

1999 Survey of BLM-Managed Public Lands  
in Southwestern Wyoming  
for  
Ute Ladies Tresses (*Spiranthes diluvialis*)  
and for Designated Weeds

Report Prepared for the BLM Rock Springs Field Office  
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## ABSTRACT

The Ute ladies tresses (*Spiranthes diluvialis*), an orchid listed as Threatened under the Endangered Species Act, is known to occur in the Uinta Basin of northeastern Utah. Earlier examinations of public lands in nearby southwestern Wyoming had indicated that habitat suitable for the species may be present there as well. During the periods of August 13 - 17 and August 22 - 25, 1999, streams on public lands in the Red Creek Basin and the Henry's Fork Basin were intensively surveyed in the present project for *S. diluvialis* and for vascular plant species designated as noxious weeds in Wyoming. *S. diluvialis* was not found, even though the effort in this survey was focused on areas of likely habitat. That habitat appears to be limited by the geomorphology of the streams, salinity of the geologic substrates, and elevation. Two streams remain to be surveyed in the 2000 field season: Spring Creek immediately west of the Red Creek Basin, and Lane Meadows Creek in the Henry's Fork Basin. Nine species of designated noxious weeds were found in the study area. Of these, perennial sowthistle (*Sonchus* sp.) and Canada thistle (*Cirsium arvense*) were widespread and abundant; tamarisk (*Tamarix chinensis*) and quackgrass (*Elymus repens*) were widespread but less common; and five species -- musk thistle (*Carduus nutans*), common burdock (*Arctium minus*), plumeless thistle (*Carduus acanthoides*), field bindweed (*Convolvulus arvensis*), and hoary cress (or whitetop, *Cardaria pubescens*) -- were localized and uncommon.

## ACKNOWLEDGEMENTS

I thank the following individuals for their assistance: Mark Anderson gave permission to cross private lands and engaged me in a stimulating discussion of the project; Walter Fertig, botanist at the Wyoming Natural Diversity Database, provided me with a large body of information about *S. diluvialis* and with valuable suggestions; Ben Franklin of the Utah Natural Heritage Program gave me useful information on *Spiranthes diluvialis* in Utah; Jim Glennon and Lorraine Keith of BLM's Rock Springs Field Office arranged details of the project, provided maps of and information about the study area, and discussed aspects of the project; Ron Hartman and B.E. Nelson provided access to the collections in the Rocky Mountain Herbarium.

## BACKGROUND

*Spiranthes diluvialis* (Ute ladies tresses), a perennial species in the orchid family (Orchidaceae), is listed as Threatened under the U.S. Endangered Species Act. *S. diluvialis* grows in riparian meadows and shrublands, sometimes within a matrix of cottonwood woodland (Moseley 1997), at low elevations in the western U.S., including the Uinta Basin of northeastern Utah (Utah Division of Wildlife Resources 1998). In April of 1999, the Bureau of Land Management's Wyoming State Office and the University of Wyoming entered a cooperative agreement for the University's Wyoming Natural Diversity Database (WYNDD) to search for *S. diluvialis* on public lands in southwestern Wyoming (Figures 1 and 2). This cooperative agreement also required WYNDD to document the distribution of plant species on Wyoming's designated weed list (Wyoming Department of Agriculture 1999) encountered during the survey.

George Jones of the WYNDD staff conducted the search from August 13 - 17 and August 22 - 25, 1999.

## METHODS

### PRIOR TO FIELD WORK

*S. diluvialis* can be positively identified only in flower, but collection of flowers is prohibited because of the plant's Threatened status. To reduce the uncertainty in identification, the author consulted with Walter Fertig, WYNDD botanist, and reviewed selected reports to familiarize himself with *S. diluvialis* and other species with which it might be confused. The latter species are the sympatric orchids *Spiranthes romanzoffiana* and *Habenaria* spp. A table and line drawings highlighting the distinguishing characteristics of the two *Spiranthes* spp. in Moseley (1998) were consulted while specimens of the two species were examined in the Rocky Mountain Herbarium. Copies of the table and drawings were also carried in the field. To reduce the chance of confusing *Spiranthes* with *Habenaria*, specimens of the two genera were compared, and dichotomous keys to the two genera (Dorn 1992, Hitchcock and Cronquist 1973) and a line drawing of a *Habenaria* flower (Hitchcock and Cronquist 1973) were examined.

On August 9, 1999, the author accompanied Walter Fertig to a site in Goshen County, southeastern Wyoming, known to contain a population of *S. diluvialis*. Plants were observed there in bud, in bloom, and past bloom, and the physical site and vegetation in which the *S. diluvialis* grows were studied.

### FIELD WORK

The author walked through areas of likely habitat at the rate of approximately 5 feet/second, scanning side to side for light-colored buds or blossoms or wilted flowers. Likely habitat was identified by these characteristics: moist soil, absence of a dense shrub layer or a dense herbaceous layer taller than roughly 1 foot (either layer >80% canopy cover), presence of herbaceous vegetation in which *Agrostis stolonifera*, *Juncus* spp., and *Carex* spp. (other than *C. nebrascensis*, *C. aquatilis*, and *C. rostrata*) contributed a substantial amount of the canopy cover, and a location that appeared to be inundated or have a high water table part of the year but not severely scoured. In

contrast, the following characteristics were judged to indicate areas unlikely to support *S. diluvialis*: vegetation with a dense shrub layer (i.e., shrub canopy with > 80% cover) or a dense herbaceous layer taller than 1 - 1.5 feet), vegetation in which *Agrostis stolonifera*, *Juncus* spp., and *Carex* spp. contributed less cover than did other species, standing water, and bare or nearly-bare sediment bars that obviously are scoured by high water. Areas unlikely to support *S. diluvialis* were surveyed more rapidly.

In all of the areas surveyed, notes were made about the substrate, size and entrenchment of the channel, evidence of disturbance, composition of the vegetation, and abundance and distribution of weeds. On most of the streams, the character of the channel and the pattern of the vegetation differed from one segment to another, so the notes were made for stream segments rather than for the entire stream. In most cases, boundaries between adjacent segments were located where the channel or the vegetation changed in some obvious way. In a few cases, stream segments were simply lengths of stream that were surveyed on different days, or (as on the Henry's Fork) they were isolated tracts of public lands.

## RESULTS

This section summarizes the results for the entire study area. Locations of the stream segments are shown on Figures 1 and 2, and detailed information about each stream segment is given in Appendix 1.

### SPIRANTHES DILUVIALIS

No *S. diluvialis* or plants suspected to be *S. diluvialis* were found during the survey. With a few exceptions, the streams in the Red Creek Basin flowed in channels 1.5 - 3 feet wide through gullies incised into the valley bottoms. Those gullies typically were 15 - 30 feet wide at the bottom and contained terraces with dry vegetation. In a number of stream segments, the gully bottoms consisted largely of bare sediment bars. Consequently, on most of the streams in the Red Creek Basin, likely habitat for *S. diluvialis* (as described above in the fieldwork methods) was restricted to a narrow (usually  $\leq 3$  feet wide), often discontinuous fringe along the channel. Those stream segments that contained more than just a channel-side fringe of likely habitat were: Daniels Creek segments D3b and D5, Ely Creek segment E3, Greenhough Creek segment G2 (in areas of broad, wet meadows), Little Red Creek segment LR3, Lizzie Spring Creek segment LS1a, Red Creek segments R1 and R2, Snow Creek segment S3 (in the areas of broad, wet meadows), and Tepee Creek segment T2.

Salt stains were noted on alluvial bars and at the foot of gully walls in several stream segments in the Red Creek Basin (the downstream part of Castello Creek, Ely Creek segments E1 and E4, and Red Creek segments R1, R4, and R8). In other stream segments, the *Agrostis stolonifera* - *Juncus balticus* vegetation indicating likely *S. diluvialis* habitat had been flattened by high water flows and, in some places, partly covered by new sediment. This flattened vegetation was noted on Castello Creek downstream from the private land, in Daniels Creek segments D1, D4, and D5, in Ely Creek segment E1, in Greenhough Creek segment G1, and in Snow Creek segments S3 and S4.

No signs of cattle were noted in the Red Creek Basin, and the vegetation had not been grazed during the 1999 growing season.

Among the areas surveyed in the Henry's Fork Drainage, Cottonwood Creek appeared to contain the largest area of likely *S. diluvialis* habitat. In segments COT1 and COT3, mesic meadow vegetation of *Juncus balticus*, *Trifolium* spp., *Agrostis stolonifera*, and other species covered most of the bottom of the 16-foot-wide gully through which the stream flowed. This vegetation was present in segment COT2 (the downstream-most segment), but there it was confined to a narrower band along the channel. Livestock were present on Cottonwood Creek and the herbaceous vegetation had been grazed to a height of several inches in places. No salt stains were noted on Cottonwood Creek.

On the three surveyed segments of the Henry's Fork itself (HF1, HF6, and HF7), much of the land surface was either terrace at least 3 feet above the river channel and supporting vegetation with substantial amounts of *Elymus smithii* and *Poa pratensis* but little *Agrostis stolonifera* and *Juncus balticus*, or it was abandoned channel with standing water. Salt stains were not noted.

## WEEDS

Nine designated noxious or prohibited weeds were found in the project area (Table 1). The general distribution patterns are described here, and descriptions of the abundance of each species in the different stream segments are given in Appendix 2.

Perennial sowthistle (*Sonchus* sp.) was noted on every stream in the project area (except the Henry's Fork), in nearly every stream segment. The species occurred in dense patches and as scattered plants, and it was found on otherwise sparsely vegetated sediment bars and alluvial and colluvial fans, as well as in dense herbaceous meadows and the undergrowth of shrub patches. Canada thistle (*Cirsium arvense*) was nearly as widespread but slightly less abundant; it also grew on sparsely vegetated microhabitats and in dense vegetation. Patches of this species on Snow Creek immediately upstream and downstream from the highway (segments S1 and S2 respectively) had been sprayed with herbicide.

Two of the weeds were intermediate in their distribution and abundance. Tamarisk (*Tamarix chinensis*) was most common on Red Creek, where some of the mature shrubs had been treated with herbicide, and it occurred in low numbers on 7 of the 10 tributary streams in the Red Creek Basin. Scattered tamarisk also were present in the Henry's Fork Basin. Quackgrass (*Elymus repens*) was common on Red Creek itself but apparently rare elsewhere in the Red Creek Basin, and it was common in the Henry's Fork Basin.

Five designated weeds were uncommon or rare in the project area. Musk thistle (*Carduus nutans*) occurred in the Red Creek Basin and in the Henry's Fork Basin, but only on upper Ely Creek (segment E3) were substantial numbers noted. Common burdock (*Arctium minus*) was noted on 5 of the tributaries in the Red Creek Basin, but it was common only on upper Tepee Creek. Plumeless thistle (*Carduus acanthoides*) was found on only two stream segments in Red Creek Basin<sup>1</sup>, and field bindweed (*Convolvulus arvensis*) on only one segment, but field bindweed is a low-growing species that might have been overlooked in the taller herbaceous vegetation. The last species,

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<sup>1</sup> The identification of *Carduus acanthoides* is tentative. The species was unknown from Sweetwater County prior to this project, and no voucher specimen was collected.

hoary cress (or whitetop, *Cardaria pubescens*), was noted only on the upper part of Cottonwood Creek (segment COT3) in the Henry's Fork Basin.

## DISCUSSION

### SPIRANTHES DILUVIALIS

Likely habitat for this orchid, as indicated by *Agrostis stolonifera* - *Juncus balticus* vegetation growing in moist soils, is widespread but appears to cover only a limited area. In the Red Creek Basin, the streams are largely confined to deep, narrow gullies where high water flows deposit substantial amounts of sediment; consequently, mesic meadow habitat occurs as a narrow fringe or as discrete patches in the gully bottoms. The area of likely habitat may be further reduced by the salinity of the alluvium and the water. This may be true especially along Red Creek, where mesic meadow habitat covers much of the stream bottom but salt stains were noted on the sediment bars. Observations in Utah suggest that *S. diluvialis* does not grow in sites with salt stains (Ben Franklin, Utah Natural Heritage Program, personal communication).

The high elevation of much of the Red Creek Basin may also reduce the amount of suitable habitat for *S. diluvialis*. Twenty-six of the 44 stream segments and springs surveyed in that basin (including all of those on Little Red Creek and Lizzie Spring Creek) lie partly or entirely above 7,000 feet elevation (Table 2). The elevation of the highest occurrence of *S. diluvialis* in Utah, near the edge of the Uinta Basin, is approximately 7,000 feet, and that occurrence sits at the top of a long, gentle slope from the center to the margin of the Basin (Ben Franklin, Utah Natural Heritage Program, personal communication). In the Henry's Fork Basin, the stream segments all lie at elevations below 7,000 feet (Table 2).

It is possible that *S. diluvialis* grows in the project area and this survey failed to find it. Perennial plants like *S. diluvialis* can remain dormant for long periods, during which even intensive survey would fail to find them. To minimize this possibility, this search was conducted during a time of the year when flowering specimens of the species have been collected in other years in Utah and when the species was in bloom in eastern Wyoming. Furthermore, the survey in this project was concentrated in habitat that resembles in vegetation and physical parameters the habitat in which the species was observed in eastern Wyoming and that seems to match the descriptions of habitat in which the species is found in Utah (Refsdal no date, Utah Division of Wildlife Resources 1998, Western Wetland Systems no date). If *S. diluvialis* is present in the area surveyed, then it probably consists of very small numbers of scattered plants.

Additional work in the stream segments surveyed during 1999 seems unwarranted, but if new information should change this conclusion, then that additional work should be concentrated on the stream segments that appear to contain the largest amounts of likely habitat (Table 3).

Two additional streams were to be surveyed in 1999 but were not surveyed then; they will be surveyed in 2000. Spring Creek, immediately west of the Red Creek Basin, has been identified as a high-priority for survey based on preliminary work suggesting the presence of potential habitat for *S. diluvialis*. Most of Spring Creek lies at an elevation below 7,000 feet. The Lane Meadows Creek drainage (including Dry Creek)

was included in the list of streams to be surveyed in 1999 but was not identified as a high-priority area. It, too, lies at elevations below 7,000 feet.

## WEEDS

Designated noxious weeds, especially perennial *Sonchus* sp. and *Cirsium arvense*, may be ubiquitous because the extensive areas of new sediment laid down in spring floods provide ideal habitat for the weeds to colonize. Streams in the Red Creek Basin especially had extensive areas of habitat for the weeds. The seeds of *Cirsium* spp., *Carduus* spp., and *Sonchus* spp. are distributed by wind, so even small patches of these species in an area probably can, over a period of several years, colonize most of the suitable habitat throughout the study area. The seeds of *Arctium minus*, *Cardaria* spp., *Elymus repens*, and *Tamarix chinensis* are distributed by water or by animals, so they may spread more slowly. But isolated patches of these species can be expected to spread eventually to new areas of suitable habitat.

