	0.65	0.90	0.94	1.27	1.22	1.96	0.70	1.00
Selenium (Se)	mg/L	0.00046	0.00041	0.00016	0.00131	0.00847	0.00645	0.0282	0.0325	0.0521	0.0157	0.00530
Silicon (Si)	mg/L	1.73	1.74	2.70	3.40	2.90	3.38	2.27	2.02	1.81	1.66	4.07
Silver (Ag)	mg/L	<0.000010	<0.000010	<0.000010	0.000019	0.000011	0.000016	<0.000010	<0.000010	<0.000010	<0.000010	0.000013
Sodium (Na)	mg/L	0.780	0.548	0.765	1.87	1.26	1.63	1.92	1.41	1.61	0.520	1.51
Strontium (Sr)	mg/L	0.0712	0.0549	0.0400	0.110	0.183	0.163	0.126	0.0997	0.118	0.0936	0.142
Sulfur (S)	mg/L	3.76	2.98	1.50	6.65	13.6	12.7	34.2	36.7	56.2	23.0	10.7
Thallium (Tl)	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	0.000033	0.000032	<0.000010	0.000014	0.000015	<0.000010	0.000033
Tin (Sn)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	0.013	<0.010	<0.010	<0.010	<0.010	0.016
Uranium (U)	mg/L	0.000481	0.000448	0.000311	0.00127	0.00102	0.000903	0.00162	0.00157	0.00251	0.000750	0.000829
Vanadium (V)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	0.0024	0.0027	<0.0010	<0.0010	<0.0010	<0.0010	0.0032
Zinc (Zn)	mg/L	<0.0030	<0.0030	<0.0030	<0.0030	0.0068	0.0068	0.0043	<0.0030	0.0096	<0.0030	0.0072

Table B.12: Water chemistry at spotted sandpiper monitoring areas not routinely sampled by Teck, July 2014.

