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U.S. FISH & WILDLIFE SERVICE
REGION 6



CONTAMINANTS PROGRAM

**AN INVESTIGATION OF
IRRIGATION-RELATED CONTAMINANTS IN
WATER, BOTTOM SEDIMENT, AND BIOTA
FROM GOSHEN COUNTY, WYOMING.**

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ABSTRACT

We conducted a comprehensive evaluation of trace element concentrations in water, sediment, aquatic vegetation, aquatic invertebrates, waterbird eggs, and fish resulting from irrigation drainwater during 1995 in Goshen County, Wyoming. We also analyzed waterbird eggs and fish from this area for organochlorine residues and attempted to determine the nesting success of various waterbirds.

Boron concentrations were elevated (>300 ug/g dry weight) in aquatic vegetation above concentrations shown to adversely affect sensitive waterfowl; however, these concentrations are similar to those found in aquatic vegetation sampled in other areas throughout Wyoming. Mercury concentrations in aquatic vegetation, aquatic invertebrates, and fish were slightly elevated above the recommended concentration of mercury (>0.1 ug/g wet weight) in food items for the protection of sensitive avian species. However, mercury presently does not appear to be bioaccumulating in birds to concentrations expected to cause adverse affects.

Cadmium was slightly elevated in aquatic invertebrates (>1.2 ug/g dw) from two sites but neither fish or bird tissue had elevated cadmium concentrations. Chromium was slightly elevated in aquatic vegetation from two sites; but, the significance of these residues is unclear. Chromium was not found in waterbird eggs or fish in concentrations (>4.4 ug/g dry weight) that suggest chromium contamination is present. Dieldrin was detectable in one avocet egg and DDE was detected in all avian eggs and fish. However, the concentrations of cadmium, chromium, and organochlorine pesticides were not at concentrations that cause adverse effects to fish and wildlife resources.

TABLE OF CONTENTS

ABSTRACT i

TABLE OF CONTENTS ii

LIST OF TABLES iii

LIST OF FIGURES iv

LIST OF APPENDICES v

INTRODUCTION 1

STUDY SITES 1

MATERIALS AND METHODS 6

RESULTS AND DISCUSSION 8

CONCLUSIONS 19

ACKNOWLEDGEMENTS 20

LITERATURE CITED 21

LIST OF TABLES

Table 1. Observations of nest fate from nest surveys conducted at Springer HMA and Table Mountain WMU in May and June 1995. 9

Table 2. Trace element concentrations (ug/g dry weight) in vegetation samples collected from Springer HMA and Table Mountain WMU. 11

Table 3. Trace element concentrations (ug/g dry weight) in aquatic invertebrate samples collected from Springer HMA and Table Mountain WMU. 14

Table 4. Trace element concentrations (ug/g dry weight) in avian egg samples collected from Springer HMA and Table Mountain WMU. 16

LIST OF FIGURES

Figure 1. State of Wyoming and Counties. Goshen County enlarged to show location of Springer HMA and Table Mountain WMU. 3

Figure 2. Springer HMA, Goshen County, Wyoming. 4

Figure 2. Table Mountain WMU, Goshen County, Wyoming. 5

LIST OF APPENDICES

Appendix A. Sample site and type, species, and number of samples collected from Springer HMA and Table Mountain WMU for trace element and organochlorine analyses. . . . 24

Appendix A.1. Sample site and type, species, and number of samples collected for trace element analyses 25

Appendix A.2. Sample site and type, species, and number of samples collected for organochlorine analyses 26

Appendix B. Trace element concentrations in water, sediment, vegetation, aquatic invertebrate, waterbird eggs, and fish samples collected from Springer HMA and Table Mountain WMU 27

Appendix B.1. Trace element concentrations (mg/l) in water samples collected from Springer HMA and Table Mountain WMU. 28

Appendix B.2. Trace element concentrations (ug/g dry weight) in sediment samples collected from Springer HMA and Table Mountain WMU 30

Appendix B.3. Trace element concentrations (ug/g dry weight) in vegetation samples collected from Springer HMA and Table Mountain WMU 32

Appendix B.4. Trace element concentrations (ug/g dry weight) in aquatic invertebrate samples collected from Springer HMA and Table Mountain WMU 34

Appendix B.5. Trace element concentrations (ug/g dry weight) in waterbird egg samples collected from Springer HMA and Table Mountain WMU 37

Appendix B.6. Trace element concentrations (ug/g dry weight) in fish samples collected from Springer HMA and Table Mountain WMU 39

Appendix C. Organochlorine concentrations in water, sediment, vegetation, aquatic invertebrate, waterbird eggs, and fish samples collected from Springer HMA and Table Mountain WMU 40

Appendix C.1. Organochlorine concentrations (ug/g dry weight) in waterbird egg samples collected from Springer HMA and Table Mountain WMU 41

Appendix C.2. Organochlorine concentrations (ug/g dry weight) in fish samples collected from Springer HMA and Table Mountain WMU 43

INTRODUCTION

Irrigation return flow is often used to create or enhance wetlands in the arid west. However, irrigation return flow may contain elevated concentrations of trace elements and pesticides, which can severely reduce water quality and cause adverse effects in fish and wildlife (Ochs 1988). In 1991, the U.S. Fish and Wildlife Service (Service) conducted a preliminary investigation of basins that receive irrigation return flows but have limited outflow in Goshen County, Wyoming. Basins at Springer Habitat Management Area (HMA) and Table Mountain Wildlife Management Unit (WMU) were identified for the potential of accumulating high concentrations of trace elements and pesticides as a result of irrigation runoff.

Because these areas provide important waterbird feeding and nesting habitat, a more comprehensive study was conducted in 1995 to assess waterbird reproduction and to determine trace element concentrations in water, sediment, aquatic vegetation, aquatic invertebrates, avian eggs, and fish. Additional avian eggs and fish were collected to determine pesticide residues.

STUDY SITES

Goshen County is a major crop producing area in the State of Wyoming (Figure 1). The main crops are wheat, beans, sugar beets, oats, corn, alfalfa, and barley (Wyoming Department of Agriculture 1995). More than 100,000 acres are irrigated (Ostresh et al. 1990).

Areas of wildlife importance that receive irrigation return flow include Springer HMA (Figure 2) and Table Mountain WMU (Figure 3). These areas provide important nesting habitat and serve as a migration stopover for a variety of water birds. The Wyoming Game and Fish Department manages these areas for fishing and waterfowl hunting. Threatened and endangered species in the vicinity include wintering bald eagles (*Haliaeetus leucocephalus*), migrating peregrine falcons (*Falco peregrinus*), and Ute Ladies'-tresses (*Spiranthes diluvialis*). Great blue herons (*Ardea herodias*) and double-crested cormorants (*Phalacrocorax auritus*) have rookeries at Springer HMA.

Basins at Springer HMA, identified for the potential of accumulating high concentrations of trace elements and pesticides as a result of irrigation runoff, include Bump Sullivan Reservoir, Bump Sullivan Goose Pond, Bump Sullivan Pond 4, and Springer Reservoir. Bump Sullivan Reservoir and Springer Reservoir are the only waterbodies that provide suitable game fish habitat. Similarly, basins identified at Table Mountain WMU include Table Mountain Ponds 1, 2, 4, 6, and 7. All basins are shallow with carp present in Ponds 1 and 4. Dry Creek, a perennial stream that receives irrigation return flow and feeds the waterfowl ponds at Table Mountain WMU, is also included as a sampling site. Shortgrass prairie is the primary upland habitat type at Springer HMA and Table Mountain WMU. Cottonwood trees, Russian olive trees, cattails, and various species of rushes and sedges surround the water bodies at Springer HMA and Table Mountain WMU.

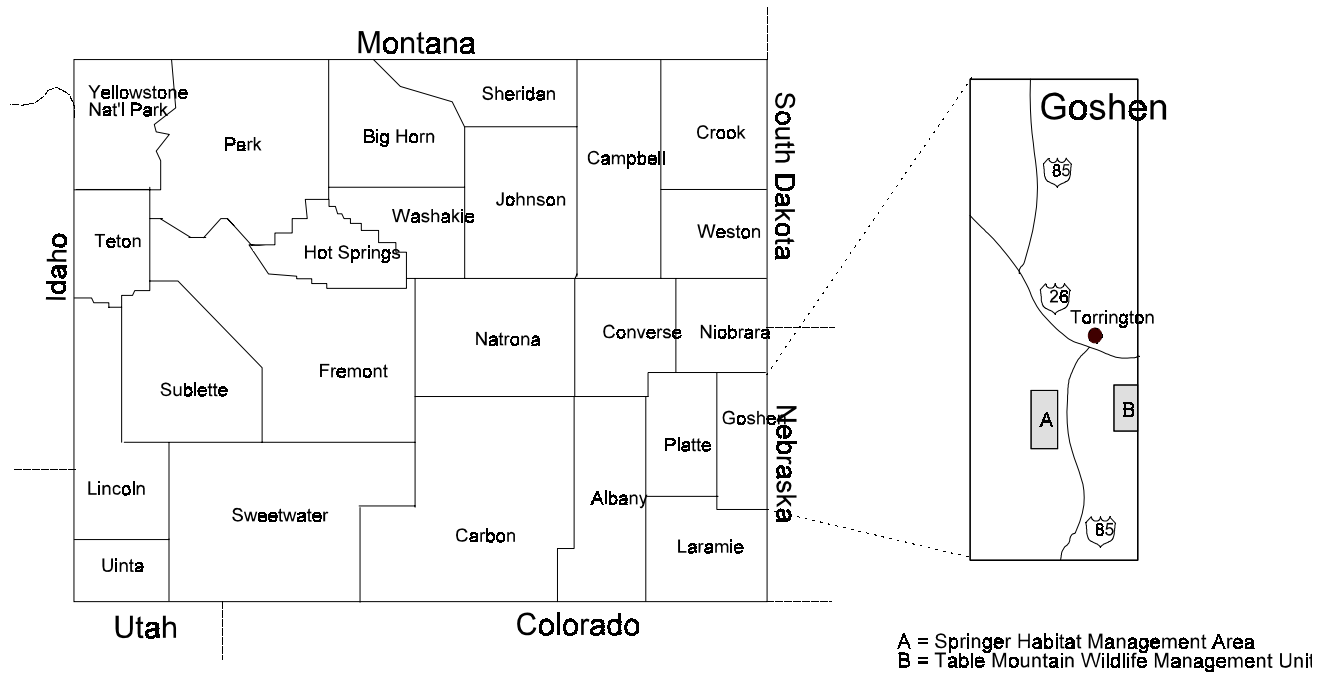


Figure 1. State of Wyoming and Counties. Goshen County enlarged to show location of Springer HMA and Table Mountain WMU.

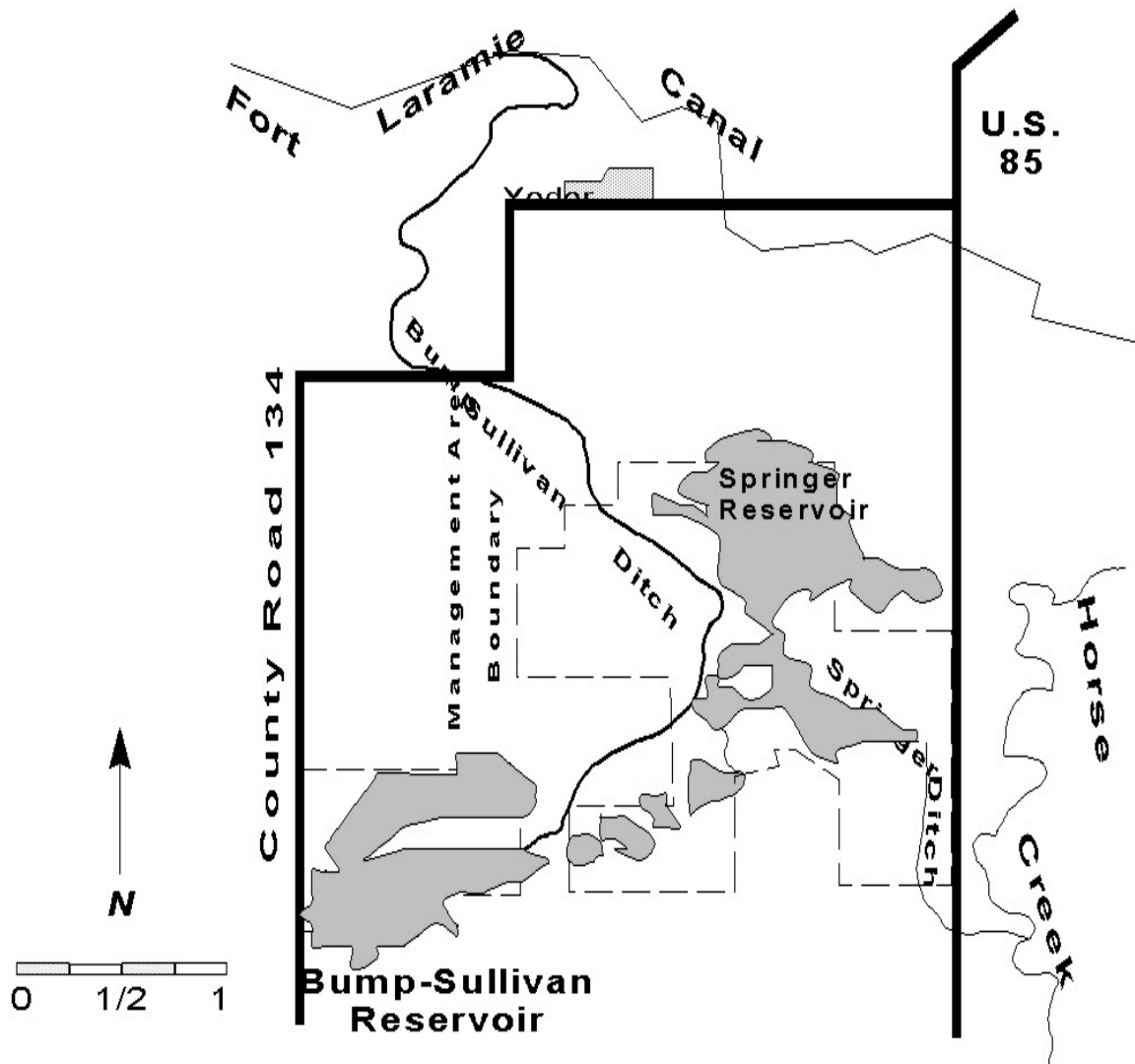


Figure 2. Springer Habitat Management Area, Goshen County, Wyoming.

