Diamond Fork and Sixth Water Creeks Riparian Vegetation and Ute Ladies'-tresses 2006 Monitoring Report

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CHAPTER 1: INTRODUCTION

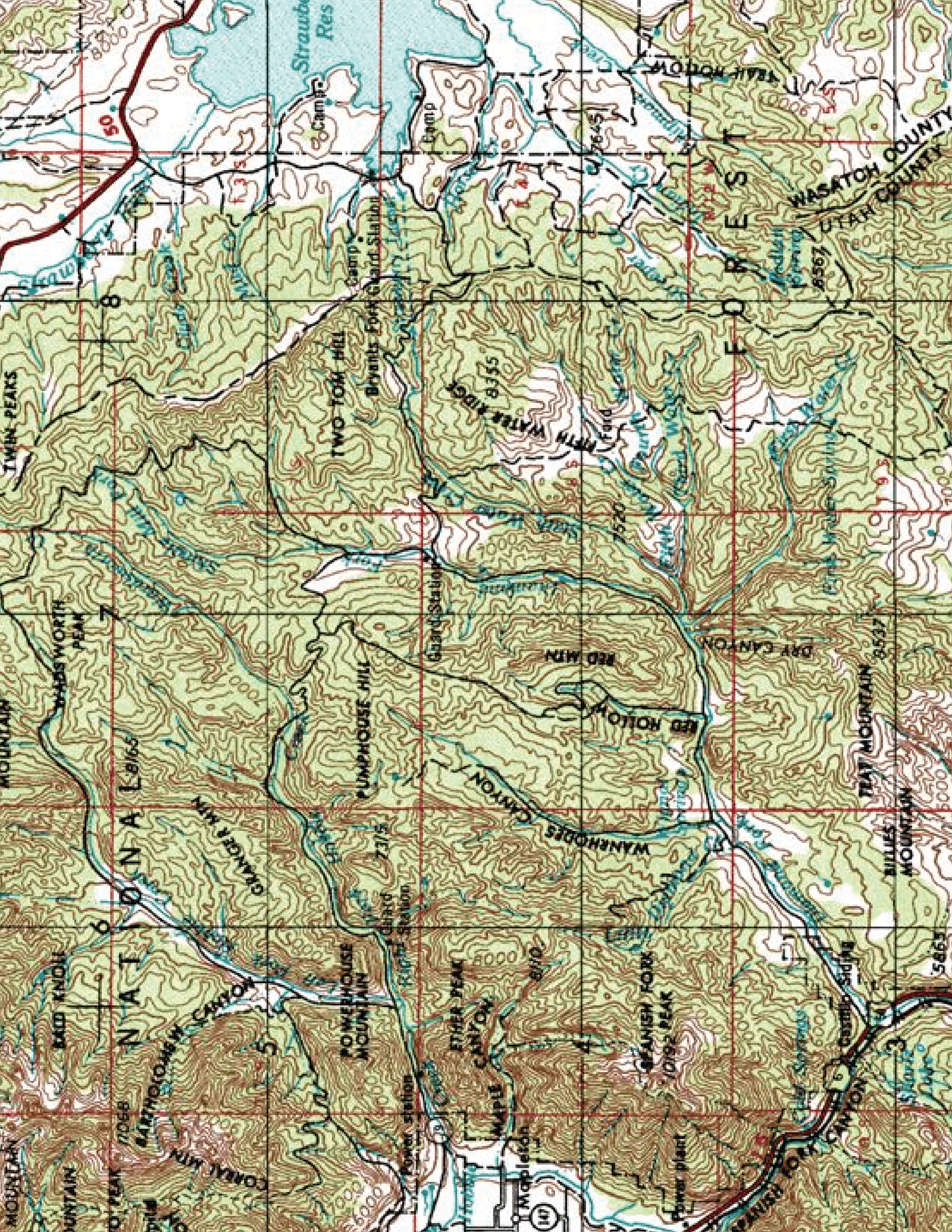
1.0 INTRODUCTION

Diamond Fork Creek and its tributary Sixth Water Creek are part of the Spanish Fork River Watershed (Figure 1.1). Between 1916 and 2004 these streams conveyed water diverted from Strawberry Reservoir in the Uinta Basin to the Wasatch Front. This trans-basin diversion increased peak flows in Diamond Fork Creek and Sixth Water Creek, severely impacted the stream channel and aquatic ecosystem, and created unique conditions that allowed the rare orchid, Ute ladies'-tresses (*Spiranthes diluvialis*) (ULT), to flourish and become the largest known population along the Wasatch Front. The ULT was listed as a threatened species on January 17, 1992 (USFWS 1992).

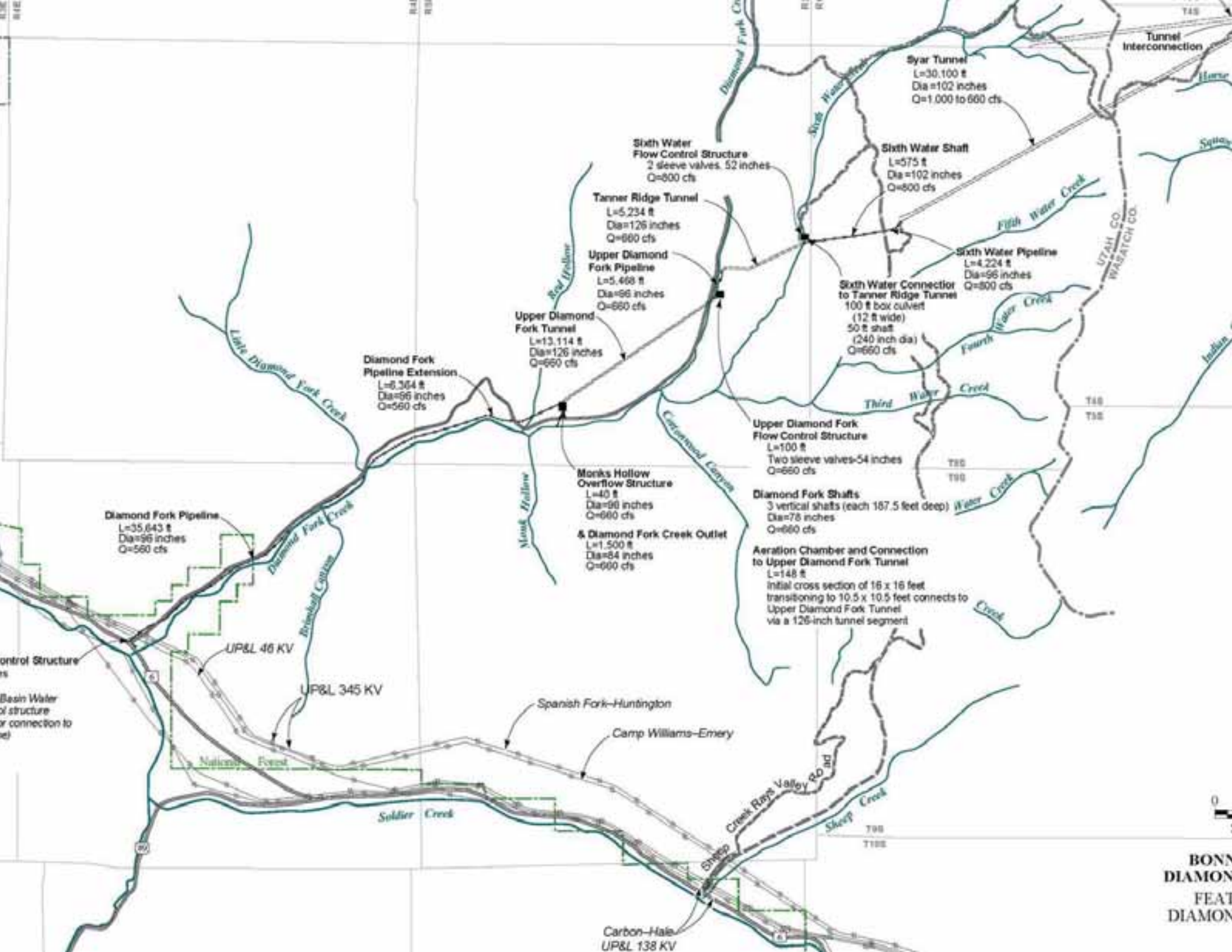
Currently, the Bonneville Unit's Diamond Fork System, completed in 2004, pipes water imported from Strawberry Reservoir directly into Spanish Fork River (Figure 1.2) and, with the exception of minimum instream flow, this imported water completely bypasses Sixth Water Creek and Diamond Fork Creek (USBOR 2005). Effects of this hydrologic change on ULT populations are largely unknown. The distribution of riparian plant species is largely driven by hydrologic and soil variables, and riparian plant communities frequently occur in relatively distinct zones along streamside elevational and soil textural gradients (Dwire et al. 2006). Vegetation zones within the riparian corridor vary in maturity due to flooding regimes and elevation. Mature sections of the corridor are composed of narrowleaf cottonwood (*Populus angustifolia*) galleries, boxelder (*Acer negundo*) with an under story of willow species, grasses, and forbs. Vegetation zones in higher elevations include common snowberry (*Symphoricarpos albus*), river birch (*Betula nigra*), and skunkbush (*Rhus trilobata*). Areas that are more regularly or newly disturbed are colonized with young willows, grasses, and forbs, and these areas support ULT populations. Previously high flows in Diamond Fork Creek deposited large amounts of sand and gravel, and produced hydrological conditions and disturbance cycles favorable for supporting unusually large ULT populations.

The Utah Reclamation Mitigation and Conservation Commission (Mitigation Commission) initiated a long-term monitoring project, in conjunction with State and Federal agencies, in order to monitor stream channel and riparian vegetation response to the altered flow regime, address aquatic and riparian habitat restoration needs, and monitor changes within ULT colonies. This report documents the results of the riparian vegetation and ULT data collection and analysis conducted in 2006. The report is organized by topic, starting with an overall introduction and project description. This introduction is followed by chapters describing the monitoring methods and results in the following order: Chapter 2-Riparian Vegetation Community Mapping, Chapter 3-Riparian Vegetation Cross Section Transects, Chapter 4-ULT Surveys, Chapter 5-ULT Habitat Analysis and Piezometer Measurements, and Chapter 6-Discussion.

Chapter 2 details the survey methods used to map vegetative communities along Sixth Water Creek and Diamond Fork Creek from the Strawberry Tunnel to the confluence of the Spanish Fork River. The riparian vegetation map is intended to provide a post-construction "base map" of vegetation communities along the streams affected by the Diamond Fork System. Chapter 3 discusses methods and results of transects used to monitor the lateral extent and compositional changes of vegetation along the stream channels in response to altered hydrology. Chapter 4 describes methods, results, and discussion of ULT surveys including a discussion of previous and current population estimates. Chapter 5 discusses methods and results of ULT habitat analysis and results of piezometer



Strawberry Res
Camp
WASATCH COUNTY
UTAH COUNTY
FOREST
NATIONAL
TWIN PEAKS
TWO TOM HILL
Bryants Fork Guard Station
FIFTH WATER RIDGE
8355
WADSWORTH PEAK
MOUNTAIN
8165
RED MTN
RED HOLLOW
DRY CANYON
Guard Station
PUMPHOUSE HILL
WANRHODES CANYON
GRANGER MTN
TEAT MOUNTAIN
BILLIES MOUNTAIN
BALD KNOLL
BARTHOLOMEW CANYON
POWERHOUSE MOUNTAIN
ETHER PEAK
MAPLE CANYON
SPANISH FORK PEAK
10192
CORRAL MTN
Power station
Power plant
Mapleton
Castilla
SPANISH FORK CANYON
50


Tunnel Interconnection
Syar Tunnel
L=30,100 ft
Dia=102 inches
Q=1,000 to 660 cfs
Sixth Water Flow Control Structure
2 sleeve valves, 52 inches
Q=800 cfs
Sixth Water Shaft
L=575 ft
Dia=102 inches
Q=800 cfs
Tanner Ridge Tunnel
L=5,234 ft
Dia=126 inches
Q=660 cfs
Upper Diamond Fork Pipeline
L=5,468 ft
Dia=96 inches
Q=660 cfs
Sixth Water Pipeline
L=4,224 ft
Dia=96 inches
Q=800 cfs
Sixth Water Connection to Tanner Ridge Tunnel
100 ft box culvert
(12 ft wide)
50 ft shaft
(240 inch dia)
Q=660 cfs
Upper Diamond Fork Tunnel
L=13,114 ft
Dia=126 inches
Q=660 cfs
Diamond Fork Pipeline Extension
L=6,364 ft
Dia=96 inches
Q=560 cfs
Upper Diamond Fork Flow Control Structure
L=100 ft
Two sleeve valves-54 inches
Q=660 cfs
Monks Hollow Overflow Structure
L=40 ft
Dia=96 inches
Q=660 cfs
& Diamond Fork Creek Outlet
L=1,500 ft
Dia=84 inches
Q=660 cfs
Diamond Fork Shafts
3 vertical shafts (each 187.5 feet deep)
Dia=78 inches
Q=660 cfs
Aeration Chamber and Connection to Upper Diamond Fork Tunnel
L=148 ft
Initial cross section of 16 x 16 feet
transitioning to 10.5 x 10.5 feet connects to
Upper Diamond Fork Tunnel
via a 126-inch tunnel segment
Diamond Fork Pipeline
L=35,643 ft
Dia=96 inches
Q=560 cfs
UP&L 46 KV
UP&L 345 KV
Spanish Fork–Huntington
Camp Williams–Emery
Carbon–Hale
UP&L 138 KV
Diamond Fork Creek
Little Diamond Fork Creek
Red Hollow
Monk Hollow
Cattleguard Canyon
Broadhead Canyon
Fifth Water Creek
Fourth Water Creek
Third Water Creek
Water Creek
Soldier Creek
Sheep Creek
Rays Valley Road
National Forest
UTAH CO.
WASATCH CO.
T4S
T5S
T6S
T7S
T8S
T9S
T10S

measurements and including a discussion on the connection between ground water and surface water elevations. The report concludes with Chapter 6, which presents a discussion of results, summary of findings, and recommendations for the next monitoring session.

1.1 WATERSHED DESCRIPTION

The Diamond Fork Creek Watershed, including its tributaries, covers over 150 square miles and is the largest headwater tributary of the Spanish Fork River (Mitigation Commission 2005). The streams are initiated just west of Strawberry Reservoir, and the streams in the upper portions of the watershed are initially high-gradient, confined, canyon-type streams until they reach the wider alluvial valley closer to the confluence with Spanish Fork River. Diamond Fork and Sixth Water Creeks were used as early as 1916 to divert water to the Spanish Fork River from Strawberry Reservoir through Strawberry Tunnel in order to support irrigation needs in the lower watershed area and Utah County (Mitigation Commission 2005a). These streams carried a significant amount of imported water during the irrigation season, creating artificially high flows for an extended duration, causing significant changes in the sediment-transport regime, and affecting channel dimensions, pattern, profile, as well as its interaction with the floodplain. These morphological impacts to the channel and floodplain have in turn affected water quality and the types and extent of riparian and wetland vegetation and aquatic communities. Historically, the watershed was used for agriculture, timber harvesting, livestock grazing, and recreation. Portions of the watershed are still used for agriculture and grazing. Some of the watershed is part of the Uinta National Forest and managed by the U.S. Forest Service. Recently, Diamond Fork Creek has become a popular recreation area. The watershed has many recreational uses including both motorized and non-motorized activities.

1.2 HISTORY OF THE COLORADO RIVER STORAGE PROJECT ACT (CRSP), CENTRAL UTAH PROJECT (CUP), AND CENTRAL UTAH PROJECT COMPLETION ACT (CUPCA)

The Diamond Fork System is a series of tunnels and pipelines that transport water from Strawberry Reservoir in the Colorado River Basin to Spanish Fork River in the Bonneville Basin. This system is a part of the Bonneville Unit of the Central Utah Project (CUP), which develops the portion of flow from the Upper Colorado River System allocated to Utah under various interstate compacts. The CUP was authorized by Congress in 1956 through the Colorado River Storage Project Act (CRSP) of 1956 (43 U.S.C. Sec 620 et seq.). The Bonneville Unit is the largest unit of the CUP (USBOR 2005). This system of reservoirs, aqueducts, pipelines, pumping plants, and conveyance facilities enables trans-basin water diversion to occur between the Colorado River Basin (Uinta Mountains) and the Bonneville Basin. The Central Utah Water Conservation District (CUWCD) manages this water, which is allocated to municipal and industrial uses, irrigation, and instream flows for areas in Utah. Other systems in the Bonneville Unit include the Starvation Collection System, the Strawberry Aqueduct and Collection System (SACS), the Municipal and Industrial System, and the Utah Lake System.

Before the present-day Diamond Fork System was completed, imported water went directly into Sixth Water Creek. Strawberry Tunnel transported water from Strawberry Reservoir into Sixth Water Creek, a tributary to Diamond Fork Creek. The water from Strawberry Reservoir eventually reached Spanish Fork River via Diamond Fork Creek. In 1990 the Syar Tunnel was constructed to replace Strawberry Tunnel. By 1996 water from Syar Tunnel flowed through the Sixth Water Aqueduct and entered Sixth Water Creek 6 miles farther downstream than it had when Strawberry Tunnel was the primary flow conveyance. Strawberry Tunnel is now used to convey minimum instream flows to the head of Sixth Water Creek (USBOR 2005).

In 1992 Congress passed the Central Utah Project Completion Act (CUPCA) (Title II through VI of Public Law 102-575), which authorized further construction to complete the Bonneville Unit of the CUP started in 1966. The CUPCA also mandated several modifications to the original design of the Bonneville Unit. Modifications to the Diamond Fork System consisted of constructing the Diamond Fork Pipeline to carry flow from Monks Hollow to Spanish Fork River in place of constructing the proposed Monks Hollow Dam. The legislation also established a minimum instream flow requirement. Currently, this requirement is 25-30 cubic feet per second (cfs) for Sixth Water Creek and 60-80 cfs for Diamond Fork Creek.

Under CUPCA in 1996, construction began on the Diamond Fork Pipeline, also known as Phase 1 of the Diamond Fork System of the CUP. This phase was completed in 1997 (Mitigation Commission 2000). Construction on Phase 2, the Diamond Fork Tunnel Alternative, was started in 2000 and completed in 2004. The Diamond Fork Tunnel Alternative is a pipeline and tunnel system that carries water from Syar Tunnel to the Diamond Fork Pipeline. Completing construction of Phase 1 and Phase 2 of the Diamond Fork System effectively removed all flow imports from Strawberry Reservoir to Sixth Water Creek and Diamond Fork Creek, except minimum instream flows.

The CUPCA also established the Mitigation Commission, a Federal agency responsible for mitigating impacts on fish, wildlife, and related recreation resources that resulted from construction of the Bonneville Unit. Congress also established standards for the Mitigation Commission to follow when coordinating and implementing plans for mitigation projects. The overall mitigation commitments concerning Sixth Water Creek and Diamond Fork Creek are monitoring ULT after completion of the Diamond Fork System, supporting the June Sucker Recovery Program, and monitoring stream channel responses to altered flow regimes following completion of the Diamond Fork System.

1.3 IMPACTS TO THE DIAMOND FORK SYSTEM

Prior to completion of the Diamond Fork System, trans-basin imports from Strawberry Reservoir increased peak flow in both Sixth Water Creek and Diamond Fork Creek, particularly during periods of high irrigation demand. These artificially high flows caused the channels to scour in order to accommodate higher and longer duration peak flows. The changes in stream geomorphology and flow regime resulted in “severely limited fish production, loss of soils, loss of riparian and wetland habitat, and reduced recreation experiences” (Mitigation Commission 2005).

Before it was used to transport water from Strawberry Reservoir, Diamond Fork Creek was most likely a single-thread, meandering channel with minor backwaters and an active floodplain estimated to be about 200-300 feet wide (Mitigation Commission 2005) from the mouth to Brimhall Canyon. Runoff was largely controlled by spring snowmelt, with peak flow occurring in mid May. Flows returned to baseflow by late June with periodic, short-term increases in flow caused by storms. Gage station data show annual peak flows before 1915 at 250 cfs near Brimhall Canyon and 200 cfs near Red Hollow.

Using the streams to convey imported water resulted in changes in magnitude, duration, and timing of peak flows, which in turn caused major changes to the geomorphology and adjacent riparian areas in both Sixth Water and Diamond Fork Creeks. From 1915 until 2004, the annual hydrographs of Sixth Water Creek and Diamond Fork Creek were dominated by the releases from Strawberry Reservoir. Peak flows were approximately 450 cfs sustained for the duration of irrigation season, which lasted approximately 140 days (Mitigation Commission 2005). In Sixth Water Creek, bank erosion occurred and the channel incised an average of 12 to 15 feet. Compared with 1939 conditions, parts of Diamond Fork Creek have become much wider, straighter, and steeper, particularly in the lower 3 miles (Mitigation Commission 2005). Diamond Fork Creek incised an average of 2 to 4 feet where the channel is confined. In areas where the valley is wide, the channel became braided and unstable.

Removal of most of the riparian forest for agriculture in the early 1900s compounded the impacts of increased flow on the channel and riparian areas. Rapid lateral migration of the stream channel, estimated at 40 to 60 feet per year, further impacted the existing riparian forest. High summer flows altered riparian and wetland communities by increasing the duration and extent of floodplain inundation as well as artificially increasing ground water elevations. However, now that the channel is so wide, increased flows do not increase water elevations as much as the extent of innundation. Currently, the water spreads more than it rises and lowers in response to changes in flow.

A plant species of particular concern is the ULT, which is listed as threatened by the Federal government. According to recent surveys, populations of this orchid were not documented in the Diamond Fork Watershed until 1992. The Diamond Fork Watershed populations are thought to contain about 95 percent of all individuals known to occur along the Wasatch Front. The species grows in moist areas, particularly near springs and perennial streams. The plants occur primarily within the 2- to 10-year floodplain and seem to be adapted to areas disturbed by channel migration or other sources of disturbance in the floodplain. Much of current habitat for ULT in the Diamond Fork Watershed seems to have developed in areas where lateral stream migration is occurring and willows, cottonwoods, and other types of riparian vegetation have been flooded out during growing seasons. It is possible that impacts from substantially increased flows in Sixth Water Creek and Diamond Fork Creek have created conditions that are favorable for ULT establishment (Mitigation Commission 2005).

Impacts have also occurred because of Diamond Fork Tunnel Alternative construction activities. During the construction of Phase 2, an unexpected source of hydrogen sulfide-laden water began flooding the original tunnel. This tunnel was closed and abandoned. A new tunnel with an alternative design route was constructed to complete Phase 2. The hydrogen sulfide associated with drilling of the original tunnel continues to leak into Diamond Fork Creek upstream of Three Forks, causing some water quality impacts that could affect fish and aquatic habitat. The additional

hydrogen-sulfide inputs are not known to affect any ULT colonies. Other impacts related to construction of the pipeline have been mitigated with varying amounts of stream restoration and riparian area restoration.

1.4 VEGETATION ISSUES

Hydrologic flow regime is the major factor governing physical and biotic processes and aquatic and riparian biota in stream-riparian corridors (Poff et al. 1997, Tabacchi et al. 1998). The decreased flow in Diamond Fork Creek affects the dynamics of vegetation communities and species composition, altering disturbance cycles and geomorphology. Riparian areas are especially prone to establishment of exotic species because of fertile soil, water availability, and seed dissemination via water and animals including livestock and wildlife that heavily use and rely on riparian areas. Because of previously high disturbance rates, hydrological changes, and historical land use practices, many introduced plant species are beginning to establish in previously disturbed and drying areas. An exotic species of particular concern within ULT habitat is Canada thistle (*Cirsium arvense*) and bull thistle (*Cirsium vulgare*). These species have been found throughout the survey area within ULT habitat. Also found within areas surveyed were a small number of saltcedar (*Tamarix ramosissima*) and Russian olive (*Elaeagnus angustifolia*). Given the invasive nature of these species and their possible impacts on riparian communities, they are a particular threat to the health of the Diamond Fork Watershed riparian ecosystem.

As the amount of hydrological disturbance is reduced, plant communities have been adapting to adjusted flows and early successional species—such as grasses, forbs, and young willows—are replaced with mature woody species like coyote willow (*Salix exigua*), Booth's willow (*Salix boothii*), shining willow (*Salix lucida*), river birch (*Betula occidentalis*), boxelder (*Acer negundo*), and narrowleaf cottonwood (*Populus angustifolia*). The ULT primarily occur in areas where the vegetation is relatively open and not overly dense or overgrown (Coyner 1989). The ULT's preference for open vegetative comminutes is also observed within the Diamond Fork Watershed, where few to no ULT individuals are found under dense willow or poplar canopies.

Habitat once ideal for ULT colonization prior to creation of the Diamond Fork System (2004) may now be too dry to support populations. The ULT require moist soil throughout the growing season. The altered hydrology from the Diamond Fork System may effect population numbers and/or survival of individual colonies. There is concern that reduced flow in Diamond Fork Creek may result in the reduction in size and or occurrences of suitable habitat and possibly the loss of existing ULT colonies within the watershed. However, there are many lower surfaces along Diamond Fork Creek that were wetter and/or seasonally inundated with water that now, with implementation of the Diamond Fork System, may be potential ULT habitat.

1.5 UTE LADIES'-TRESSES (ULT) ALONG DIAMOND FORK CREEK

The ULT species is a small terrestrial, insect-pollinated orchid (Sipes and Tepedino 1995) found in wet meadows, abandoned oxbow meanders, marshes, raised bogs, and along streambanks at 4,500 to 6,900 feet (Welsh et al. 2003). Scattered populations are found throughout the west-central United States (Dressler 1981, Heidel 1997, Hildebrand 1998) including the currently known range of Idaho, Montana, Nebraska, Washington, Wyoming, Utah, Nevada, and Colorado (Fertig et al. 2005). In

1992 the ULT orchid was listed as a Federally threatened species because of relatively low population numbers, fluctuations in monitored population size, and loss of the species' riparian habitat through urban development, stream channelization, recreational development, and exotic species invasion (USFWS 1992). Historical accounts and herbarium records indicate that ULT were once much more common than its present range (Coyner 1990, Jennings 1990, Coyner 1991). Unique conditions exist along Diamond Fork Creek, created by manipulated water regimes and hydrological and geomorphological impacts, that create an ideal ecosystem for ULT populations.

The bloom period for the ULT populations in the Diamond Fork Watershed occurs in late summer, generally mid August through early September, although the bloom period may come as early as late July or last through late September depending on climate and elevation. Because ULT reproductive biology requires pollinators as well as nutrients, water, and sunlight, pollinators become an important element in the preservation of this and other rare species. The most likely cause of the decrease in ULT population abundance seems to be disturbance and fragmentation of riparian habitat (Coyner 1990), which may be related to a decrease in visiting pollinators. Rare plants may suffer depressed reproduction if they occur in small or sparse populations due to lack of mates and/or pollinator visits (Levin 1972; Feinsinger et al. 1986; Kunin 1992, 1993). In addition, the introduction of exotic species that have similar bloom periods and thus compete for pollinators may be causing further impacts. Monitoring and maintenance of large ULT populations, such as those occurring in the Diamond Fork Watershed, are important to maintain genetic variation and survival within the species.

1.6 PREVIOUS STUDIES OF UTE LADIES'-TRESSES (ULT) IN THE DIAMOND FORK WATERSHED

Prior to 2006, the ULT populations in Diamond Fork Watershed were monitored by HDR Engineering, Inc. (HDR). Surveys were conducted by HDR on surfaces known to support ULT populations from 1992 to 2005, and flowering ULT individuals were counted. During the 2005 monitoring period, efforts were made to monitor flowering individuals in known and potentially occupied sites, estimate the ratio of flowering to non-flowering individuals along transects, and conduct habitat analyses at known occupied surfaces, and evaluate the relationship between surface and ground water elevations. Although methods were established in 2005, implementation of those monitoring methods was incomplete and much of the data collection and analysis was inadequate to identify trends, associations, and management practices required to successfully monitor and manage this unique ecosystem and its associated plant community. Comparisons were made with previous data collected by HDR and BIO-WEST during the 2006 monitoring period when possible, primarily to identify coarse vegetation trends (Black and Gruwell 2005).

1.7 PURPOSE OF AND NEED FOR MONITORING

Mitigating impacts resulting from adjustments of the Diamond Fork System is required under CUPCA (1992). The Mitigation Commission has committed to several general areas of mitigation: (1) monitoring leatherside chub (*Gila copei*) populations, (2) monitoring water quality and stream

channel responses to altered flow regimes; and (3) monitoring ULT colonies and riparian vegetation in response to altered flow regimes following the completion of the Diamond Fork System.

As adjustments are made to the Diamond Fork System, effects to riparian vegetation communities, and specifically ULT populations, should be monitored. Riparian ecosystems are unusually complex, dynamic, and diverse (Sharitz et al. 1992), making these systems key for the preservation of biodiversity (Naimen et al. 1993). Monitoring and maintaining ULT populations located along Diamond Fork Creek are important for the preservation and genetic diversity of the species. The purpose and priorities of monitoring riparian vegetation communities along Sixth Water and Diamond Fork Creeks, including continued ULT surveys, are as follows:

1. Map vegetation along the entire length of Sixth Water Creek and Diamond Fork Creek to quantify baseline conditions after construction of the Diamond Fork System.

2. Measure the lateral extent of riparian vegetation communities during cross-section surveys to accurately map changes to their composition and structure as flows decrease from historically altered high flows.

3. Acquire data to accurately monitor changes over time of occupied, potentially occupied, and non-occupied habitat types, and classify plant communities found within ULT known and potentially occupied sites.

4. Continue ULT surveys of known and potentially occupied sites to monitor changes in ULT colonies and associated vegetation communities as hydrologic and geomorphic conditions change in response to the new Diamond Fork System.

5. Use best available scientific knowledge to ensure that the Mitigation Commission meets commitments to Sixth Water Creek and Diamond Fork Creek as set forth under CUPCA (1992).

1.8 SCOPE OF WORK FOR RIPARIAN VEGETATION MONITORING

The purpose of this monitoring is to establish a baseline that can be used to evaluate changes in riparian vegetation communities along Sixth Water Creek and Diamond Fork Creek, and continue ULT surveys at known and potentially occupied sites. The overall 2006 study area included the entire length of Sixth Water Creek and Diamond Fork Creek. These studies are a continuation of previous surveys conducted by HDR Engineering, Inc. and include adjustments incorporated into survey methods to streamline the ULT surveys and ensure a higher degree of precision and repeatability for surveys conducted in following years.

CHAPTER 2: RIPARIAN VEGETATION COMMUNITY MAPPING

2.0 RIPARIAN VEGETATION COMMUNITY MAPPING

2.1 INTRODUCTION

Riparian systems are transition zones between land and water ecosystems (Nilsson et al. 2002), making them especially sensitive to changes in hydrology. Natural riparian ecosystems include a variety of vegetation community types, depending on climate, topography, geology, hydrology, etc. (Stanford et al. 1996, Hughes 1997). The Diamond Fork System of the Bonneville Unit, which was completed in 2004, pipes water imported from Strawberry Reservoir directly into Spanish Fork River and, with the exception of minimum instream flow, completely bypasses Sixth Water and Diamond Fork Creeks (USBOR 2005). Prior to 2004 water imported from Strawberry Reservoir was tunneled directly into Sixth Water and Diamond Fork Creeks, which markedly increased flow and changed the type and extent of vegetation communities in the riparian areas. To establish a baseline for riparian vegetation after Diamond Fork System construction, vegetation surveys were conducted along the entire lengths of Sixth Water and Diamond Fork Creeks.

2.2 METHODS

2.2.1 Vegetation Community Mapping

In 2006 riparian vegetation community surveys were conducted to establish a post Diamond Fork System pipeline baseline map. Vegetation communities were delineated in the field using available natural color aerial imagery (NAIP 2004). Boundaries were placed where obvious demarcations between communities were found. Species composition provide indications for overall health and vigor of the riparian system.

Analyses of vegetation communities were divided into distinct geomorphic reaches of Sixth Water and Diamond Fork Creeks. The following geomorphic reaches were used in this analysis: (1) Strawberry Tunnel to Syar Tunnel (Upper Sixth Water), (2) Syar Tunnel to Fifth Water (Middle Sixth Water), (3) Fifth Water to Three Forks (confluence with Diamond Fork) (Lower Sixth Water), (4) Three Forks to Monks Hollow (Upper Diamond Fork), (5) Monks Hollow to Brimhall Bridge (Middle Diamond Fork), and (6) Brimhall Bridge to Spanish Fork River (Lower Diamond Fork).

2.2.2 Vegetation Community Classifications

Vegetation community boundaries were drawn in the field directly onto the aerial imagery printed at 1inch = 100 feet scale, and species composition was recorded for all species that comprised 20 percent or more of the vegetation community. Each of the polygons mapped area was classified as either a vegetation community or other cover type. The vegetation community classification follows the National Vegetation Classification for Utah, which is based on the National Vegetation Classification Standard and the Standardized National Vegetation Classification System (SNVCS) (USDI 1994). Two levels of vegetation community classification were used for this project, the alliance and the association. “The alliance is a physiognomically uniform group of plant associations sharing one or more diagnostic species (dominant, differential, indicator, or character), which, as a rule, are found in the uppermost strata of the vegetation” (USDI 1994). The association level is more

specific and is usually found as a repeating landscape pattern within areas of an alliance. The SNVCS description of this level of classification is rather obtuse, but it is also tolerant and inclusive in its use. To summarize the SNVCS: The association is a finer stratification of the plant community based on more detailed vegetative data. More information on plants in the different strata such as the canopy, ground cover, or shrub layers of a forest may separate various associations within an alliance. Environmental information may also be used to separate associations, especially in wetlands. This information could include substrate or soil types, length of inundation, salinity, and alkalinity.

The names of alliances and associations are similar. Alliances, however, are most often named for the dominant or set (usually two) of codomninant species. The species are then combined with environmental descriptors and the physiognomic or plant structural type. Examples include:

1. *Allenrolfea occidentalis* Shrubland Alliance

2. *Typha* (*angustifolia, latifolia*) - (*Schoenoplectus* spp.) Semipermanently Flooded Herbaceous Alliance

3. *Elaeagnus angustifolia* Semi-natural Woodland Alliance

Associations are often named for the dominant canopy or the tallest species and the dominant species in the ground layer or shrub layer. In many single-layer communities only a single species is used in the name or, as with alliances, codominant species are used in the name. As with alliances environmental features are sometimes used in the name of associations where the feature provide information that the dominant species alone would not. The physigonomic type is also usually used in the name of associations. Examples include:

- *Carex aquatilis* Herbaceous Vegetation Association

- *Carex nebrascensis* - *Carex microptera* Herbaceous Vegetation Association

- *Populus balsamifera* ssp. *trichocarpa* / Mixed Herbs Forest Association

Detailed descriptions of associations are found in the Natureserve Database (Natureserve 2006), which is the depository of vegetation community information for most state and national agencies and organizations, and follows the SNVCS (see above). Where our data did not match associations listed for Utah, associations for adjacent states (notably Colorado and Idaho), were used. These attributions to an association were based on our species composition data and environmental characteristics of each polygon.

2.3 RESULTS

2.3.1 Vegetation Community Mapping

A comprehensive species list of native species found in the study area is located in Appendix 2.1A, and a comprehensive species list of non-native species found in the study area is located in Appendix 2.1B. Vegetation community maps outlining association boundaries are included in Appendix 2.2. Each vegetation community type is classified by color and associated letter, and includes a surface number that references species and percentages within a specific polygon. These data serve as a baseline representation of the riparian corridor along Sixth Water and Diamond Fork Creeks in 2006, soon after the construction of the Diamond Fork System. Appendix 2.3 contains raw data collected for vegetation community mapping, which lists percent cover for individual species mapped within each associated polygon.

The results of the vegetation community mapping for Sixth Water and Diamond Fork Creeks show that riparian vegetation communities may be adjusting at different rates to more natural flows introduced after construction of the Diamond Fork System. The nature of the Lower Diamond Fork reach is such that vegetation communities may be more dynamic in response to lower flows. Some sites located within the Lower Diamond Fork reach appear to have become disconnected from the stream and recently dried out. As vegetation communities are adjusting to the altered flows of Diamond Fork Creek, areas are drying and the potential for nonindigenous, invasive species to establish increases. Canada thistle (*Cirsium arvense*) was found throughout the riparian corridor, occupying large areas that at one time may have been prime ULT habitat. Other species of concern found within drying areas include saltcedar (*Tamarisk ramosissima*) and Russian olive (*Elaeagnus angustifolia*), which are currently found in relatively low numbers within the riparian corridor.

2.3.2 Vegetation Community Acreage

The overall ecological context of the study area consists of vegetation communities dominated by narrowleaf cottonwood (*Populus angustifolia*), Fremont cottonwood (*Populus fremontii*), coyote willow (*Salix exigua*), Booth's willow (*Salix boothii*), boxelder (*Acer negundo*), and water birch (*Betula occidentalis*). Upland vegetation communities also occur within the riparian corridor due to channel incision and/or down cutting.

A baseline of riparian vegetative community boundaries, alliances, and associations was established along Sixth Water Creek and Diamond Fork Creek. Table 2.1 quantifies vegetation community acreage by reach. The riparian corridor along Sixth Water Creek reaches are dominated by narrowleaf cottonwood, coyote willow, boxelder, and water birch with a herbaceous under story comprised of redtop (*Agrostis gigantea*), Baltic rush (*Juncus balticus*), and Nebraska sedge (*Carex nebrascensis*). This reach also contains upland vegetation within the riparian corridor because the stream has down cut through bedrock leaving the historic riparian area drier and hydrologically disconnected from the channel. Upland species include Wyoming big sagebrush (*Artemisia tridentata*) and Utah serviceberry (*Amelanchier utahensis*). The Upper Diamond Fork reach is dominated by narrowleaf cottonwood and coyote willow; co-dominant species include boxelder, skunkbush sumac (*Rhus trilobata*), and bigtooth maple (*Acer grandidentatum*). Middle Diamond Fork is dominated by narrowleaf cottonwood and coyote willow. Lower Diamond Fork, beginning at

Table 2-1. Vegetation Community Acreage - Alliances and Associations by Reach.

REACH	NUMBER OF POLYGONS	ACRES	PERCENT
Upper Sixth Water			
AGROSTIS STOLONIFERA SEASONALLY FLOODED HERBACEOUS ALLIANCE			
Agrostis gigantea Herbaceous Vegetation	2	0.18	0.3
Alliance Total	2	0.18	0.3
ARTEMISIA TRIDENTATA SHRUBLAND ALLIANCE			
Artemisia tridentata (ssp. vaseyana, ssp. wyomingensis) - Amelanchier utahensis	3	1.61	2.6
Alliance Total	3	1.61	2.6
BETULA OCCIDENTALIS SEASONALLY FLOODED SHRUBLAND ALLIANCE			
Betula occidentalis Shrubland	3	2.21	3.5
Alliance Total	3	2.21	3.5
CAREX NEBRASCENSIS SEASONALLY FLOODED HERBACEOUS ALLIANCE			
Carex nebrascensis Herbaceous Vegetation	1	0.2	0.32
Alliance Total	1	0.2	0.32
JUNCUS BALTICUS SEASONALLY FLOODED HERBACEOUS ALLIANCE			
Juncus balticus Herbaceous Vegetation	1	0.2	0.32
Alliance Total	1	0.2	0.32
POPULUS ANGUSTIFOLIA TEMPORARILY FLOODED WOODLAND ALLIANCE			
Populus angustifolia - Acer negundo Woodland	1	0.51	0.81
Populus angustifolia / Betula occidentalis Woodland	7	8.39	13.4
Populus angustifolia / Salix (monticola, drummondiana, lucida) Woodland	2	2.13	3.4
Populus angustifolia / Salix exigua Woodland	15	15.45	24.6
Alliance Total	25	26.47	42.21
SALIX BOOTHII TEMPORARILY FLOODED SHRUBLAND ALLIANCE			
Salix boothii / Mesic Graminoids Shrubland	1	0.36	0.57
Alliance Total	1	0.36	0.57
SALIX (EXIGUA, INTERIOR) TEMPORARILY FLOODED SHRUBLAND ALLIANCE			
Salix exigua / Mesic Graminoids Shrubland	27	25.98	41.4
Salix exigua Temporarily Flooded Shrubland	5	4.43	7.1
Alliance Total	32	30.41	48.5
UNDESIGNATED ALLIANCE			
Mixed Wetland Forb Herbaceous Vegetation	2	1.07	1.7
Alliance Total	2	1.07	1.7
Reach Total	70	62.7	12.2

REACH	NUMBER OF POLYGONS	ACRES	PERCENT
Middle Sixth Water			
AGROSTIS STOLONIFERA SEASONALLY FLOODED HERBACEOUS ALLIANCE			
Agrostis gigantea Herbaceous Vegetation	1	0.07	0.64
Alliance Total	1	0.07	0.64
POPULUS ANGUSTIFOLIA TEMPORARILY FLOODED WOODLAND ALLIANCE			
Populus angustifolia - Acer negundo Woodland	1	0.78	7.0
Populus angustifolia / Betula occidentalis Woodland	3	3.32	30.0
Populus angustifolia / Salix (monticola, drummondiana, lucida) Woodland	1	1.21	11.0
Populus angustifolia / Salix exigua Woodland	3	5.4	49.0
Alliance Total	8	10.71	97.0
SALIX (EXIGUA, INTERIOR) TEMPORARILY FLOODED SHRUBLAND ALLIANCE			
Salix exigua / Mesic Graminoids Shrubland	1	0.22	2.0
Alliance Total	1	0.22	2.0
Reach Total	10	10.99	2.0
Lower Sixth Water			
ACER NEGUNDO TEMPORARILY FLOODED WOODLAND ALLIANCE			
Acer negundo / Salix exigua Woodland	1	0.15	71.4
Alliance Total	1	0.15	71.4
SALIX (EXIGUA, INTERIOR) TEMPORARILY FLOODED SHRUBLAND ALLIANCE			
Salix exigua Temporarily Flooded Shrubland	1	0.06	28.6
Alliance Total	1	0.06	28.6
Reach Total	2	0.21	0.04
Upper Diamond Fork			
ACER GRANDIDENTATUM MONTANE FOREST ALLIANCE			
Acer grandidentatum / Quercus gambelii Forest	1	0.31	0.9
Alliance Total	1	0.31	0.9
ACER NEGUNDO TEMPORARILY FLOODED WOODLAND ALLIANCE			
Acer negundo / Salix exigua Woodland	1	2.88	8.3
Alliance Total	1	2.88	8.3
POPULUS ANGUSTIFOLIA TEMPORARILY FLOODED WOODLAND ALLIANCE			
Populus angustifolia - Acer negundo Woodland	4	13.51	38.8
Populus angustifolia / Rhus trilobata Woodland	3	15.18	43.6
Populus angustifolia / Salix (monticola, drummondiana, lucida) Woodland	3	1.81	5.2
Populus angustifolia / Salix exigua Woodland	1	0.54	1.5
Alliance Total	11	31.05	89.1

REACH	NUMBER OF POLYGONS	ACRES	PERCENT
SALIX (EXIGUA, INTERIOR) TEMPORARILY FLOODED SHRUBLAND ALLIANCE			
Salix exigua / Mesic Forbs Shrubland	1	0.38	1.1
Salix exigua / Mesic Graminoids Shrubland	1	0.2	0.57
Alliance Total	2	0.58	1.67
Reach Total	15	34.83	6.7
Middle Diamond Fork			
POPULUS ANGUSTIFOLIA TEMPORARILY FLOODED WOODLAND			
Populus angustifolia - Acer negundo Woodland	2	4.66	12.24
Populus angustifolia / Betula occidentalis Woodland	1	0.46	1.2
Populus angustifolia / Rhus trilobata Woodland	8	27.4	71.7
Populus angustifolia / Salix (monticola, drummondiana, lucida) Woodland	1	0.71	1.8
Populus angustifolia / Salix exigua Woodland	2	2.33	6.1
Alliance Total	14	35.55	93.0
RHUS TRILOBATA INTERMITTENTLY FLOODED SHRUBLAND ALLIANCE			
Rhus trilobata Intermittently Flooded Shrubland	1	0.81	2.1
Alliance Total	1	0.81	2.1
SALIX (EXIGUA, INTERIOR) TEMPORARILY FLOODED SHRUBLAND ALLIANCE			
Salix exigua / Mesic Forbs Shrubland	1	0.4	1.04
Salix exigua Temporarily Flooded Shrubland	1	1.42	3.7
Alliance Total	2	1.82	4.74
Reach Total	17	38.18	7.4
Lower Diamond Fork			
BROMUS INERMIS SEMI-NATURAL HERBACEOUS ALLIANCE			
Bromus inermis Semi-natural Herbaceous Vegetation	8	110.28	29.9
Alliance Total	8	110.28	29.9
POPULUS ANGUSTIFOLIA TEMPORARILY FLOODED WOODLAND ALLIANCE			
Populus angustifolia - Acer negundo Woodland	4	16.25	4.4
Populus angustifolia / Rhus trilobata Woodland	6	7.93	2.2
Populus angustifolia / Salix (monticola, drummondiana, lucida) Woodland	18	73.59	19.9
Populus angustifolia / Salix exigua Woodland	18	33	8.95
Alliance Total	46	130.77	35.45
SALIX BOOTHII TEMPORARILY FLOODED SHRUBLAND ALLIANCE			
Salix boothii / Mesic Forbs Shrubland	3	5.46	1.5
Salix boothii / Mesic Graminoids Shrubland	1	3.95	1.07
Alliance Total	4	9.42	2.57

REACH	NUMBER OF POLYGONS	ACRES	PERCENT
SALIX (EXIGUA, INTERIOR) TEMPORARILY FLOODED SHRUBLAND ALLIANCE			
Salix exigua / Mesic Forbs Shrubland	21	47.9	12.9
Salix exigua / Mesic Graminoids Shrubland	15	30.93	8.4
Salix exigua Temporarily Flooded Shrubland	4	1.53	0.41
Alliance Total	40	80.36	21.71
TYPHA (ANGUSTIFOLIA, LATIFOLIA) - (SCHOENOPLECTUS SPP.) SEMIPERMANENTLY FLOODED ALLIANCE			
Typha latifolia Western Herbaceous Vegetation	2	8.88	2.4
Alliance Total	2	8.88	2.4
UNDESIGNATED ALLIANCE			
Open Water	1	5	1.35
Sparsely vegetated	1	23.89	6.5
Alliance Total	2	28.89	7.85
Reach Total	102	368.59	7.85
Grand Total	216	515.5	100.0

Brimhall Bridge and ending at the Spanish Fork River, is comprised of large galleries of narrowleaf cottonwood, coyote willow, and Booth's willow. Associations characterized by narrowleaf cottonwood make up 35 percent total acreage, and smooth brome (*Bromus inermis*) composes 29 percent. Along the upper elevations of the floodplain, semi-natural herbaceous species including smooth brome, redtop, and cheatgrass (*Bromus tectorum*) dominate these areas historically used as agricultural lands. The large galleries of cottonwood forests in Lower Diamond Fork are not necessarily characteristic of streams of this size. As vegetative communities adjust, the extent of cottonwood recruitment may be a good indicator of how reduced flows affect this association.

2.4 DISCUSSION

Because vegetation communities can take several growing seasons to adjust to changes in hydrology, annual mapping at this scale is not necessary. However, the most dramatic changes will occur during the first few years after the Diamond Fork System begins operation; vegetation mapping should be repeated every other year for four years (2008 and 2010), every 5 years for the next 10 years (2015 and 2020), and every 10 years thereafter. This mapping schedule should be sufficient to track large-scale changes within vegetation communities.

As vegetation communities adjust to lower flows, particular attention should be paid to non-native species whose potential as early successional components of disturbed systems could greatly affect the structure of native vegetation communities. It is recommended that a non-native vegetation inventory be conducted along the length of the Diamond Fork Creek and all associated drainages. Invasive and exotic species have been identified as a possible threat to ULT populations and habitat. The ULT and many non-native species are particularly adapted to disturbance regimes that historically occurred on Diamond Fork Creek. Because these species have similar habitat requirements, careful monitoring and treatment programs for non-native species are recommended for the study area.

CHAPTER 3: RIPARIAN VEGETATION TRANSECTS

3.0 RIPARIAN VEGETATION TRANSECTS

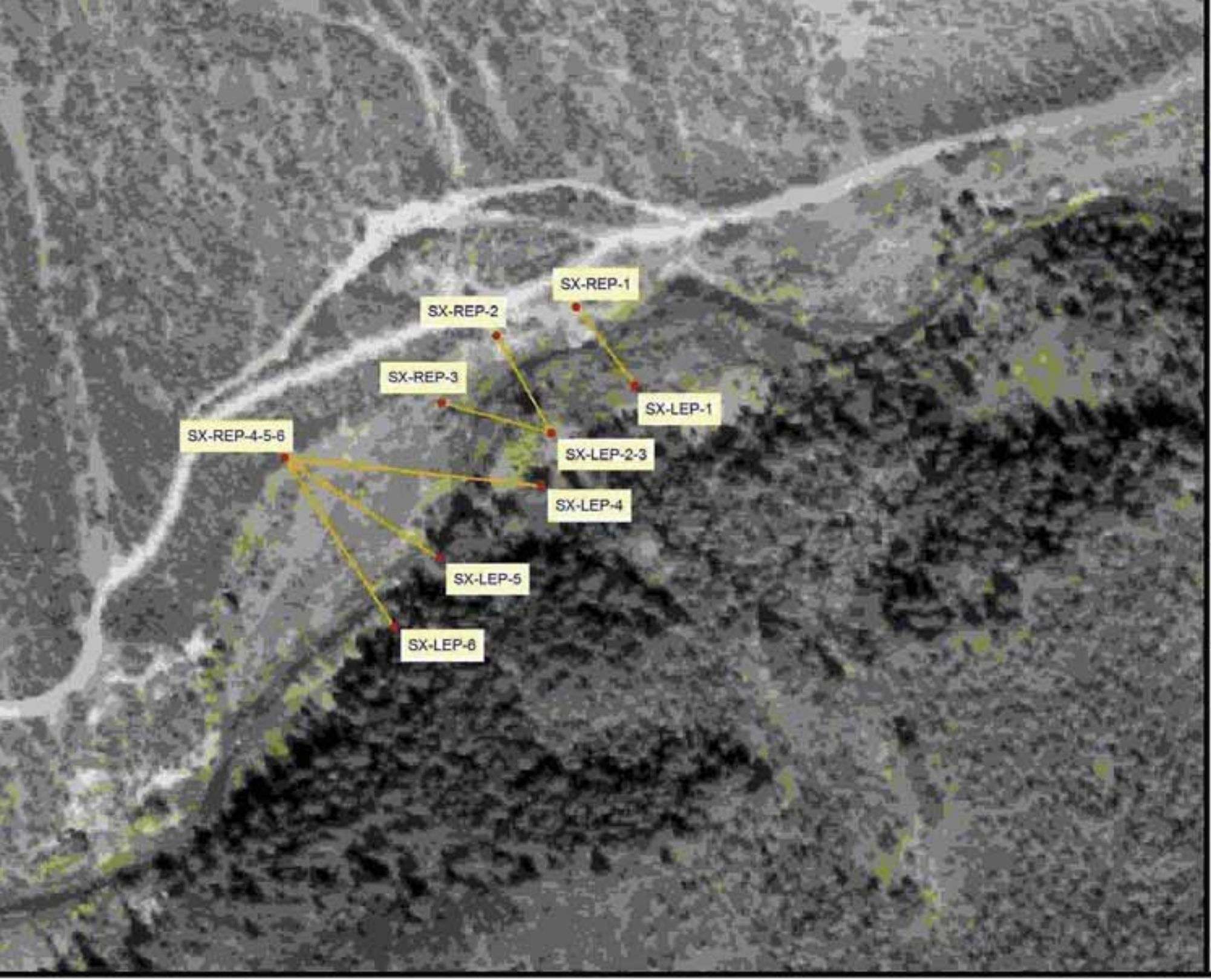
3.1 INTRODUCTION

In heavily altered systems, vegetation species composition, community structure, and successional processes can adjust to changes in the stream hydrology. Typical vegetative responses to altered flow and disturbance regimes include encroachment of the active stream channel, loss of vegetation species and diversity, and invasion within the riparian zone by non-native or invasive species. In an attempt to monitor the vegetation communities' response to changes in hydrology, this study was designed to establish a post Diamond Fork System baseline of the lateral extent of riparian vegetation. The goal of this study was to delineate the extent of plant species that dominate the vegetative communities along Diamond Fork and Sixth Water Creeks in order to eventually assess vegetation response to altered flow. Because the existing geomorphic transects (BIO-WEST 2006) were previously established in areas where potential changes in stream floodplain may occur and future surveys are planned for these transects. The same geomorphic transects were also used for vegetation monitoring. Transects were established in areas along Diamond Fork and Sixth Water Creeks that represent topographic reaches along the stream. Four sites were previously established for geomorphic monitoring: Sixth Water (SXW) (Figure 3.1a), Ray's Crossing (RC) (Figure 3.1b), Diamond Fork Campground (DFC) (Figure 3.1c), Mother (MO) (Figure 3.1d), and Oxbow (OX) (Figure 3.1e) (BIO-WEST 2006). A fifth vegetation transect site located immediately upstream of RC was established on Sixth Water in spring 2006. The RC site (Figure 3.1b) will be used primarily for vegetation transect monitoring, not for detailed geomorphic analyses. Field surveys of riparian vegetation were conducted between July and October 2006 to assess vegetation during the growing season for more accurate plant species identification and compositional estimates.

The transect vegetation community sampling methodology developed for this project reflects a compromise between the need to identify vegetation community types that are indicators of key physical processes and the realistic limitations of vegetation monitoring. The vegetation classification system used in this study is based on Monitoring the Vegetation Resources in Riparian Areas (Winward 2000) for vegetative and greenline sampling.

3.2 METHODS

Changes in riparian vegetation extent and condition since the construction of the Diamond Fork pipeline were assessed using cross-sectional transects of the riparian area. This study was designed to quantify the percent of vegetative community types along a cross section within geomorphic stream reaches. Data collected this year will serve as baseline information that, when compared with data collected in future years, can be used to estimate the lateral and compositional change within riparian communities that has occurred within each study site. Geomorphic/topographic features and vegetation were surveyed simultaneously along the transect line to reduce the amount of effort required for each study.



B W

BIO-WE
1063 W
Logan,
(435) 75

April 2

1

130 65

40 20

NV

ork Campground site 2006 vegetation transect map.