Analytes	Units	Reference			Mine-Exposed											
		CHCK	WWR	WWRBP	EL19	FO10	FO23	FO29	FO52	FOBC	KSPS	LEPD	UTHP	GAPD	WOPD	LK02
Physical Tests																
Hardness (as $CaCO_3$)	mg/L	130	149	199	197	388	309	329	274	189	583	806	887	1160	852	165
Total Suspended Solids (TSS)	mg/L	<3.0	3.3	<3.0	7.3	<3.0	<3.0	<3.0	<3.0	<3.0	5.9	<3.0	<3.0	12.8	<3.0	<3.0
Anions and Nutrients																
Ammonia, Total (as N)	mg/L	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0059	<0.0050	<0.0050	0.0184	0.0060	0.0123	<0.0050	<0.0050
Bromide (Br)	mg/L	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.50	<0.50	<0.50	<1.0	<0.50	<0.050
Chloride (Cl)	mg/L	<0.50	<0.50	<0.50	0.83	0.85	0.99	0.83	0.54	<0.50	<5.0	<5.0	18.7	<10	<5.0	0.93
Fluoride (F)	mg/L	0.197	0.171	0.538	0.199	0.212	0.232	0.204	0.224	0.219	0.30	0.27	0.30	0.44	0.31	0.167
Nitrate (as N)	mg/L	0.0140	0.0317	0.116	1.79	13.0	7.12	8.89	5.68	2.96	33.9	52.8	2.55	18.9	35.9	0.888
Nitrite (as N)	mg/L	<0.0010	<0.0010	<0.0010	0.0013	0.0045	0.0050	0.0048	0.0074	0.0013	<0.010	0.064	<0.010	0.050	0.013	0.0014
Total Kjeldahl Nitrogen (TKN)	mg/L	0.074	0.070	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.060
Total Phosphorus (P)	mg/L	0.0050	0.0033	<0.0020	0.0163	0.0054	0.0044	0.0038	0.0059	0.0034	0.0034	0.0081	0.0190	0.0233	0.0037	0.0092
Sulfate (SO_4)	mg/L	10.8	8.06	20.3	40.7	151	111	114	104	47.6	211	444	601	872	495	30.9
Organic / Inorganic Carbon																
Dissolved Organic Carbon (DOC)	mg/L	1.88	0.67	<0.50	0.84	0.83	0.95	0.81	0.84	0.65	0.67	3.82	1.46	2.45	3.19	0.85
Total Organic Carbon (TOC)	mg/L	0.86	<0.50	<0.50	1.04	0.85	0.94	0.80	0.94	0.71	0.82	3.74	1.59	3.34	3.14	0.96
Total Metals																
Aluminum (Al)	mg/L	0.0043	0.0133	<0.0030	0.0865	0.0125	0.0100	0.0103	0.0094	0.0092	0.0046	0.0052	0.0103	0.0462	0.0076	0.0924
Antimony (Sb)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	0.00025	0.00018	0.00019	0.00029	<0.00010	0.00039	0.00114	0.00025	0.00061	0.00218	<0.00010
Arsenic (As)	mg/L	0.00013	0.00028	0.00016	0.00026	0.00012	0.00013	0.00012	0.00012	0.00012	<0.00010	0.00042	0.00022	0.00043	0.00036	0.00030
Barium (Ba)	mg/L	0.0496	0.0795	0.0828	0.0557	0.0822	0.0789	0.0859	0.0574	0.0472	0.0627	0.169	0.0705	0.0639	0.153	0.0680
Beryllium (Be)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth (Bi)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L	<0.010	<0.010	0.011	<0.010	0.014	0.013	0.012	0.012	<0.010	0.019	0.041	0.025	0.023	0.026	<0.010
Cadmium (Cd)	mg/L	<0.000010	<0.000010	<0.000010	0.000034	0.000053	0.000072	0.000030	0.000063	0.000015	0.000131	0.000022	0.000073	0.000029	0.000032	0.000018
Calcium (Ca)	mg/L	36.5	38.6	48.7	54.1	90.9	75.4	79.4	67.4	51.9	134	166	176	223	175	45.2
Chromium (Cr)	mg/L	0.00022	0.00026	0.00061	0.00047	0.00017	0.00017	0.00020	0.00013	0.00018	<0.00010	<0.00010	0.00011	0.00017	<0.00010	0.00034
Cobalt (Co)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00045	<0.00010	0.00012	0.00107	<0.00010
Copper (Cu)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00078	<0.00050	0.00074	0.00074	<0.00050
Iron (Fe)	mg/L	<0.010	0.015	<0.010	0.112	0.018	0.014	0.017	0.015	<0.010	<0.010	<0.010	0.019	0.052	<0.010	0.095
Lead (Pb)	mg/L	<0.000050	<0.000050	<0.000050	0.000108	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000093	<0.000050	0.000093
Lithium (Li)	mg/L	0.00222	0.00275	0.00480	0.00531	0.0213	0.0152	0.0146	0.0169	0.00441	0.0342	0.174	0.0226	0.0562	0.0597	0.00417
Magnesium (Mg)	mg/L	9.32	12.8	18.7	15.0	39.0	29.3	31.6	25.8	14.5	60.2	95.1	109	146	100	12.6
Manganese (Mn)	mg/L	0.000501	0.00109	0.000294	0.0112	0.00280	0.00188	0.00326	0.00494	0.00254	0.000566	0.00193	0.00880	0.00248	0.00287	0.00556
Mercury (Hg)	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)	mg/L	0.000557	0.000954	0.00134	0.00113	0.00127	0.00120	0.00107	0.00141	0.000771	0.00151	0.00757	0.00103	0.00606	0.0128	0.000987
Nickel (Ni)	mg/L	<0.00050	<0.00050	<0.00050	0.00072	0.00209	0.00158	0.00089	0.00252	<0.00050	0.00431	0.0235	0.00424	0.00818	0.0614	0.00050
Phosphorus (P)	mg/L	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Potassium (K)	mg/L	0.32	0.54	0.65	0.60	1.65	1.10	1.14	1.31	0.62	2.82	4.56	2.06	3.42	4.71	0.54
Selenium (Se)	mg/L	0.00049	0.00076	0.00138	0.00733	0.0458	0.0287	0.0320	0.0253	0.00854	0.0825	0.0863	0.100	0.183	0.0815	0.00427
Silicon (Si)	mg/L	1.65	3.01	3.47	1.99	1.78	1.95	1.83	1.61	1.51	1.57	2.26	2.94	2.86	2.81	2.07
Silver (Ag)	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L	0.595	1.36	1.97	1.32	1.43	2.19	1.46	1.09	0.475	1.43	49.1	7.19	2.66	14.6	1.41
Strontium (Sr)	mg/L	0.0620	0.0862	0.121	0.194	0.115	0.134	0.117	0.0957	0.0869	0.121	0.665	0.380	0.314	0.509	0.138
Sulfur (S)	mg/L	3.68	4.54	7.10	13.6	50.9	37.5	39.1	34.0	16.2	68.7	153	198	280	165	10.1
Thallium (Tl)	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000016	<0.000010	<0.000010	<0.000010	0.000032	0.000011	0.000048	0.000022	<0.000010
Tin (Sn)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)	mg/L	0.000494	0.000813	0.00131	0.000933	0.00213	0.00164	0.00160	0.00141	0.000661	0.00422	0.00537	0.00421	0.00715	0.00837	0.000711
Vanadium (V)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Zinc (Zn)	mg/L	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0033	<0.0030	0.0033	<0.0030	0.0038	<0.0030	0.0031	<0.0030	<0.0030	<0.0030