## REFERENCES

- Dorn, Robert D. 1992. Vascular plants of Wyoming. Second edition. Mountain West Publishing, Cheyenne WY. iv + 340 pp.
- Hitchcock, C. Leo and Arthur Cronquist. 1973. Flora of the Pacific Northwest. An illustrated manual. University of Washington Press, Seattle WA. 730 pp.
- Moseley, Robert. 1997. Ute ladies tresses (*Spiranthes diluvialis*) inventory: Snake River corridor and selected other areas. Unpublished report prepared for the Upper Snake River Districts, Bureau of Land Management by the Conservation Data Center, Idaho Department of Fish and Game, Boise ID. 18 pp. + appendices.
- Moseley, Robert. 1998. Ute ladies tresses (*Spiranthes diluvialis*) in Idaho: 1997 status report. Status survey report prepared for Idaho Department of Parks and Recreation by the Conservation Data Center, Idaho Department of Fish and Game, Boise ID. 35 pp.<sup>2</sup>
- Refsdal, Charmaine. No date. Summary from Charmaine Refsdal of raft trip with Duane Atwood and Lucy Jordan, August 2, 3, 1994, the Green River and Browns Park, Utah. Unpublished notes on file at Wyoming Natural Diversity Database.
- Utah Division of Wildlife Resources. 1998. Endemic and rare plants of Utah: an overview of their distribution and status. Prepared for the Utah Reclamation Mitigation and Conservation Commission and the U.S. Department of Energy under Cooperative Agreement No. UC-95-0015, Section V.A.10.a. 696 pp.

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<sup>2</sup> This report has been published in: Moseley, Robert. 1998. Ute ladies tresses (*Spiranthes diluvialis*) in Idaho: 1997 and 1998 status reports. Technical Bulletin No. 98-16, Idaho Bureau of Land Management, Boise ID. December 1998.

Western Wetland Systems. No date. Ute ladies'-tresses management in the Green River watershed. Prepared for the Bureau of Land Management, Vernal District. 5 pp.

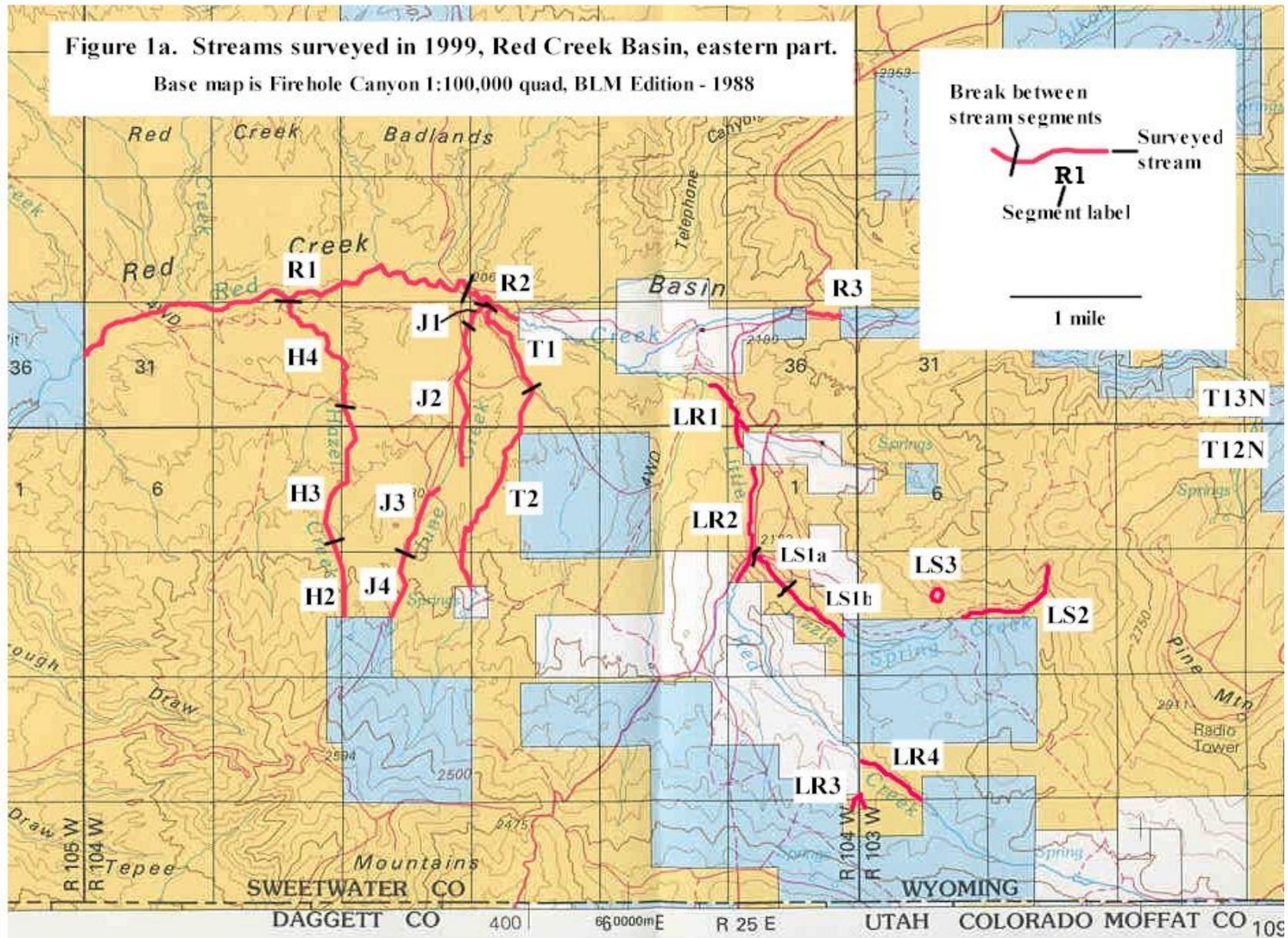
Whitson, Tom D., Larry C. Burrill, Steven A. Dewey, David W. Cudney, B.E. Nelson, Richard D. Lee, and Robert Parker. 1991. Weeds of the West. The Western Society of Weed Science in cooperation with the Western United States Land Grant Universities Cooperative Extension Service and the University of Wyoming. x + 630 pp.

Wyoming Department of Agriculture. 1999. Wyoming weed and pest control act designated list. Wyoming Department of Agriculture, Cheyenne WY. Updated January 6, 1999.

FIGURES 1 AND 2 (FOLLOWING PAGES): MAPS OF STREAM SEGMENTS SURVEYED IN 1999.

Figure 1a. Streams surveyed in 1999, Red Creek Basin, eastern part.

Base map is Firehole Canyon 1:100,000 quad, BLM Edition - 1988



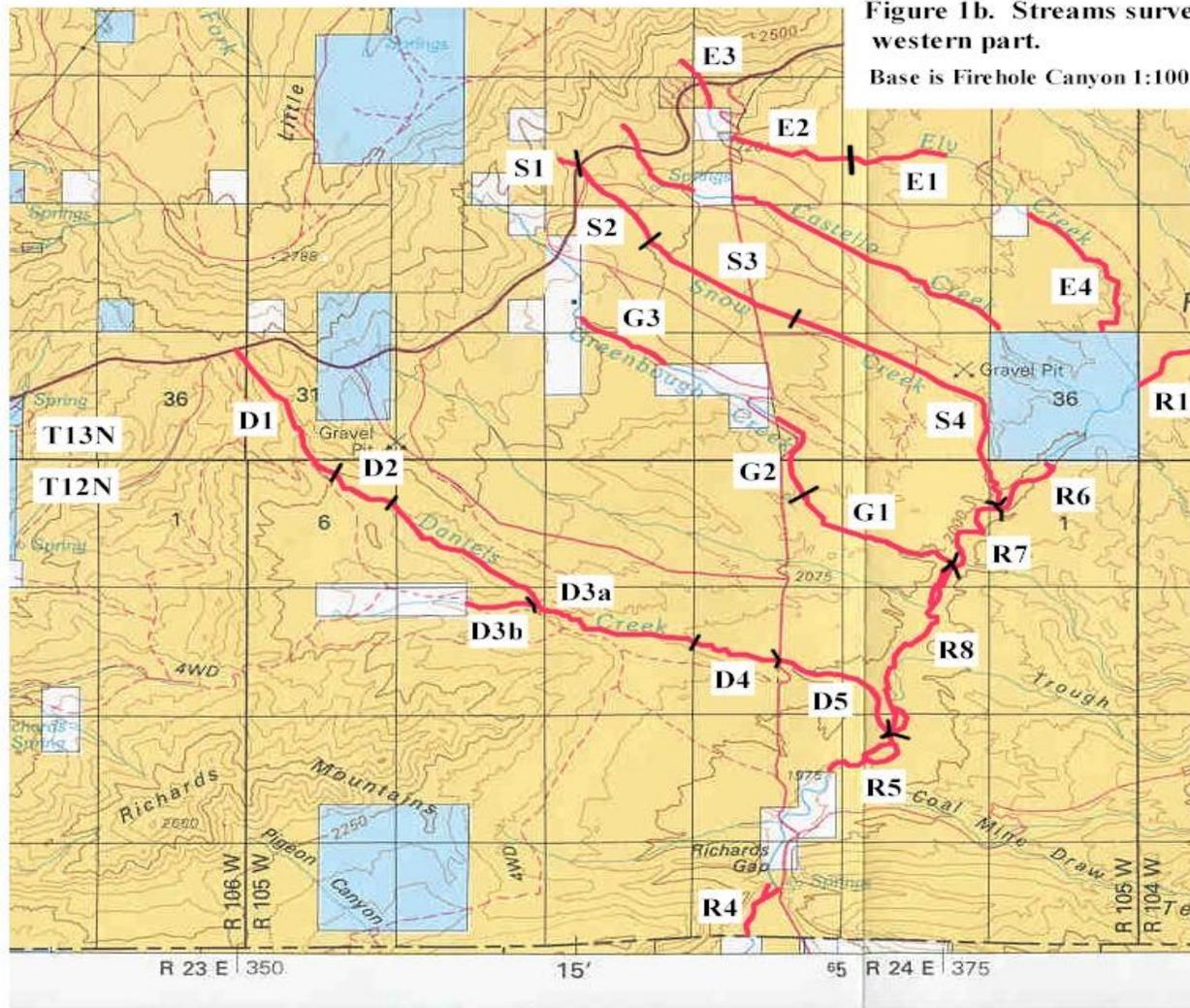
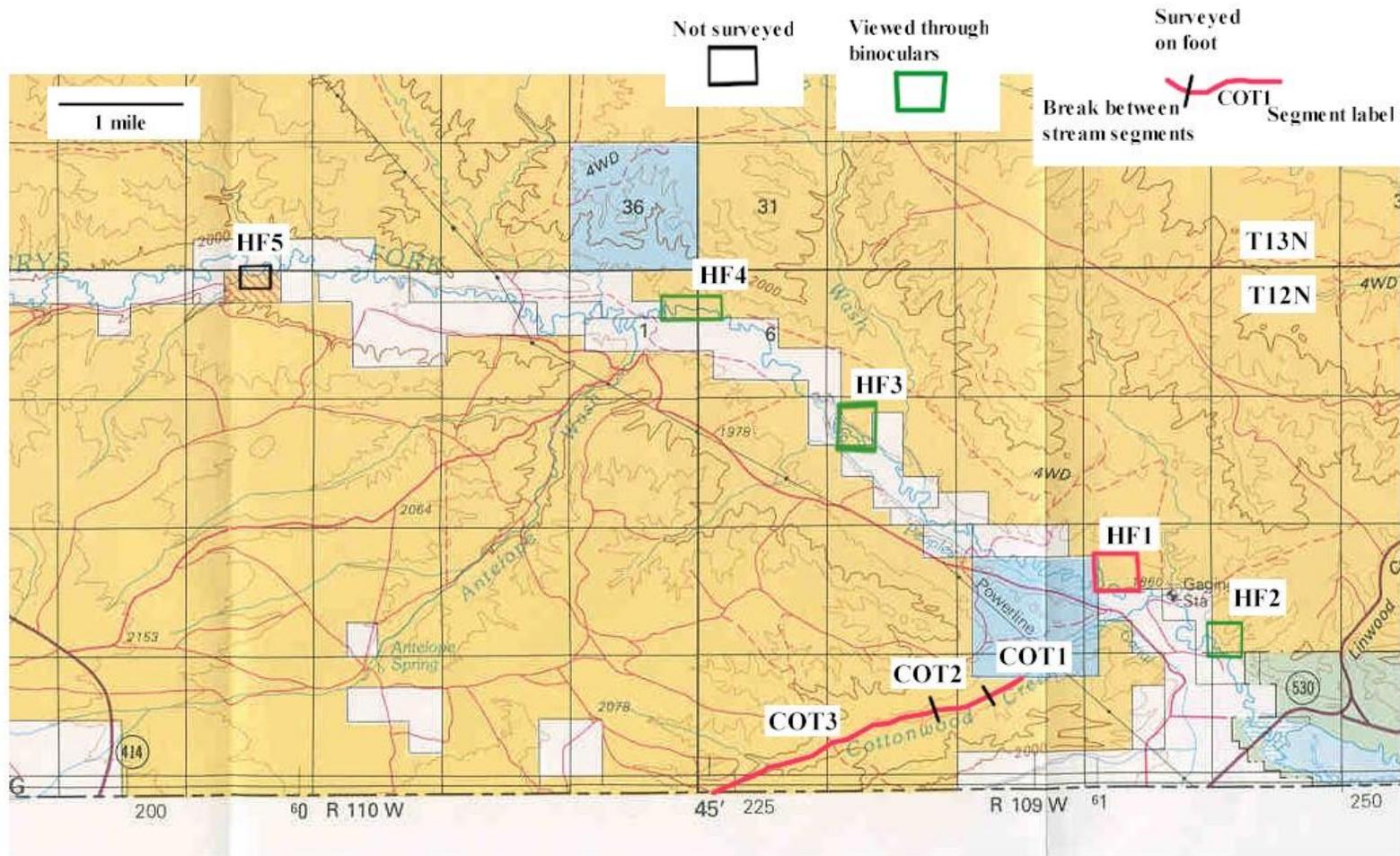


Figure 1b. Streams surveyed in 1999, Red Creek Basin, western part.