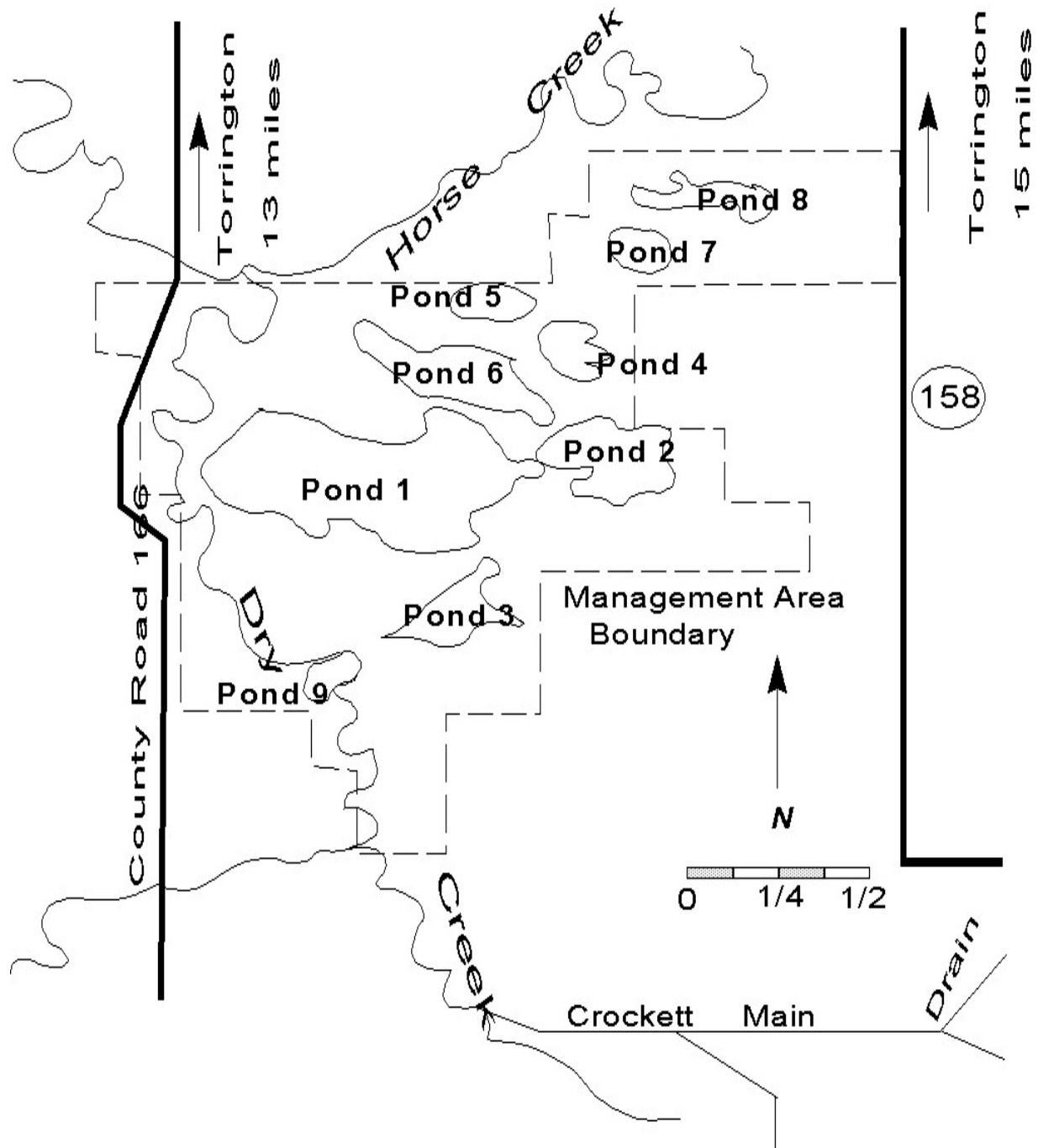


Figure 3. Table Mountain WMU, Goshen County, Wyoming.

MATERIALS AND METHODS

Searches for Canada goose (*Branta canadensis*), mallard (*Anas platyrhynchos*), and American avocet (*Recurvirostra americana*) nests were conducted in May and June of 1995 at Springer HMA and Table Mountain WMU using rope drags as described in Klett et al. (1986). Nests were checked once every 2 weeks and observations of egg condition were noted. Nesting success was assessed by recording the number of eggs present in each nest, date, presence of a hen, egg viability, and suspected fate of the nest. One random egg was collected from each avocet or mallard nest that had a clutch of two or more eggs (Appendix A.1). Embryos were removed from the eggs, examined for deformities, and frozen for trace element or pesticide analysis. Addled eggs were also collected and the embryos examined for deformities.

A total of five samples of each matrix were collected at one point in time. Water was collected in 1000-ml chemically-clean polyethylene jars rinsed three times with sample water. Care was taken to avoid sampling water where materials were suspended by wading. Samples were acidified with 70% nitric acid to a pH of <2. Sediment was collected as a composite sample with a stainless steel spoon rinsed with deionized water and hexane. Sediment was placed in whirl-pak bags and frozen. Aquatic vegetation was collected by hand, placed in whirl-pak bags, and frozen. Light traps similar to those described by Espinosa and Clark (1972) were used to collect aquatic invertebrates. Invertebrates were sorted by taxonomic grouping, placed into 40-ml chemically-cleaned glass vials, and frozen. Gill nets were deployed for the collection of carp. Individual carp were weighed, wrapped in aluminum foil, and frozen (Appendix A.1 and A.2).

Samples were shipped with dry ice to laboratory facilities under contract with the U.S. Fish and Wildlife Service's Patuxent Analytical Control Facility (PACF). Mercury analysis was by cold vapor atomic absorption spectroscopy, selenium and arsenic by hydride generation atomic absorption spectroscopy, and the remaining trace elements by inductively coupled plasma atomic emission spectrophotometry (ICP scan) without preconcentration. Organochlorine analysis was by gas chromatograph with dual capillary column/dual electron capture detector. PACF approved

laboratory quality assurance/quality control of the chemical analyses. The precision and accuracy was verified by duplicate samples, procedural blanks, reference material samples, and spiked samples.

The geometric mean was computed for sample matrices with elevated trace element or organochlorine concentrations. The mean selenium concentration of all biological samples was computed because selenium is a trace element of special concern due to its association with irrigation drainwater and its ability to biomagnify through the food chain. In cases where a sample had a trace element or organochlorine concentration below detection limit, one-half of the detection limit was used so that the geometric mean could be computed for that group of samples. Trace element and organochlorine concentrations are reported in g/g dry weight (dw) or g/g wet weight (ww).

RESULTS AND DISCUSSION

Nesting Success

A total of four mallard nests, 27 Canada goose nests, and 28 American avocet nests were located during nest searches conducted during May and June 1995 (Table 1). The fate of most nests was unknown because the 2 week interval between visits to the nests was too long to document success or failure. However, one Canada goose nest was successful because goslings were observed in the nest.

Six Canada goose, one mallard, and eight avocet nests from Bump Sullivan Reservoir as well as three Canada goose nests from Springer Reservoir at Springer HMA were recorded as possible hatches because of the presence of egg fragments. Several broods of Canada geese were observed on the open water of Springer and Bump Sullivan Reservoirs but no broods of ducks or avocet chicks were observed at any of the sites.

One Canada goose nest and one mallard nest from Springer Reservoir and one mallard nest from Table Mountain WMU were destroyed by predators. Observations of predators included bull snakes, red fox, skunk, and raccoon. Many ring-necked pheasant (*Phasianus colchicus*) nests were found destroyed by predators.

USFWS - Region 6 - Environmental Contaminants Report

Table 1. Observations of nest fate from nest surveys conducted at Springer HMA and Table Mountain WMU in May and June 1995.

Site ^a	Species	No Eggs	Abandoned	Destroyed	Fate Unknown	Possible Hatch	Successful	Total Nests
BSR	Canada Goose	2	0	0	1	6	0	9
BSR	Mallard	0	0	0	1	1	0	2
BSR	Avocet	0	3	0	3	8	0	14
SR	Canada Goose	0	0	1	11	3	1	16
SR	Mallard	0	0	1	0	0	0	1
TMWMU	Canada Goose	0	1	0	1	0	0	2
TMWMU	Mallard	0	0	1	0	0	0	1
TMWMU	Avocet	0	0	0	14	0	0	14

^aBSR=Bump Sullivan Reservoir, SR=Springer Reservoir, TMWMU=Table Mountain WMU

Trace Elements

Water/Sediment

The concentration of all trace elements in water samples (Appendix B.1) from Dry Creek at Table Mountain WMU, Table Mountain WMU Ponds 1, 2 and 7, Bump Sullivan Goose Pond, Bump Sullivan Pond 4, and Bump Sullivan Reservoir were below detection limits or below concentrations that could adversely affect fish and wildlife resources. Trace element concentrations in sediments collected (Appendix B.2) from Table Mountain Ponds 1, 2, and 7, Bump Sullivan Goose Pond, Bump Sullivan Pond 4, and Bump Sullivan Reservoir were within background concentrations reported for soils from the western United States and the Northern Great Plains (Harms et al. 1990). Sediment was not collected from Dry Creek.

Aquatic Vegetation

Mean concentrations of boron in aquatic vegetation (Table 2; Appendix B.3) at Bump Sullivan Pond 4, Bump Sullivan Goose Pond, and Table Mountain WMU Ponds 1, 2, and 7 were greater than 300 g/g (dw), which is the concentration shown to reduce growth in mallard ducklings (Eisler 1990). However, aquatic vegetation collected from other sites around Wyoming also exhibit boron concentrations greater than 300 g/g (dw) (Dickerson and Ramirez 1993; Ramirez and Armstrong 1992). The Frontier Formation, which occurs throughout the state and has naturally high concentrations of boron, may explain the elevated concentrations of boron in the vegetation samples (Ramirez and Armstrong 1992).

Table 2. Trace element concentrations (g/g dry weight) in vegetation samples collected from Springer HMA and Table Mountain WMU.

Element	Site ^a	Range	Geometric Mean (n=5)
Boron	BSP4	327 - 472	378
	BSGP	639 - 1183	939
	TMP1	457 - 666	583
	TMP2	396 - 767	489
	TMP7	424 - 626	511
Chromium	BSP4	4.3 - 7.6	5.7
	TMP7	3.8 - 5.3	4.4
Mercury	BSP4	0.59 - 1.2	0.75
	BSGP	0.66 - 9.9	1.4
	TMP1	0.38 - 0.96	0.66
	TMP2	0.44 - 1.5	0.74
	TMP7	0.27 - 0.65	0.45
Selenium	BSP4	3.2 - 5.8	4.4
	BSGP	2.0 - 2.9	2.5
	TMP1	3.2 - 6.1	4.3
	TMP2	2.5 - 4.1	3.5
	TMP7	3.4 - 4.4	3.8

^aBSP4=Bump Sullivan Pond 4; BSGP=Bump Sullivan Goose Pond; TMP1, TMP2, TMP7=Table Mountain Pond 1, Pond 2, and Pond 7, respectively.

The mean chromium concentrations in vegetation from Bump Sullivan Pond 4 (5.7 g/g dw) and Table Mountain Pond 7 (4.4 g/g dw) were slightly elevated. However, the significance of these residues is unclear because chromium was not found in waterbird eggs or fish in concentrations (>4.4 g/g dw) that suggest chromium contamination is present (Eisler 1986). Additionally, the toxicity of chromium depends on its chemical form with the hexavalent form being the most toxic (mutagenic and carcinogenic). In biological tissues, chromium occurs primarily in the trivalent form. Dietary concentrations of 5.1 and 10 g/g hexavalent and trivalent chromium respectively, have been shown to cause adverse effects to sensitive species of waterfowl in laboratory studies (Eisler 1986); but, in a study in which black ducks (*Anas rubripes*) and their ducklings were fed a diet of 0, 20 and 100 g/g trivalent chromium for 7 days, no adverse effects were found (Heinz and Haseltine 1981).

Mercury concentrations in vegetation were slightly elevated at all sampling sites. Current recommendations indicate that fish and other aquatic food items consumed by avian predators should not exceed 0.1 g/g (ww) or 0.4 g/g (dw assuming 75% moisture) (Eisler 1987). This recommended food item concentration is based on the ability of mercury to bioaccumulate and biomagnify in the food chain (Jernelov and Lann 1971). However, the toxicity of mercury to avian species varies with form, dose, route of administration species, sex, age, and physiological condition of the bird. Source(s) of mercury at the sampling sites from geologic deposits (Jim Case, Wyoming Geological Survey, personal communication, 4/4/96), hydrologic features (Ted Bartkey, U.S. Geological Survey, personal communication, 4/3/96), or nearby mercury-contaminated sites (Kevin Frederick, Wyoming Department of Environmental Quality, personal communication, 4/3/96) are not known. One explanation may be past use of fungicides containing mercury for sugarbeet crops in the area (Eisler 1987).