APPENDIX C

PHOTOGRAPHS OF SPOTTED SANDPIPER NESTS AND UNHATCHED EGG CONTENTS

Spotted Sandpiper nest on the Elk River just upstream of Elko Reservoir (ELKO-11) on July 5, 2013.

Spotted Sandpiper nest on the Upper Fording River near Kilmarnock (F052-4) on July 17, 2013.

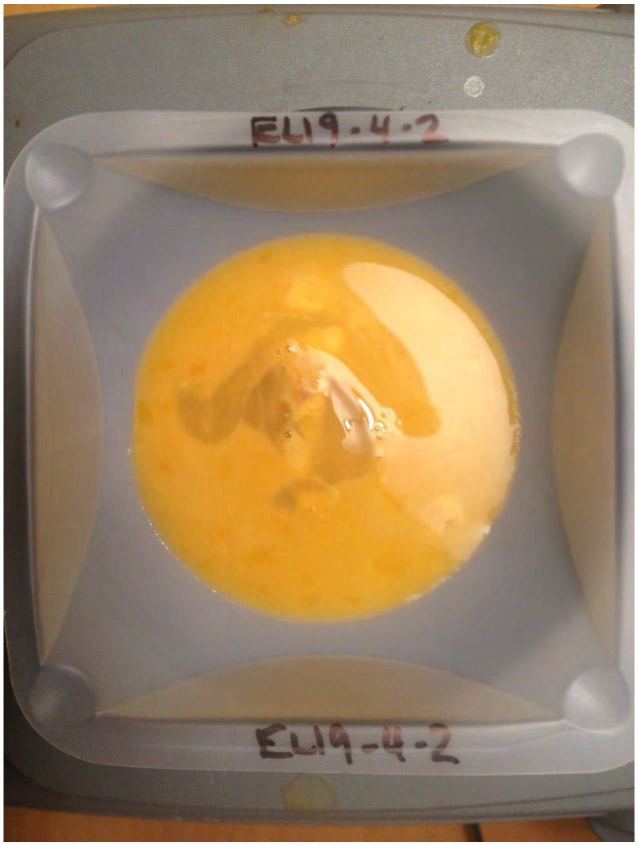
Spotted Sandpiper nest near the Line Creek Contingency Ponds (LCCPL-3) on July 10, 2013.

Spotted Sandpiper nest on the Wigwam River (WWR-2) on June 17, 2014.

Spotted Sandpiper nest on Kilmarnock Settling Pond (KSP-1) on July 21, 2014.

Spotted Sandpiper nest on the Fording River beside Clode Pond (FOBC-2) on July 21, 2014.