Base is Firehole Canyon 1:100,000 quad, BLM edition - 1988

**Figure 2a. Streams surveyed in 1999, Henry's Fork Basin, eastern part.**  
 Base is Firehole Canyon 1:100,000 quad, BLM Edition - 1988



**Figure 2b. Streams surveyed in 1999, Henry's Fork Basin, western part.**  
 Base is Firehole Canyon 1:100,000 quad, BLM Edition - 1988

Surveyed  
 on foot

 HF6-Segment label

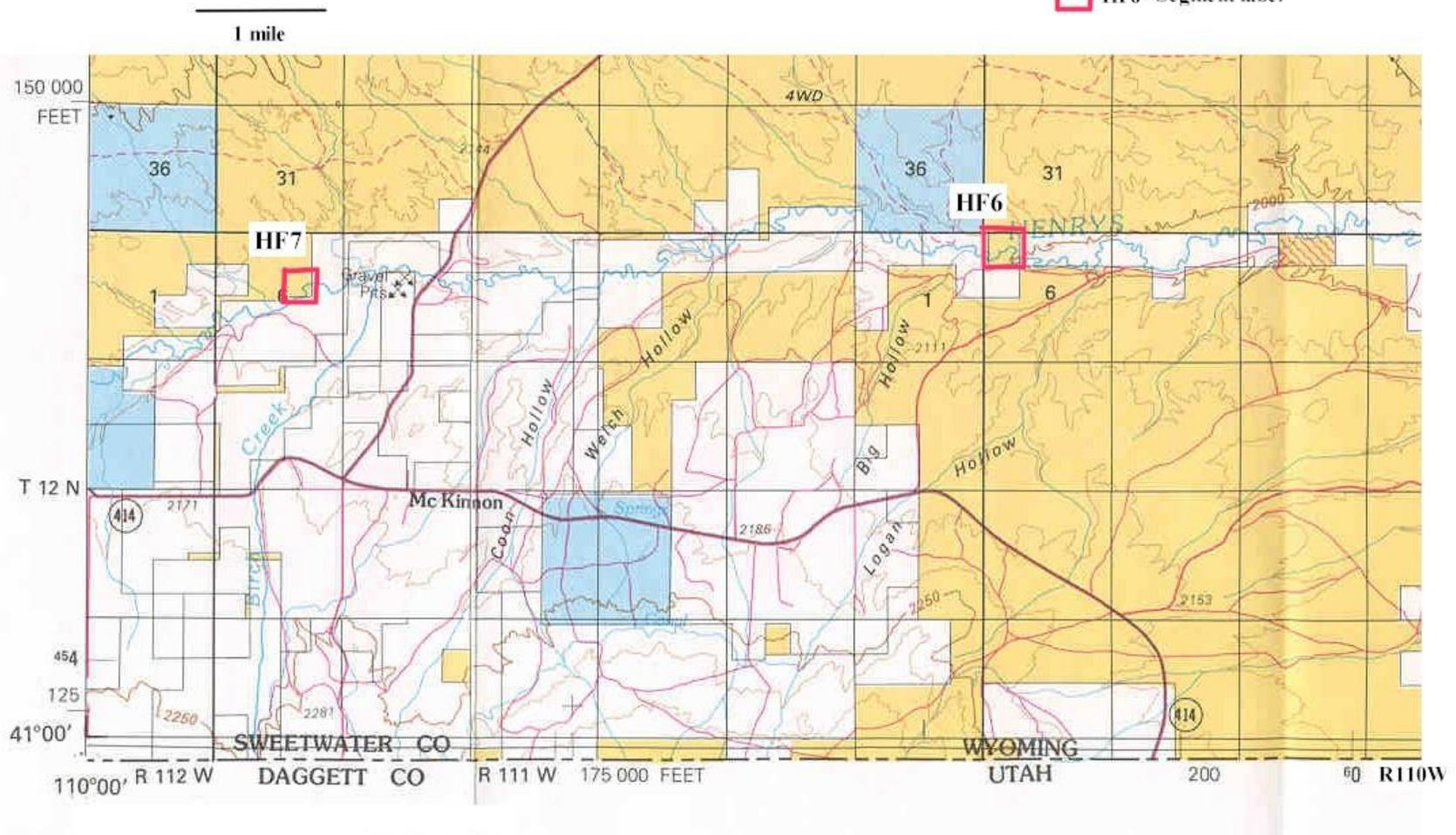


TABLE 1. DESIGNATED NOXIOUS OR PROHIBITED WEEDS FOUND IN THE PROJECT AREA.

Except where otherwise noted, the names are those given on Wyoming's designated list (Wyoming Department of Agriculture 1999).

SCIENTIFIC NAME	COMMON NAME
<i>Arctium minus</i>	Common burdock
<i>Carduus acanthoides</i> <sup>(1)</sup>	Plumeless thistle
<i>Carduus nutans</i>	Musk thistle
<i>Cardaria pubescens</i>	Hoary cress, Whitetop
<i>Cirsium arvense</i>	Canada thistle
<i>Convolvulus arvensis</i>	Field bindweed
<i>Elymus repens</i> ( <i>Agropyron repens</i> ) <sup>(2)</sup>	Quackgrass
<i>Sonchus arvensis</i> (and <i>S. uliginosus</i> ) <sup>(3)</sup>	Perennial sowthistle
<i>Tamarix</i> spp. ( <i>T. chinensis</i> , <i>T. ramosissima</i> , <i>T. parviflora</i> ) <sup>(4)</sup>	Tamarisk

(1) The identification of *Carduus acanthoides* is tentative. The species was unknown from Sweetwater County prior to this project, and no voucher specimen was collected.

(2) The scientific name on the state list is *Agropyron repens*, but Dorn (1992) uses *Elymus repens*.

(3) The state list includes only *S. arvensis*. Dorn (1992) lists a second perennial sowthistle, *S. uliginosus* Bieb. Whitson et al. (1991) note that *S. arvensis* and *S. uliginosus* are very similar to each other morphologically and ecologically, and they consider *S. uliginosus* to be a subspecies of *S. arvensis*, *S. arvensis* L. ssp. *uliginosus* (Bieb.) Neiman.

(4) Dorn (1992) recognizes only *T. chinensis* from Wyoming.

TABLE 2. ELEVATIONS OF STREAM SEGMENTS AND SPRINGS.

Elevations were estimated from 1:24,000-scale topographic maps.

STREAM SEGMENT OR SPRING	ELEVATION (FEET)
<b>RED CREEK BASIN</b>	
Castello Creek	6,720 - 7,800
Daniels Creek D1	7,400 - 8,080
Daniels Creek D2	7,240 - 7,400
Daniels Creek D3a	6,690 - 7,400
Daniels Creek D3b	6,880 - 7,000
Daniels Creek D4	6,600 - 6,690
Daniels Creek D5	6,430 - 6,600
Ely Creek E1	ca. 6,940 -ca. 7,100
Ely Creek E2	ca. 7,100 - 7,360
Ely Creek E3	7,500 - 7,860
Ely Creek E4	6,660 - 6,820
Greenhough Creek G1	6,500 - 6,700
Greenhough Creek G2	6,700 - 6,900
Greenhough Creek G3	7,160 - 7,370
Hazel Creek H2	7,220 - 7,480
Hazel Creek H3	6,900 - 7,220
Hazel Creek H4	6,700 - 6,900
June Creek J1	6,800 - 6,840
June Creek J2	6,840 - 7,100
June Creek J3	7,200 - 7,280
June Creek J4	7,280 - 7,460
Little Red Creek LR1	6,080 - 7,050
Little Red Creek LR2	7,080 - 7,220
Little Red Creek LR3	7,280
Little Red Creek LR4	7,660 - 7,820
Lizzie Spring Creek LS1a	7,200 - 7,270
Lizzie Spring Creek LS1b	7,270 - 7,400
Lizzie Spring Creek LS2	7,340 - 8,300
Lizzie Spring Creek LS3	7,700 - 7,800
Red Creek R1	6,600 - 6,780
Red Creek R2	6,780 - 6,840
Red Creek R3	7,240 - 7,280
Red Creek R4	6,300 - 6,330
Red Creek R5	6,430
Red Creek R6	6,540
Red Creek R7	6,500 - 6,540
Red Creek R8	6,430 - 6,500
Snow Creek S1	7,100 - 7,180

TABLE 2 (CONTINUED).

Snow Creek S2	7,400 - 7,800
Snow Creek S3	6,680 - 7,400
Snow Creek S4	6,530 - 6,680
Tepee Creek T1	6,800 - 6,900
Tepee Creek T2	6,900 - 7,300
<b>HENRY'S FORK BASIN</b>	
Cottonwood Creek COT1	6,290 - 6,380
Cottonwood Creek COT2	6,270 - 6,290
Cottonwood Creek COT3	6,380 - 6,570
Henry's Fork HF1	6,140
Henry's Fork HF2	6,100
Henry's Fork HF3 (not surveyed)	6,240
Henry's Fork HF4 (not surveyed)	6,300
Henry's Fork HF5 (not surveyed)	6,460
Henry's Fork HF6	6,600
Henry's Fork HF7	6,900

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TABLE 3. STREAM SEGMENTS SURVEYED IN 1999 THAT CONTAIN THE LARGEST AMOUNTS OF LIKELY HABITAT FOR *S. diluvialis*.

These are the stream segments where vegetation with large amounts of *Agrostis stolonifera* and *Juncus* spp. growing in moist soils formed more than just a fringe or scattered patches along the stream channel.

STREAM AND SEGMENT	COMMENT
Daniels Creek	
segment D3b	Zone of likely habitat 6 - 10 feet wide
segment D5	In herbaceous vegetation types
Ely Creek, segment E4	Band of likely habitat to 10 feet wide in places, but note presence of salt stains
Greenhough Creek, segment G3	Zone of likely habitat to 5 feet wide in places
Hazel Creek, segment H3	Zone of likely habitat to 6 feet wide on each side of channel
Little Red Cr.	Note high elevation
segment LR1	Zone of likely habitat to 50 feet wide
segment LR2	Zone of likely habitat 6 - 12 feet wide, but vegetation 1.5 - 3 feet tall
Lizzie Springs Creek	Note high elevation
segment LS1	Zone of likely habitat to 30 feet wide
segment LS2	Zone of likely habitat to 15 feet wide
Red Creek	
segment R1	On lowest, wettest of vegetated surfaces. But note salt stains.
segment R2	On lowest, wettest of vegetated surfaces
segment R4	On lowest of two vegetated surfaces (but note salt stains) and at spring
segment R6	On lowest vegetated bars
Snow Creek, segment S3	On margins of broad wetlands
Tepee Creek, segment T2	Zone of likely habitat to 50 feet wide

## APPENDIX 1: DESCRIPTIONS OF STREAM SEGMENTS

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Brief descriptions are given here of the physical environment and the vegetation along the streams and around the few springs surveyed in 1999, to show where likely habitat occurs. On most of the streams, the character of the channel and the pattern of the vegetation differs from one segment to another, so the descriptions were made for stream segments rather than for the entire stream. Notes were also made on the distribution and abundance of weeds in each stream segment.

Stream segments were delimited in the field. In most cases, boundaries between adjacent segments were located where the channel or the vegetation changed in some obvious way. In a few cases, stream segments are simply lengths of stream that were surveyed on different days, or (as on the Henry's Fork) they are isolated tracts of public lands. Figures 1 and 2 show the locations of the stream segments.

Except where noted, these descriptions were made from survey on foot.

### **RED CREEK BASIN**

#### CASTELLO CREEK

**Entire stream on public land.** From the boundary with state land on the southern side of the SW1/4 SW1/4 Section 25, upstream to the spring above the highway in the SW1/4 NE1/4 Section 21, T13N, R105W. Elevation 6,720 - 7,800 feet. Surveyed August 13, 1999.

*Spiranthes diluvialis?* No

Physical environment: Between the spring and the highway, the stream flowed through a gully roughly 10 feet deep and 3 feet wide at the bottom; below the highway, the gully deepened to 10 - 13 feet, and widened to approximately 10 feet at the bottom. The alluvium in the bottom was saturated in most of the gully. In the downstream half of the valley, the gully was 13 feet deep and 25 – 30 feet wide.

Salt stains were present in the downstream part of the valley, on the alluvium in the gully bottom and on the lower gully walls.

Vegetation: In the wetland at the spring, and along the channel between the spring and the highway, the dominant species were *Agrostis stolonifera*, *Juncus tracyi*, *Carex nebrascensis*, and *Cirsium arvense*; margin of wetland and sides of gully were mainly *Elymus cinereus*. Below the highway, the vegetation was *Carex nebrascensis* immediately along the channel, and *Juncus balticus* and *Agrostis stolonifera* across most of bottom of gully, with *Equisetum arvense* common in wet soil.

Below the private land in SW1/4 NW1/4 Section 22, *Agrostis stolonifera* and *Juncus balticus* grew across most of the bottom, often with *Equisetum arvense* in wet soil and *Carex nebrascensis* in water immediately along the channel; *Carex nebrascensis* became uncommon in the downstream half of the valley. Much of this vegetation in the gully bottom had been flattened by high water. *Artemisia tridentata* ssp. *tridentata*

shrubland grew in patches in the gully bottom and on a terrace approximately 3 feet above the channel; the undergrowth was *Chrysothamnus viscidiflorus* and *Poa pratensis* with some *Equisetum arvense*, *Agrostis stolonifera*, *Sonchus* sp., *Elymus trachycaulus* var. *trachycaulus*, and *Aster ascendens*.

Weeds:

*Cirsium arvense* was a major species in the wetland around the spring at the head of the creek, and was common (patches of dense stems and areas of sparse stems) in the gully throughout the valley, mainly on the lower parts of the gully walls.

*Sonchus* sp. patches (< 1000 square feet each) were uncommon in bare soils on banks of slump blocks above the highway. Below the highway, the species abounded in patches on the sparsely vegetated gully sides; the patches typically covered < 1000 square feet each, but some were larger. *Sonchus* sp. also grew in the *Artemisia tridentata* ssp. *tridentata* shrub stands on drier alluvium in the gully bottom.

*Carduus nutans* was present (1 plant noted) along the stream above the highway.

*Carduus acanthoides* was present (several plants noted) throughout the reach of the stream below the private land in SW1/4 NW1/4 Sec 22.

*Arctium minus* was present but rare (< 10 plants noted) throughout the reach of the stream below the private land in SW1/4 NW1/4 Sec 22.

*Tamarix chinensis* was rare (2 or 3 plants noted) in gully in downstream half of valley.

## DANIELS CREEK

**Segment D1.** From highway in NE1/4 NE1/4 Section 36, T13N, R106W downstream approximately 1.5 miles to a point in NE1/4 NW1/4 Section 6, T12N, R105W. Elevation 8,080 to 7,400 feet. Surveyed August 17, 1999.

*Spiranthes diluvialis*? No

Physical environment: Stream flowed in deep, V-shaped gully, 25 feet deep and to 3 feet wide at bottom. The channel was < 1.5 feet wide.

Vegetation: Sides of gully supported dense, tall vegetation of *Elymus cinereus*, *Cirsium arvense*, and *Rosa* sp. A fringe of *Agrostis stolonifera*, *Carex nebrascensis*, and *Juncus balticus* grew along channel, and much of it had been flattened by high water. The gully sides were so steep and so densely vegetated that roughly half of this segment was surveyed from the top of the gully.

Weeds:

*Cirsium arvense* abounded in patches up to several thousand square feet each, growing throughout on sides of gully.

**Segment D2.** From a point in NE1/4 NW1/4 Section 6 downstream to a point in SE1/4 NE1/4 Section 6, T12N, R105W. Elevation 7,400 to 7,240 feet. Surveyed August 17, 1999.

*Spiranthes diluvialis?* No

Physical environment: Stream flowed through gully to 25 feet deep and 15 feet wide at bottom. Bars of sandy alluvium were common in the gully bottom.

Vegetation: *Agrostis stolonifera* and *Juncus balticus* formed fringe approximately 3 feet wide in gully bottom; on lowest, wettest bars, *Juncus tracyi* was common; on higher bars, *Poa pratensis*, *Cirsium arvense*, and *Elymus cinereus* were common. The gully sides were vegetated with tall, open vegetation of *Rosa* sp., *Artemisia tridentata* ssp. *tridentata*, *Cirsium arvense*, *Chrysothamnus viscidiflorus*, and *Elymus cinereus*.

Weeds:

*Cirsium arvense* was common in patches covering approximately 500 square feet each.

*Sonchus* sp. was present on the drier sediment bars and fans along the gully sides. This species occurred as scattered rosettes and stems, and as patches of plants.

**Segment D3a.** Main stem of Daniels Creek, from a point in SE1/4 NE1/4 Section 6 downstream to the eastern side of SE1/4 NE1/4 Section 9, T12N, R105W. Elevation 7,240 to 6,690 feet. Surveyed August 17, 1999.

*Spiranthes diluvialis?* No

Physical environment: Stream flowed through gully incised 20 - 23 feet deep into valley bottom and 5 - 10 feet wide at bottom; in much of this segment, the channel was incised to 1.5 feet into the bottom of the gully.

Vegetation: Vegetation was sparse and patchy. *Agrostis stolonifera*, *Juncus balticus*, and *Aster ascendens* formed a fringe (usually flattened by high water) 1.5 feet wide on each side of the channel; the gully walls supported a sparse shrub vegetation of *Artemisia tridentata* ssp. *tridentata*, *Chrysothamnus viscidiflorus*, *Symphoricarpos oreophilus*, with a *Poa pratensis* undergrowth in places.

Two seeps at the upper end of the segment supported *Carex nebrascensis*, *Juncus balticus*, *Agrostis stolonifera*, *Epilobium* sp., and *Cirsium arvense* in saturated soil.