Elevated selenium concentrations in biota are often associated with irrigation runoff in the western United States (Ohlendorf et al. 1986). The mean selenium concentration in aquatic vegetation collected from the study sites was <5.0 g/g (dw). Lemly (1993) stated that concentrations of selenium in dietary items including aquatic vegetation should be <3 g/g (dw) to protect fish and aquatic birds. However, concentrations of 3.0 g/g to 5.0 g/g (dw) would present low to minimal hazard (Lemly 1993).

Aquatic Invertebrates

Mean cadmium concentrations in aquatic invertebrates collected from Bump Sullivan Pond 4 and Table Mountain WMU Pond 7 were slightly elevated (Table 3; Appendix B.4) and one invertebrate sample from Table Mountain Pond 1 had an individual chromium concentration of 8.65 g/g (dw). According to Eisler (1985), dietary cadmium concentrations that exceed 0.10 g/g (ww or 0.4 g/g dw assuming 75% moisture) can result in reduced growth, inhibited reproduction, and increased mortality in sensitive fish and wildlife species; but adverse effects (i.e. kidney lesions) in mallards were observed only after ducklings had been fed a dietary cadmium concentration of 20 g/g for a period of 12 weeks (Cain et al. 1983).

The mean mercury concentration in invertebrates was slightly elevated at all sampling sites (Table 3; Appendix B.4). Dietary concentrations of mercury should not exceed 0.1 g/g (ww) or 0.4 g/g dw assuming 75% moisture) for the protection of avian consumers (Eisler 1987). The mean selenium concentration in invertebrates from Table Mountain WMU Pond 1 was 9.0 g/g (dw) and 3.8 g/g (dw) from Bump Sullivan Pond 4. The three remaining sites had a mean selenium concentration <3.0 g/g (dw). Dietary selenium concentrations >3.0 g/g (dw) can bioaccumulate through the food chain leading to reproductive effects in aquatic birds (Lemly and Smith 1987; Ohlendorf et al. 1986); but, according to Lemly (1993) concentrations of 3.0 g/g to 5.0 g/g (dw) present a low to minimal hazard (Lemly 1993).

Table 3. Trace element concentrations (g/g dry weight) in aquatic invertebrate samples collected from Springer HMA and Table Mountain WMU.

Element	Site ^a	Range	Geometric Mean (n=5)
Cadmium	BSP4	1.6 - 4.1	2.1
	TMP7	0.94 - 1.4	1.2
Mercury	BSP4	0.97 - 2.0	1.3
	TMP1	0.070* - 0.91	0.16
	TMP2	0.61 - 0.73	0.65
	TMP7	0.27 - 0.75	0.39
Selenium	BSP4	2.5 - 5.6	3.8
	BSGP	1.0 - 7.5	2.0
	TMP1	7.4 - 13.3	9.0
	TMP2	1.8 - 4.0	2.4
	TMP7	1.1 - 8.2	2.9

^aBSP4=Bump Sullivan Pond 4; BSGP=Bump Sullivan Goose Pond; TMP1, TMP2, TMP7=Table Mountain Pond 1, Pond 2, and Pond 7, respectively.

*The trace element concentration in the sample was below detection limit; therefore, the value was divided by two following standard procedures for data censoring.

Avian Eggs

Mean mercury concentrations in avian eggs from Bump Sullivan Reservoir, Bump Sullivan Pond 4, and Table Mountain WMU Pond 6 (Table 4; Appendix B.5) were less than 0.5 g/g (dw). Concentrations of mercury ≥ 0.9 g/g (ww) or ≥ 3.6 g/g (dw assuming 75% moisture) in eggs have been associated with adverse affects (Eisler 1987). Although mercury can bioaccumulate through the food chain and concentrations of mercury were slightly elevated in waterbird food sources sampled, presently mercury does not appear to be bioaccumulating in birds to concentrations expected to cause adverse affects.

Selenium concentrations in mallard eggs from Bump Sullivan Reservoir, Bump Sullivan Goose Pond, Springer Reservoir, and Table Mountain WMU Pond 4 (Table 4) were below the mean egg concentration of 8 g/g associated with the onset of adverse effects including impaired reproduction (Skorupa and Ohlendorf 1991). Selenium concentrations in avocet eggs from Bump Sullivan Ponds 4 and 5 and Table Mountain WMU Pond 6 were below the individual-risk threshold (>40 g/g) for teratogenesis in avocet eggs as described by Skorupa (personal communication, December 14, 1995). No deformed embryos were found in any of the eggs.

Table 4. Trace element concentrations (g/g dry weight) in avian egg samples collected from Springer HMA and Table Mountain WMU.

Element	Species	Site ^a	Range	Geometric Mean
Mercury	Mallard	BSR	0.28 - 0.57	0.43 (n=5)
	Avocet	BSP4	0.32 - 0.86	0.47 (n=6)
	Avocet	TMP6	0.16 - 0.38	0.25 (n=11)
Selenium	Mallard	BSR	3.2 - 5.0	4.0 (n=5)
	Mallard	BSGP	3.2	(n=1)
	Mallard	SR	2.6	(n=1)
	Mallard	TMP4	4.6	(n=1)
	Avocet	BSP4	3.6 - 5.0	4.0 (n=6)
	Avocet	BSP5	5.0 - 8.1	6.6 (n=2)
	Avocet	TMP6	5.4 - 12.1	7.1 (n=11)

^aBSR=Bump Sullivan Reservoir; BSP4, BSP5=Bump Sullivan Pond 4 and Pond 5 respectively; BSGP=Bump Sullivan Goose Pond; SR=Springer Reservoir; TMP4, TMP6=Table Mountain Pond 4 and Pond 6, respectively.

Fish

Mean mercury concentrations in carp from Bump Sullivan Reservoir and Table Mountain WMU Pond 1 were 0.56 g/g (dw) (n=5) and 0.40 g/g (dw) (n=5), respectively (Appendix B.6). Individual concentrations ranged from 0.29 to 0.96 g/g (dw) at Bump Sullivan Reservoir and from 0.29 to 0.74 g/g (dw) at Table Mountain WMU Pond 1. The geometric mean of 315 whole fish composite samples collected by the U.S. Fish and Wildlife Biomonitoring program (1976-1984) was 0.40 g/g (dw assuming 75% moisture) (Schmitt and Brumbaugh 1990). However, Eisler (1987) recommended that dietary concentrations of mercury should not exceed 0.1 g/g (ww) or 0.4 g/g (dw assuming 75% moisture) in food organisms for the protection of sensitive avian consumers. The mean selenium concentrations in carp from Bump Sullivan Reservoir and Table Mountain WMU Pond 1 were 2.4 g/g (dw) (n=5) and 2.0 g/g (dw) (n=5) respectively. Individual concentrations

ranged from 1.6 to 3.1 g/g (dw) at Bump Sullivan Reservoir and from 1.8 to 2.5 g/g (dw) at Table Mountain WMU Pond 1. All selenium concentrations are less than 3.0 g/g (dw), which is the threshold of dietary selenium necessary to protect fish and avian consumers (Ohlendorf et al. 1986).

Organochlorines

Avian Eggs

Most organochlorine compounds analyzed in fish and avian eggs were below detection limits (Appendix C.1). One American avocet egg collected at Bump Sullivan Pond 5 had a detectable dieldrin concentration of 0.034 g/g (dw). Although, the registration of dieldrin was cancelled for use in the United States in 1975 because of its potential for bioconcentration (up to 2,000 times that of water concentration) in the food chain (Nebeker et al. 1994) and damage to avian reproduction through eggshell thinning (Briggs 1992), little data is present on background concentrations of dieldrin in wild populations of waterbirds. The geometric mean concentration of dieldrin in red-breasted merganser (*Mergus serrator*) eggs collected from islands in Lake Michigan was 0.78 g/g (ww) (Haseltine et al. 1981). Another study on the affects of DDT, DDE, and dieldrin on American kestrel (*Falco sparverius*) reproduction, found that a geometric mean of <0.06 g/g (ww) (approximately 0.2 g/g dw assuming 75% moisture) in eggs caused no adverse affects (Wiemeyer et al. 1986). Furthermore, in mallard ducklings, the 8-day dietary LC50 has been shown to be as high as 91 g/g (ww) (Hudson et al. 1984).

DDE was detected in all of the avocet eggs collected, with a mean concentration of 0.52 g/g (dw) (n=9) (Appendix C.1). Six of the eggs collected at Bump Sullivan Pond 5 contained concentrations of less than 0.30 g/g (dw). Concentrations in the other three eggs from Pond 5 were 0.5, 4.14, and 5.0 g/g (dw). The only avocet egg collected at Bump Sullivan Pond 4 contained a DDE concentration of 0.72 g/g (dw). Concentrations of DDE >4 g/g (ww) or 16 g/g (dw assuming 75% moisture) were significantly correlated with eggshell thinning and decreased productivity in the white-faced ibis (*Plegadis chihi*) (Henny and Herron 1989). In brown pelicans

(*Pelecanus occidentalis*), 8 g/g (ww) of DDE has been associated with eggshell thinning and in some populations the critical value may be as low as 5 g/g (ww) (Blus 1984). Concentrations in avocet eggs from our study sites were well below these concentrations and we believe that adverse affects associated with the concentrations are minimal.

Fish

Three of the five fish collected at Bump Sullivan reservoir had p,p'-DDE concentrations of 0.056, 0.059, and 0.059 g/g (dw) (Appendix C.2). The geometric mean concentration of p,p'-DDE from a composite sample of 321 fish from around the United States in 1984 was 0.19 g/g (ww) or 0.76 g/g (dw assuming 75% moisture) (Schmitt et al. 1990). DDT or DDE should not exceed 1.0 g/g (ww) in whole fish tissue in order to protect fish-eating wildlife (NAS/NAE 1973); but all concentrations in the carp were below concentrations detrimental to avian consumers.

CONCLUSIONS

This report establishes important baseline information for Springer HMA and Table Mountain WMU. Because these areas provide important waterbird feeding and nesting habitat, any changes in future irrigation practices or land use that may potentially threaten the resources can then be determined.

Concentrations of boron and chromium were elevated in vegetation. Aquatic invertebrates had slightly elevated concentrations of cadmium and selenium. Mercury was slightly elevated in aquatic invertebrates, aquatic vegetation, and fish but not in avian eggs. This indicates that mercury is not bioaccumulating through food sources to concentrations determined to adversely affect the health of avian consumers. All other trace elements were either not detectable or not above normal background concentrations. Detectable organochlorine pesticides concentrations in fish and avian eggs were below concentrations detrimental to avian consumers. DDT was not detected in any of the samples, indicating that DDT is not currently entering the system. Predator observations and evidence of egg predation indicate that predators could be affecting waterbird nest success significantly.

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APPENDIX A

Sample site and type, species, and number of samples collected from Springer HMA and Table Mountain WMU for trace element and organochlorine analyses.

Appendix A.1. Sample site and type, species, and number of samples collected from Springer HMA and Table Mountain WMU for trace element analyses.

Site ^a	Matrix	Species	Number of Samples
BSR	Water		5
BSR	Sediment		5
BSR	Avian Egg	Mallard	5
BSR	Fish	Common Carp	5
BSGP	Water		5
BSGP	Sediment		5
BSGP	Vegetation	Sago Pondweed	5
BSGP	Invertebrate	Odonate	5
BSGP	Avian Egg	Mallard	2
BSP4	Water		5
BSP4	Sediment		5
BSP4	Vegetation	Sago Pondweed	5
BSP4	Invertebrate	Cladoceran	5
BSP4	Avian Egg	American Avocet	6
BSP5	Avian Egg	American Avocet	2
TMDC	Water		5
TMP1	Water		5
TMP1	Sediment		5
TMP1	Vegetation	Sago Pondweed	5
TMP1	Invertebrate	Cladoceran	5
TMP1	Fish	Common Carp	5
TMP2	Water		4 ^b
TMP2	Sediment		5
TMP2	Vegetation	Sago Pondweed	5

Appendix A.1. Continued.

Site ^a	Matrix	Species	Number of Samples
TMP2	Invertebrate	Heteropteran	5
TMP4	Avian Egg	Mallard	1
TMP6	Avian Egg	American Avocet	11
TMP7	Water		5
TMP7	Sediment		5
TMP7	Vegetation	Sago Pondweed	5
TMP7	Invertebrate	Heteropteran	5

^a BSR=Bump Sullivan Reservoir; BSGP=Bump Sullivan Goose Pond; BSP4=Bump Sullivan Pond 4; BSP5=Bump Sullivan Pond 5; TMDC=Table Mountain Dry Creek; TMP1, TMP2, TMP4, TMP6, TMP7=Table Mountain Pond 1, Pond 2, Pond 4, Pond 6, and Pond 7 respectively.

^b One water sample leaked during shipment and was assumed contaminated.

Appendix A.2. Sample site and type, species, and number of samples collected from Springer HMA and Table Mountain WMU for organochlorine analyses.