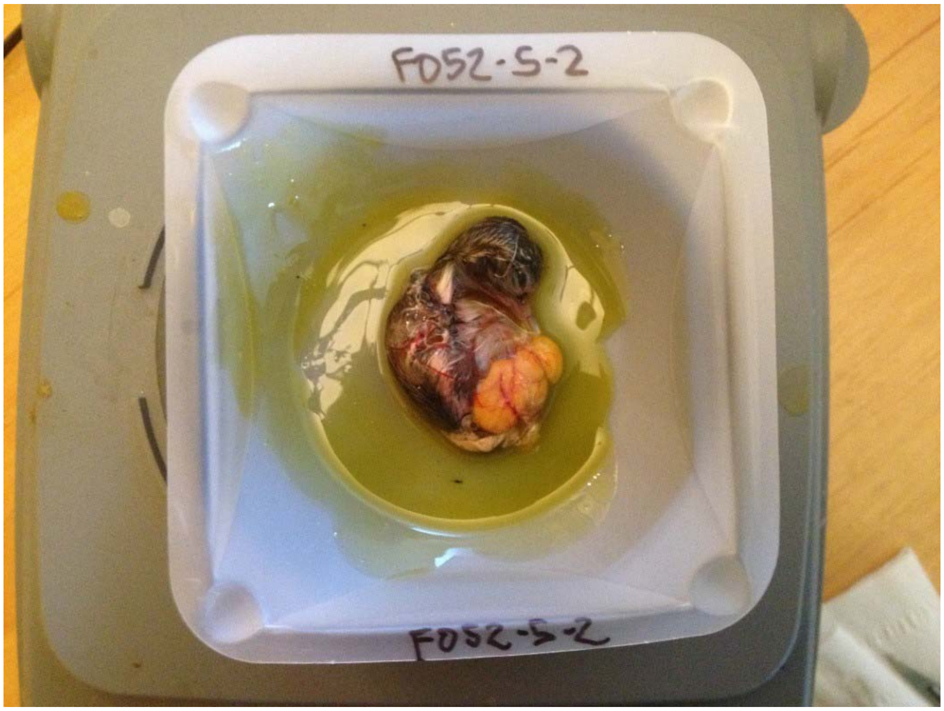
Contents of egg that failed to hatch on the Elk River below the confluence with the Fording River (EL19-3- 2), 2013. Suspected cause of failure is infertility.



Contents of egg that failed to hatch on the Elk River below the confluence with the Fording River (EL19-4- 2), 2013. Suspected cause of failure is infertility.

Contents of egg that failed to hatch on the lower Fording River above the confluence with the Elk River (FO23-5-2), 2013. Suspected cause of failure is abandonment possibly related to asynchronous hatch.

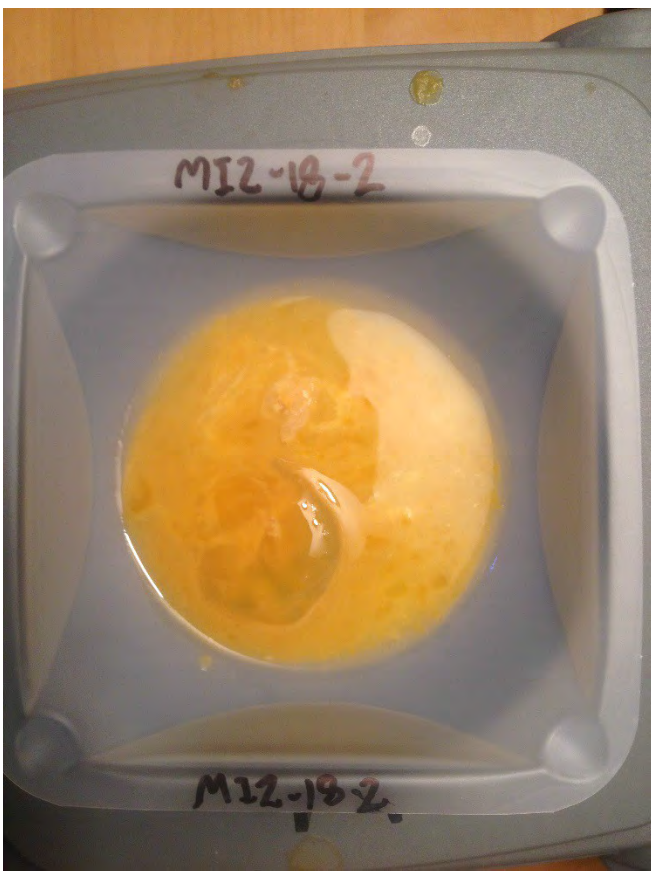
Contents of egg that failed to hatch on the lower Fording River above the confluence with the Elk River (FO23-5-3), 2013.
Suspected cause of failure is abandonment possibly related to asynchronous hatch.



Contents of egg that failed to hatch on the upper Fording River above the confluence near Kilmarnock (FO52-5-2), 2013. Suspected cause of failure is abandonment possibly related to asynchronous hatch.

Contents of egg that failed to hatch on the upper Fording River above the confluence near Kilmarnock (FO52-5-3), 2013. Suspected cause of failure is abandonment possibly related to asynchronous hatch.