BIO-WEST
1063 West
Logan, UT
(435) 752-

April 200

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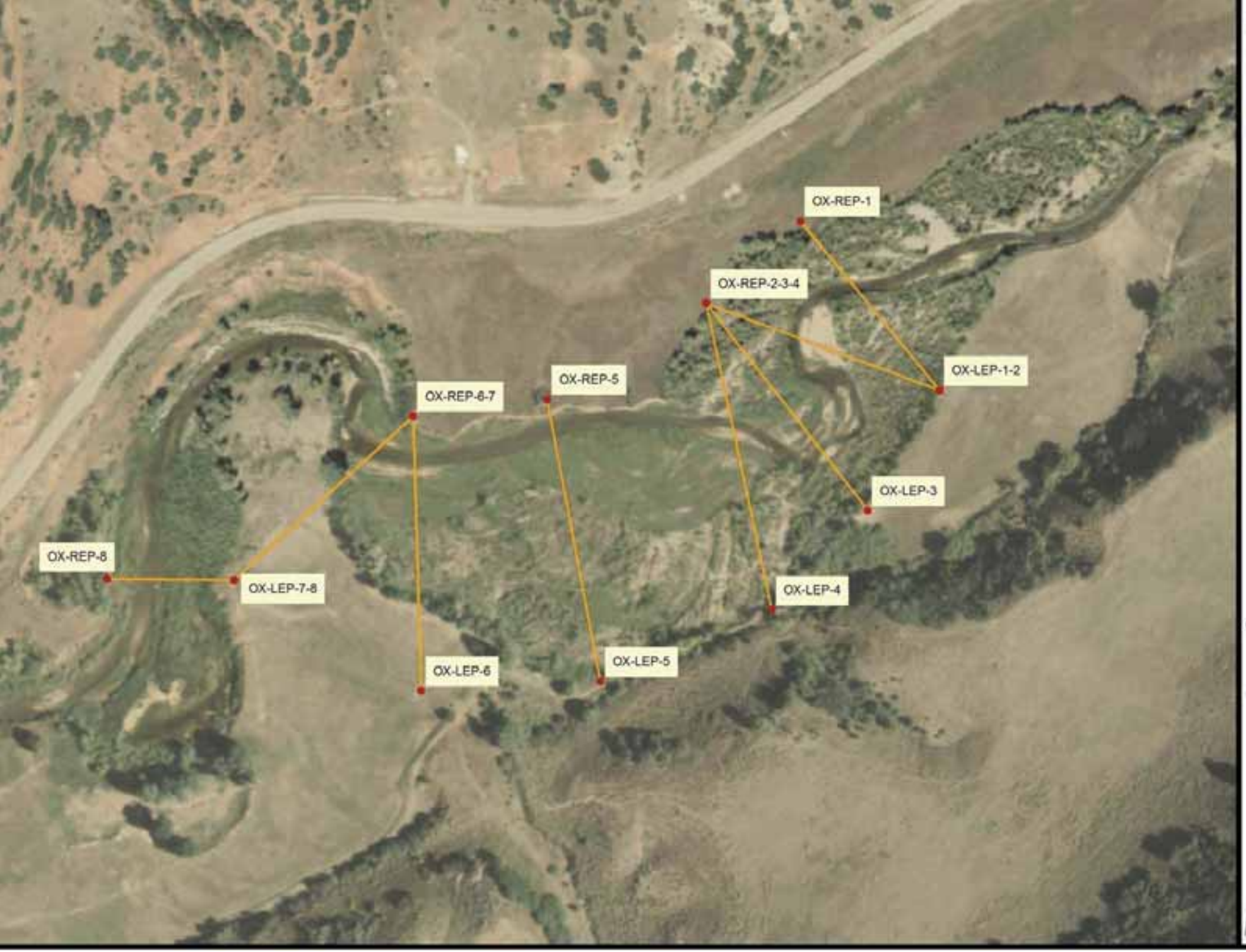
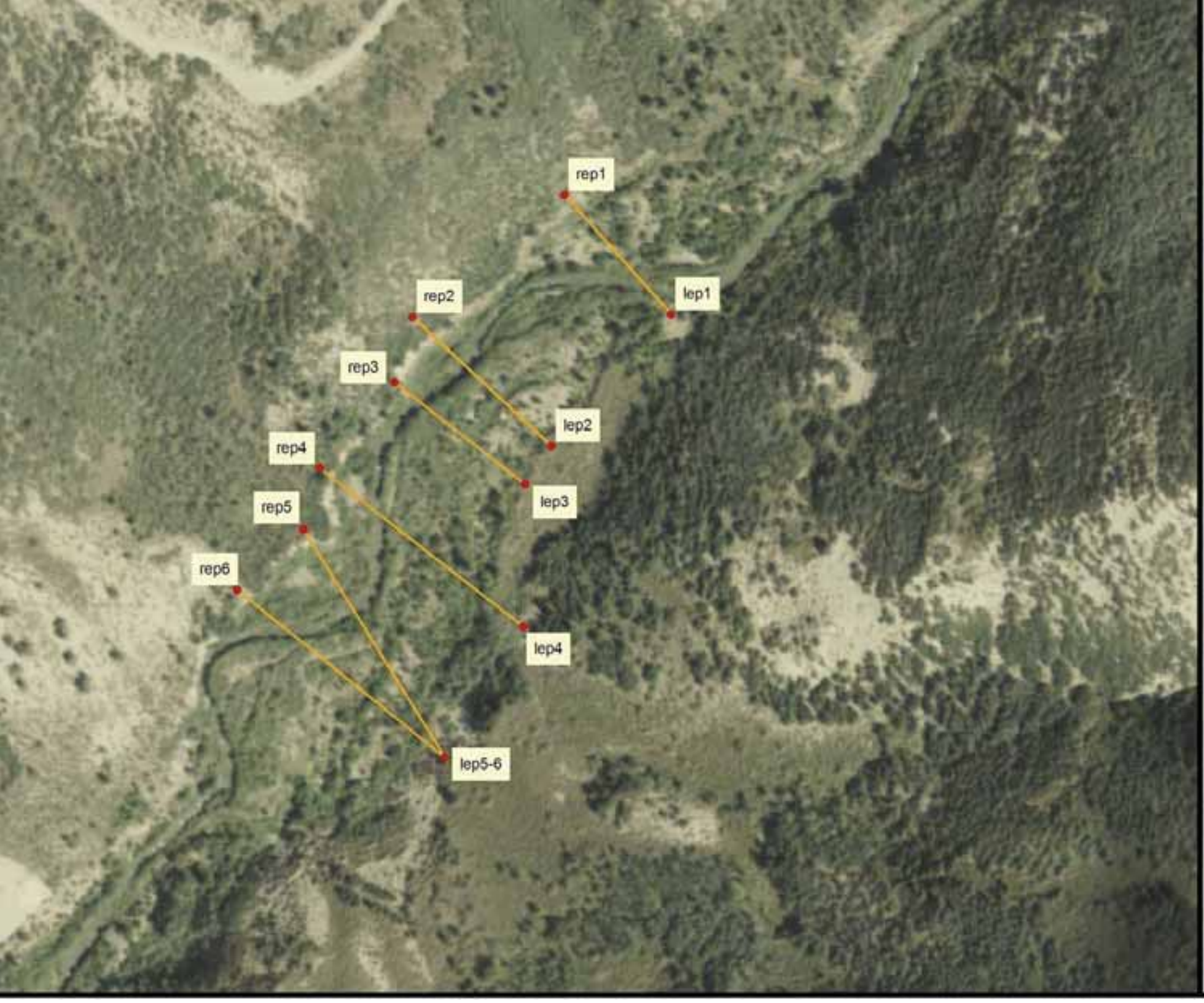
130 65

40 20

NV



2004 vegetation transect map



BIO-WEST
1063 West
Logan, UT
(435) 752-2

April 200

1:2,

130 65

40 20

3.2.1 Field Work

Each transect has a left endpoint (LEP) and right endpoint (REP) that consist of a labeled aluminum cap on a 3-foot Rebar stake with known coordinates (Appendix 3.1). Since geomorphic cross sections are traditionally plotted looking downstream, the LEP is the beginning of the transect and the REP is end. The total station instrument is set over one of these permanent endpoints. Survey laser on the total station (not tapes or taglines) is used to align the survey points and determine distances between the endpoints. The total station can keep the rod holder on line by using the opposite endpoint and directing the rod holder to the imaginary line between the REP and LEP. Since a total station is based on angles, the rod holder is at the transect if the total station angle is 0 degrees (Figure 3.2).

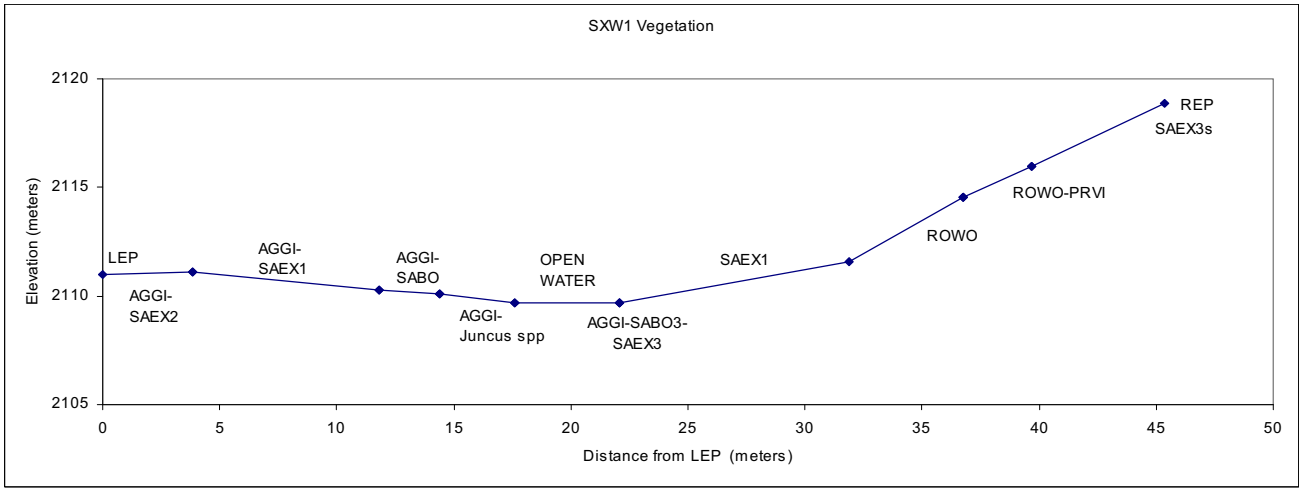


Figure 3.2. An example of a vegetation transect survey done with a total station. Each survey point marks the right endpoint of a vegetation community. Therefore, LEP to AGGI-SAEX2 is the distance covered by AGGI-SAEX2 (redtop and coyote willow mix).

If the rod holder is working from the LEP to the REP, each point represents the end of a vegetation segment. If, however, the rod person is walking the transect from the REP to the LEP, each vegetation point represents the start of a vegetation segment. Segments can be considered akin to a line crossing a vegetation polygon in which the polygon is a distinct grouping of a vegetation community.

Because the total station has limited characters available for a point description, the rod holder writes the description of the vegetation segment in a field notebook and correlates it with the point number from the total station. For example, cross-section MO 5 would be a unique data file in the total station datalogger. Within that file point 5 would be described as vegetation (veg). The rod holder, however, would note in the field book that point 5 occurred in willows and cottonwoods. Data would also be recorded for the height and density of the woody vegetation.

A code for species name, height, and density was developed for vegetation community descriptions. A height code—1, 2, and 3—was developed for woody species (Table 3.1). Average density was assumed unless an s (sparse) or d (dense) was added at the end of the species and height codes.

Table 3.1. Height codes for Diamond Fork vegetation transect surveys.

CODE	*POPULUS* (COTTONWOOD)	*SALIX* (WILLOW)
1	+25 feet	+6 feet
2	15-25 feet	4-6 feet
3	0-15 feet	0-4 feet

For example, the description "SAEX1sJUBAAGGI" would be translated as *Salix exigua*, height between 0 and 6 feet, sparse, with *Juncus arcticus* and *Agrostis gigantea*.

Sometimes scientific and common names are used for species names codes. A master list of species codes for Diamond Fork and Sixth Water Creeks was developed in the field (Table 3.2).

Table 3.2. Vegetation codes for Diamond Fork vegetation transect surveys.

CODE	SPECIES
AGGI	*Agrostis gigantea*
Aster	*Aster* spp.
BRIN	*Bromus inermis*
BRTE	*Bromus tectorum*
CANE	*Carex nebrascensis*
Carex	*Carex* spp.
CIAR	*Cirseum arvense*
CIVU	*Cirsium vulgare*
ELPA	*Eleocharis palustris*
ELTR	*Elymus trachycaulus*
Epi	*Epilobium* spp.
EQAR	*Equisetum arvense*
EUOC	*Euthamia occidentalis*
JUBA	*Juncus arcticus*
JUEN	*Juncus ensifolius*
Juncus	*Juncus* spp.
LASE	*Latuca serriola*
MEOF	*Melilotus officinalis*
Panicum	*Panicum* spp.
PHAR	*Phalaris arundinacea*
SAEX	*Salix exigua*
SOCA	*Solidago canadensis*
THIN	*Thinopyrum intermedium*

CODE	SPECIES
TYLA	*Typha latifolia*
Upland mix	Upland mix
URDI	*Urtica dioica*
VETH	*Verbascum thapsus*
Wet mix	Wetland mix
Mixed herbaceous	Mixed herbaceous
AMEL	*Amelanchier*
ARTR	*Artemisia tridentata*
BEOC	*Betula occidentalis*
COSE	*Cornus sericea*
Crataegus spp.	*Crataegus* spp.
POAN	*Populus angustifolia*
Populus	*Populus* spp.
PRVI	*Prunus virginiana*
QUTU	*Quercus turbinella*
Ribes	*Ribes* spp.
ROWO	*Rosa woodsii*
SABO	*Salix boothii*
SALU	*Salix lucida*
SABO-LU	*Salix boothii/lucida*
Salix	*Salix* spp.
SYAL	*Symphoricarpus albus*
bare	bare ground
gravel	gravel bar/deposit
open water	open water

3.2.2 Data Input

Once the survey data are downloaded as text files, they are imported into Microsoft Excel. The survey data have columns for point number, northing, easting, elevation, and description. The description column is the description typed into the datalogger as a simple description of the point. The actual vegetation description from the field book is manually input into the Excel spreadsheet. Additional columns for scientific name, common name, height (1, 2, or 3), density (s or d), and stratum (herbaceous or woody) are added to the spreadsheet from the vegetation description. The complete dataset for each site is shown in Appendix 3.2, and example transects from each site are plotted in Appendix 3.3.

One topographical location represents a vegetation boundary. However, as noted in the example above, it is possible (and probable) that each point will have more than one species. In order to accommodate this detail in Excel, the point information is copied so that each species' information is

contained in one line on the spreadsheet. The earlier example of SAEX1sJUBAAGGI would have three lines with the same point designation and location because three different species are present within that vegetation community.

The data are sorted by northing or easting so that the LEP is the top of the transect data and the REP is at the end of the transect data (Figure 3.3).

3.2.3 Data Analysis

The species encountered were assigned classifications based on species structure/growth form, height, wetland indicator status (upland [UPL], facultative upland [FACU], facultative [FAC], facultative wetland [FACW], obligate [OBL]), and life cycle (annual, perennial, biannual). Dominant species were also classifies based on native status (indigenous, nonindigenous) as well as their specific vegetative traits (grass, herbaceous, woody) and assessed to provide a baseline for lateral vegetation composition. The transect lengths that each species group occupied along the transects were summed and percentages compared. Lengths along the transect that contained communities dominated by more that one dominant species for the total length were divided by the number of dominant species, with each species having equal representation along the transect. Specific characteristics were assigned for all known species from the USDA NRCS PLANTS database (USDA NRCS 2007). The lengths of the transects were then totaled and averaged for the transects and reaches. This analysis supplies information on the general conditions of riparian area and a tool for long-term monitoring.

3.3 RESULTS

This section examines current riparian zone conditions including vegetation characteristics such as growth form, wetland indicator status, life cycle, species composition, and whether a plant is native or non-native (Tables 3.3, 3.4, and 3.5). Currently, bare ground only represents about 3 percent of the cross-sectional areas and wetland vegetation is more than two times more common than upland vegetation within areas surveyed. Because the cross-sectional transect surveys were conducted late in the growing season, the majority of the vegetative species recognizable in late autumn (more than 20 to 1) are perennial. Also, 85 percent of species observed during these surveys are native.

Riparian vegetation transects show a distinct pattern of vegetation communities within each geomorphic reach. Vegetation communities transition from communities containing a majority of woody species to communities containing a majority of herbaceous species from higher elevation reaches (SXW) in the Diamond Fork watershed to areas in the lower reaches. Ray's Crossing and SXW, which are located in the upper reaches of the watershed on Sixth Water Creek, are characterized by a narrower, steeper stream channel. The monitoring sites DFC, OX, and MO, which are located in the lower reaches of the watershed along Diamond Fork Creek, contain communities with more herbaceous species. The higher occurrence of herbaceous vegetation in the lower reaches is likely a result of the wider floodplain and more gradual slopes. Going downstream from Upper SXW to OX, the open water area does not show any distinct trends as the watershed area increases. Areas of bare ground and gravel bar were lowest at MO.

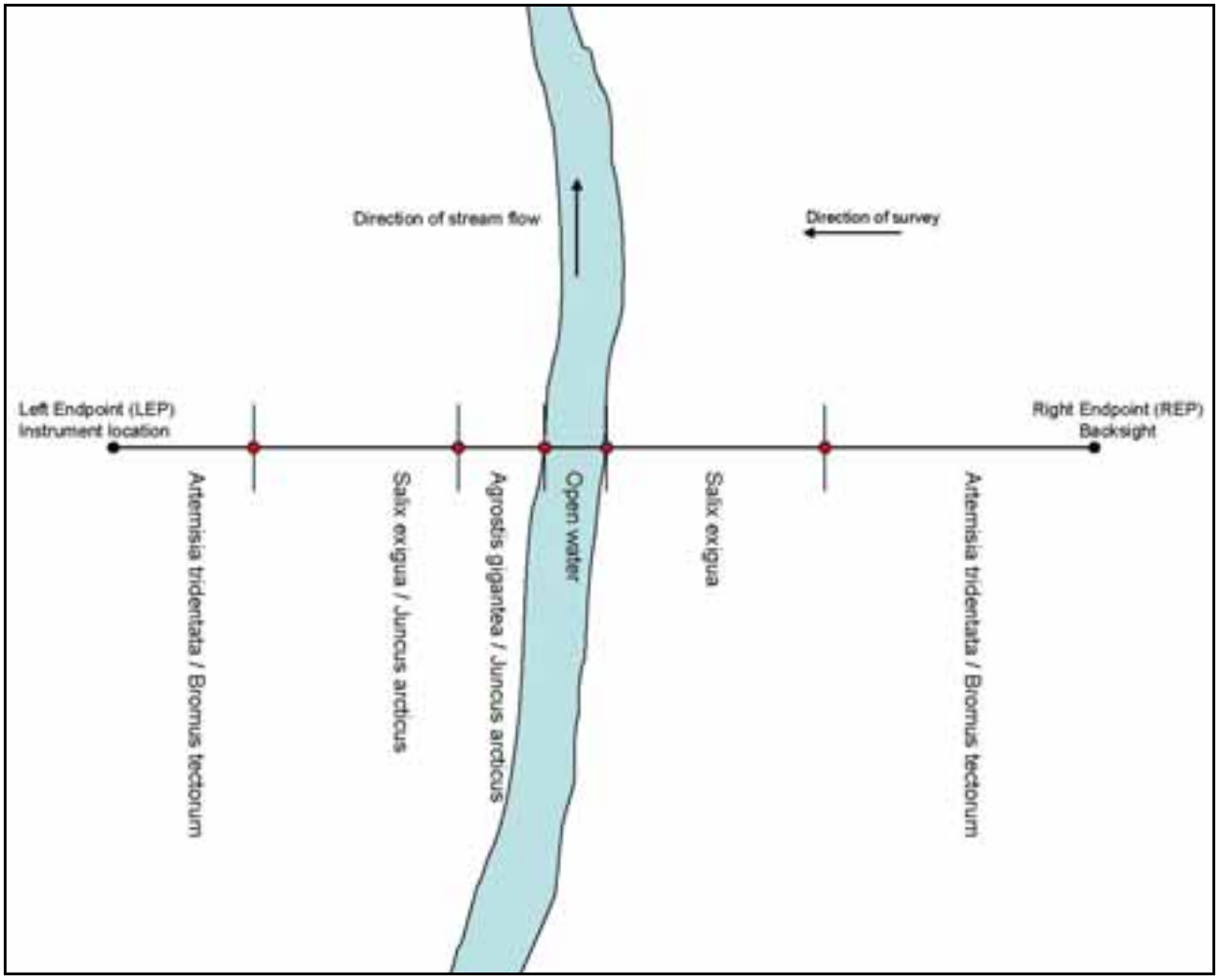


Figure 3.3. Survey method used to gather vegetation data.

3.3.1 Growth Form

The riparian areas were narrower in the higher-elevation reaches of SXW and contained higher percentages of woody vegetation than the lower reaches of Diamond Fork (Table 3.3). The Upper SXW and RC sites contained 55 percent and 58 percent woody vegetation, respectively, compared with the DFC, MO, and OX transects, which contained 31, 23, and 44 percent, respectively. The overall composition of woody vs herbaceous vegetation shifts distinctly between the higher and lower elevation reaches, with a higher percentage of herbaceous vegetation in the lower reaches (DFC, OX and MO).

3.3.2 Wetland Indicator Status

The wetland status was similar for all sites, with roughly 60 to 75 percent of the vegetative communities dominated by wetland species (Table 3.4). Individual transects within a site had a wide range of wetland indicator status vegetation. The OX site had the greatest range (33 to 93

Table 3.3. Composition of transects with percentage of transect distances shown in parentheses.

REACH	TRANSECT	WOODY VEGETATION		HERBACEOUS VEGETATION		BARE GROUND OR GRAVEL BAR		OPEN WATER		TOTAL TRANSECT DISTANCE
		Distance (m)	Percent	Distance (m)	Percent	Distance (m)	Percent	Distance (m)	Percent	
SXW	1	32.13	(70.7)	3.20	(7.0)			10.11	(22.3)	45.44
SXW	2	29.38	(56.1)	4.31	(8.2)	5.26	(10.0)	13.38	(25.6)	52.34
SXW	3	26.24	(49.9)	11.35	(21.6)			14.97	(28.5)	52.56
SXW	4	57.36	(47.7)	54.22	(45.1)			8.59	(7.1)	120.17
SXW	5	43.93	(50.9)	36.62	(42.4)			5.83	(6.7)	86.38
SXW	6	57.84	(61.8)	28.59	(30.5)	1.84	(2.0)	5.35	(5.7)	93.63
SXW, total of distances		246.89	(54.8)	138.30	(30.7)	7.10	(1.6)	58.23	(12.9)	450.51
RC	1	42.44	(57.7)	18.87	(25.7)	2.89	(3.9)	9.35	(12.7)	73.55
RC	2	52.22	(59.8)	17.56	(20.1)	5.89	(6.8)	11.60	(13.3)	87.27
RC	3	45.28	(59.4)	9.09	(11.9)	14.43	(18.9)	7.45	(9.8)	76.25
RC	4	76.63	(64.3)	26.77	(22.5)	7.13	(6.0)	8.66	(7.3)	119.21
RC	5	77.21	(62.7)	25.60	(20.8)	10.65	(8.6)	9.759865929	(7.9)	123.23
RC	6	57.35	(46.8)	43.32	(35.4)	9.19	(7.5)	12.67583088	(10.3)	122.54
RC, total of distances		351.14	(58.3)	141.22	(23.5)	50.20	(8.3)	59.49	(9.9)	602.05
DFC	1	66.49	(35.8)	106.40	(57.3)			12.90	(6.9)	185.79
DFC	2	95.02	(50.3)	78.02	(41.3)			15.75	(8.3)	188.79
DFC	3	48.02	(37.5)	61.75	(48.3)	8.99	(7.0)	9.20	(7.2)	127.97
DFC	4	18.60	(17.5)	69.99	(65.9)	2.29	(2.2)	15.27	(14.4)	106.16
DFC	5	8.44	(9.3)	57.51	(63.4)	13.57	(15.0)	11.26	(12.4)	90.78
DFC	6	17.82	(22.1)	40.37	(50.1)			22.38	(27.8)	80.57
DFC	7	6.58	(8.8)	47.11	(63.0)	4.65	(6.2)	16.40	(21.9)	74.74
DFC, total of distances		260.97	(30.5)	461.16	(53.9)	29.51	(3.5)	103.16	(12.1)	854.80
MO	1	25.79	(38.0)	34.03	(50.2)			8.00	(11.8)	67.82
MO	2	57.64	(26.0)	145.19	(65.4)			23.98	(10.8)	222.04
MO	3	32.73	(18.2)	132.15	(73.6)			14.57	(8.1)	179.45
MO	4	32.93	(27.2)	59.60	(49.3)			28.38	(23.5)	120.92
MO	5	21.67	(17.7)	81.94	(67.1)			18.49	(15.1)	122.09
MO	6	15.80	(16.7)	64.72	(68.4)	6.49	(6.9)	7.55	(8.0)	94.56
MO, total of distances		186.57	(23.0)	517.63	(63.8)	6.49	(0.8)	100.97	(12.4)	811.67

REACH	TRANSECT	WOODY VEGETATION		HERBACEOUS VEGETATION		BARE GROUND OR GRAVEL BAR		OPEN WATER		TOTAL TRANSECT DISTANCE
		Distance (m)	Percent	Distance (m)	Percent	Distance (m)	Percent	Distance (m)	Percent	
OX	1	94.88	(64.1)	35.66	(24.1)	7.11	(4.8)	10.30	(7.0)	147.95
OX	2	99.50	(59.1)	60.52	(36.0)			8.31	(4.9)	168.33
OX	3	93.23	(52.6)	61.62	(34.8)	6.80	(3.8)	15.55	(8.8)	177.21
OX	4	107.11	(50.7)	61.33	(29.0)	29.42	(13.9)	13.48	(6.4)	211.34
OX	5	83.34	(43.0)	93.92	(48.5)	1.54	(0.8)	14.86	(7.7)	193.66
OX	6	67.55	(36.5)	99.71	(53.9)	8.27	(4.5)	9.59	(5.2)	185.12
OX	7	19.23	(11.7)	122.82	(75.0)	4.20	(2.6)	17.49	(10.7)	163.74
OX	8	16.53	(19.2)	57.44	(66.8)			11.99	(13.9)	85.96
OX, total of distances		581.37	(43.6)	593.02	(44.5)	57.34	(4.3)	101.57	(7.6)	1,333.30
Total, all transects		**1,649.46**	**(40.7)**	**1,828.29**	**(45.1)**	**123.43**	**(3.0)**	**423.64**	**(10.5)**	**4,052.33**

Table 3.4. Vegetated transect distances by wetland status (percentages in parentheses).

REACH	TRANSECT	WETLAND VEGETATION (FAC, FACW, FACU, OBL)[a]		UPLAND VEGETATION		UNSPECIFIED		TOTAL TRANSECT DISTANCE (Vegetated)
		Distance (m)	Percent	Distance (m)	Percent	Distance (m)	Percent	
SXW	1	35.33	(100.0)					35.33
SXW	2	28.69	(85.1)	5.01	(14.9)			33.70
SXW	3	23.11	(61.5)	14.48	(38.5)			37.59
SXW	4	63.44	(56.9)	48.15	(43.1)			111.59
SXW	5	44.00	(54.6)	36.55	(45.4)			80.55
SXW	6	56.00	(64.8)	30.44	(35.2)			86.44
SXW, total of distances		250.56	(65.0)	134.63	(35.0)			385.19
RC	1	35.32	(57.6)	25.99	(42.4)			61.31
RC	2	42.67	(61.2)	27.10	(38.8)			69.77
RC	3	47.50	(87.4)	6.87	(12.6)			54.38
RC	4	67.25	(65.0)	36.15	(35.0)			103.41
RC	5	83.14	(80.9)	19.67	(19.1)			102.81
RC	6	86.62	(86.0)	14.06	(14.0)			100.67
RC, total of distances		362.51	(73.6)	129.84	(26.4)			492.35

REACH	TRANSECT	WETLAND VEGETATION (FAC, FACW, FACU, OBL)[a]		UPLAND VEGETATION		UNSPECIFIED		TOTAL TRANSECT DISTANCE (Vegetated)
		Distance (m)	Percent	Distance (m)	Percent	Distance (m)	Percent	
DFC	1	113.17	(65.5)	59.72	(34.5)			172.89
DFC	2	141.50	(81.8)	31.54	(18.2)			173.04
DFC	3	76.68	(69.9)	33.09	(30.1)			109.77
DFC	4	51.59	(58.2)	37.00	(41.8)			88.60
DFC	5	25.38	(38.5)	40.57	(61.5)			65.95
DFC	6	27.02	(46.4)	31.17	(53.6)			58.19
DFC	7	18.38	(34.2)	35.31	(65.8)			53.69
DFC, total of distances		453.72	(62.8)	268.40	(37.2)			722.13
MO	1	51.46	(86.0)	8.37	(14.0)			59.83
MO	2	155.91	(76.9)	46.92	(23.1)			202.84
MO	3	104.77	(63.5)	29.49	(17.9)	30.62	(18.6)	164.88
MO	4	65.80	(71.1)	21.93	(23.7)	4.80	(5.2)	92.54
MO	5	62.67	(60.5)	36.03	(34.8)	4.90	(4.7)	103.60
MO	6	45.29	(56.2)	26.04	(32.3)	9.19	(11.4)	80.52
MO, total of distances		485.91	(69.0)	168.79	(24.0)	49.51	(7.0)	704.20
OX	1	121.81	(93.3)	8.73	(6.7)			130.54
OX	2	127.28	(79.5)	32.74	(20.5)			160.03
OX	3	115.42	(74.5)	39.43	(25.5)			154.85
OX	4	137.80	(81.8)	30.64	(18.2)			168.44
OX	5	157.20	(88.7)	20.06	(11.3)			177.26
OX	6	96.09	(57.4)	71.18	(42.6)			167.26
OX	7	46.50	(32.7)	95.55	(67.3)			142.04
OX	8	51.20	(69.2)	21.74	(29.4)	1.03	(1.4)	73.97
OX, total of distances		853.29	(72.7)	320.07	(27.3)	1.03	(0.1)	1,174.40
Total, all transects		**2,405.98**	**(69.2)**	**1,021.74**	**(29.4)**	**50.54**	**(1.5)**	**3,478.27**

a FAC = facultative, FACW = facultative wetland, FACU = facultative upland, OBL = obligate.

XW	2	8.07	(23.9)	21.31	(63.3)	3.56	(10.6)	0.75	(2.2)							33.70
XW	3	5.50	(14.6)	20.74	(55.2)	4.17	(11.1)	0.92	(2.4)	6.27	(16.7)					37.60
XW	4	9.16	(8.2)	48.20	(43.2)	37.63	(33.7)	0.75	(0.7)	12.05	(10.8)	3.80	(3.4)			111.59
XW	5	3.56	(4.4)	40.37	(50.1)	31.14	(38.7)			2.45	(3.0)	3.04	(3.8)			80.55
XW	6	3.02	(3.5)	54.82	(63.4)	24.68	(28.6)			1.03	(1.2)	2.88	(3.3)			86.44
XW, total of istances		29.32	(7.6)	217.57	(56.5)	101.17	(26.3)	2.42		25.00	(6.5)	9.71	(2.5)			385.19
C	1	10.70	(17.5)	27.27	(44.5)	13.15	(21.5)			8.31	(13.6)	1.88	(3.1)			61.31
C	2	7.76	(11.1)	40.47	(58.0)	16.95	(24.3)			4.60	(6.6)					69.77
C S	3	9.38	(17.3)	35.90	(66.0)	3.72	(6.8)			5.37	(9.9)					54.38
C	4	5.05	(4.9)	82.20	(79.5)	10.85	(10.5)			5.30	(5.1)					103.41
C	5			67.83	(66.0)	21.35	(20.8)			13.64	(13.3)					102.81
C	6			57.35	(57.0)	25.80	(25.6)			17.52	(17.4)					100.67
C, total of distances		32.90	(6.7)	311.02	(63.2)	91.82	(18.6)			54.74	(11.1)	1.88	(0.4)			492.35
FC	1	20.49	(11.9)	46.00	(26.6)	25.06	(14.5)			58.90	(34.1)	4.42	(2.6)	18.01	(10.4)	172.89
FC	2	14.24	(8.2)	80.78	(46.7)	3.27	(1.9)			70.09	(40.5)	1.56	(0.9)	3.10	(1.8)	173.04
FC	3	5.65	(5.2)	42.36	(38.6)	9.35	(8.5)			46.75	(42.6)			5.65	(5.2)	109.77
FC	4			18.60	(21.0)	7.46	(8.4)			48.96	(55.3)			13.56	(15.3)	88.60
FC	5			8.44	(12.8)	5.31	(8.1)			40.44	(61.3)	11.76	(17.8)		(0.0)	65.95
FC	6	1.21	(2.1)	16.61	(28.5)	4.60	(7.9)			27.73	(47.6)			8.04	(13.8)	58.19
FC	7			6.58	(12.2)	3.23	(6.0)			26.47	(49.3)			17.42	(32.4)	53.69
FC, total of istances		41.60	(5.8)	219.37	(30.4)	58.28	(8.1)			319.34	(44.2)	17.75	(2.5)	65.80	(9.1)	722.13
MO	1			25.79	(43.1)	4.49	(7.5)			28.14	(47.0)			1.40	(2.3)	59.83
MO	2	2.83	(1.4)	54.82	(27.0)	18.72	(9.2)			123.69	(61.0)			2.78	(1.4)	202.84
MO	3	5.77	(3.5)	26.96	(16.4)	16.26	(9.9)			85.27	(51.7)			30.62	(18.6)	164.88
MO	4			32.93	(35.6)					54.81	(59.2)			4.80	(5.2)	92.54
MO	5			21.67	(20.9)	5.60	(5.4)	4.90	(4.7)	56.49	(54.5)			14.95	(14.4)	103.60
MO	6			15.80	(19.6)	8.12	(10.1)			44.40	(55.1)			12.19	(15.1)	80.52
MO, total of distances		8.60	(1.2)	177.97	(25.3)	53.20	(7.6)	4.90	(0.7)	392.79	(55.8)			66.74	(9.5)	704.20
OX	1	72.92	(55.9)	21.96	(16.8)	8.12	(6.2)			11.02	(8.4)			16.52	(12.7)	130.54
OX	2	86.93	(54.3)	12.57	(7.9)					17.41	(10.9)			43.11	(26.9)	160.03
OX	3	48.38	(31.2)	44.85	(29.0)	7.37	(4.8)	1.38	(0.9)	20.87	(13.5)			32.00	(20.7)	154.85
OX	4	59.25	(35.2)	47.86	(28.4)	8.29	(4.9)	4.89	(2.9)	28.36	(16.8)			19.78	(11.7)	168.44
OX	5	58.05	(32.7)	25.28	(14.3)	13.31	(7.5)			52.24	(29.5)			28.37	(16.0)	177.26
OX	6	32.44	(19.4)	35.11	(21.0)	14.04	(8.4)	2.27	(1.4)	74.10	(44.3)	1.02	(0.6)	8.29	(5.0)	167.26
OX	7	3.52	(2.5)	15.71	(11.1)	9.23	(6.5)			108.54	(76.4)			5.04	(3.5)	142.04
OX	8			16.53	(22.3)	7.54	(10.2)			34.32	(46.4)			15.58	(21.1)	73.97

percent) and DFC site had the lowest overall percentage (63 percent) of wetland indicator species, while the RC site had the highest amount, with 74 percent of the transect distance containing species with wetland indicator status. There was a slight difference in composition for SXW when compared to RC. In the SXW transects, only 65 percent of vegetal cover found is classified as wetland vegetation (FAC, FACW, FACU, OBL), while RC contained 73 percent of vegetal cover dominated by wetland species.

3.3.3 Life Cycle

All of the sites were highly dominated by perennial vegetation. This may be partially due to the time of year at which surveys were conducted, as well as classifications methods used to assign dominance along a given transect. The survey was conducted in the fall when many annuals are not alive or identifiable. In general, less than 1 percent of the total transect distances include annual forbs and graminoids (Table 3.5). In contrast, over 32 percent of the total transect distances were comprised of perennial graminoids and shrubs.

3.3.4 Species Composition

Coyote willow was prevalent throughout the reaches surveyed, comprising nearly 23 percent of the total length for all transects. In most reaches willow species are the dominant woody vegetation; however, cottonwood species were also found in large amounts, especially at the OX site where they comprised nearly 31 percent of transect length. Other willow species (Booth's willow [*Salix boothii*]) and shining willow [*Salix lucida*]) were mostly found at DFC and RC, but these species did dominate some communities in all reaches. Reed canarygrass (*Phalaris arundinacea*) was a dominant understory and stabilizing component in the lower reaches (DFC, MO, and OX). Reed canarygrass is the primary species that has become established along the edge of Diamond Fork Creek, providing a buffer against the force of moving water with its strongly rhizomatous root system (Winward 2000). Between 67 and 74 percent of the species in all areas were dominated by native vegetation. The OX and RC sites had the lowest percentages of non-native species at 6 percent each (Table 3.6).

3.4 SUMMARY AND DISCUSSION

Riparian vegetation performs many functions in natural river systems. Hydrologic and geomorphic changes following altered flow regimes can effect the physical processes that control riparian vegetation, thereby changing species distribution, abundance, and composition. The purpose of this study was to gather the data necessary to record and monitor any changes that might occur as a result of the altered flow regime in the Diamond Fork watershed.

The first year of vegetation sampling along the riparian corridor showed that the riparian vegetation communities were indicative of the disturbance regime before implementation of the Diamond Fork System; vegetation communities were largely composed of early successional or disturbance-adapted species and immature late successional species. A high percentage of the vegetation throughout the watershed is perennial, since the area has experienced large amounts of disturbance a higher component of annual species was anticipated. Since surveys cover the entire floodplain, which is more stable than areas immediately adjacent to the active stream channel, the portion of

Table 3-6. Sum of vegetated distances by species and by reach (percent of reach distances in meters given in parentheses).

VEGETATION	REACH										ALL REACHES	
	SXW		RC		DFC		MO		OX			
Native Trees												
Crataegus rivularis			2.53	(0.5)	1.93	(0.3)			5.83	(0.5)	10.29	(0.3)
Populus angustifolia	20.88	(5.0)	12.16	(2.4)	39.67	(5.5)	8.60	(1.2)	355.67	(30.7)	436.98	(12.4)
Populus spp.			26.67	(5.3)							26.67	(0.8)
Prunus virginiana	11.74	(2.8)									11.74	(0.3)
Quercus turbinella			1.55	(0.3)							1.55	0.0
All Native Trees	32.62	(7.8)	42.91	(8.5)	41.60	(5.8)	8.60	(1.2)	361.50	(31.2)	487.23	(13.9)
Native Shrubs												
Artemisia tridentata			13.74	(2.7)					2.54	(0.2)	16.28	(0.5)
Artemisia tridentata spp.							5.56	(0.8)			5.56	(0.2)
Artemsia tridentata	5.93	(1.4)	0.95	(0.2)							6.88	(0.2)
Betula occidentalis			66.81	(13.2)	12.45	(1.7)					79.26	(2.3)
Cornus sericea			3.11	(0.6)	1.98	(0.3)			1.91	(0.2)	7.01	(0.2)
Ribes aureum					7.76	(1.1)					7.76	(0.2)
Rosa woodsii	13.22	(3.1)	3.85	(0.8)	3.45	(0.5)					20.52	(0.6)
Salix boothii	7.87	(1.9)	25.36	(5.0)	41.28	(5.7)					74.51	(2.1)
Salix boothii-lucida					36.96	(5.1)	6.21	(0.9)	8.45	(0.7)	51.61	(1.5)
Salix exigua	171.45	(40.8)	176.57	(34.8)	75.56	(10.5)	166.20	(23.6)	206.98	(17.9)	796.75	(22.7)
Salix lucida	4.12	(1.0)	37.10	(7.3)	38.18	(5.3)					79.41	(2.3)
Salix spp.			1.52	(0.3)	1.76	(0.2)					3.28	(0.1)
Symphoricarpos albus	15.71	(3.7)	13.37	(2.6)							29.08	(0.8)
All Native Shrubs	218.31	(52.0)	342.39	(67.6)	219.37	(30.4)	177.97	(25.3)	219.87	(19.0)	1,177.92	(33.6)
Native Forbs												
Epilobium ciliatum	8.56	(2.0)	0.32	(0.1)							8.89	(0.3)
Equisetum arvense			2.76	(0.5)	2.57	(0.4)			18.62	(1.6)	23.96	(0.7)
Euthamia occidentalis					27.99	(3.9)	29.22	(4.2)	23.39	(2.0)	80.60	(2.3)
Solidago canadensis			4.01	(0.8)	5.28	(0.7)	1.42	(0.2)	14.95	(1.3)	25.66	(0.7)
Typha latifolia									5.89	(0.5)	5.89	(0.2)
Urtica dioica	5.33	(1.3)									5.33	(0.2)
All Native Forbs	13.89	(3.3)	7.10	(1.4)	35.84	(5.0)	30.64	(4.4)	62.85	(5.4)	150.33	(4.3)

VEGETATION	REACH										ALL REACHES	
	SXW		RC		DFC		MO		OX			
Introduced Forbs												
Cirseum arvense			1.26	(0.2)	22.43	(3.1)	22.56	(3.2)			46.26	(1.3)
Cirsium vulgare									2.78	(0.2)	2.78	(0.1)
Latuca serriola							4.90	(0.7)			4.90	(0.1)
Melilotus officinalis									8.54	(0.7)	8.54	(0.2)
Verbascum thapsus									2.27	(0.2)	2.27	(0.1)
All Introduced Forbs			1.26	(0.2)	22.43	(3.1)	27.46	(3.9)	13.59	(1.2)	64.75	(1.8)
Native Graminoids												
Bromus inermis					159.88	(22.1)	127.58	(18.1)	206.34	(17.8)	493.81	(14.1)
Carex nebrascensis			0.32	(0.1)			1.52	(0.2)			1.84	(0.1)
Eleocharis palustris							9.57	(1.4)	17.47	(1.5)	27.03	(0.8)
Elymus trachycaulus					7.06	(1.0)	12.33	(1.8)	9.03	(0.8)	28.42	(0.8)
Juncus arcticus			2.88	(0.6)	35.88	(5.0)	34.93	(5.0)	30.21	(2.6)	103.90	(3.0)
Juncus ensifolius									1.37	(0.1)	1.37	0.0
Phalaris arundinacea					29.84	(4.1)	131.39	(18.7)	47.70	(4.1)	208.93	(6.0)
All Native Graminoids			3.20	(0.6)	232.67	(32.2)	317.32	(45.1)	312.12	(27.0)	865.31	(24.6)
Introduced Graminoids												
Agrostis gigantea	37.25	(8.9)	30.16	(6.0)	84.35	(11.7)	75.47	(10.7)	34.75	(3.0)	261.98	(7.5)
Bromus tectorum	9.71	(2.3)	1.94	(0.4)	17.75	(2.5)			1.02	(0.1)	30.43	(0.9)
Thinopyrum intermedium					2.32	(0.3)					2.32	(0.1)
All Introduced Graminoids	46.96	(11.2)	32.10	(6.3)	104.41	(14.5)	75.47	(10.7)	35.78	(3.1)	294.72	(8.4)
Unspecified Species												
Amelanchier spp.	6.02	(1.4)	2.50	(0.5)							8.53	(0.2)
Aster spp.	3.35	(0.8)									3.35	(0.1)
Carex spp.	1.95	(0.5)			5.71	(0.8)	14.23	(2.0)	9.88	(0.9)	31.76	(0.9)
Juncus spp.	1.60	(0.4)							1.03	(0.1)	2.63	(0.1)
Panicum sp.							18.92	(2.7)			18.92	(0.5)
Upland Mix	91.93	(21.9)	73.13	(14.4)	51.75	(7.2)			72.08	(6.2)	288.90	(8.2)
Wetland Mix			2.15	(0.4)	8.34	(1.2)	3.00	(0.4)	69.17	(6.0)	82.66	(2.4)
Mixed Herbaceous							30.59	(4.3)			30.59	(0.9)
Other Unspecified	3.24	(0.8)									3.24	(0.1)
All Unspecified Species	108.10	(25.7)	77.79	(15.4)	65.80	(9.1)	66.74	(9.5)	152.16	(13.1)	470.58	(13.4)
Total Vegetated Distances	419.89		506.74		722.13		704.20		1,157.87		3,510.83	

transect outside of riparian area may account for the discrepancy. It is also possible that annual plants died off prior to the surveys, which were conducted in autumn. As monitoring is repeated in subsequent years, riparian area responses to the hydrologic modifications made by the implementation of the Diamond Fork System should become apparent within data trends. If changes are noted over time, such as reduction of wetland species in a certain area, other data aspects can be analyzed (e.g., elevation above stream or successional properties of particular species).

3.5 LIMITATIONS AND RECOMMENDATIONS

When this study was designed, vegetation along each transect was to be categorized for future comparisons. Areas that contained no single dominant (20% or greater) species were considered either mixed upland or mixed wetland and, therefore, no species information was gathered for those segments along the transects. A limitation of the survey methods used in 2006 is that data describing percent cover by species were not collected. Upon closer examination of the data and consultation with other vegetation experts, it became apparent that this method would result in the loss of important information that would allow for analysis of finer-scaled changes.

Therefore, it was decided that data collected during subsequent monitoring should remain as species data rather than being categorized as was done in 2006. Instead of recording species with dominance greater than 20 percent, all dominant species should be recorded by a visually estimated percent cover. For areas without a dominant species, the three species that are significant indicators of the area should be recorded. This method would enable the transect data to be analyzed and compared for several different parameters in different sites and at different distances away from and elevation above the stream. We recommend revising the 2007 monitoring protocols by collecting species information for all vegetation communities and an estimated percent cover for each species, thereby eliminating the 11 percent of study area that could not be classified in 2006. This adjustment would provide a more accurate estimate of percent cover in vegetation communities containing more than one dominate species. After establishing a more detailed baseline, we also recommend repeating transect monitoring every 5 years until the area stabilizes enough that a 10-year monitoring cycle is appropriate.

CHAPTER 4: *UTE LADIES'-TRESSES SURVEYS*

4.0 UTE LADIES'-TRESSES SURVEYS

4.1 INTRODUCTION

Ute ladies'-tresses (ULT) population surveys were conducted during late summer (August through early September) to assess population trends and relative abundance of individuals located on riparian surfaces along Diamond Fork Creek. Surveys BIO-WEST conducted in 2006 were adapted from previous surveys done by HDR Engineering, Inc. (HDR) that occurred from 1992 to 2005 (Black and Gruwell 2005). The BIO-WEST surveys were designed to more rapidly assess population trends of ULT colonies located on surfaces they previously occupied. First, ULT individuals were counted on a sub-sample of currently occupied surfaces; second, meandering surveys were used to estimate relative abundance of individuals located on each riparian surface along Diamond Fork Creek. The meandering surveys were performed to capture gross trends in abundance and distribution without counting all ULT individuals. Finally, flowering and non-flowering plant counts were done along permanent transects to further understand the complex ecological processes of a species that has been inconsistent when studying emergence, flowering and non-flowering habits, and potential effects of hydrologic change within Diamond Fork Creek.

4.2 METHODS

4.2.1 Data Collection

All ULT colonies along Diamond Fork Creek were surveyed one of two ways: actual counts and abundance estimates. Based on previous ULT counts, colonies that were most indicative of overall canyon-wide population trends (with a correlation of 50 percent or more as shown in Appendix 4.1) (Rice 2006) were re-counted in 2006. Individual ULT located within polygons 2A, 2B, 10A, 13.1, 13.2, 13.3, 14, 17A, 20, 24B, 30, and 36, as shown in the ULT polygon map located in Appendix 4.2, were counted. Colonies that showed more sporadic trends were surveyed and ranked for relative abundance: none, few, moderate, and abundant. Within each ULT colony dominant native and non-native species were also recorded.

4.2.2 Habitat Known to be Occupied by Ute Ladies'-tresses

Surfaces within the Diamond Fork Watershed have historically been surveyed and monitored with an emphasis on exact counts of flowering ULT individuals. Total counts were time intensive, and the number of ULT individuals found varied between years. During BIO-WEST's initial survey in 2006, surfaces were selected by the Mitigation Commission (Rice 2006) that were known to have ULT and showed count trends somewhat representative of ULT colonies found throughout the watershed. Surveys were performed along arbitrary transect lines, with surveyors spaced no more than 5 feet apart. This method provided effective detection of flowering individuals (Figure 4.1) and minimized the possibility of overlap counting. All flowering ULT individuals were counted, and data were compared with HDR's data collected during previous years (Black and Gruwell 2005) in order to identify possible trends. Data gathered before and after Diamond Fork System construction were summarized to clarify potential effects to the Diamond Fork ULT population as a result of construction.

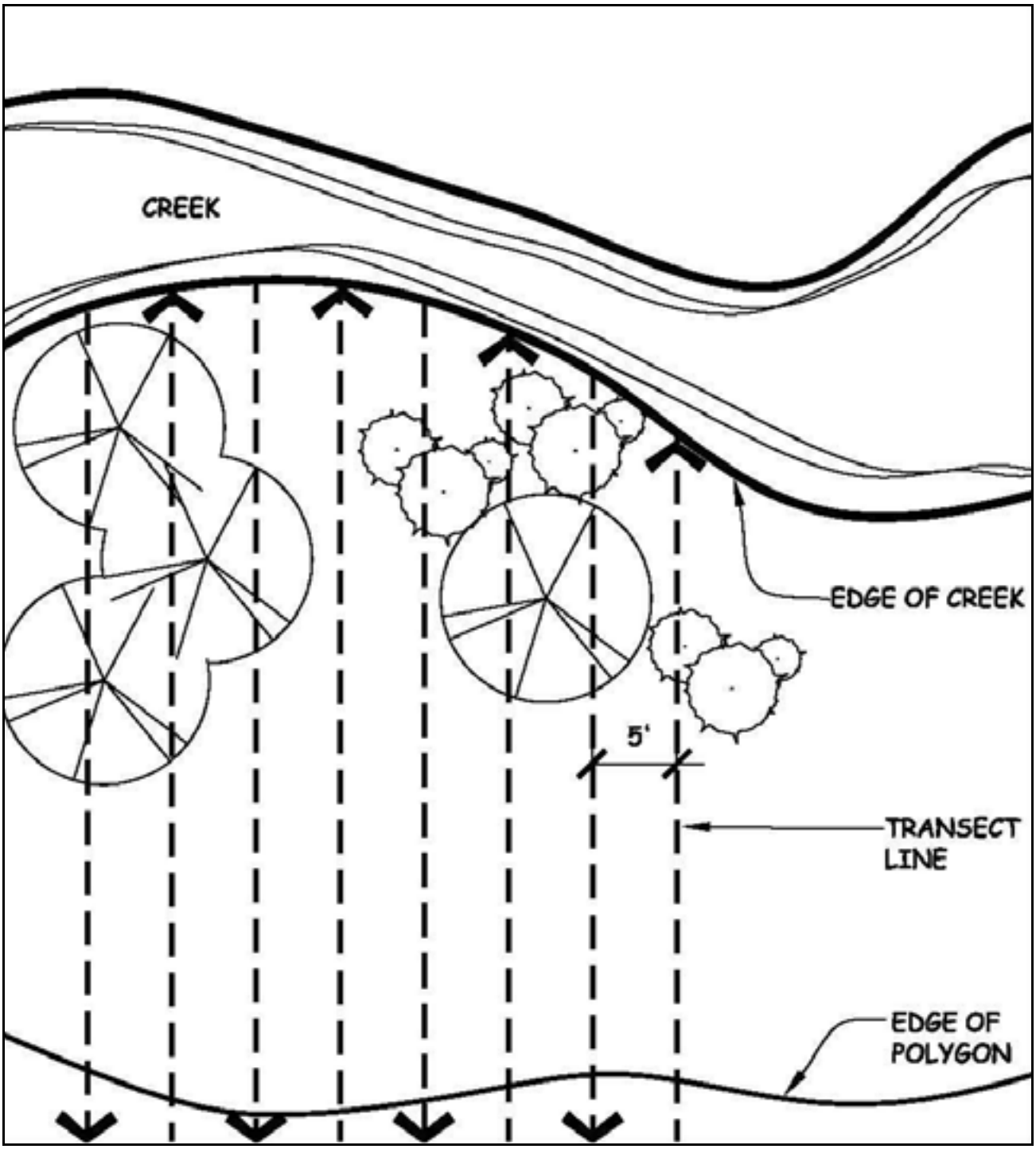


Figure 4.1. Method used for actual plant counts on known Ute ladies'-tresses-occupied sites.

Meandering surveys were conducted on remaining known ULT colony surfaces to rapidly determine relative abundance in a consistent and efficient manner (Figure 4.2). Particular attention was paid to areas of potential ULT habitat, as well as dense willow stands, to get an accurate representation of the surface. Rough counts were made, and abundance was rated by comparing numbers and overall surface sizes. Surfaces were ranked and characterized by color according to relative abundance: none, few, moderate, and abundant.

4.2.3 Habitat Suitable for Ute Ladies'-tresses Occupation

As hydrology and geomorphology change within the Diamond Fork System, new surfaces with ideal conditions for ULT have begun to develop along Diamond Fork Creek. As surfaces with ecological conditions favorable for establishment of ULT colonies develop surveys were, and will continually be, conducted to identify new colonies. New colonies found during the surveys were mapped, rated for abundance, and will be monitored in subsequent years.

4.2.4 Flowering and Non-flowering Ute Ladies'-tresses

Surveys conducted to assess the ratio of flowering and non-flowering ULT individuals were performed on surfaces known to be occupied by ULT. Data were collected in circular plots located along permanent transects. Transects were established by HDR in 2005 (HDR 2006) and resurveyed in 2006 (Appendix 4.3).

Surveys to determine flowering and non-flowering ratios began on the upstream end of the transects and subsequently ran downstream in the direction of water flow. Each circular plot was 1meter in diameter and placed on center every 5 meters along the transect. Within each circular plot the number of ULT flowering and non-flowering individuals were enumerated. Any observations of herbivory of or pollinators on ULT individuals were noted.

4.2.5 Occupied and Suitable Ute Ladies'-tresses Habitat

During individual ULT counts and relative abundance surveys, dominant plant species and non-native species were recorded for each surface. Also included in the data collection were general observations including health of the vegetative community (e.g., drying, extent of non-native species infestations).

Transects were placed deliberately in micro-topography, particularly in areas slightly wetter than where ULT individuals are normally found (Figure 4.3). It is estimated that the permanent transects established in 2005 were set in wetter areas in anticipation that these areas would dry as a result of reduced flows in Diamond Fork Creek, which would make conditions in these areas more suitable for ULT.

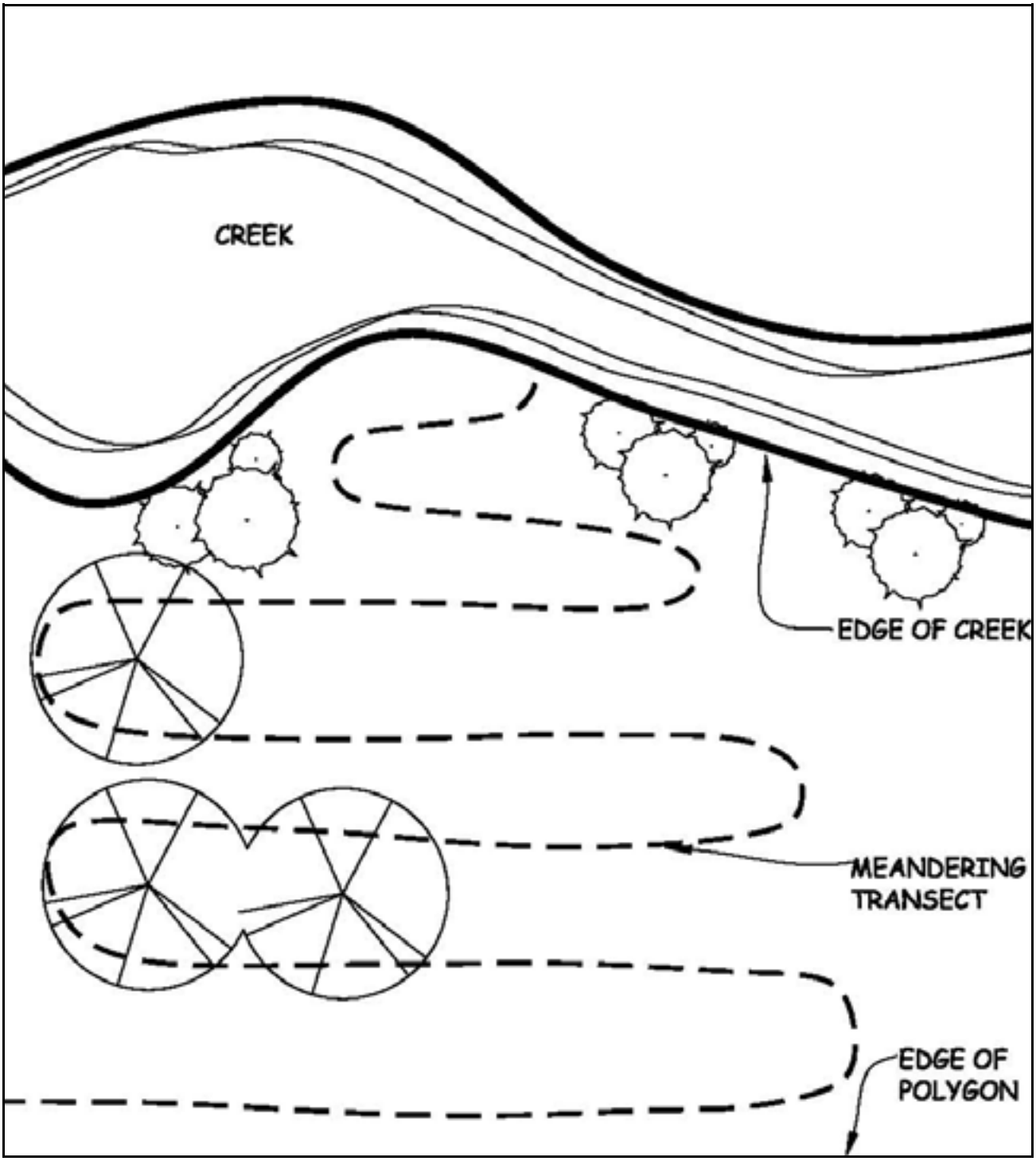


Figure 4.2. Method used for meandering Ute ladies'-tresses relative abundance estimates on known colony surfaces.