Springs on the north valley wall in SW1/4 SW1/4 Section 4 and NW1/4 NW1/4 Section 9 had water on the soil surface, and dense vegetation (80% - 100% canopy cover) 1.5 - 3 feet tall of *Carex nebrascensis*, *Juncus balticus*, *Muhlenbergia richardsonis*, *Epilobium* sp., and *Cirsium arvense*.

Weeds:

*Cirsium arvense* abounded at the springs on the north valley wall but was uncommon (scattered throughout) along Daniels Creek.

*Carduus nutans* was present but uncommon.

*Sonchus* sp. was present but uncommon.

**Segment D3b.** Tributary flowing from Hanks Meadow, in N1/2 NE1/4 Section 8, T12N, R105W, from confluence with Daniels Creek upstream approximately ½ mile to private land. Elevation 6,880 to 7,000 feet. Surveyed August 17, 1999.

*Spiranthes diluvialis*? No

Physical environment: Stream flowed in channel approximately 1.5 feet wide, on the valley floor.

Vegetation: *Agrostis stolonifera* formed a fringe 5 - 10 feet wide, with *Carex nebrascensis* and *Juncus tracyi* in the water of the channel and *Juncus balticus* in the drier soil.

Weeds:

*Cirsium arvense* abounded in the riparian zone along the stream.

*Sonchus* sp. was present, and was most common on bare alluvium.

*Tamarix chinensis* was present; one plant was noted along the stream.

**Segment D4.** From point on western line of SW1/4 NW1/4 Section 10 downstream to the county road in NW1/4 SE1/4 Section 10, T12N, R105W. Elevation 6,690 to 6,600 feet. Surveyed August 17, 1999.

*Spiranthes diluvialis*? No

Physical environment: Stream flowed through a gully 15 - 20 feet deep and up to 25 feet wide at bottom.

Vegetation: *Salix exigua* patches with virtually no undergrowth filled much of the gully bottom. *Agrostis stolonifera* and *Juncus balticus* formed a fringe, usually flattened by high water, along the channel.

Weeds:

*Sonchus* sp. was common in openings in the *Salix exigua* shrubland and along the foot of the gully walls.

*Tamarix chinensis* was present; 6 mature shrubs were noted in this segment.

**Segment D5.** From the county road in NW1/4 SE1/4 Section 10 downstream to the confluence with Red Creek in NE1/4 NW1/4 Section 14, T12N, R105W. Elevation 6,600 to 6,430 feet. Surveyed August 17, 1999.

*Spiranthes diluvialis*? No

Physical environment: Stream flowed through a gully 5 - 10 feet deep and up to 40 feet wide at bottom. Bare alluvial bars covered much of the gully bottom.

Vegetation: The lowest bars supported sparse vegetation of scattered *Agrostis stolonifera*, *Juncus balticus*, and *Melilotus officinalis*, which had largely been flattened by high water and partly covered by sediment. Higher surfaces supported patches of *Artemisia tridentata* ssp. *tridentata* and *Chrysothamnus viscidiflorus* shrub vegetation with *Melilotus officinalis* and *Sonchus* sp., and herbaceous vegetation of *Agrostis stolonifera*, *Juncus balticus*, *Glycyrrhiza lepidota*, *Melilotus officinalis*, *Sonchus* sp., and *Aster ascendens*. The herbaceous vegetation was 10 - 20 inches tall and appeared to be likely habitat for *Spiranthes diluvialis*.

Weeds:

*Sonchus* sp. abounded and co-dominated much of the herbaceous vegetation and the undergrowth of the shrub stands. It also was common on sparsely vegetated bars.

*Cirsium arvense* patches were present, as were scattered stems, but this species was notably less common than in upstream segments.

*Tamarix chinensis* was present; approximately 20 plants were noted scattered throughout the segment.

*Carduus nutans* was uncommon (few flowering plants noted)

## ELY CREEK

**Segment E1.** Eastern end is seismograph trail in NW1/4 SE1/4 Sec 23, western end is a point in NW1/4 SW1/4 Section 23, T13N, R105W. Elevation 6,930 - 7,100 feet. Surveyed August 13, 1999.

*Spiranthes diluvialis*? No

Physical environment: Three draws were surveyed. The southern-most had running water in a meandering channel approximately 1.5 feet wide, in a gully 6 - 10 feet deep and approximately 15 feet across. The central draw had no water. The northern-most draw had a trickle of water in a gully 10 feet deep; the bottom of the gully was mostly moist, bare sediment.

Salt stains were present on both damp and dry alluvial bars in the gully bottom.

Vegetation: In the southern-most draw, fringe of *Agrostis stolonifera*, *Juncus balticus*, and *Elymus cinereus* in gully bottom. In central draw, *Poa pratensis*, *Artemisia tridentata* ssp. *tridentata*, *Aster ascendens*, and *Artemisia ludoviciana* in bottom of gully.

In northern-most draw, *Juncus balticus* and *Agrostis stolonifera* in bottom of draw, largely flattened by high water.

Weeds:

*Sonchus* sp. was common as rosettes and flowering stems, at the foot of the gully walls in most of the segment in all three draws.

*Cirsium arvense* patches were present in the southern-most gully (each roughly 1000 stems and covering approximately 2000 square feet).

**Segment E2.** From a point in NW1/4 SW1/4 Section 23 upstream to the private land in SW1/4 NW1/4 Sec 22, T13N, R105W. Elevation 7,100 - 7,360 feet. Surveyed August 13, 1999.

*Spiranthes diluvialis?* No

Physical environment: Most of stretch was gully approximately 10 feet wide at bottom, with new sediment bars (loamy sand with gravel) common. Higher terrace, approximately 5 feet above gully bottom, was present in places in gully.

Vegetation: Fringe of *Agrostis stolonifera*, *Juncus balticus*, and *Elymus cinereus* in gully bottom. Intermittent higher terrace had *Poa pratensis*, *Elymus trachycaulus* var. *trachycaulus*, *Solidago* sp., *Artemisia tridentata* ssp. *tridentata*, and *Chrysothamnus nauseosus*.

*Habenaria* sp. was present from approximately 7,400 feet elevation in the NE1/4 SW1/4 Section 22 upstream < 0.25 mile to the private land: 100-200 plants in 30-foot long stretch at foot of north wall and on wet channel bank, in vegetation of *Agrostis stolonifera* and *Juncus tracyi*, growing in sandy clay loam alluvium.

Weeds:

*Sonchus* sp. patches (rosettes and flowering stems) were scattered in gully (less common than in segment E1).

*Cirsium arvense* was common: in most of segment, as patches of roughly 1000 stems each, covering approximately 2000 square feet.

*Carduus acanthoides* was present; noted one patch of < 10 plants in approximately 500 square feet.

*Arctium minus* was present; noted 1 plant.

**Segment E3.** From northern boundary of private land (SW1/4 NW1/4 Sec 22, T13N, R105W) upstream to Jones Spring (SE1/4 SE1/4 Sec 16, T13N, R105W). Elevation 7,500 - 7,860 feet. Surveyed August 13, 1999.

*Spiranthes diluvialis?* No

Physical environment: Channel 3 - 5 feet wide, with running water.

Vegetation: Dense herbaceous vegetation (80-100% canopy cover) grew in bottom of draw. The main species were *Agrostis stolonifera*, *Juncus* spp., *Carex nebrascensis*, and *Cirsium arvense*.

Weeds:

*Cirsium arvense* abounded on sides of draw both above and below highway.

*Carduus nutans* was present above the road (roughly 100 plants).

*Arctium minus* was rare (two plants noted), one below the road and one above.

**Segment E4.** NE1/4 NE1/4 Section 36 upstream to NW1/4 NW1/4 Section 25 (both T13N, R105W) Elevation 6,660 feet to 6,820 feet. Surveyed August 13, 1999.

*Spiranthes diluvialis?* No

Physical environment: Stream flowed through gully incised 3 - 5 feet into valley floor and 15 – 30 feet wide. Salt stains were present on bare alluvial bars, both damp and dry.

Vegetation: The vegetation was largely a fringe of *Agrostis stolonifera*, *Juncus balticus*, and *Aster ascendens* along the channel. This fringe was approximately 6 feet wide in most of the gully but widened to 10 feet in a few places. On the terraces above the channel, *Artemisia tridentata* ssp. *tridentata*, *Sarcobatus vermiculatus*, and *Chrysothamnus viscidiflorus* formed a shrubland, with an undergrowth of *Poa pratensis*, *Elymus smithii*, and *Distichlis stricta*; this vegetation was dense and often grew to 3 feet tall.

Weeds:

*Tamarix chinensis*: 6 plants were noted.

*Cirsium arvense* was present but uncommon.

*Sonchus* sp. was present throughout this segment and generally consisted of scattered stems, except in a few patches of dense stems covering < 500 square feet.

## GREENHOUGH CREEK

**Segment G1.** From the confluence with Red Creek in SW1/4 SE1/4 Section 2, upstream to a point in the SW1/4 NE1/4 Section 3, T12N, R105W. Elevation 6,500 to 6,700 feet. Surveyed August 23, 1999.

*Spiranthes diluvialis?* No

Physical environment: Stream flowed in braided and meandering channels through a gully 10 feet deep and up to 30 feet across at the bottom. Bare sediment was common in the gully bottom

Vegetation: *Agrostis stolonifera*, *Juncus balticus*, and *Aster ascendens* formed a discontinuous fringe approximately 3 feet wide on the lowest vegetated bars. Most of this vegetation had been flattened by high water, and it was partly covered by new

sediment. *Chrysothamnus viscidiflorus* grew on higher terraces, and it, too, had been partly flattened.

Weeds:

*Sonchus* sp. was rare, occurring as a few scattered plants.

**Segment G2.** From a point in the SW1/4 NE1/4 Section 3, T12N, R105W, upstream < 1 mile to the pipeline crossing in NW1/4 SE1/4 Section 34, T13N, R105W. Elevation 6,700 to 6,900 feet. Surveyed August 23, 1999.

*Spiranthes diluvialis*? No

Physical environment: Broad wet meadows alternated with gullies. Each gully had a headcut at the upstream end and became gradually shallower downstream, eventually merging into a broad meadow.

Vegetation: The bottoms of the gullies and the broad wet meadows were largely vegetated with *Carex nebrascensis* and some *Juncus balticus*; this wet vegetation was 10 feet wide in places and absent in others. On slightly drier substrate, *Agrostis stolonifera* and *Juncus balticus* formed a zone 1 - 5 feet wide on one or both sides of the wet vegetation. Patches of *Salix exigua* with *Salix lutea* were present, with an undergrowth of *Agrostis stolonifera* and *Sonchus* sp. Higher terraces support *Artemisia tridentata* ssp. *tridentata* and *Chrysothamnus viscidiflorus* with *Poa pratensis* in the undergrowth.

Weeds:

*Sonchus* sp. was common, growing in patches of 50 - 200 plants covering approximately 100 square feet. These patches grew mostly at the bases of gully walls and under *Salix exigua* shrubs.

*Convolvulus arvensis* was noted in 1 patch of approximately 100 square feet near the upper end of the segment.

**Segment G3.** From the northern boundary of the private land in NE1/4 Section 33 upstream < 1 mile to the boundary of the private land in SW1/4 Section 28, T13N, R105W. Elevation 7,160 to 7,360 feet. Surveyed August 23, 1999.

*Spiranthes diluvialis*? No

Physical environment: Stream flowed through a gully up to 13 feet deep and 5 feet wide at bottom.

Vegetation: The herbaceous vegetation was dense (>80% canopy cover) and 1 foot tall. *Carex nebrascensis* and *Juncus tracyi* formed a narrow fringe (1.5 feet wide) immediately along the channel and a wide zone in some wet spots. *Agrostis stolonifera* and *Juncus balticus*, with some *Carex nebrascensis*, *Juncus tracyi*, and *Poa pratensis*, grew on mesic soils in a zone 3 - 5 feet wide; *Mentha arvensis*, *Potentilla anserina*, and

*Aster ascendens* were common. Scattered *Betula occidentalis* and *Salix lutea* grew throughout, with *Equisetum arvense* beneath.

Weeds:

*Sonchus* sp. was present throughout, as scattered plants.

*Cirsium arvense* was rare: only 10 plants were noted.

## HAZEL CREEK

**Segment H2.** From a point on the eastern edge of the SE1/4 NE1/4 Section 8, downstream < 1 mile to a point in the SE1/4 SE1/4 Section 5, T12N, R104W. Elevation 7,480 to 7,220 feet. Surveyed August 22, 1999.

*Spiranthes diluvialis?* No

Physical environment: The channel for roughly half the length of this segment was dry, and in approximately 80% of the length, the channel was unvegetated and incised 3 - 10 feet into the alluvium of gravel, cobbles, and boulders.

Vegetation: The riparian vegetation consisted of patches of *Agrostis stolonifera*, *Juncus balticus*, and *Equisetum laevigatum*, with *Carex nebrascensis* and *Juncus tracyi* in small areas of wet soil.

Weeds:

*Cirsium arvense* was present in patches covering approximately 1000 square feet around 2 seeps.

*Sonchus* sp. was common in patches covering up to 1000 square feet.

**Segment H3.** From a point in the SE1/4 SE1/4 Section 5, T12N, R104W, downstream approximately 1.5 miles to the reservoir in the SW1/4 SW1/4 Section 33, T13N, R104W. Elevation 7,220 to 6,900 feet. Surveyed August 22, 1999.

*Spiranthes diluvialis?* No

Physical environment: About 10% of the length of this segment contained an unvegetated channel in a vertical-walled gully. Elsewhere, the stream flowed in a channel 1.5 - 3 feet wide, through a gully to 10 feet deep and up to 15 feet wide at the bottom. Bare bars were common in the gully bottom.

Vegetation: In most of the segment, *Agrostis stolonifera* and *Juncus balticus* dominated a band of vegetation 3 - 5 feet wide on each side of the channel. *Juncus tracyi* and *Aster ascendens* were usually present. *Carex nebrascensis* formed a fringe along both sides of the channel, approximately 10 inches wide.

Weeds:

*Cirsium arvense* was present but uncommon, occurring in patches covering approximately 100 square feet each.

*Sonchus* sp. was uncommon, occurring in patches of 50 - 100 plants at the bases of the gully walls.

*Tamarix chinensis* was rare in most of the segment, with only 6 plants noted above the reservoir. But it was common (12 mature plants with many patches of seedlings) in the 220 yards upstream from the reservoir and on the mudflats at the upstream end of the reservoir.

**Segment H4.** From the reservoir in the SW1/4 SW1/4 Section 33, downstream > 1 mile to the confluence with Red Creek in NW1/4 NE1/4 Section 29, T13N, R104W. Elevation 6,900 to 6,700 feet. Surveyed August 22, 1999

*Spiranthes diluvialis*? No

Physical environment: The stream flowed in a channel 1.5 feet wide, through a gully 10 feet deep and 10 - 30 feet wide at the bottom. Much of the bottom was bare bars of new alluvium, and the lower 2/3 of the segment lacked vegetation.

Vegetation: Patches of *Agrostis stolonifera*, *Juncus balticus*, and *Equisetum laevigatum* occurred in some meanders. Wetter soils in meanders supported *Juncus tracyi* and *Carex nebrascensis*. Higher terraces had shrub patches of *Artemisia tridentata* ssp. *tridentata* and *Chrysothamnus viscidiflorus* with *Elymus smithii* and *Oryzopsis hymenoides* in the undergrowth.