Site ^a	Matrix	Species	Number of Samples
BSP4	Avian Egg	American Avocet	1
BSP5	Avian Egg	American Avocet	9
BSR	Fish	Common Carp	5
TMP1	Fish	Common Carp	5

^a BSP4=Bump Sullivan Pond 4; BSP5=Bump Sullivan Pond 5; BSR=Bump Sullivan Reservoir; TMP1=Table Mountain Pond 1.

APPENDIX B

Trace element concentrations in water, sediment, vegetation, aquatic invertebrate, waterbird eggs, and fish samples collected from Springer HMA and Table Mountain WMU.

USFWS - Region 6 - Environmental Contaminants Report

Appendix B.1. Trace element concentrations (mg/l) in water samples collected from Springer HMA and Table Mountain WMU.

Water Sample #	Site	Al	As	B	Ba	Be	Cd	Cr	Cu	Fe	Hg
BSWT01	Bump Sullivan Reservoir	10.2	0.023	0.388	0.19	<0.0004	<0.001	0.006	0.006	7.19	<0.0002
BSWT02	Bump Sullivan Reservoir	8.29	0.016	0.377	0.18	<0.0004	<0.001	0.005	0.006	6.06	<0.0002
BSWT03	Bump Sullivan Reservoir	9.35	0.020	0.374	0.18	<0.0004	<0.001	0.005	0.005	6.45	<0.0002
BSWT04	Bump Sullivan Reservoir	9.33	0.021	0.371	0.18	<0.0004	<0.001	0.005	0.006	6.37	<0.0002
BSWT05	Bump Sullivan Reservoir	8.96	0.020	0.372	0.18	<0.0004	0.001	0.005	0.005	6.40	<0.0002
BSGPWT01	Bump Sullivan Goose Pond	0.250	0.021	1.07	0.042	<0.0004	<0.001	<0.002	0.002	0.202	<0.0002
BSGPWT02	Bump Sullivan Goose Pond	0.120	0.019	1.06	0.054	<0.0004	<0.001	<0.002	0.002	0.100	<0.0002
BSGPWT03	Bump Sullivan Goose Pond	0.140	0.019	1.06	0.081	<0.0004	<0.001	<0.002	<0.002	0.109	<0.0002
BSGPWT04	Bump Sullivan Goose Pond	0.140	0.019	1.08	0.021	<0.0004	<0.001	<0.002	<0.002	0.114	<0.0002
BSGPWT05	Bump Sullivan Goose Pond	0.210	0.021	1.23	0.091	<0.0004	<0.001	<0.002	0.003	0.156	<0.0002
BSP4WT01	Bump Sullivan Pond 4	16.5	0.055	1.24	0.065	0.001	<0.001	0.009	0.01	11.7	<0.0002
BSP4WT02	Bump Sullivan Pond 4	14.2	0.057	1.19	0.079	0.001	<0.001	0.008	0.01	10.2	<0.0002
BSP4WT03	Bump Sullivan Pond 4	14.1	0.058	1.2	0.092	0.001	<0.001	0.008	0.009	10.0	<0.0002
BSP4WT04	Bump Sullivan Pond 4	20.8	0.056	1.23	0.14	0.001	<0.001	0.01	0.01	14.3	<0.0002
BSP4WT05	Bump Sullivan Pond 4	16.6	0.055	1.81	0.13	0.001	<0.001	0.009	0.01	11.2	<0.0002
TMP1WT01	Table Mountain Pond 1	2.92	0.045	0.502	0.14	<0	<0.001	<0.002	0.003	1.54	<0.0002
TMP1WT02	Table Mountain Pond 1	3.11	0.044	0.498	0.12	<0	<0.001	<0.002	0.003	1.65	<0.0002
TMP1WT03	Table Mountain Pond 1	2.81	0.046	0.503	0.14	<0	<0.001	<0.002	0.003	1.51	<0.0002
TMP1WT04	Table Mountain Pond 1	2.83	0.045	0.561	0.14	<0	<0.001	<0.002	0.002	1.50	<0.0002
TMP1WT05	Table Mountain Pond 1	2.73	0.044	0.488	0.13	<0	<0.001	<0.002	0.003	1.46	<0.0002
TMP2WT02	Table Mountain Pond 2	2.87	0.045	0.447	0.10	<0	<0.001	0.004	0.003	1.68	<0.0002
TMP2WT03	Table Mountain Pond 2	2.80	0.042	0.462	0.11	<0	<0.001	<0.002	0.003	1.64	<0.0002
TMP2WT04	Table Mountain Pond 2	11.4	0.068	0.422	0.14	0.001	<0.001	0.006	0.009	7.71	<0.0002
TMP2WT05	Table Mountain Pond 2	9.50	0.063	0.431	0.13	<0	<0.001	0.005	0.007	6.44	<0.0002
TMDCW01	Table Mountain Dry Creek	0.801	0.016	0.224	0.083	<0.0004	<0.001	<0.002	0.003	0.555	<0.0002
TMP7WT01	Table Mountain Pond 7	1.08	0.033	0.316	0.036	<0	<0.001	<0.002	0.003	0.667	<0.0002
TMP7WT02	Table Mountain Pond 7	0.837	0.033	0.306	0.036	<0	<0.001	<0.002	0.003	0.538	<0.0002
TMP7WT03	Table Mountain Pond 7	1.02	0.034	0.294	0.035	<0	<0.001	<0.002	0.003	0.612	<0.0002
TMP7WT04	Table Mountain Pond 7	1.01	0.039	0.312	0.035	<0	<0.001	<0.002	0.003	0.638	<0.0002
TMP7WT05	Table Mountain Pond 7	0.987	0.037	0.293	0.035	<0	<0.001	<0.002	0.003	0.602	<0.0002
TMDCW02	Table Mountain Dry Creek	0.754	0.017	0.221	0.081	<0.0004	<0.001	<0.002	0.003	0.512	<0.0002
TMDCW03	Table Mountain Dry Creek	0.955	0.016	0.204	0.084	<0.0004	<0.001	<0.002	0.003	0.666	<0.0002
TMDCW04	Table Mountain Dry Creek	0.920	0.016	0.245	0.086	<0.0004	<0.001	<0.002	0.002	0.615	<0.0002
TMDCW05	Table Mountain Dry Creek	0.947	0.016	0.22	0.085	<0.0004	<0.001	<0.002	0.003	0.667	<0.0002

USFWS - Region 6 - Environmental Contaminants Report

Appendix B.1. Cont.

Water Sample #	Site	Mg	Mn	Mo	Ni	Pb	Se	Sr	V	Zn
BSWT01	Bump Sullivan Reservoir	30.6	0.25	0.01	0.0050	<0.010	0.003	0.508	0.036	0.023
BSWT02	Bump Sullivan Reservoir	28.9	0.23	0.01	0.017	0.011	0.004	0.489	0.033	0.021
BSWT03	Bump Sullivan Reservoir	28.9	0.23	0.01	0.0070	<0.010	0.003	0.489	0.034	0.019
BSWT04	Bump Sullivan Reservoir	28.1	0.22	0.01	0.0080	0.011	0.004	0.477	0.033	0.026
BSWT05	Bump Sullivan Reservoir	29.4	0.23	0.01	0.0080	0.011	0.004	0.494	0.034	0.028
BSGPWT01	Bump Sullivan Goose Pond	71.0	0.024	0.01	0.0040	<0.010	<0.002	0.856	0.0040	<0.0040
BSGPWT02	Bump Sullivan Goose Pond	70.6	0.021	0.01	0.023	<0.010	0.004	0.843	0.0040	0.0050
BSGPWT03	Bump Sullivan Goose Pond	70.0	0.023	0.01	0.015	0.014	0.002	0.846	0.0040	0.0080
BSGPWT04	Bump Sullivan Goose Pond	72.4	0.023	0.01	0.018	<0.010	0.002	0.859	0.0040	0.0060
BSGPWT05	Bump Sullivan Goose Pond	71.2	0.024	0.01	0.026	<0.010	0.003	0.858	0.0050	0.0080
BSP4WT01	Bump Sullivan Pond 4	27.7	0.24	0.08	0.011	0.017	0.006	0.591	0.028	0.042
BSP4WT02	Bump Sullivan Pond 4	25.5	0.2	0.09	0.016	<0.010	0.006	0.563	0.026	0.042
BSP4WT03	Bump Sullivan Pond 4	25.1	0.19	0.09	0.012	0.014	0.007	0.555	0.036	0.034
BSP4WT04	Bump Sullivan Pond 4	28.6	0.26	0.09	0.012	0.024	0.005	0.594	0.033	0.053
BSP4WT05	Bump Sullivan Pond 4	25.4	0.21	0.09	0.010	0.011	0.005	0.566	0.028	0.043
TMP1WT01	Table Mountain Pond 1	12.7	0.082	0.01	0.0030	<0.010	<0.002	0.421	0.013	0.013
TMP1WT02	Table Mountain Pond 1	13.1	0.076	0.009	0.0080	<0.010	<0.002	0.424	0.014	0.013
TMP1WT03	Table Mountain Pond 1	12.7	0.080	0.01	0.017	<0.010	<0.002	0.417	0.013	0.0090
TMP1WT04	Table Mountain Pond 1	12.7	0.084	0.01	0.0030	<0.010	<0.002	0.419	0.013	0.014
TMP1WT05	Table Mountain Pond 1	12.3	0.66	0.01	0.0030	<0.010	<0.002	0.401	0.013	0.0080
TMP2WT02	Table Mountain Pond 2	12.5	0.072	0.009	0.0050	0.011	<0.002	0.365	0.016	0.013
TMP2WT03	Table Mountain Pond 2	12.7	0.077	0.009	<0.0020	0.017	<0.002	0.376	0.016	0.012
TMP2WT04	Table Mountain Pond 2	14.2	0.28	0.01	0.0050	0.029	0.002	0.455	0.029	0.036
TMP2WT05	Table Mountain Pond 2	13.0	0.2	0.02	0.0060	0.012	<0.002	0.388	0.027	0.032
TMDCW01	Table Mountain Dry Creek	17.1	0.019	<0.008	<0.0020	<0.010	0.003	0.492	0.015	0.033
TMP7WT01	Table Mountain Pond 7	13.7	0.014	0.01	0.0070	<0.010	0.002	0.209	0.019	0.027
TMP7WT02	Table Mountain Pond 7	13.7	0.013	0.01	<0.0020	<0.010	0.002	0.210	0.019	0.0050
TMP7WT03	Table Mountain Pond 7	13.3	0.013	0.01	0.0020	<0.010	0.002	0.206	0.018	0.0060
TMP7WT04	Table Mountain Pond 7	13.4	0.014	0.01	<0.0020	<0.010	<0.002	0.202	0.019	<0.0040
TMP7WT05	Table Mountain Pond 7	13.2	0.013	0.01	<0.0020	<0.010	0.002	0.202	0.018	0.0050
TMDCW02	Table Mountain Dry Creek	16.7	0.016	<0.008	<0.0020	<0.010	0.003	0.497	0.015	0.014
TMDCW03	Table Mountain Dry Creek	16.9	0.022	<0.008	0.0030	<0.010	0.003	0.487	0.015	0.020
TMDCW04	Table Mountain Dry Creek	17.3	0.020	<0.008	0.0090	<0.010	0.003	0.500	0.015	0.011
TMDCW05	Table Mountain Dry Creek	17.0	0.022	<0.008	0.0060	<0.010	0.003	0.491	0.015	0.017

USFWS - Region 6 - Environmental Contaminants Report

Appendix B.2. Trace element concentrations (ug/g dry weight) in sediment samples collected from Springer HMA and Table Mountain WMU.