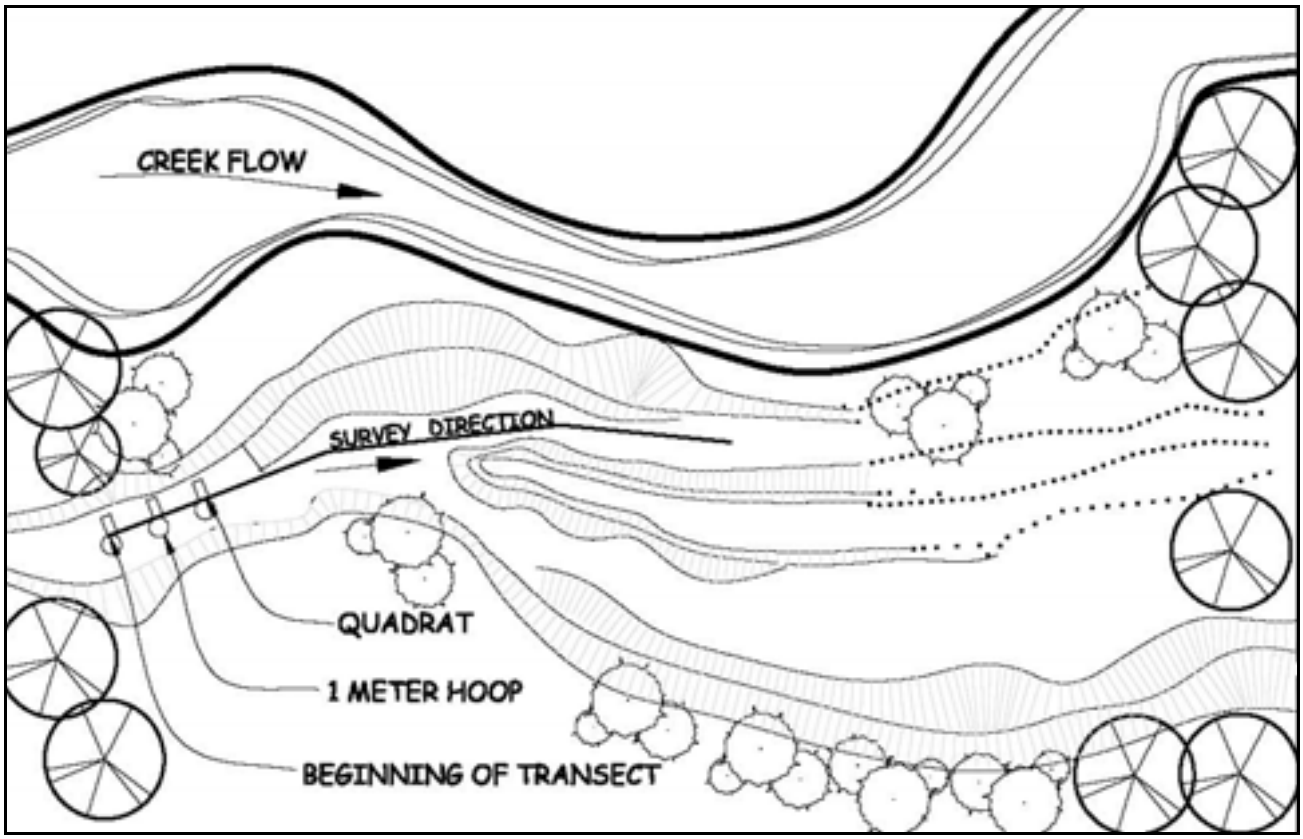


Figure 4.3. Diagram showing permanent transect placement and survey methodology.

4.3 RESULTS

4.3.1 Known Ute Ladies'-tresses Surfaces

4.3.1.1 Counts of Flowering Ute Ladies'-tresses Individuals

Counts of flowering ULT individuals on the 10 representative surfaces ranged from 0 to 879 (Table 4.1). The number of flowering individuals recorded by HDR (2006) indicates that ULT numbers generally deceased in 2002, 2003, 2004, and 2005. Figure 4.4 illustrates the sum of annual counts of flowering ULT for the 10 representative colonies. Counts recorded in 2006 on the 10 representative surfaces indicate no significant change in most colonies, except for colonies 14, 30, and 24, where numbers had increased significantly, and colony 20, where numbers had decreased significantly and were the lowest on record for that particular site. However, because ULT numbers have followed no significant trends in past surveys, no discernable patterns can be detected in the new data.

Table 4.1. Ute ladies'-tresses counts of flowering individuals on representative surfaces.

UTE LADIES'-TRESSES COUNTS													
COLONY ID	1992	1993	1994	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
2A	NA [a]	NA	NA	NA	6	0	40	63	14	4	1	0	0
2B	NA	NA	NA	NA	45	19	432	380	118	28	0	5	2
10A	NA	NA	NA	96	58	34	339	523	482	1	0	64	297
13	NA	67	0	1	52	17	83	79	1	0	0	2	
13.1												0	
13.2												0	3
13.3												0	
14	NA	97	200	957	96	440	638	663	111	23	18	58	879
17A	NA	NA	NA	47	21	25	39	42	53	2	0	34	0
20	28	804	91	1,888	236	122	990	863	480	17	34	290	4
24B	NA	NA	NA	1,409	38	341	795	952	565	8	91	155	872
30	NA	8	GI [b]	0	89	23	54	474	289	43	6	451	680
36	NA	141	138	382	162	22	25	84	61	5	2	70	104

Note: Filled cells indicate remnants of a larger colony that has subsequently been fragmented.
[a] NA - Flowering plants had not yet been identified at this location.
[b] Grazing impacts, no data collected.

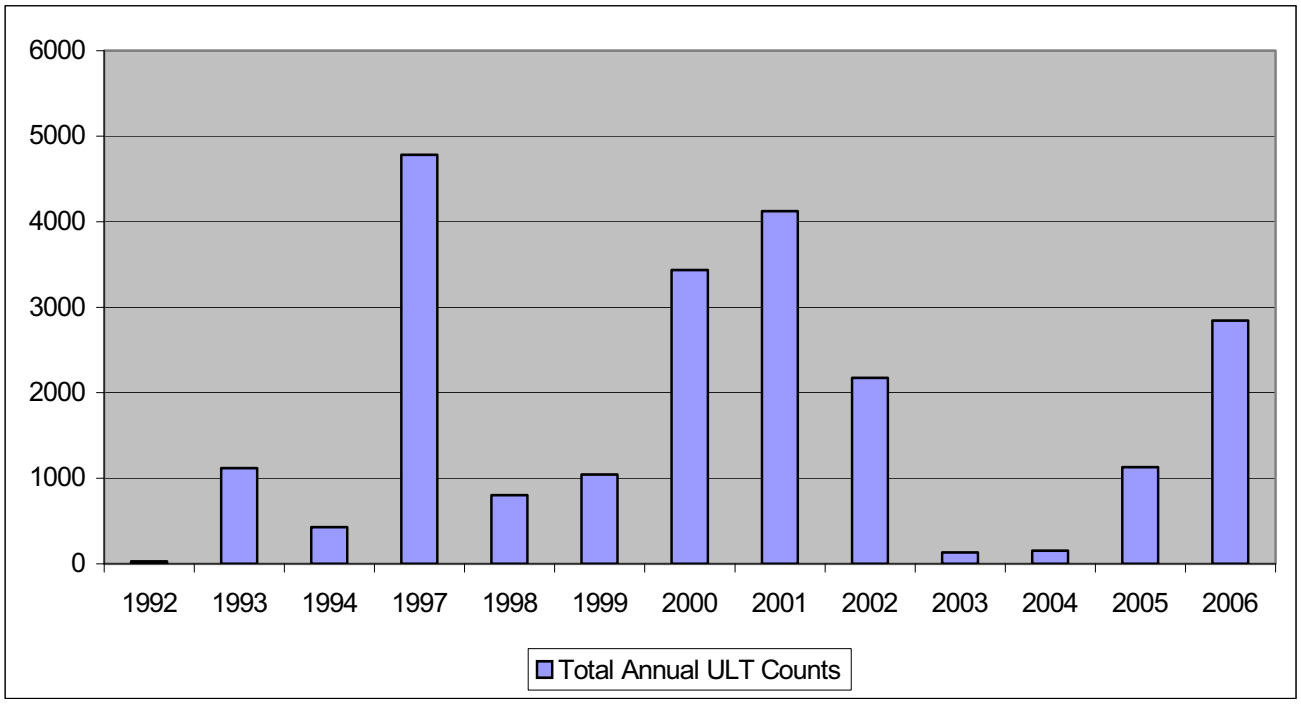


Figure 4.4. Time-series of total annual counts of flowering Ute ladies'-tresses individuals on the 10 representative surfaces.

4.3.1.2 Relative Abundance Estimates

The relative abundance of flowering ULT individuals on known ULT surfaces ranged from none to abundant (Table 4.2 and Appendix 4.4). Patterns observed during 2006 surveys had not significantly changed on the majority of surfaces since the general decrease observed in 2002, 2003, 2004, and 2005. Some surveyed surfaces contained the highest number or abundance ranking recorded. Abundance estimates were assigned by roughly counting individual ULT found on each surface and relating the number to surface size. If no ULT were found the rating was none, when 1 to 10 were found the surface was rated as few. Surfaces that contained 10 through 89 were rated as moderate, and surfaces with 90 ULT or more were rated as abundant. Abundance estimates on surfaces 27A, 36B, 8A, 8B, 8C, and 4B were at the highest recorded level for those particular colonies. Abundance at colonies 1 and 23A had also significantly increased (HDR 2005). Other decreases or slight increases observed in particular colonies may be attributed to annual fluctuations in numbers similar to those found during previous surveys. Only one surface, 24C, had a significant drop in ULT numbers. During HDR surveys (HDR 2005), 889 flowering ULT individuals were found on this surface. During the 2006 surveys, no flowering individuals were recorded for this surface and most of the obligate vegetation on the site was drying and dying back. This appears to be a recent phenomenon as replacement species, either non-native or upland, have yet to establish in this area. Table 4.2 lists surface number and relative abundance estimates recorded during 2006 surveys.

Of the surfaces surveyed 51 percent contained no ULT individuals, 20 percent contained few, 11 percent contained a moderate number, and 16 percent contained an abundant number of flowering ULT individuals (Table 4.3).

Abundance estimates for the majority of ULT colonies surveyed showed no discernable differences in population trends in the Diamond Fork Watershed. The variability of counts from year to year is so great that discernable trends are currently difficult to identify. Appendix 4.4 contains maps illustrating abundance for individual surfaces surveyed in 2006.

4.3.2 New Ute Ladies'-tresses-Occupied Sites

The location of each new surface occupied by ULT is illustrated in Appendix 4.5. There were 10 surfaces along Diamond Fork Creek on which ULT were counted during 2006 monitoring that had no previous number assigned to them. All of these colonies were found adjacent to previously monitored surfaces and were rated to contain few ULT (1-10). New surface occupation could be a result of changed hydrology, but it is likely that these colonies were missed during previously conducted surveys or were separated from the main body of previously surveyed surfaces.

4.3.3 Ute Ladies'-tresses Flowering and Non-flowering Ratio

The data that were gathered along the ULT transects included counts of flowering and non-flowering individuals within circular plots for each hoop. When these counts were analyzed, a normal distribution was not observed. In addition, the ratios for each hoop were widely variable and often contained just one individual. Hoops with low-, no-flowering, or non-flowering ULT individuals skewed the data considerably. Since there was also no known density-dependent relationship of flowering to non-flowering ratios for ULT, data analyses were carried out cumulatively for all the individuals counted. This allows for a more direct analysis since this type of data is binomial: Each

individual can either be classified as flowering or non-flowering. The number of samples needed to estimate the mean of the population was then carried out using the equation (Krebs 1989) shown on page 4-10 after Table 4.3. Table 4.4 shows the sample number required to achieve a margin of error of *d* and a confidence level of α.

Table 4.2. Ute ladies'-tresses abundance estimates for ULT-occupied surfaces 2006.

SITE	ABUNDANCE	COUNT	NOTES
1	Abundant	400+	
2.1	None	0	
2.2	Few	2	
2.3	Moderate	13	
2C	None	0	
2D	None	0	
2E	None	0	
3	Few	6	
3A	Abundant	90	
3B	None	0	
3C	None	0	
4	Abundant	114	
4A	None	0	
4B	Abundant	96	
4C	None	0	
5	Moderate	29	
6	Moderate	47	
6A	Few	6	
7	None	0	
8	Few	9	
8A	Few	17	
8B	Abundant	152	
8C	Abundant	105	
9	None	0	
11	Few	8	
12	Few	2	
12A	None	0	
15	None	0	
15B	None	0	
16	None	0	
16A	None	0	
16B	None	0	
17	None	0	
17B	None	0	

SITE	ABUNDANCE	COUNT	NOTES
18	Few	4	
18A	None	0	
19	None	0	
19A	None	0	
20B	Moderate	40	
20C	Abundant	400+	
20D	None	0	
21	Abundant		
21A	Few	10	
21B	None	0	
23	None	0	
23A	Few	2	
24	None	0	
24A	None	0	
24B			Previously done w/ colony survey
24C	None	0	
24D	Few	5	
25	Abundant	520+	
25A	None	0	
25B	Few	20	
26	Abundant	425	
27	Moderate	12	
27A	Abundant	245	
28	Moderate	77	
28A	None	0	
29	None	0	
29A	None	0	Site washed out
33	Abundant	173	
33A	None	0	
34	None	0	
34A	None	0	
35	Abundant	300	
35A	Few	10	
35B	None	0	
36B	Moderate	82	
37A	None	0	
37B	Moderate	39	
37C	None	0	
37D	Few	18	
37E	Few	3	

Table 4.3. Abundance estimates for surfaces surveyed; percentage of surfaces ranked as none, few, moderate, or abundant.

ABUNDANCE RATING	PERCENTAGE OF SURFACES
None	51%
Few	20.54%
Moderate	10.95%
Abundant	16.43%

$$n = \frac{t^2{}_{\alpha} \ \hat{p}\hat{q}}{d^2}$$

n - The number of samples for:

t - Student's t-value for α (the alpha level / probability that the mean is not within the margin of error)

$\hat{p}$ - proportion of one state (flowering) estimate

$\hat{q}$ - proportion of other state (non-flowering) estimate

d - margin of error desired

With data from sampling:

$$383 \qquad = \frac{1.96^2{}_{\alpha=.05} \quad (0.528 * \ (1 - 0.528))}{0.05^2}$$

Table 4.4. Sample number for various values of α and *d*.

d = margin of error	α = .05	α = .01
0.05	383	664
0.02	2,393	4,147
0.01	9,574	16,589

Using the equation above, we assumed that the sampled individuals were from the same populations. However, in this situation this is a problematic assumption. There is also reason to suspect that ULT found in various habitats may exhibit different phenology, and possibly even different flowering ratios, depending on environmental factors. Determination of the proper sample size is complicated by the biology of the species and may require a more complex, stratified, and rigorous sampling design than was used in this study.

The ratio of flowering to non-flowering ULT individuals was highly variable and did not follow a normal distribution (Figure 4.5). Data from a total of 290 hoops were recorded along transects located in surfaces with known ULT colonies and surfaces that may be occupied in the future. Of the hoop data gathered, only 39 hoops contained flowering or non-flowering ULT individuals. The majority of hoops surveyed (251) contained no flowering or non-flowering ULT individuals.

The lack of ULT individuals within hoop surveys created a data set that, when analyzed, skewed the results considerably and didn't allow for development of a ratio of flowering to non-flowering individuals. When data were analyzed excluding hoops containing no ULT, a more reasonable conclusion for flowering to non-flowering ratios could be made.

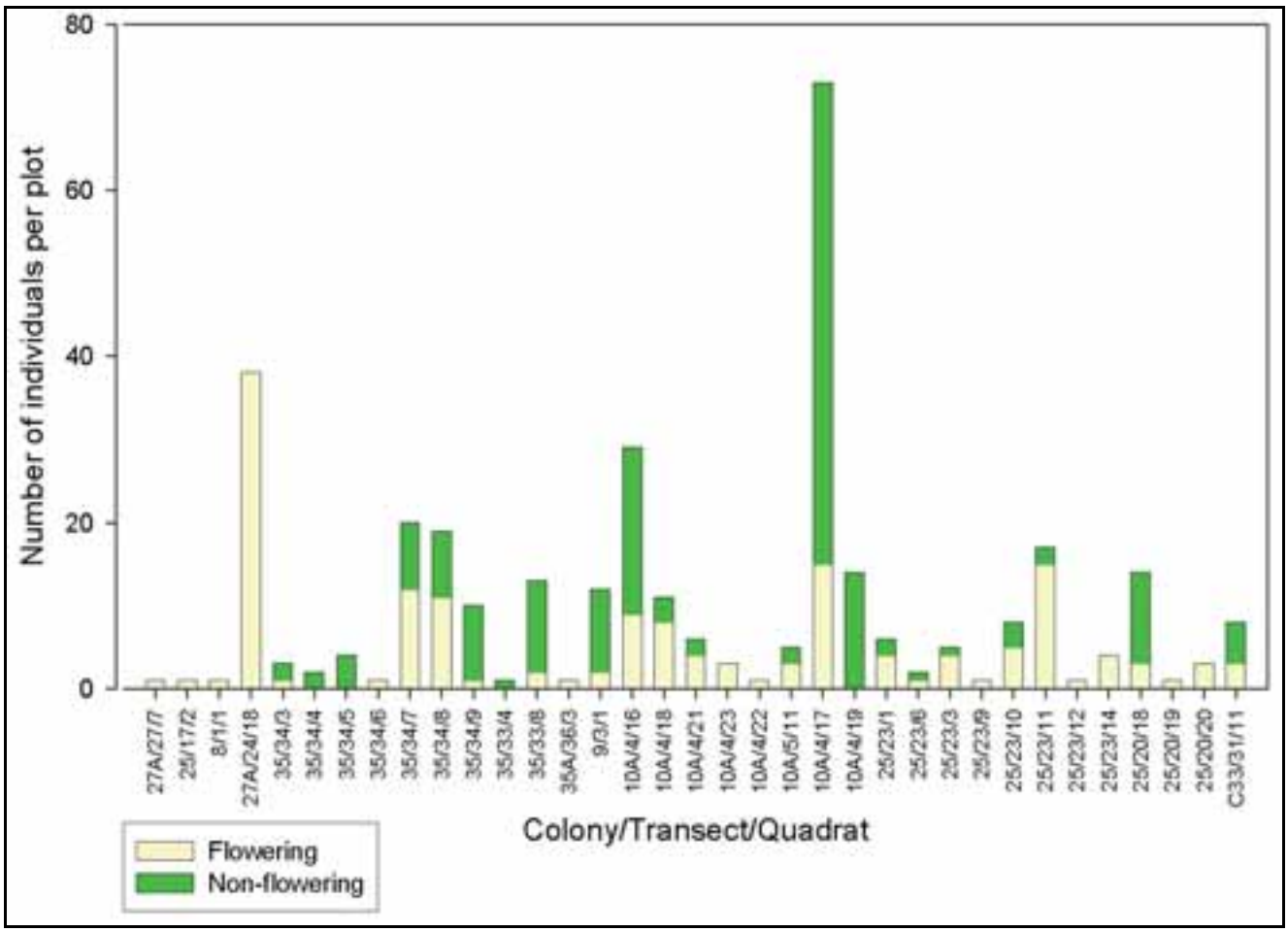


Figure 4.5. Ute ladies'-tresses flowering and non-flowering ratio histogram.

Within a 95 percent confidence interval, the percentage of flowering to non-flowering ULT individuals falls between 52.6 and 41.8 percent, with a mean of 47.19 percent (Appendix 4.6). The ratio of flowering to non-flowering individuals is 1 to 1.119, indicating that for every flowering ULT individual there is one non-flowering individual. Year-to-year differences of the ratio are also likely be highly variable, as are historical counts of flowering ULT individuals. To determine a meaningful estimate of the ratio of flowering to non-flowering ULT individuals within a reasonable confidence interval would require enormous effort; that ratio may not be applicable in the context of this project.

$$\underset{\hat{q}}{\overset{\hat{p}}{\hat{p} \pm \left[\left(z_{\alpha} \sqrt{1-f} \sqrt{\frac{\hat{p}\hat{q}}{n-1}} \right) + \frac{1}{2n} \right]}}$$

z_{α}

$\hat{p}$	=	Estimated proportion of flowering plants (X types)
z_{α}	=	Standard normal deviation (1.96 for 95% confidence interval)
f	=	Sampling fraction - Number of samples/population (25,000)
$\hat{q}$	=	Proportion of non-flowering plants (Y or other types)
n	=	Sample size

The 95% confidence interval of the proportion of flowering plants is: (0.526, 0.418).

$$0.471976 \pm \left[\left(1.96 \sqrt{1 - 0.01356} \sqrt{\frac{0.471976 * 0.528024}{338}} \right) + \frac{1}{2*339} \right]$$

4.3.4 Dominant Native and Non-native Species

Dominant native and non-native species observed while conducting ULT surveys were recorded for each colony. Successional processes within vegetative communities, changes in ground water hydrology, and competition from non-native species occupying ULT habitat may affect population numbers. Colonies with previously high individual counts may be decreasing or increasing as habitat changes; therefore, general observations about surface conditions were recorded during ULT surveys (Appendix 4.7).

4.4 DISCUSSION

Currently, the best method for assessing ULT populations is counting flowering individuals annually in representative colonies and determining abundance estimates for colonies with more variable historical counts. By counting flowering individuals on representative surfaces, it provides managers with information that may be pertinent to population health and a vigor. Another function of monitoring flowering ULT individuals is to assess the number of colonies within a population, which may be another indicator of how current management is affecting ULT numbers. It may be appropriate in subsequent years to compare ULT abundance estimates observed before and after construction of the Diamond Fork System

Impacts to ULT populations in the Diamond Fork Watershed may be attributed to changes in vegetation rather than changes in water levels. Mechanisms changing vegetation composition include: competition from non-native plant species, changes in disturbance regimes, and establishment of late successional species. Ute ladies'-tresses are typically found in areas that are heavily vegetated by early successional species or species that are in early stages of establishment or development. Because proximal vegetation appears to ultimately affect and impact ULT numbers, the methodology for habitat assessment may need revision

Transects were placed in microhabitats that were predicted to dry as flows decreased in Diamond Fork Creek (Black and Gruwell 2005); hence these transects are not representative of the dynamics of surfaces surveyed. For added accuracy in estimating flowering to non-flowering ratios and more accurately capturing changes occurring on surfaces, permanent transects should be placed in locations better representative of ULT-occupied surfaces; particularly surfaces where ULT colonies are currently found. As mentioned in the results section, placing more transects in areas occupied by ULT colonies—as well as employing a more complex, stratified, and rigorous sampling design—could increase the statistical power of analysis for better estimating ratios of flowering to non-flowering ULT. This is significant if the overall management and monitoring of Diamond Fork ULT populations require this level of detailed information.

CHAPTER 5: UTE LADIES'TRESSES HABITAT ANALYSIS

5.0 UTE LADIES'-TRESSES HABITAT ANALYSIS

5.1 INTRODUCTION

Ute ladies'-tresses are endemic to moist areas and occur in the following habitats: along riparian edges, gravel bars, old oxbows, and high-flow channels; in moist-to-wet meadows along perennial streams in apparently stable wetlands and seeps associated with established landscape features; within historical floodplains of major rivers; and in the eastern Great Basin in wetlands and seeps near freshwater lakes or springs (USFWS 1992). These areas are highly dynamic ecosystems sensitive to fluctuations in hydrology. As flows in Sixth Water Creek and Diamond Fork Creek were reduced in 2004, after implementation of the Diamond Fork System, attention to changes within the riverine ecosystem and its associated ULT habitat has increased.

In 2005 HDR attempted to establish a baseline for monitoring changes within ULT habitat. This was done by monitoring groundwater hydrology as well as monitoring plant communities where ULT colonies are found. However, the course scale of those efforts—as well as incomplete data sets—made it difficult to establish a baseline to track changes such as species composition and vegetation coverage within ULT habitat (Black and Gruwell 2005).

Potential impacts to ULT populations in the Diamond Fork Watershed could be attributed to changes in water levels in addition to changes in vegetation. Mechanisms changing vegetation composition include competition with non-native plant species, changed disturbance regimes, and establishment of late successional species. Because of changes in vegetal cover, such as species composition and subsequent successional processes, a baseline ULT habitat analysis was established in order to track compositional changes in vegetation through time.

Ground water monitoring was conducted as part of the riparian monitoring and ULT surveys. Conducting ground water monitoring in conjunction with recording surface water levels may help explain the relationship, if any, between the flow in the Diamond Fork Creek and ground water elevations at various geomorphic surfaces where unique vegetation communities, including ULT colonies, have established.

BIO-WEST began vegetation and groundwater monitoring in 2006 at existing transects and piezometers, examining compositional changes and groundwater fluctuations within ULT habitat in closer detail. Quadrats located along existing transects were used to establish baseline data to track vegetation composition changes. The intent of these surveys was to identify correlations between ULT and accompanying species.

5.2 METHODS

5.2.1 Survey Methods

In 2005 HDR established permanent transects on surfaces where ULT individuals had been found or where habitat was predicted to be ideal for colonization as hydrology changed. Many transects were placed deliberately in micro-topography, particularly in areas slightly wetter than where ULT

individuals are normally found (Black and Gruwell 2005) (Figure 5.1). These areas, prior to construction of the Diamond Fork System, likely could not support ULT establishment because high flows would have inundated these sites with water during growing period. It is probable that permanent transects were set up in wetter areas with the anticipation that reduced flow in Diamond Fork Creek would eventually cause these areas to dry slightly, making conditions more suitable for ULT. The same transects used to assess the ratio of non-flowering and flowering ULT were used for habitat assessments.

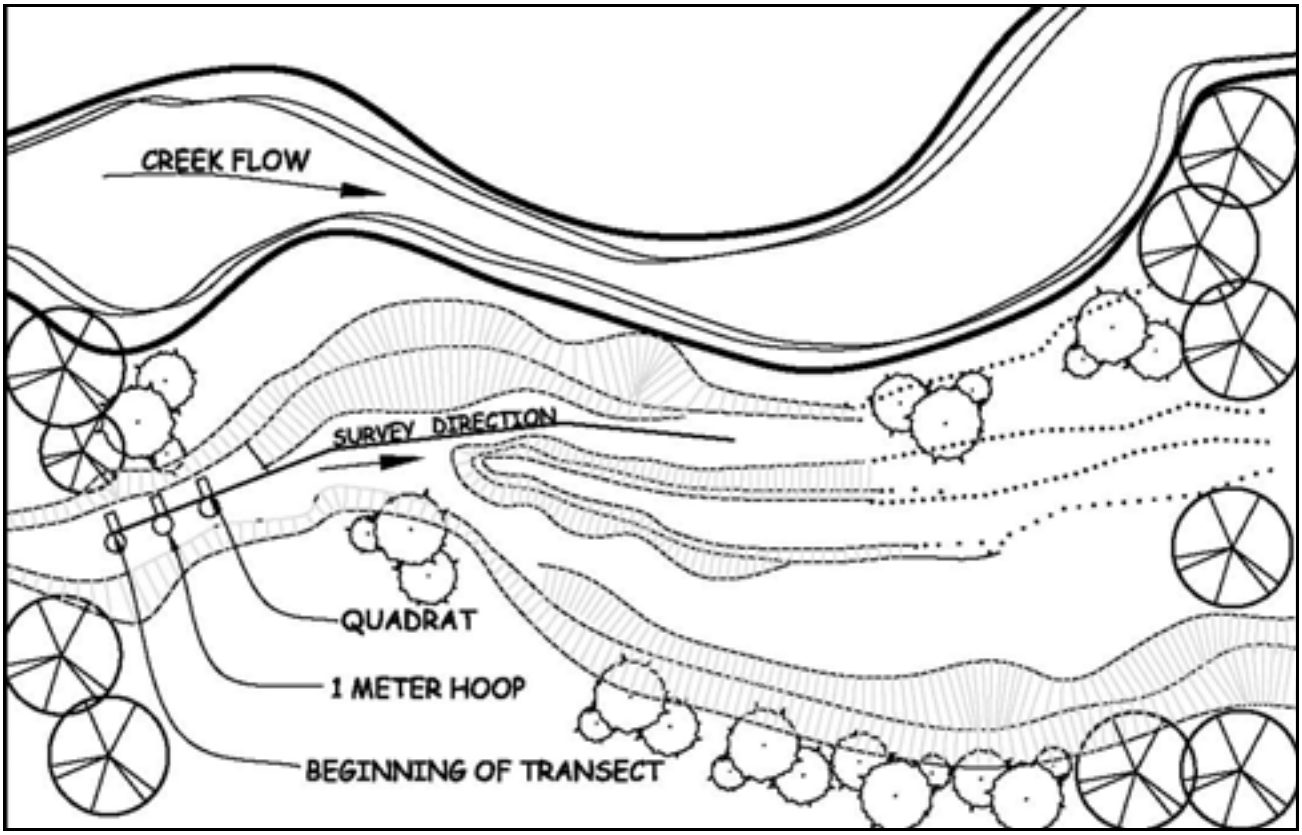


Figure 5.1. Transect placement within microtopography.

5.2.2 Transect Quadrats

The permanent transects established by HDR were used for BIO-WEST's 2006 surveys. Because endpoints for many of the transects were not found, BIO-WEST replaced rebar and labeled endcaps, as well as placed metal posts with flagging for subsequent surveys. Each site contained a total of 30 quadrats or more, which were re-established and sampled. Quadrats were placed along transects, placing the top corner of the quadrat on the transect and spacing quadrats every 5 meters (Figure 5.1). Within each quadrat, the absolute cover of vegetation (by species of grasses, forbs, and shrubs less than 0.5 meter tall), moss, bare ground, litter, and rock was visually estimated. Every species found within the quadrat was recorded, and percent cover was estimated. All flowering ULT individuals found within the quadrats were counted and recorded.

5.2.3 Piezometer Measurements

Piezometers were installed in 2005 by HDR at three locations within the three lower geomorphic monitoring sites, DFC (Surface 10), MO (Surface 25), and OX (Surface 35) on Diamond Fork Creek (Black and Gruwell 2005). In November 2006 each piezometer's location and elevation were surveyed using a total station and known real-world coordinates from cross section endpoints used for geomorphic monitoring (BIO-WEST 2005). At each piezometer the top of the well casing and the ground surface were surveyed (Table 5.1).

Table 5.1. Location of the top of piezometers used for 2006 ground water monitoring.

SITE	PIEZOMETER NAME	COLONY NUMBER	NORTHING (UTM METERS)	EASTING (UTM METERS)	ELEVATION (NAVD 1988 METERS)
DFC	Well 1 top of casing	10A	4,435,457	462,680.2	1,577.07
	Well 1 ground		4,435,456	462,680.3	1,576.96
DFC	Well 2 top of casing	10A	4,435,463	462,665.3	1,576.95
	Well 2 ground		4,435,463	462,665.4	1,576.77
DFC	Well 3 top of casing	10A	4,435,453	462,642.3	1,576.63
	Well 3 ground		4,435,452	462,642.3	1,576.48
MO	Well 1 top of casing	25	4,432,709	459,629.8	1,522.59
	Well 1 ground		4,432,709	459,629.9	1,522.36
MO	Well 2 top of casing	25	4,432,735	459,618	1,522.68
	Well 2 ground		4,432,735	459,618	1,522.48
MO	Well 3 top of casing	25	4,432,772	459,600.7	1,522.23
	Well 3 ground		4,432,772	459,600.8	1,522.09
OX	Well 1 top of casing	35	4,432,219	458,314.8	1,525.622
	Well 1 ground		4,432,219	458,314.8	1,525.398
OX	Well 2 top of casing	35	4,432,172	458,302.1	1,525.239
	Well 2 ground		4,432,172	458,302.1	1,525.134
OX	Well 3 top of casing	35	4,432,192	458,309.3	1,525.243
	Well 3 ground		4,432,172	458,302.1	1,525.134

The proposed sampling schedule included measurements at seven times during the year. These sampling periods included the following:

- April or May during base flow,
- during peak runoff,
- 3 weeks post-peak runoff,
- early July,

- end of July,
- mid-August, and
- the end of September.

However, in 2006 measurements occurred on a monthly basis from June through November, with two measurements taken in August. Therefore, there are six sets of water level measurements for 2006.

Water-level measurements for each piezometer included depth of ground water from the top of the piezometer and the elevation of the water surface in Diamond Fork Creek near the piezometer (perpendicular to flow in the creek). An electronic water-level meter was used to measure the depth of the ground water from the top of the piezometer. Rebar was installed near the streambank to gage stream elevation from a set point above the stream. However, the rebar was often bent or removed between sampling efforts and proved to be an unreliable method for determined stream elevations relative to the piezometers.

Because the piezometer locations were surveyed, ground water elevations could be adjusted to real-world elevations with the following simple subtraction:

> Top of casing (NAVD 1988 elevation) - Depth of water from top of well casing = Elevation of ground water (NAVD 1988 elevation)

In order to calculate the elevation of the surface water as real elevations, the change in elevation from the top of the casing to the water surface was subtracted from the elevation at the top of the well casing. The average daily flow in Diamond Fork Creek was noted from the USGS gage 10149400 Diamond Fork Above Red Hollow through the USGS website for days when piezometer measurements were taken. All data were plotted as a time series with the measurement date on the X axis, flow on the primary Y axis, and ground water elevation on the secondary Y axis.

5.2.4 Data Analysis

All vegetation data were compiled in a database (Microsoft Access®) and organized by transect. Correlation analyses were conducted on the quadrat vegetal cover data in a pair-wise manner with ULT densities measured for each transect. Ute ladies'-tresses density was estimated by coverage of individuals within a 1-meter-diameter hoop placed opposite each quadrat (Figure 5.1). These counts were then averaged for each transect, and this value was used as the correlation value for the coverage amount of each species and other cover-type parameters measured. In addition species were grouped into categories for analysis: forb, graminoid (grass-like plants including sedges and rushes), grass, non-grass gramninoids (only sedges, rushes, and spikerushes), woody plants, and non-native plants.

A Kruskal-Wallis test was then carried out on the data (Systat 2006). The non-parametric Kruskal-Wallis test was used to compare vegetal cover based on habitat type (occupied, potentially occupied and non-occupied) because much of the vegetal cover data did not appear to be normally distributed based on graphing analysis. Although some of the species or species category data did seem normally distributed, most did not appear to meet this criteria. Analysis of variance (ANOVA), a standard method used to compare population means between groups, assumes normality of the data,

and could lead to inaccurate estimates of p-values if used where data are not normally distributed. However, to compare all the data consistently, the Kruskal-Wallis test was used. The Kruskal-Wallis test is a non-parametric test that does not assume normality, ranks vegetal cover data, and tests the null hypothesis: 'There is no difference between the mean ranks of vegetal covers based on habitat type.' Some information is lost with this technique; however, it is a statistically robust test for this type of data, and is considered a standard method in ecological studies. Three surface groups were described based on transect placement: occupied surfaces, potentially occupied surfaces, and unoccupied surfaces. Occupied surfaces are surfaces that contain ULT colonies where transects were placed directly within microsites containing previously identified colonies. Potential ULT surfaces are areas that have ULT individuals located somewhere on the surface but not necessarily within the microsites where the transects were placed. Unoccupied surfaces are surfaces that have vegetation and hydrologic characteristics similar to occupied sites but where no ULT plants have been found during previous studies. The Kruskal-Wallis test compared the coverage amount of each species and other cover-type parameters measured, as well as for the groups of species developed for the correlation analysis. Complete statistical analyses and results are located in Appendices 5.1, 5.2A, 5.2B, and 5.3B. Appendix 5.1 contains quadrat data collected during habitat analysis. Appendices 5.2A and 5.2B contain correlations for individual species found within the habitat analysis and scatter plots illustrating frequency of species occurrence within ULT habitat.

5.3 RESULTS

5.3.1 Vegetation Cover and Composition

Cover types used for the ULT habitat analysis were total vegetal cover, bare ground, rock, and litter. Occupied, potentially occupied, and unoccupied sites were all analyzed independently (Figure 5.2). The results indicated that occupied and potentially occupied sites had higher vegetal cover with smaller standard deviations than unoccupied sites. Bare ground areal cover was significantly higher at the unoccupied sites than at the occupied and potentially occupied sites. Occupied sites had less rock areal cover than the potentially occupied sites, and much less rock areal cover than the unoccupied sites. There was no difference in litter cover between sites.

The results showed that total vegetal cover was highest in occupied sites, as shown in Figure 5.2, with a P-value of 0.001. In other words, there was a significant statistical difference in total vegetal cover between sites. Furthermore, the percentage of bare ground was much higher in the unoccupied sites with a low P-value (<0.001), also indicating a statistically significant difference between sites.

Species found within quadrats were placed in one of the following groups: forb, graminoid, grass, non-grass graminoid, woody plant, or non-native plant (Figure 5.3). The number of woody plant individuals was significantly higher at the occupied sites than at the potentially occupied or unoccupied sites. Non-native plant numbers were also highest at the occupied sites. Woody plant species, as well as non-native species, showed a highly significant relationship with P-values of <0.001 within occupied sites. Since ULT and most non-native plants are disturbance-adapted species, this is not unexpected. However, the occurrence of a higher rate of woody plants associated with ULT individuals is less intuitive. Woody plant communities, mainly willows, generally did not have a high percentage of vegetal cover at the occupied sites and were still in early developmental stages. When mature willow thickets were sampled, no ULT plants were found. The low-to-

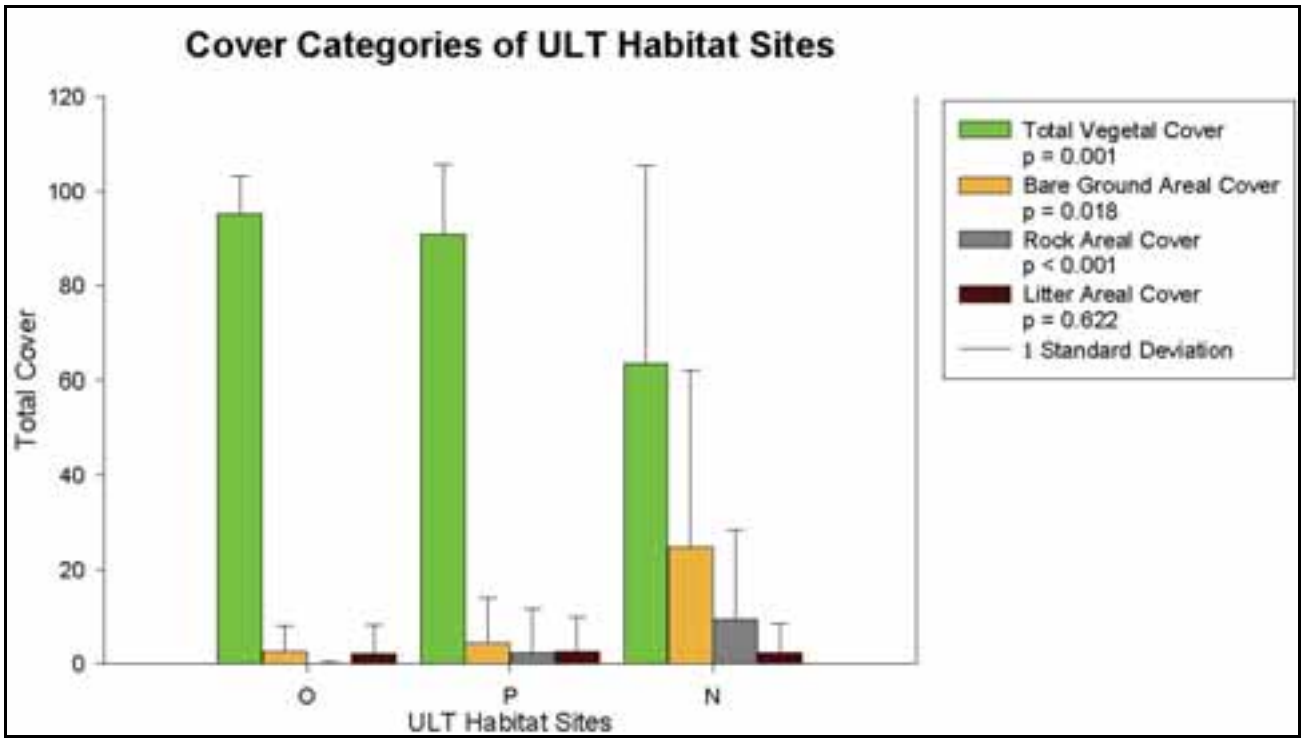


Figure 5.2. Significance of total cover categories within ULT habitat sites.

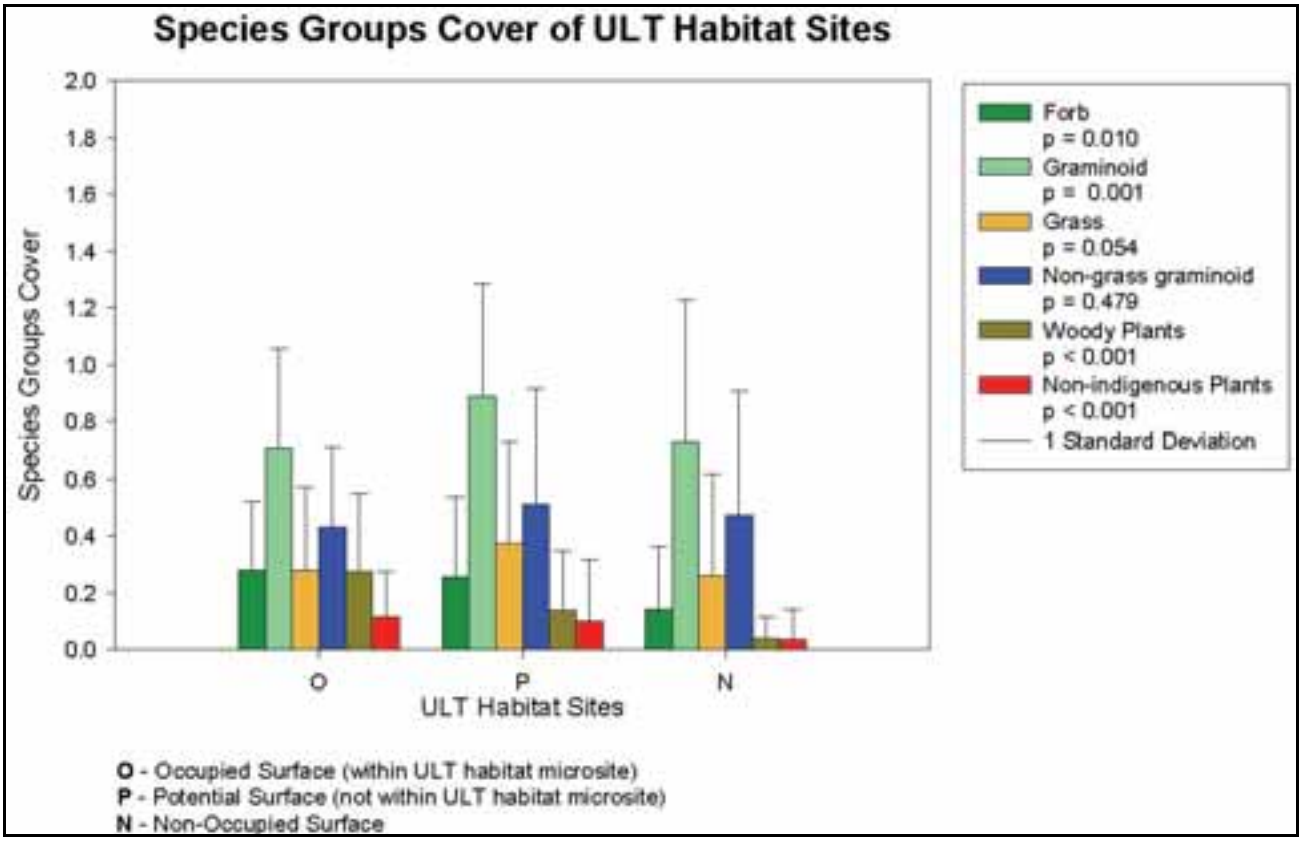


Figure 5.3. Significance of species groups cover categories within ULT habitat sites.

moderate cover of woody species seems to indicate a moderate-disturbance regime along Diamond Fork Creek to which the ULT species is adapted.

The quadrat data were also analyzed by selected species found within each of the ULT habitat types (Figures 5.4a and 5.4b). Although many more species existed in the data set, the species shown in Figures 5.4a and 5.4b were those that showed a high correlation with P-values that were highly significant or significant when comparisons were made between sites. A comprehensive list of species found within all quadrats can be found in Appendix 5.3. A set of species was selected for further analysis based on whether the species was found within each habitat type. Each species was then compared by ULT habitat type, and Kruskal-Wallis tests were performed for each species. The P-values (Appendix 5.3) describe species and cover type differences between habitat types: occupied, potentially occupied, and non-occupied. The P-values are not a result of paired comparisons between any two habitat types; these values simply illustrate that there are significant differences between habitat types in species found and cover categories.

Correlations between the density of ULT plants on a transect and vegetal parameters recorded within the quadrats were not strong. A large majority of the hoops surveyed along established transects, even within the occupied sites, contained no ULT individuals. The method used to attribute the ULT densities from the transect to the quadrats may have influenced the lack of correlation, but other factors associated with the size and shape of occupied micro-habitats may also confound the results. Since the correlation analysis assumes a linear relationship between the data, and a normal distribution of parameters, deviations from these assumptions can largely influence the correlation results. The fact that the data were collected in a pre-determined, non-random manner, using hoops that many times missed ULT plants may also have influenced these analyses.

5.3.2 Non-native Plant Species

The coverage analysis of species groups found within ULT habitat indicated that there was a highly significant correlation with a P-value of <0.001 between presence of ULT individuals and the presence of non-native plant species. Because both ULT and many non-native species require and or thrive in environmental situations caused by regular disturbance regimes, these species were in many cases competing for very similar resources and habitat. Since non-native species are characteristically early successional species, it is understandable that a highly significant correlation exists between them.

It is likely that the invasion of non-native plant species can become as much of a concern for the persistence of ULT populations within the Diamond Fork Watershed as hydrological changes and the adaptation of the native vegetation community structure to those changes. Particular non-native species of concern along Diamond Fork Creek are Canada thistle (*Cirsium arvense*), bull thistle (*Cirsium vulgare*), perennial pepperweed (*Lepidium latifolium*), salt cedar (*Tamarix ramosissima*), and Russian olive (*Elaegnus angustifolia*). Since many of these species currently occur in relatively low numbers, early detection and rapid treatment response could affect the persistence of ULT along Diamond Fork Creek.

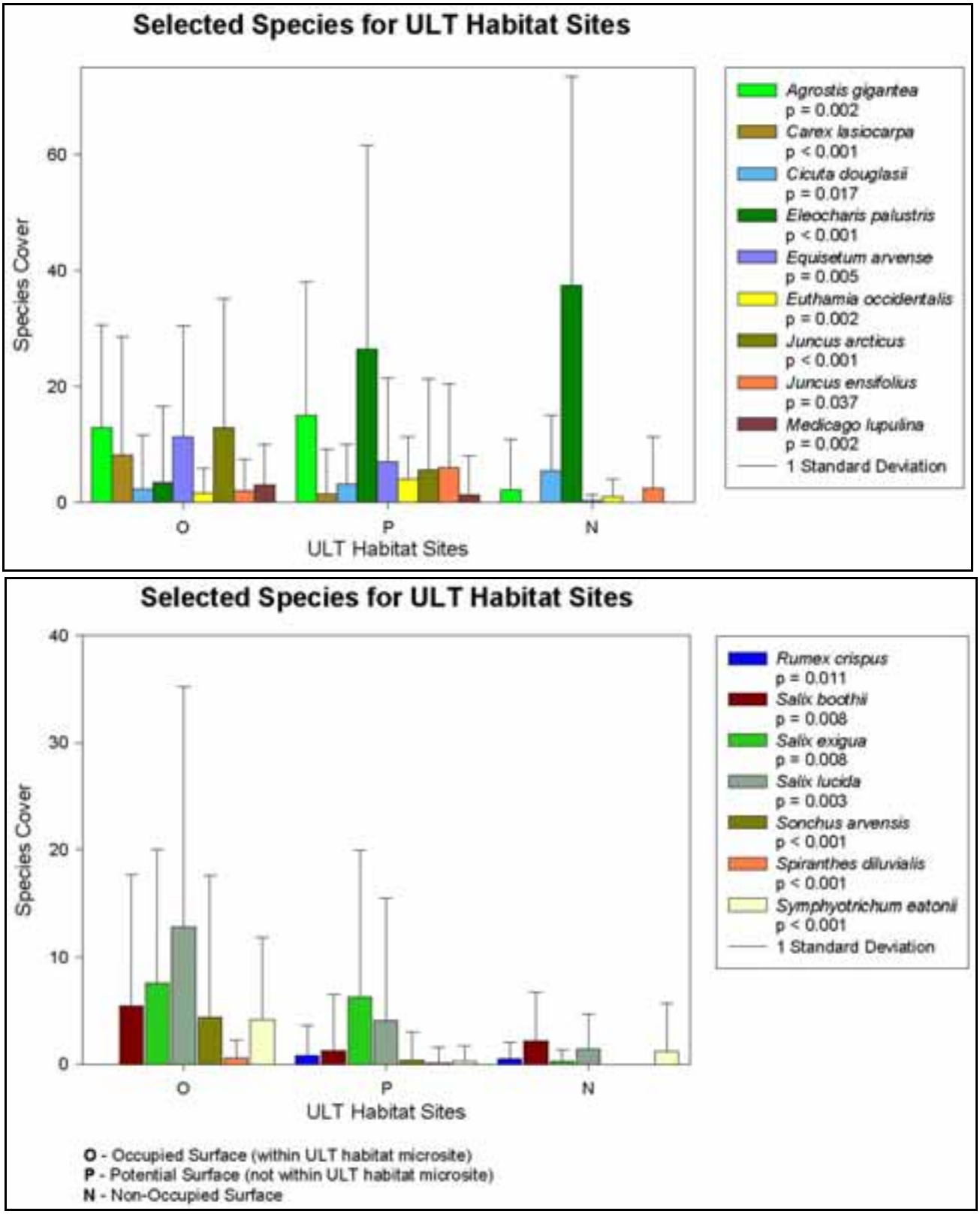


Figure 5.4. Significance of species cover within ULT habitat sites.

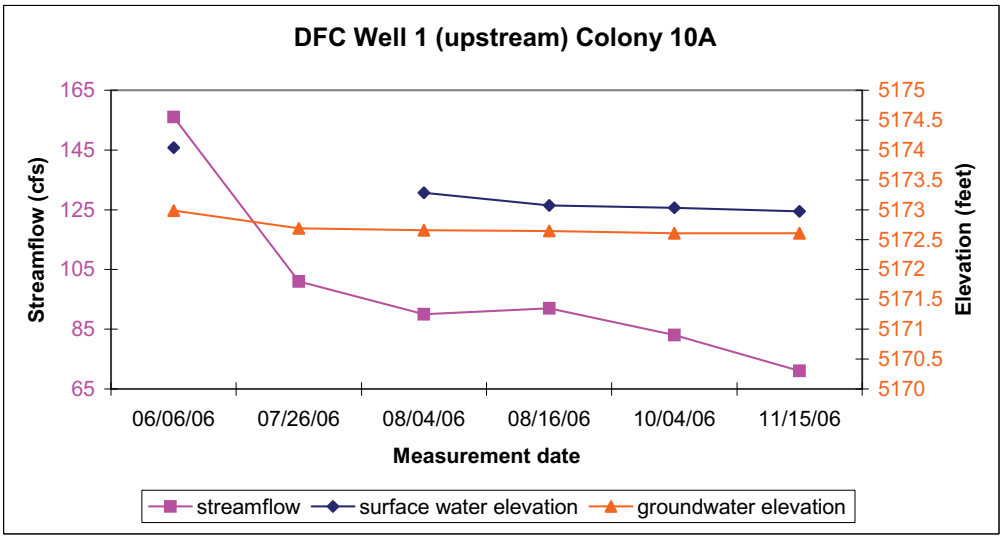
5.3.3 Piezometer Measurements

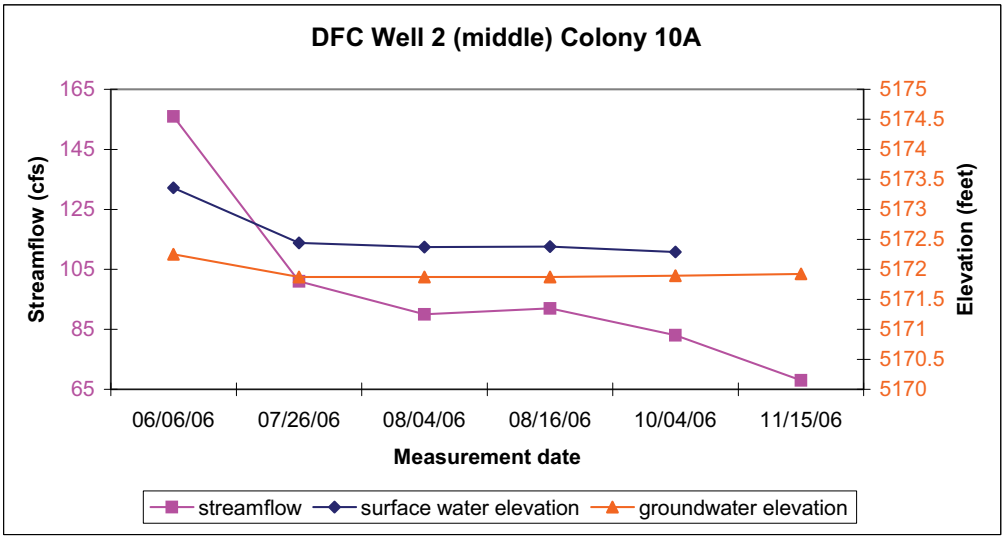
Piezometer measurements taken in 2006 inconsistently correlated with stream discharge and surface water elevations between sites (Appendix 5.4; Figures 5.5, 5.6, and 5.7). The DFC site appears to be a "losing reach" (losing surface water to the nearby alluvial aquifer), whereas the MO and OX sites appear to be "gaining reaches" (water flows from the near-surface alluvial aquifer to the stream). Ground water elevations were approximately 1 foot lower at the DFC piezometers than the elevation of the surface water in Diamond Fork Creek perpendicular to the piezometers during high flow and approximately 0.4 foot lower during low flow (Figure 5.5). Therefore, high flows were important in recharging the near-surface alluvial aquifer at the DFC site. The ground water elevation fluctuated less than 0.4 foot within each piezometer at the DFC site from June through November (Figure 5.5). Major surface water fluctuations followed the same seasonal pattern as ground water fluctuations; however, the response in ground water to changes in flow in October and November at the DFC piezometers was confusing. The alluvial water table (presumably being supported by streamflow) seemed to stay at the same elevation at the DFC site throughout the summer and rise slightly later in the fall (by 0.02 to 0.05 foot) when flows were decreased during October and November (compared with July and August flows). Since the flows decreased during this period, a drop in evapotranspiration rates is the most logical cause for the slight increase in ground water elevations at this site.

The alignment of the three piezometers at MO was perpendicular to flow (across the floodplain), whereas piezometers at DFC and OX were aligned more parallel to flow. Therefore, there was only one surface water measurement site for all three piezometers at the MO site. Further complicating surface water measurements at this site was the fact that the stream was relatively steep and uneven (i.e., in a riffle) directly perpendicular to the piezometers. Although a rebar was placed along the bank at a set elevation above the water, it was tampered with and disturbed between measurements, especially between October and November (Figure 5.6). Therefore, some of the surface water measurements at the MO site (especially from November) were suspect and should be discarded.

The piezometer readings indicated that the MO site was a gaining reach during all monitored seasons. The ground water elevations were higher than the surface water in the stream and increased with distance from the stream (Figure 5.6). These results indicate that the alluvial aquifer at this site is being supported by water sources other than lateral interchanges with the stream. Seasonal fluctuation in water levels in all three piezometers were much greater (>2X) than at DFC, especially at MO 1. The MO 1 piezometer (farthest from the stream) had the greatest ground water level fluctuations, whereas piezometer MO 3 (closest to the stream) had the least fluctuating ground water levels at this site. The slope of the water table was likely greater at the MO 1 piezometer than the MO 3 piezometer. One problem with the late summer and fall measurements at the MO site was that the piezometers were not drilled deep enough; they all became dry or near dry in October and November.

The piezometer readings indicated that the OX site was also a gaining reach during all monitored seasons with ground water elevations approximately 0.15 to 0.30 foot higher (perpendicular to flow) than surface water elevations (Figure 5.7). These results also indicate that the alluvial aquifer at this site was being supported by water sources other than lateral interchanges with the stream. The stage of flow in the stream probably functions more as a dam controlling ground water discharge to the stream rather than the source of ground water from the stream.