Weeds:

*Tamarix chinensis* was common in the upstream half of the segment: approximately 40 mature shrubs, and patches of 5 - 10 seedlings on point bars, were noted. No *Tamarix chinensis* was noted in the downstream half.

## JUNE CREEK

**Segment J1.** NW1/4 NW1/4 Section 34, T13N, R104W, from the confluence with Red Creek upstream approximately ¼ mile. Elevation 6,800 to 6,840 feet. Surveyed August 22, 1999.

*Spiranthes diluvialis*? No

Physical environment: Stream flowed through gully 10 feet deep and 15 feet wide at bottom.

Vegetation: Virtually no riparian vegetation was present in the gully bottom. *Artemisia tridentata* ssp. *tridentata* and *Chrysothamnus nauseosus*, with an undergrowth of *Poa pratensis*, grew on higher terraces.

Weeds:

*Sonchus* sp. was common throughout, at the bases of the gully walls and on the sides of terraces.

**Segment J2.** From a point on the eastern side of SE1/4 NE1/4 Section 33, T13N, R104W, upstream to a point in SE1/4 NE1/4 Section 4, T12N, R104W where dry channel was encountered in the easternmost fork of the stream. Elevation 6,840 to 7,100 feet. Surveyed August 22, 1999.

*Spiranthes diluvialis?* No

Physical environment: Stream flowed in channel < 3 feet wide through gully 1.5 -10 feet deep and up to 15 feet wide at bottom.

Vegetation: *Agrostis stolonifera*, *Juncus balticus*, *Poa pratensis*, and *Muhlenbergia richardsonis* were the most common species in a fringe approximately 3 feet wide on each side of the channel; *Juncus tracyi* and *Ranunculus cymbalaria* were also present. This fringe was discontinuous near the downstream end of the segment, but became nearly continuous (with interruptions at stream meanders) in the upper part, where *Calamagrostis inexpansa* became common. At the upstream end of the segment, where the upstream limit of flowing water was encountered in the easternmost branch of the stream, this vegetation disappeared.

Weeds:

*Tamarix chinensis* was uncommon: 4 mature shrubs and 1 seedling were noted. *Sonchus* sp. was common throughout, at the bases of the gully walls and on the sides of terraces.

*Elymus repens* was noted, in one patch covering < 100 square feet.

**Segment J3.** From springs on the southern edge of SW1/4 SE1/4 Section 4 downstream to approximately 500 feet below trail crossing in SW1/4 NE1/4 Section 4, T12N, R104W. Elevation 7,280 feet to 7,200 feet. Surveyed August 14, 1999.

*Spiranthes diluvialis?* No

Physical environment: Stream was flowing in channel 3 - 6 feet wide, in a draw incised 3 - 6 feet into the valley bottom.

Vegetation: Herbaceous vegetation of *Carex nebrascensis*, *Juncus balticus*, and *Agrostis stolonifera* with some *Aster ascendens* largely filled the bottom of the draw. The adjacent sides of the draw were largely vegetated with upland vegetation.

Weeds:

*Cirsium arvense* was common, growing as scattered stems or as patches, each with up to roughly 100 stems and covering 200 square feet.

**Segment J4.** From the springs on the southern side of the SW1/4 SE1/4 Section 4, upstream approximately 1 mile to the confluence of the two branches in SE1/4 SW1/4 Section 9, T12N, R104W. Elevation 7,280 to 7,460 feet. Surveyed August 22, 1999.

*Spiranthes diluvialis*? No

Physical environment: Stream flowed in channel 3 - 6 feet wide, in gully incised 3 - 6 feet into valley bottom. Water was flowing in both stream branches upstream from the upper end of this segment, but the valleys of those two branches were so steep and sharply V-shaped that they were assumed to contain no suitable habitat for *Spiranthes diluvialis* and they were not surveyed.

Vegetation: Most of the riparian vegetation was *Juncus balticus*, *Carex nebrascensis*, *Agrostis stolonifera*, and *Juncus tracyi* (with some patches of *Glyceria* sp.) growing in wet soil with water on the surface. A narrow fringe (< 1.5 feet wide) of drier *Agrostis stolonifera*, *Juncus balticus*, and *Poa pratensis* grew farther from the channel in most of the segment.

Weeds:

*Cirsium arvense* was common, in patches up to 6 feet wide and 80 feet long on the edge of the wet soil.

*Carduus nutans* was uncommon: fewer than 10 plants were noted.

### LITTLE RED CREEK

**Segment LR1.** From western edge of private land in NW1/4 NW1/4 Section 1, T12N, R104W downstream to point in NE1/4 SE1/4 Section 35, T13N, R104W approximately 500 feet upstream from the mouth of the intermittent stream; includes short stretch (approximately 500 feet) of tributary draw in SW1/4 SW1/4 Section 36. Elevation 7,050 feet to 6,080 feet. Surveyed August 15, 1999.

*Spiranthes diluvialis*? No

Physical environment: Stream flowed in gully incised 25 - 30 feet into the valley floor and 30 - 45 feet wide at the bottom.

Vegetation: Most of the gully bottom was covered with herbaceous vegetation in which the most common species were *Agrostis stolonifera* and *Juncus balticus*, with *Carex nebrascensis* and *Equisetum arvense* in the wetter places. Also present were *Potentilla anserina*, *Glycyrrhiza lepidota*, *Melilotus officinalis*, *Aster ascendens*, and *Sisyrinchium* sp. Clumps of *Salix lutea* and *Salix exigua* were common; shrub cover was roughly 10% overall.

At the downstream end of this segment, *Salix exigua* shrubland completely filled the bottom of the gully.

Weeds:

*Sonchus* sp. was common throughout.

**Segment LR2.** Above and below mouth of Lizzie Spring Creek, from the southern edge of the private land in SW1/4 NW1/4 Section 1 upstream to the northern edge of the private land in NW1/4 NW1/4 Section 12, both T12N, R104W. Elevation 7,080 feet to 7,220 feet. Surveyed August 16, 1999.

*Spiranthes diluvialis*? No

Physical environment: Stream was flowing in a gully 6 - 12 feet deep and 6 - 12 feet wide at the bottom. The channel was < 3 feet wide. An active beaver dam was noted in the lower part of the segment.

Vegetation: The gully was covered with dense herbaceous vegetation (canopy cover 80 - 100%) 1.5 - 3 feet tall, with scattered patches of willow and groves of cottonwood. Over most of the gully bottom, the dominant species were *Agrostis stolonifera*, *Juncus balticus*, *Equisetum laevigatum*, and *Equisetum arvense*; *Trifolium pratense* was common. *Carex nebrascensis*, *Juncus tracyi*, and *Equisetum arvense* were common in the wettest places (generally immediately along the channel). *Salix lutea* patches, to 3 feet tall, were common and covered roughly 15% of the entire gully. *Populus angustifolia* was present in small groves and as scattered trees. Higher, drier surfaces supported shrubland of *Artemisia tridentata* ssp. *tridentata* with a herbaceous component of *Poa pratensis*, *Elymus cinereus*, *Elymus trachycaulus* var. *trachycaulus*, *Aster ascendens*, and *Glycyrrhiza lepidota*; *Pentaphylloides floribunda* and *Maianthemum stellatum* were present.

Weeds:

*Sonchus* sp. was common in patches (each covering up to approximately 100 square feet) on the gully sides, and as scattered plants throughout.

*Cirsium arvense* was present, mostly as widely scattered plants, with very few patches of up to 30 plants covering approximately 200 square feet.

*Arctium minus* was rare: 1 plant was noted.

**Segment LR3.** Intermittent tributary in upper Little Red Creek valley, in corners of SE1/4 SE1/4 Section 13 and NE1/4 NE1/4 Section 24, T12N, R104W, and SW1/4 SW1/4 Section 18 and NW1/4 NW1/4 Section 19, T12N, R103W. Elevation 7,820 feet. Surveyed August 16, 1999.

*Spiranthes diluvialis*? No

Physical environment: Wide valley bottom with no discrete channel.

Vegetation: Most common species in mesic portion (largest part of area) were *Carex praegracilis*, *Poa pratensis*, *Elymus trachycaulus* var. *trachycaulus*, and *Aster ascendens*.

Wetter areas had *Carex nebrascensis*, *Juncus balticus*, and *Deschampsia cespitosa*. *Iris missouriensis* was present throughout. Elk beds and droppings were common.

Weeds: No notes

**Segment LR4.** SW1/4 Section 18, T12N, R103W; between private land downstream and state land upstream. Elevation 7,660 to 7,820 feet. Surveyed August 16, 1999.

*Spiranthes diluvialis?* No

Physical environment: Stream flowed in channel to 3 feet wide, with cobble and boulder bottom. Approximately 25% of valley bottom was cobble bar; remainder was cobbles with a veneer of finer alluvium.

Vegetation: Over most of riparian zone, the vegetation was *Agrostis stolonifera*, *Juncus balticus*, *Deschampsia cespitosa*, and *Aster ascendens*; *Carex nebrascensis* and *Juncus tracyi* grew in wet soil; *Eleocharis* sp. and *Carex nebrascensis* grew in channel; *Poa pratensis* was common in drier soil. Scattered *Populus angustifolia* trees were present, as were patches of *Populus angustifolia* sprouts and *Salix exigua*. Vegetation cover was approximately 75% on finer alluvium, and very sparse on cobble bars.

Weeds:

Noted no *Sonchus* sp. or *Cirsium arvense*, which were the common weeds elsewhere.

### LIZZIE SPRING CREEK

**Segment LS1a.** From confluence with Little Red Creek in NW1/4 NW1/4 Section 12 upstream approximately ½ mile to NE1/4 NW1/4 Section 12, T12N, R104W. Elevation 7,200 - 7,270 feet. Surveyed August 16, 1999.

*Spiranthes diluvialis?* No

Physical environment: Stream flowed through channel < 1.5 feet wide and essentially on valley floor (entrenched < 1.5 feet). Riparian zone roughly 30 feet wide.

Vegetation: Canopy cover varied from 60% to 100%; > 80% in most of riparian zone. Areas with water at surface supported vegetation of *Carex nebrascensis* and *Juncus balticus*, often with patches of *Salix exigua*; this vegetation choked the channel in many places and formed wetlands covering approximately 1000 square feet. Much of the riparian zone was slightly drier and supported vegetation of *Agrostis stolonifera* and *Juncus balticus*. The highest parts of the riparian zone were vegetated with *Elymus cinereus*, *Poa pratensis*, and *Chrysothamnus viscidiflorus*.

Weeds: No notes

**Segment LS1b.** From point in NE1/4 NW1/4 Section 12 approximately ½ mile upstream from mouth, upstream approximately ½ mile to state land in NE1/4 SE1/4 Section 12, T12N, R104W. Elevation 7,270 - 7,400 feet. Surveyed August 16, 1999.

*Spiranthes diluvialis?* No

Physical environment: Stream flowed through channel <1.5 feet wide, in gully approximately 6 feet deep and 15 feet wide at bottom.

Vegetation: Most common species were *Agrostis stolonifera* and *Juncus balticus*, with some *Glycyrrhiza lepidota* and *Poa pratensis*. Wet areas of *Carex nebrascensis* and *Juncus* spp. (*Juncus tracyi* and *Juncus balticus*) were restricted to a fringe along the channel and a few wider patches.

Weeds:

*Sonchus* sp. was common, growing as scattered plants and as dense patches of stems, on all but the wettest soils.

**Segment LS2.** From the northern edge of the state land in SE1/4 NE1/4 Section 7 upstream to the spring in NE1/4 NW1/4 Section 8, T12N, R103W. Elevation 7,340 to 8,300 feet. Surveyed August 16, 1999.

*Spiranthes diluvialis?* No

Physical environment: Stream flowed through channel 1.5 feet wide in gully 13 - 15 feet deep and 3 - 6 feet wide at bottom; strongly V-shaped.

Vegetation: The vegetation was dense (canopy cover roughly 100%) and tall (1.5 - 3 feet) in most of gully. *Carex nebrascensis*, *Juncus* spp. (*Juncus tracyi* and *Juncus balticus*), *Mimulus guttatus*, *Glyceria* sp., and *Epilobium* sp. formed fringe immediately along channel. Lower parts of gully walls supported mainly *Agrostis stolonifera* and *Juncus balticus* with *Aster ascendens*. Higher parts of gully walls were mainly *Poa pratensis* and *Juncus balticus* with *Aster ascendens*, *Antennaria* sp., and *Plantago major*.

Two groves of *Populus tremuloides* grew in valley bottom in middle of segment and around spring in SE1/4 NW1/4 Section 8. Undergrowth was mainly *Elymus cinereus* and *Cirsium arvense*.

Weeds:

*Sonchus* sp. grew in patches (each < 50 square feet) and as scattered plants.

*Cirsium arvense* was common in the *Populus tremuloides* groves around the spring in SE1/4 NW1/4 Section 8, in undergrowth with *Elymus cinereus*.

**Area LS3.** Springs on slump block on the northern side of the valley of Lizzie Spring Creek, SW1/4 NE1/4 Section 7, T12N, R103W. Elevation 7,700 - 7,800 feet. Surveyed August 16, 1999.

*Spiranthes diluvialis?* No

Physical environment: Wet and mesic areas covered 1 -2 acres, around springs on the slump block at the foot of the landslide.

Vegetation: Dominant species over most of area were *Juncus balticus*, *Phleum pratense*, *Elymus trachycaulus* var. *trachycaulus*, *Sonchus* sp., and *Antennaria* sp. *Juncus tracyi* and *Carex nebrascensis* grew in wetter soils.

Weeds:

*Sonchus* sp. was one of the major species in most of the vegetation.

*Cirsium arvense* grew in 3 patches, each < 100 square feet.

## RED CREEK

**Segment R1.** SW1/4 NW1/4 Section 31 (Section 31/36 line) upstream to crossing of jeep trail in SE1/4 SE1/4 Section 28, both T13N, R104 W. Elevation 6,600 feet to 6,780 feet. Surveyed August 14, 1999.

*Spiranthes diluvialis?* No

Physical environment: Creek was flowing in active floodplain up to 150 feet wide; floodplain consisted of braided channels 6 - 10 feet wide and numerous bare or sparsely vegetated bars, with old channels or active overflow channels threading between them. Terraces were also present above the floodplain. Salt stains were present on damp and on dry alluvium, mainly on bare alluvial bars but also on the bases of gully sides.

Vegetation: Four vegetation types were noted:

(1) On the wettest alluvial substrates, the main species were *Spartina gracilis*, *Plantago major*, and *Juncus balticus*, with *Hordeum jubatum*, *Equisetum laevigatum*, *Triglochin concinnum*, *Muhlenbergia asperifolia*, *Melilotus officinalis*, *Melilotus albus*, and *Agrostis stolonifera*. This vegetation was sparse in places and denser (to roughly 50% canopy cover) in others. The search effort was concentrated in this vegetation type.

At the upstream end of this stretch, from the mouth of Hazel Creek upstream, *Calamagrostis inexpansa* was common in this vegetation.

(2) On slightly higher and drier substrate the main species were *Juncus balticus*, *Elymus trachycaulus* var. *trachycaulus*, *Distichlis stricta*, *Glycyrrhiza lepidota*, *Equisetum laevigatum*, *Melilotus officinalis*, *Melilotus albus*, and *Aster ascendens*. Patches of *Salix exigua* < 3 feet tall were present. This vegetation often had canopy cover > 50%.

(3) On drier terraces, the main species were *Chrysothamnus viscidiflorus*, *Glycyrrhiza lepidota*, *Elymus trachycaulus* var. *trachycaulus*, *Juncus balticus*, and *Distichlis stricta*. This vegetation often was dense (canopy cover >60%).