Contents of egg that failed to hatch on Harmer Pond (HA7-2-2), 2013.
Cause of failure is unknown.



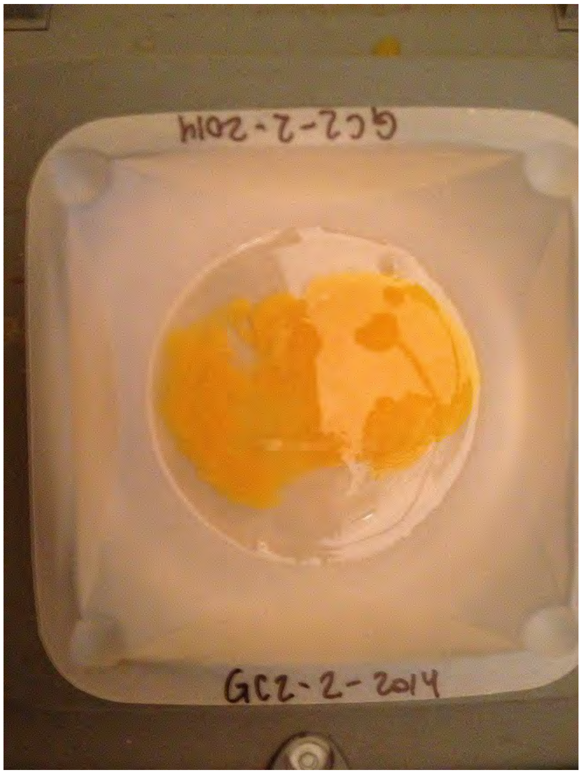
Contents of egg that failed to hatch on Lower Michel (MI2-18-2), 2013. Suspected cause of failure is infertility.

Contents of egg that failed to hatch on the upper Fording River near Kilmarnock (FO52-1), 2013. Cause of failure is unknown.

Contents of egg that failed to hatch on the Elk River below the confluence with the Fording River (EL19-7), 2014. Suspected cause of failure is infertility.

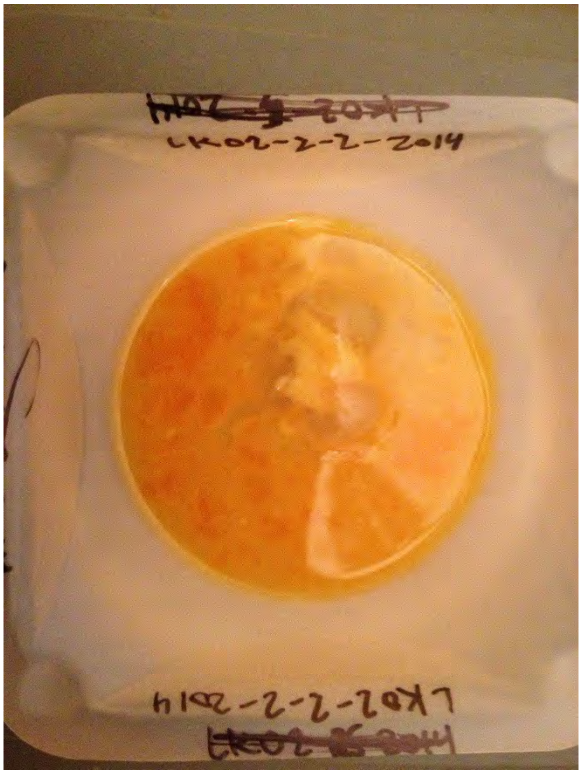
Contents of egg that failed to hatch on the Fording River Oxbow (FO10-1-2), 2014. Cause of failure is unknown.

Contents of egg that failed to hatch on the Fording River Oxbow (FO10-3), 2014. Suspected cause of failure is infertility.



Contents of egg that failed to hatch near the mouth of Goddard Creek on the Elk River (GC2-2), 2014. Suspected cause of failure is infertility.

Contents of egg that failed to hatch on Harmer Pond (HA7-1-2), 2014. Suspected cause of failure is infertility.



Contents of egg that failed to hatch near the mouth of the Elk River on Lake Koocanusa (LK02-2-2), 2014. Suspected cause of failure is infertility.

Contents of egg that failed to hatch on Upper Thompson Settling Pond (UTHP-1), 2014. Suspected cause of failure is infertility.

Contents of egg that failed to hatch on Upper Wolfram Creek (UWOP-1), 2014. Cause of failure is unknown.