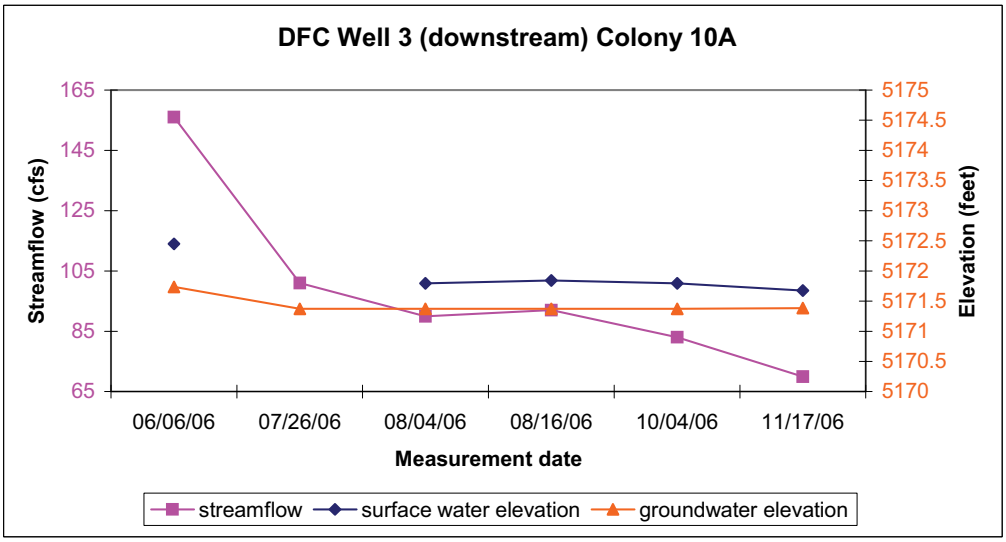
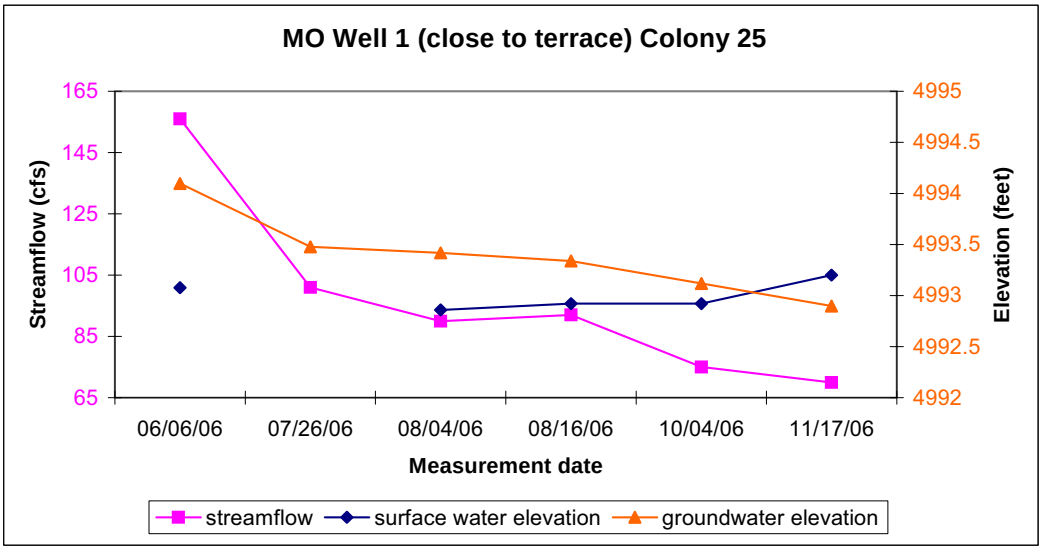
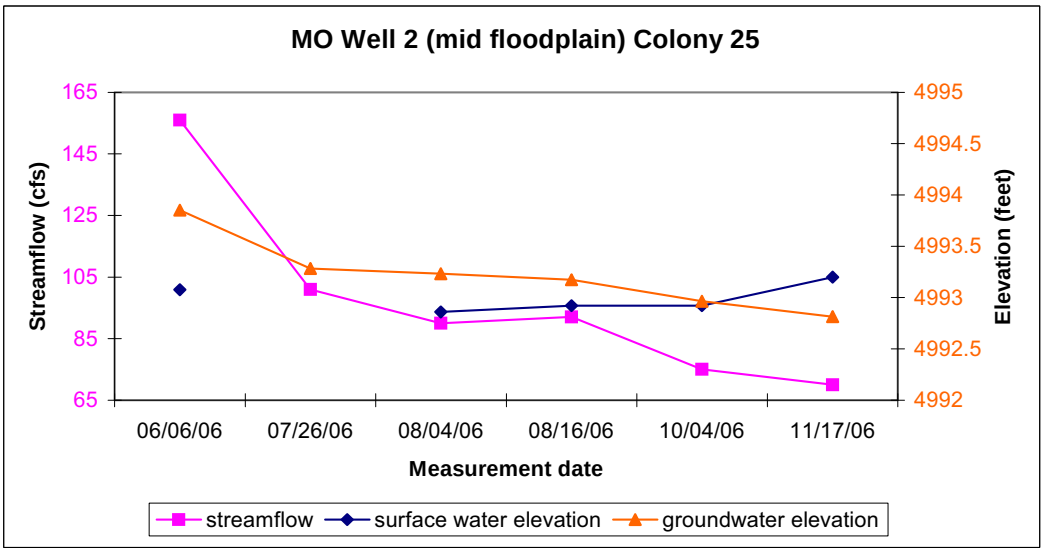


Figure 5.5. Streamflow, ground water, and surface water measurement time series for DFC piezometer wells 1, 2, and 3 for Colony 10A.





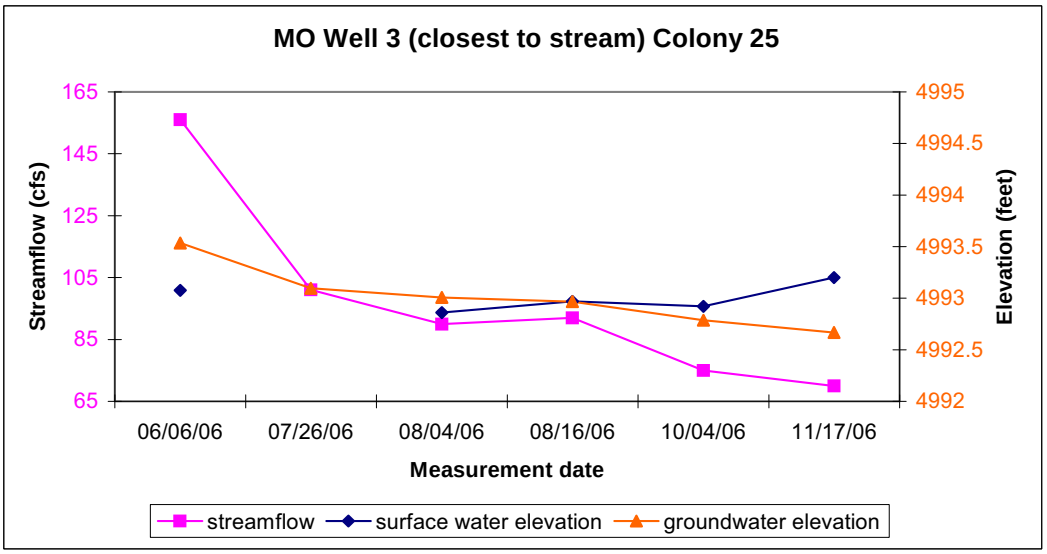
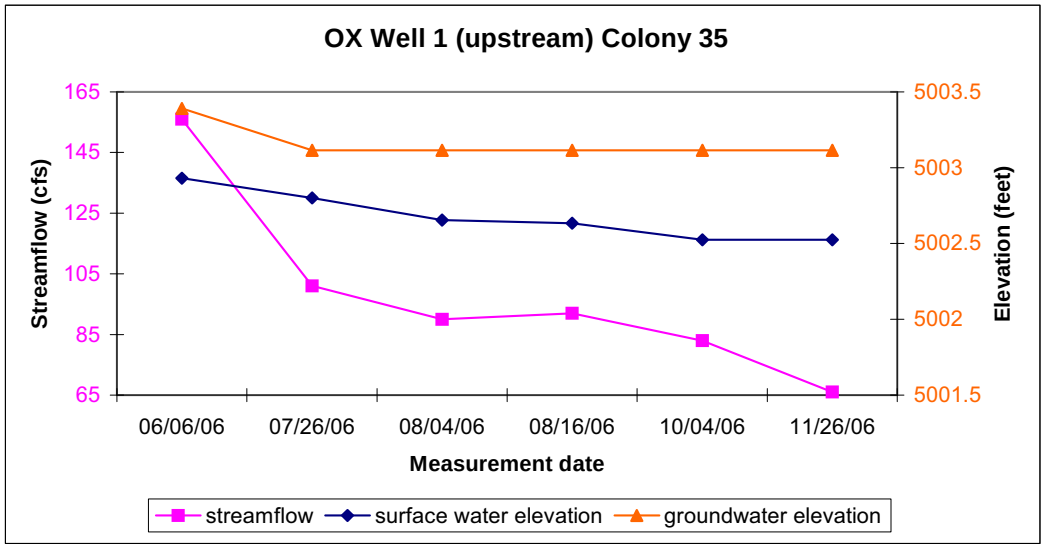
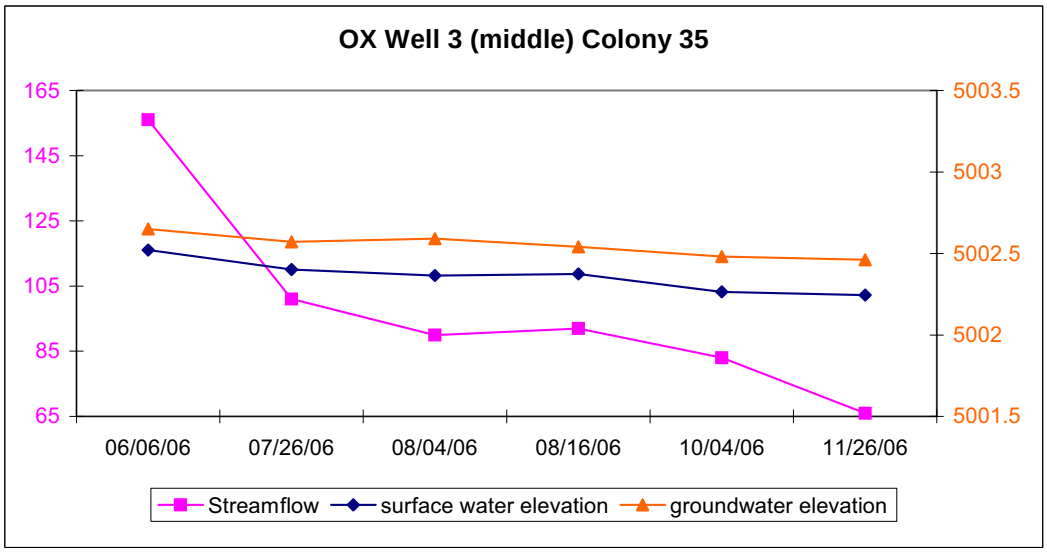


Figure 5.6. Streamflow, ground water, and surface water measurement time series for MO piezometer wells 1, 2, and 3 for Colony 25.





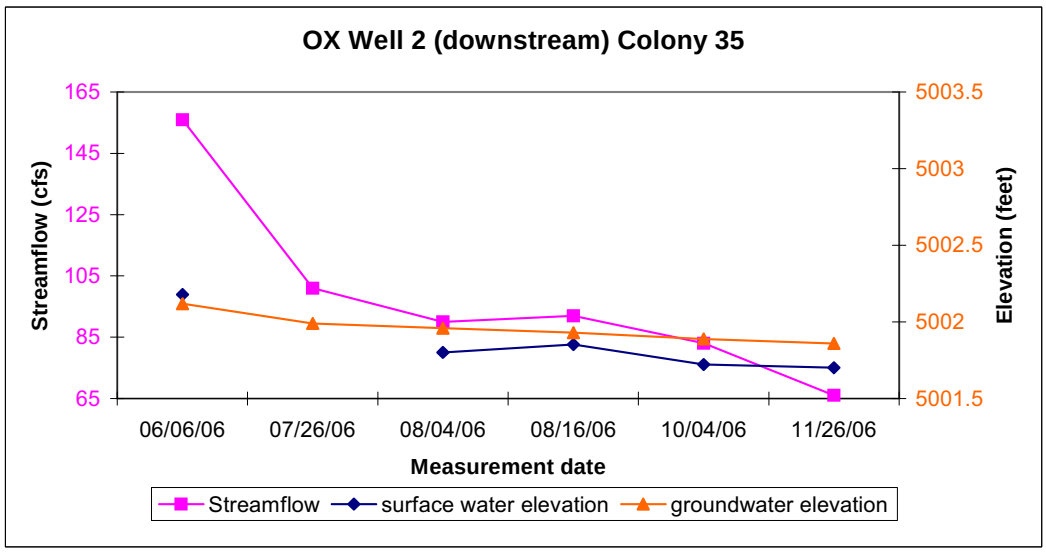


Figure 5.7. Streamflow, ground water, and surface water measurement time series for OX piezometer wells 1, 2, and 3 for Colony 35.

Seasonal groundwater fluctuations at the OX site were low (approximately 0.2 foot) in all piezometers. The OX 1 piezometer fluctuated the most between June and July but became unmeasurable as the well dried up during the summer. The other OX piezometers seemed to be only minimally responsive to changes in discharge or surface water elevation in the stream (Figure 5.7). For example, the OX 3 piezometer had an inverse relationship with flow and surface water elevations during July and August (Figure 5.7).

5.4 DISCUSSION

Both bare ground and total vegetal cover may be influenced by specific transect locations as portions of some of the potentially occupied and unoccupied transects bisected active segments of the streambed. The transects were originally located within the different sites based on very narrow corridors of micro-topography (surfaces) that were either occupied (i.e., transects located at the right elevation for previous ULT colonization), potentially occupied (i.e., transects located on occupied surfaces but at slightly lower and wetter elevations on the same surface), or unoccupied (transects located on unoccupied surfaces that are also slightly lower and wetter than the occupied sites). The question is: how will these habitats and associated ULT colonies change over time with a more natural hydrologic regime?

Sampling methods that were used to assess ULT habitat may not be representative of all surfaces. Placing a randomized set of transects within ULT habitat may eliminate confounding factors while specifically looking at ULT habitat. Placing transects in areas more representative of all surfaces may be a more biologically appropriate experimental design and thereby provide a more accurate estimate of ULT habitat.

Non-native species were recorded both in quadrats and on sites containing ULT colonies. As previously discussed, particular species may compete directly with ULT for similar soil, moisture, light, and pollinator requirements. An effort to map and treat weeds within the Diamond Fork Watershed may be important in the preservation of existing and establishment of future ULT colonies.

Ground water and its association with the instream flows of Diamond Fork Creek was inconsistent at the three piezometer monitoring sites. Two of the sites (OX and MO) were gaining reaches and one site (DFC) was a losing reach. The implications that instream flows control ground water elevations at OX and MO via lateral exchanges were not supported by the data collected in 2006. With this in mind, the number and placement of piezometers at the three occupied sites were insufficient for gathering the data necessary to really understand ground water-surface water interactions at any of the sites.

While past assumptions may have been made about how and to what extent ground water and surface water are connected in Diamond Fork Creek, to our knowledge no studies have really examined this relationship. The current study was designed to specifically look at ULT habitat and the fluctuating ground water levels where ULT individuals currently exist. However, this study contained a design flaw: the wells were only installed at elevations correlating with ULT populations and not in general elevations of the alluvial aquifer. In order to get a more accurate idea of how ground water and streamflows are related, a grid system would need to be developed along a

portion of the stream and floodplain, and monitoring wells placed a minimum of 30 feet apart in a grid of equal width and length. Placing wells closer than every 30 feet would not allow for interpretation beyond the standard error in collecting elevation data. This grid should encompass the entire active floodplain so the effects of the valley's local ground water sources could also be determined. These data would allow us to map the surface of the alluvial aquifer and hopefully determine how it is affected by rising and falling streamflows. Once we have a better understanding of the effects of streamflow on ground water levels in Diamond Fork Creek, we will hopefully be able to refine our ULT monitoring efforts in areas where the greatest impacts are expected within the Diamond Fork System.

CHAPTER 6: SUMMARY AND DISCUSSIONS

6.0 SUMMARY AND DISCUSSION

Diamond Fork Creek and its tributary, Sixth Water Creek, have conveyed water imported from Strawberry Reservoir to the Wasatch Front as an important component of the Strawberry Valley Project. The artificially high flows ceased with the completion of the Diamond Fork System, which is part of the Bonneville Unit of the CUP. Today, the Diamond Fork System transports imported water through a series of tunnels and pipes to lower Diamond Fork River and can largely bypass Diamond Fork and Sixth Water Creeks. The only flows sent through Sixth Water and Diamond Fork Creeks are waters imported to satisfy instream flow requirements (USWFS 1999) and water in excess of the system's capacity.

Mitigation of impacts that were caused by the Diamond Fork System is required under CUPCA (1992). In order to fulfill these commitments, the Mitigation Commission established a long-term monitoring program to evaluate the geomorphic and ecological changes related to the new flow regime set by instream flow requirements. Long-term monitoring will allow analysis of change over time in order to set and prioritize restoration efforts and adaptively maintain the riverine and riparian ecosystem in a desirable and functional condition. The main study objectives include riparian vegetation mapping, plant community classification, ULT counts and relative abundance estimates to assess population trends, ULT habitat assessment, and monitoring ground water elevation, surface water elevation, and instream flow. This report documents findings from the 2006 monitoring effort, which is considered a baseline analysis with which future monitoring efforts will be compared.

6.1 Vegetation Mapping

Because vegetation communities can take several growing seasons to adjust to changes in hydrology, annual mapping at this scale is not necessary. However, during the first years after Diamond Fork System completion the most dramatic chances will occur; therefore, vegetation mapping should be repeated every other year for four years (2008 and 2010), every 5 years for the next 10 years (2015 and 2020), and every 10 years thereafter. This mapping schedule should be sufficient to track large-scale changes within vegetation communities.

As vegetation communities adjust to lower flows, particular attention should be paid to non-native species whose potential as early successional components of disturbed systems could greatly affect the structure of native plant communities. It is recommended that a non-native vegetation inventory be conducted along the length of the Diamond Fork Creek and any associated drainages. Invasive and exotic species have been identified as a possible threat to ULT populations and habitat. Ute ladies'-tresses, as well as many non-native species, is particularly adapted to disturbance regimes that historically occurred on Diamond Fork Creek. Because these species have similar habitat requirements, careful monitoring of and treatment programs for non-native species are recommended for the area.

6.1.1 Riparian Vegetation Transects

Riparian vegetation performs many functions in natural river systems. Hydrologic and geomorphic changes following changes to a flow regime can alter the physical processes that control riparian vegetation, thereby changing species distributions, abundance, and composition. The purpose of this study was to gather the data necessary to record and monitor those changes if they occur.

The first year of vegetation sampling along the riparian corridor showed that the riparian vegetation communities were indicative of the disturbance regime before implementation of the Diamond Fork System; vegetation communities were largely composed of early successional or disturbance-adapted species and immature late successional species. It is surprising that such a high percentage of the vegetation throughout the watershed is perennial since the area has experienced large amounts of disturbance. Our findings may be partially explained by the stability of the entire floodplain, which our surveys covered, compared with the areas immediately adjacent to the active stream channel. Furthermore, annual plants had died off by the time the surveys were conducted in late summer. As monitoring efforts are repeated, trends should emerge to clarify how riparian areas are responding to hydrologic modifications. If changes are noted over time, such as reduction of wetland species in a certain area, the data can be analyzed on other levels (e.g., elevation above stream, successional properties of particular species).

6.2 Limitations and Recommendations

When the study was first designed, the plan was to lump vegetation segments into broad categories for comparison. Because the data were collected with this assumption, areas that contained no single dominant (>20%) species were considered either mixed upland or mixed wetland, and no specific species information was gathered. Hence a limitation of this study is that we did not collect species and percent cover data during the field effort. Upon closer examination of the data and consultation with experts in the field, it became apparent that important information would be overlooked by continuing with broad categorization. Therefore, it was decided that the data collected should be species specific rather than categorical. Instead of recording species that are more than 20% dominant in areal coverage, all dominant species should be recorded by visually estimating percent cover. For areas where no species is at least 20% dominant, three species that are significant indicators of the area should be recorded. This would enable the transect data to be analyzed for several different parameters and compared against data from different reaches and at different distances away from and elevation above the stream. It is our recommendation that methods for next year's vegetation monitoring study be revised by collecting species information for all vegetation communities and estimating percent cover for each species. This would enable us to classify the remaining 11% of area that was unclassified during this study as a result of sampling methods and allow for a more accurate estimate of percent cover in communities containing more than one dominant species. After creating a more detailed baseline, we would recommend that the study be repeated on a 5-year monitoring cycle (2015, 2020) until the area stabiles to a point at which a 10-year monitoring cycle is more appropriate.

6.2.1 Ute Ladies'-tresses (ULT) Surveys

Currently, the best method for assessing ULT population is annually counting flowering individuals in representative colonies and determining abundance estimates for colonies with more historically variable counts. It may be appropriate in subsequent years to compare ULT counts and abundance estimates observed before and after Diamond Fork System implementation.

Impacts to ULT populations in the Diamond Fork Watershed may be attributed to changes in vegetation rather than changes in water levels. Mechanisms changing vegetation composition include: non-native plant species invasion, altered disturbance regimes, and late successional species establishment. Ute ladies'-tresses are typically found in areas that are heavily vegetated by early successional species or species that are in early stages of establishment or development. Because competing vegetation appears to ultimately affect and impact ULT numbers, the methodology for habitat assessment may need revision.

Transects were placed in microhabitats that were predicted to dry as flows decreased in Diamond Fork Creek (Black and Gruwell 2005). These transects are not representative of the dynamics of surfaces surveyed. For added accuracy in both estimating flowering to non-flowering ratios and capturing changes occurring on surfaces, permanent transects should be placed in locations better representative of all surfaces, particularly surfaces where known ULT colonies occur. As mentioned in the results section, placing more transects in areas occupied by ULT colonies and implementing a more complex, stratified, and rigorous sampling design could increase the statistical power of our analysis to better estimate ratios of flowering to non-flowering ULT. This is significant to providing a greater level of detail for the overall management and monitoring of the Diamond Fork ULT populations.

CHAPTER 7: LITERATURE CITED

7.0 LITERATURE CITED

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APPENDIX 2.1A NATIVE SPECIES FOUND IN THE DIAMOND FORK AND SIXTH WATER CREEKS VEGETATION MONITORING STUDY AREA

NATIVE AND NON-INDIGENOUS SPECIES FOUND IN THE DIAMOND FORK AND SIXTH WATER CREEKS VEGETATION MONITORING STUDY AREA

CODE	SCIENTIFIC NAME	COMMON NAME	INDICATOR STATUS[a]
ACGR3	*Acer grandidentatum*	bigtooth maple	
ACNE2	*Acer negundo*	boxelder	FACW
ACMI2	*Achillea millefolium*	common yarrow	FACU
AGGI2	*Agrostis gigantea*	redtop	NI
ALIN2	*Alnus incana*	speckled alder	FACW
APCA	*Apocynum cannabinum*	clasping-leaf dogbane	FAC
ARCA13	*Artemisia cana*	silver sagebrush	FAC
ARTR2	*Artemisia tridentata*	big sagebrush	
BEOC2	*Betula occidentalis*	water birch	FACW
BRIN2	*Bromus inermis*	smooth brome	NI
CANU4	*Carduus nutans*	musk thistle	
CAAU3	*Carex aurea*	golden-fruit sedge	OBL
CACA11	*Carex canescens*	silvery sedge	OBL
CALAA	*Carex lasiocarpa* var. *americana*	woollyfruit sedge	OBL
CALU7	*Carex luzulina*	woodrush sedge	OBL
CANE2	*Carex nebrascensis*	Nebraska sedge	OBL
CAREX	*Carex* sp.	sedge	
CAEX6	*Castilleia exilis*	small-flower Indian-paintbrush	OBL
CAMI13	*Castilleja minor*	lesser Indian paintbrush	OBL
CAMIM6	*Castilleja minor* ssp. *minor*	lesser Indian paintbrush	OBL
CHVI8	*Chrysothamnus viscidiflorus*	yellow rabbitbrush	
CIDO	*Cicuta douglasii*	western water hemlock	OBL
CIMA2	*Cicuta maculata*	spotted water hemlock	NI
CIAR4	*Cirsium arvense*	Canada thistle	FACU
COCA5	*Conyza canadensis*	Canadian horseweed	UPL
COSE16	*Cornus sericea*	redosier dogwood	FACW
CRDO2	*Crataegus douglasii*	black hawthorn	FAC
ELPA3	*Eleocharis palustris*	creeping spikerush	OBL
EPBR3	*Epilobium brachycarpum*	tall annual willowherb	UPL

CODE	SCIENTIFIC NAME	COMMON NAME	INDICATOR STATUS [a]
EPCI	*Epilobium ciliatum*	fringed willowherb	FAC
EQAR	*Equisetum arvense*	field horsetail	FAC+
EQHY	*Equisetum hyemale*	rough horsetail	FACW
EQLA	*Equisetum laevigatum*	smooth scouring-rush	FACW
ERNA10	*Ericameria nauseosa*	rubber rabbitbrush	UPL
EUOC4	*Euthamia occidentalis*	western golden-rod	OBL
FEPR	*Festuca pratensis*	meadow fescue	FACU
GEMA4	*Geum macrophyllum*	large-leaf avens	OBL
GRSQ	*Grindelia squarrosa*	curlycup gumweed	FACU
HEAN3	*Helianthus annuus*	common sunflower	FACU
HOJU	*Hordeum jubatum*	foxtail barley	FAC
JUAC2	*Juncus acutus*	spiny rush	FACW+
JUARL	*Juncus arcticus* ssp. *littoralis*	Baltic rush	FACW
JUAR4	*Juncus articulatus*	jointleaf rush	OBL
JUAR	*Juncus articus*	arctic rush	FACW
JUCO2	*Juncus confusus*	Colorado rush	FAC+
JUEN	*Juncus ensifolius*	swordleaf rush	FACW+
JUTO	*Juncus torreyi*	Torrey'ss rush	FACW+
JUSC2	*Juniperus scopulorum*	Rocky Mountain juniper	
MEAL12	*Melilotus alba*	white sweetclover	FACU
MEAR4	*Mentha arvensis*	Field mint	FACW
MIGU	*Mimulus guttatus*	common large monkey-flower	OBL
PHPR2	*Phacelia procera*	tall phacelia	NI
PHAR3	*Phalaris arundinacea*	Reed canary grass	OBL
PHAU7	*Phragmites australis*	common reed	FACW+
PITHOP	*Pithophora*	horsehair algae	
PLLA	*Plantago lanceolata*	narrowleaf plantain	FACU
PLMA2	*Plantago major*	common plantain	FAC
POAN3	*Populus angustifolia*	narrowleaf cottonwood	FAC
POFR2	*Populus fromontii*	Fremont cottonwood	FACW
PRVU	*Prunella vulgaris*	common selfheal	FACU

CODE	SCIENTIFIC NAME	COMMON NAME	INDICATOR STATUS [a]
PSSP6	*Pseudoroegneria spicata*	bluebunch wheatgrass	UPL
QUGA	*Quercus gambelii*	Gambel oak	
RACY	*Ranunculus cymbalaria*	alkali buttercup	OBL
RHTR	*Rhus trilobata*	skunkbush sumac	NI
ROWO	*Rosa woodsii*	Wood's rose	FAC-
RUCR	*Rumex crispus*	curly dock	FACW
SABO2	*Salix boothii*	Booth's willow	OBL
SAEX	*Salix exigua*	coyote willow	OBL
SALU	*Salix lucida*	shining willow	NI
SCPR4	*Schedonorus pratensis*	meadow fescue	FACU
SCAM6	*Schoenoplectus americanus*	Olney's threesquare	OBL
SCPU10	*Schoenoplectus pungens*	common threesquare	OBL
SCAM2	*Scirpus americanus*	Olney's bulrush	OBL
SOCA6	*Solidago canadensis*	Canada golden-rod	FACU
SOAR2	*Sonchus arvensis*	field sowthistle	FACU
SOOL	*Sonchus oleraceus*	common sowthistle	UPL
SPDI6	*Sprianthes diluvialis*	Ute ladies'-tresses	FACW+
SYOR2	*Symphoricarpos oreophilus*	mountain snowberry	FACU
SYEA2	*Symphyotrichum eatonii*	Eaton's aster	FAC+
TAOF	*Taraxacum officinale*	common dandelion	FACU+
TRRE3	*Trifolium repens*	white clover	FACU
TYLA	*Typha latifolia*	broadleaf cattail	OBL
URDI	*Urtica dioica*	stinging nettle	FAC
VEAN2	*Veronic anallis-aquatica*	water speedwell	OBL
VEAM2	*Veronica americana*	American speedwell	OBL

[a] FAC = facultative, FACU = facultative upland species, FACW = facultative wetland species, OBL = obligate wetland species, NI = not an indicator, UPL = obligate upland species.

APPENDIX 2.1B NON-NATIVE SPECIES FOUND IN THE DIAMOND FORK AND SIXTH WATER CREEKS VEGETATION MONITORING STUDY AREA

NON-NATIVE SPECIES FOUND IN THE DIAMOND FORK AND SIXTH WATER CREEKS VEGETATION MONITORING STUDY AREA

CODE	SCIENTIFIC NAME	COMMON NAME	INDICATOR STATUS [a]
AGCR	*Agropyron cristatum*	crested wheatgrass	
ARMI2	*Arctium minus*	common burdock	NI
BRTE	*Bromus tectorum*	cheatgrass	
CADR	*Cardaria draba*	hoary cress	NI
CANU4	*Carduus nutans*	musk thistle	UPL
CIAR4	*Cirsium arvense*	Canada thistle	FACU
CIVU	*Cirsium vulgare*	bull thistle	UPL
CYOF	*Cynoglossum officinale*	houndstongue	NI
ELAN	*Elaeagnus angustifolia*	Russian olive	FAC
LELA2	*Lepidium latifolium*	perennial pepperweed	FAC
LIDAD	*Linaria dalmatica*	dalmation toadflax	NI
MELU	*Medicago lupulina*	black medic	FAC
MESA	*Medicago sativa*	alfalfa	NI
MEOF	*Melilotus officinalis*	yellow sweetclover	FACU
PHPR3	*Phleum pratense*	timothy	FACU
TARA	*Tamarix ramosissima*	salt cedar	FACW
TAOF	*Taraxsacum officianale*	common dandelion	FACU
TRDU	*Tragopogon dubius*	yellow salsify	NI
TRPR2	*Trifolium pratense*	red clover	FACU
TRRE3	*Trifolium repens*	white clover	FACU
ULPA	*Ulmus pumila*	Siberian elm	NI
VETH	*Verbascum thapsus*	common mullein	NI
XASP2	*Xanthium spinosum*	spiny cocklebur	FACU

[a] FAC = facultative, FACU = facultative upland species, FACW = facultative wetland species, OBL = obligate wetland species, NI = not an indicator, UPL = obligate upland species.

APPENDIX 2.2 RIPARIAN VEGETATION COMMUNITY MAPS

ALLIANCES AND ASSOCIATIONS

POPULUS ANGUSTIFOLIA TEMPORARILY FLOODED WOODLAND

- A - Populus angustifolia / Salix exigua Woodland
- C - Populus angustifolia / Salix (monticola, drummondiana, lucida) Woodland
- E - Populus angustifolia / Rhus trilobata Woodland
- F - Populus angustifolia - Acer negundo Woodland
- G - Populus angustifolia / Betula occidentalis Woodland

SALIX (EXIGUA, INTERIOR) TEMPORARILY FLOODED SHRUBLAND

- B - Salix exigua / Mesic Forbs Shrubland
- D - Salix exigua / Mesic Forbs Shrubland
- H - Salix exigua Temporarily Flooded Shrubland

BROMUS INERMIS SEMI-NATURAL HERBACEOUS

- I - Bromus inermis Semi-natural Herbaceous Vegetation

SALIX BOOTHII TEMPORARILY FLOODED SHRUBLAND

- M - Salix boothii / Mesic Graminoids Shrubland
- P - Salix boothii / Mesic Forbs Shrubland

AGROSTIS STOLONIFERA SEASONALLY FLOODED HERBACEOUS

- J - Agrostis gigantea Herbaceous Vegetation

ARTEMISIA TRIDENTATA SHRUBLAND

- K - Artemisia tridentata (ssp. vaseyana, ssp. wyomingensis) - Amelanchier utahensis Shrubland

ACER NEGUNDO TEMPORARILY FLOODED WOODLAND

- N - Acer negundo / Salix exigua Woodland

BETULA OCCIDENTALIS SEASONALLY FLOODED

- L - Betula occidentalis Shrubland

UNDESIGNATED

- O - Mixed Wetland Forb Herbaceous Vegetation
- Q - Sparsely vegetated
- V - Open Water

TYPHA (ANGUSTIFOLIA, LATIFOLIA) - (SCHOENOPLECTUS SPP.) SEMIPERMANENTLY FLOODED

- R - Typha latifolia Western Herbaceous Vegetation

ACER GRANDIDENTATUM MONTANE FOREST

- S - Acer grandidentatum / Quercus gambelii Forest

CAREX NEBRASCENSIS SEASONALLY FLOODED

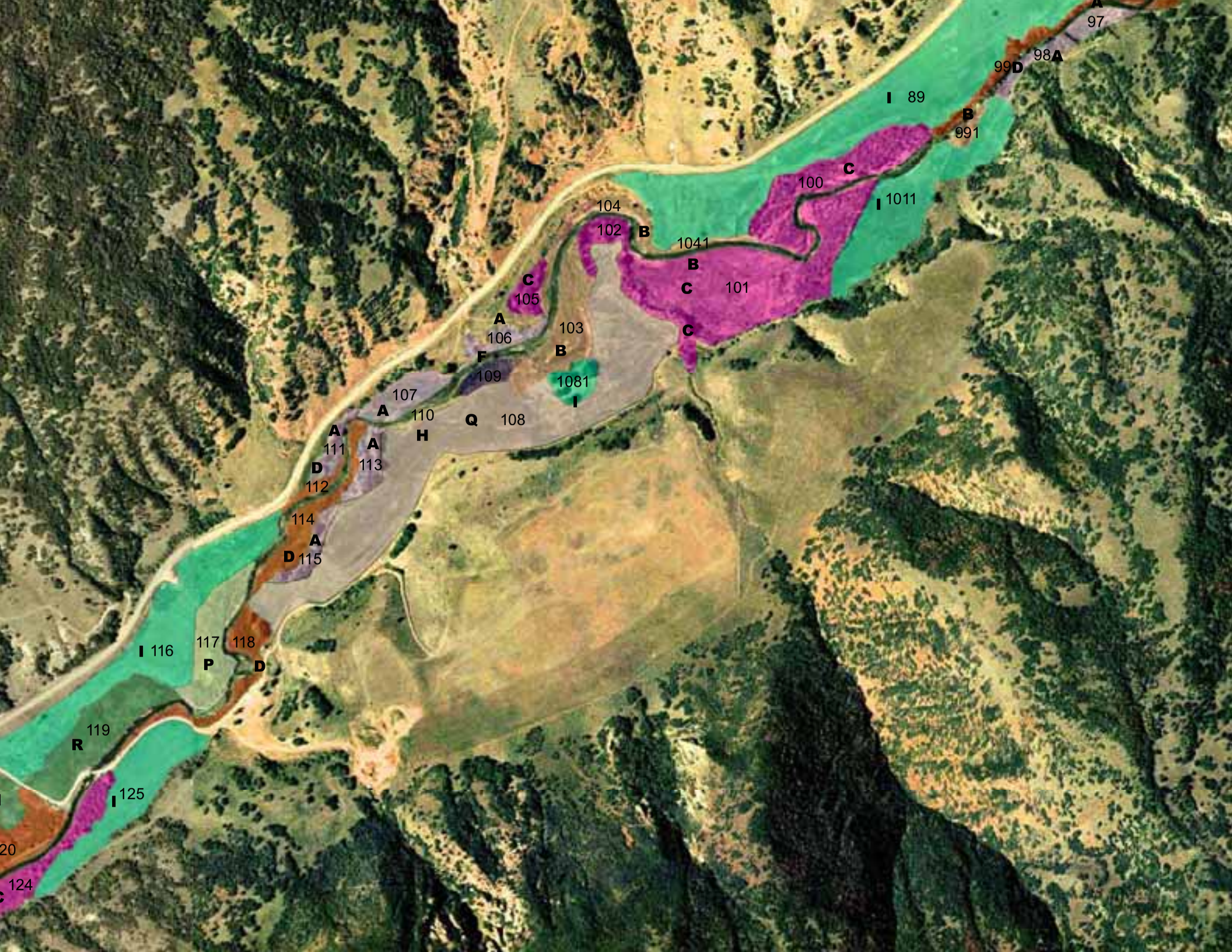
- T - Carex nebrascensis Herbaceous Vegetation

JUNCUS BALTICUS SEASONALLY FLOODED

- U - Juncus balticus Herbaceous Vegetation

RHUS TRILOBATA INTERMITTENTLY FLOODED SHRUBLAND

- W - Rhus trilobata Intermittently Flooded Shrubland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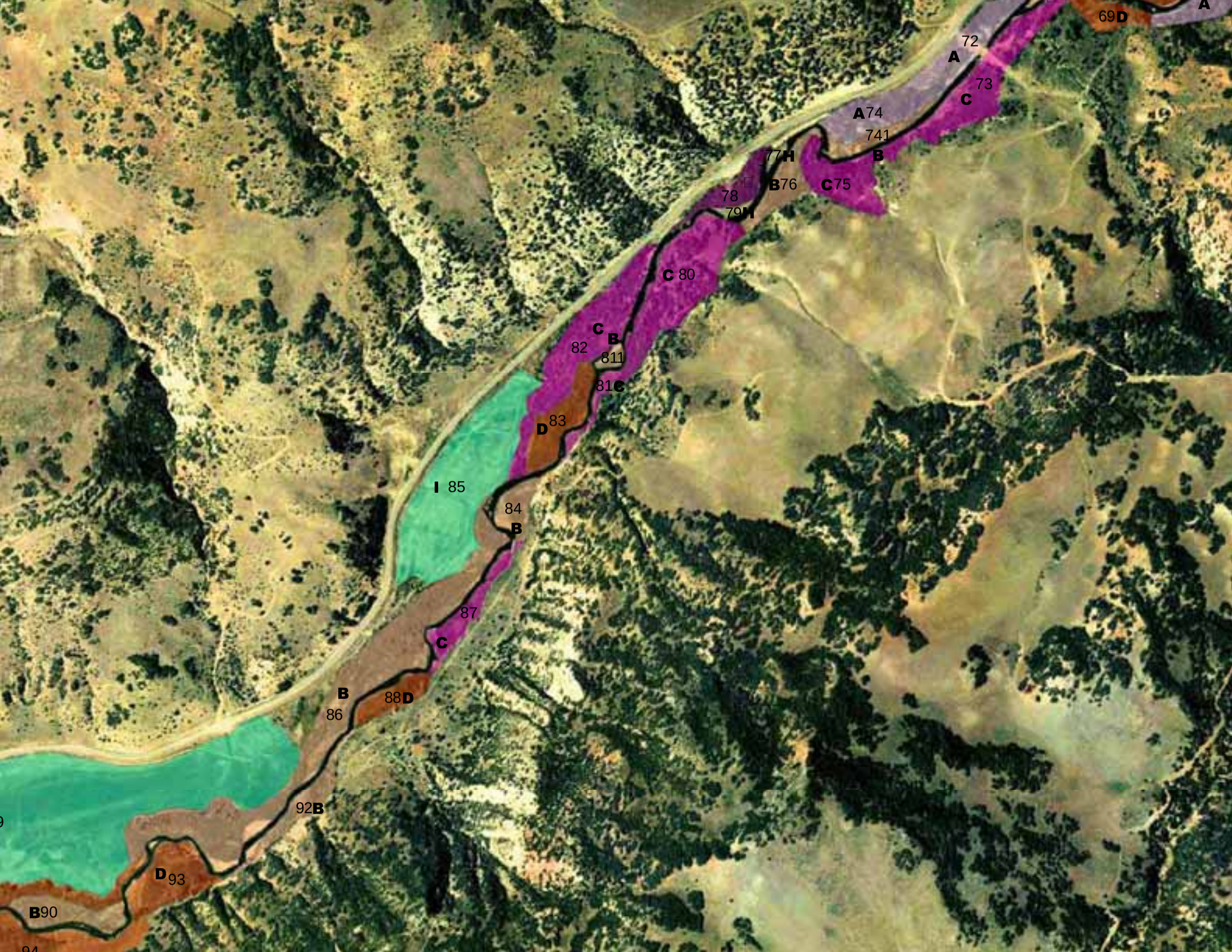
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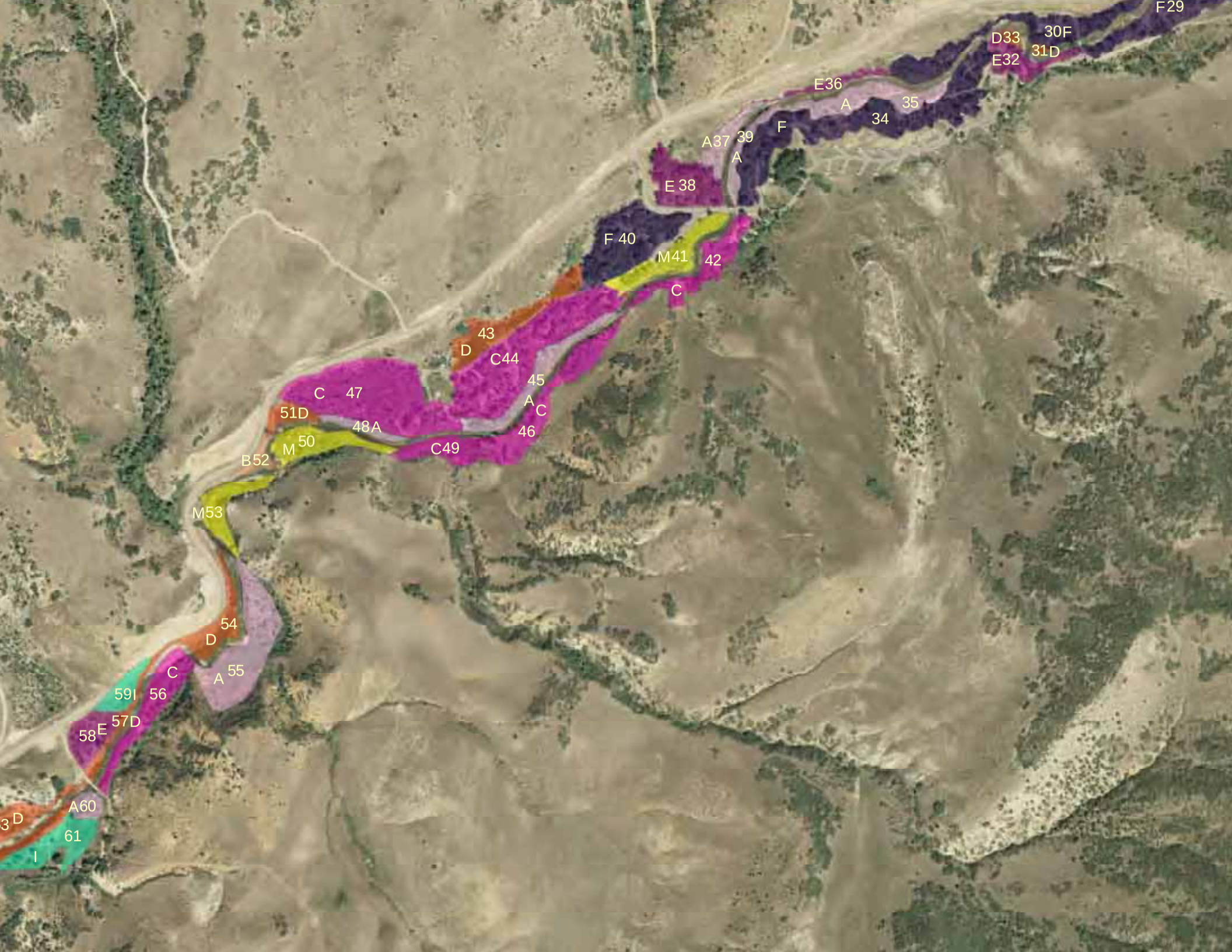
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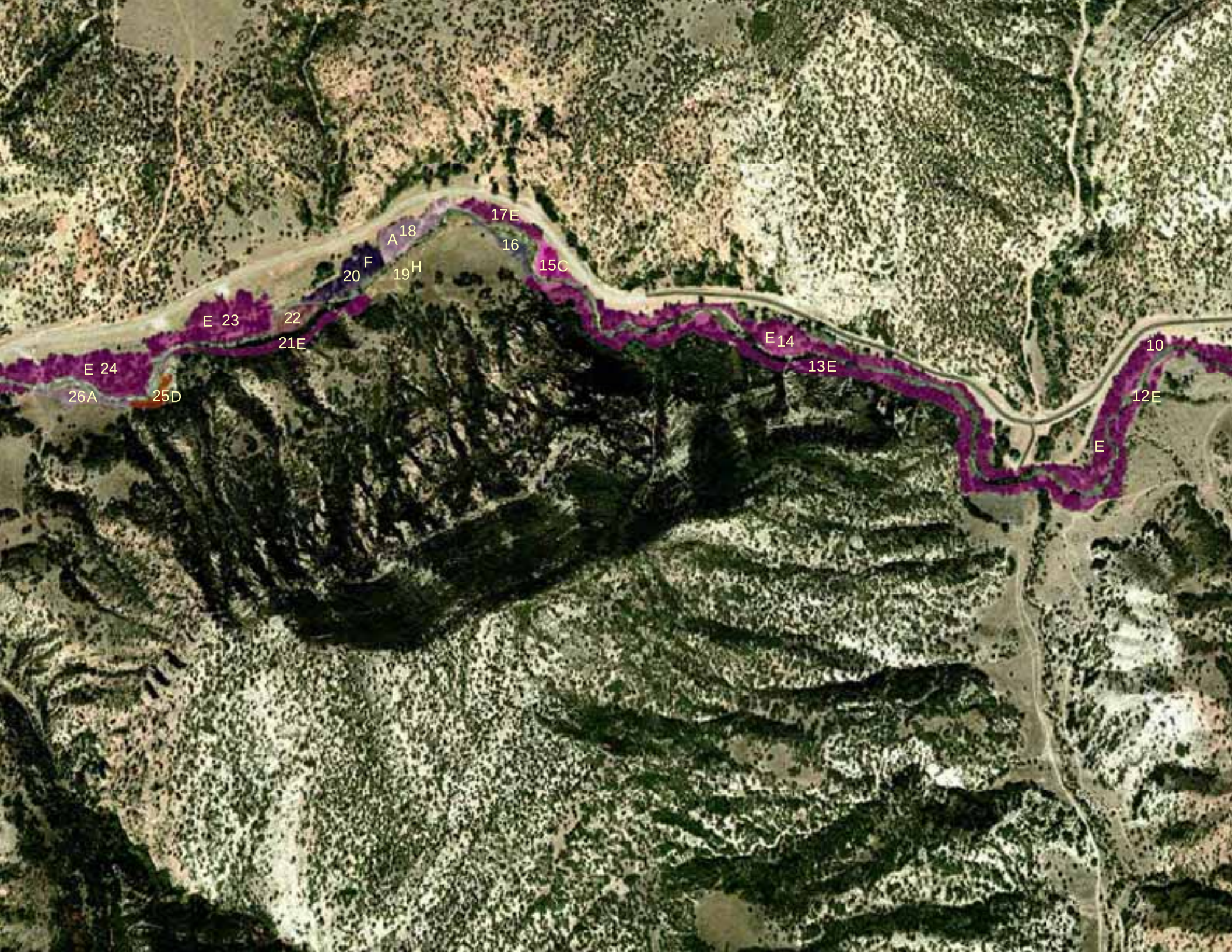
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APPENDIX 2.3 VEGETATION MAPPING DATA

POAN3/ACNE2WL	POAN3	60	ACNE2	30	BRIN2	50		0		0		0		0	
POAN3/SAEXWL	POAN3	40	SAEX	20		0		0		0		0		0	
POAN3/ACNE2WL	POAN3	70	ACNE2	20	BRIN2	40		0		0		0		0	
POAN3/SADRWL	POAN3	80		0		0		0		0		0		0	
SAEX/MFSL	SAEX	70	SALU	20	SOCA6	20		0		0		0		0	
POAN3/SADRWL	POAN3	70	BRIN2	20		0		0		0		0		0	
ACGR3/QUGAF	QUGA	70	ACGR3	30		0		0		0		0		0	
POAN3/SADRWL	POAN3	80		0		0		0		0		0		0	
POAN3/RHTRWL	POAN3	70	QUGA	20		0		0		0		0		0	
POAN3/RHTRWL	POAN3	50	ACNE2	30	RHTR	20		0		0		0		0	
POAN3/RHTRWL	POAN3	50	RHTR	20	QUGA	15		0		0		0		0	
POAN3/RHTRWL	POAN3	50	RHTR	40		0		0		0		0		0	
POAN3/RHTRWL	POAN3	50	RHTR	50		0		0		0		0		0	
POAN3/RHTRWL	POAN3	50	RHTR	40		0		0		0		0		0	
POAN3/SADRWL	POAN3	50	SAEX	20	SALU	20		0		0		0		0	
POAN3/BEOC2WL	SAEX	20	BEOC2	30	POAN3	45		0		0		0		0	
POAN3/RHTRWL	POAN3	70	RHTR	40		0		0		0		0		0	
POAN3/SAEXWL	SAEX	45	POAN3	30	SALU	10		0		0		0		0	
SAEXTFSL	SAEX	25	PHAR3	45		0		0		0		0		0	
POAN3/ACNE2WL	ACNE2	20	POAN3	60		0		0		0		0		0	
POAN3/RHTRWL	POAN3	70	RHTR	20		0		0		0		0		0	
RHTRIFSL	RHTR	50	CHVI8	20		0		0		0		0		0	
POAN3/RHTRWL	POAN3	40	RHTR	60		0		0		0		0		0	
POAN3/RHTRWL	RHTR	40	POAN3	40	SAEX	20		0		0		0		0	
SAEX/MFSL	SAEX	70		0		0		0		0		0		0	
POAN3/SAEXWL	SAEX	60	POAN3	20	SABO2	10		0		0		0		0	
POAN3/RHTRWL	POAN3	60	SAEX	30	RHTR	20		0		0		0		0	
POAN3/RHTRWL	POAN3	50	RHTR	30		0		0		0		0		0	
POAN3/ACNE2WL	POAN3	70	ACNE2	10		0		0		0		0		0	
POAN3/ACNE2WL	POAN3	60	ACNE2	30		0		0		0		0		0	
SAEX/MFSL	SABO2	20	SAEX	30	SALU	20		0		0		0		0	
POAN3/RHTRWL	POAN3	70	RHTR	30		0		0		0		0		0	
SAEX/MFSL	SAEX	70	SABO2	10	SALU	5		0		0		0		0	
POAN3/ACNE2WL	POAN3	55	ACNE2	30		0		0		0		0		0	
POAN3/SAEXWL	SAEX	50	SALU	10	SABO2	15	POAN3	45		0		0		0	
POAN3/RHTRWL	SAEX	30	POAN3	50	ROWO	10		0		0		0		0	
POAN3/SAEXWL	SAEX	50	POAN3	20	SABO2	20	SALU	10		0		0		0	
POAN3/RHTRWL	ACNE2	40	POAN3	50	RHTR	20	SAEX	15		0		0		0	
POAN3/SAEXWL	SAEX	60	SABO2	20	SALU	10	POAN3	20		0		0		0	
POAN3/ACNE2WL	POAN3	45	ACNE2	60	CRDO2	2		0		0		0		0	
SABO2/MFSL	SALU	40	SABO2	10	SAEX	30	POAN3	10	CRDO2	5		0		0	
POAN3/SADRWL	SAEX	30	SALU	20	POAN3	30		0		0		0		0	
SAEX/MFSL	SAEX	70	CRDO2	20		0		0		0		0		0	
POAN3/SADRWL	POAN3	80	BRIN2	20		0		0		0		0		0	
POAN3/SAEXWL	SAEX	30	POAN3	30	AGGI2	30		0		0		0		0	
POAN3/SADRWL	SAEX	30	SALU	20	POAN3	40	SABO2	10		0		0		0	
POAN3/SADRWL	SAEX	40	POAN3	30	BEOC2	15	SALU	10	SABO2	15		0		0	
POAN3/SAEXWL	POAN3	40	SAEX	30		0		0		0		0		0	
POAN3/SADRWL	POAN3	50	SAEX	30	SABO2	5	SALU	10		0		0		0	
SABO2/MFSL	SAEX	30	SALU	20	SABO2	30	POAN3	10	EUOC4	20		0		0	

SABO2/MFSL	EUOC4	50	SAEX	10	SABO2	10	SALU	30	AGGI2	20		0		0	
SAEX/MFSL	SAEX	60	SALU	30	SABO2	20		0		0		0		0	
POAN3/SAEXWL	POAN3	60	SAEX	20		0		0		0		0		0	
POAN3/SADRWL	POAN3	50	SAEX	20	SABO2	20	SALU	10		0		0		0	
SAEX/MFSL	SAEX	40	SALU	30	SABO2	30	POAN3	10		0		0		0	
POAN3/RHTRWL	POAN3	40	RHTR	20	BRIN2	30		0		0		0		0	
BRIN2SNHV	BRIN2	80	HEAN3	10	BRTE	30		0		0		0		0	
POAN3/SAEXWL	POAN3	40	SAEX	60		0		0		0		0		0	
BRIN2SNHV	AGCR	50	BRIN2	50		0		0		0		0		0	
SAEX/MFSL	SAEX	50	SABO2	20	SALU	20		0		0		0		0	
SAEX/MFSL	SAEX	65	EUOC4	20		0		0		0		0		0	
POAN3/SAEXWL	BG	50	POAN3	30	SAEX	10	SABO2	5	PHAR3	10		0		0	
SAEXTFSL	PHAR3	50	SAEX	10	BG	20		0		0		0		0	
POAN3/SAEXWL	POAN3	75	SAEX	20	SALU	10		0		0		0		0	
POAN3/SADRWL	POAN3	35	SAEX	40	SALU	30	SABO2	10	BRIN2	25		0		0	
SAEX/MFSL	SAEX	60	SALU	20	SABO2	10		0		0		0		0	
SAEX/MFSL	SAEX	50	SALU	30	POAN3	10		0		0		0		0	
POAN3/RHTRWL	POAN3	80	RHTR	15		0		0		0		0		0	
SAEXMGSL	SAEX	65	PHAR3	30	SALU	15		0		0		0		0	
POAN3/SAEXWL	POAN3	20	SAEX	50	SALU	15	SABO2	5		0		0		0	
POAN3/SADRWL	POAN3	20	SAEX	35	SABO2	25	SALU	10		0		0		0	
POAN3/SAEXWL	SAEX	20	POAN3	75	SALU	10		0		0		0		0	
POAN3/SADRWL	POAN3	75	BRIN2	25		0		0		0		0		0	
SAEXMGSL	SAEX	50	PHAR3	30	POAN3	10	SALU	15		0		0		0	
SAEXTFSL	PHAR3	50	AGGI2	30	SAEX	10		0		0		0		0	
POAN3/RHTRWL	POAN3	75	RHTR	10		0		0		0		0		0	
SAEXTFSL	PHAR3	40	SAEX	20		0		0		0		0		0	
POAN3/SADRWL	POAN3	70	BRIN2	40	AGCR	20		0		0		0		0	
POAN3/SADRWL	POAN3	30	SABO2	20	PHAU7	45		0		0		0		0	
POAN3/SADRWL	BRIN2	30	POAN3	50	SAEX	35	SABO2	15	SALU	10		0		0	
SAEX/MFSL	SAEX	20	PHAR3	70		0		0		0		0		0	
SAEXMGSL	SAEX	40	SABO2	30	SALU	20	POAN3	10	PHAR3	20		0		0	
BRIN2SNHV	AGCR	35	BRIN2	30	BRTE	25	BG	15		0		0		0	
SAEXMGSL	SAEX	35	SABO2	20	SALU	30	POAN3	10	PHAR3	15		0		0	
POAN3/SADRWL	SAEX	35	SABO2	15	SALU	30	POAN3	15		0		0		0	
SAEX/MFSL	SAEX	70	SALU	20	SABO2	10		0		0		0		0	
BRIN2SNHV	MESA	50	AGCR	30	BRIN2	25		0		0		0		0	
SAEXMGSL	SAEX	50	SABO2	30	SALU	10	PHAR3	30		0		0		0	
POAN3/SADRWL	POAN3	50	SAEX	20	SABO2	20	PHAR3	20		0		0		0	
SAEXMGSL	SAEX	50	PHAR3	40	SALU	20	POAN3	10		0		0		0	
SAEX/MFSL	SAEX	50	SABO2	30	SALU	20		0		0		0		0	
SAEX/MFSL	SAEX	50	SABO2	30	SALU	20		0		0		0		0	
SAEX/MFSL	SAEX	70	SABO2	30	SALU	20		0		0		0		0	
SAEX/MFSL	SAEX	70	SALU	20	SABO2	10	POAN3	5		0		0		0	
POAN3/SAEXWL	SAEX	70	SALU	10	SABO2	5	POAN3	10		0		0		0	
POAN3/SAEXWL	POAN3	70	SAEX	15	BRIN2	10	PHAR3	20		0		0		0	
SAEX/MFSL	SAEX	45	SALU	20	SABO2	15		0		0		0		0	
POAN3/SADRWL	POAN3	75	SAEX	10	SABO2	20	PHAR3	20		0		0		0	
POAN3/SADRWL	POAN3	80	SAEX	20	SABO2	15	PHAR3	35		0		0		0	
POAN3/SADRWL	POAN3	70	BRIN2	20		0		0		0		0		0	