(4) *Sarcobatus vermiculatus* shrub stands grew on the higher terraces.

Weeds:

*Sonchus* sp. was scattered throughout the valley bottom. No dense patches were noted.

*Tamarix chinensis* was present: dead shrubs approximately 5 feet tall were scattered on intermediate terraces (in vegetation types 2 and 3), and live seedlings or sprouts were present on the lower surfaces (vegetation type 1, and on bare bars).

*Cirsium arvense* was present: 2 patches were noted, each with several hundred stems in approximately 2500 square feet.

*Elymus repens* was noted in several (<5) patches, each approximately 50 square feet, on the lower, sparsely vegetated surfaces with vegetation type 2.

**Segment R2.** From crossing of jeep trail in SE1/4 SE1/4 Section 28 upstream to private land in NE1/4 NW1/4 Section 34, both T13N, R104W. Elevation 6,780 feet to 6,840 feet. Surveyed August 14, 1999.

*Spiranthes diluvialis*? No

Physical environment: The stream channel was in a gully to approximately 100 feet wide (narrower than in R1 downstream). The stream channel was incised approximately 3 feet into the gully bottom and was better defined as a single channel than in R1 downstream.

Vegetation: Much of the gully bottom (a higher proportion than in R1 downstream) was *Juncus balticus* - *Agrostis stolonifera* vegetation; *Calamagrostis inexpansa* was common in this vegetation. Patches of *Salix exigua* grew scattered in bottom; higher surfaces had patches of *Artemisia tridentata* ssp. *tridentata* shrubland with *Elymus trachycaulus* var. *trachycaulus* and *Poa pratensis* in the undergrowth.

Weeds: No notes

**Segment R3.** NE1/4 Section 36, T13N, R104W. Elevation 7,240 - 7,280 feet. Surveyed August 15, 1999.

*Spiranthes diluvialis*? No

Physical environment: The stream flowed through a gully 13 - 15 feet wide, incised 10 - 13 feet into the valley bottom.

Vegetation: On the bottom and the lower walls of the gully, *Salix lutea* and some *Salix exigua* formed a patchy shrub layer with roughly 50% canopy cover; the most common species in the undergrowth were *Equisetum arvense*, *Agrostis stolonifera*, *Juncus balticus*, *Juncus tracyi*, *Elymus trachycaulus* var. *trachycaulus*, and *Aster ascendens*.

Higher on the gully sides, the vegetation was largely *Artemisia tridentata* ssp. *tridentata* with *Poa pratensis* and *Aster ascendens*.

Weeds:

*Sonchus* sp. was common, growing in scattered patches of plants.

*Cirsium arvense* was uncommon; scattered stems and small patches were noted.

**Segment R4.** Section 22, T12N, R105W, from the Wyoming/Utah state line upstream approximately ½ mile to the mouth of the tributary flowing in from the east. Elevation 6,300 to 6,330 feet. Surveyed August 15, 1999.

*Spiranthes diluvialis*? No

Physical environment: The stream flowed in an active floodplain up to 160 feet wide. Most of the floodplain was stream channel (a main channel and several smaller channels) and bare bars. At least two higher surfaces (bars or terraces) were noted. Salt stains were noted on the new alluvium and on the plants on the lower bars in the floodplain.

Several springs flowed from the foot of the Richards Mountains on the western side of the stream. The soil around the springs was saturated.

Vegetation: The lowest, wettest vegetated surfaces (old channels or active overflow channels) supported dense herbaceous vegetation (< 80% canopy cover) dominated by *Elymus trachycaulus* var. *trachycaulus*, *Plantago major*, *Juncus balticus*, *Equisetum laevigatum*, *Melilotus officinalis*, *Melilotus albus*, and *Scirpus pungens*. Slightly higher surfaces had similar vegetation that varied from sparse to roughly 70% canopy cover; the main species were *Elymus trachycaulus* var. *trachycaulus*, *Plantago major*, *Juncus balticus*, *Equisetum laevigatum*, *Melilotus* sp., *Distichlis stricta*, *Aster ascendens*, and *Spartina gracilis*. The highest terraces supported patchy shrub vegetation of *Chrysothamnus viscidiflorus* with *Artemisia tridentata* ssp. *tridentata* and an undergrowth of *Glycyrrhiza lepidota*, *Distichlis stricta*, *Melilotus* spp., and *Elymus smithii*; bare soil was common in this type.

At the springs, the vegetation was *Carex praegracilis*, *Agrostis stolonifera*, *Juncus balticus*, with lesser amounts of *Carex nebrascensis*, *Potentilla anserina*, *Calamagrostis inexpansa*, *Viola* sp., and *Equisetum arvense*.

Weeds:

*Tamarix chinensis* was present, as approximately 20 mature shrubs scattered throughout the floodplain.

*Elymus repens* grew in at least two patches, each covering 1000 - 2000 square feet in the floodplain.

*Sonchus* sp. was common in the herbaceous vegetation on the lower terraces. (The identity of these plants was uncertain because they were not flowering, but undulate to entire, fleshy leaves that exuded latex when torn were the same as the leaves on the flowering *Sonchus* sp. observed elsewhere.)

**Segment R5.** From the mouth of Daniels Creek in NE1/4 NW1/4 Section 14 downstream to the private land in SE1/4 NE1/4 Section 15, T12N, R105W. Elevation 6,410 feet. Surveyed August 17, 1999.

*Spiranthes diluvialis?* No

Physical environment: Stream flowed in one main channel and several side channels; 25% - 35% of the active floodplain was channel and bare bar. Floodplain was > 160 feet wide. Terraces were present in the valley bottom.

This stream segment seems to have been disturbed more than the segments upstream (R1 - R4). Daniels Creek and the tributaries flowing in from the south have dumped lots of sediment and debris into Red Creek.

Vegetation: The lowest vegetated terraces were mainly *Elymus repens*, *Melilotus* spp., *Sonchus* sp., and *Hordeum jubatum*; in places the vegetation on these terraces was *Elymus trachycaulus* var. *trachycaulus* and *Melilotus* spp. The higher terraces were vegetated with *Artemisia tridentata* ssp. *tridentata* and *Chrysothamnus viscidiflorus* shrub stands, which often had no undergrowth.

No *Agrostis stolonifera* - *Juncus balticus* vegetation was noted.

Weeds:

*Elymus repens* dominated or co-dominated in an area of 10 - 20 acres.

*Sonchus* sp. abounded in much of the herbaceous vegetation.

*Tamarix chinensis* was present; 5 - 10 live plants were noted.

**Segment R6.** From the boundary with the state land on the northern side of NE1/4 NW1/4 Section 1, downstream to the mouth of Snow Creek in the SW1/4 NW1/4 Section 1, T12N, R105W. Elevation 6,540 feet. Surveyed August 23, 1999.

*Spiranthes diluvialis?* No

Physical environment: The stream flowed in one main channel and several side channels through a floodplain with a large area of bare bars.

Vegetation: The lowest vegetated bars generally had < 50% canopy cover and were dominated by *Spartina gracilis*, *Plantago major*, and *Juncus balticus*. Slightly higher bars had denser vegetation (at least 70% canopy cover) in which *Elymus trachycaulus* var. *trachycaulus*, *Distichlis stricta*, *Poa* sp., *Melilotus* spp., and *Glycyrrhiza lepidota* were the most common species. Patches of *Salix exigua* were present in the first type and more common in the second. The highest terraces supported *Artemisia tridentata* ssp. *tridentata* and *Chrysothamnus viscidiflorus* with an undergrowth dominated by *Distichlis stricta*.

Survey was limited to the two herbaceous types; the shrub vegetation on the highest terraces was not surveyed.

Weeds:

*Sonchus* sp. abounded in the herbaceous vegetation types, especially in the drier type where it contributed substantial cover to the vegetation.

*Tamarix chinensis* was present throughout. The mature shrubs had been killed by herbicide, but patches of live seedlings (10 - 200 per patch) grew on new sediment bars along small overflow channels.

*Elymus repens* was present in at least 4 patches in the drier herbaceous vegetation type. Three of the patches covered approximately 200 square feet, and the 4th patch covered at least 1000 square feet. In all patches, the *Elymus repens* was mixed with other species.

**Segment R7.** From the mouth of Snow Creek in the SW1/4 NW1/4 Section 1, downstream to the mouth of Greenhough Creek in the SW1/4 SE1/4 Section 2, T12N, R105W. Elevation 6,540 to 6,500 feet. Surveyed August 23, 1999.

*Spiranthes diluvialis?* No

Physical environment: The stream flowed in one main channel and several side channels through a floodplain with a large area of bare bars.

Vegetation: Most of the vegetation was low *Chrysothamnus viscidiflorus* with an understory of *Melilotus* spp. and some *Elymus trachycaulus* var. *trachycaulus*. The herbaceous meadows common in segment R6 immediately upstream were all but lacking here.

Weeds:

*Elymus repens* was present in a patch covering at least 1000 square feet on a fan opposite the mouth of Snow Creek, and in 2 or 3 smaller patches mixed with other species.

**Segment R8.** From the mouth of Greenhough Creek in the SW1/4 SE1/4 Section 2, downstream to the mouth of Daniels Creek in the NE1/4 NW1/4 Section 14, T12N, R105W. Elevation 6,500 to 6,430 feet. Surveyed August 23, 1999.

*Spiranthes diluvialis?* No

Physical environment: The stream flowed in one main channel and several side channels through a floodplain with a large area of bare bars. Salt crusts were common on the alluvial bars, and Geomyidae burrows were present on the higher bars and the terraces.

Vegetation: The vegetation was largely herbaceous meadow of *Elymus trachycaulus* var. *trachycaulus*, *Elymus repens*, *Melilotus* spp., *Plantago major*, *Triglochin concinnum*, *Sonchus* sp., *Equisetum laevigatum*, *Potentilla anserina*, *Glycyrrhiza lepidota*, and *Distichlis stricta*.

Weeds:

*Sonchus* sp. abounded throughout, mainly in patches of several thousand square feet each in which it co-dominated the vegetation.

*Elymus repens* was common throughout, in patches covering 100 to over 1000 square feet, mixed with other species.

*Tamarix chinensis* was present throughout. The mature shrubs had been sprayed with herbicide, but live seedlings were present on bare alluvial bars.

## SNOW CREEK

**Segment S1.** Upstream from highway, in NW1/4 SW1/4 Section 21, T13N, R105W. Elevation 7,100 to 7,180 feet. Surveyed August 15, 1999.

*Spiranthes diluvialis*? No

Physical environment: Two flowing streams were surveyed, each < 3 feet wide. Both rose in a wetland covering approximately 1 acre.

Vegetation: Dense herbaceous vegetation covered the valley bottom; the main species were *Carex nebrascensis* and *Mimulus* sp. immediately next to the channels, and *Agrostis stolonifera*, *Juncus balticus*, *Elymus trachycaulus* var. *trachycaulus*, and *Poa pratensis* farther from the channels. *Rosa* sp., *Symphoricarpos oreophilus*, *Ribes oxycanthoides* (?), *Artemisia tridentata* ssp. *vaseyana*, and *Chrysothamnus viscidiflorus* were present but contributed little cover in the riparian zone. Part of the area was a *Populus tremuloides* grove. The wetland was primarily *Carex nebrascensis*, *Glyceria* sp., *Hordeum brachyantherum*, and *Mimulus guttatus*.

Weeds:

*Cirsium arvense* was a major species over several acres, mixed with the shrubs. Part of the area apparently had been sprayed with herbicide.

*Carduus nutans* was present; < 50 plants were scattered throughout the area.

**Segment S2.** From the highway in NE1/4 SW1/4 Section 21 downstream to the spring in SW1/4 NE1/4 Section 28, T13N, R105W. Elevation 7,800 to 7,400 feet. Surveyed August 23, 1999.

*Spiranthes diluvialis*? No

Physical environment: Stream flowed through channel 1.5 feet wide, in a draw 3 - 6 feet deep and 3 - 10 feet wide at the bottom.

Vegetation: *Carex nebrascensis* filled the channel; *Agrostis stolonifera*, *Juncus tracyi*, *Juncus balticus*, *Equisetum laevigatum*, *Aster ascendens*, and *Poa pratensis* formed a band roughly 3 feet wide on each side of the channel, in drier soil. This herbaceous vegetation was dense (75 - 100% canopy cover) and 1.5 feet tall. Scattered *Betula occidentalis* and *Salix lutea* were present.

Weeds:

*Sonchus* sp. was present, mainly in patches of 50 - 500 plants covering < 100 square feet.

*Cirsium arvense* abounded, also in patches covering up to 100 square feet. This species had been sprayed with herbicide within approximately 220 yards of the highway.

*Elymus repens* was noted in a patch of approximately 700 square feet at the downstream end of the segment, up a tributary draw above the spring.

**Segment S3.** From the spring in SW1/4 NE1/4 Section 28, downstream to the southward bend in the NE1/4 SE1/4 Section 35, T13N, R105W. Elevation 7,400 to 6,680 feet.

Surveyed August 23, 1999

*Spiranthes diluvialis?* No

Physical environment: This segment contained gullies 5 - 15 feet wide alternating with broad (to 30 feet) riparian zones where the channel was not entrenched. Each gully was deepest (to 10 feet) at a headcut at the upstream end and become shallower downstream from the headcut as it merged into the broad riparian area. Water was flowing in the entire length of the channel.

Vegetation: *Carex nebrascensis* and *Juncus balticus* grew in wet soil, forming a fringe < 10 inches wide along the channel in the gullies and dominating much of the broad wetlands. *Agrostis stolonifera*, *Juncus balticus*, *Glycyrrhiza lepidota*, and *Poa pratensis* dominated in drier soils, in a band 1.5 feet wide in the gullies and up to 6 feet wide around the margins of the broad areas. The vegetation had been flattened by high water in much of the lower part of the segment; where it was still upright, it was dense (> 75% canopy cover) and 1.5 feet tall.

Weeds:

*Sonchus* sp. was common throughout, in patches covering up to 500 square feet and including several hundred plants, on bare gully sides and around the margins of the wide riparian areas. Scattered flowering stems also grew throughout the segment.

*Cirsium arvense* was common in patches containing up to roughly 1,000 stems and covering up to 2500 square feet, on the gully sides and around the margins of the broad riparian areas.

*Elymus repens* was noted in one patch of approximately 300 square feet, approximately 300 yards upstream from the pipeline crossing in the SE1/4 SW1/4 Section 27.

*Arctium minus* was uncommon; 1 plant was noted in the entire segment.

*Tamarix chinensis* was noted in the lower half of the segment, where 20 plants grew in two clumps.

**Segment S4.** From the southward bend in the NE1/4 SE1/4 Section 35, T13N, R105W, downstream to the confluence with Red Creek in the SW1/4 NW1/4 Section 1, T12N, R105W. Elevation 6,680 to 6,530 feet. Surveyed August 23, 1999

*Spiranthes diluvialis?* No

Physical environment: This segment contained virtually no riparian zone. For the most part, the stream flowed among bare bars in a gully to 13 feet deep and 30 feet across at the bottom. Newly-deposited sediment was common. Water had run 3 - 5 feet deep during the growing season.

Vegetation: A few patches of *Agrostis stolonifera* - *Juncus balticus* vegetation grew on lateral bars along the channel; most had been flattened by high water and partly covered by sediment. *Artemisia tridentata* ssp. *tridentata* and *Chrysothamnus viscidiflorus* grew on higher terraces.

Weeds:

*Tamarix chinensis* was present, but only 5 plants were noted near the upstream part of the segment.

## TEPEE CREEK

**Segment T1.** From confluence with Red Creek in NW1/4 NW1/4 Section 34 upstream to the confluence of the two forks in NE1/4 SW1/4 Section 34, T13N, R104W. Elevation 6,800 feet to 6,900 feet. Surveyed August 14, 1999.