Sediment Sample #	Site	Al	As	B	Ba	Be	Cd	Cr	Cu	Fe	Hg
BSRSED01	Bump Sullivan Reservoir	5393.58	1.91	5.47	107.9	0.24	<0.21	5.23	3.72	6370.26	0.067
BSRSED02	Bump Sullivan Reservoir	5160.31	1.71	5.74	105.3	0.23	<0.22	5.10	3.79	6167.94	0.090
BSRSED03	Bump Sullivan Reservoir	2578.71	2.13	2.79	42.88	0.15	<0.22	3.34	2.43	5097.45	0.097
BSRSED04	Bump Sullivan Reservoir	2034.96	1.46	2.22	61.67	0.13	<0.18	2.87	2.16	4382.02	0.039
BSRSED05	Bump Sullivan Reservoir	3107.77	1.57	3.10	60.65	0.2	<0.18	3.10	2.78	3922.31	0.051
GPSED01	Bump Sullivan Goose Pond	3055.56	2.08	4.72	35.35	0.14	<0.18	2.84	2.29	3472.22	0.044
GPSED02	Bump Sullivan Goose Pond	4561.17	2.29	4.77	45.08	0.19	<0.20	4.15	3.06	5013.30	0.039
GPSED03	Bump Sullivan Goose Pond	12664.4	3.37	16.7	142.0	0.51	<0.25	8.53	7.82	10387.9	0.049
GPSED04	Bump Sullivan Goose Pond	12406.0	3.12	18.4	126.3	0.50	<0.27	8.87	8.05	10921.1	0.070
GPSED05	Bump Sullivan Goose Pond	13116.9	2.65	16.6	138.2	0.51	<0.27	8.87	8.01	10779.2	0.074
BSP4SED1	Bump Sullivan Pond 4	6920.73	1.81	16.5	119.5	0.33	<0.22	5.63	5.41	7667.68	0.069
BSP4SED2	Bump Sullivan Pond 4	7059.64	1.86	15.8	87.93	0.37	<0.20	5.70	4.72	7642.16	0.074
BSP4SED3	Bump Sullivan Pond 4	8564.81	2.35	17.0	112.5	0.38	<0.23	6.74	5.29	8472.22	0.063
BSP4SED4	Bump Sullivan Pond 4	8426.32	2.92	13.4	122.3	0.55	<0.21	6.25	9.37	12861.2	0.13
BSP4SED5	Bump Sullivan Pond 4	5638.13	1.70	13.8	138.1	0.26	<0.23	4.99	9.03	6122.78	0.11
TMP1SD01	Table Mountain Pond 1	13703.1	2.50	10.5	280.6	0.08	<0.23	5.40	5.29	7553.02	<0.016
TMP1SD02	Table Mountain Pond 1	8145.16	3.53	8.97	196.8	0.40	<0.22	4.71	4.18	6080.65	<0.016
TMP1SD03	Table Mountain Pond 1	18965.7	4.90	18.8	260.9	0.84	<0.34	8.22	8.35	11098.4	<0.023
TMP1SD04	Table Mountain Pond 1	16198.2	3.95	12.6	385.6	0.70	<0.26	5.73	5.77	8126.13	<0.018
TMP1SD05	Table Mountain Pond 1	7814.99	3.51	7.58	468.9	0.35	<0.22	4.13	3.51	5215.31	<0.016
TMP2SD01	Table Mountain Pond 2	21292.7	5.85	23.2	232.9	0.86	<0.36	10.5	10.8	13902.4	<0.024
TMP2SD02	Table Mountain Pond 2	25000.0	6.76	26.5	247.5	0.97	<0.37	11.8	12.1	15717.8	<0.025
TMP2SD03	Table Mountain Pond 2	29397.0	5.85	30.2	261.3	1.2	<0.35	12.7	14.3	17738.7	<0.025
TMP2SD04	Table Mountain Pond 2	21548.2	8.53	24.0	236.3	0.96	<0.38	10.8	15.8	15253.8	<0.025
TMP2SD05	Table Mountain Pond 2	14142.56	6.24	14.6	192.5	0.61	<0.29	7.44	8.44	10000.0	<0.019
TMP7SD01	Table Mountain Pond 7	6251.69	2.48	7.21	86.06	0.25	<0.19	6.10	2.73	6657.64	<0.014
TMP7SD02	Table Mountain Pond 7	4966.08	2.69	5.81	73.54	0.21	<0.20	4.99	2.42	5590.23	<0.014
TMP7SD03	Table Mountain Pond 7	3667.51	2.07	3.64	46.07	0.15	<0.19	4.61	1.76	5228.43	<0.013
TMP7SD04	Table Mountain Pond 7	7140.72	2.96	8.16	98.50	0.30	<0.22	6.12	3.55	7020.96	<0.015
TMP7SD05	Table Mountain Pond 7	8016.42	2.82	7.84	82.22	0.36	<0.20	6.79	4.39	8139.53	<0.014

USFWS - Region 6 - Environmental Contaminants Report

Appendix B.2. Cont.

Sediment Sample #	Site	Mg	Mn	Mo	Ni	Pb	Se	Sr	V	Zn
BSRSED01	Bump Sullivan Reservoir	2478.1	85.71	<1.39	3.85	2.81	0.61	47.96	14.53	16.18
BSRSED02	Bump Sullivan Reservoir	2427.5	85.34	<1.47	3.42	2.72	0.44	52.06	14.35	15.73
BSRSED03	Bump Sullivan Reservoir	1193.4	80.21	<1.45	2.43	2.47	0.40	22.34	11.92	9.61
BSRSED04	Bump Sullivan Reservoir	993.76	156.1	<1.23	1.94	4.58	<0.25	20.60	10.51	8.290
BSRSED05	Bump Sullivan Reservoir	1679.2	81.33	<1.23	2.71	2.67	0.29	30.70	4.870	10.30
GPSED01	Bump Sullivan Goose Pond	1477.3	74.62	<1.21	2.18	1.64	0.47	47.85	6.000	9.440
GPSED02	Bump Sullivan Goose Pond	1861.7	86.84	<1.31	3.35	2.09	0.47	44.41	9.470	11.58
GPSED03	Bump Sullivan Goose Pond	6222.6	239.5	<1.64	6.21	4.70	0.96	251.3	20.91	31.03
GPSED04	Bump Sullivan Goose Pond	5733.1	253.8	<1.83	7.01	5.23	1.1	221.8	23.68	31.95
GPSED05	Bump Sullivan Goose Pond	6103.9	241.2	<1.80	6.23	3.80	1.0	250.4	22.82	32.47
BSP4SED1	Bump Sullivan Pond 4	3673.8	207.3	<1.48	4.09	7.59	1.3	88.41	15.24	22.26
BSP4SED2	Bump Sullivan Pond 4	4063.8	163.7	<1.36	4.22	5.16	0.68	71.15	14.15	21.08
BSP4SED3	Bump Sullivan Pond 4	4892.0	197.5	<1.54	4.66	4.49	0.79	96.45	17.44	22.84
BSP4SED4	Bump Sullivan Pond 4	3819.7	307.6	<1.41	6.41	6.05	0.56	47.93	23.89	31.04
BSP4SED5	Bump Sullivan Pond 4	3457.2	145.4	<1.55	3.30	13.6	0.82	172.9	12.76	18.09
TMP1SD01	Table Mountain Pond 1	5220.2	156.9	<1.50	3.98	3.98	0.34	88.09	15.04	20.88
TMP1SD02	Table Mountain Pond 1	3500.0	138.7	<1.49	3.68	3.60	0.35	85.32	14.94	15.56
TMP1SD03	Table Mountain Pond 1	7757.4	242.6	<2.25	6.45	6.66	0.71	153.6	29.98	29.06
TMP1SD04	Table Mountain Pond 1	6378.4	164.0	<1.72	4.40	5.64	<0.36	120.4	30.45	20.54
TMP1SD05	Table Mountain Pond 1	3173.8	126.3	<1.58	2.97	2.50	<0.32	78.47	14.24	13.03
TMP2SD01	Table Mountain Pond 2	9024.4	292.7	<2.37	7.68	7.56	1.3	211.0	36.59	37.32
TMP2SD02	Table Mountain Pond 2	10346	326.7	<2.46	7.97	7.20	2.0	250.0	41.58	41.58
TMP2SD03	Table Mountain Pond 2	12135	366.8	<2.48	8.97	7.51	2.4	263.8	46.98	47.74
TMP2SD04	Table Mountain Pond 2	9517.8	319.8	<2.50	8.48	9.39	2.5	212.2	42.13	41.12
TMP2SD05	Table Mountain Pond 2	6289.0	237.0	<1.92	5.45	4.95	1.8	196.5	26.78	31.60
TMP7SD01	Table Mountain Pond 7	2476.3	72.80	<1.28	3.37	3.46	0.78	55.21	19.49	15.70
TMP7SD02	Table Mountain Pond 7	2035.3	64.04	<1.34	3.09	2.66	0.45	53.19	15.06	12.43
TMP7SD03	Table Mountain Pond 7	1370.6	54.57	<1.27	2.44	1.93	<0.25	30.96	13.83	10.29
TMP7SD04	Table Mountain Pond 7	2994.0	99.10	<1.46	3.68	3.88	0.58	81.14	19.31	17.22
TMP7SD05	Table Mountain Pond 7	3160.1	89.60	<1.32	4.43	3.91	0.33	45.42	20.25	19.70

USFWS - Region 6 - Environmental Contaminants Report

Appendix B.3. Trace element concentrations (ug/g dry weight) in vegetation collected from Springer HMA and Table Mountain WMU.

Vegetation Sample #	Site	Common Name	Al	As	B	Ba	Be	Cd	Cr	Cu	Fe	Hg
GPAV01	Bump Sullivan Goose Pond	Pondweed	1061.29	3.87	1182.8	115.1	<0.22	<0.65	1.42	7.68	1000.0	0.828
GPAV02	Bump Sullivan Goose Pond	Pondweed	1368.42	1.93	938.6	116.7	<0.18	<0.52	1.33	7.12	1175.4	0.842
GPAV03	Bump Sullivan Goose Pond	Pondweed	1978.02	2.53	1142.9	165.9	<0.22	<0.65	1.86	19.7	1747.3	1.24
GPAV04	Bump Sullivan Goose Pond	Pondweed	803.530	2.12	901.18	95.76	<0.24	<0.71	1.19	5.92	867.06	0.659
GPAV05	Bump Sullivan Goose Pond	Pondweed	821.350	3.03	639.33	82.02	<0.22	<0.67	1.24	7.07	857.30	9.91
BSP4AV01	Bump Sullivan Pond 4	Pondweed	6448.72	4.23	366.67	86.79	0.33	<0.77	5.46	38.1	5384.6	0.628
BSP4AV02	Bump Sullivan Pond 4	Pondweed	5835.45	6.20	326.58	89.11	0.30	<0.75	5.18	25.8	5139.3	1.20
BSP4AV03	Bump Sullivan Pond 4	Pondweed	7301.20	4.34	419.28	85.54	0.30	<0.71	6.73	25.3	5674.7	0.590
BSP4AV04	Bump Sullivan Pond 4	Pondweed	10090.9	5.09	472.73	91.09	0.40	<1.1	7.62	23.6	7381.8	0.727
BSP4AV05	Bump Sullivan Pond 4	Pondweed	5647.06	2.86	327.73	60.17	0.23	<0.5	4.30	9.58	4218.5	0.714
TMP1AV01	Table Mountain Pond 1	Pondweed	3021.28	5.11	457.45	202.8	<0.43	<1.3	3.23	7.17	1991.5	0.957
TMP1AV02	Table Mountain Pond 1	Pondweed	1068.18	3.64	553.03	165.2	<0.30	<0.91	<1.50	11.9	750.00	0.379
TMP1AV03	Table Mountain Pond 1	Pondweed	3526.31	6.84	665.79	224.0	<0.53	<1.6	2.87	10.2	2210.5	0.474
TMP1AV04	Table Mountain Pond 1	Pondweed	3625.00	4.79	662.50	212.5	<0.42	<1.3	2.62	15.3	2229.2	0.792
TMP1AV05	Table Mountain Pond 1	Pondweed	3297.87	5.32	602.13	191.5	<0.43	<1.3	<2.11	6.40	2023.4	0.894
TMP2AV01	Table Mountain Pond 2	Pondweed	1897.06	3.82	495.59	191.2	<0.29	<0.88	1.53	11.0	1277.9	0.441
TMP2AV02	Table Mountain Pond 2	Pondweed	1255.17	6.21	451.72	120.7	<0.34	<1.0	<1.71	8.53	465.52	0.707
TMP2AV03	Table Mountain Pond 2	Pondweed	2214.28	3.93	396.43	145.0	<0.36	<1.1	2.34	14.6	1525.0	0.696
TMP2AV04	Table Mountain Pond 2	Pondweed	2304.34	2.83	767.39	287.0	<0.43	<1.3	<2.17	7.35	1567.4	1.543
TMP2AV05	Table Mountain Pond 2	Pondweed	3901.23	5.19	409.88	203.7	<0.25	<0.74	2.70	5.32	3024.7	0.667
TMP7AV01	Table Mountain Pond 7	Pondweed	5877.20	8.07	594.74	243.9	<0.35	<1.1	3.81	7.07	4315.8	0.649
TMP7AV02	Table Mountain Pond 7	Pondweed	7014.93	5.67	517.91	207.5	0.31	<0.90	3.84	5.85	4686.6	0.493
TMP7AV03	Table Mountain Pond 7	Pondweed	8270.59	5.41	423.53	235.3	0.35	<0.71	4.31	5.98	5470.6	0.271
TMP7AV04	Table Mountain Pond 7	Pondweed	9969.23	5.69	626.15	284.6	0.43	<0.92	5.34	9.72	6615.4	0.338
TMP7AV05	Table Mountain Pond 7	Pondweed	10160.0	6.00	425.33	274.7	0.47	<0.80	5.07	6.27	6600.0	0.640

USFWS - Region 6 - Environmental Contaminants Report

Appendix B.3. Cont.