POAN3/SADRWL	POAN3	80	BRIN2	20		0		0		0		0		0
POAN3/SAEXWL	POAN3	80	SAEX	20		0		0		0		0		0
POAN3/SAEXWL	POAN3	70	SAEX	25	PHAR3	15		0		0		0		0
BRIN2SNHV	BRIN2	80	BG	20		0		0		0		0		0
POAN3/ACNE2WL	ACNE2	40	POAN3	45	BRIN2	25		0		0		0		0
SAEXTFSL	PHAR3	30	SAEX	20	EUOC4	10	BG	20		0		0		0
POAN3/SAEXWL	POAN3	80	SAEX	20		0		0		0		0		0
SAEX/MFSL	SAEX	50	SABO2	30	SALU	20		0		0		0		0
POAN3/SAEXWL	POAN3	80	SAEX	30		0		0		0		0		0
SAEX/MFSL	SAEX	70	SABO2	30	SALU	20		0		0		0		0
POAN3/SAEXWL	POAN3	70	SAEX	25		0		0		0		0		0
BRIN2SNHV	AGGI2	20	PHAR3	20	JUARL	15	BRIN2	25	CALAA	20		0		0
SABO2/MGSL	SAEX	30	PHAR3	40	SALU	20	SABO2	20		0		0		0
SAEX/MFSL	SAEX	50	SABO2	20	SALU	10		0		0		0		0
TYLAHV	TYLA	90		0		0		0		0		0		0
SAEX/MFSL	SAEX	50	POAN3	10	SABO2	20	SALU	30		0		0		0
TYLAHV	TYLA	90	ELPA3	20		0		0		0		0		0
OW	OW	65	PITHOP	35		0		0		0		0		0
SAEXMGSL	SAEX	50	TYLA	30	ELPA3	20	CACA11	10		0		0		0
POAN3/SADRWL	SABO2	25	SALU	30	SAEX	40	POAN3	20		0		0		0
BRIN2SNHV	PHPR3	30	BRIN2	45	AGGI2	40		0		0		0		0
POAN3/ACNE2WL	POAN3	10	ACNE2	60	SAEX	10		0		0		0		0
SAEXMGSL	SAEX	90		0		0		0		0		0		0
POAN3/ACNE2WL	ACNE2	90	POAN3	10		0		0		0		0		0
POAN3/ACNE2WL	SAEX	30	ACNE2	40	POAN3	10	SABO2	20		0		0		0
AGGI2HV	EPILO	20	AGGI2	30		0		0		0		0		0
SAEXMGSL	SAEX	60	AGGI2	30	SABO2	20		0		0		0		0
AGGI2HV	AGGI2	90		0		0		0		0		0		0
POAN3/SADRWL	POAN3	40	SABO2	30	SYOR2	20		0		0		0		0
AGGI2HV	AGGI2	70	EPILO	20		0		0		0		0		0
SAEXTFSL	SAEX	20	COSE16	20	AGGI2	35	SOCA6	20		0		0		0
SAEXMGSL	SAEX	60	AGGI2	30	SABO2	20		0		0		0		0
MWFHV	AGGI2	40	EPILO	40		0		0		0		0		0
SAEXMGSL	SAEX	60	AGGI2	30	SABO2	20		0		0		0		0
SAEXMGSL	SAEX	80	SABO2	20	AGGI2	20		0		0		0		0
SAEXMGSL	SAEX	80	POAN3	10	SABO2	20		0		0		0		0
SAEXMGSL	SAEX	75	POAN3	5	SABO2	20		0		0		0		0
MWFHV	EPILO	40	AGGI2	40	SABO2	10		0		0		0		0
POAN3/SAEXWL	POAN3	20	SAEX	30	SYOR2	30	ARCA13	20		0		0		0
SAEXMGSL	SAEX	80	SABO2	20		0		0		0		0		0
POAN3/SAEXWL	POAN3	30	SAEX	30	SABO2	20		0		0		0		0
POAN3/SAEXWL	POAN3	80	SAEX	20		0		0		0		0		0
SAEXMGSL	SAEX	90	SABO2	20		0		0		0		0		0
SAEXMGSL	SAEX	80	POAN3	10		0		0		0		0		0
SAEXMGSL	SAEX	75	SABO2	20	POAN3	10	AGGI2	10		0		0		0
POAN3/SAEXWL	SAEX	30	SYOR2	30	POAN3	10		0		0		0		0
POAN3/SAEXWL	POAN3	80	SAEX	10		0		0		0		0		0
SAEXMGSL	SAEX	95	POAN3	10		0		0		0		0		0
POAN3/SAEXWL	POAN3	30	SAEX	50		0				0		0		0
POAN3/SAEXWL	POAN3	30	SAEX	50	SABO2	20		0		0		0		0

SAEXMGSL	SAEX	70	POAN3	15	BEOC2	10		0		0		0		0
POAN3/BEOC2WL	POAN3	30	SYOR2	10	BEOC2	50	AGGI2	30	SAEX	10		0		0
ARTR2/AMUTSL	ARTR2	40	SYOR2	60		0		0		0		0		0
POAN3/SAEXWL	POAN3	40	BEOC2	20	SAEX	30		0		0		0		0
BEOC2SL	SAEX	50	BEOC2	50		0		0		0		0		0
POAN3/SAEXWL	SAEX	20	ARTR2	20	SYOR2	30	POAN3	10		0		0		0
POAN3/SADRWL	BEOC2	40	POAN3	20	SAEX	20	SABO2	30		0		0		0
SAEXMGSL	SAEX	80	BEOC2	5	SABO2	10		0		0		0		0
POAN3/BEOC2WL	BEOC2	20	POAN3	20	SAEX	20	SABO2	20	WET MIX	20		0		0
ARTR2/AMUTSL	SYOR2	50	ARTR2	50		0		0		0		0		0
POAN3/BEOC2WL	BEOC2	70	POAN3	20		0		0		0		0		0
SAEXMGSL	SAEX	80	BEOC2	10	SABO2	5	POAN3	5		0		0		0
SAEXMGSL	SAEX	70	BEOC2	20	POAN3	5		0		0		0		0
POAN3/BEOC2WL	BEOC2	50	POAN3	15	SAEX	15	ARTR2	5		0		0		0
POAN3/BEOC2WL	BEOC2	60	SABO2	20	POAN3	10	SAEX	10	WET MIX	5	AGGI2	5	JUEN	5
ARTR2/AMUTSL	ARTR2	40	SAEX	20	POAN3	5	JUSC2	5		0		0		0
SAEXMGSL	SAEX	85	SABO2	10	BEOC2	5	AGGI2	10	ROWO	10		0		0
POAN3/BEOC2WL	BEOC2	30	SAEX	5	POAN3	60		0		0		0		0
SAEXMGSL	SAEX	90	BEOC2	5	SABO2	5		0		0		0		0
POAN3/SAEXWL	BEOC2	20	SAEX	40	POAN3	20	AGGI2	30	JUARL	20		0		0
CANE2HV	CANE2	40	JUARL	40	AGGI2	30		0		0		0		0
SAEXMGSL	SAEX	90	BEOC2	5	POAN3	5		0		0		0		0
POAN3/SAEXWL	POAN3	30	SAEX	5		0		0		0		0		0
POAN3/SAEXWL	SAEX	40	SABO2	5	POAN3	5	WET MIX	50		0		0		0
SV	ARTR2	40	SAEX	5		0		0		0		0		0
SAEXMGSL	SAEX	85	SABO2	5	BEOC2	5	AGGI2	5		0		0		0
SAEXTFSL	SAEX	35	BEOC2	5	WET MIX	45		0		0		0		0
JUBAHV	AGGI2	30	JUARL	70		0		0		0		0		0
ARTR2/AMUTSL	ARTR2	10		0		0		0		0		0		0
SAEXMGSL	SAEX	55	POAN3	5	BEOC2	5	SABO2	10	AGGI2	10	JUAC2	10		0
SAEXMGSL	SAEX	65	WET MIX	80	AGGI2	5	JUARL	5		0		0		0
SAEXTFSL	SAEX	10	BEOC2	5	WET MIX	80		0		0		0		0
POAN3/SAEXWL	POAN3	30	ARTR2	10	SAEX	10		0		0		0		0
SAEXMGSL	SAEX	100		0		0		0		0		0		0
BEOC2SL	BEOC2	30	SAEX	20	WET MIX	80		0		0		0		0
SAEXTFSL	SAEX	50	WET MIX	80		0		0		0		0		0
BEOC2SL	BEOC2	75	SAEX	5	ARTR2	5		0		0		0		0
SAEXMGSL	SAEX	90	BEOC2	5	WET MIX	25		0		0		0		0
POAN3/SAEXWL	SAEX	30	BEOC2	5	POAN3	15	WET MIX	80		0		0		0
SAEXMGSL	SAEX	85	SABO2	10	BEOC2	5	WET MIX	70		0		0		0
SAEXMGSL	SAEX	95	WET MIX	10		0		0		0		0		0
POAN3/SAEXWL	POAN3	30	SAEX	15		0		0		0		0		0
SABO2/MGSL	SABO2	30	SAEX	15	WET MIX	50		0		0		0		0
SAEXMGSL	SAEX	70	SABO2	10	WET MIX	10		0		0		0		0
SAEXTFSL	BEOC2	40	SAEX	50	ROWO	5		0		0		0		0
POAN3/BEOC2WL	BEOC2	70	POAN3	30		0		0		0		0		0
POAN3/SAEXWL	POAN3	20	SAEX	50	SABO2	20	BEOC2	10		0		0		0
SAEXMGSL	SAEX	95	SABO2	5		0		0		0		0		0
POAN3/BEOC2WL	POAN3	60	WET MIX	40		0		0		0		0		0
POAN3/SADRWL	POAN3	40	SABO2	40	SAEX	20		0		0		0		0

POAN3/ACNE2WL	POAN3	10	ACNE2	60	SAEX	10	CIAR4	5		0		0		0		
SAEXMGSL	SAEX	70	AGGI2	40	PHAR3	20		0		0		0		0		
ACNE2/SAEXWL	SAEX	30	ACNE2	40	SAEX	10	SABO2	20	TARA	1	CIAR4	5		0		
SAEXTFSL	SAEX	50	UPLAND M	50		0		0		0		0		0		
ACNE2/SAEXWL	SAEX	10	ACNE2	30	UPLAND M	20	WET MIX	80		0		0		0		
AGGI2HV	JUARL	40	AGGI2	90	EPBR3	20	SAEX	10		0		0		0		
POAN3/SAEXWL	SAEX	5	POAN3	20		0		0		0		0		0		
POAN3/SAEXWL	POAN3	40	JUSC2	10	ACNE2	10	SAEX	25	SABO2	10		0		0		
SAEXMGSL	SAEX	100		0		0		0		0		0		0		
POAN3/ACNE2WL	POAN3	10	ACNE2	60	SAEX	10	UPLAND M	80	CIAR4	5		0		0		
SAEXTFSL	ARTR2	40	SAEX	20	POAN3	5	JUSC2	5		0		0		0		
SAEXMGSL	SAEX	25	SALU	25	PHAR3	50		0		0		0		0		
SAEXMGSL	SAEX	80	PHAR3	20		0		0		0		0		0		
SAEXMGSL	SAEX	45	SALU	20	SABO2	15		0		0		0		0		
BRIN2SNHV	BRIN2	80	BG	20		0		0		0		0		0		
SAEXMGSL	SAEX	70	PHAR3	30		0		0		0		0		0		
BRIN2SNHV	BRIN2	80	BG	20		0		0		0		0		0		
POAN3/ACNE2WL	POAN3	10	ACNE2	60	SAEX	10	CIAR4	5	UPLAND M	50		0		0		

APPENDIX 3.1 ENDPOINT COORDINATES

Easting	Northing	Elevation	Comment	Point_ID	SITE
476057.7	4445801.13	2118.88	rep1	1	SXW 2006
476020.79	4445787.82	2118.14	rep2	2	SXW 2006
475995.48	4445756.59	2108.01	rep3	3	SXW 2006
475922.93	4445731.04	2111.75	rep456	4	SXW 2006
476084.76	4445764.73	2111	lep1	5	SXW 2006
476046.11	4445742.51	2110.2	lep2-3	6	SXW 2006
476041.6	4445717.89	2109.62	lep4	7	SXW 2006
475994.53	4445684.05	2107.29	lep5	8	SXW 2006
475973.5988	4445652.311	2109.283969	lep6	9	SXW 2006

Easting	Northing	Elevation	Comment	Point_ID	SITE
474710.07	4444911.43	2035.83	lep1	1	RC (veg only)
474654.7403	4444851.436	2033.12	lep2	2	RC (veg only)
474642.51	4444833.98	2032.44	lep3	3	RC (veg only)
474641.6	4444769.34	2035.47	lep4	4	RC (veg only)
474605.1649	4444709.958	2035.73	lep5-6	5	RC (veg only)
474660.5826	4444965.739	2043.28	rep1	6	RC (veg only)
474590.2435	4444910.162	2046.02	rep2	7	RC (veg only)
474582.0645	4444880.456	2040.4	rep3	8	RC (veg only)
474547.3861	4444841.56	2037.56	rep4	9	RC (veg only)
474539.8123	4444813.557	2036.66	rep5	10	RC (veg only)
474509.1567	4444786.04	2034.99	rep6	11	RC (veg only)

Easting	Northing	Elevation	Comment	Point_ID	site
462855.080	4435557.767	1582.130	DFC-REP-1	1	DFC
462746.593	4435553.853	1583.162	DFC-REP-2	2	DFC
462656.147	4435484.219	1578.176	DFC-REP-3	3	DFC
462612.837	4435445.240	1580.406	DFC-REP-4	4	DFC
462586.015	4435385.243	1579.860	DFC-REP-5-6-7	5	DFC
462587.462	4435310.518	1585.932	DFC-LEP-7	6	DFC
462647.073	4435332.725	1586.842	DFC-LEP-6	7	DFC
462672.331	4435357.397	1586.970	DFC-LEP-3-4-5	8	DFC
462709.623	4435363.029	1587.179	DFC-LEP-2	9	DFC
462869.865	4435372.647	1584.037	DFC-LEP-1	10	DFC

Easting	Northing	Elevation	Comment	Point_ID	SITE
460101.282	4432997.957	1546.183	MO-REP-1	1	MO
460015.578	4433013.975	1547.047	MO-REP-2	2	MO
459892.216	4432982.203	1545.042	MO-REP-3	3	MO
459850.802	4432895.619	1543.816	MO-REP-4	4	MO
459818.580	4432847.995	1542.713	MO-REP-5-6	5	MO
459856.049	4432761.330	1546.340	MO-LEP-6	6	MO
459933.745	4432807.721	1549.076	MO-LEP-2-3-4-5	7	MO
460149.020	4432949.666	1548.723	MO-LEP-1	8	MO

Easting	Northing	Elevation	Comment	Point_ID	SITE
458756.916	4432364.023	1533.385	OX-REP-1	1	OX
458693.331	4432308.607	1532.500	OX-REP-2-3-4	2	OX
458585.881	4432244.073	1530.627	OX-REP-5	3	OX
458495.212	4432232.762	1533.659	OX-REP-6-7	4	OX
458374.451	4432122.365	1529.140	OX-LEP-7-8	5	OX
458288.554	4432123.248	1526.165	OX-REP-8	6	OX
458500.762	4432047.812	1529.836	OX-LEP-6	7	OX
458621.931	4432054.016	1530.133	OX-LEP-5	8	OX
458737.358	4432102.144	1531.664	OX-LEP-4	9	OX
458802.239	4432169.137	1531.300	OX-LEP-3	10	OX
458850.937	4432250.128	1531.909	OX-LEP-1-2	11	OX

APPENDIX 3.2 VEGETATION TRANSECT DATA

ing (UTM NAD83 meters)	elevation (NAVD 88 meters)	distance from LEP (m)	distance of veg community (m)	distance_all species (m)	scientific	common	density	height	stratum	wetland indicator status regio
476084.76	2110.99	0.00	0.00	0.00	lep	lep				
476082.56	2111.12	3.87	3.87	3.87	*Agrostis gigantea*	Redtop			herb	FACW
476082.56	2111.12	3.87	0.00	3.87	*Salix exigua*	Coyote willow		2	woody	OBL
476077.88	2110.30	11.84	7.97	7.97	*Agrostis gigantea*	Redtop			herb	FACW
476077.88	2110.30	11.84	0.00	7.97	*Salix exigua*	Coyote willow		1	woody	OBL
476076.14	2110.11	14.42	2.59	2.59	*Agrostis gigantea*	Redtop			herb	FACW
476076.14	2110.11	14.42	0.00	2.59	*Salix Boothii*	Booths willow		1	woody	OBL
476074.24	2109.70	17.62	3.20	3.20	*Agrostis gigantea*	Redtop			herb	FACW
476074.24	2109.70	17.62	0.00	3.20	*Juncus* spp.	Rush spp			herb	
476071.58	2109.71	22.06	4.45	4.45	*Agrostis gigantea*	Redtop			herb	FACW
476071.58	2109.71	22.06	0.00	4.45	*Salix Boothii*	Booths willow		3	woody	OBL
476071.58	2109.71	22.06	0.00	4.45	*Salix exigua*	Coyote willow		3	woody	OBL
476065.73	2111.57	31.89	9.83	9.83	*Salix exigua*	Coyote willow		1	woody	OBL
476062.83	2114.55	36.75	4.86	4.86	*Rosa woodsii*	Woods Rose			woody	FAC-
476062.83	2114.55	36.75	0.00	4.86		unknown			woody	
476062.83	2114.55	36.75	0.00	4.86		unknown			woody	
476061.07	2115.96	39.70	2.95	2.95	*Prunus virginiana*	Chokecherry			woody	FACU
476061.07	2115.96	39.70	0.00	2.95	*Rosa woodsii*	Woods Rose			woody	FAC-
476057.70	2118.88	45.36	5.66	5.66	*Salix exigua*	Coyote willow	S	3	woody	OBL
476046.11	2110.20	0.00	0.00	0.00	lep	lep				
476041.55	2109.46	9.27	9.27	9.27	*Populus angustifolia*	Cottonwood		1	woody	FAC*
476041.55	2109.46	9.27	0.00	9.27	*Rosa woodsii*	Woods Rose			woody	FAC-
476039.14	2108.83	14.19	4.91	4.91	*Agrostis gigantea*	Redtop			herb	FACW
476039.14	2108.83	14.19	0.00	4.91	*Epliobium* spp.	Willowherb			herb	
476036.53	2108.45	19.57	5.38	5.38	*Salix exigua*	Coyote willow	S	1	woody	OBL
476034.89	2107.72	23.06	3.50	3.50	*Agrostis gigantea*	Redtop			herb	FACW
476034.89	2107.72	23.06	0.00	3.50	*Salix exigua*	Coyote willow	S	1	woody	OBL
476033.04	2108.27	26.74	3.67	3.67	*Agrostis gigantea*	Redtop			herb	FACW
476033.04	2108.27	26.74	0.00	3.67	*Epliobium spp.*	Willowherb			herb	
476028.01	2108.09	37.11	10.37	10.37	*open water*	open water				
476027.22	2108.18	38.68	1.57	1.57	*Salix exigua*	Coyote willow		1	woody	OBL
476026.24	2108.83	40.79	2.11	2.11	*Agrostis gigantea*	Redtop			herb	FACW
476026.24	2108.83	40.79	0.00	2.11	*Salix exigua*	Coyote willow		1	woody	OBL
476022.81	2115.26	47.65	6.86	6.86	*Prunus virginiana*	Chokecherry			woody	FACU
476022.81	2115.26	47.65	0.00	6.86	*Rosa woodsii*	Woods Rose			woody	FAC-
476020.79	2118.14	51.90	4.25	4.25	*Symphoricarpos albus*	Snowberry			woody	UPL
476020.79	2118.14	51.90	0.00	4.25	*Artemsia tridentata*	Big Sagebrush			woody	UPL
476046.12	2110.20	0.00	0.00	0.00	lep	lep				
476030.24	2108.99	16.50	16.50	16.50	*Amelanchier* spp.	Serviceberry			woody	FACU
476030.24	2108.99	16.50	0.00	16.50	*Symphoricarpos albus*	Snowberry			woody	UPL
476030.24	2108.99	16.50	0.00	16.50	*Populus angustifolia*	Cottonwood			woody	FAC*
476026.93	2107.10	19.91	3.42	3.42	*Salix exigua*	Coyote willow	D	1	woody	OBL
476019.95	2107.44	27.17	7.26	7.26	*open water*	open water				
476018.18	2107.50	29.00	1.83	1.83	*Carex* spp.	Unknown sedge			herb	
476018.18	2107.50	29.00	0.00	1.83	*Epilobium* spp.	Willowherb			herb	
476016.90	2107.81	30.32	1.32	1.32	*Agrostis gigantea*	Redtop			herb	FACW
476016.90	2107.81	30.32	0.00	1.32	*Salix exigua*	Coyote willow	D	2	woody	OBL
476013.82	2107.57	33.52	3.19	3.19	*Agrostis gigantea*	Redtop			herb	FACW
476013.82	2107.57	33.52	0.00	3.19	*Urtica dioica*	Nettle			herb	FAC
476001.46	2108.13	46.36	12.84	12.84	*Upland mix*	Upland mix			herb	FACU
476001.46	2108.13	46.36	0.00	12.84	*Salix exigua*	Coyote willow	S	3	woody	OBL
475995.48	2108.01	52.56	6.20	6.20	*Agrostis gigantea*	Redtop			herb	FACW
475995.48	2108.01	52.56	0.00	6.20	*Salix exigua*	Coyote willow	D	2	woody	OBL
476041.60	2109.62	0.00	0.00	0.00	lep	lep				
476037.27	2108.95	4.34	4.34	4.34	*Symphoricarpos albus*	Snowberry			woody	UPL
476037.27	2108.95	4.34	0.00	4.34	*Populus angustifolia*	Cottonwood		1	woody	FAC*
476030.92	2109.06	10.73	6.39	6.39	*Populus angustifolia*	Cottonwood		3	woody	FAC*
476030.92	2109.06	10.73	0.00	6.39	*Salix exigua*	Coyote willow		2	woody	OBL
476014.05	2106.76	27.71	16.98	16.98	*Upland mix*	Upland mix			herb	FACU
476014.05	2106.76	27.71	0.00	16.98	*Salix exigua*	Coyote willow		3	woody	OBL
476009.34	2105.84	32.46	4.76	4.76	*Agrostis gigantea*	Redtop			herb	FACW
476009.34	2105.84	32.46	0.00	4.76	*Salix exigua*	Coyote willow	D	3	woody	OBL
475999.34	2106.80	42.52	10.06	10.06	*Salix exigua*	Coyote willow	D	1	woody	OBL
475999.34	2106.80	42.52	0.00	10.06	*Aster* spp.	aster			herb	
475999.34	2106.80	42.52	0.00	10.06	*Epliobium* spp.	willowherb			herb	
475980.10	2106.87	61.86	19.34	19.34	*Agrostis gigantea*	Redtop			herb	FACW
475980.10	2106.87	61.86	0.00	19.34	*Salix exigua*	Coyote willow		2	woody	OBL
475976.01	2107.25	65.99	4.12	4.12	*Rosa woodsii*	Woods Rose			woody	FAC-

475934.25	2107.09	108.00	42.01	42.01	*Upland mix*	Upland mix			herb	FACU
475934.25	2107.09	108.00	0.00	42.01	*Salix exigua*	Coyote willow	S	3	woody	OBL
475922.93	2111.75	119.40	11.40	11.40	*Bromus tectorum*	Cheatgrass			herb	UPL
475922.93	2111.75	119.40	0.00	11.40	*Prunus virginiana*	Chokecherry			woody	FACU
475922.93	2111.75	119.40	0.00	11.40	*Artemsia tridentata*	Big Sagebrush			woody	UPL
475994.53	2107.29	0.00	0.00	0.00	lep	lep				
475993.68	2106.80	1.05	1.05	1.05	*Amelanchier* spp.	Serviceberry			woody	FACU
475993.68	2106.80	1.05	0.00	1.05	*Populus angustifolia*	Cottonwood		1	woody	FAC*
475991.01	2104.68	4.20	3.15	3.15	*Agrostis gigantea*	Redtop			herb	FACW
475991.01	2104.68	4.20	0.00	3.15	*Salix exigua*	Coyote willow	S	1	woody	OBL
475984.75	2105.69	11.65	7.46	7.46	*Salix exigua*	Coyote willow		2	woody	OBL
475984.75	2105.69	11.65	0.00	7.46	*Urtica dioica*	Nettle			herb	FAC
475976.19	2105.24	21.92	10.27	10.27	*Upland mix*	Upland mix			herb	FACU
475976.19	2105.24	21.92	0.00	10.27	*Salix exigua*	Coyote willow	S	3	woody	OBL
475974.75	2104.87	23.67	1.75	1.75	*Agrostis gigantea*	Redtop			herb	FACW
475974.75	2104.87	23.67	0.00	1.75	*Salix exigua*	Coyote willow		3	woody	OBL
475972.04	2106.50	26.89	3.22	3.22	*Salix exigua*	Coyote willow		2	woody	OBL
475930.54	2106.07	76.53	49.64	49.64	*Upland mix*	Upland mix			herb	FACU
475930.54	2106.07	76.53	0.00	49.64	*Salix exigua*	Coyote willow	S	3	woody	OBL
475922.93	2111.75	85.64	9.11	9.11	*Bromus tectorum*	Cheatgrass			herb	UPL
475922.93	2111.75	85.64	0.00	9.11	*Prunus virginiana*	Chokecherry			woody	FACU
475922.93	2111.75	85.64	0.00	9.11	*Symphoricarpos albus*	Snowberry			woody	UPL
475973.60	2109.28	0.00	0.00	9.11	lep	lep				
475969.06	2104.94	8.24	8.24	8.24	*Upland mix*	Upland mix			herb	FACU
475969.06	2104.94	8.24	0.00	8.24	*Salix lucida*	Shiny willow	S	1	woody	OBL
475967.68	2104.91	11.10	2.86	2.86	*Upland mix*	Upland mix			herb	FACU
475967.68	2104.91	11.10	0.00	2.86	*Populus angustifolia*	Cottonwood		3	woody	FAC*
475965.55	2103.34	14.88	3.78	3.78	*Salix boothii*	Booths willow		1	woody	OBL
475965.55	2103.34	14.88	0.00	3.78	*Salix exigua*	Coyote willow	D	1	woody	OBL
475962.65	2103.59	20.23	5.35	5.35	*open water*	open water				
475962.15	2103.88	21.26	1.03	1.03	*Carex* spp.	Unknown sedge			herb	
475960.20	2104.39	24.68	3.43	3.43	*Populus angustifolia*	Cottonwood		3	woody	FAC*
475951.69	2106.05	40.44	15.75	15.75	*Salix exigua*	Coyote willow		2	woody	OBL
475948.23	2105.89	46.85	6.41	6.41	*Salix boothii*	Booths willow	S	3	woody	OBL
475948.23	2105.89	46.85	0.00	6.41	*Salix exigua*	Coyote willow	S	3	woody	OBL
475926.04	2108.78	87.87	41.02	41.02	*Upland mix*	Upland mix			herb	FACU
475926.04	2108.78	87.87	0.00	41.02	*Salix exigua*	Coyote willow	S	3	woody	OBL
475922.93	2111.75	93.62	5.76	5.76	*Bromus tectorum*	Cheatgrass			herb	UPL
475922.93	2111.75	93.62	0.00	5.76	*Symphoricarpos albus*	Snowberry			woody	UPL

474701.04	2032.86	13.43	0.49	0.49	*Salix exigua*	Coyote willow	D	1	woody	OBL	wet
474694.74	2032.80	22.77	9.34		open water	open water					
474694.10	2032.88	23.72	0.96	0.96	*Agrostis gigantea*	Redtop			herb	FACW	wet
474694.10	2032.88	23.72	0.00	0.96	*Carex nebrascensis*	Nebraska sedge			herb	OBL	wet
474694.10	2032.88	23.72	0.00	0.96	*Juncus arcticus*	Baltic rush			herb	FACW	wet
474690.01	2032.92	29.81	6.09	6.09	*Salix exigua*	Coyote willow	S	3	herb	OBL	wet
474687.28	2033.40	33.87	4.06	4.06	*Salix exigua*	Coyote willow	D	1	woody	OBL	wet
474679.30	2033.63	45.77	11.90	11.90	*Upland mix*	Upland mix			herb	FACU	not wet
474679.30	2033.63	45.77	0.00	11.90	*Betula occidentalis*	Water birch		2	woody	FACW	wet
474673.98	2033.71	53.49	7.72	7.72	Upland mix	Upland mix			herb	FACU	not wet
474673.98	2033.71	53.49	0.00	7.72	*Betula occidentalis*	Water birch		1	woody	FACW	wet
474669.32	2033.57	60.40	6.91	6.91	Upland mix	Upland mix			herb	FACU	not wet
474669.32	2033.57	60.40	0.00	6.91	*Populus* spp.	Cottonwood			woody	FAC*	wet
474669.32	2033.57	60.40	0.00	6.91	*Salix exigua*	Coyote willow		3	woody	OBL	wet
474661.51	2042.80	71.96	11.56	11.56	*Populus* spp.	Cottonwood			woody	FAC*	wet
474661.51	2042.80	71.96	0.00	11.56	*Rosa woodsii*	Woods Rose			woody	FAC-	wet
474661.51	2042.80	71.96	0.00	11.56	*Salix exigua*	Coyote willow		2	woody	OBL	wet
474660.58	2043.27	73.47	1.52	1.52	*Artemisia tridentata*	Big Sagebrush			woody	UPL	wet
474654.73	2033.11	0.00	0.00	0.00	lep	lep					
474648.81	2033.05	8.03	8.03	8.03	*Solidago canadensis*	Canada goldenrod			herb	FACU	not wet
474648.81	2033.05	8.03	0.00	8.03	*Symphoricarpos albus*	Snowberry			woody	UPL	not wet
474645.88	2030.36	11.97	3.94	3.94	*Populus* spp.	Cottonwood	S	3	woody	FAC*	wet
474645.88	2030.36	11.97	0.00	3.94	*Salix exigua*	Coyote willow	S	3	woody	OBL	wet
474632.91	2030.30	29.52	17.55	17.55	Upland mix	Upland mix			herb	FACU	not wet
474632.91	2030.30	29.52	0.00	17.55	*Betual occidentalis*	Water birch	S	2	woody	FACW	wet
474632.91	2030.30	29.52	0.00	17.55	*Populus* spp.	Cottonwood			woody	FAC*	wet
474632.91	2030.30	29.52	0.00	17.55	*Salix exigua*	Coyote willow		3	woody	OBL	wet
474631.52	2029.82	31.28	1.77	1.77	open water	open water					
474628.31	2029.82	35.61	4.32	4.32	*Juncus arcticus*	Baltic rush			herb	FACW	wet
474628.31	2029.82	35.61	0.00	4.32	*Salix boothii*	Booths willow		3	woody	OBL	wet
474628.31	2029.82	35.61	0.00	4.32	*Salix exigua*	Coyote willow		3	woody	OBL	wet
474625.13	2030.62	40.03	4.42	4.42	*Betual occidentalis*	Water birch		1	woody	FACW	wet
474620.43	2030.72	46.39	6.36	6.36	Upland mix	Upland mix			herb	FACU	not wet
474617.20	2029.78	50.72	4.33	4.33	*Salix exigua*	Coyote willow	D	1	woody	OBL	wet
474612.20	2029.95	57.45	6.73	6.73	open water	open water					
474611.90	2030.06	58.06	0.64	0.64	*Salix exigua*	Coyote willow		1	woody	OBL	wet
474608.62	2030.37	62.44	4.38	4.38	*Agrostis gigantea*	Redtop			herb	FACW	wet
474608.62	2030.37	62.44	0.00	4.38	*Salix exigua*	Coyote willow	D	1	woody	OBL	wet
474607.73	2030.00	63.65	1.21	1.21	*Salix exigua*	Coyote willow		3	woody	OBL	wet
474607.12	2030.37	64.41	0.76	0.76		sc					
474605.15	2030.59	67.16	2.75	2.75	*Agrostis gigantea*	Redtop			herb	FACW	wet
474605.15	2030.59	67.16	0.00	2.75	*Populus* spp.	Cottonwood		3	woody	FAC*	wet
474600.78	2035.04	72.95	5.79	5.79	*Salix exigua*	Coyote willow		2	woody	OBL	wet
474597.93	2040.22	77.06	4.12	4.12	bare ground	bare ground					
474590.25	2046.01	87.21	10.16	10.16	*Artemisia tridentata*	Big Sagebrush			woody	UPL	wet
474640.05	2032.46	0.00	0.00	0.00	lep	lep					
474640.01	2032.45	0.04	0.04	0.04	*Symphoricarpos albus*	Snowberry			woody	UPL	not wet
474637.41	2030.56	3.33	3.29	3.29	*Salix exigua*	Coyote willow		2	woody	OBL	wet
474637.41	2030.56	3.33	0.00	3.29	Upland mix	Upland mix			herb		
474635.14	2029.94	6.19	2.86	2.86	*Populus* spp.	Cottonwood			woody	FAC*	wet
474635.14	2029.94	6.19	0.00	2.86	*Salix exigua*	Coyote willow		2	woody	OBL	wet
474635.14	2029.94	6.19	0.00	2.86	Upland mix	Upland mix			herb		
474621.46	2030.12	23.43	17.24	17.24	*Betula occidentalis*	Water birch		2	woody	FACW	wet
474621.46	2030.12	23.43	0.00	17.24	*Populus* spp.	Cottonwood		3	woody	FAC*	wet
474621.46	2030.12	23.43	0.00	17.24	*Salix exigua*	Coyote willow		2	woody	OBL	wet
474617.69	2029.56	28.25	4.82	4.82	*Populus* spp.	Cottonwood			woody	FAC*	wet
474617.69	2029.56	28.25	0.00	4.82	*Salix exigua*	Coyote willow		3	woody	OBL	wet
474617.69	2029.56	28.25	0.00	4.82	wetland mix	wetland mix			herb		
474612.49	2029.71	34.84	6.59	6.59	*Betula occidentalis*	Water birch			woody	FACW	wet
474609.97	2030.18	37.96	3.12	3.12	*Populus* spp.	Cottonwood			woody	FAC*	wet
474609.97	2030.18	37.96	0.00	3.12	*Salix exigua*	Coyote willow	S	2	woody	OBL	wet
474609.97	2030.18	37.96	0.00	3.12	*Salix exigua*	Coyote willow	D	1	woody	OBL	wet
474604.39	2030.26	45.02	7.06	7.06	*Agrostis gigantea*	Redtop	D	1	herb	FACW	wet
474604.39	2030.26	45.02	0.00	7.06	*Salix exigua*	Coyote willow	D	1	woody	OBL	wet
474597.52	2029.22	53.59	8.57	8.57	*Salix exigua*	Coyote willow	D	2	woody	OBL	wet
474591.70	2029.25	61.03	7.45	7.45	open water	open water					
474588.73	2029.74	64.79	3.76	3.76	*Salix exigua*	Coyote willow		2	woody	OBL	wet
474588.83	2029.73	64.72	0.10	0.10	*Agrostis gigantea*	Redtop			herb	FACW	wet
474588.83	2029.73	64.72	0.00	0.10	*Salix exigua*	Coyote willow	S	2	woody	OBL	wet
474588.83	2029.73	64.72	0.00	0.10	*Salix exigua*	Coyote willow		2	woody	OBL	wet

474582.42	2028.36	53.74	0.00	9.34	*Salix lucida*	Shiny willow		1	woody	OBL	wet
474578.37	2027.71	59.08	5.35	5.35	*Betula occidentalis*	Water birch	D	2	woody	FACW	wet
474578.37	2027.71	59.08	0.00	5.35	*Salix exigua*	Coyote willow		2	woody	OBL	wet
474575.28	2027.72	62.79	3.72	3.72	*Salix exigua*	Coyote willow	S	3	woody	OBL	wet
474570.46	2027.75	68.64	5.85	5.85	*Agrostis gigantea*	Redtop			herb	FACW	wet
474570.46	2027.75	68.64	0.00	5.85	*Salix exigua*	Coyote willow		2	woody	OBL	wet
474570.46	2027.75	68.64	0.00	5.85	*Salix lucida*	Shiny willow		2	woody	OBL	wet
474557.36	2028.46	85.20	16.57	16.57	Upland mix	Upland mix			herb	FACU	not wet
474557.31	2028.46	85.26	0.05	0.05	*Agrostis gigantea*	Redtop			herb	FACW	wet
474557.31	2028.46	85.26	0.00	0.05	*Salix exigua*	Coyote willow		2	woody	OBL	wet
474557.31	2028.46	85.26	0.00	0.05	*Salix lucida*	Shiny willow		2	woody	OBL	wet
474554.49	2028.46	89.01	3.76	3.76	open water	open water					
474548.52	2037.20	96.12	7.13	7.13	bare ground	bare ground					
474547.38	2037.55	97.66	1.55	1.55	*Quercus turbinella*	scruboak			woody	UPL	not wet
474605.16	2035.73	0.00	0.00	0.00	lep	lep					
474595.02	2027.24	18.65	18.65	18.65	*Betula occidentalis*	Water birch		1	woody	FACW	wet
474595.15	2027.24	18.76	0.25	0.25	*Symphoricarpos albus*	Snowberry			woody	UPL	not wet
474595.15	2027.24	18.76	0.00	0.25	Upland mix	Upland mix			herb	FACU	not wet
474593.90	2026.45	20.91	2.15	2.15	*Salix lucida*	Shiny willow	D	1	woody	OBL	wet
474590.67	2026.60	26.63	5.72	5.72	*Betula occidentalis*	Water birch		1	woody	FACW	wet
474590.67	2026.60	26.63	0.00	5.72	*Populus* spp.	Cottonwood		3	woody	FAC*	wet
474590.67	2026.60	26.63	0.00	5.72	*Salix lucida*	Shiny willow	D	1	woody	OBL	wet
474574.00	2027.09	58.73	32.11	32.11	*Salix boothii*	Booths willow		2	woody	OBL	wet
474574.00	2027.09	58.73	0.00	32.11	*Salix exigua*	Coyote willow	S	3	woody	OBL	wet
474574.00	2027.09	58.73	0.00	32.11	*Salix lucida*	Shiny willow		2	woody	OBL	wet
474567.49	2026.69	70.72	11.99	11.99	*Agrostis gigantea*	Redtop			herb	FACW	wet
474567.49	2026.69	70.72	0.00	11.99	*Salix exigua*	Coyote willow	D	1	woody	OBL	wet
474566.15	2026.61	73.42	2.71	2.71	*Salix exigua*	Coyote willow		1	woody	OBL	wet
474565.84	2026.34	73.97	0.55	0.55	*Salix lucida*	Shiny willow		2	woody	OBL	wet
474565.44	2026.61	74.61	0.65	0.65	*Agrostis gigantea*	Redtop			herb	FACW	wet
474565.44	2026.61	74.61	0.00	0.65	*Salix lucida*	Shiny willow		2	woody	OBL	wet
474563.68	2026.54	77.98	3.37	3.37	*Salix boothii*	Booths willow		2	woody	OBL	wet
474563.68	2026.54	77.98	0.00	3.37	*Salix exigua*	Coyote willow		2	woody	OBL	wet
474563.36	2026.40	79.04	1.10	1.10	open water	open water					
474559.55	2026.35	85.59	6.56	6.56	*Salix exigua*	Coyote willow	D	1	woody	OBL	wet
474559.20	2026.56	86.55	0.97	0.97	*Agrostis gigantea*	Redtop			herb	FACW	wet
474559.20	2026.56	86.55	0.00	0.97	*Epilobium* spp.	Willowherb			herb	FAC-OBL	wet
474559.20	2026.56	86.55	0.00	0.97	*Salix exigua*	Coyote willow	D	1	woody	OBL	wet
474556.94	2026.91	90.31	3.78	3.78	*Cirseum arvense*	Canada thistle			herb	FACU-	not wet
474556.94	2026.91	90.31	0.00	3.78	*Agrostis gigantea*	Redtop			herb	FACW	wet
474556.94	2026.91	90.31	0.00	3.78	*Salix exigua*	Coyote willow		2	woody	OBL	wet
474546.31	2026.93	110.87	20.56	20.56	*Salix exigua*	Coyote willow		2	woody	OBL	wet
474540.34	2036.56	121.52	10.65	10.65	bare ground	bare ground					
474539.80	2036.65	122.47	0.95	0.95	*Artemsia tridentata*	Big Sagebrush			woody	UPL	wet
474605.16	2035.73	0.00	0.00	0.00	lep	lep					
474595.74	2028.25	11.95	11.95	11.95	*Symphoricarpos albus*	Snowberry			woody	UPL	not wet
474595.74	2028.25	11.95	0.00	11.95	Upland mix	Upland mix			herb	FACU	not wet
474595.70	2028.24	12.00	0.06	0.06	Upland mix	Upland mix			herb	FACU	not wet
474595.70	2028.24	12.00	0.00	0.06	*Crataegus* spp.	Hawthorne			woody		
474589.74	2026.15	19.74	7.74	7.74	*Agrostis gigantea*	Redtop			herb	FACW	wet
474589.74	2026.15	19.74	0.00	7.74	*Salix lucida*	Shiny willow	D	1	woody	OBL	wet
474585.20	2026.21	25.69	5.95	5.95	Upland mix	Upland mix			herb	FACU	not wet
474585.20	2026.21	25.69	0.00	5.95	*Betula occidentalis*	Water birch		2	woody	FACW	wet
474585.20	2026.21	25.69	0.00	5.95	*Populus angustifolia*	Cottonwood		2	woody	FAC*	wet
474567.23	2026.26	48.70	23.02	23.02	Upland mix	Upland mix			herb	FACU	not wet
474567.23	2026.26	48.70	0.00	23.02	*Populus angustifolia*	Cottonwood	S	2	woody	FAC*	wet
474567.23	2026.26	48.70	0.00	23.02	*Salix exigua*	Coyote willow	S	3	woody	OBL	wet
474548.23	2025.89	72.92	24.22	24.22	Upland mix	Upland mix			herb	FACU	not wet
474548.23	2025.89	72.92	0.00	24.22	*Salix exigua*	Coyote willow		3	woody	OBL	wet
474543.17	2026.01	79.22	6.30	6.30	*Agrostis gigantea*	Redtop			herb	FACW	wet
474543.17	2026.01	79.22	0.00	6.30	*Salix exigua*	Coyote willow		1	woody	OBL	wet
474535.67	2025.64	88.62	9.41	9.41	*Salix exigua*	Coyote willow		1	woody	OBL	wet
474527.06	2025.04	99.55	10.92	10.92	open water	open water					
474525.60	2025.29	101.35	1.80	1.80	*Salix exigua*	Coyote willow		2	woody	OBL	wet
474524.41	2025.85	102.98	1.64	1.64	*Agrostis gigantea*	Redtop			herb	FACW	wet
474524.41	2025.85	102.98	0.00	1.64	*Salix exigua*	Coyote willow		2	woody	OBL	wet
474524.41	2025.85	102.98	0.00	1.64	wetland mix	wetland mix			herb		
474517.68	2026.03	111.26	8.29	8.29	*Agrostis gigantea*	Redtop			herb	FACW	wet
474517.68	2026.03	111.26	0.00	8.29	*Equisetum arvense*	Field horsetail			herb	FAC+	wet
474517.68	2026.03	111.26	0.00	8.29	*Salix exigua*	Coyote willow	D	1	woody	OBL	wet

462867.78	1578.48	26.11	13.14	13.14	*Agrostis gigantea*	Redtop			herb	FACW	wet	Gra
462867.78	1578.48	26.11	0.00	13.14	*Salix exigua*	Coyote willow		2	woody	OBL	wet	S
462866.78	1578.46	39.01	12.90	12.90	*open water*	open water						
462866.38	1579.27	44.05	5.04	5.04	*Phalaris arundinacea*	Reed canary grass			herb	OBL	wet	Gra
462866.38	1579.27	44.05	0.00	5.04	*Salix exigua*	Coyote willow		2	woody	OBL	wet	S
462865.58	1579.36	54.46	10.41	10.41	*Bromus inermis*	Brome			herb	UPL	not wet	Gra
462865.58	1579.36	54.46	0.00	10.41	*Salix boothii/lucida*	Shiny/Booths willow		2	woody	OBL	wet	S
462864.16	1579.18	72.47	18.01	18.01	Upland mix	Upland mix			herb	FACU	not wet	
462862.54	1578.88	93.15	20.68	20.68	*Agrostis gigantea*	Redtop			herb	FACW	wet	Gra
462862.54	1578.88	93.15	0.00	20.68	*Betula occidentalis*	Water birch	S	2	woody	FACW	wet	S
462862.54	1578.88	93.15	0.00	20.68	*Juncus arcticus*	Baltic rush			herb	FACW	wet	Gra
462862.54	1578.88	93.15	0.00	20.68	*Populus angustifolia*	Cottonwood	S	3	woody	FAC*	wet	T
462861.71	1578.86	103.71	10.56	10.56	*Solidago canadensis*	Canada goldenrod			herb	FACU	not wet	F
462861.71	1578.86	103.71	0.00	10.56	*Juncus arcticus*	Baltic rush			herb	FACW	wet	Gra
462859.81	1578.68	128.23	24.52	24.52	*Populus angustifolia*	Cottonwood		3	woody	FAC*	wet	T
462859.81	1578.68	128.23	0.00	24.52	*Salix exigua*	Coyote willow		2	woody	OBL	wet	S
462856.79	1578.49	161.66	33.43	33.43	*Cirseum arvense*	Canada thistle			herb	FACU-	not wet	F
462856.79	1578.49	161.66	0.00	33.43	*Juncus arcticus*	Baltic rush			herb	FACW	wet	Gra
462856.48	1578.48	164.86	3.20	3.20	*Juncus arcticus*	Baltic rush			herb	FACW	wet	Gra
462856.48	1578.48	164.86	0.00	3.20	*Salix boothii/lucida*	Shiny/Booths willow	D	1	woody	OBL	wet	S
462856.03	1578.44	172.17	7.31	7.31	*Juncus arcticus*	Baltic rush			herb	FACW	wet	Gra
462856.03	1578.44	172.17	0.00	7.31	*Salix exigua*	Coyote willow	D	2	woody	OBL	wet	S
462855.56	1581.03	181.36	9.19	9.19	*Cirseum arvense*	Canada thistle			herb	FACU-	not wet	F
462855.56	1581.03	181.36	0.00	9.19	*Populus angustifolia*	Cottonwood		3	woody	FAC*	wet	T
462855.56	1581.03	181.36	0.00	9.19	*Salix exigua*	Coyote willow		1	woody	OBL	wet	S
462855.09	1582.11	185.78	4.42	4.42	*Bromus tectorum*	Cheatgrass			herb	UPL	not wet	Gra
462709.61	1587.18	0.00	0.00	0.00	lep	lep						
462709.62	1587.18	0.09	0.09	0.09	*Bromus inermis*	Brome			herb	UPL	not wet	Gra
462709.62	1587.18	0.09	0.00	0.09	*Elymus trachycaulus*	Slender wheatgrass			herb	FACU	not wet	Gra
462711.44	1583.21	10.51	10.42	10.42	*Bromus inermis*	Brome			herb	UPL	not wet	Gra
462711.83	1582.63	12.31	1.80	1.80	*Ribes* spp.	Currant			woody			
462712.34	1581.33	15.69	3.39	3.39	*Bromus inermis*	Brome			herb	UPL	not wet	Gra
462713.82	1577.92	21.46	5.78	5.78	*Agrostis gigantea*	Redtop			herb	FACW	wet	Gra
462713.82	1577.92	21.46	0.00	5.78	*Populus angustifolia*	Cottonwood		2	woody	FAC*	wet	T
462713.82	1577.92	21.46	0.00	5.78	*Crataegus spp.*	Hawthorn			herb			
462716.92	1577.83	38.06	16.60	16.60	*Bromus inermis*	Brome			herb	UPL	not wet	Gra
462716.92	1577.83	38.06	0.00	16.60	*Agrostis gigantea*	Redtop			herb	FACW	wet	Gra
462716.92	1577.83	38.06	0.00	16.60	*Salix lucida*	Shiny willow	D	1	woody	OBL	wet	S
462720.15	1577.30	54.64	16.58	16.58	*Bromus inermis*	Brome			herb	UPL	not wet	Gra
462720.15	1577.30	54.64	0.00	16.58	*Betula occidentalis*	Water birch		2	woody	FACW	wet	S
462720.15	1577.30	54.64	0.00	16.58	*Populus angustifolia*	Cottonwood		2	woody	FAC*	wet	T
462721.37	1577.32	61.66	7.02	7.02	*Betula occidentalis*	Water birch		3	woody	FACW	wet	S
462721.37	1577.32	61.66	0.00	7.02	*Juncus arcticus*	Baltic rush			herb	FACW	wet	Gra
462721.37	1577.32	61.66	0.00	7.02	*Populus angustifolia*	Cottonwood		3	woody	FAC*	wet	T
462721.37	1577.32	61.66	0.00	7.02	*Salix* spp.	Willow			woody	OBL	wet	S
462722.67	1577.38	68.20	6.54	6.54	*Agrostis gigantea*	Redtop			herb	FACW	wet	Gra
462722.67	1577.38	68.20	0.00	6.54	*Euthamia occidentalis*	Western goldenrod			herb	OBL	wet	F
462725.64	1577.21	83.94	15.75	15.75	open water	open water						
462726.50	1577.76	88.84	4.90	4.90	*Agrostis gigantea*	Redtop			herb	FACW	wet	Gra
462726.50	1577.76	88.84	0.00	4.90	*Salix lucida*	Shiny willow		2	woody	OBL	wet	S
462743.75	1579.71	179.45	90.60	90.60	*Agrostis gigantea*	Redtop			herb	FACW	wet	Gra
462743.75	1579.71	179.45	0.00	90.60	*Salix boothii*	Booths willow	D	1	woody	OBL	wet	S
462743.75	1579.71	179.45	0.00	90.60	*Salix lucida*	Shiny willow	D	1	woody	OBL	wet	S
462744.91	1580.85	185.65	6.21	6.21	*Upland mix*	Upland mix			herb	FACU	not wet	
462744.91	1580.85	185.65	0.00	6.21	*Populus angustifolia*	Cottonwood	S	3	woody	FAC*	wet	T
462745.51	1582.06	188.77	3.12	3.12	*Bromus tectorum*	Cheatgrass			herb	UPL	not wet	Gra
462745.51	1582.06	188.77	0.00	3.12	*Ribes* spp.	Currant			woody			
462672.34	1586.97	0.00	0.00	0.00	lep	lep						
462670.30	1581.86	16.07	16.07	16.07	*Bromus inermis*	Brome			herb	UPL	not wet	Gra
462668.94	1577.00	20.85	4.83	4.83	*Agrostis gigantea*	Redtop			herb	FACW	wet	Gra
462668.94	1577.00	20.85	0.00	4.83	*Ribes* spp.	Currant		2	woody			
462665.39	1577.50	54.88	34.05	34.05	*Bromus inermis*	Brome			herb	UPL	not wet	Gra
462665.39	1577.50	54.88	0.00	34.05	*Salix boothii/lucida*	Shiny/Booth willow		1	woody	OBL	wet	S
462663.24	1576.50	71.84	16.96	16.96	*Populus angustifolia*	Cottonwood		3	woody	FAC*	wet	T
462663.24	1576.50	71.84	0.00	16.96	*Salix exigua*	Coyote willow		2	woody	OBL	wet	S
462663.24	1576.50	71.84	0.00	16.96	wetland mix	wetland mix			herb	FACW	wet	
462662.52	1576.62	77.53	5.69	5.69	*Agrostis gigantea*	Redtop			herb	FACW	wet	Gra
462662.52	1576.62	77.53	0.00	5.69	*Euthamia occidentalis*	Western goldenrod			herb	OBL	wet	F
462662.52	1576.62	77.53	0.00	5.69	*Phalaris arundinacea*	Reed canarygrass			herb	OBL	wet	Gra
462662.15	1576.42	80.47	2.94	2.94	gravel bar	gravel bar						

462656.91	1576.51	121.85	0.00	7.71	*Salix exigua*	Coyote willow		3	woody	OBL	wet	S
462656.15	1578.18	127.90	6.05	6.05	gravel bar	gravel bar						
462672.37	1586.98	0.00	0.00	0.00	lep	lep						
462660.73	1577.03	20.75	20.75	20.75	*Bromus inermis*	Brome			herb	UPL	not wet	Gra
462652.06	1576.21	36.20	15.45	15.45	*Bromus inermis*	Brome			herb	UPL	not wet	Gra
462652.06	1576.21	36.20	0.00	15.45	*Salix boothii*	Booths willow		2	woody	OBL	wet	S
462650.16	1575.93	39.61	3.40	3.40	*Juncus arcticus*	Baltic rush			herb	FACW	wet	Gra
462650.16	1575.93	39.61	0.00	3.40	*Salix exigua*	Coyote willow		2	woody	OBL	wet	S
462642.16	1576.18	53.87	14.26	14.26	*Agrostis gigantea*	Redtop			herb	FACW	wet	Gra
462642.16	1576.18	53.87	0.00	14.26	*Euthamia occidentalis*	Western goldenrod			herb	OBL	wet	F
462642.16	1576.18	53.87	0.00	14.26	*Phalaris arundinacea*	Reed canarygrass			herb	OBL	wet	Gra
462639.12	1576.22	59.29	5.42	5.42	*Euthamia occidentalis*	Western goldenrod			herb	OBL	wet	F
462639.12	1576.22	59.29	0.00	5.42	*Salix exigua*	Coyote willow		3	woody	OBL	wet	S
462635.24	1576.01	66.21	6.92	6.92	*Phalaris arundinacea*	Reed canarygrass			herb	OBL	wet	Gra
462629.52	1575.82	76.41	10.20	10.20	open water	open water						
462626.88	1576.34	81.11	4.71	4.71	*Phalaris arundinacea*	Reed canarygrass			herb	OBL	wet	Gra
462626.88	1576.34	81.11	0.00	4.71	*Carex* spp.	unknown sedge			herb			
462625.59	1576.23	83.41	2.29	2.29	gravel bar	gravel bar						
462624.09	1575.96	86.09	2.68	2.68	wetland mix	wetland mix	S		herb	FACW	wet	
462621.28	1575.87	91.16	5.07	5.07	open water	open water						
462619.57	1577.79	94.19	3.02	3.02	*Salix Boothii-Lucida*	Shiny/Booths willow			woody	OBL	wet	S
462617.62	1579.62	97.63	3.45	3.45	*Rosa woodsii*	Wood's Rose			woody	FAC-	wet	S
462612.84	1580.41	106.16	8.53	8.53	Upland mix	Upland mix			herb	FACU	not wet	
462672.40	1586.99	0.00	0.00	0.00	lep	lep						
462649.71	1577.87	23.83	23.83	23.83	*Bromus inermis*	Brome			herb	UPL	not wet	Gra
462647.52	1575.37	26.15	2.31	2.31	*hinopyrum intermediu*	wheatgrass			herb	FACU	not wet	Gra
462640.00	1575.62	34.07	7.92	7.92	gravel bar	gravel bar						
462638.31	1575.76	35.83	1.76	1.76	*Phalaris arundinacea*	Reed canarygrass			herb	OBL	wet	Gra
462635.20	1575.89	39.09	3.26	3.26	gravel bar	gravel bar						
462632.76	1575.85	41.63	2.54	2.54	*Phalaris arundinacea*	Reed canarygrass			herb	OBL	wet	Gra
462630.50	1575.72	44.02	2.39	2.39	bare ground	bare ground						
462619.79	1575.72	55.27	11.26	11.26	open water	open water						
462609.70	1576.04	65.90	10.62	10.62	*Cirseum arvense*	Canada thistle			herb	FACU-	not wet	F
462609.70	1576.04	65.90	0.00	10.62	*Agrostis gigantea*	Redtop			herb	FACW	wet	Gra
462609.70	1576.04	65.90	0.00	10.62	*Euthamia occidentalis*	Western goldenrod			herb	OBL	wet	F
462609.70	1576.04	65.90	0.00	10.62	*Salix exigua*	Coyote willow		2	woody	OBL	wet	S
462599.26	1575.82	76.89	11.00	11.00	*Agrostis gigantea*	Redtop			herb	FACW	wet	Gra
462599.26	1575.82	76.89	0.00	11.00	*Phalaris arundinacea*	Reed canarygrass			herb	OBL	wet	Gra
462599.26	1575.82	76.89	0.00	11.00	*Salix exigua*	Coyote willow		1	woody	OBL	wet	S
462597.21	1576.18	79.00	2.12	2.12	*Salix Boothii/Lucida*	Shiny/Booths willow		1	woody	OBL	wet	S
462586.02	1579.86	90.77	11.76	11.76	*Bromus tectorum*	Cheatgrass			herb	UPL	not wet	Gra
462647.10	1586.82	0.00	0.00	0.00	lep	lep						
462629.52	1576.84	23.12	23.12	23.12	*Bromus inermis*	Brome			herb	UPL	not wet	Gra
462612.60	1575.49	45.50	22.38	22.38	open water	open water						
462602.10	1575.84	59.31	13.81	13.81	*Agrostis gigantea*	Redtop			herb	FACW	wet	Gra
462602.10	1575.84	59.31	0.00	13.81	*Euthamia occidentalis*	Western goldenrod			herb	OBL	wet	F
462602.10	1575.84	59.31	0.00	13.81	*Salix exigua*	Coyote willow		2	woody	OBL	wet	S
462593.03	1576.83	71.31	12.01	12.01	*Salix boothii/lucida*	Shiny/Booths willow		1	woody	OBL	wet	S
462593.03	1576.83	71.31	0.00	12.01	*Salix exigua*	Coyote willow	D	1	woody	OBL	wet	S
462591.17	1578.18	73.73	2.42	2.42	Upland mix	Upland mix			herb	FACU	not wet	
462591.17	1578.18	73.73	0.00	2.42	*Populus angustifolia*	Cottonwood	S	1	woody	FAC*	wet	T
462586.02	1579.86	80.57	6.84	6.84	Upland mix	Upland mix			herb	FACU	not wet	
462587.46	1585.91	0.00	0.00	0.00	lep	lep						
462587.10	1576.23	21.24	21.24	21.24	*Bromus inermis*	Brome			herb	UPL	not wet	Gra
462586.66	1575.18	37.64	16.40	16.40	open water	open water						
462586.73	1575.22	39.32	1.68	1.68	gravel bar	gravel bar						
462586.69	1575.34	41.31	2.00	2.00	*Phalaris arundinacea*	Reed canarygrass			herb	OBL	wet	Gra
462586.63	1575.14	44.29	2.98	2.98	gravel bar	gravel bar						
462586.46	1575.44	53.97	9.68	9.68	*Agrostis gigantea*	Redtop			herb	FACW	wet	Gra
462586.46	1575.44	53.97	0.00	9.68	*Euthamia occidentalis*	Western goldenrod			herb	OBL	wet	F
462586.46	1575.44	53.97	0.00	9.68	*Salix exigua*	Coyote willow	D	2	woody	OBL	wet	S
462586.28	1575.71	60.67	6.70	6.70	*Salix boothii*	Booths willow	D	1	woody	OBL	wet	S
462586.28	1575.71	60.67	0.00	6.70	*Carex* spp.	unknown sedge			herb			
462586.02	1579.86	74.74	14.07	14.07	Upland mix	Upland mix			herb	FACU	not wet	