*Spiranthes diluvialis?* No

Physical environment: Stream flowed through draw cut into sandstone bedrock and alluvium. Bottom of the draw was 30 - 65 feet wide, and much of it was bare bars and channel. Tepee Creek was markedly less incised than were Ely and Castello Creeks, but little likely habitat was present here.

Vegetation: Fringe of *Agrostis stolonifera* with *Juncus balticus*, *Juncus tracyi*, *Calamagrostis inexpansa*, and *Aster ascendens* grew along the edge of the channel and on the adjacent low bars. Shrub patches of *Artemisia tridentata* ssp. *tridentata* and *Chrysothamnus viscidiflorus* with *Poa pratensis* in the undergrowth grew on higher terraces.

Weeds:

*Tamarix chinensis* was present throughout the stream segment: roughly 20 mature shrubs grew mostly on the edges of higher terraces, and roughly 100 seedlings or sprouts were noted on the lower bars and the edge of the channel.

**Segment T2.** Western fork, from confluence of two forks in NE1/4 SW1/4 Section 34, T13N, R104W upstream to private land in NE1/4 NE1/4 Section 9, T12N, R104W. Elevation 6,900 feet to 7,300 feet. Surveyed August 14, 1999.

*Spiranthes diluvialis*? No

Physical environment: The stream flowed in a channel < 3 feet wide. In most of the segment, the valley bottom was wider and the stream less entrenched than in segment T1 downstream: in places the channel was entrenched into a gully 3 feet deep and approximately 13 feet wide at the bottom, but in much of the segment, the channel was not at all entrenched into the valley bottom.

In the upper 1/4-mile to 1/2-mile of this segment, the stream was entrenched in a gully 16 - 23 feet deep and 13 - 15 feet wide at the bottom, with wet alluvium in most of the bottom.

Vegetation: In most of this segment, a fringe of herbaceous vegetation to approximately 15 feet wide grew along the edge of the stream channel; *Agrostis stolonifera* was the dominant species, and *Juncus balticus*, *Juncus tracyi*, *Calamagrostis inexpansa*, and *Aster ascendens* were common. This vegetation also grew around several seeps, and it covered the drier parts of the gully bottom in the upper 1/4-mile to 1/2-mile part. In most places, this herbaceous vegetation was dense (canopy cover > 60%). In the wider part of the valley, this vegetation merged into open *Artemisia tridentata* ssp. *tridentata* shrubland with *Poa pratensis* undergrowth on the higher, drier terraces. In the upper 1/4-mile to 1/2-mile part, dense *Carex nebrascensis* vegetation (canopy cover >65%) grew in wet soils in much of the gully bottom.

Weeds:

*Sonchus* sp. was common throughout this segment in places with dense vegetation.

*Cirsium arvense* was present. It was rare in most of the segment (2 small patches, each < 100 square feet), but in the upper 1/4-mile to 1/2-mile, large patches (each < 1000 square feet with 100-200 stems) were common on the sides of the gully and on blocks of alluvium fallen from the gully sides.

*Tamarix chinensis* was present; two mature shrubs (10 feet tall) were noted.

*Arctium minus* was present in the gully in the upper 1/2-mile to 1/4-mile of the segment; roughly 10 patches of plants were noted, each with 5 - 20 plants, on the sides of the gully and on blocks fallen from the gully sides.

## HENRY'S FORK BASIN

### HENRY'S FORK

**Segment HF1.** NW1/4 Section 15, T12N, R109W. Elevation 6,140 feet. Surveyed August 24, 1999.

*Spiranthes diluvialis*? No

Physical environment: Floodplain with old meander.

Vegetation: On the lower surface, with water on soil surface, the most common species were *Agrostis stolonifera* and *Equisetum laevigatum*. A higher surface supported a *Populus angustifolia* woodland with an undergrowth of *Elymus smithii*, *Iva axillaris*, *Equisetum laevigatum*, *Bromus inermis* var. *inermis*, and *Chrysothamnus nauseosus*.

Weeds:

*Elymus repens* was present in at least one patch on the higher surface, covering approximately 100 square feet.

*Tamarix chinensis*: one shrub was noted

*Cardaria pubescens* was present in the undergrowth of the *Populus angustifolia* woodland, with *Elymus smithii*. Its abundance was not noted.

*Cirsium arvense* was present as scattered plants in the woodland.

**Segment HF2.** SW1/4 SW1/4 Section 14, T12N, R109W. Elevation 6,100 feet. **This tract was viewed August 24, 1999 through binoculars from the top of the bluff approximately 250 feet above and to the north.**

*Spiranthes diluvialis*? Unknown: the tract was not surveyed on foot, but it appears to contain little suitable habitat.

Physical environment: Active channel with small areas of floodplain on the north and south sides of the channel. On the north, the floodplain lay between the channel and a cliff to the north. On the south side of the active channel was an abandoned meander with standing water.

Vegetation: *Salix exigua*, other *Salix* spp., and *Populus angustifolia* saplings form thickets that covered most of the tract. Openings contained *Melilotus* sp., *Glycyrrhiza lepidota*, and bare ground.

Weeds: No notes

**Segment HF3.** NW1/4 Section 8, T12N, R109W. Elevation 6,240 feet. **This tract was viewed August 24, 1999 through binoculars from a public road approximately ½ mile to the south.**

*Spiranthes diluvialis?* Unknown: the tract was not surveyed on foot, but it appears to contain little suitable habitat.

Physical environment: Tract contained a small area of floodplain south of the active channel. The channel lay at the foot of the north valley wall, so no floodplain was present north of the channel.

Vegetation: The topographic map and observations through binoculars suggest that the tract was largely covered with *Populus angustifolia* woodland and *Salix exigua* thickets.

Weeds: No notes

**Segment HF4.** Tract contains the active channel and floodplain mainly south of the channel, in NW1/4 Section 6, T12N, R109W and NE1/4 Section 1, T12N, R110W. Elevation 6,300 feet. **This tract was viewed August 24, 1999 through binoculars from the county road approximately ½ mile to the southwest.**

*Spiranthes diluvialis?* Unknown: tract was not surveyed on foot, but it appears to contain little suitable habitat.

Physical environment: Active channel and floodplain.

Vegetation: The topographic map and observations through binoculars suggest that the vegetation was primarily *Populus angustifolia* woodland and thickets of *Salix exigua* and *Populus angustifolia* saplings, both with sparse undergrowth, on cobble and boulder bars. The herbaceous vegetation appears to be sparse.

Weeds: No notes

**Segment HF5.** NW1/4 NE1/4 and NE1/4 NW1/4 Section 4, T12N, R110W. Elevation 6,460 feet. **This tract was neither surveyed nor viewed through binoculars.**

*Spiranthes diluvialis?* Unknown: tract was not surveyed

Physical environment: The topographic map shows that this tract contains a short segment of one meander in the active channel, a small area of land north of the channel (inside the meander), and a larger area south of the channel (on the outside of the meander). Observations at other tracts suggest that the area south of the channel probably lies on a surface several feet above the channel, and the small area north of the channel was active floodplain.

Vegetation: The topographic map shows some woodland on the tract, which must be *Populus angustifolia* woodland (according to survey on other tracts). The nature of the non-woodland vegetation was unknown.

Weeds: No notes

**Segment HF6.** NW1/4 NW1/4 Section 6, T12N, R110W. Elevation 6,600 feet. Surveyed August 24, 1999. Only the part of the tract south of the channel was surveyed.

*Spiranthes diluvialis?* No

Physical environment: Tract contained active channel, terrace, and abandoned channel. The terrace was at least 3 feet higher than the active channel, while the abandoned channel was < 3 feet above the active channel.

Vegetation: The higher terrace supported woodland of *Populus angustifolia* with an undergrowth of *Elymus smithii*, *Bromus inermis* var. *inermis*, and *Elymus repens*. In the wet soil within the abandoned channel, the common species were *Carex* spp. and *Juncus* sp. Patches of *Salix exigua* or *Populus angustifolia* saplings and seedlings grew in various places.

Weeds:

*Elymus repens* was present throughout the vegetation on the higher terrace.

**Segment HF7.** SW1/4 NE1/4 Section 6, T12N, R111W. Elevation 6,900 feet. Surveyed August 25, 1999. Only the part of the tract east and south of the river was surveyed.

*Spiranthes diluvialis?* No

Physical environment: The tract included the active channel and areas on both sides of the channel. Because the channel made an S-curve, the tract contained areas on the insides and on the outsides of meanders. The tract consisted largely of terrace at least 3 feet above the channel and an abandoned channel with standing water.

Vegetation: The higher terrace supported herbaceous vegetation of *Elymus repens*, *Melilotus officinalis*, *Glycyrrhiza lepidota*, and *Agrostis stolonifera*. Some of the area on this terrace had been burned, and scattered *Populus angustifolia* sprouts and saplings grew there in the herbaceous vegetation. The abandoned channel contained *Carex rostrata*, *Carex nebrascensis*, and *Glyceria* sp. growing in standing water.

The western bank of the north-south part of the meander appeared to contain a small amount of likely habitat: the land surface was 3 feet above the channel, and the vegetation consisted of a 3- to 5-foot-wide band of *Agrostis stolonifera*, *Glycyrrhiza lepidota*, and *Scirpus* sp. nearest the channel, with a band of *Populus angustifolia* seedlings and *Agrostis stolonifera* farther from the channel. That side of the river was inaccessible and was viewed through binoculars from the opposite bank approximately 40 feet away.

Weeds:

*Elymus repens* grew in patches covering several acres total, on the higher terrace.  
*Cirsium arvense* grew in patches covering roughly 100 square feet each in the burned area on the higher terrace.

### COTTONWOOD CREEK

**Segment COT1.** From the trail crossing in SE1/4 NE1/4 Section 20, downstream approximately ½ mile to a point in SE1/4 NW1/4 Section 21, T12N, R109W. Elevation 6,380 to approximately 6,290 feet. Surveyed August 24, 1999.

*Spiranthes diluvialis?* No

Physical environment: Stream flowed in a channel 1.5 feet wide entrenched approximately 1.5 feet into the bottom of a gully 10 - 13 feet deep and 15 feet wide at the bottom.

Vegetation: Most of the gully bottom was mesic meadow of *Juncus balticus*, *Trifolium pratense*, *Sonchus* sp., *Agrostis stolonifera*, *Glaux maritima*, *Plantago major*, *Muhlenbergia asperifolia*, and *Melilotus officinalis*. Wetter soils (mainly next to the channel and in low areas off of the channel) contained *Scirpus pungens* (?), *Hordeum jubatum*, and *Polypogon monspeliensis*. The vegetation had been grazed to a height of approximately 3 inches in places. *Salix exigua* patches were present but covered only a small area.

Higher terraces and the foot of the gully wall were vegetated with *Chrysothamnus viscidiflorus* shrubland, containing some *Artemisia tridentata* ssp. *tridentata* and an undergrowth of *Sonchus* sp.

Groves of *Populus angustifolia* poles and bunches of saplings (or sprouts) were present in the lower part of the segment.

Weeds:

*Sonchus* sp. abounded, both in the mesic meadow (where it often co-dominated the vegetation) and in the undergrowth of the shrub patches on higher terraces.

*Cirsium arvense* was rare; only a few plants were noted throughout.

*Tamarix chinensis* was present, but fewer than 5 mature shrubs were noted.

**Segment COT2.** From a point in the SE1/4 NW1/4 Section 21, downstream approximately ¼ mile to the boundary of the state land in the NE1/4 NW1/4 Section 31, T12N, R109W. Elevation approximately 6,290 to approximately 6,270 feet. Surveyed August 24, 1999.

*Spiranthes diluvialis?* No

Physical environment: The stream flowed through a gully 10 - 13 feet deep and over 15 feet wide at the bottom. Most of the land surface in the gully was on terraces above the gully bottom.

Vegetation: Mesic meadow of *Juncus balticus*, *Trifolium pratense*, *Sonchus* sp., *Agrostis stolonifera*, *Glaux maritima*, *Plantago major*, *Muhlenbergia asperifolia*, and *Melilotus officinalis* grew in a band 3 - 6 feet wide along the channel. Most of the vegetation was *Artemisia tridentata* ssp. *tridentata* and *Chrysothamnus viscidiflorus* shrubs with an undergrowth of *Distichlis stricta* and *Sonchus* sp.

Weeds:

*Sonchus* sp. abounded, both in the mesic meadow (where it often co-dominated the vegetation) and in the undergrowth of the shrub patches on higher terraces.

*Cirsium arvense* was rare; only a few plants were noted throughout.

*Tamarix chinensis* was present, but fewer than 5 mature shrubs were noted.

**Segment COT3.** From the trail crossing in SE1/4 NE1/4 Section 20, upstream approximately 2 miles to the Wyoming/Utah state line on the southern side of the SE1/4 SW1/4 Section 19, T12N, R109W. Elevation 6,380 to 6,570 feet. Surveyed August 25, 1999.

*Spiranthes diluvialis*? No

Physical environment: Stream flowed in a channel 1.5 feet wide incised 0.4 - 1.5 feet into the bottom of a gully 6 - 12 feet deep and 15 feet wide at the bottom.

Vegetation: The vegetation in the gully bottom was mesic meadow of *Juncus balticus*, *Trifolium fragiferum*, *Agrostis stolonifera*, and *Sonchus* sp., with lesser amounts of *Iva axillaris*, *Potentilla anserina*, *Cirsium arvense*, *Hordeum jubatum*, *Taraxacum* sp., *Ranunculus cymbalaria*, *Triglochin concinnum*, and *Plantago major*. Geomyidae burrows were common. Higher terraces supported shrub vegetation of *Artemisia tridentata* ssp. *tridentata* with an undergrowth of *Iva axillaris* and *Sonchus* sp.

Weeds:

*Sonchus* sp. was abundant throughout. It co-dominated much of the mesic meadow and grew at the bases of the gully walls and in the *Artemisia tridentata* ssp. *tridentata* shrub patches on higher terraces.

*Cirsium arvense* was present as scattered plants throughout.

*Carduus nutans* grew as scattered plants throughout. One patch of 20 plants was also noted.

*Cardaria pubescens* was present in at least 2 patches, one covering approximately 40 square feet in the middle of Section 20, and the other of unknown extent farther downstream.

*Tamarix chinensis* was rare: 4 or 5 mature shrubs were noted in the downstream ½ mile of the segment.

## APPENDIX 2: ABUNDANCE OF THE DESIGNATED WEEDS IN EACH STREAM SEGMENT.

The species are listed alphabetically by scientific name. This information has been extracted from the descriptions of stream segments in Appendix 1.

### **Common burdock (*Arctium minus*)**

#### RED CREEK BASIN

##### CASTELLO CREEK

*Arctium minus* was present but rare (< 10 plants noted) throughout the reach of the stream below the private land in SW1/4 NW1/4 Sec 22.

##### ELY CREEK

Segment E2: *Arctium minus* was present; noted 1 plant.

Segment E3: *Arctium minus* was rare (two plants noted, one below the road and one above).

##### LITTLE RED CREEK

Segment LR2: *Arctium minus* was rare: 1 plant was noted.

##### SNOW CREEK

Segment S3: *Arctium minus* was uncommon; 1 plant was noted in the entire segment.

##### TEPEE CREEK

Segment T2: *Arctium minus* was present in the gully in the upper 1/2-mile to 1/4-mile of the segment; roughly 10 patches of plants were noted, each with 5 - 20 plants, on the sides of the gully and on blocks fallen from the gully sides.