Vegetation Sample #	Site	Common Name	Mg	Mn	Mo	Ni	Pb	Se	Sr	V	Zn
GPA V01	Bump Sullivan Goose Pond	Pondweed	14731.2	594.62	<4.27	2.27	<5.33	2.80	453.76	1.96	20.65
GPA V02	Bump Sullivan Goose Pond	Pondweed	12105.3	450.00	<3.46	1.87	<4.32	2.89	421.05	2.26	20.70
GPA V03	Bump Sullivan Goose Pond	Pondweed	13296.7	600.00	<4.35	4.47	<5.44	2.64	620.88	3.32	29.67
GPA V04	Bump Sullivan Goose Pond	Pondweed	13411.8	427.06	<4.67	1.65	<5.84	2.00	427.06	1.98	23.18
GPA V05	Bump Sullivan Goose Pond	Pondweed	8741.58	247.19	<4.47	1.61	<5.58	2.47	325.84	1.76	25.62
BSP4A V01	Bump Sullivan Pond 4	Pondweed	9782.05	338.46	<5.10	6.68	<6.37	3.97	229.49	9.50	56.28
BSP4A V02	Bump Sullivan Pond 4	Pondweed	9177.22	416.46	<5.01	6.41	<6.27	5.82	217.72	8.32	49.49
BSP4A V03	Bump Sullivan Pond 4	Pondweed	8903.61	400.00	<4.75	7.69	<5.94	4.34	214.46	11.9	44.82
BSP4A V04	Bump Sullivan Pond 4	Pondweed	11636.4	381.82	<7.20	6.82	<9.00	5.45	240.00	13.3	47.64
BSP4A V05	Bump Sullivan Pond 4	Pondweed	7327.73	268.91	3.48	3.66	<4.18	3.19	168.91	7.31	29.33
TMP1A V01	Table Mountain Pond 1	Pondweed	7659.58	674.47	<8.47	2.85	<10.6	3.83	244.68	7.28	49.15
TMP1A V02	Table Mountain Pond 1	Pondweed	9499.99	792.42	<6.02	<1.80	<7.52	3.18	206.06	2.73	39.39
TMP1A V03	Table Mountain Pond 1	Pondweed	11973.7	1389.5	<10.5	<3.13	<13.1	6.05	268.42	8.66	50.79
TMP1A V04	Table Mountain Pond 1	Pondweed	10937.5	893.75	<8.29	2.96	<10.4	4.58	281.25	8.81	40.00
TMP1A V05	Table Mountain Pond 1	Pondweed	9808.52	912.77	<8.47	<2.53	<10.6	4.26	242.55	7.55	32.34
TMP2A V01	Table Mountain Pond 2	Pondweed	9705.88	106.32	<5.85	1.93	<7.32	2.50	348.53	4.16	36.91
TMP2A V02	Table Mountain Pond 2	Pondweed	13534.5	158.79	<6.84	2.84	<8.55	3.79	382.76	4.22	28.97
TMP2A V03	Table Mountain Pond 2	Pondweed	7249.99	114.11	<7.11	6.41	<8.87	4.11	241.07	5.87	30.54
TMP2A V04	Table Mountain Pond 2	Pondweed	14500.0	151.74	<8.70	<2.61	<10.9	4.13	513.04	5.74	27.61
TMP2A V05	Table Mountain Pond 2	Pondweed	7901.23	146.91	<4.91	2.49	<6.14	3.46	328.39	9.78	19.51
TMP7A V01	Table Mountain Pond 7	Pondweed	14052.6	289.47	<6.96	3.46	<8.7	4.39	466.67	9.56	39.47
TMP7A V02	Table Mountain Pond 7	Pondweed	11268.7	258.21	<5.94	3.48	<7.42	4.03	382.09	9.54	37.01
TMP7A V03	Table Mountain Pond 7	Pondweed	11517.7	272.94	<4.67	3.48	<5.84	3.41	440.00	9.87	36.24
TMP7A V04	Table Mountain Pond 7	Pondweed	14907.7	335.38	<6.12	4.43	<7.66	3.69	527.69	13.3	51.54
TMP7A V05	Table Mountain Pond 7	Pondweed	12666.7	298.67	<5.31	4.25	<6.63	3.73	518.67	12.8	36.80

USFWS - Region 6 - Environmental Contaminants Report

Appendix B.4. Trace element concentrations (ug/g dry weight) in aquatic invertebrates collected from Springer HMA and Table Mountain WMU.

Aquatic Invertebrate Sample #	Site	Common Name	Al	As	B	Ba	Be	Cd	Cr
SPGPAI01	Bump Sullivan Goose Pond	Damselfly larvae	19.260	0.99	12.0	1.120	<0.06	<0.17	0.30
SPGPAI02	Bump Sullivan Goose Pond	Damselfly larvae	12.870	0.52	6.02	0.650	<0.03	<0.08	0.17
SPGPAI03	Bump Sullivan Goose Pond	Damselfly larvae	69.660	0.53	6.00	1.880	<0.03	<0.10	0.24
SPGPAI04	Bump Sullivan Goose Pond	Damselfly larvae	21.180	0.40	4.28	0.890	<0.03	<0.090	0.20
SPGPAI05	Bump Sullivan Goose Pond	Damselfly larvae	227.72	2.5	29.4	6.920	<0.20	<0.59	1.3
BSP4AI01	Bump Sullivan Pond 4	Water fleas	7282.1	6.4	88.5	241.5	<0.51	4.1	7.9
BSP4AI02	Bump Sullivan Pond 4	Water fleas	2067.8	3.2	46.8	61.02	<0.34	1.7	3.4
BSP4AI03	Bump Sullivan Pond 4	Water fleas	1228.9	2.9	60.6	51.45	<0.24	1.7	2.4
BSP4AI04	Bump Sullivan Pond 4	Water fleas	1211.7	4.0	65.7	58.33	<0.33	2.0	2.0
BSP4AI05	Bump Sullivan Pond 4	Water fleas	1320.3	4.8	59.8	62.03	<0.34	1.6	2.5
TMP1AI01	Table Mountain Pond 1	Water fleas	2189.7	5.2	52.8	76.03	<0.34	<1.0	2.7
TMP1AI02	Table Mountain Pond 1	Water fleas	5684.2	5.8	99.5	163.3	<0.35	<1.0	8.7
TMP1AI05	Table Mountain Pond 1	Water fleas	3745.5	6.4	41.1	172.6	<0.36	<1.1	3.4
TMP1AI06	Table Mountain Pond 1	Water fleas	2824.3	4.3	93.4	134.3	<0.27	<0.80	2.6
TMP1AI07	Table Mountain Pond 1	Water fleas	3021.7	7.2	72.0	136.5	<0.43	<1.3	3.5
TMP2AI01	Table Mountain Pond 2	Backswimmers	60.590	1.5	8.18	14.00	<0.12	0.36	0.75
TMP2AI02	Table Mountain Pond 2	Waterboatmen	1711.9	2.7	42.9	122.0	<0.17	<0.51	2.3
TMP2AI03	Table Mountain Pond 2	Waterboatmen	922.08	1.3	24.8	21.36	<0.13	<0.38	1.4
TMP2AI04	Table Mountain Pond 2	Waterboatmen	1364.6	2.2	37.8	26.35	<0.21	<0.61	2.2
TMP2AI05	Table Mountain Pond 2	Backswimmers	144.61	0.56	10.0	8.140	<0.07	0.41	0.66
TMP7AI01	Table Mountain Pond 7	Backswimmers/Waterboatmen	176.99	1.8	35.3	11.50	<0.18	1.0	1.1
TMP7AI02	Table Mountain Pond 7	Backswimmers/Waterboatmen	261.06	1.4	31.2	11.77	<0.18	0.94	1.1
TMP7AI03	Table Mountain Pond 7	Backswimmers/Waterboatmen	115.76	1.4	10.9	12.77	<0.11	1.4	0.82
TMP7AI04	Table Mountain Pond 7	Backswimmers/Waterboatmen	83.820	<.35	15.7	12.02	<0.12	1.4	0.77
TMP7AI05	Table Mountain Pond 7	Backswimmers/Waterboatmen	99.440	0.51	18.7	12.99	<0.11	1.3	0.80

USFWS - Region 6 - Environmental Contaminants Report

Appendix B.4. Cont.

Aquatic Invertebrate Sample #	Site	Common Name	Cu	Fe	Hg	Mg	Mn	Mo	Ni
SPGPAI01	Bump Sullivan Goose Pond	Damselfly larvae	5.47	42.21	0.311	464.59	2.360	<1.13	<0.340
SPGPAI02	Bump Sullivan Goose Pond	Damselfly larvae	2.92	23.50	0.0420	263.66	1.640	<0.550	2.49
SPGPAI03	Bump Sullivan Goose Pond	Damselfly larvae	3.54	75.93	0.0470	349.15	3.880	<0.680	0.510
SPGPAI04	Bump Sullivan Goose Pond	Damselfly larvae	3.31	41.07	0.0480	273.78	1.790	<0.570	<0.170
SPGPAI05	Bump Sullivan Goose Pond	Damselfly larvae	20.2	289.1	0.455	1742.6	13.17	<3.95	<1.19
BSP4AI01	Bump Sullivan Pond 4	Water fleas	16.8	5154	2.03	5769.2	165.4	<10.1	5.00
BSP4AI02	Bump Sullivan Pond 4	Water fleas	6.15	1532	1.24	1983.1	47.97	<6.68	2.69
BSP4AI03	Bump Sullivan Pond 4	Water fleas	8.45	1064	1.07	1891.6	37.35	<4.78	2.58
BSP4AI04	Bump Sullivan Pond 4	Water fleas	13.9	1230	0.967	2866.7	44.33	<6.63	4.78
BSP4AI05	Bump Sullivan Pond 4	Water fleas	10.5	1268	1.36	2847.5	42.88	<6.71	3.02
TMP1AI01	Table Mountain Pond 1	Water fleas	7.93	1693	0.224	1793.1	79.14	<6.86	3.07
TMP1AI02	Table Mountain Pond 1	Water fleas	13.9	3860	<0.175	3122.8	177.19	<6.91	7.07
TMP1AI05	Table Mountain Pond 1	Water fleas	12.4	2509	<0.182	2745.5	161.1	<7.24	2.73
TMP1AI06	Table Mountain Pond 1	Water fleas	8.95	1892	<0.135	2040.5	114.7	<5.34	1.91
TMP1AI07	Table Mountain Pond 1	Water fleas	10.9	2009	0.913	2478.3	117.4	<8.63	3.63
TMP2AI01	Table Mountain Pond 2	Backswimmers	14.9	225.9	0.653	1947.1	28.88	<2.33	<0.70
TMP2AI02	Table Mountain Pond 2	Waterboatmen	15.6	1423	0.610	2457.6	70.00	<3.36	1.75
TMP2AI03	Table Mountain Pond 2	Waterboatmen	9.87	766.2	0.727	1519.5	50.19	<2.56	<0.770
TMP2AI04	Table Mountain Pond 2	Waterboatmen	16.0	1145	0.635	2583.3	68.33	<4.11	<1.24
TMP2AI05	Table Mountain Pond 2	Backswimmers	13.8	216.0	0.647	1475.8	18.70	<1.48	<0.440
TMP7AI01	Table Mountain Pond 7	Backswimmers/Waterboatmen	12.0	347.8	0.752	1619.5	16.90	<3.50	2.96
TMP7AI02	Table Mountain Pond 7	Backswimmers/Waterboatmen	9.03	377.0	0.381	1504.4	17.61	<3.49	1.24
TMP7AI03	Table Mountain Pond 7	Backswimmers/Waterboatmen	11.6	417.9	0.326	1701.1	20.16	<2.16	<0.650
TMP7AI04	Table Mountain Pond 7	Backswimmers/Waterboatmen	13.9	427.2	0.266	1884.4	21.27	<2.30	<0.690
TMP7AI05	Table Mountain Pond 7	Backswimmers/Waterboatmen	12.9	388.7	0.373	1774.0	20.96	<2.25	<0.670

USFWS - Region 6 - Environmental Contaminants Report

Appendix B.4. Cont.

Aquatic Invertebrate Sample #	Site	Common Name	Pb	Se	Sr	V	Zn
SPGPAI01	Bump Sullivan Goose Pond	Damselfly larvae	<1.42	2.49	13.03	<0.140	22.52
SPGPAI02	Bump Sullivan Goose Pond	Damselfly larvae	<0.680	1.02	7.950	<0.070	13.55
SPGPAI03	Bump Sullivan Goose Pond	Damselfly larvae	<0.850	1.53	11.47	0.14	17.29
SPGPAI04	Bump Sullivan Goose Pond	Damselfly larvae	<0.720	1.08	6.710	0.08	14.41
SPGPAI05	Bump Sullivan Goose Pond	Damselfly larvae	<4.94	7.52	57.72	<0.500	88.61
BSP4AI01	Bump Sullivan Pond 4	Water fleas	<12.7	5.64	1897.4	12.5	94.87
BSP4AI02	Bump Sullivan Pond 4	Water fleas	<8.34	2.88	588.1	3.61	38.64
BSP4AI03	Bump Sullivan Pond 4	Water fleas	<5.98	2.53	555.4	2.57	55.66
BSP4AI04	Bump Sullivan Pond 4	Water fleas	<8.30	4.17	695.0	2.40	106.8
BSP4AI05	Bump Sullivan Pond 4	Water fleas	<8.39	4.41	767.8	2.36	73.73
TMP1AI01	Table Mountain Pond 1	Water fleas	<8.57	7.76	272.4	3.71	84.48
TMP1AI02	Table Mountain Pond 1	Water fleas	<8.63	7.37	471.9	9.56	177.2
TMP1AI05	Table Mountain Pond 1	Water fleas	<9.05	10.2	610.9	5.75	98.73
TMP1AI06	Table Mountain Pond 1	Water fleas	<6.68	7.84	475.7	3.92	68.11
TMP1AI07	Table Mountain Pond 1	Water fleas	<10.8	13.3	547.8	4.35	78.70
TMP2AI01	Table Mountain Pond 2	Backswimmers	<2.91	4.00	44.24	<0.290	164.1
TMP2AI02	Table Mountain Pond 2	Waterboatmen	<4.20	2.20	69.41	4.02	233.1
TMP2AI03	Table Mountain Pond 2	Waterboatmen	<3.19	2.08	69.48	2.05	177.3
TMP2AI04	Table Mountain Pond 2	Waterboatmen	<5.15	2.19	65.31	2.94	314.6
TMP2AI05	Table Mountain Pond 2	Backswimmers	<1.85	1.82	26.36	0.450	136.4
TMP7AI01	Table Mountain Pond 7	Backswimmers/Waterboatmen	<4.38	3.10	49.65	0.790	151.3
TMP7AI02	Table Mountain Pond 7	Backswimmers/Waterboatmen	<4.35	1.95	51.42	0.990	126.6
TMP7AI03	Table Mountain Pond 7	Backswimmers/Waterboatmen	<2.70	4.13	59.78	0.880	170.7
TMP7AI04	Table Mountain Pond 7	Backswimmers/Waterboatmen	<2.88	8.21	61.85	0.680	193.1
TMP7AI05	Table Mountain Pond 7	Backswimmers/Waterboatmen	<2.81	1.07	63.84	0.890	184.8

USFWS - Region 6 - Environmental Contaminants Report

Appendix B.5. Trace element concentrations (ug/g dry weight) in waterbird egg samples collected from Springer HMA and Table Mountain WMU.