01	460130.93	1544.24	25.68	7.00	7.00	*Cirseum arvense*	Canada thistle			herb	FACU-	not we
01	460130.93	1544.24	25.68	0.00	7.00	*Agrostis gigantea*	Redtop			herb	FACW	wet
01	460130.93	1544.24	25.68	0.00	7.00	*Carex* spp.	Unknown sedge			herb		wet
01	460130.93	1544.24	25.68	0.00	7.00	*Juncus arcticus*	Baltic rush			herb	FACW	wet
01	460130.93	1544.24	25.68	0.00	7.00	*Salix exigua*	Coyote willow		2	woody	OBL	wet
68	460125.30	1544.25	33.68	8.00	8.00	open water	open water					
47	460116.60	1544.40	46.05	12.37	12.37	*Cirseum arvense*	Canada thistle			herb	FACU-	not we
47	460116.60	1544.40	46.05	0.00	12.37	*Agrostis gigantea*	Redtop			herb	FACW	wet
47	460116.60	1544.40	46.05	0.00	12.37	*Juncus arcticus*	Baltic rush			herb	FACW	wet
47	460116.60	1544.40	46.05	0.00	12.37	*Salix exigua*	Coyote willow		2	woody	OBL	wet
44	460111.68	1544.09	53.04	6.99	6.99	*Phalaris arundinacea*	Reed canarygrass			herb	OBL	wet
44	460111.68	1544.09	53.04	0.00	6.99	*Salix exigua*	Coyote willow			woody	OBL	wet
33	460107.83	1544.19	58.51	5.47	5.47	*Juncus arcticus*	Baltic rush			herb	FACW	wet
33	460107.83	1544.19	58.51	0.00	5.47	*Salix exigua*	Coyote willow		1	woody	OBL	wet
20	460104.01	1544.36	63.95	5.44	5.44	*Agrostis gigantea*	Redtop			herb	FACW	wet
20	460104.01	1544.36	63.95	0.00	5.44	*Juncus arcticus*	Baltic rush			herb	FACW	wet
20	460104.01	1544.36	63.95	0.00	5.44	*Salix exigua*	Coyote willow		2	woody	OBL	wet
96	460101.28	1546.18	67.82	3.87	3.87	*Bromus inermis*	Brome			herb	UPL	not we
72	459933.75	1549.08	0.00	0.00	0.00	lep	lep					
30	459938.76	1542.84	13.55	13.55	13.55	*Bromus inermis*	Brome			herb	UPL	not we
52	459941.60	1542.40	21.30	7.76	7.76	*Bromus inermis*	Brome			herb	UPL	not we
52	459941.60	1542.40	21.30	0.00	7.76	*Phalaris arundinacea*	Reed canarygrass			herb	OBL	wet
52	459941.60	1542.40	21.30	0.00	7.76	*Salix exigua*	Coyote willow		1	woody	OBL	wet
59	459943.61	1542.47	26.76	5.46	5.46	*Phalaris arundinacea*	Reed canarygrass			herb	OBL	wet
56	459950.34	1542.72	45.01	18.25	18.25	*Agrostis gigantea*	Redtop			herb	FACW	wet
56	459950.34	1542.72	45.01	0.00	18.25	*Salix exigua*	Coyote willow	D	1	woody	OBL	wet
09	459954.92	1542.65	57.42	12.41	12.41	*Phalaris arundinacea*	Reed canarygrass			herb	OBL	wet
09	459954.92	1542.65	57.42	0.00	12.41	*Salix exigua*	Coyote willow		1	woody	OBL	wet
32	459966.12	1542.75	87.79	30.37	30.37	*Agrostis gigantea*	Redtop			herb	FACW	wet
32	459966.12	1542.75	87.79	0.00	30.37	*Juncus arcticus*	Baltic rush			herb	FACW	wet
32	459966.12	1542.75	87.79	0.00	30.37	*Salix exigua*	Coyote willow	D	1	woody	OBL	wet
64	459969.42	1543.00	96.73	8.94	8.94	*Phalaris arundinacea*	Reed canarygrass			herb	OBL	wet
29	459972.85	1543.04	106.05	9.32	9.32	open water	open water					
04	459977.12	1543.02	117.61	11.57	11.57	*Phalaris arundinacea*	Reed canarygrass			herb	OBL	wet
23	459980.77	1542.98	127.50	9.88	9.88	open water	open water					
06	459981.49	1543.12	129.46	1.96	1.96	*Carex* spp.	Unknown sedge			herb		wet
06	459981.49	1543.12	129.46	0.00	1.96	*Euthamia occidentalis*	Western goldenrod			herb	OBL	wet
06	459981.49	1543.12	129.46	0.00	1.96	*Salix exigua*	Coyote willow	S		woody	OBL	wet
10	459984.28	1543.18	137.04	7.58	7.58	*Phalaris arundinacea*	Reed canarygrass			herb	OBL	wet
38	459986.38	1543.34	142.71	5.68	5.68	*Solidago canadensis*	Canada goldenrod			herb	FACU	not we
38	459986.38	1543.34	142.71	0.00	5.68	*Agrostis gigantea*	Redtop			herb	FACW	wet
38	459986.38	1543.34	142.71	0.00	5.68	*Juncus arcticus*	Baltic rush			herb	FACW	wet
38	459986.38	1543.34	142.71	0.00	5.68	*Salix exigua*	Coyote willow	S	1	woody	OBL	wet
29	459988.72	1543.24	149.08	6.36	6.36	*Cirseum arvense*	Canada thistle			herb	FACU-	not we
29	459988.72	1543.24	149.08	0.00	6.36	*Carex* spp.	Unknown sedge			herb		wet
29	459988.72	1543.24	149.08	0.00	6.36	*Salix exigua*	Coyote willow		1	woody	OBL	wet
43	459993.94	1543.36	163.21	14.13	14.13	*Agrostis gigantea*	Redtop			herb	FACW	wet
43	459993.94	1543.36	163.21	0.00	14.13	*Juncus arcticus*	Baltic rush			herb	FACW	wet
43	459993.94	1543.36	163.21	0.00	14.13	*Phalaris arundinacea*	Reed canarygrass			herb	OBL	wet
43	459993.94	1543.36	163.21	0.00	14.13	*Populus angustifolia*	Cottonwood		3	woody	FAC*	wet
43	459993.94	1543.36	163.21	0.00	14.13	*Salix exigua*	Coyote willow		2	woody	OBL	wet
20	459995.83	1543.31	168.35	5.14	5.14	*Agrostis gigantea*	Redtop			herb	FACW	wet
20	459995.83	1543.31	168.35	0.00	5.14	*Salix exigua*	Coyote willow	D	1	woody	OBL	wet
27	459996.65	1543.34	170.57	2.22	2.22	*Agrostis gigantea*	Redtop			herb	FACW	wet
27	459996.65	1543.34	170.57	0.00	2.22	*Salix exigua*	Coyote willow	D	1	woody	OBL	wet
15	459997.79	1543.33	173.67	3.10	3.10	*Phalaris arundinacea*	Reed canarygrass			herb	OBL	wet
15	459997.79	1543.33	173.67	0.00	3.10	*Salix exigua*	Coyote willow	D	1	woody	OBL	wet
53	460005.05	1543.41	193.43	19.76	19.76	*Cirseum arvense*	Canada thistle			herb	FACU-	not we
53	460005.05	1543.41	193.43	0.00	19.76	*Agrostis gigantea*	Redtop			herb	FACW	wet
53	460005.05	1543.41	193.43	0.00	19.76	*Salix exigua*	Coyote willow		1	woody	OBL	wet
28	460010.94	1545.07	209.31	15.88	15.88	*Cirseum arvense*	Canada thistle			herb	FACU-	not we
28	460010.94	1545.07	209.31	0.00	15.88	*Salix exigua*	Coyote willow	D	1	woody	OBL	wet
11	460015.63	1547.06	222.04	12.73	12.73	*Bromus inermis*	Brome			herb	UPL	not we
72	459933.75	1549.08	0.00	0.00	0.00	lep	lep					
89	459932.99	1548.48	3.26	3.26	3.26	*Elymus trachycaulus*	Slender wheatgrass			herb	FACU	not we
35	459931.69	1543.24	8.87	5.61	5.61	*Bromus inermis*	Brome			herb	UPL	not we
93	459930.86	1541.96	12.54	3.68	3.68	*Phalaris arundinacea*	Reed canarygrass			herb	OBL	wet
93	459930.86	1541.96	12.54	0.00	3.68	*Salix exigua*	Coyote willow	S	2	woody	OBL	wet
97	459929.42	1541.99	18.76	6.21	6.21	open water	open water					
43	459925.94	1542.08	33.63	14.87	14.87	*Agrostis gigantea*	Redtop			herb	FACW	wet

53	459915.86	1542.55	76.92	14.48	14.48	*Salix exigua*	Coyote willow	S	3	woody	OBL	wet
53	459915.86	1542.55	76.92	0.00	14.48	*Panicum* spp.	unknown panicgrass			herb		
53	459915.86	1542.55	76.92	0.00	14.48		herbaceous mixed			herb		
44	459914.82	1542.50	81.94	5.02	5.02	*Euthamia occidentalis*	Western goldenrod			herb	OBL	wet
44	459914.82	1542.50	81.94	0.00	5.02	*Phalaris arundinacea*	Reed canarygrass			herb	OBL	wet
40	459910.34	1542.38	100.44	18.50	18.50	*Bromus inermis*	Brome			herb	UPL	not we
40	459910.34	1542.38	100.44	0.00	18.50	*Agrostis gigantea*	Redtop			herb	FACW	wet
40	459910.34	1542.38	100.44	0.00	18.50	*Salix exigua*	Coyote willow		2	woody	OBL	wet
72	459907.69	1542.36	112.07	11.63	11.63	*Agrostis gigantea*	Redtop			herb	FACW	wet
72	459907.69	1542.36	112.07	0.00	11.63	*Phalaris arundinacea*	Reed canarygrass			herb	OBL	wet
72	459907.69	1542.36	112.07	0.00	11.63	*Salix exigua*	Coyote willow	S	3	woody	OBL	wet
24	459903.98	1542.21	128.03	15.96	15.96		herbaceous mixed	S		herb		
94	459902.82	1542.17	133.84	5.82	5.82	open water	open water					
58	459899.38	1542.70	148.88	15.04	15.04	*Agrostis gigantea*	Redtop			herb	FACW	wet
58	459899.38	1542.70	148.88	0.00	15.04	*Salix exigua*	Coyote willow		2	woody	OBL	wet
58	459899.38	1542.70	148.88	0.00	15.04		herbaceous mixed			herb		
38	459895.21	1542.44	166.19	17.32	17.32	*Bromus inermis*	Brome			herb	UPL	not we
38	459895.21	1542.44	166.19	0.00	17.32	*Agrostis gigantea*	Redtop			herb	FACW	wet
38	459895.21	1542.44	166.19	0.00	17.32	*Populus angustifolia*	Cottonwood		3	woody	FAC*	wet
86	459894.32	1543.50	170.76	4.57	4.57	*Carex nebrascensis*	Nebraska sedge			herb	OBL	wet
86	459894.32	1543.50	170.76	0.00	4.57	*Phalaris arundinacea*	Reed canarygrass			herb	OBL	wet
86	459894.32	1543.50	170.76	0.00	4.57	*Salix exigua*	Coyote willow		2	woody	OBL	wet
29	459892.20	1545.04	179.44	8.69	8.69	*Bromus inermis*	Brome			herb	UPL	not we
72	459933.75	1549.08	0.00	0.00	0.00	lep	lep					
91	459930.74	1547.87	4.38	4.38	4.38	*Elymus trachycaulus*	Slender wheatgrass			herb	FACU	not we
01	459926.85	1542.87	10.03	5.65	5.65	*Bromus inermis*	Brome			herb	UPL	not we
44	459923.57	1541.91	14.78	4.74	4.74	*Phalaris arundinacea*	Reed canarygrass			herb	OBL	wet
44	459923.57	1541.91	14.78	0.00	4.74	*Salix exigua*	Coyote willow		1	woody	OBL	wet
21	459913.45	1541.70	29.56	14.78	14.78	open water	open water					
69	459907.42	1542.11	38.41	8.85	8.85	*Agrostis gigantea*	Redtop			herb	FACW	wet
69	459907.42	1542.11	38.41	0.00	8.85	*Salix exigua*	Coyote willow	D	1	woody	OBL	wet
90	459893.02	1542.39	59.35	20.94	20.94	*Phalaris arundinacea*	Reed canarygrass			herb	OBL	wet
90	459893.02	1542.39	59.35	0.00	20.94	*Salix exigua*	Coyote willow		1	woody	OBL	wet
80	459890.13	1541.92	63.45	4.10	4.10	*Agrostis gigantea*	Redtop			herb	FACW	wet
80	459890.13	1541.92	63.45	0.00	4.10	*Phalaris arundinacea*	Reed canarygrass			herb	OBL	wet
80	459890.13	1541.92	63.45	0.00	4.10	*Salix exigua*	Coyote willow		1	woody	OBL	wet
42	459880.19	1541.86	77.99	14.54	14.54	*Phalaris arundinacea*	Reed canarygrass			herb	OBL	wet
42	459880.19	1541.86	77.99	0.00	14.54	*Salix exigua*	Coyote willow	S	1	woody	OBL	wet
41	459870.96	1541.80	91.60	13.60	13.60	open water	open water					
43	459868.96	1541.76	94.44	2.85	2.85	*Eleocharis palustris*	Common spikerush			herb	OBL	wet
43	459868.96	1541.76	94.44	0.00	2.85		mixed herbaceous			herb		
44	459867.75	1542.12	96.01	1.58	1.58	*Agrostis gigantea*	Redtop			herb	FACW	wet
44	459867.75	1542.12	96.01	0.00	1.58	*Phalaris arundinacea*	Reed canarygrass			herb	OBL	wet
44	459867.75	1542.12	96.01	0.00	1.58	*Salix exigua*	Coyote willow		3	woody	OBL	wet
41	459863.17	1542.09	102.76	6.75	6.75	*Salix exigua*	Coyote willow		2	woody	OBL	wet
41	459863.17	1542.09	102.76	0.00	6.75		mixed herbaceous			herb		
00	459858.93	1543.32	109.01	6.25	6.25	*Phalaris arundinacea*	Reed canarygrass			herb	OBL	wet
00	459858.93	1543.32	109.01	0.00	6.25	*Salix exigua*	Coyote willow		1	woody	OBL	wet
66	459850.77	1543.80	120.91	11.90	11.90	*Bromus inermis*	Brome			herb	UPL	not we
72	459933.75	1549.08	0.00	0.00	0.00	lep	lep					
27	459929.32	1548.83	4.69	4.69	4.69	*Elymus trachycaulus*	Slender wheatgrass			herb	FACU	not we
33	459920.58	1542.65	13.95	9.26	9.26	*Bromus inermis*	Brome			herb	UPL	not we
62	459913.76	1541.63	21.14	7.19	7.19	*Carex* spp.	unknown sedge			herb		wet
62	459913.76	1541.63	21.14	0.00	7.19	*Phalaris arundinacea*	Reed canarygrass			herb	OBL	wet
62	459913.76	1541.63	21.14	0.00	7.19	*Salix exigua*	Coyote willow		1	woody	OBL	wet
66	459905.02	1541.59	30.40	9.26	9.26	open water	open water					
47	459894.44	1541.92	41.64	11.25	11.25	*Agrostis gigantea*	Redtop			herb	FACW	wet
47	459894.44	1541.92	41.64	0.00	11.25	*Carex* spp.	unknown sedge			herb		wet
47	459894.44	1541.92	41.64	0.00	11.25	*Juncus arcticus*	Baltic rush			herb	FACW	wet
47	459894.44	1541.92	41.64	0.00	11.25	*Phalaris arundinacea*	Reed canarygrass			herb	OBL	wet
47	459894.44	1541.92	41.64	0.00	11.25	*Salix exigua*	Coyote willow		2	woody	OBL	wet
41	459883.16	1541.63	53.58	11.94	11.94	*Carex* spp.	unknown sedge			herb		wet
41	459883.16	1541.63	53.58	0.00	11.94	*Juncus arcticus*	Baltic rush			herb	FACW	wet
41	459883.16	1541.63	53.58	0.00	11.94	*Salix exigua*	Coyote willow		2	woody	OBL	wet
35	459877.60	1541.70	59.48	5.89	5.89	*Phalaris arundinacea*	Reed canarygrass			herb	OBL	wet
35	459877.60	1541.70	59.48	0.00	5.89	*Salix exigua*	Coyote willow		2	woody	OBL	wet
27	459872.12	1541.86	65.29	5.81	5.81	*Eleocharis palustris*	common spikerush			herb	OBL	wet
27	459872.12	1541.86	65.29	0.00	5.81	*Euthamia occidentalis*	Western goldenrod			herb	OBL	wet
27	459872.12	1541.86	65.29	0.00	5.81	*Phalaris arundinacea*	Reed canarygrass			heb	OBL	wet
11	459866.87	1541.89	70.84	5.56	5.56	*Salix exigua*	Coyote willow		3	woody	OBL	wet

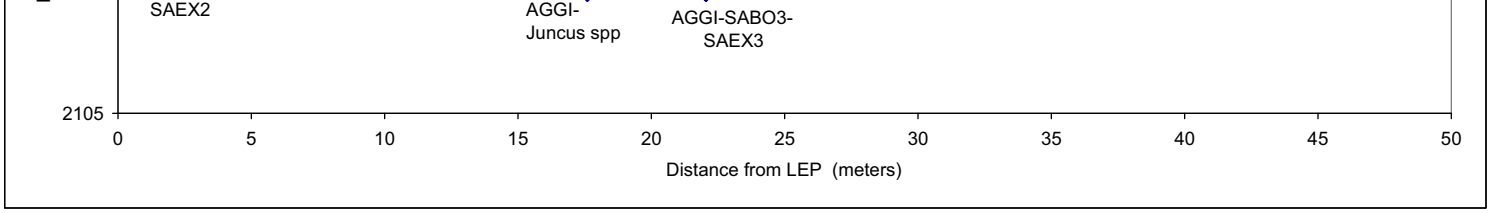
32	459833.38	1542.16	106.33	6.87	6.87	*Agrostis gigantea*	Redtop		herb	FACW	wet
32	459833.38	1542.16	106.33	0.00	6.87	*Juncus arcticus*	Baltic rush		herb	FACW	wet
32	459833.38	1542.16	106.33	0.00	6.87	*Salix boothii/lucida*	Shiny/Booths willow	3	woody	OBL	wet
02	459818.50	1542.69	122.09	15.76	15.76	*Bromus inermis*	Brome		herb	UPL	not we
26	459856.08	1546.32	0.00	0.00	0.00	lep	lep				
49	459851.70	1541.21	11.13	11.13	11.13	*Bromus inermis*	Brome		herb	UPL	not we
49	459851.70	1541.21	11.13	0.00	11.13	*Artemisia tridentata*	Big Sagebrush		woody	UPL	wet
43	459848.73	1541.20	18.68	7.55	7.55	open water	open water				
63	459845.08	1541.44	27.66	8.98	8.98	*Euthamia occidentalis*	Western goldenrod		herb	OBL	wet
63	459845.08	1541.44	27.66	0.00	8.98	*Phalaris arundinacea*	Reed canarygrass		herb	OBL	wet
60	459842.52	1541.35	34.15	6.49	6.49	gravel bar	gravel bar				
28	459839.64	1541.54	41.42	7.27	7.27	*Euthamia occidentalis*	Western goldenrod		herb	OBL	wet
28	459839.64	1541.54	41.42	0.00	7.27	*Phalaris arundinacea*	Reed canarygrass		herb	OBL	wet
73	459836.02	1541.54	50.61	9.19	9.19	*Panicum* spp.	Unknown panicgrass		herb		
02	459830.26	1541.58	65.10	14.48	14.48	*Phalaris arundinacea*	Reed canarygrass		herb	OBL	wet
02	459830.26	1541.58	65.10	0.00	14.48	*Salix exigua*	Coyote willow	2	woody	OBL	wet
27	459826.69	1541.88	74.09	9.00	9.00	*Juncus arcticus*	Baltic rush		herb	FACW	wet
27	459826.69	1541.88	74.09	0.00	9.00	*Salix exigua*	Coyote willow	2	woody	OBL	wet
27	459826.69	1541.88	74.09	0.00	9.00	wetland mix	wetland mix		herb	FACW	wet
06	459818.55	1549.95	94.56	20.47	20.47	*Bromus inermis*	Brome		herb	UPL	not we

458828.27	1530.85	35.85	23.51	23.51	*Populus angustifolia*	Cottonwood	d	3	woody	FAC*	wet
458828.27	1530.85	35.85	0.00	23.51	*Salix exigua*	Coyote willow		1	woody	OBL	wet
458814.57	1530.78	57.37	21.52	21.52	*Populus angustifolia*	Cottonwood	D	3	woody	FAC*	wet
458809.87	1530.87	64.48	7.11	7.11	gravel bar	gravel bar					
458802.43	1530.56	76.45	11.98	11.98	*Populus angustifolia*	Cottonwood	S	3	woody	FAC*	wet
458796.18	1529.59	86.26	9.81	9.81	*Populus angustifolia*	Cottonwood	D	3	woody	FAC*	wet
458789.73	1529.55	96.56	10.30	10.30	open water	open water					
458787.49	1529.77	100.00	3.44	3.44	*Agrostis gigantea*	Redtop			herb	FACW	wet
458787.49	1529.77	100.00	0.00	3.44	*Euthamia occidentalis*	Western goldenrod			herb	OBL	wet
458787.49	1529.77	100.00	0.00	3.44	*Phalaris arundinacea*	Reed canarygrass			herb	OBL	wet
458785.41	1530.90	103.23	3.24	3.24	*Salix exigua*	Coyote willow		3	woody	OBL	wet
458778.11	1530.74	114.65	11.42	11.42							
458775.10	1530.58	119.53	4.88	4.88	*Populus angustifolia*	Cottonwood	D	1	woody	FAC*	wet
458761.69	1530.61	140.44	20.91	20.91	*Equisetum arvense*	Field horsetail			herb	FAC+	wet
458761.69	1530.61	140.44	0.00	20.91	*Populus angustifolia*	Cottonwood	D	1	woody	FAC*	wet
458761.69	1530.61	140.44	0.00	20.91	*Salix exigua*	Coyote willow		2	woody	OBL	wet
458756.91	1533.37	147.94	7.51	7.51	*Bromus inermis*	Brome			herb	UPL	not wet
458851.15	1532.07	0.00	0.00	0.00	lep	lep					
458850.74	1532.04	0.43	0.43	0.43	*Bromus inermis*	Brome			herb	UPL	not wet
458845.37	1530.34	6.14	5.70	5.70	*Populus angustifolia*	Cottonwood		1	woody	FAC*	wet
458786.49	1530.39	68.99	62.85	62.85	*Populus angustifolia*	Cottonwood	D	3	woody	FAC*	wet
458784.47	1529.42	71.14	2.15	2.15	*Phalaris arundinacea*	Reed canarygrass			herb	OBL	wet
458784.47	1529.42	71.14	0.00	2.15	*Salix exigua*	Coyote willow		3	woody	OBL	wet
458776.41	1529.48	79.75	8.61	8.61	wetland mix	wetland mix			herb	FACW	wet
458772.42	1529.54	84.00	4.26	4.26	*Salix exigua*	Coyote willow		3	woody	OBL	wet
458755.45	1529.24	102.10	18.09	18.09	wetland mix	wetland mix			herb	FACW	wet
458747.66	1529.28	110.41	8.31	8.31	open water	open water					
458734.07	1530.61	124.89	14.49	14.49	*Populus angustifolia*	Cottonwood		3	woody	FAC*	wet
458734.07	1530.61	124.89	0.00	14.49	*Salix exigua*	Coyote willow		2	woody	OBL	wet
458702.75	1530.07	158.28	33.39	33.39	*Bromus inermis*	Brome			herb	UPL	not wet
458702.75	1530.07	158.28	0.00	33.39	Upland mix	Upland mix			herb	FACU	not wet
458702.75	1530.07	158.28	0.00	33.39	*Populus angustifolia*	Cottonwood		2	woody	FAC*	wet
458697.81	1530.42	163.56	5.27	5.27	*Upland mix*	Upland mix			herb	FACU	not wet
458693.33	1532.50	168.33	4.77	4.77	*Bromus inermis*	Brome			herb	UPL	not wet
458802.38	1531.45	0.00	0.00	0.00	lep	lep					
458800.27	1531.41	3.48	3.48	3.48	*Bromus inermis*	Brome			herb	UPL	not wet
458797.74	1529.78	7.70	4.22	4.22	*Populus angustifolia*	Cottonwood		1	woody	FAC*	wet
458797.74	1529.78	7.70	0.00	4.22	*Salix exigua*	Coyote willow	D	1	woody	OBL	wet
458785.32	1529.63	27.71	20.01	20.01	*Populus angustifolia*	Cottonwood		2	woody	FAC*	wet
458785.32	1529.63	27.71	0.00	20.01	*Populus angustifolia*	Cottonwood	D	3	woody	FAC*	wet
458785.32	1529.63	27.71	0.00	20.01	*Salix exigua*	Coyote willow		1	woody	OBL	wet
458775.48	1528.42	43.87	16.15	16.15	*Equisetum arvense*	Field horsetail			herb	FAC+	wet
458775.48	1528.42	43.87	0.00	16.15	*Juncus arcticus*	Baltic rush			herb	FACW	wet
458775.48	1528.42	43.87	0.00	16.15	*Populus angustifolia*	Cottonwood		3	woody	FAC*	wet
458771.40	1528.27	50.67	6.80	6.80	gravel bar	gravel bar					
458767.82	1528.27	56.24	5.58	5.58	open water	open water					
458765.20	1528.51	60.38	4.14	4.14	*Melilotus officinalis*	Sweetclover			herb	FACU	not wet
458765.20	1528.51	60.38	0.00	4.14	*Phalaris arundinacea*	Reed canarygrass			herb	OBL	wet
458765.20	1528.51	60.38	0.00	4.14	*Salix exigua*	Coyote willow		2	woody	OBL	wet
458759.10	1528.65	70.36	9.97	9.97	open water	open water					
458757.41	1528.94	73.08	2.72	2.72	*Agrostis gigantea*	Redtop			herb	FACW	wet
458757.41	1528.94	73.08	0.00	2.72	*Phalaris arundinacea*	Reed canarygrass			herb	OBL	wet
458757.41	1528.94	73.08	0.00	2.72	*Salix exigua*	Coyote willow		2	woody	OBL	wet
458746.91	1529.18	90.06	16.98	16.98	*Juncus arcticus*	Baltic rush			herb	FACW	wet
458746.91	1529.18	90.06	0.00	16.98	*Populus angustifolia*	Cottonwood		3	woody	FAC*	wet
458746.91	1529.18	90.06	0.00	16.98	*Salix exigua*	Coyote willow		2	woody	OBL	wet
458746.91	1529.18	90.06	0.00	16.98	*Salix exigua*	Coyote willow		3	woody	OBL	wet
458743.22	1529.28	96.03	5.97	5.97	*Euthamia occidentalis*	Western goldenrod			herb	OBL	wet
458743.22	1529.28	96.03	0.00	5.97	*Salix exigua*	Coyote willow		1	woody	OBL	wet
458743.22	1529.28	96.03	0.00	5.97	*Carex* spp.	Unknown sedge			herb		
458728.77	1529.45	119.65	23.63	23.63	*Populus angustifolia*	Cottonwood		3	woody	FAC*	wet
458728.77	1529.45	119.65	0.00	23.63	*Salix exigua*	Coyote willow		1	woody	OBL	wet
458707.54	1530.53	154.12	34.47	34.47	Upland mix	Upland mix			herb	FACU	not wet
458707.54	1530.53	154.12	0.00	34.47	*Populus angustifolia*	Cottonwood		2	woody	FAC*	wet
458707.54	1530.53	154.12	0.00	34.47	*Salix exigua*	Coyote willow		1	woody	OBL	wet
458696.14	1530.54	172.64	18.52	18.52	Upland mix	Upland mix			herb	FACU	not wet
458693.33	1532.50	177.20	4.56	4.56	*Bromus inermis*	Brome			herb	UPL	not wet
458737.40	1531.81	0.00	0.00	0.00	lep	lep					
458736.33	1528.59	5.83	5.83	5.83	*Crataegus* spp.	Hawthorne			woody		

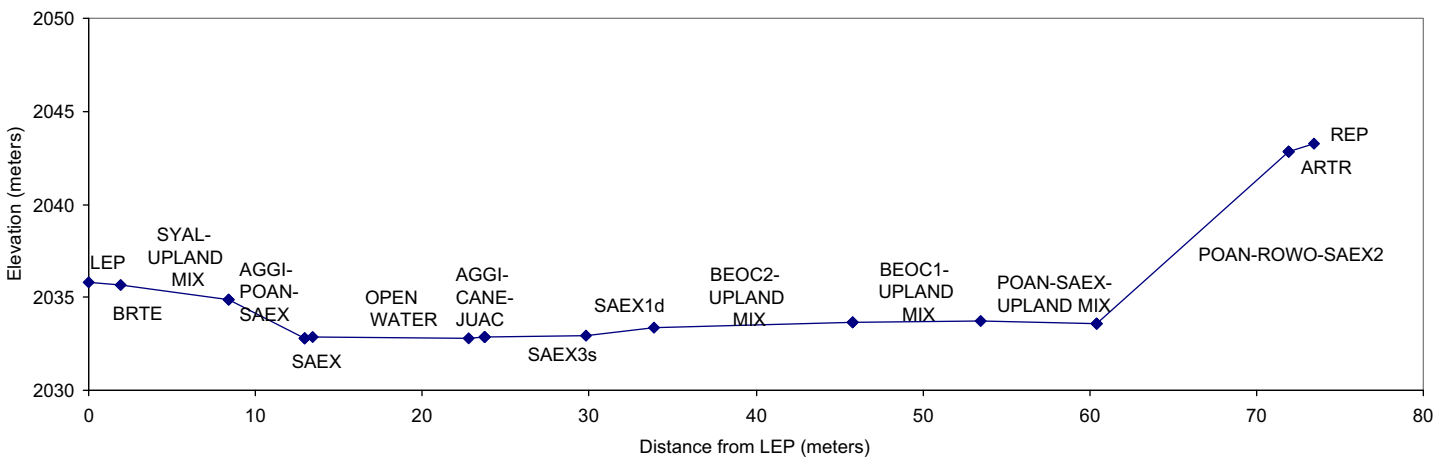
458720.11	1528.93	83.36	4.83	4.83	wetland mix	wetland mix			herb	FACW	wet
458720.11	1528.93	83.36	0.00	4.83	bare ground	bare ground					
458718.33	1527.99	91.87	8.52	8.52	*Agrostis gigantea*	Redtop			herb	FACW	wet
458718.33	1527.99	91.87	0.00	8.52	*Salix exigua*	Coyote willow		3	woody	OBL	wet
458718.33	1527.99	91.87	0.00	8.52	wetland mix	wetland mix			herb	FACW	wet
458717.43	1528.17	95.99	4.12	4.12	*Agrostis gigantea*	Redtop			herb	FACW	wet
458717.43	1528.17	95.99	0.00	4.12	*Euthamia occidentalis*	Western goldenrod			herb	OBL	wet
458717.43	1528.17	95.99	0.00	4.12	*Juncus ensifolius*	Swordrush			herb	FACW	wet
458714.37	1528.28	110.68	14.68	14.68	*Melilotus officinalis*	Sweet clover			herb	FACU	not wet
458714.37	1528.28	110.68	0.00	14.68	*Phalaris arundinacea*	Reed canarygrass			herb	OBL	wet
458714.37	1528.28	110.68	0.00	14.68	*Salix exigua*	Coyote willow	S	3	woody	OBL	wet
458713.49	1528.09	114.39	3.72	3.72	*Agrostis gigantea*	Redtop			herb	FACW	wet
458713.49	1528.09	114.39	0.00	3.72	*Euthamia occidentalis*	Western goldenrod			herb	OBL	wet
458713.49	1528.09	114.39	0.00	3.72	*Phalaris arundinacea*	Reed canarygrass			herb	OBL	wet
458712.54	1528.10	119.26	4.87	4.87	open water	open water					
458711.18	1527.78	125.62	6.36	6.36	gravel bar	gravel bar					
458709.37	1527.78	134.23	8.61	8.61	open water	open water					
458708.94	1528.83	136.48	2.25	2.25	*Equisetum arvense*	Field horsetail			herb	FAC+	wet
458708.94	1528.83	136.48	0.00	2.25	*Euthamia occidentalis*	Western goldenrod			herb	OBL	wet
458707.74	1529.97	142.12	5.64	5.64	gravel bar	gravel bar					
458706.40	1529.87	148.47	6.35	6.35	*Populus angustifolia*	Cottonwood		2	woody	FAC*	wet
458703.56	1530.00	162.36	13.89	13.89	*Populus angustifolia*	Cottonwood	S	1	woody	FAC*	wet
458703.56	1530.00	162.36	0.00	13.89	gravel bar	gravel bar					
458694.46	1530.55	205.93	43.57	43.57	Upland mix	Upland mix			herb	FACU	not wet
458694.46	1530.55	205.93	0.00	43.57	*Populus angustifolia*	Cottonwood	S	1	woody	FAC*	wet
458694.46	1530.55	205.93	0.00	43.57	*Salix exigua*	Coyote willow		2	woody	OBL	wet
458693.33	1532.50	211.33	5.39	5.39	*Bromus inermis*	Brome			herb	UPL	not wet
458621.97	1530.28	0.00	0.00	0.00	lep	lep					
458621.73	1530.00	1.22	1.22	1.22	*Elymus trachycaulus*	Slender wheatgrass			herb		
458620.46	1527.89	8.86	7.63	7.63	*Bromus inermis*	Brome			herb	UPL	not wet
458620.46	1527.89	8.86	0.00	7.63	*Solidago canadensis*	Canada goldenrod			herb	FACU	not wet
458620.46	1527.89	8.86	0.00	7.63	*Cornus sericea*	Redosier dogwood			woody	FACW	wet
458620.46	1527.89	8.86	0.00	7.63	*Salix exigua*	Coyote willow	S	1	woody	OBL	wet
458613.65	1527.25	44.84	35.99	35.99	*Populus angustifolia*	Cottonwood		3	woody	FAC*	wet
458613.65	1527.25	44.84	0.00	35.99	*Salix exigua*	Coyote willow	S	2	woody	OBL	wet
458613.65	1527.25	44.84	0.00	35.99	wetland mix	wetland mix			herb	FACW	wet
458612.93	1527.48	48.69	3.85	3.85	*Agrostis gigantea*	Redtop			herb	FACW	wet
458612.93	1527.48	48.69	0.00	3.85	*Euthamia occidentalis*	Western goldenrod			herb	OBL	wet
458606.18	1527.87	84.75	36.06	36.06	*Solidago canadensis*	Canada goldenrod			herb	FACU	not wet
458606.18	1527.87	84.75	0.00	36.06	*Agrostis gigantea*	Redtop			herb	FACW	wet
458606.18	1527.87	84.75	0.00	36.06	*Juncus arcticus*	Balric rush			herb	FACW	wet
458606.18	1527.87	84.75	0.00	36.06	*Salix exigua*	Coyote willow	S	3	woody	OBL	wet
458606.18	1527.87	84.75	0.00	36.06	wetland mix	wetland mix			herb	FACW	wet
458597.57	1527.10	130.81	46.06	46.06	*Populus angustifolia*	Cottonwood	S	3	woody	FAC*	wet
458596.82	1527.27	134.86	4.06	4.06	*Agrostis gigantea*	Redtop			herb	FACW	wet
458596.82	1527.27	134.86	0.00	4.06	*Eleocharis palustris*	Common spikerush			herb	OBL	wet
458595.13	1527.64	143.90	9.04	9.04	*Agrostis gigantea*	Redtop			herb	FACW	wet
458595.13	1527.64	143.90	0.00	9.04	*Euthamia occidentalis*	Western goldenrod			herb	OBL	wet
458595.13	1527.64	143.90	0.00	9.04	*Salix exigua*	Coyote willow	S	3	woody	OBL	wet
458595.13	1527.64	143.90	0.00	9.04	wetland mix	wetland mix			herb	FACW	wet
458592.55	1527.27	157.72	13.81	13.81	*Phalaris arundinacea*	Reed canarygrass			herb	OBL	wet
458592.55	1527.27	157.72	0.00	13.81	wetland mix	wetland mix			herb	FACW	wet
458590.68	1527.24	168.01	10.29	10.29	*Eleocharis palustris*	Common spikerush			herb	OBL	wet
458587.90	1527.24	182.87	14.86	14.86	open water	open water					
458587.63	1527.99	184.31	1.44	1.44	*Eleocharis palustris*	Common spikerush			herb	OBL	wet
458587.63	1527.99	184.31	0.00	1.44	*Phalaris arundinacea*	Reed canarygrass			herb	OBL	wet
458587.34	1530.39	185.85	1.54	1.54	bare ground	bare ground					
458585.88	1530.63	193.66	7.80	7.80	*Bromus inermis*	Slender wheatgrass			herb	UPL	not wet
458500.76	1529.81	0.00	0.00	0.00	lep	lep					
458499.00	1528.97	58.87	58.87	58.87	*Bromus inermis*	Brome			herb	UPL	not wet
458498.89	1527.52	62.60	3.72	3.72	*Bromus inermis*	Brome			herb	UPL	not wet
458498.89	1527.52	62.60	0.00	3.72	*Phalaris arundinacea*	Reed canarygrass			herb	OBL	wet
458498.89	1527.52	62.60	0.00	3.72	*Populus angustifolia*	Cottonwood		3	woody	FAC*	wet
458498.83	1527.21	64.62	2.02	2.02	bare ground	bare ground					
458498.49	1526.97	75.69	11.07	11.07	*Solidago canadensis*	Canada goldenrod			herb	FACU	not wet
458498.49	1526.97	75.69	0.00	11.07	*Agrostis gigantea*	Redtop			herb	FACW	wet
458498.49	1526.97	75.69	0.00	11.07	*Populus angustifolia*	Cottonwood		1	woody	FAC*	wet
458498.49	1526.97	75.69	0.00	11.07	*Salix exigua*	Coyote willow		1	woody	OBL	wet
458498.49	1526.97	75.69	0.00	11.07	*Carex* spp.	Unknown sedge			herb		
458498.28	1526.92	82.68	6.99	6.99	*Populus angustifolia*	Cottonwood		1	woody	FAC*	wet

458496.17	1526.64	153.26	3.33	3.33	*Agrostis gigantea*	Redtop			herb	FACW	wet
458496.17	1526.64	153.26	0.00	3.33	*Euthamia occidentalis*	Western goldenrod			herb	OBL	wet
458496.17	1526.64	153.26	0.00	3.33	*Phalaris arundinacea*	Reed canarygrass			herb	OBL	wet
458495.88	1526.64	162.85	9.59	9.59	open water	open water					
458495.83	1526.92	164.49	1.64	1.64	*Phalaris arundinacea*	Reed canarygrass			herb	OBL	wet
458495.58	1526.80	172.83	8.35	8.35	*Cirsium vulgare*	Bull thistle			herb	FAC	wet
458495.58	1526.80	172.83	0.00	8.35	*Euthamia occidentalis*	Western goldenrod			herb	OBL	wet
458495.58	1526.80	172.83	0.00	8.35	wetland mix	wetland mix			herb	FACW	wet
458495.57	1527.73	175.80	2.97	2.97	*Phalaris arundinacea*	Reed canarygrass			herb	OBL	wet
458495.57	1527.73	175.80	0.00	2.97	*Salix exigua*	Coyote willow		1	woody	OBL	wet
458495.57	1527.73	175.80	0.00	2.97	*Typha latifolia*	Cattail			herb	OBL	wet
458495.30	1533.42	182.04	6.25	6.25	bare ground	bare ground					
458495.21	1533.66	185.12	3.07	3.07	*Bromus tectorum*	Cheatgrass			herb	UPL	not wet
458495.21	1533.66	185.12	0.00	3.07	Upland mix	Upland mix			herb	FACU	not wet
458495.21	1533.66	185.12	0.00	3.07	*Artemisia tridentata*	Big Sagebrush			woody	UPL	wet
458374.36	1529.17	0.00	0.00	0.00	lep	lep					
458439.79	1527.27	88.65	88.65	88.65	*Bromus inermis*	Brome			herb	UPL	not wet
458447.75	1526.38	99.42	10.77	10.77	*Bromus inermis*	Brome			herb	UPL	not wet
458447.75	1526.38	99.42	0.00	10.77	*Solidago canadensis*	Canada goldenrod			herb	FACU	not wet
458447.75	1526.38	99.42	0.00	10.77	*Salix boothii/lucida*	Shiny/Booths willow		1	woody	OBL	wet
458447.75	1526.38	99.42	0.00	10.77	*Salix exigua*	Coyote willow		1	woody	OBL	wet
458450.07	1526.39	102.57	3.15	3.15	open water	open water					
458451.78	1526.61	104.89	2.32	2.32	*Phalaris arundinacea*	Reed canarygrass			herb	OBL	wet
458456.01	1526.62	110.62	5.73	5.73	*Euthamia occidentalis*	Western goldenrod			herb	OBL	wet
458456.01	1526.62	110.62	0.00	5.73	*Phalaris arundinacea*	Reed canarygrass			herb	OBL	wet
458458.34	1526.77	113.78	3.16	3.16	*Phalaris arundinacea*	Reed canarygrass			herb	OBL	wet
458459.65	1526.69	115.55	1.78	1.78	*Euthamia occidentalis*	Western goldenrod			herb	OBL	wet
458464.85	1526.58	122.60	7.05	7.05	*Populus angustifolia*	Cottonwood		3	woody	FAC*	wet
458464.85	1526.58	122.60	0.00	7.05	wetland mix	wetland mix			herb	FACW	wet
458475.44	1526.58	136.94	14.34	14.34	open water	open water					
458476.98	1526.71	139.04	2.09	2.09	gravel bar	gravel bar					
458482.60	1526.68	146.64	7.60	7.60	*Agrostis gigantea*	Redtop			herb	FACW	wet
458482.60	1526.68	146.64	0.00	7.60	*Euthamia occidentalis*	Western goldenrod			herb	OBL	wet
458482.60	1526.68	146.64	0.00	7.60	*Phalaris arundinacea*	Reed canarygrass			herb	OBL	wet
458482.60	1526.68	146.64	0.00	7.60	*Salix exigua*	Coyote willow		3	woody	OBL	wet
458488.20	1526.78	154.23	7.59	7.59	*Agrostis gigantea*	Redtop			herb	FACW	wet
458488.20	1526.78	154.23	0.00	7.59	*Phalaris arundinacea*	Reed canarygrass			herb	OBL	wet
458488.20	1526.78	154.23	0.00	7.59	*Salix exigua*	Coyote willow		2	woody	OBL	wet
458491.43	1530.12	158.61	4.38	4.38	*Salix exigua*	Coyote willow		1	woody	OBL	wet
458492.98	1533.56	160.71	2.10	2.10	bare ground	bare ground					
458495.21	1533.66	163.74	3.02	3.02	upland mix	upland mix			herb	FACU	not wet
458495.21	1533.66	163.74	0.00	3.02	*Artemisia tridentata*	Big Sagebrush			woody	UPL	wet
458374.45	1529.14	0.00	0.00	0.00	lep	lep					
458359.98	1528.97	14.47	14.47	14.47	*Bromus inermis*	Brome			herb	UPL	not wet
458349.90	1524.84	24.55	10.07	10.07	*Phalaris arundinacea*	Reed canarygrass			herb	OBL	wet
458349.90	1524.84	24.55	0.00	10.07	*Salix exigua*	Coyote willow	D	1	woody	OBL	wet
458343.80	1524.93	30.66	6.11	6.11	*Juncus arcticus*	Baltic rush			herb	FACW	wet
458343.80	1524.93	30.66	0.00	6.11	*Salix boothii/lucida*	Shinning/Booth's willow		2	woody	OBL	wet
458340.36	1525.05	34.09	3.44	3.44	*Agrostis gigantea*	Redtop			herb	FACW	wet
458340.36	1525.05	34.09	0.00	3.44	*Equisetum arvense*	Field horsetail			herb	FAC+	wet
458338.74	1524.62	35.71	1.62	1.62	*Agrostis gigantea*	Redtop			herb	FACW	wet
458338.74	1524.62	35.71	0.00	1.62	*Salix boothii/lucida*	Shiny/Booths willow		2	woody	OBL	wet
458331.13	1524.55	43.32	7.61	7.61	*Salix exigua*	Coyote willow		1	woody	OBL	wet
458331.13	1524.55	43.32	0.00	7.61	*Typha latifolia*	Cattail			herb	OBL	wet
458331.13	1524.55	43.32	0.00	7.61	*Carex* spp.	Unknown sedge			herb		
458326.20	1524.58	48.25	4.93	4.93	*Agrostis gigantea*	Redtop			herb	FACW	wet
458326.20	1524.58	48.25	0.00	4.93	*Salix exigua*	Coyote willow	D	1	woody	OBL	wet
458326.20	1524.58	48.25	0.00	4.93	*Carex* spp.	Unknown sedge			herb		
458320.01	1524.17	54.45	6.20	6.20	*Carex* spp.	Common spikerush			herb	OBL	wet
458320.01	1524.17	54.45	0.00	6.20	*Juncus arcticus*	Baltic rush			herb	FACW	wet
458320.01	1524.17	54.45	0.00	6.20	*Phalaris arundinacea*	Reed canarygrass			herb	OBL	wet
458320.01	1524.17	54.45	0.00	6.20	*Salix exigua*	Coyote willow	S	3	woody	OBL	wet
458320.01	1524.17	54.45	0.00	6.20	wetland mix	wetland mix			herb	FACW	wet
458320.01	1524.17	54.45	0.00	6.20	*Juncus* spp.	Unknown rush			herb		
458308.02	1524.20	66.44	11.99	11.99	open water	open water					
458296.69	1524.42	77.76	11.33	2.36	*Typha latifolia*	Cattail			herb	OBL	wet
458299.05	1524.20	75.41	2.36	8.97	*Eleocharis palustris*	Common spikerush			herb	OBL	wet
458299.05	1524.20	75.41	0.00	8.97	*Juncus arcticus*	Baltic rush			herb	FACW	wet
458299.05	1524.20	75.41	0.00	8.97	*Phalaris arundinacea*	Reed canarygrass			herb	OBL	wet
458299.05	1524.20	75.41	0.00	8.97	*Salix exigua*	Coyote willow	S	3	woody	OBL	wet

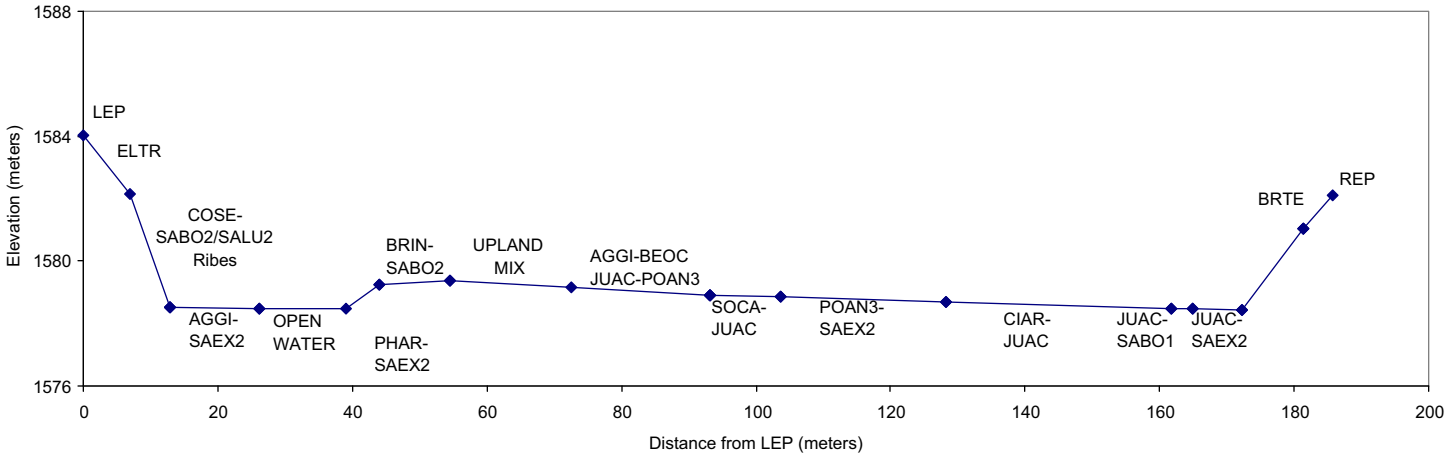
APPENDIX 3.3 VEGETATION TRANSECTS EXAMPLE



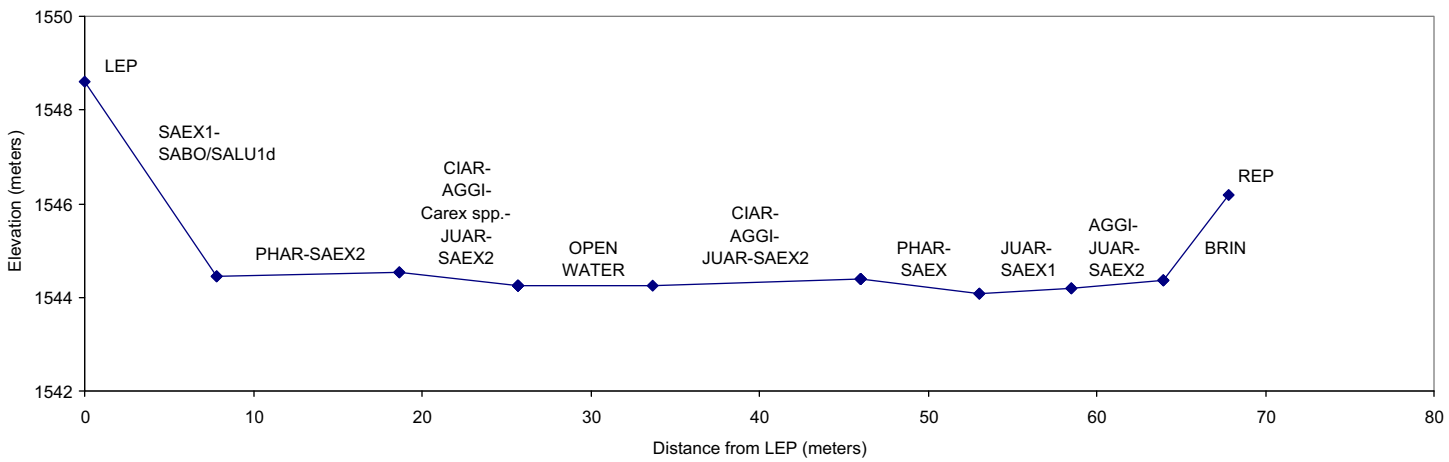
Rays 1 Vegetation



DFC 1 Vegetation



MO 1 Vegetation



OX 1 Vegetation

APPENDIX 4.1 UTE LADIES'-TRESSES MONITORING SITE CHARACTERISTICS

Proposed ULT Total Count Sites

Colony #	R-sq	Max	Median	Min
Upper				
2A	0.62	63	3	0
2B	0.56	432	37	0
Midddle				
10A	0.69	523	61	0
13	0.56	83	27	0
14	0.36	958	104	18
17A	0.70	53	30	0
Lower				
20	0.73	1888	253	17
24B	0.58	1409	250	8
30	0.37	474	49	0
36	0.36	382	43	2
Total # Colonies	0.61	89	76	54

2A, 14	Similar trend pattern as total # flowering plants
10A, 30, 36	Same trend pattern as total # flowering plants

Sites with Correlation >50% = 10
Of these, 3 had a median <1
Substituted for these sites the three sites with the greatest correlation that had the same or similar trend pattern as the total count.