### **Plumeless thistle (*Carduus acanthoides*)**

#### RED CREEK BASIN

##### CASTELLO CREEK

*Carduus acanthoides* was present (several plants noted) throughout the reach of the stream below the private land in SW1/4 NW1/4 Sec 22.

##### ELY CREEK

Segment E2: *Carduus acanthoides* was present; noted one patch of < 10 plants in approximately 500 square feet.

**Musk thistle (*Carduus nutans*)**

RED CREEK BASIN

CASTELLO CREEK

*Carduus nutans* was present (1 plant noted) along the stream above the highway.

DANIELS CREEK

Segment D3a: *Carduus nutans* was present but uncommon.

Segment D5: *Carduus nutans* was uncommon (few flowering plants noted)

ELY CREEK

Segment E3: *Carduus nutans* was present above the road (approximately 100 plants).

JUNE CREEK

Segment J4: *Carduus nutans* was uncommon: fewer than 10 plants were noted.

SNOW CREEK

Segment S1: *Carduus nutans* was present; < 50 plants were scattered throughout the area.

HENRY'S FORK BASIN

COTTONWOOD CREEK

Segment COT3: *Carduus nutans* grew as scattered plants throughout. One patch of 20 plants was also noted.

**Hoary cress (whitetop) (*Cardaria pubescens*)**

HENRY'S FORK BASIN

HENRY'S FORK

Segment HF1: *Cardaria pubescens* was present in the undergrowth of the *Populus angustifolia* woodland, with *Elymus smithii*. Its abundance was not noted.

COTTONWOOD CREEK

Segment COT3: *Cardaria pubescens* was present in at least 2 patches, one covering approximately 40 square feet in the middle of Section 20, and the other of unknown extent farther downstream.

## Canada thistle (*Cirsium arvense*)

### RED CREEK BASIN

#### CASTELLO CREEK

*Cirsium arvense* was a major species in the wetland around the spring at the head of the creek, and was common (patches of dense stems and areas of sparse stems) in the stream gully throughout the valley, mainly on the lower parts of the gully walls.

#### DANIELS CREEK

Segment D1: *Cirsium arvense* abounded in patches up to several thousand square feet each, growing throughout on gully sides.

Segment D2: *Cirsium arvense* was common in patches covering approximately 500 square feet each.

Segment D3a: *Cirsium arvense* abounded at the springs on the north valley wall but was uncommon (scattered throughout) along Daniels Creek.

Segment D3b: *Cirsium arvense* abounded in the riparian zone along the stream.

Segment D5: *Cirsium arvense* patches were present, as were scattered stems, but this species was notably less common than in upstream segments.

#### ELY CREEK

Segment E1: *Cirsium arvense* patches were present in the southern-most gully (each roughly 1000 stems and covering approximately 2000 square feet).

Segment E2: *Cirsium arvense* was common as patches of roughly 1000 stems each, covering approximately 2000 square feet.

Segment E3: *Cirsium arvense* abounded on sides of draw both above and below highway.

Segment E4: *Cirsium arvense* was present but uncommon.

#### GREENHOUGH CREEK

Segment G3: *Cirsium arvense* was rare: only 10 plants were noted.

#### HAZEL CREEK

Segment H2: *Cirsium arvense* was present in patches covering approximately 1000 square feet around 2 seeps.

Segment H3: *Cirsium arvense* was present but uncommon, occurring in patches covering approximately 100 square feet each.

#### JUNE CREEK

Segment J3: *Cirsium arvense* was common, growing as scattered stems or as patches, each with up to roughly 100 stems and covering 200 square feet.

Segment J4: *Cirsium arvense* was common, in patches up to 6 feet wide and 80 feet long on the edge of the wet soil.

#### LITTLE RED CREEK

Segment LR2: *Cirsium arvense* was present, mostly as widely scattered plants, with very few patches of up to 30 plants covering approximately 200 square feet.

#### LIZZIE SPRING CREEK

Segment LS2: *Cirsium arvense* was common in the *Populus tremuloides* groves around the spring in SE1/4 NW1/4 Section 8, in undergrowth with *Elymus cinereus*.

Area LS3: *Cirsium arvense* grew in 3 patches, each < 100 square feet.

#### RED CREEK

Segment R1: *Cirsium arvense* was present: 2 patches were noted, each with several hundred stems in approximately 2500 square feet.

Segment R3: *Cirsium arvense* was uncommon; scattered stems and small patches were noted.

#### SNOW CREEK

Segment S1: *Cirsium arvense* abounded, and was a major species over several acres, mixed with the shrubs. Part of the area apparently had been sprayed with herbicide.

Segment S2: *Cirsium arvense* abounded, in patches covering up to 100 square feet. This species had been sprayed with herbicide within approximately 220 yards of the highway.

Segment S3: *Cirsium arvense* was common in patches containing up to roughly 1,000 stems and covering up to 2500 square feet, on the gully sides and around the margins of the broad riparian areas.

#### TEPEE CREEK

Segment T2: *Cirsium arvense* was present. It was rare in most of the segment (2 small patches, each < 100 square feet), but in the upper ¼-mile to ½-mile, large patches (each < 1000 square feet with 100-200 stems) were common on the sides of the gully and on blocks of alluvium fallen from the gully sides.

#### HENRY'S FORK BASIN

##### HENRY'S FORK

Segment HF1: *Cirsium arvense* was present as scattered plants in the woodland.

Segment HF7: *Cirsium arvense* grew in patches covering approximately 100 square feet each in the burned area on the higher terrace.

#### COTTONWOOD CREEK

Segment COT1: *Cirsium arvense* was rare; only a few plants were noted throughout.

Segment COT2: *Cirsium arvense* was rare; only a few plants were noted throughout.

Segment COT3: *Cirsium arvense* was present as scattered plants throughout.

**Field bindweed (*Convolvulus arvensis*)**

RED CREEK BASIN

GREENHOUGH CREEK

Segment G2

*Convolvulus arvensis* was noted in 1 patch of approximately 100 square feet near the upper end of the segment.

**Quackgrass (*Elymus repens*, *Agropyron repens*)**

RED CREEK BASIN

JUNE CREEK

Segment J2: *Elymus repens* was noted, in one patch covering < 100 square feet.

RED CREEK

Segment R1: *Elymus repens* was noted in several (<5) patches, each approximately 50 square feet, on the lower, sparsely vegetated surfaces in vegetation type 2.

Segment R4: *Elymus repens* grew in at least two patches, each covering 1000 - 2000 square feet in the floodplain.

Segment R5: *Elymus repens* dominated or co-dominated in an area of 10 - 20 acres.

Segment R6: *Elymus repens* was present in at least 4 patches in the drier herbaceous vegetation type. Three of the patches covered approximately 200 square feet, and the 4th patch covered at least 1000 square feet. In all patches, the *Elymus repens* was mixed with other species.

Segment R7: *Elymus repens* was present in a patch covering at least 1000 square feet on a fan opposite the mouth of Snow Creek, and in 2 or 3 smaller patches mixed with other species.

Segment R8: *Elymus repens* was common throughout, in patches covering 10 to over 1000 square feet, mixed with other species.

SNOW CREEK

Segment S2: *Elymus repens* was noted in a patch of approximately 700 square feet at the downstream end of the segment, up a tributary draw above the spring.

Segment S3: *Elymus repens* was noted in one patch of approximately 300 square feet, approximately 300 yards upstream from the pipeline crossing in the SE1/4 SW1/4 Section 27.

HENRY'S FORK BASIN

HENRY'S FORK

Segment HF1: *Elymus repens* was present in at least one patch on the higher surface, covering approximately 100 square feet.

Segment HF6: *Elymus repens* was present throughout the vegetation on the higher terrace.

Segment HF7: *Elymus repens* grew in patches covering several acres total, on the higher terrace.

**Perennial sowthistle (*Sonchus arvensis* + *S. uliginosus*)**

RED CREEK BASIN

CASTELLO CREEK

*Sonchus* sp. patches (< 1000 square feet each) were uncommon on bare soils banks of slump blocks above the highway. Below the highway, the species abounded in patches on the sparsely vegetated gully sides; the patches typically covered < 1000 square feet each, but some were larger. *Sonchus* sp. also grew in the *Artemisia tridentata* ssp. *tridentata* shrub stands on drier alluvium in the gully bottom.

DANIELS CREEK

Segment D2: *Sonchus* sp. was present on the drier sediment bars and fans along the gully sides. This species occurred as scattered rosettes and stems, and patches of plants.

Segment D3a: *Sonchus* sp. was present but uncommon.

Segment D3b: *Sonchus* sp. was present, and was most common on bare alluvium.

Segment D4: *Sonchus* sp. was common in openings in the *Salix exigua* shrubland and along the foot of the gully walls.

Segment D5: *Sonchus* sp. abounded and co-dominated much of the herbaceous vegetation and the undergrowth of the shrub stands. It also was common on sparsely vegetated bars.

ELY CREEK

Segment E1: *Sonchus* sp. was common as rosettes and flowering stems, at the foot of the gully walls in most of the segment in all three draws.

Segment E2: *Sonchus* sp. patches (rosettes and flowering stems) were scattered in gully (less common than in segment E1).

Segment E4: *Sonchus* sp. was present throughout this segment and generally consisted of scattered stems, except in a few patches of dense stems covering < 500 square feet.

GREENHOUGH CREEK

Segment G1: *Sonchus* sp. was rare, occurring as a few scattered plants.

Segment G2: *Sonchus* sp. was common, growing in patches of 50 - 200 plants covering approximately 100 square feet. These patches grew mostly at the bases of gully walls and under *Salix exigua* shrubs.

Segment G3: *Sonchus* sp. was present throughout, as scattered plants.

HAZEL CREEK

Segment H2: *Sonchus* sp. was common in patches covering up to 1000 square feet.

Segment H3: *Sonchus* sp. was uncommon, occurring in patches of 50 - 100 plants at the bases of the gully walls.

#### JUNE CREEK

Segment J1: *Sonchus* sp. was common throughout, at the bases of the gully walls and on the sides of terraces.

Segment J2: *Sonchus* sp. was common throughout, at the bases of the gully walls and on the sides of terraces.

#### LITTLE RED CREEK

Segment LR1: *Sonchus* sp. was common throughout.

Segment LR2: *Sonchus* sp. was common in patches (each covering up to approximately 100 square feet) on the gully sides, and as scattered plants throughout.

#### LIZZIE SPRING CREEK

Segment LS1b: *Sonchus* sp. was common, growing as scattered plants and as dense patches of stems, on all but the wettest soils.

Segment LS2: *Sonchus* sp. grew in patches (each < 50 square feet) and as scattered plants.

Area LS3: *Sonchus* sp. was one of the major species in most of the vegetation.

#### RED CREEK

Segment R1: *Sonchus* sp. was scattered throughout the valley bottom. No dense patches were noted.

Segment R3: *Sonchus* was common, growing in scattered patches of plants.

Segment R4: *Sonchus* sp. was common in the herbaceous vegetation on the lower terraces. (The identity of these plants was uncertain because they were not flowering, but undulate to entire, fleshy leaves that exuded latex when torn were the same as the leaves on the flowering *Sonchus* sp. observed elsewhere.)

Segment R5: *Sonchus* sp. abounded in much of the herbaceous vegetation.

Segment R6: *Sonchus* sp. abounded in the herbaceous vegetation types, especially in the drier type where it contributed substantial cover to the vegetation.

Segment R8: *Sonchus* sp. abounded throughout, mainly in patches of several thousand square feet each in which it co-dominated the vegetation.

#### SNOW CREEK

Segment S2: *Sonchus* sp. was present, mainly in patches of 50 - 500 plants covering < 100 square feet.

Segment S3: *Sonchus* sp. was common throughout, in patches covering up to 500 square feet and including several hundred plants, on bare gully sides and around the margins of the wide riparian areas. Scattered flowering stems also grew throughout the segment.

#### TEPEE CREEK

Segment T2: *Sonchus* sp. was common throughout this segment in places with dense vegetation.

## HENRY'S FORK BASIN

### COTTONWOOD CREEK

Segment COT1: *Sonchus* sp. abounded, both in the mesic meadow (where it often co-dominated the vegetation) and in the undergrowth of the shrub patches on higher terraces.

Segment COT2. : *Sonchus* sp. abounded, both in the mesic meadow (where it often co-dominated the vegetation) and in the undergrowth of the shrub patches on higher terraces.

Segment COT3.: *Sonchus* sp. was abundant throughout. It co-dominated much of the mesic meadow and grew at the bases of the gully walls and in the *Artemisia tridentata* ssp. *tridentata* shrub patches on higher terraces.

### **Tamarisk (*Tamarix chinensis*)**

## RED CREEK BASIN

### CASTELLO CREEK

*Tamarix chinensis* was rare (2 or 3 plants noted) in gully in downstream half of valley.

### DANIELS CREEK

Segment D3b: *Tamarix chinensis* was present; one plant was noted along the stream.

Segment D4: *Tamarix chinensis* was present; 6 mature shrubs were noted in this segment.

Segment D5: *Tamarix chinensis* was present; roughly 20 plants were noted throughout the segment.

### ELY CREEK

Segment E4: *Tamarix chinensis* was present; 6 plants were noted.

### HAZEL CREEK

Segment H3: *Tamarix chinensis* was rare in most of the segment, with only 6 plants noted above the reservoir. But it was common (12 mature plants with many patches of seedlings) in the 220 yards upstream from the reservoir and on the mudflats at the upstream end of the reservoir.

Segment H4: *Tamarix chinensis* was common in the upstream half of the segment: roughly 40 mature shrubs, and patches of 5 - 10 seedlings on point bars, were noted. No *Tamarix chinensis* was noted in the downstream half.

### JUNE CREEK

Segment J2: *Tamarix chinensis* was uncommon: 4 mature shrubs and 1 seedling were noted.

### RED CREEK

Segment R1: *Tamarix chinensis* was present: dead shrubs approximately 5 feet tall were scattered on intermediate terraces (in vegetation types 2 and 3), and live seedlings or sprouts were present on the lower surfaces (vegetation type 1, and on bare bars).

Segment R4: *Tamarix chinensis* was present, as roughly 20 mature shrubs scattered throughout the floodplain.

Segment R5: *Tamarix chinensis* was present; 5 - 10 live plants were noted.

Segment R6: *Tamarix chinensis* was present throughout. The mature shrubs had been killed by herbicide, but patches of live seedlings (10 - 200 per patch) grew on new sediment bars along small overflow channels.

Segment R8: *Tamarix chinensis* was present throughout. The mature shrubs had been sprayed with herbicide, but live seedlings were present on bare alluvial bars.

#### SNOW CREEK

Segment S3: *Tamarix chinensis* was noted in the lower half of the segment, where 20 plants grew in two clumps.

Segment S4: *Tamarix chinensis* was present, but only 5 plants were noted near the upstream part of the segment.

#### TEPEE CREEK

Segment T1: *Tamarix chinensis* was present throughout the stream stretch: roughly 20 mature shrubs grew mostly on the edges of higher terraces, and roughly 100 seedlings or sprouts were noted on the lower bars and the edge of the channel.

Segment T2: *Tamarix chinensis* was present; two mature shrubs (10 feet tall) were noted.

#### HENRY'S FORK

Segment HF1: *Tamarix chinensis*: one shrub was noted

#### COTTONWOOD CREEK

Segment COT1: *Tamarix chinensis* was present, but fewer than 5 mature shrubs were noted.

Segment COT2: *Tamarix chinensis* was present, but fewer than 5 mature shrubs were noted.

Segment COT3: *Tamarix chinensis* was rare: 4 or 5 mature shrubs were noted in the downstream ½ mile of the segment.