Avian Egg Sample #	Site	Common Name	Al	As	B	Ba	Be	Cd	Cr	Cu	Fe	Hg
BSME02	Bump Sullivan Reservoir	Mallard	<3.33	0.64	10.3	79.5	<0.07	<0.20	0.54	3.49	191.61	0.497
BSME03	Bump Sullivan Reservoir	Mallard	<3.35	0.47	2.48	17.2	<0.07	<0.20	0.65	3.94	154.55	0.572
BSME04	Bump Sullivan Reservoir	Mallard	<3.42	0.48	2.13	9.00	<0.07	<0.21	1.0	4.76	113.79	0.303
BSME05	Bump Sullivan Reservoir	Mallard	<3.31	1.0	<1.33	44.7	<0.07	<0.20	0.51	3.90	188.33	0.520
BSME06	Bump Sullivan Reservoir	Mallard	<2.94	0.68	1.79	7.21	<0.06	<0.18	0.74	4.36	84.870	0.312
SPBSME01	Bump Sullivan Reservoir	Mallard	<3.28	<0.23	2.21	10.5	<0.07	<0.20	1.5	4.32	108.97	0.282
SPGPME01	Bump Sullivan Goose Pond	Mallard	<3.76	0.45	2.39	13.8	<0.08	<0.23	2.1	2.73	153.79	0.117
BSP4AE01	Bump Sullivan Pond 4	American Avocet	<3.94	0.75	2.78	6.56	<0.08	<0.24	0.67	3.36	121.34	0.316
BSP4AE02	Bump Sullivan Pond 4	American Avocet	<3.24	0.42	2.22	3.26	<0.07	<0.20	1.7	3.18	114.33	0.375
BSP4AE04	Bump Sullivan Pond 4	American Avocet	4.58	0.36	3.11	3.55	<0.08	<0.24	0.84	3.16	149.40	0.494
BSP4AE05	Bump Sullivan Pond 4	American Avocet	<3.91	<0.28	3.90	7.39	<0.08	<0.23	0.51	3.42	119.37	0.470
BSP4AE06	Bump Sullivan Pond 4	American Avocet	<4.02	0.85	1.96	6.38	<0.08	<0.24	0.54	3.63	139.02	0.862
BSP4AE08	Bump Sullivan Pond 4	American Avocet	<3.30	0.33	3.62	15.9	<0.07	<0.20	0.42	2.48	115.61	0.425
BSP5AE03	Bump Sullivan Pond 5	American Avocet	<4.33	0.44	4.17	6.39	<0.09	<0.26	0.52	3.56	139.65	0.604
BSP5AE07	Bump Sullivan Pond 5	American Avocet	<4.31	0.43	2.77	4.91	<0.09	<0.26	0.48	4.35	129.13	0.361
TMP4ME01	Table Mountain Pond 4	Mallard	<3.44	<0.24	2.18	15.6	<0.07	<0.21	0.37	3.92	112.50	1.66
TMP6AE01	Table Mountain Pond 6	American Avocet	<3.80	<0.27	1.55	8.93	<0.08	<0.23	1.9	4.12	111.83	0.160
TMP6AE02	Table Mountain Pond 6	American Avocet	<3.55	0.32	3.05	13.5	<0.07	<0.21	0.40	2.94	123.21	0.307
TMP6AE03	Table Mountain Pond 6	American Avocet	<3.79	<0.27	1.92	9.31	<0.08	<0.23	0.69	2.70	135.50	0.305
TMP6AE04	Table Mountain Pond 6	American Avocet	<3.63	0.40	2.16	9.71	<0.07	<0.22	0.60	3.45	125.55	0.230
TMP6AE05	Table Mountain Pond 6	American Avocet	<3.79	<0.27	1.88	5.15	<0.08	<0.23	0.71	3.68	143.89	0.210
TMP6AE06	Table Mountain Pond 6	American Avocet	<3.73	<0.27	<1.49	11.5	<0.08	<0.22	0.80	3.02	104.55	0.307
TMP6AE07	Table Mountain Pond 6	American Avocet	<3.65	<0.26	<1.46	10.9	<0.07	<0.22	0.39	2.58	107.38	0.251
TMP6AE08	Table Mountain Pond 6	American Avocet	<4.13	<0.29	2.32	5.44	<0.08	<0.25	1.8	3.45	149.79	0.382
TMP6AE09	Table Mountain Pond 6	American Avocet	4.33	0.32	2.14	6.23	<0.08	<0.24	2.3	3.53	144.44	0.258
TMP6AE10	Table Mountain Pond 6	American Avocet	<3.77	<0.27	1.70	8.98	<0.08	<0.23	0.42	3.06	117.80	0.182
TMP6AE11	Table Mountain Pond 6	American Avocet	<3.48	0.28	1.50	16.8	<0.07	<0.21	0.56	2.37	57.340	0.217

USFWS - Region 6 - Environmental Contaminants Report

Appendix B.5. Cont.

Avian Egg Sample #	Site	Common Name	Mg	Mn	Mo	Ni	Pb	Se	Sr	V	Zn
BSME02	Bump Sullivan Reservoir	Mallard	483.22	2.25	<1.33	<0.40	<1.66	4.13	21.91	<0.17	80.54
BSME03	Bump Sullivan Reservoir	Mallard	501.68	1.76	<1.34	<0.40	<1.68	4.04	18.55	<0.17	59.93
BSME04	Bump Sullivan Reservoir	Mallard	689.66	2.60	<1.37	0.88	<1.71	4.03	72.07	<0.17	62.76
BSME05	Bump Sullivan Reservoir	Mallard	456.67	1.75	<1.33	<0.40	<1.66	5.00	27.20	<0.17	69.33
BSME06	Bump Sullivan Reservoir	Mallard	370.92	1.95	<1.18	0.47	<1.47	3.15	15.85	<0.15	58.16
SPBSME01	Bump Sullivan Reservoir	Mallard	435.22	2.07	<1.31	2.1	<1.64	2.56	16.61	<0.16	47.51
SPGPME01	Bump Sullivan Goose Pond	Mallard	465.91	1.44	<1.50	2.8	<1.88	3.22	14.24	<0.19	66.67
BSP4AE01	Bump Sullivan Pond 4	American Avocet	355.34	1.34	<1.57	0.62	<1.97	3.83	11.78	<0.20	38.74
BSP4AE02	Bump Sullivan Pond 4	American Avocet	351.79	1.31	<1.30	2.0	<1.62	3.91	12.35	<0.16	35.83
BSP4AE04	Bump Sullivan Pond 4	American Avocet	413.65	1.71	<1.59	1.6	<1.99	5.02	16.39	<0.20	42.57
BSP4AE05	Bump Sullivan Pond 4	American Avocet	415.02	2.83	<1.57	<0.47	<1.96	3.56	17.00	<0.20	50.99
BSP4AE06	Bump Sullivan Pond 4	American Avocet	487.80	1.81	<1.61	<0.48	<2.01	3.74	11.63	<0.20	49.19
BSP4AE08	Bump Sullivan Pond 4	American Avocet	401.99	1.71	<1.32	<0.40	<1.65	3.89	23.32	<0.17	44.85
BSP5AE03	Bump Sullivan Pond 5	American Avocet	458.15	2.87	<1.74	0.62	<2.17	8.06	35.42	<0.22	44.93
BSP5AE07	Bump Sullivan Pond 5	American Avocet	486.96	2.17	<1.73	<0.52	<2.16	5.00	16.39	<0.22	54.35
TMP4ME01	Table Mountain Pond 4	Mallard	381.94	1.14	<1.38	<0.41	<1.72	4.58	14.79	<0.17	55.21
TMP6AE01	Table Mountain Pond 6	American Avocet	435.11	1.78	<1.52	3.1	<1.90	6.87	16.07	<0.19	46.18
TMP6AE02	Table Mountain Pond 6	American Avocet	382.14	1.85	<1.42	<0.43	<1.78	12.1	23.71	<0.18	47.50
TMP6AE03	Table Mountain Pond 6	American Avocet	511.45	2.18	<1.52	0.47	<1.89	8.44	19.47	<0.19	53.82
TMP6AE04	Table Mountain Pond 6	American Avocet	445.26	1.34	<1.45	<0.43	<1.81	5.51	17.52	<0.18	46.35
TMP6AE05	Table Mountain Pond 6	American Avocet	379.01	1.61	<1.52	0.47	<1.90	10.2	8.130	<0.19	48.47
TMP6AE06	Table Mountain Pond 6	American Avocet	420.45	2.14	<1.49	0.59	<1.87	6.29	16.59	<0.19	47.73
TMP6AE07	Table Mountain Pond 6	American Avocet	450.18	2.32	<1.46	<0.44	<1.83	5.42	20.07	<0.18	38.75
TMP6AE08	Table Mountain Pond 6	American Avocet	369.29	2.30	<1.65	2.1	<2.07	8.63	8.420	<0.21	43.98
TMP6AE09	Table Mountain Pond 6	American Avocet	387.30	2.74	<1.58	3.5	<1.97	5.40	15.12	<0.20	44.44
TMP6AE10	Table Mountain Pond 6	American Avocet	386.36	1.25	<1.51	<0.45	<1.88	6.52	10.68	<0.19	45.08
TMP6AE11	Table Mountain Pond 6	American Avocet	337.06	1.60	<1.39	0.64	<1.74	5.42	16.54	<0.17	33.78

USFWS - Region 6 - Environmental Contaminants Report

Appendix B.6. Trace element concentrations (ug/g dry weight) in fish samples collected from Springer HMA and Table Mountain WMU.

Fish Sample #	Site	Matrix	Common Name	Al	As	B	Ba	Be	Cd	Cr	Cu	Fe	Hg
BSCC06	Bump Sullivan Reservoir	Whole Body	Common Carp	12.07	0.50	2.23	59.0	<0.08	<0.23	0.54	10.5	56.70	0.720
BSCC07	Bump Sullivan Reservoir	Whole Body	Common Carp	38.32	0.68	2.25	41.7	<0.10	<0.31	1.1	5.21	92.15	0.958
BSCC08	Bump Sullivan Reservoir	Whole Body	Common Carp	12.04	0.27	<1.80	47.5	<0.09	<0.27	<0.45	10.1	64.71	0.480
BSCC09	Bump Sullivan Reservoir	Whole Body	Common Carp	20.67	0.67	3.30	45.9	<0.11	<0.34	1.5	8.83	115.1	0.547
BSCC10	Bump Sullivan Reservoir	Whole Body	Common Carp	13.35	0.33	3.62	48.1	<0.08	0.56	<0.41	6.78	84.10	0.293
TMP1CC06	Table Mountain Pond 1	Whole Body	Common Carp	9.110	0.76	<1.77	9.38	<0.09	<0.27	0.88	5.38	88.89	0.289
TMP1CC07	Table Mountain Pond 1	Whole Body	Common Carp	45.78	0.52	5.14	13.8	<0.08	<0.24	0.95	3.89	105.2	0.434
TMP1CC08	Table Mountain Pond 1	Whole Body	Common Carp	29.39	0.38	<1.52	13.2	<0.08	<0.23	0.47	3.23	74.05	0.359
TMP1CC09	Table Mountain Pond 1	Whole Body	Common Carp	21.93	0.67	<1.47	8.36	<0.07	<0.22	<0.37	3.08	75.84	0.316
TMP1CC10	Table Mountain Pond 1	Whole Body	Common Carp	9.840	0.45	3.52	11.7	<0.08	<0.24	0.97	5.16	72.36	0.744

Fish Sample #	Site	Matrix	Common Name	Mg	Mn	Mo	Ni	Pb	Se	Sr	V	Zn
BSCC06	Bump Sullivan Reservoir	Whole Body	Common Carp	1812.26	4.18	<1.52	<0.46	<1.90	1.61	796.93	0.82	294.64
BSCC07	Bump Sullivan Reservoir	Whole Body	Common Carp	1591.62	4.57	<2.08	<0.62	<2.60	2.93	412.57	0.63	247.12
BSCC08	Bump Sullivan Reservoir	Whole Body	Common Carp	1701.36	4.03	<1.80	<0.54	<2.25	2.17	692.31	0.73	285.97
BSCC09	Bump Sullivan Reservoir	Whole Body	Common Carp	1938.55	5.02	<2.22	<0.67	<2.78	3.13	511.73	0.88	349.72
BSCC10	Bump Sullivan Reservoir	Whole Body	Common Carp	1539.75	3.58	<1.66	<0.50	<2.08	2.59	548.12	0.52	246.03
TMP1CC06	Table Mountain Pond 1	Whole Body	Common Carp	1168.89	3.25	<1.77	<0.53	<2.21	2.49	225.33	0.50	192.44
TMP1CC07	Table Mountain Pond 1	Whole Body	Common Carp	1120.48	4.70	<1.60	<0.48	<2.00	2.13	216.47	0.39	159.04
TMP1CC08	Table Mountain Pond 1	Whole Body	Common Carp	1301.53	3.10	<1.52	<0.45	<1.89	1.95	309.54	0.50	146.95
TMP1CC09	Table Mountain Pond 1	Whole Body	Common Carp	1197.03	3.42	<1.47	<0.44	<1.84	1.78	233.46	0.38	139.78
TMP1CC10	Table Mountain Pond 1	Whole Body	Common Carp	1146.34	3.93	<1.61	<0.48	<2.01	1.95	200.00	0.29	146.34

APPENDIX C

Organochlorine concentrations in water, sediment, vegetation, aquatic invertebrate, waterbird eggs, and fish samples collected from Springer HMA and Table Mountain WMU.