APPENDIX 4.2 UTE LADIES'-TRESSES SURFACE NUMBERS MAPS

SIXTH WATER & DIAMOND FORK 2006 ULT SURFACES

BIO-WEST
1063 West 1400 North
Logan, UT 84321
(435) 752-2732

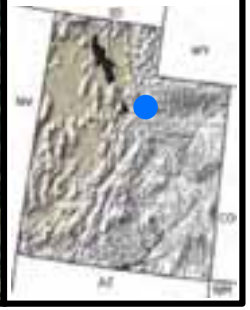
March 1, 2007

N

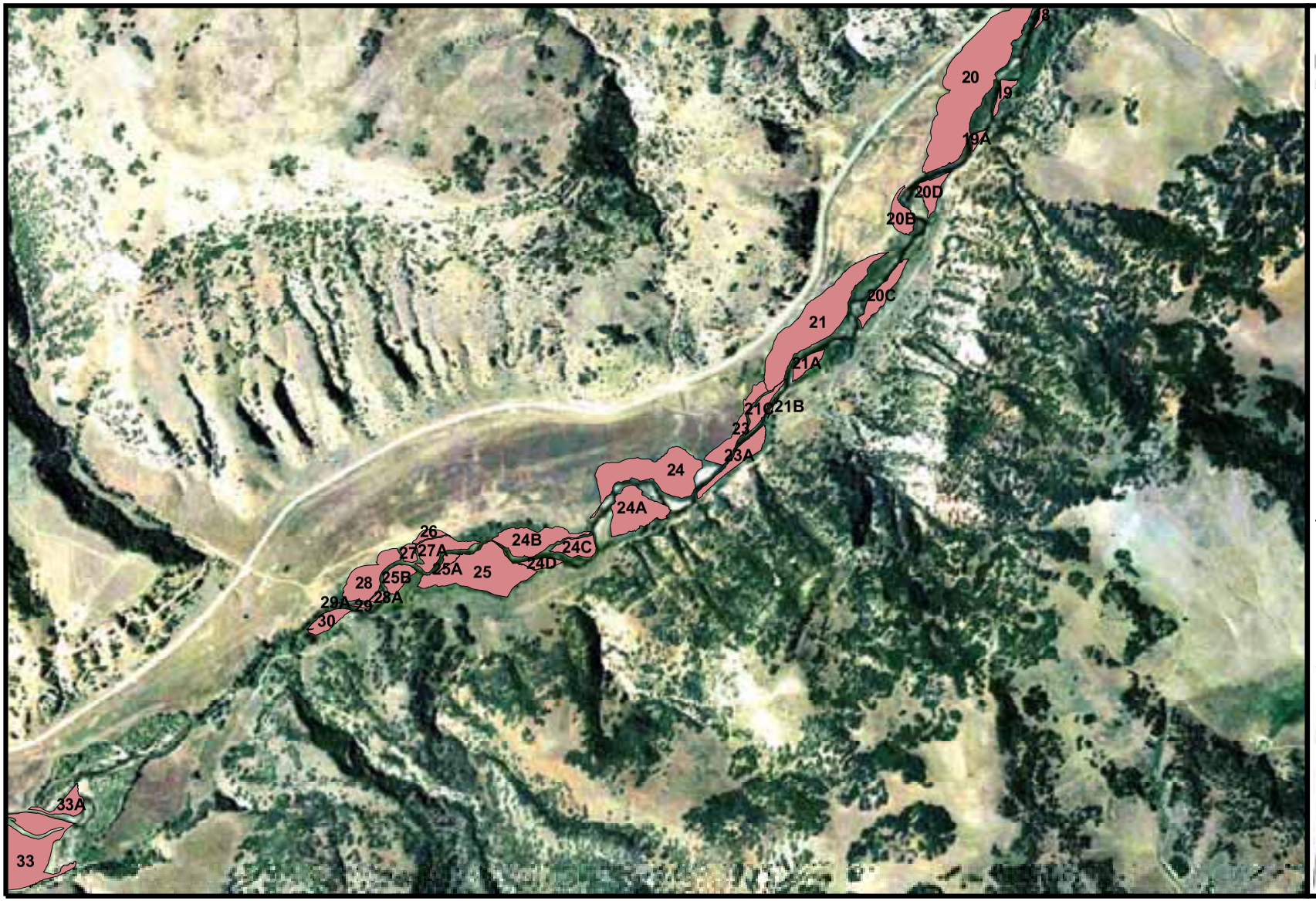
1:8,000

Feet
470 235 0 470

Meters
150 75 0 150



SIXTH WATER & DIAMOND FORK 2006 ULT SURFACES



BIO-WEST
1063 West 1400 North
Logan, UT 84321
(435) 752-2732

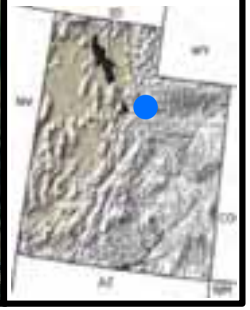
March 1, 2007

N

1:8,000

Feet
470 235 0 470

Meters
150 75 0 150



SIXTH WATER & DIAMOND FORK 2006 ULT SURFACES

BIO-WEST
1063 West 1400 North
Logan, UT 84321
(435) 752-2732

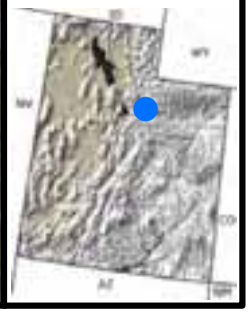
March 1, 2007

N

1:8,000

Feet
470 235 0 470

Meters
150 75 0 150



SIXTH WATER & DIAMOND FORK 2006 ULT SURFACES

BIO-WEST
1063 West 1400 North
Logan, UT 84321
(435) 752-2732

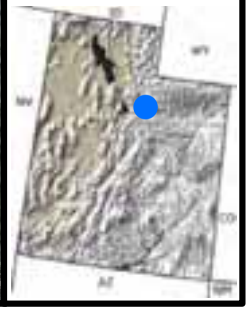
March 1, 2007

N

1:8,000

Feet
470 235 0 470

Meters
150 75 0 150



SIXTH WATER & DIAMOND FORK 2006 ULT SURFACES

BIO-WEST
1063 West 1400 North
Logan, UT 84321
(435) 752-2732

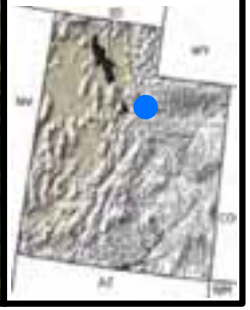
March 1, 2007

N

1:8,000

Feet
470 235 0 470

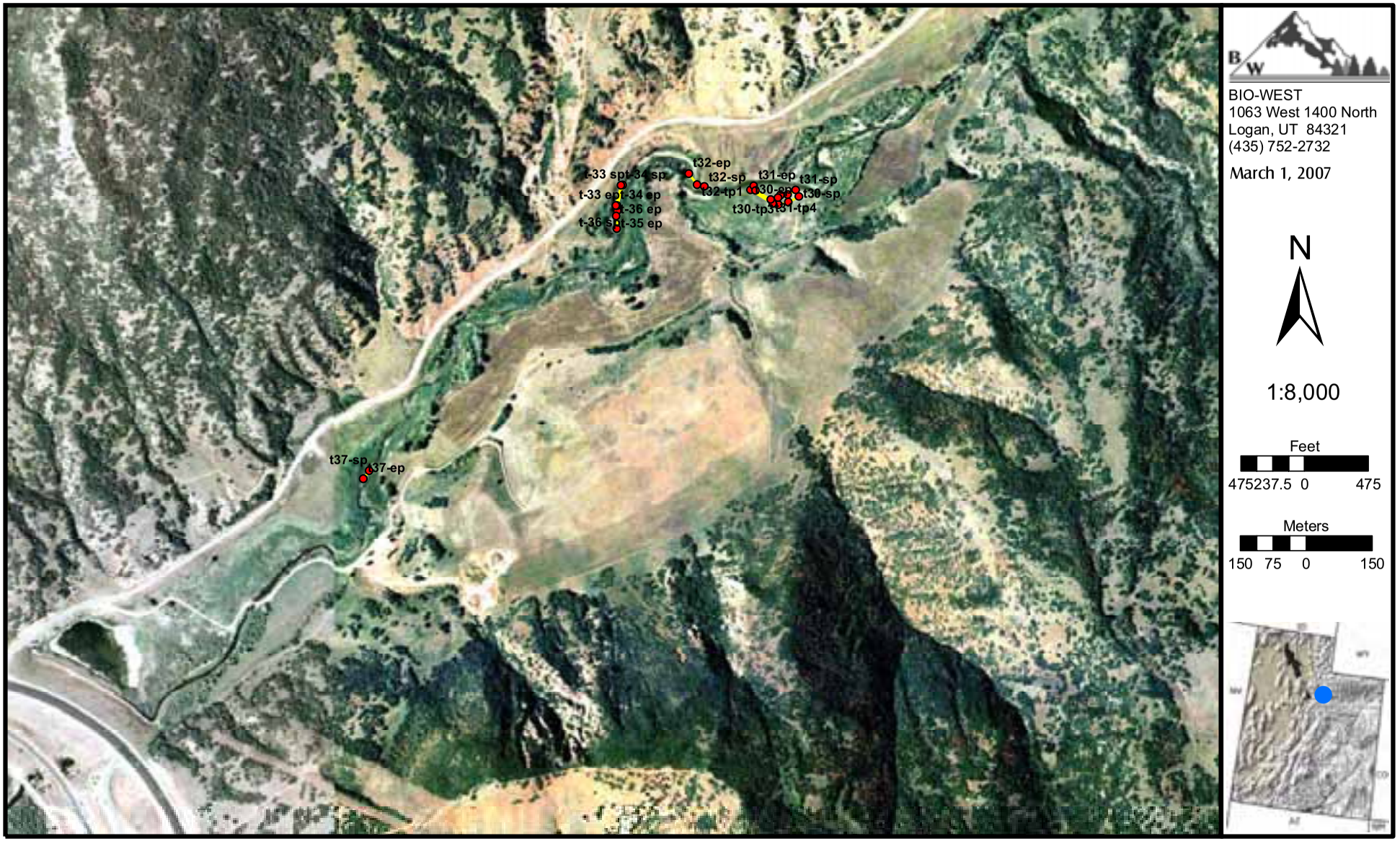
Meters
150 75 0 150



APPENDIX 4.3 TRANSECT LOCATION MAPS

t-3 ep	462726.1	4435451.0	1561.5
t-4 sp	462655.4	4435474.6	1560.4
t-4 ep	462680.6	4435451.5	1560.8
t-5 sp	462648.5	4435472.4	1560.8
t-5 ep	462674.5	4435451.6	1560.0
t-6 sp	462630.0	4435467.8	1559.6
t-6 ep	462652.7	4435450.1	1559.9
t-7 sp	462652.4	4435391.0	1559.7
t-7 ep	462639.3	4435404.5	1559.3
t-8 ep	462630.8	4435393.1	1559.2
t-8 sp	462648.7	4435388.5	1559.1
t-9 sp	462647.8	4435385.5	1559.0
t-9 ep	462629.0	4435388.6	1559.0
t-10 sp	462562.5	4435333.0	1558.1
t-10 ep	462541.0	4435327.4	1557.3
t-11 sp	462539.0	4435319.9	1557.2
t-11 ep	462527.4	4435308.0	1555.7
t-14 sp	462573.5	4435068.0	1554.3
t-14 ep	462570.9	4435056.2	1554.3
t-13 sp	462569.9	4435069.4	1554.4
t-13 tp	462567.6	4435058.9	1554.4
t-13 ep	462556.6	4435053.8	1555.1
t-15 sp	462543.9	4435029.9	1553.8
t-15 ep	462528.7	4435011.2	1553.7
t-15 ep	462528.8	4435011.1	1553.7
t-35 ep	458301.7	4432120.5	1506.8
t-35 sp	458304.7	4432165.5	1507.1
t-36 sp	458303.5	4432160.9	1507.1
t-36 ep	458300.6	4432149.7	1506.9
t-33 ep	458302.8	4432173.4	1508.0
t-33 sp	458315.8	4432220.1	1508.1
t-34 sp	458311.2	4432219.5	1508.6
t-34 ep	458299.9	4432173.1	1507.9
t-16 sp	459690.3	4432774.3	1522.9
t-16 ep	459677.0	4432780.9	1522.4
t-17 sp	459639.9	4432793.6	1522.9
t-17 ep	459608.1	4432772.4	1522.1
t-23 sp	459547.2	4432749.3	1521.7
t-23 ep	459517.3	4432710.3	1521.2
t-20 ep	459536.7	4432749.2	1520.8
t-20 tp1	459566.5	4432755.5	1521.6
t-20 sp	459591.6	4432760.6	1522.0
t-18 ep	459591.7	4432725.4	1521.7
t-18 ep	459646.7	4432727.3	1522.5
t-18 tp	459619.4	4432726.4	1522.5
t-19 sp	459637.9	4432708.0	1521.6
t-19 ep	459613.9	4432713.6	1523.4
t-21 sp	459587.2	4432803.9	1522.0
t-21 ep	459571.8	4432805.7	1522.2
t-22 sp	459571.1	4432794.0	1522.2
t-22 ep	459534.8	4432815.8	1521.1
t-25 sp	459516.7	4432813.1	1521.8
t-25 ep	459492.2	4432807.3	1521.7
t-24 sp	459528.5	4432800.2	1522.6
t-24 tp1	459516.0	4432785.9	1519.5
t-24 tp2	459501.6	4432773.6	1521.5
t-24 ep	459490.8	4432769.4	1521.4
t-27 ep	459479.0	4432775.5	1521.6
t-27 tp	459476.5	4432791.1	1520.9
t-27 sp	459489.3	4432803.0	1521.3
t-28 sp	459464.0	4432734.1	1521.4
t-28 ep	459451.1	4432722.9	1520.9
t-29 sp	459446.7	4432725.3	1520.8
t-29 ep	459426.2	4432691.0	1520.6
t-26 ep	459477.5	4432755.6	1521.1
t-26 sp	459502.1	4432748.2	1521.6
t30-sp	458714.9	4432193.5	1510.3
t30-tp1	458691.5	4432181.4	1510.1
t30-tp2	458668.2	4432175.5	1509.8

SIXTH WATER & DIAMOND FORK 2006 TRANSECT LOCATION MAP



SIXTH WATER & DIAMOND FORK 2006 TRANSECT LOCATION MAP

BIO-WEST
1063 West 1400 North
Logan, UT 84321
(435) 752-2732

March 1, 2007

N

1:8,000

Feet
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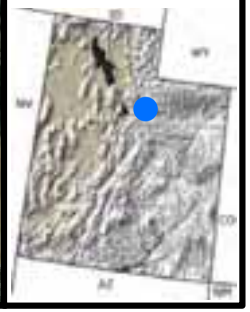
Meters
150 75 0 150



SIXTH WATER & DIAMOND FORK 2006 TRANSECT LOCATION MAP

BIO-WEST
1063 West 1400 North
Logan, UT 84321
(435) 752-2732

March 1, 2007

N

1:8,000

Feet
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Meters
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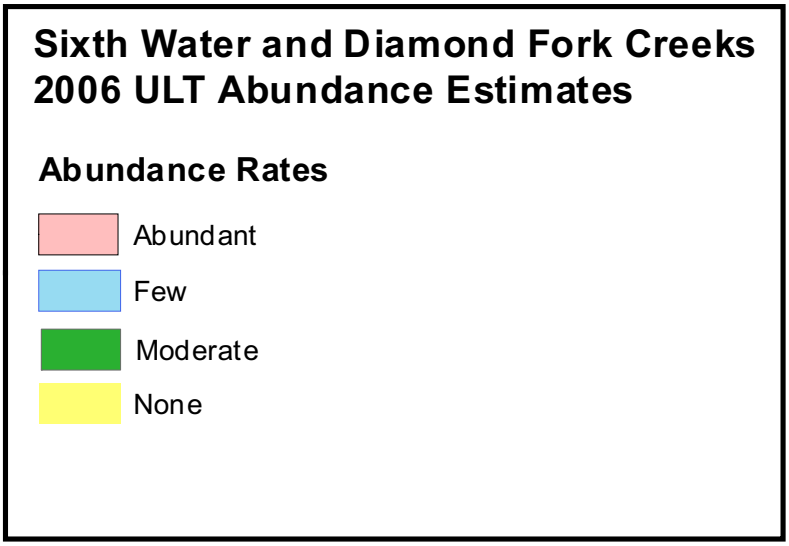
APPENDIX 4.4 UTE LADIES'-TRESSES ABUNDANCE ESTIMATES


Sixth Water and Diamond Fork Creeks
2006 ULT Abundance Estimates
Abundance Rates
Abundant
Few
Moderate
None

SIXTH WATER & DIAMOND FORK 2006 ULT ABUNDANCE ESTIMATE MAP

BIO-WEST
1063 West 1400 North
Logan, UT 84321
(435) 752-2732

March 1, 2007

N

1:8,000

Feet
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Meters
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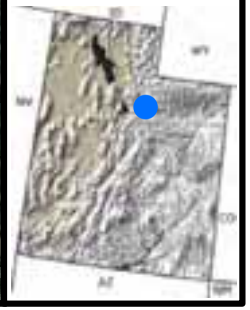
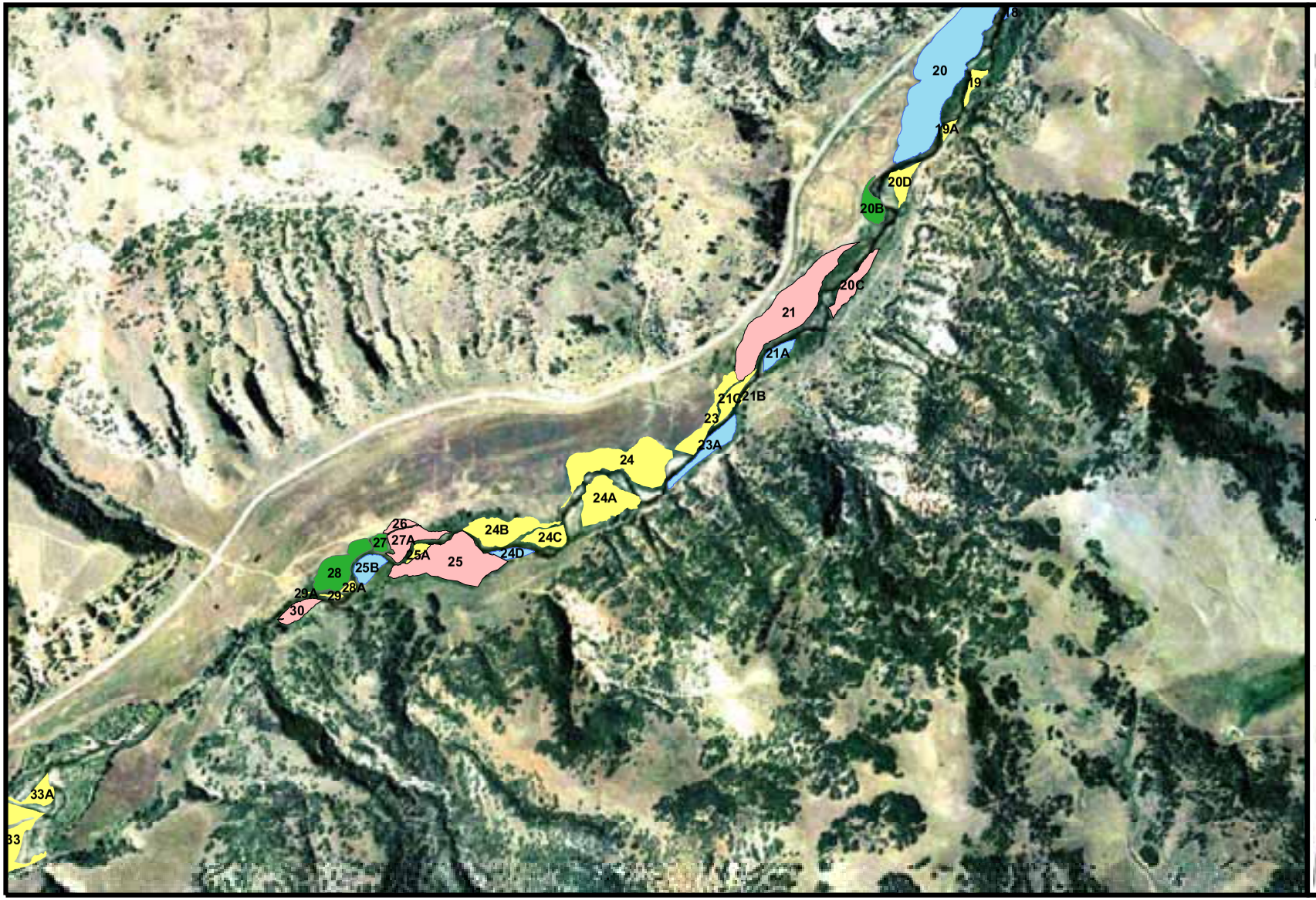


SIXTH WATER & DIAMOND FORK 2006 ULT ABUNDANCE ESTIMATE MAP



BIO-WEST
1063 West 1400 North
Logan, UT 84321
(435) 752-2732

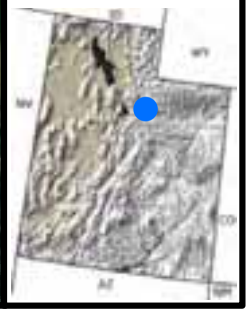
March 1, 2007

N

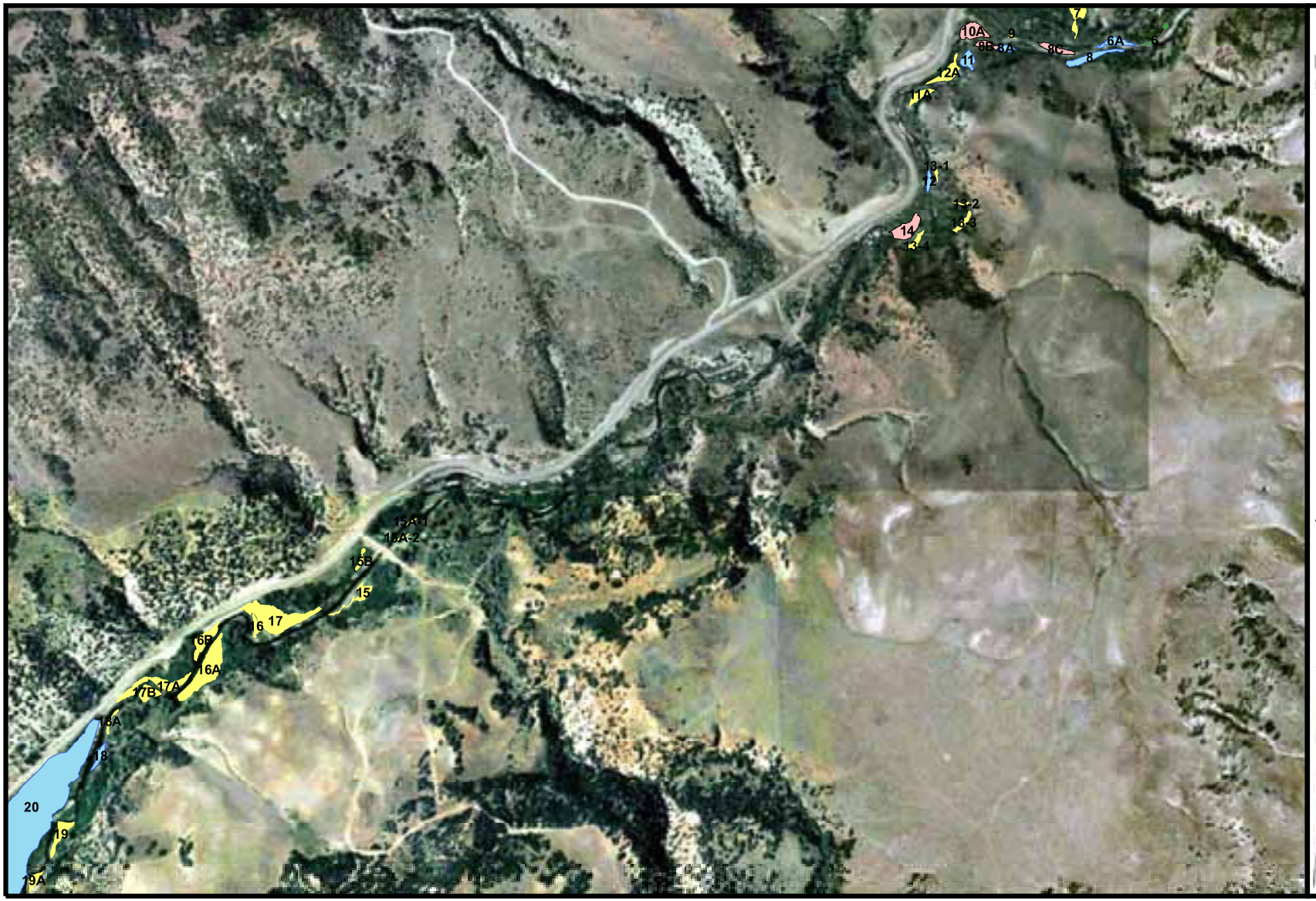
1:8,000

Feet
470 235 0 470

Meters
150 75 0 150



SIXTH WATER & DIAMOND FORK 2006 ULT ABUNDANCE ESTIMATE MAP



BIO-WEST
1063 West 1400 North
Logan, UT 84321
(435) 752-2732

March 1, 2007

N

1:8,000

Feet
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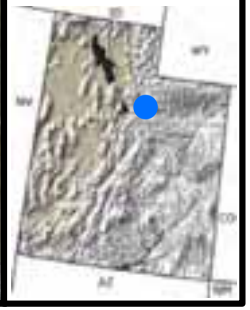
Meters
150 75 0 150



SIXTH WATER & DIAMOND FORK 2006 ULT ABUNDANCE ESTIMATE MAP

BIO-WEST
1063 West 1400 North
Logan, UT 84321
(435) 752-2732

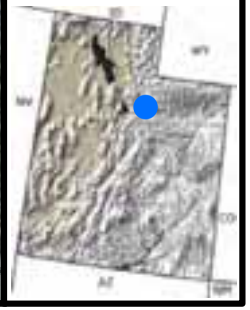
March 1, 2007

N

1:8,000

Feet
470 235 0 470

Meters
150 75 0 150



SIXTH WATER & DIAMOND FORK 2006 ULT ABUNDANCE ESTIMATE MAP

BIO-WEST
1063 West 1400 North
Logan, UT 84321
(435) 752-2732

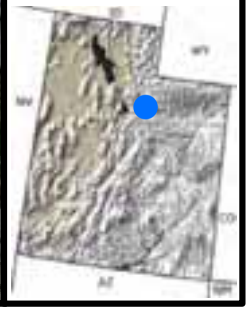
March 1, 2007

N

1:8,000

Feet
470 235 0 470

Meters
150 75 0 150



SIXTH WATER & DIAMOND FORK 2006 ULT ABUNDANCE ESTIMATE MAP

BIO-WEST
1063 West 1400 North
Logan, UT 84321
(435) 752-2732

March 1, 2007

N

1:8,000

Feet
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Meters
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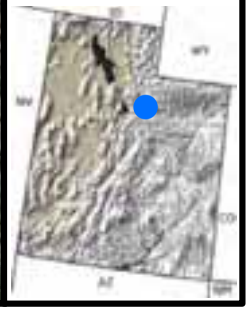
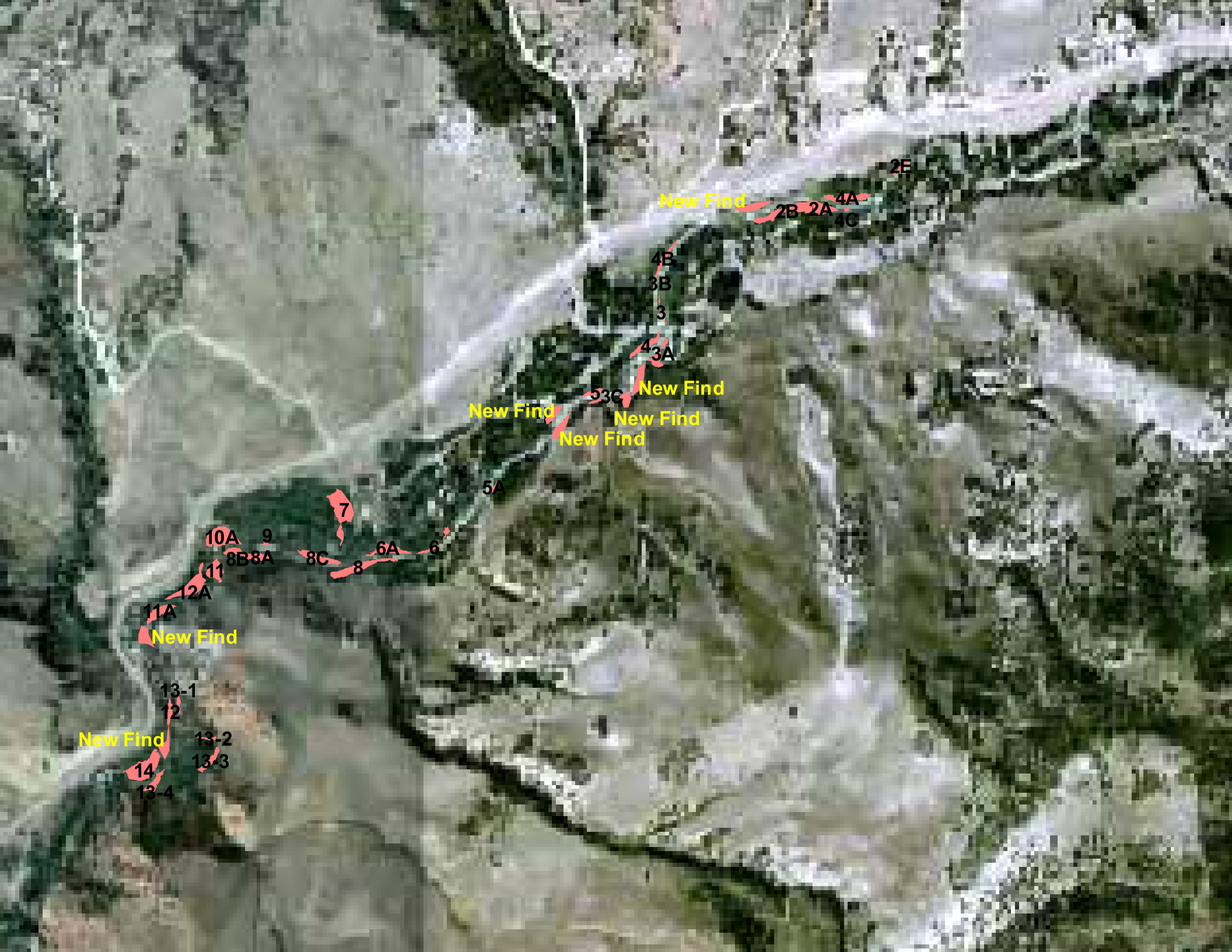


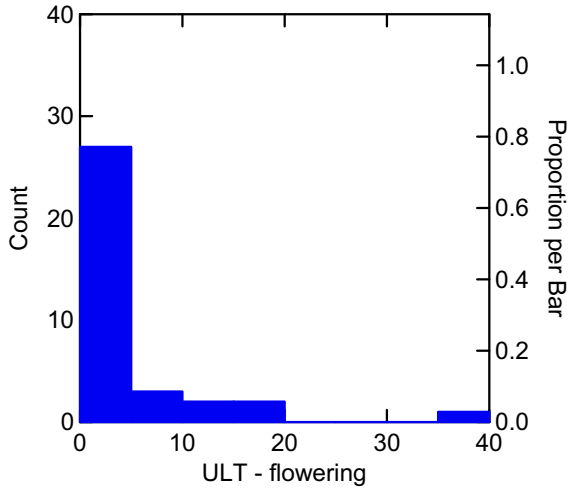
APPENDIX 4.5 NEW UTE LADIES'-TRESSES COLONIES LOCATION MAPS

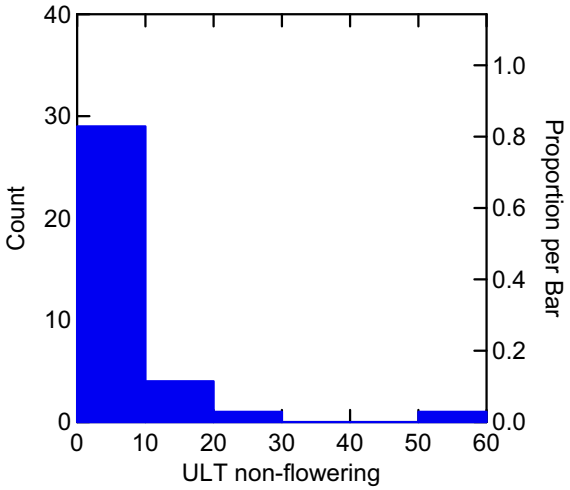

2E
New Find
2B
2A
4A
4C
4B
3B
3
4
3A
New Find
3C
New Find
New Find
New Find
5A
7
10A
9
8B
8A
8C
8
6A
6
11
12A
11A
New Find
13-1
2
New Find
13-2
13-3
14
13-4

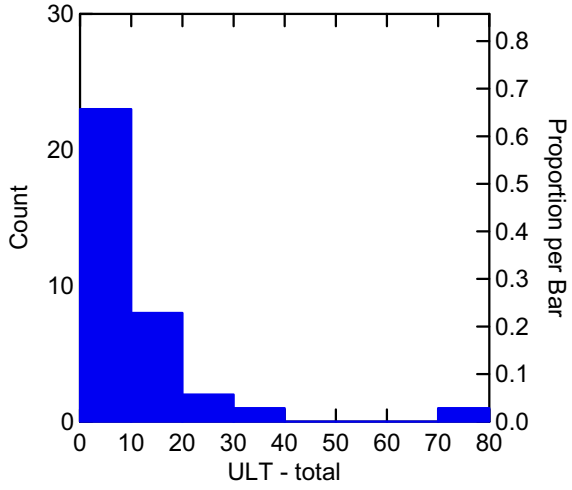

16B
16A
17B
17A
New Find
18A
18
20
19
19A
20D
20B
New Find
20C
21
21A
21C
21B
23
23A
24
24A
24B
24C
24D

APPENDIX 4.6 HISTOGRAMS OF UTE LADIES'-TRESSES NUMBERS PER HOOP

Histograms of ULT numbers per hoop - A normal distribution is not apparent.







APPENDIX 4.7 UTE LADIES'-TRESSES COLONY SURFACE CHARACTERISTICS AND CONDITIONS

ida	Shining willow	CIAR4	*Cirsium arvense*	Canada thistle	
othii	Booth's willow	CIVU	*Cirsium vulgare*	Bull thistle	
igua	Coyote willow				
arundinacea	Reed canary grass	CIAR4	*Cirsium arvense*	Canada thistle	
othii	Booth's willow	VETH	*Verbascum thapsus*	Common mullein	
igua	Coyote willow				
um arvense	Field horsetail				
cida	Shining willow	CIAR4	*Cirsium arvense*	Canada thistle	
othii	Booth's willow	CIVU	*Cirsium vulgare*	Bull thistle	
arundinacea	Reed canary grass	VETH	*Verbascum thapsus*	Common mullein	
gigantea	Black bentgrass				
canadensis	Canadian horseweed				
m jubatum	Foxtail Barley				
cida	Shining willow	CIAR4	*Cirsium arvense*	Canada thistle	Surface thickly populated with willow spp.
igua	Coyote willow	CIVU	*Cirsium vulgare*	Bull thistle	
angustifolia	Narrowleaf cottonwood	VETH	*Verbascum thapsus*	Common mullein	
gigantea	Black bentgrass	MEOF	*Melilotus officianalis*	Yellow sweetclover	
a occidentalis	Western golden-rod				
igua	Coyote willow	CIVU	*Cirsium vulgare*	Bull thistle	Majority of ULT found in open areas dominated by immature willows and Field horsetail.
arundinacea	Reed canary grass				
canadensis	Canadian horseweed				
angustifolia	Narrowleaf cottonwood	CIAR4	*Cirsium arvense*	Canada thistle	Large, dense patches of Canada thisle found in areas of site that have begun drying. Willows are dying out and being replace
othii	Booth's willow	CANU4	*Carduus nutans*	Musk thistle	
arundinacea	Reed canary grass	VETH	*Verbascum thapsus*	Common mullein	
inermis	Smooth brome				
othii	Booth's willow	CIAR4	*Cirsium arvense*	Canada thistle	Site extremely dry, 80 percent of vegetation dry.
igua	Coyote willow	CIVU	*Cirsium vulgare*	Bull thistle	
arundinacea	Reed canary grass				
angustifolia	Narrowleaf cottonwood	TARA	*Tamarix ramosissima*	Salt cedar	Two Salt cedars found on this polygon. Portions of this site are drying, the ULT plants found were dry and not in good health.
um arvense	Field horsetail	CIAR4	*Cirsium arvense*	Canada thistle	
arundinacea	Reed canary grass	CANU4	*Carduus nutans*	Musk thistle	
		VETH	*Verbascum thapsus*	Common mullein	
		LIDAD	*Linaria dalmatica*	Dalmation toadflax	
igua	Coyote willow	CIAR4	*Cirsium arvense*	Canada thistle	
othii	Booth's willow				
igua	Coyote willow	CIAR4	*Cirsium arvense*	Canada thistle	
othii	Booth's willow				

Vegetation **Nonindigenous Plant Species**

ic Name	**Common Name**	**Code**	**Scientific Name**	**Common Name**	**Unique Site Characteristics**
igua	Coyote willow	CIAR4	*Cirsium arvense*	Canada thistle	No ULT found, dry and cobbly ground. Willows still relatively healthy.
othii	Booth's willow	VETH	*Verbascum thapsus*	Common mullein	
canadensis	Canada golden-rod				
igua	Coyote willow	ARMI2	*Arctium minus*	Common burdock	
othii	Booth's willow	CYOF	*Cynoglossum officinale*	Houndstongue	
canadensis	Canada golden-rod				
othii	Booth's willow	TARA	*Tamarix ramosissima*	Salt cedar	Site dry, understory dry and willows beginning to dry.
igua	Coyote willow	VETH	*Verbascum thapsus*	Common mullein	
angustifolia	Narrowleaf cottonwood	CANU4	*Carduus nutans*	Musk thistle	
othii	Booth's willow				
igua	Coyote willow				
angustifolia	Narrowleaf cottonwood				
arcticus ssp. *littoralis*	Baltic rush	CIAR4	*Cirsium arvense*	Canada thistle	
gigantea	Black bentgrass	LIDAD	*Linaria dalmatica*	Dalmation toadflax	
othii	Booth's willow				

igua	Coyote willow	CANU4	*Carduus nutans*	Musk thistle	
um arvense	Field horsetail				
arcticu ssp. *littoralis*	Arctic rush				
arundinacea	Reed canary grass	CIAR4	*Cirsium arvense*	Canada thistle	Native species over 7 ft tall. No ULT individuals found.
cida	Shining willow	CANU4	*Carduus nutans*	Musk thistle	
igua	Coyote willow	CIVU	*Cirsium vulgare*	Bull thistle	
ris palustris	Creeping spikerush	CIAR4	*Cirsium arvense*	Canada thistle	
othii	Booth's willow				
gigantea	Black bentgrass				
gigantea	Black bentgrass	CIAR4	*Cirsium arvense*	Canada thistle	
angustifolia	Narrowleaf cottonwood				
igua	Coyote willow				
othii	Booth's willow				
igua	Coyote willow				
gigantea	Black bentgrass				
arundinacea	Reed canary grass				
arundinacea	Reed canary grass	CIAR4	*Cirsium arvense*	Canada thistle	
arcticu ssp. *littoralis*	Baltic rush				
gigantea	Black bentgrass				
igua	Coyote willow		*Cirsium arvense*	Canada thistle	
othii	Booth's willow				
arundinacea	Reed canary grass				
um arvense	Field horsetail		*Cirsium arvense*	Canada thistle	
cida	Shining willow				
othii	Booth's willow				
arcticu ssp. *littoralis*	Baltic rush				
a exilis	Small-flower Indian-paintbrush				
o canadensis	Canada golden-rod				
gigantea	Black bentgrass				
othii	Booth's willow		*Cirsium arvense*	Canada thistle	
cida	Shining willow				
igua	Coyote willow				
ris palustris	Creeping spikerush				
um arvense	Field horsetail				
guttatus	Common large monkey-flower				
a exilis	Small-flower Indian-paintbrush				
arundinacea	Reed canary grass				
um hymemale	Rough horsetail				
igua	Coyote willow				
arundinacea	Reed canary grass		*Cirsium arvense*	Canada thistle	Willow species mature.
arcticu ssp. *littoralis*	Baltic rush				
um arvense	Field horsetail				
igua	Coyote willow				
othii	Booth's willow				

a occidentalis	Western golden-rod	CIAR4	*Cirsium arvense*	Canada thistle	
arundinacea	Reed canary grass	CIVU	*Cirsium vulgare*	Bull thistle	
gigantea	Black bentgrass				
igua	Coyote willow				
gigantea	Black bentgrass	CIVU	*Cirsium vulgare*	Bull thistle	Surface vegetation average 3-4 ft high.
a occidentalis	Western golden-rod	CIAR4	*Cirsium arvense*	Canada thistle	
othii	Booth's willow	MEOF	*Melilotus officinalis*	Yellow sweetclover	
igua	Coyote willow				
othii	Booth's willow	CANU4	*Carduus nutans*	Musk thistle	Much of site is starting to dry. Canary reed grass is dying back, as are smooth brome and field mint.
canadensis	Canada golden-rod	CIAR4	*Cirsium arvense*	Canada thistle	
a occidentalis	Western golden-rod	CIVU	*Cirsium vulgare*	Bull thistle	
igua	Coyote willow	ARMI2	*Arctium minus*	Common burdock	
arundinacea	Reed canary grass				
igua	Coyote willow	CIVU	*Cirsium vulgare*	Bull thistle	
othii	Booth's willow	CIAR4	*Cirsium arvense*	Canada thistle	
cida	Shining willow				
canadensis	Canada golden-rod				
a exilis	Small-flower Indian-paintbrush				
igua	Coyote willow	TARA	*Tamarix ramosissima*	Salt cedar (1)	Portions of this site are beginning to dry, and two-thirds of site is covered with mature willow species.
othii	Booth's willow				
um arvense	Field horsetail				
othii	Booth's willow	CYOF	*Cynoglossum officinale*	Houndstongue	
igua	Coyote willow	LIDAD	*Linaria dalmatica*	Dalmation toadflax	
angustifolia	Narrowleaf cottonwood	VETH	*Verbascum thapsus*	Common mullein	
um arvense	Field horsetail	ULPU	*Ulmus pumila*	Siberian elm	
a occidentalis	Western golden-rod	TARA	*Tamarix ramosissima*	Salt cedar	
gigantea	Black bentgrass				
igua	Coyote willow	CIAR	*Cirsium arvense*	Canada thistle	Perennial pepperweed found on northern perimeter along road to Child's Bridge.
cida	Shining willow	ELAN	*Elaeagnus angustifolia*	Russian olive	
a occidentalis	Western golden-rod				
atifolia	Broadleaf cattail	CADR	*Cardaria draba*	Hoary cress	Majority of site contains mature vegetation.
othii	Booth's willow	LELA2	*Lepidium latifolium*	Perennial pepperweed	
igua	Coyote willow	CIAR4	*Cirsium arvense*	Canada thistle	
um arvense	Field horsetail	VETH	*Verbascum thapsus*	Common mullein	
arundinacea	Reed canary grass	LIDAD	*Linaria dalmatica*	Dalmation toadflax	
		CANU4	*Carduus nutans*	Musk thistle	
othii	Booth's willow				
igua	Coyote willow				
cida	Shining willow	CIAR4	*Cirsium arvense*	Canada thistle	
igua	Coyote willow	VETH	*Verbascum thapsus*	Common mullein	
gigantea	Black bentgrass				
a occidentalis	Western golden-rod				
igua	Coyote willow				Vegetation extremely dense throughout site and 6-10 ft tall.
cida	Shining willow				
a occidentalis	Western golden-rod				
igua	Coyote willow	LIDAD	*Linaria dalmatica*	Dalmation toadflax	
arundinacea	Reed canary grass	CIVU	*Cirsium vulgare*	Bull thistle	
gigantea	Black bentgrass	VETH	*Verbascum thapsus*	Common mullein	
		CIAR4	*Cirsium arvense*	Canada thistle	
		ARMI2	*Arctium minus*	Common burdock	
		CYOF	*Cynoglossum officinale*	Houndstongue	
atifolia	Broadleaf cattail	LIDAD	*Linaria dalmatica*	Dalmation toadflax	
um arvense	Field horsetail	CYOF	*Cynoglossum officinale*	Houndstongue	
igua	Coyote willow				
angustifolia	Narrowleaf cottonwood				
um arvense	Field horsetail	CANU4	*Carduus nutans*	Musk thistle	

ULT found at seep.

New willows on side channel.

Good habitat.

Lots of Russian olive on surface.

Large, dense colony.

Good habitat.

Lots of young willows.

arundinacea	Reed canary grass
ensifolius	Swordleaf rush
ia occidentalis	Western golden-rod
ris palustris	Creeping spikerush
arcticus ssp. *littoralis*	Baltic rush
othii	Booth's willow
igua	Coyote willow
cida	Shining willow
gigantea	Black bentgrass
arundinacea	Reed canary grass
ensifolius	Swordleaf rush
ia occidentalis	Western golden-rod
ris palustris	Creeping spikerush
arcticus ssp. *littoralis*	Baltic rush
othii	Booth's willow

a occidentalis	Western golden-rod				
ris palustris	Creeping spikerush				
igua	Coyote willow	MEOF	Melilotus officinalis	Yellow sweetclover	
othii	Booth's willow	CIAR4	Cirsium arvense	Canada thistle	
arcticu ssp. *littoralis*	Baltic rush	MELU	Medicago lupulina	Black medic	
o canadensis	Canada golden-rod				
otrichum eatonii	Eaton's aster				
ris palustris	Creeping spikerush				
pecies	Sedge				
ensifolius	Swordleaf rush				
arundinacea	Reed canary grass	CIAR4	Cirsium arvense	Canada thistle	
a occidentalis	Western golden-rod				
othii	Booth's willow				
igua	Coyote willow				
um arvense	Field horsetail				
ris palustris	Creeping spikerush				
a americana	American speedwell				
arundinacea	Reed canary grass				
arvensis	Field mint				
a occidentalis	Western golden-rod				
othii	Booth's willow				
igua	Coyote willow				
confusus	Colorado rush				
igua	Coyote willow				Creek hydrology has significanly changed surface, mapped polygon no longer matches accurately.
othii	Booth's willow				
arundinacea	Reed canary grass				
um arvense	Field horsetail				
arcticu ssp. *littoralis*	Baltic rush				
cida	Shining willow				
ris palustris	Creeping spikerush	CIAR4	Cirsium arvense	Canada thistle	
pecies	Sedge				
gigantea	Black bentgrass				
arundinacea	Reed canary grass				
a occidentalis	Western golden-rod				
ris palustris	Creeping spikerush	CIAR4	Cirsium arvense	Canada thistle	Site drying out.
gigantea	Black bentgrass				
othii	Booth's willow				
igua	Coyote willow				
ensifolius	Swordleaf rush				

APPENDIX 5.1 QUADRAT DATA

Quadrat Data

Colony 10A Transect: 4 Quadrat: 16

Vegetal Cover: 90 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 5 **Litter Areal Cover:** 5

species	cover
AGGI2	10
CAREX	15
JUARL	10
SABO2	5
SAEX	20
SOAR2	10
SPDI6	2
SYEA2	10

Colony 10A Transect: 4 Quadrat: 17

Vegetal Cover: 90 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 5 **Litter Areal Cover:** 5

species	cover
EQAR	50
MEAL12	5
RACY	5
SABO2	10
SALU	10
SOAR2	10

Colony 10A Transect: 4 Quadrat: 18

Vegetal Cover: 70 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 5 **Litter Areal Cover:** 25

species	cover
AGGI2	20
CAREX	10
EQAR	20
EUOC4	5
RACY	10
SPDI6	5
SYEA2	20

Colony 10A Transect: 4 Quadrat: 19

Vegetal Cover: 85 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 10 **Litter Areal Cover:** 5

species	cover
CIVU	5
EQAR	10
JUARL	5
MELU	5
PHAR3	5
SALU	15
SYEA2	5

Colony 10A Transect: 4 Quadrat: 20

Vegetal Cover: 60 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 40

species	cover
CAREX	15
PHAR3	20
SALU	10
SOAR2	5
SYEA2	15

Colony 10A Transect: 4 Quadrat: 21

Vegetal Cover: 85 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 10 **Litter Areal Cover:** 5

species	cover
CALAA	15
MELU	10
SABO2	40
SAEX	10
SALU	30

Colony 10A Transect: 4 Quadrat: 22

Vegetal Cover: 85 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 10 **Litter Areal Cover:** 5

species	cover

CAAU3	8
CALAA	5
EQAR	15
MELU	20
SABO2	5
SALU	5
SYEA2	20

Colony 10A Transect: 4 Quadrat: 23

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
CAREX	20
MELU	25
PHAR3	15
SAEX	10
SOAR2	10
SYEA2	20
TRRE3	5

Colony 10A Transect: 5 Quadrat: 10

Vegetal Cover: 95 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 5

species	cover
CALAA	65
MELU	15
SABO2	35

Colony 10A Transect: 5 Quadrat: 11

Vegetal Cover: 95 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 5

species	cover
MELU	10
PRVU	5
SAEX	40
SALU	25
SPDI6	2
SYEA2	20

Colony 10A Transect: 5 Quadrat: 12

Vegetal Cover: 90 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 10 **Litter Areal Cover:** 0

species	cover
CANE2	5
JUARL	20
SALU	35

Colony 10A Transect: 5 Quadrat: 13

Vegetal Cover: 95 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 5 **Litter Areal Cover:** 0

species	cover
JUARL	90
MEAR4	5
ROWO	5
SAEX	15

Colony 10A Transect: 5 Quadrat: 14

Vegetal Cover: 80 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 20

species	cover
CIVU	5
JUARL	85
SABO2	10
SAEX	15
SOAR2	20

Colony 10A Transect: 5 Quadrat: 15

Vegetal Cover: 95 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 5

species	cover
CIVU	5
EUOC4	10
GEMA4	5
JUARL	30
SAEX	30

Colony 10A Transect: 5 Quadrat: 8

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
MELU	25
SALU	90
SPDI6	1
SYEA2	10

Colony 10A Transect: 5 Quadrat: 9

Vegetal Cover: 95 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 5

species	cover
CALAA	5
JUARL	5
MEAL12	10
SABO2	10
SALU	80

Colony 10A Transect: 6 Quadrat: 1

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
ELPA3	20
PHAR3	60
SAEX	30

Colony 10A Transect: 6 Quadrat: 2

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
CIVU	25
PHAR3	90

Colony 10A Transect: 6 Quadrat: 3

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
CIVU	30
ELPA3	40
PHAR3	10
SAEX	25

Colony 10A Transect: 6 Quadrat: 4

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	5
CIDO	65
ELPA3	30
PHAR3	5

Colony 10A Transect: 6 Quadrat: 5

Vegetal Cover: 90 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 10 **Litter Areal Cover:** 0

species	cover
AGGI2	5
ELPA3	5
PHAR3	50
SAEX	50

Colony 10A Transect: 6 Quadrat: 6

Vegetal Cover: 75 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 25 **Litter Areal Cover:** 0

species	cover
AGGI2	5
CIDO	25
PHAR3	30
SAEX	15

Colony 10A Transect: 6 Quadrat: 7

Vegetal Cover: 85 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 15 **Litter Areal Cover:** 0

species	cover

CIVU	5
ELPA3	5
EUOC4	10
PHAR3	15
SAEX	35

Colony 11 Transect: 7 Quadrat: 16

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
CIDO	10
ELPA3	10
JUARL	85
SAEX	15

Colony 11 Transect: 7 Quadrat: 17

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	5
ELPA3	80
JUEN	20
PHAR3	25
RACY	85
SABO2	5
SAEX	5

Colony 11 Transect: 7 Quadrat: 18

Vegetal Cover: 70 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 30 **Litter Areal Cover:** 0

species	cover
ELPA3	20
EUOC4	5
MELU	5
PHAR3	5
SALU	40

Colony 11 Transect: 7 Quadrat: 19

Vegetal Cover: 85 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 15

species	cover
ACMI2	5
EQAR	10
JUARL	25
JUEN	5
PHAR3	5
SABO2	10
SALU	45

Colony 11 Transect: 7 Quadrat: 20

Vegetal Cover: 95 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 5 **Litter Areal Cover:** 0

species	cover
CALAA	15
ELPA3	35
EQAR	10
EUOC4	20
MELU	5
SABO2	20
SALU	15

Colony 11 Transect: 8 Quadrat: 1

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	5
ELPA3	85
PHAR3	45

Colony 11 Transect: 8 Quadrat: 2

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
CIDO	5
CIDO	15

ELPA3	85
JUEN	5
PHAR3	10
SALU	10

Colony 11 Transect: 8 Quadrat: 3

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
ELPA3	60
JUEN	5
RACY	70
SALU	10
SCPR4	20

Colony 11 Transect: 8 Quadrat: 4

Vegetal Cover: 95 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 5 **Litter Areal Cover:** 0

species	cover
ELPA3	95
PHAR3	15
UNKNOWN	5

Colony 11 Transect: 8 Quadrat: 5

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
CIDO	20
ELPA3	70
EUOC4	5
MEAR4	5
PHAR3	20

Colony 11 Transect: 9 Quadrat: 16

Vegetal Cover: 95 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 5 **Litter Areal Cover:** 0

species	cover
CIDO	10
ELPA3	70
JUARL	10
PHAR3	60
UNKNOWN	5

Colony 11 Transect: 9 Quadrat: 17

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
ELPA3	50
MELU	5
PHAR3	75

Colony 11 Transect: 9 Quadrat: 18

Vegetal Cover: 60 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 10 **Litter Areal Cover:** 30

species	cover
CIDO	5
ELPA3	40
PHAR3	20
RUCR	5
SALU	5

Colony 11 Transect: 9 Quadrat: 19

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	5
ELPA3	100
PHAR3	5
RUCR	5
SAEX	5

Colony 11 Transect: 9 Quadrat: 20

Vegetal Cover: 35 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 65 **Litter Areal Cover:** 0

species	cover

ELAN	25
MELU	5
PHAR3	30
RUCR	5

Colony 11A Transect: 10 Quadrat: 1

Vegetal Cover: 75 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 25

species	cover
PHAR3	75

Colony 11A Transect: 10 Quadrat: 2

Vegetal Cover: 45 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 5 **Litter Areal Cover:** 50

species	cover
CIDO	10
EQAR	5
PHAR3	65

Colony 11A Transect: 10 Quadrat: 3

Vegetal Cover: 95 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 5 **Litter Areal Cover:** 0

species	cover
CIAR4	5
CIVU	10
EQAR	25
EUOC4	10
MEAR4	5
PHAR3	30

Colony 11A Transect: 10 Quadrat: 4

Vegetal Cover: 95 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 5 **Litter Areal Cover:** 0

species	cover
AGGI2	30
CIVU	10
EQAR	25
EUOC4	10
GEMA4	40
MEAR4	5
PHAR3	30
SAEX	40

Colony 11A Transect: 10 Quadrat: 5

Vegetal Cover: 95 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 5 **Litter Areal Cover:** 0

species	cover
AGGI2	30
EQAR	5
EUOC4	10
GEMA4	40
MEAR4	5
PHAR3	25
SAEX	40

Colony 11A Transect: 10 Quadrat: 6

Vegetal Cover: 90 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 10

species	cover
CALAA	50
EQAR	10
EUOC4	15
GEMA4	5
SAEX	5

Colony 11A Transect: 11 Quadrat: 16

Vegetal Cover: 95 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 5 **Litter Areal Cover:** 0

species	cover
ELPA3	80
EQAR	40
EUOC4	5
JUEN	20

Colony 11A Transect: 11 Quadrat: 17

Vegetal Cover: 95 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 5 **Litter Areal Cover:** 0

species	cover
CIDO	10
ELPA3	80
JUEN	15

Colony 11A Transect: 11 Quadrat: 18

Vegetal Cover: 95 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 5 **Litter Areal Cover:** 0

species	cover
CIDO	20
ELPA3	75
EQAR	20
PHAR3	5

Colony 11A Transect: 11 Quadrat: 19

Vegetal Cover: 95 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 5 **Litter Areal Cover:** 0

species	cover
CIDO	25
ELPA3	55
EQAR	10
PHAR3	35

Colony 13-4 Transect: 15 Quadrat: 1

Vegetal Cover: 95 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 5 **Litter Areal Cover:** 0

species	cover
AGGI2	10
PHAR3	95
SAEX	5

Colony 13-4 Transect: 15 Quadrat: 2

Vegetal Cover: 95 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 5 **Litter Areal Cover:** 0

species	cover
AGGI2	30
CIDO	10
EUOC4	5
PHAR3	30
SAEX	40

Colony 13-4 Transect: 15 Quadrat: 3

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	20
CIDO	10
PHAR3	85
SAEX	70

Colony 13-4 Transect: 15 Quadrat: 4

Vegetal Cover: 90 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 10 **Litter Areal Cover:** 0

species	cover
AGGI2	25
CIDO	15
EUOC4	40
PHAR3	45

Colony 13-4 Transect: 15 Quadrat: 5

Vegetal Cover: 85 **RockAreal Cover:** 5 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 10

species	cover
CIDO	20
ELPA3	5
EQAR	10
PHAR3	25
SALU	10
SOCA6	15

Colony 13-4 Transect: 15 Quadrat: 6

Vegetal Cover: 95 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 5 **Litter Areal Cover:** 0

species	cover
CIDO	15
CIVU	5
EQAR	55
PHAR3	25
SAEX	20

Colony 24B Transect: 16 Quadrat: 1

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	10
CIAR4	25
EUOC4	10
JUARL	20
PHAR3	90
PLMA2	10