USFWS - Region 6 - Environmental Contaminants Report

Appendix C.1. Organochlorine concentrations (ug/g dry weight) in waterbird egg samples collected from Springer HMA and Table Mountain WMU.

Avian Egg Sample #	Site	Common Name	alpha BHC	alpha chlordane	beta BHC	cis-nonachlor	delta BHC	dieldrin
BSP4AE11	Bump Sullivan Pond 4	American avocet	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
BSP5AE12	Bump Sullivan Pond 5	American avocet	<0.034	<0.034	<0.034	<0.034	<0.034	<0.034
BSP5AE13	Bump Sullivan Pond 5	American avocet	<0.033	<0.033	<0.033	<0.033	<0.033	<0.033
BSP5AE14	Bump Sullivan Pond 5	American avocet	<0.031	<0.031	<0.031	<0.031	<0.031	<0.031
BSP5AE15	Bump Sullivan Pond 5	American avocet	<0.036	<0.036	<0.036	<0.036	<0.036	<0.036
BSP5AE16	Bump Sullivan Pond 5	American avocet	<0.034	<0.034	<0.034	<0.034	<0.034	0.034
BSP5AE17	Bump Sullivan Pond 5	American avocet	<0.034	<0.034	<0.034	<0.034	<0.034	<0.034
BSP5AE18	Bump Sullivan Pond 5	American avocet	<0.034	<0.034	<0.034	<0.034	<0.034	<0.034
BSP5AE19	Bump Sullivan Pond 5	American avocet	<0.034	<0.034	<0.034	<0.034	<0.034	<0.034
BSP5AE20	Bump Sullivan Pond 5	American avocet	<0.038	<0.038	<0.038	<0.038	<0.038	<0.038

Avian Egg Sample #	Site	Common Name	endrin	gamma BHC	gamma chlordane	HCB	heptachlor epoxide	mirex
BSP4AE11	Bump Sullivan Pond 4	American avocet	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
BSP5AE12	Bump Sullivan Pond 5	American avocet	<0.0344828	<0.0344828	<0.0344828	<0.0344828	<0.0344828	<0.0344828
BSP5AE13	Bump Sullivan Pond 5	American avocet	<0.0333333	<0.0333333	<0.0333333	<0.0333333	<0.0333333	<0.0333333
BSP5AE14	Bump Sullivan Pond 5	American avocet	<0.03125	<0.03125	<0.03125	<0.03125	<0.03125	<0.03125
BSP5AE15	Bump Sullivan Pond 5	American avocet	<0.0357143	<0.0357143	<0.0357143	<0.0357143	<0.0357143	<0.0357143
BSP5AE16	Bump Sullivan Pond 5	American avocet	<0.0344828	<0.0344828	<0.0344828	<0.0344828	<0.0344828	<0.0344828
BSP5AE17	Bump Sullivan Pond 5	American avocet	<0.0344828	<0.0344828	<0.0344828	<0.0344828	<0.0344828	<0.0344828
BSP5AE18	Bump Sullivan Pond 5	American avocet	<0.0344828	<0.0344828	<0.0344828	<0.0344828	<0.0344828	<0.0344828
BSP5AE19	Bump Sullivan Pond 5	American avocet	<0.0344828	<0.0344828	<0.0344828	<0.0344828	<0.0344828	<0.0344828
BSP5AE20	Bump Sullivan Pond 5	American avocet	<0.0384615	<0.0384615	<0.0384615	<0.0384615	<0.0384615	<0.0384615

Appendix C.1. Cont.

Avian Egg Sample #	Site	Common Name	o,p'-DDD	o,p'-DDE	o,p'-DDT	oxychlordane	p,p'-DDD	p,p'-DDE
BSP4AE11	Bump Sullivan Pond 4	American avocet	<0.040	<0.040	<0.040	<0.040	<0.040	0.72
BSP5AE12	Bump Sullivan Pond 5	American avocet	<0.034	<0.034	<0.034	<0.034	<0.034	0.28
BSP5AE13	Bump Sullivan Pond 5	American avocet	<0.033	<0.033	<0.033	<0.033	<0.033	0.20
BSP5AE14	Bump Sullivan Pond 5	American avocet	<0.031	<0.031	<0.031	<0.031	<0.031	0.50
BSP5AE15	Bump Sullivan Pond 5	American avocet	<0.036	<0.036	<0.036	<0.036	<0.036	5.0
BSP5AE16	Bump Sullivan Pond 5	American avocet	<0.034	<0.034	<0.034	<0.034	<0.034	4.1
BSP5AE17	Bump Sullivan Pond 5	American avocet	<0.034	<0.034	<0.034	<0.034	<0.034	0.26
BSP5AE18	Bump Sullivan Pond 5	American avocet	<0.034	<0.034	<0.034	<0.034	<0.034	0.24
BSP5AE19	Bump Sullivan Pond 5	American avocet	<0.034	<0.034	<0.034	<0.034	<0.034	0.29
BSP5AE20	Bump Sullivan Pond 5	American avocet	<0.038	<0.038	<0.038	<0.038	<0.038	0.28

Avian Egg Sample #	Site	Common Name	p,p'-DDT	PCB-TOTAL	toxaphene	trans-nonachlor
BSP4AE11	Bump Sullivan Pond 4	American avocet	<0.040	<0.20	<0.20	<0.040
BSP5AE12	Bump Sullivan Pond 5	American avocet	<0.034	<0.17	<0.17	<0.034
BSP5AE13	Bump Sullivan Pond 5	American avocet	<0.033	<0.17	<0.17	<0.033
BSP5AE14	Bump Sullivan Pond 5	American avocet	<0.031	<0.16	<0.16	<0.031
BSP5AE15	Bump Sullivan Pond 5	American avocet	<0.036	<0.18	<0.18	<0.036
BSP5AE16	Bump Sullivan Pond 5	American avocet	<0.034	<0.17	<0.17	<0.034
BSP5AE17	Bump Sullivan Pond 5	American avocet	<0.034	<0.17	<0.17	<0.034
BSP5AE18	Bump Sullivan Pond 5	American avocet	<0.034	<0.17	<0.17	<0.034
BSP5AE19	Bump Sullivan Pond 5	American avocet	<0.034	<0.17	<0.17	<0.034
BSP5AE20	Bump Sullivan Pond 5	American avocet	<0.038	<0.19	<0.19	<0.038

USFWS - Region 6 - Environmental Contaminants Report

Appendix C.2. Organochlorine concentrations (ug/g dry weight) in fish samples collected from Springer HMA and Table Mountain WMU.

Fish Sample #	Site	Matrix	Common Name	alpha BHC	alpha chlordane	beta BHC	cis-nonachlor	delta BHC	dieldrin
BSCC01	Bump Sullivan Reservoir	Whole Body	Common Carp	<0.051	<0.051	<0.051	<0.051	<0.051	<0.051
BSCC02	Bump Sullivan Reservoir	Whole Body	Common Carp	<0.054	<0.054	<0.054	<0.054	<0.054	<0.054
BSCC03	Bump Sullivan Reservoir	Whole Body	Common Carp	<0.054	<0.054	<0.054	<0.054	<0.054	<0.054
BSCC04	Bump Sullivan Reservoir	Whole Body	Common Carp	<0.049	<0.049	<0.049	<0.049	<0.049	<0.049
BSCC05	Bump Sullivan Reservoir	Whole Body	Common Carp	<0.051	<0.051	<0.051	<0.051	<0.051	<0.051
TMP1CC01	Table Mountain Pond 1	Whole Body	Common Carp	<0.048	<0.048	<0.048	<0.048	<0.048	<0.048
TMP1CC02	Table Mountain Pond 1	Whole Body	Common Carp	<0.037	<0.037	<0.037	<0.037	<0.037	<0.037
TMP1CC03	Table Mountain Pond 1	Whole Body	Common Carp	<0.048	<0.048	<0.048	<0.048	<0.048	<0.048
TMP1CC04	Table Mountain Pond 1	Whole Body	Common Carp	<0.048	<0.048	<0.048	<0.048	<0.048	<0.048
TMP1CC05	Table Mountain Pond 1	Whole Body	Common Carp	<0.053	<0.053	<0.053	<0.053	<0.053	<0.053

Fish Sample #	Site	Matrix	Common Name	endrin	gamma BHC	gamma chlordane	HCB	heptachlor epoxide	mirex
BSCC01	Bump Sullivan Reservoir	Whole Body	Common Carp	<0.0512821	<0.0512821	<0.0512821	<0.0512821	<0.0512821	<0.0512821
BSCC02	Bump Sullivan Reservoir	Whole Body	Common Carp	<0.0540541	<0.0540541	<0.0540541	<0.0540541	<0.0540541	<0.0540541
BSCC03	Bump Sullivan Reservoir	Whole Body	Common Carp	<0.0540541	<0.0540541	<0.0540541	<0.0540541	<0.0540541	<0.0540541
BSCC04	Bump Sullivan Reservoir	Whole Body	Common Carp	<0.0487805	<0.0487805	<0.0487805	<0.0487805	<0.0487805	<0.0487805
BSCC05	Bump Sullivan Reservoir	Whole Body	Common Carp	<0.0512821	<0.0512821	<0.0512821	<0.0512821	<0.0512821	<0.0512821
TMP1CC01	Table Mountain Pond 1	Whole Body	Common Carp	<0.047619	<0.047619	<0.047619	<0.047619	<0.047619	<0.047619
TMP1CC02	Table Mountain Pond 1	Whole Body	Common Carp	<0.037037	<0.037037	<0.037037	<0.037037	<0.037037	<0.037037
TMP1CC03	Table Mountain Pond 1	Whole Body	Common Carp	<0.047619	<0.047619	<0.047619	<0.047619	<0.047619	<0.047619
TMP1CC04	Table Mountain Pond 1	Whole Body	Common Carp	<0.047619	<0.047619	<0.047619	<0.047619	<0.047619	<0.047619
TMP1CC05	Table Mountain Pond 1	Whole Body	Common Carp	<0.0526316	<0.0526316	<0.0526316	<0.0526316	<0.0526316	<0.0526316

USFWS - Region 6 - Environmental Contaminants Report

Appendix C.2. Cont.

Fish Sample #	Site	Matrix	Common Name	o,p'-DDD	o,p'-DDE	o,p'-DDT	oxychlorane	p,p'-DDD	p,p'-DDE
BSCC01	Bump Sullivan Reservoir	Whole Body	Common Carp	<0.051	<0.051	<0.051	<0.051	<0.051	0.056
BSCC02	Bump Sullivan Reservoir	Whole Body	Common Carp	<0.054	<0.054	<0.054	<0.054	<0.054	0.059
BSCC03	Bump Sullivan Reservoir	Whole Body	Common Carp	<0.054	<0.054	<0.054	<0.054	<0.054	<0.054
BSCC04	Bump Sullivan Reservoir	Whole Body	Common Carp	<0.049	<0.049	<0.049	<0.049	<0.049	0.059
BSCC05	Bump Sullivan Reservoir	Whole Body	Common Carp	<0.051	<0.051	<0.051	<0.051	<0.051	<0.051
TMP1CC01	Table Mountain Pond 1	Whole Body	Common Carp	<0.048	<0.048	<0.048	<0.048	<0.048	<0.048
TMP1CC02	Table Mountain Pond 1	Whole Body	Common Carp	<0.037	<0.037	<0.037	<0.037	<0.037	<0.037
TMP1CC03	Table Mountain Pond 1	Whole Body	Common Carp	<0.048	<0.048	<0.048	<0.048	<0.048	<0.048
TMP1CC04	Table Mountain Pond 1	Whole Body	Common Carp	<0.048	<0.048	<0.048	<0.048	<0.048	<0.048
TMP1CC05	Table Mountain Pond 1	Whole Body	Common Carp	<0.053	<0.053	<0.053	<0.053	<0.053	<0.053

Fish Sample #	Site	Matrix	Common Name	p,p'-DDT	PCB-TOTAL	toxaphene	trans-nonachlor
BSCC01	Bump Sullivan Reservoir	Whole Body	Common Carp	<0.051	<0.26	<0.26	<0.051
BSCC02	Bump Sullivan Reservoir	Whole Body	Common Carp	<0.054	<0.27	<0.27	<0.054
BSCC03	Bump Sullivan Reservoir	Whole Body	Common Carp	<0.054	<0.27	<0.27	<0.054
BSCC04	Bump Sullivan Reservoir	Whole Body	Common Carp	<0.049	<0.24	<0.24	<0.049
BSCC05	Bump Sullivan Reservoir	Whole Body	Common Carp	<0.051	<0.26	<0.26	<0.051
TMP1CC01	Table Mountain Pond 1	Whole Body	Common Carp	<0.048	<0.24	<0.24	<0.048
TMP1CC02	Table Mountain Pond 1	Whole Body	Common Carp	<0.037	<0.18	<0.18	<0.037
TMP1CC03	Table Mountain Pond 1	Whole Body	Common Carp	<0.048	<0.24	<0.24	<0.048
TMP1CC04	Table Mountain Pond 1	Whole Body	Common Carp	<0.048	<0.24	<0.24	<0.048
TMP1CC05	Table Mountain Pond 1	Whole Body	Common Carp	<0.053	<0.26	<0.26	<0.053