Colony 24B Transect: 16 Quadrat: 2

Vegetal Cover: 95 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 5 **Litter Areal Cover:** 0

species	cover
AGGI2	10
CIAR4	5
ELPA3	20
EQAR	5
PHAR3	80

Colony 24B Transect: 16 Quadrat: 3

Vegetal Cover: 95 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 5 **Litter Areal Cover:** 0

species	cover
AGGI2	10
ELPA3	45
PHAR3	35
SABO2	10
SAEX	20

Colony 24B Transect: 16 Quadrat: 4

Vegetal Cover: 95 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 5 **Litter Areal Cover:** 0

species	cover
AGGI2	30
ELPA3	25
EQAR	10
EUOC4	10
JUTO	10
PHAR3	50

Colony 25 Transect: 17 Quadrat: 1

Vegetal Cover: 80 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 20 **Litter Areal Cover:** 0

species	cover
AGGI2	10
AGGI2	10
ELPA3	25
PHAR3	65

Colony 25 Transect: 17 Quadrat: 2

Vegetal Cover: 80 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 20 **Litter Areal Cover:** 0

species	cover
AGGI2	10
ELPA3	25
EQAR	20
JUEN	10
PHAR3	80

Colony 25 Transect: 17 Quadrat: 3

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	20
CIDO	35
ELPA3	10
EQAR	45
EUOC4	5
JUEN	10
PHAR3	35
SYEA2	10

Colony 25 Transect: 17 Quadrat: 4

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	25
CIAR4	25
CIDO	5
ELPA3	5
EQAR	5
EUOC4	10
PHAR3	60

Colony 25 Transect: 17 Quadrat: 5

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
JUARL	35
PHAR3	85
SAEX	25

Colony 25 Transect: 17 Quadrat: 6

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	5
EQAR	40
EUOC4	10
MEAR4	35
PHAR3	20
PLMA2	10
SOCA6	15

Colony 25 Transect: 17 Quadrat: 7

Vegetal Cover: 95 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 5 **Litter Areal Cover:** 0

species	cover
AGGI2	10
CIDO	5
ELPA3	95
EUOC4	20
PHAR3	20

Colony 25 Transect: 17 Quadrat: 8

Vegetal Cover: 90 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 10 **Litter Areal Cover:** 0

species	cover
AGGI2	30
EQAR	10
EUOC4	20
JUARL	25
PHAR3	35
PLMA2	5

Colony 25 Transect: 17 Quadrat: 9

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
CIAR4	5
EQAR	35
PHAR3	25
SAEX	15

SOCA6	35
SPDI6	5

Colony 25 Transect: 20 Quadrat: 16

Vegetal Cover: 98 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 2 **Litter Areal Cover:** 0

species	cover
AGGI2	20
CALAA	20
EQAR	30
JUARL	10
JUCO2	15
SOAR2	25
SPDI6	10

Colony 25 Transect: 20 Quadrat: 17

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	30
EQAR	40
JUCO2	5
PHAR3	10
SAEX	10
SOAR2	25

Colony 25 Transect: 20 Quadrat: 18

Vegetal Cover: 95 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 5

species	cover
AGGI2	35
EQAR	20
JUARL	10
MELU	10
SYEA2	30

Colony 25 Transect: 20 Quadrat: 19

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	25
CALAA	10
EQAR	20
MELU	30
SAEX	50
SOCA6	15

Colony 25 Transect: 20 Quadrat: 20

Vegetal Cover: 95 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 5

species	cover
AGGI2	20
EQAR	20
JUARL	10
JUCO2	30
SAEX	10
SYEA2	20

Colony 25 Transect: 20 Quadrat: 21

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	35
CALU7	5
EQAR	15
JUARL	75
SABO2	35
SAEX	5
SOAR2	20

Colony 25 Transect: 20 Quadrat: 22

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	25

ALIN2	35
CALU7	15
JUARL	10
SABO2	20
SALU	20

Colony 25 Transect: 23 Quadrat: 1

Vegetal Cover: 95 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 5 **Litter Areal Cover:** 0

species	cover
AGGI2	5
EQAR	20
JUARL	65
JUEN	5
SAEX	10
SOCA6	10

Colony 25 Transect: 23 Quadrat: 10

Vegetal Cover: 90 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 5 **Litter Areal Cover:** 5

species	cover
AGGI2	50
JUCO2	15
JUEN	10
MELU	5
SABO2	10
SAEX	10
SALU	20
SOCA6	25

Colony 25 Transect: 23 Quadrat: 11

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	20
CALAA	15
EQAR	10
JUEN	10
PRVU	10
SPDI6	2
SYEA2	15

Colony 25 Transect: 23 Quadrat: 12

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	50
CALAA	10
JUARL	20
JUEN	10
SAEX	10
SALU	5
SOCA6	5
SPDI6	5

Colony 25 Transect: 23 Quadrat: 13

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	85
JUCO2	20
JUEN	10
SAEX	10
SOAR2	15

Colony 25 Transect: 23 Quadrat: 14

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	70
CALAA	30
JUEN	15
MEAR4	5
SAEX	5
SOAR2	5

Colony 25 Transect: 23 Quadrat: 15

Vegetal Cover: 90 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 10 **Litter Areal Cover:** 0

species	cover
AGGI2	35
MEAL12	5
MEAR4	5
PHAR3	5
SAEX	30
SCAM6	5

Colony 25 Transect: 23 Quadrat: 2

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	15
JUARL	50
SAEX	15
SALU	75
SOCA6	20

Colony 25 Transect: 23 Quadrat: 3

Vegetal Cover: 98 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 2

species	cover
AGGI2	20
JUARL	35
SABO2	20
SAEX	5
SALU	55

Colony 25 Transect: 23 Quadrat: 4

Vegetal Cover: 90 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 10

species	cover
AGGI2	10
EQAR	40
JUCO2	10
MELU	20
SALU	35
SPDI6	1
SYEA2	15

Colony 25 Transect: 23 Quadrat: 6

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	5
EQAR	10
JUARL	35
JUCO2	10
JUEN	15
SALU	60
SOCA6	5

Colony 25 Transect: 23 Quadrat: 7

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	20
EQAR	20
EUOC4	10
JUARL	30
SAEX	5
SPDI6	2
SYEA2	5

Colony 25 Transect: 23 Quadrat: 8

Vegetal Cover: 95 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 5 **Litter Areal Cover:** 0

species	cover
AGGI2	10
EUOC4	10
JUARL	20

JUCO2	25
JUEN	30
SYEA2	5

Colony 25 Transect: 23 Quadrat: 9

Vegetal Cover: 95 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 5 **Litter Areal Cover:** 0

species	cover
AGGI2	50
JUEN	15
JUTO	5
SAEX	25
SYEA2	5

Colony 25B Transect: 28 Quadrat: 16

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
CALAA	5
CIDO	15
EQAR	10
PHAR3	80
SAEX	20

Colony 25B Transect: 28 Quadrat: 17

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
EUOC4	10
JUARL	15
SAEX	20
SOAR2	30

Colony 25B Transect: 28 Quadrat: 18

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
CALAA	65
CAREX	15
CIDO	10
JUARL	45
SAEX	5
SALU	10

Colony 25B Transect: 28 Quadrat: 19

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
CALAA	45
EQAR	10
EUOC4	35
JUARL	30

Colony 25B Transect: 28 Quadrat: 20

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
CALAA	40
GEMA4	10
JUARL	45
SOAR2	10

Colony 25B Transect: 29 Quadrat: 1

Vegetal Cover: 45 **RockAreal Cover:** 5 **Bare Ground Areal Cover:** 50 **Litter Areal Cover:** 0

species	cover
ELPA3	60
SAEX	5

Colony 25B Transect: 29 Quadrat: 2

Vegetal Cover: 90 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 10 **Litter Areal Cover:** 0

species	cover
CIDO	20
ELPA3	75

EUOC4	5
RUCR	5

Colony 25B Transect: 29 Quadrat: 3

Vegetal Cover: 95 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 5 **Litter Areal Cover:** 0

species	cover
ELPA3	65
JUEN	5
PHAR3	5
SALU	5

Colony 25B Transect: 29 Quadrat: 4

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
ELPA3	90
EUOC4	5
JUEN	5
JUTO	5
SALU	10

Colony 25B Transect: 29 Quadrat: 5

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
ELPA3	90
RACY	10
RUCR	5
TYLA	20

Colony 25B Transect: 29 Quadrat: 6

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
ELPA3	100

Colony 25B Transect: 29 Quadrat: 7

Vegetal Cover: 90 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 10 **Litter Areal Cover:** 0

species	cover
AGGI2	40
ELPA3	45
EQAR	20
PHAR3	15

Colony 25B Transect: 29 Quadrat: 8

Vegetal Cover: 85 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 15 **Litter Areal Cover:** 0

species	cover
AGGI2	20
CAREX	5
PHAR3	15
SAEX	5
TRRE3	15

Colony 25B Transect: 29 Quadrat: 9

Vegetal Cover: 55 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 45

species	cover
AGGI2	20
CALAA	10
EUOC4	45
JUEN	15

Colony 27A Transect: 21 Quadrat: 1

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
CIDO	5
ELPA3	95
EQAR	15

Colony 27A Transect: 21 Quadrat: 2

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	40
CIDO	5
ELPA3	70
JUEN	5
PHAR3	20
RUCR	5
SAEX	5

Colony 27A Transect: 21 Quadrat: 3

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	25
ELPA3	80
JUARL	5
JUTO	20
PHAR3	5
SALU	5

Colony 27A Transect: 21 Quadrat: 4

Vegetal Cover: 90 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 10 **Litter Areal Cover:** 0

species	cover
AGGI2	80
CIDO	25
ELPA3	15
EUOC4	10
PHAR3	5
SAEX	5

Colony 27A Transect: 22 Quadrat: 16

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	20
ELPA3	35
EUOC4	15
PHAR3	25

Colony 27A Transect: 22 Quadrat: 17

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	15
ELPA3	90
EUOC4	20
JUARL	10
JUEN	5
SABO2	5
SALU	5

Colony 27A Transect: 22 Quadrat: 18

Vegetal Cover: 95 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 5 **Litter Areal Cover:** 0

species	cover
AGGI2	80
CIDO	5
ELPA3	40
EUOC4	10
JUEN	5
SALU	5

Colony 27A Transect: 22 Quadrat: 19

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	15
ELPA3	85
EUOC4	5
JUEN	25

PHAR3	5

Colony 27A Transect: 22 Quadrat: 20

Vegetal Cover: 95 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 5 **Litter Areal Cover:** 0

species	cover
AGGI2	5
ELPA3	95
EUOC4	10
PHAR3	10
SABO2	5

Colony 27A Transect: 22 Quadrat: 21

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	10
ELPA3	70
EQAR	5
EUOC4	10
PHAR3	5
RUCR	5
TYLA	10

Colony 27A Transect: 22 Quadrat: 22

Vegetal Cover: 75 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 25 **Litter Areal Cover:** 0

species	cover
AGGI2	90
HOJU	15

Colony 27A Transect: 22 Quadrat: 23

Vegetal Cover: 90 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 10 **Litter Areal Cover:** 0

species	cover
AGGI2	85
EUOC4	15
JUEN	5
SABO2	5

Colony 27A Transect: 22 Quadrat: 24

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	90
ELPA3	10
EQAR	10
EUOC4	10
TRRE3	25

Colony 27A Transect: 24 Quadrat: 16

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
CAMIM6	10
CIVU	5
EUOC4	10
MEAL12	10
MELU	75
SAEX	20
SYEA2	5

Colony 27A Transect: 24 Quadrat: 17

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	50
EQAR	50
EUOC4	10
PHAR3	25
SABO2	35

Colony 27A Transect: 24 Quadrat: 18

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	10
CIVU	5
EQAR	50
PHAR3	25
SABO2	10
SPDI6	1

Colony 27A Transect: 24 Quadrat: 19

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	15
EQAR	5
JUEN	50
PHAR3	35
SOCA6	15

Colony 27A Transect: 24 Quadrat: 20

Vegetal Cover: 85 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 15 **Litter Areal Cover:** 0

species	cover
ELPA3	55
EQAR	20
PHAR3	15
RUCR	10
UNKNOWN	5

Colony 27A Transect: 24 Quadrat: 21

Vegetal Cover: 65 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 35 **Litter Areal Cover:** 0

species	cover
ELPA3	15
EQAR	55
PHAR3	25
SYEA2	10

Colony 27A Transect: 24 Quadrat: 22

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
ELPA3	95
JUEN	10
PHAR3	5

Colony 27A Transect: 24 Quadrat: 23

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
ELPA3	95
EUOC4	5
PHAR3	10
RUCR	10

Colony 27A Transect: 24 Quadrat: 24

Vegetal Cover: 95 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 5 **Litter Areal Cover:** 0

species	cover
CIDO	5
ELPA3	10
JUARL	5
JUEN	25
PHAR3	25
RUCR	5
SOCA6	15

Colony 27A Transect: 24 Quadrat: 25

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
ELPA3	35

EUOC4	5
JUEN	30
PHAR3	30
SALU	40
SYEA2	15

Colony 27A Transect: 24 Quadrat: 26

Vegetal Cover: 95 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 5 **Litter Areal Cover:** 0

species	cover
JUARL	75
JUARL	10
SOCA6	5
SPDI6	20

Colony 27A Transect: 25 Quadrat: 16

Vegetal Cover: 90 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 10 **Litter Areal Cover:** 0

species	cover
ELPA3	45
JUEN	25
PHAR3	5
SAEX	10
VEAN2	15

Colony 27A Transect: 25 Quadrat: 17

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	45
ELPA3	70
SAEX	10

Colony 27A Transect: 25 Quadrat: 18

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
ELPA3	95
PHAR3	5
VEAN2	20

Colony 27A Transect: 25 Quadrat: 19

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	15
ELPA3	95

Colony 27A Transect: 25 Quadrat: 20

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
ELPA3	95
JUTO	10
RACY	10

Colony 27A Transect: 25 Quadrat: 21

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
ELPA3	95
VEAN2	20

Colony 27A Transect: 26 Quadrat: 1

Vegetal Cover: 50 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 50 **Litter Areal Cover:** 0

species	cover
EQAR	10
PHAR3	5
RUCR	10

Colony 27A Transect: 26 Quadrat: 2

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover

AGGI2	45
EUOC4	25
PHAR3	25

Colony 27A Transect: 26 Quadrat: 3

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	15
ELPA3	20
EUOC4	5
PHAR3	95
RUCR	5
VEAN2	5

Colony 27A Transect: 26 Quadrat: 4

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
ELPA3	75
PHAR3	65
SALU	10
VEAN2	10

Colony 27A Transect: 26 Quadrat: 5

Vegetal Cover: 95 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 5 **Litter Areal Cover:** 0

species	cover
ELPA3	35
JUEN	5
PHAR3	55
SAEX	5
SALU	10

Colony 27A Transect: 26 Quadrat: 6

Vegetal Cover: 85 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 15 **Litter Areal Cover:** 0

species	cover
ELPA3	15
EQAR	65
PHAR3	35
SALU	10

Colony 27A Transect: 27 Quadrat: 1

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	20
ELPA3	85
RACY	5
VEAN2	5

Colony 27A Transect: 27 Quadrat: 2

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	95
CIDO	5
ELPA3	20
RUCR	5
SAEX	15

Colony 27A Transect: 27 Quadrat: 3

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	85
EUOC4	5
SABO2	5
SALU	10

Colony 27A Transect: 27 Quadrat: 4

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover

ELPA3	75
JUEN	25
SALU	15

Colony 27A Transect: 27 Quadrat: 5

Vegetal Cover: 95 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 5 **Litter Areal Cover:** 0

species	cover
AGGI2	15
ELPA3	65
EUOC4	5
JUEN	10
SALU	20

Colony 27A Transect: 27 Quadrat: 6

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	95
JUEN	15
SCPR4	5

Colony 27A Transect: 27 Quadrat: 7

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	20
ELPA3	75
EQAR	10
JUEN	25
JUTO	10

Colony 27A Transect: 27 Quadrat: 8

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
ELPA3	100

Colony 34A Transect: 32 Quadrat: 16

Vegetal Cover: 75 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 20 **Litter Areal Cover:** 5

species	cover
AGGI2	15
EQAR	35
EUOC4	5
PHAR3	65
SAEX	5
VEAN2	10

Colony 34A Transect: 32 Quadrat: 17

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	25
CIVU	5
CIVU	10
ELPA3	20
EQAR	20
EUOC4	5
SCPR4	70
SOAR2	10

Colony 34A Transect: 32 Quadrat: 18

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	35
CIAR4	10
EQAR	40
MELU	15
SAEX	45

Colony 34A Transect: 32 Quadrat: 19

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
ELPA3	35
EQAR	50
EUOC4	15
JUEN	15
JUTO	5
PHAR3	50
SAEX	10

Colony 34A Transect: 32 Quadrat: 20

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	35
CIDO	25
EQAR	50
EUOC4	10
PHAR3	30
RUCR	5

Colony 34A Transect: 32 Quadrat: 21

Vegetal Cover: 80 **RockAreal Cover:** 20 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
CIDO	30
EQAR	50
PHAR3	20
VEAN2	25

Colony 34A Transect: 32 Quadrat: 22

Vegetal Cover: 85 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 10 **Litter Areal Cover:** 5

species	cover
ELPA3	70
EQAR	20
PHAR3	10
SABO2	10
UNKNOWN	10

Colony 34A Transect: 32 Quadrat: 23

Vegetal Cover: 55 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 45 **Litter Areal Cover:** 0

species	cover
ELPA3	20
EQAR	20
PHAR3	60

Colony 34A Transect: 32 Quadrat: 24

Vegetal Cover: 95 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 5 **Litter Areal Cover:** 0

species	cover
ELPA3	85
PHAR3	20
SABO2	5
SAEX	5

Colony 34A Transect: 32 Quadrat: 25

Vegetal Cover: 85 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 15

species	cover
COCA5	5
ELPA3	60
SABO2	20
SOAR2	10

Colony 34A Transect: 32 Quadrat: 26

Vegetal Cover: 80 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 20 **Litter Areal Cover:** 0

species	cover
CIDO	20
JUEN	5

RUCR	10
SALU	15

Colony 35 Transect: 33 Quadrat: 1

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	20
CALAA	55
CIDO	25
JUEN	15
PHAR3	25
SYEA2	25

Colony 35 Transect: 33 Quadrat: 10

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	15
EQAR	20
PHAR3	5
SAEX	25
SOAR2	35
SOCA6	65

Colony 35 Transect: 33 Quadrat: 11

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
BRIN2	75
MELU	5
PHAR3	25

Colony 35 Transect: 33 Quadrat: 2

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	5
BRIN2	20
EQAR	65
MELU	10
PHAR3	30
SYEA2	15

Colony 35 Transect: 33 Quadrat: 4

Vegetal Cover: 95 **RockAreal Cover:** 5 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
CALAA	35
CIVU	5
SALU	45
SOCA6	5

Colony 35 Transect: 33 Quadrat: 5

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
JUARL	30
MELU	15
PHAR3	5
PLMA2	15
SALU	20
SOCA6	10

Colony 35 Transect: 33 Quadrat: 6

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
CIVU	5
JUARL	65
SABO2	30
SALU	10
SOCA6	10
SYEA2	25

Colony 35 Transect: 33 Quadrat: 7

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	25
EUOC4	10
JUARL	45
JUTO	5
SABO2	10
SALU	25
SPDI6	4
SYEA2	5

Colony 35 Transect: 33 Quadrat: 8

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	20
EQAR	25
MELU	20
SALU	15
TRRE3	20

Colony 35 Transect: 33 Quadrat: 9

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
EQAR	75
MEAL12	30
SOAR2	45
SOCA6	30
SPDI6	4

Colony 35 Transect: 34 Quadrat: 1

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
CANU4	5
GRSQ	5
PLMA2	5
PSSP6	20
TRRE3	75
UNKNOWN	10

Colony 35 Transect: 34 Quadrat: 10

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
CIVU	10
EQAR	90
JUARL	20
PHAR3	5
SALU	35

Colony 35 Transect: 34 Quadrat: 11

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
EQAR	15
JUARL	35
SALU	45
SOCA6	35

Colony 35 Transect: 34 Quadrat: 2

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	20
CALAA	75
CIVU	10
SOAR2	10
SYEA2	10

Colony 35 Transect: 34 Quadrat: 3

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
CALAA	95
CIVU	10
PHAR3	5
SABO2	25

Colony 35 Transect: 34 Quadrat: 4

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
CALAA	85
CIDO	5
SABO2	55

Colony 35 Transect: 34 Quadrat: 5

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
CALAA	45
SALU	80

Colony 35 Transect: 34 Quadrat: 6

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
CALAA	35
JUARL	25
SABO2	45
SALU	25

Colony 35 Transect: 34 Quadrat: 7

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	45
EQAR	15
SABO2	30
SALU	20
SOCA6	10

Colony 35 Transect: 34 Quadrat: 8

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	15
EQAR	40
MESA	25
PHAR3	20
SALU	10
SOCA6	15
TRRE3	15

Colony 35 Transect: 34 Quadrat: 9

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
JUARL	60
SABO2	10
SALU	50
SOAR2	90
SOCA6	5

Colony 35A Transect: 35 Quadrat: 1

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	15
CIDO	5
ELPA3	90
PHAR3	15

Colony 35A Transect: 35 Quadrat: 10

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
CIVU	25
ELPA3	50
EUOC4	10
JUEN	25
PHAR3	5

Colony 35A Transect: 35 Quadrat: 2

Vegetal Cover: 90 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 5 **Litter Areal Cover:** 5

species	cover
AGGI2	70
JUEN	20
SOCA6	10
SYEA2	5

Colony 35A Transect: 35 Quadrat: 3

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
CIDO	20
JUARL	60
SABO2	50
SAEX	20
SALU	35

Colony 35A Transect: 35 Quadrat: 4

Vegetal Cover: 80 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 20

species	cover
AGGI2	5
CIDO	10
JUARL	90
SAEX	10
SOAR2	10
SYEA2	5

Colony 35A Transect: 35 Quadrat: 5

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	10
JUARL	70
SALU	25
SOCA6	30

Colony 35A Transect: 35 Quadrat: 6

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
CIDO	35
EQAR	40
JUARL	15
PHAR3	10
PLMA2	45
SOCA6	30

Colony 35A Transect: 35 Quadrat: 7

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
JUARL	50
SALU	85

Colony 35A Transect: 35 Quadrat: 8

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	15
CIAR4	10
CIDO	15

CIVU	5
EQAR	50
GEMA4	5
JUARL	70
SAEX	15

Colony 35A Transect: 35 Quadrat: 9

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	75
ELPA3	5
EUOC4	10
JUARL	50
PHAR3	5

Colony 35A Transect: 36 Quadrat: 1

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
CIDO	10
ELPA3	95
PHAR3	15

Colony 35A Transect: 36 Quadrat: 2

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
CIDO	5
ELPA3	85
EQAR	40
SCPR4	20

Colony 35A Transect: 36 Quadrat: 3

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
CIDO	5
ELPA3	65
EQAR	45
SCPR4	25

Colony 8 Transect: 1 Quadrat: 1

Vegetal Cover: 70 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 10 **Litter Areal Cover:** 20

species	cover
AGGI2	35
CIVU	5
EQAR	35
JUARL	20
PHAR3	25

Colony 8 Transect: 1 Quadrat: 2

Vegetal Cover: 90 **RockAreal Cover:** 5 **Bare Ground Areal Cover:** 5 **Litter Areal Cover:** 0

species	cover
EQAR	10
EUOC4	5
JUEN	5
PHAR3	15
SAEX	20
SALU	75

Colony 8 Transect: 1 Quadrat: 3

Vegetal Cover: 85 **RockAreal Cover:** 10 **Bare Ground Areal Cover:** 5 **Litter Areal Cover:** 0

species	cover
CIDO	5
ELPA3	15
EQAR	15
JUARL	15
JUEN	10
SALU	30
SOCA6	15

Colony 8 Transect: 1 Quadrat: 4

Vegetal Cover: 90 **RockAreal Cover:** 5 **Bare Ground Areal Cover:** 5 **Litter Areal Cover:** 0

species	cover
AGGI2	5
CIDO	15
EQAR	10
EUOC4	5
JUARL	10
MELU	5
PHAR3	15
SAEX	10
SALU	25

Colony 8 Transect: 1 Quadrat: 5

Vegetal Cover: 80 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 5 **Litter Areal Cover:** 15

species	cover
AGGI2	10
CIVU	25
MELU	5
PHAR3	30
SALU	10
TAOF	5

Colony 8 Transect: 1 Quadrat: 6

Vegetal Cover: 95 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 5

species	cover
CIAR4	5
CIDO	15
EQAR	50
GEMA4	15
SAEX	5
SALU	5

Colony 8C Transect: 2 Quadrat: 16

Vegetal Cover: 80 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 20

species	cover
AGGI2	5
CIVU	5
MEAL12	35
PHAR3	75
SALU	5

Colony 8C Transect: 2 Quadrat: 17

Vegetal Cover: 70 **RockAreal Cover:** 5 **Bare Ground Areal Cover:** 20 **Litter Areal Cover:** 5

species	cover
AGGI2	5
JUARL	5
MELU	15
PHAR3	50
SABO2	10
SAEX	5

Colony 8C Transect: 2 Quadrat: 18

Vegetal Cover: 95 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 5

species	cover
CIVU	5
EQAR	10
JUARL	15
PHAR3	65
SAEX	20

Colony 8C Transect: 2 Quadrat: 19

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
CALAA	20
CIVU	10
EUOC4	15

JUARL	5
PHAR3	15
SAEX	20
SALU	5

Colony 8C Transect: 2 Quadrat: 20

Vegetal Cover: 80 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 20

species	cover
CALAA	15
CIVU	5
EUOC4	25
PHAR3	15
SALU	20

Colony 8C Transect: 2 Quadrat: 21

Vegetal Cover: 80 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 20

species	cover
AGGI2	5
CIDO	10
CIVU	25
EUOC4	5
MEAR4	10
PHAR3	20
SAEX	20

Colony 8C Transect: 2 Quadrat: 22

Vegetal Cover: 90 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 5 **Litter Areal Cover:** 5

species	cover
AGGI2	15
CIDO	5
CIVU	10
EUOC4	5
PHAR3	60
SAEX	10
SALU	10

Colony 8C Transect: 2 Quadrat: 23

Vegetal Cover: 95 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 5 **Litter Areal Cover:** 0

species	cover
ELPA3	15
EQAR	35
JUARL	5
PHAR3	25
SABO2	5
SAEX	5
SALU	15

Colony 8C Transect: 2 Quadrat: 24

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
CIDO	10
ELPA3	10
EQAR	10
JUARL	20
PHAR3	20
SAEX	65

Colony 9 Transect: 3 Quadrat: 1

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	15
BEOC2	50
EQAR	15
JUARL	5
MELU	5
PHAR3	10
SALU	10

Colony 9 Transect: 3 Quadrat: 2

Vegetal Cover: 90 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 5 **Litter Areal Cover:** 5

species	cover
AGGI2	5
BEOC2	25
EQAR	25
JUARL	20
JUEN	5
MELU	10
PHAR3	30
SALU	15
SOCA6	5

Colony 9 Transect: 3 Quadrat: 3

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
CIVU	5
EQAR	5
MEAL12	35
SALU	25
SOCA6	80
SYEA2	5

Colony C33 Transect: 30 Quadrat: 1

Vegetal Cover: 55 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 35 **Litter Areal Cover:** 10

species	cover
MEAL12	75
SOCA6	10

Colony C33 Transect: 30 Quadrat: 10

Vegetal Cover: 85 **RockAreal Cover:** 10 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 5

species	cover
AGGI2	45
PHAR3	45
SOCA6	5

Colony C33 Transect: 30 Quadrat: 11

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	10
ELPA3	85
JUTO	15
PHAR3	5
RUCR	10

Colony C33 Transect: 30 Quadrat: 12

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
CIDO	20
ELPA3	70
JUARL	15
JUEN	10
SOCA6	15

Colony C33 Transect: 30 Quadrat: 13

Vegetal Cover: 95 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 5 **Litter Areal Cover:** 0

species	cover
AGGI2	30
EUOC4	25
JUEN	35
PHAR3	10

Colony C33 Transect: 30 Quadrat: 14

Vegetal Cover: 90 **RockAreal Cover:** 10 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	50

JUEN	5
PHAR3	30
SOCA6	5
TRRE3	20

Colony C33 Transect: 30 Quadrat: 15

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
EUOC4	5
MESA	95
PHAR3	10
SOCA6	5

Colony C33 Transect: 30 Quadrat: 16

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
EUOC4	10
MESA	95

Colony C33 Transect: 30 Quadrat: 17

Vegetal Cover: 85 **RockAreal Cover:** 15 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
MESA	75
PHAR3	15

Colony C33 Transect: 30 Quadrat: 18

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
MESA	75
PHAR3	15
SAEX	35

Colony C33 Transect: 30 Quadrat: 19

Vegetal Cover: 90 **RockAreal Cover:** 10 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	15
CAMI13	10
EUOC4	15
MESA	40
SAEX	10

Colony C33 Transect: 30 Quadrat: 2

Vegetal Cover: 50 **RockAreal Cover:** 50 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
MEAL12	10
SAEX	35
VETH	5

Colony C33 Transect: 30 Quadrat: 20

Vegetal Cover: 85 **RockAreal Cover:** 15 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	30
EUOC4	5
MESA	20
PHAR3	10
SAEX	25

Colony C33 Transect: 30 Quadrat: 21

Vegetal Cover: 90 **RockAreal Cover:** 10 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
EUOC4	10
MESA	15
SAEX	85
SOCA6	10

Colony C33 Transect: 30 Quadrat: 22

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	25
EUOC4	5
MESA	10
PHAR3	15
SAEX	45

Colony C33 Transect: 30 Quadrat: 23

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	45
CAREX	15
SAEX	15
SALU	30

Colony C33 Transect: 30 Quadrat: 24

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	35
CIAR4	40
EUOC4	20
PHAR3	25
SAEX	15

Colony C33 Transect: 30 Quadrat: 25

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	35
CIAR4	40
EUOC4	20
PHAR3	10
SAEX	45

Colony C33 Transect: 30 Quadrat: 3

Vegetal Cover: 55 **RockAreal Cover:** 20 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 25

species	cover
AGGI2	20
MELU	30
PHAR3	5

Colony C33 Transect: 30 Quadrat: 4

Vegetal Cover: 70 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 15 **Litter Areal Cover:** 15

species	cover
MELU	35
SAEX	35

Colony C33 Transect: 30 Quadrat: 5

Vegetal Cover: 80 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 15 **Litter Areal Cover:** 5

species	cover
CIVU	10
COCA5	5
MELU	20
SAEX	45

Colony C33 Transect: 30 Quadrat: 6

Vegetal Cover: 60 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 15 **Litter Areal Cover:** 25

species	cover
MEAL12	25
SAEX	30

Colony C33 Transect: 30 Quadrat: 7

Vegetal Cover: 85 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 15 **Litter Areal Cover:** 0

species	cover

AGGI2	15
CIAR4	25
COCA5	20
SAEX	25

Colony C33 Transect: 30 Quadrat: 8

Vegetal Cover: 85 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 15 **Litter Areal Cover:** 0

species	cover
MEAL12	40
SAEX	15
TRRE3	25

Colony C33 Transect: 30 Quadrat: 9

Vegetal Cover: 85 **RockAreal Cover:** 15 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
EPCI	5
PHAR3	85
PLLA	10

Colony C33 Transect: 31 Quadrat: 1

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
CIVU	5
EQAR	30
EUOC4	15
JUTO	5
RUCR	5
SCPR4	80

Colony C33 Transect: 31 Quadrat: 10

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	75
ELPA3	30
EQAR	5
JUARL	5
JUTO	25
RUCR	5
SABO2	10
SOCA6	10

Colony C33 Transect: 31 Quadrat: 11

Vegetal Cover: 90 **RockAreal Cover:** 10 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	20
ELPA3	65
JUEN	10
SOCA6	5
TRRE3	25

Colony C33 Transect: 31 Quadrat: 12

Vegetal Cover: 80 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 20 **Litter Areal Cover:** 0

species	cover
AGGI2	25
CAMI13	35
ELPA3	40
EUOC4	5
JUARL	5
PHAR3	30
PLMA2	5
TRRE3	10

Colony C33 Transect: 31 Quadrat: 13

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	45
CAMI13	10
JUARL	25

JUEN	5
PLMA2	35

Colony C33 Transect: 31 Quadrat: 14

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	25
CAMI13	5
JUARL	10
JUEN	25
PLMA2	5
SCPR4	35
SOCA6	5

Colony C33 Transect: 31 Quadrat: 15

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
ELPA3	50
JUARL	20
JUEN	75
SAEX	5
SOCA6	15

Colony C33 Transect: 31 Quadrat: 16

Vegetal Cover: 95 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 5 **Litter Areal Cover:** 0

species	cover
JUARL	20
JUEN	20
PHAR3	15
PLMA2	65
RACY	15

Colony C33 Transect: 31 Quadrat: 17

Vegetal Cover: 50 **RockAreal Cover:** 45 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 5

species	cover
AGGI2	5
CAREX	20
CIDO	10
PLMA2	15
RUCR	10
SOCA6	10
VEAN2	10

Colony C33 Transect: 31 Quadrat: 18

Vegetal Cover: 85 **RockAreal Cover:** 15 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	60
EUOC4	15
MEAL12	15
SAEX	10
SOCA6	15
TRRE3	10

Colony C33 Transect: 31 Quadrat: 19

Vegetal Cover: 55 **RockAreal Cover:** 45 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	20
CIDO	25
EUOC4	5
SAEX	5
SOCA6	10

Colony C33 Transect: 31 Quadrat: 2

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	45
EUOC4	10
JUEN	10

JUTO	10

Colony C33 Transect: 31 Quadrat: 20

Vegetal Cover: 95 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 5 **Litter Areal Cover:** 0

species	cover
AGGI2	50
ELPA3	30
JUEN	15
RACY	15
SALU	5
SOCA6	10

Colony C33 Transect: 31 Quadrat: 21

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	80
EUOC4	10
JUARL	5
PHAR3	5
SABO2	5

Colony C33 Transect: 31 Quadrat: 22

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	10
EUOC4	15
JUARL	20
JUEN	45
RACY	10
SAEX	5

Colony C33 Transect: 31 Quadrat: 23

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	55
EUOC4	10
JUEN	25
JUTO	10

Colony C33 Transect: 31 Quadrat: 24

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	15
EUOC4	5
JUEN	95
SABO2	5

Colony C33 Transect: 31 Quadrat: 25

Vegetal Cover: 90 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 10 **Litter Areal Cover:** 0

species	cover
AGGI2	20
JUARL	20
JUEN	30
JUTO	10
SALU	25

Colony C33 Transect: 31 Quadrat: 26

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
ELPA3	20
JUARL	20
JUEN	70
SABO2	5

Colony C33 Transect: 31 Quadrat: 3

Vegetal Cover: 15 **RockAreal Cover:** 85 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover

JUEN	15

Colony C33 Transect: 31 Quadrat: 4

Vegetal Cover: 50 **RockAreal Cover:** 35 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 15

species	cover
AGGI2	5
JUEN	15
SCPR4	45

Colony C33 Transect: 31 Quadrat: 5

Vegetal Cover: 95 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 5

species	cover
AGGI2	15
JUEN	5
SCPR4	95

Colony C33 Transect: 31 Quadrat: 6

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	20
JUEN	65
SCPR4	40
VEAN2	10

Colony C33 Transect: 31 Quadrat: 7

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	30
ELPA3	35
JUEN	65

Colony C33 Transect: 31 Quadrat: 8

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	5
EPCI	5
PHAR3	30
RUCR	25
VEAN2	40

Colony C33 Transect: 31 Quadrat: 9

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	35
EQAR	5
JUEN	25
RUCR	5
SCPR4	40

Colony Surface1 Transect: 12 Quadrat: 16

Vegetal Cover: 80 **RockAreal Cover:** 20 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
CIVU	30
ELPA3	30
PHAR3	40

Colony Surface1 Transect: 12 Quadrat: 17

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
CIDO	20
CIVU	25
ELPA3	100
PHAR3	10
PLMA2	5

Colony Surface1 Transect: 12 Quadrat: 18

Vegetal Cover: 0 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 100 **Litter Areal Cover:** 0

species	cover
RIVER	100

Colony Surface1 Transect: 12 Quadrat: 19

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
PHAR3	100

Colony Surface1 Transect: 12 Quadrat: 20

Vegetal Cover: 80 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 20

species	cover
CIDO	15
ELPA3	55
PHAR3	30

Colony Surface1 Transect: 12 Quadrat: 21

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
ELPA3	100
PHAR3	10

Colony Surface2 Transect: 13 Quadrat: 1

Vegetal Cover: 0 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 100 **Litter Areal Cover:** 0

species	cover
RIVER	100

Colony Surface2 Transect: 13 Quadrat: 2

Vegetal Cover: 0 **RockAreal Cover:** 40 **Bare Ground Areal Cover:** 60 **Litter Areal Cover:** 0

species	cover
BG	40

Colony Surface2 Transect: 13 Quadrat: 3

Vegetal Cover: 65 **RockAreal Cover:** 20 **Bare Ground Areal Cover:** 15 **Litter Areal Cover:** 0

species	cover
CIDO	20
ELPA3	30
PHAR3	50

Colony Surface2 Transect: 13 Quadrat: 4

Vegetal Cover: 70 **RockAreal Cover:** 20 **Bare Ground Areal Cover:** 10 **Litter Areal Cover:** 0

species	cover
CIDO	10
ELPA3	30
PHAR3	50
SAEX	5

Colony Surface2 Transect: 13 Quadrat: 5

Vegetal Cover: 95 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 5 **Litter Areal Cover:** 0

species	cover
AGGI2	40
PHAR3	65
SALU	5
SYEA2	5

Colony Surface2 Transect: 13 Quadrat: 6

Vegetal Cover: 75 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 5 **Litter Areal Cover:** 20

species	cover
CIDO	35
ELPA3	45
EQAR	5
SOCA6	10
SYEA2	20

Colony Surface2 Transect: 14 Quadrat: 16

Vegetal Cover: 0 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 100 **Litter Areal Cover:** 0

species	cover
RIVER	100

Colony Surface2 Transect: 14 Quadrat: 17

Vegetal Cover: 5 **RockAreal Cover:** 75 **Bare Ground Areal Cover:** 20 **Litter Areal Cover:** 0

species	cover
UNKNOWN	5

Colony Surface2 Transect: 14 Quadrat: 18

Vegetal Cover: 2 **RockAreal Cover:** 25 **Bare Ground Areal Cover:** 73 **Litter Areal Cover:** 0

species	cover
UNKNOWN	2

Colony Surface4 Transect: 37 Quadrat: 1

Vegetal Cover: 70 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 30 **Litter Areal Cover:** 0

species	cover
ELPA3	70

Colony Surface4 Transect: 37 Quadrat: 2

Vegetal Cover: 90 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 10

species	cover
CIDO	10
ELPA3	45
JUEN	40
PHAR3	20
SABO2	10
SALU	10

Colony Surface4 Transect: 37 Quadrat: 3

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
ELPA3	85
EUOC4	10
SABO2	15
SALU	10

Colony Surface4 Transect: 37 Quadrat: 4

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
ELPA3	70
EUOC4	10
JUEN	10
PHAR3	15
RUCR	5
SABO2	10
SALU	5

Colony Surface4 Transect: 37 Quadrat: 5

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
AGGI2	5
CIDO	5
ELPA3	45
PHAR3	40
PLMA2	10
RUCR	5
SABO2	10

Colony Surface4 Transect: 37 Quadrat: 6

Vegetal Cover: 100 **RockAreal Cover:** 0 **Bare Ground Areal Cover:** 0 **Litter Areal Cover:** 0

species	cover
CAREX	45
ELPA3	80

APPENDIX 5.2A PEARSON CORRELATIONS FOR UTE LADIES'-TRESSES HABITAT DATA

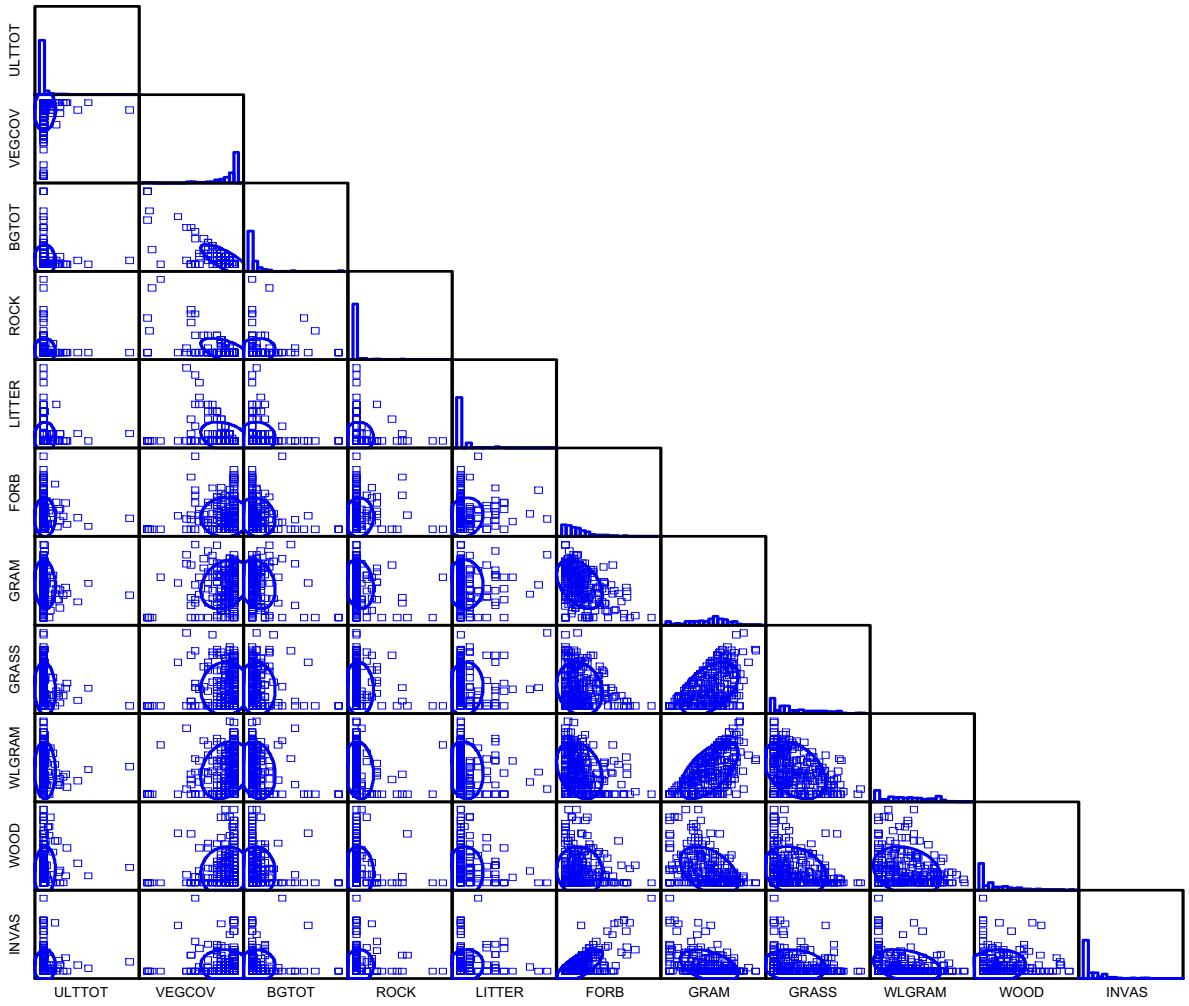
Pearson Product Moment Correlation (Pearson r) for ULT Habitat Data: Correlations for Individual Species Found within All Habitat Analyses and Scatter Plots.

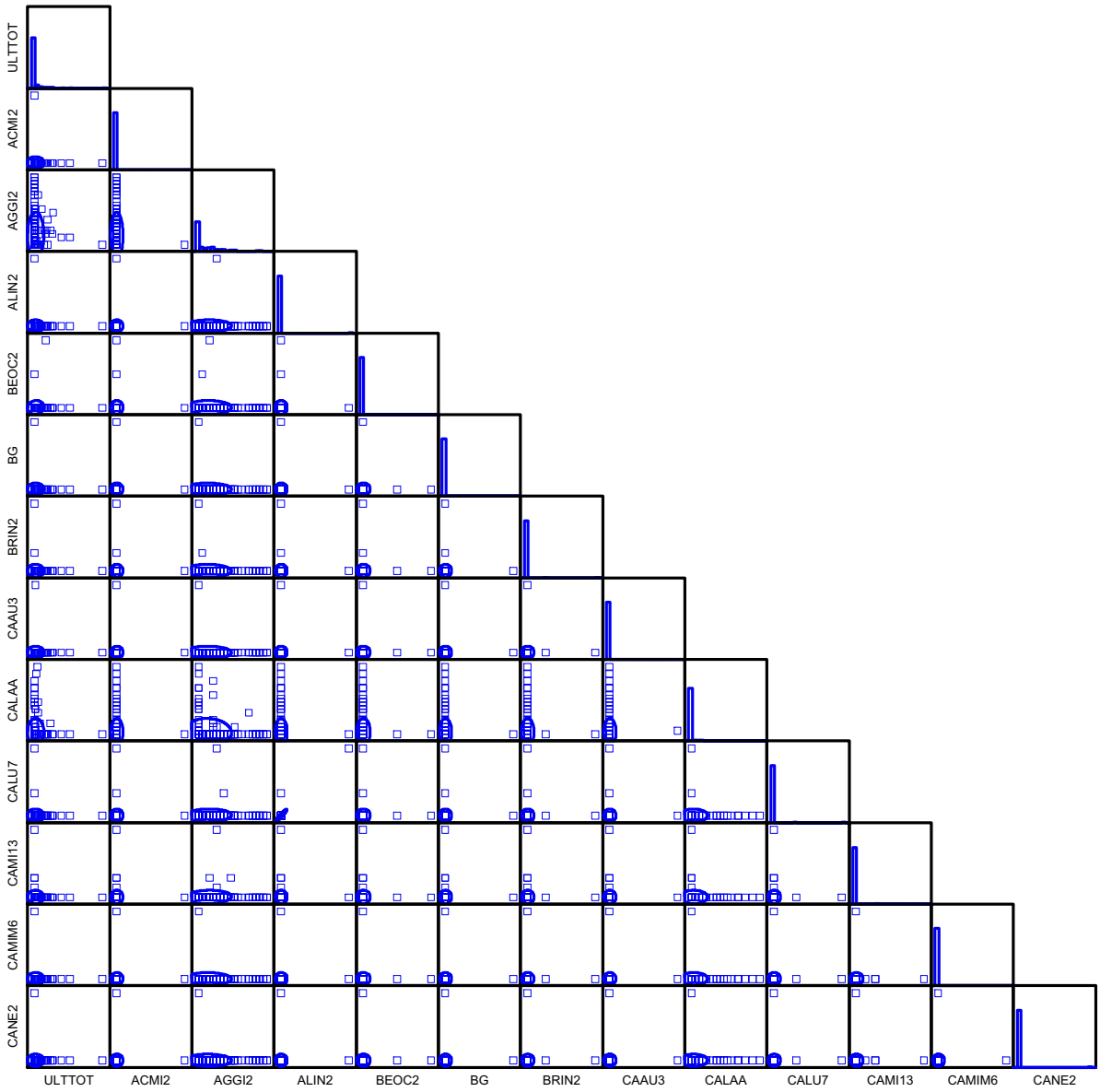
Code[a]	Pearson r	Code	Pearson r	Code	Pearson r	Code	Pearson r
VEGCOV	0.046	CAAU3	-0.002	EUOC4	-0.094	RUCR	-0.052
BGTOT	-0.042	CALAA	0.007	GEMA4	-0.025	SABO2	0.139
ROCK	-0.045	CALU7	-0.016	GRSQ	-0.012	SAEX	-0.044
LITTER	0.023	CAMI13	-0.02	HOJU	-0.012	SALU	0.06
FORB	0.001	CAMIM6	-0.012	JUAR4	-0.012	SCAM6	-0.012
GRAM	-0.11	CANE2	-0.012	JUARL	-0.019	SCPR4	-0.034
GRASS	-0.089	CANU4	-0.012	JUCO2	0.015	SOAR2	0.126
WLGRAM	-0.035	CAREX	0.069	JUEN	-0.053	SOCA6	0.004
WOOD	0.073	CIAR4	-0.033	JUTO	-0.038	SPDI6	0.051
INVAS	0.025	CIDO	-0.081	MEAL12	0.001	SYEA2	0.139
ACMI2	-0.012	CIVU	-0.017	MEAR4	-0.02	TAOF	-0.012
AGGI2	0	COCA5	-0.018	MELU	0.023	TRRE3	0.051
ALIN2	-0.012	ELAN	-0.012	MESA	-0.004	TYLA	-0.017
BEOC2	0.094	ELPA3	-0.121	RACY	0.017	UNKNOWN	-0.03
BG	-0.012	EPCI	-0.018	RIVER	-0.022	VEAN2	-0.035
BRIN2	-0.015	EQAR	0.225	ROWO	-0.012	VETH	-0.012

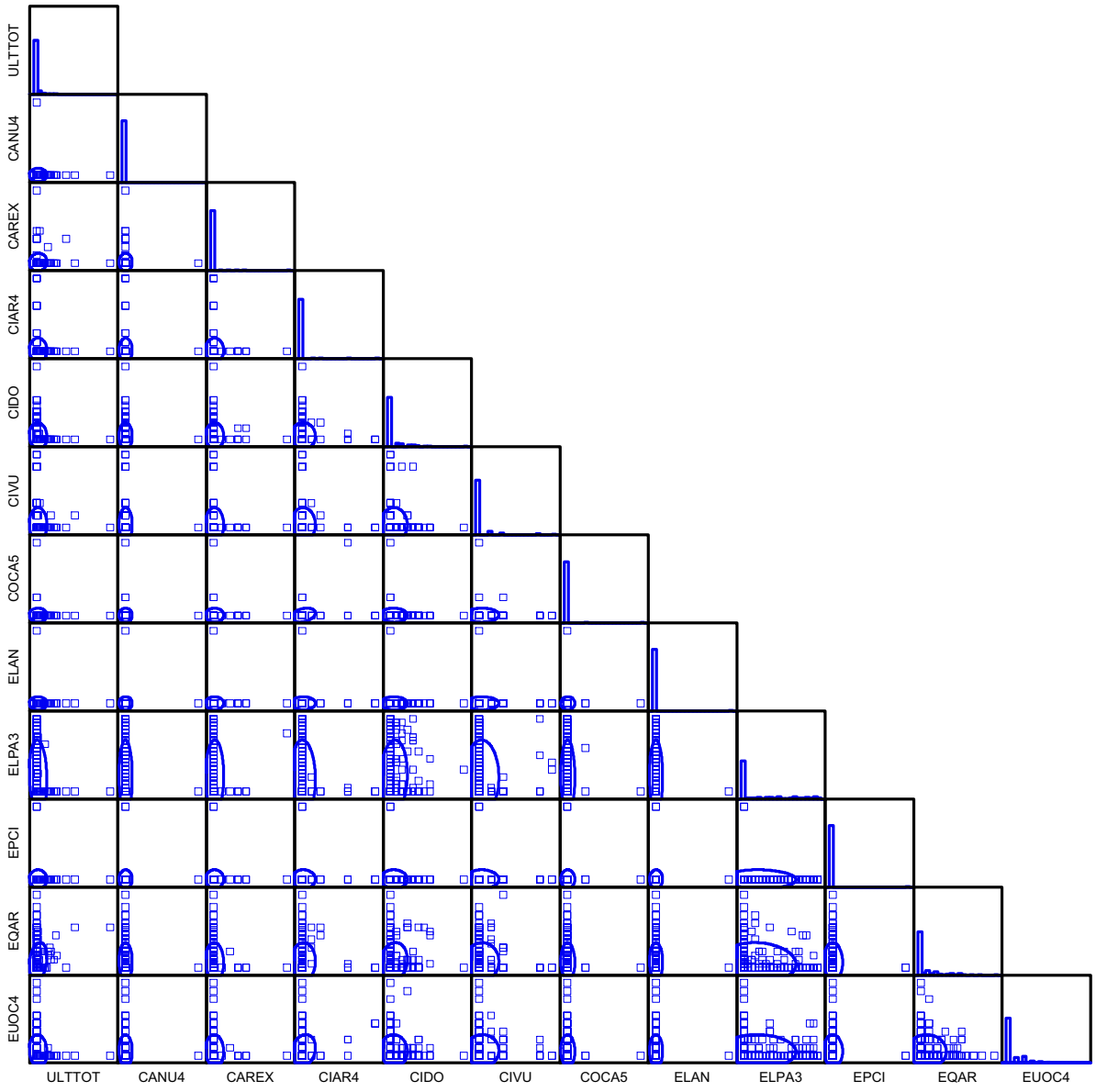
[a] Codes can be found in Table 3.2.

APPENDIX 5.2B SCATTER PLOTS AND HISTOGRAMS OF UTE LADIES'-TRESSES HABITAT DATA

Scatter Plots and Frequency Histograms of ULT Habitat Data




ULTTOT
ACMI2
AGGI2
ALIN2
BEOC2
BG
BRIN2
CAAU3
CALAA
CALU7
CAMI13
CAMIM6
CANE2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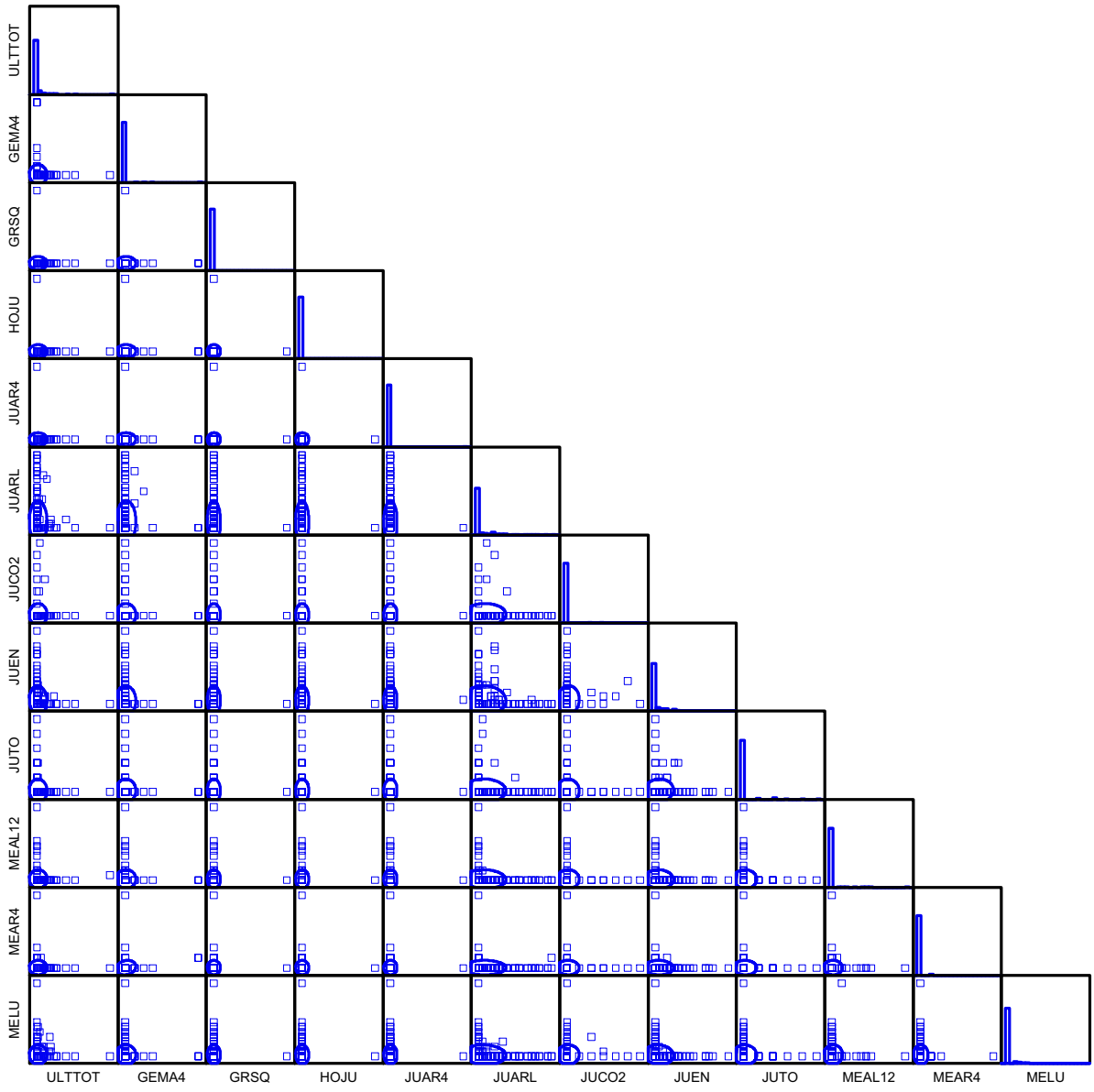
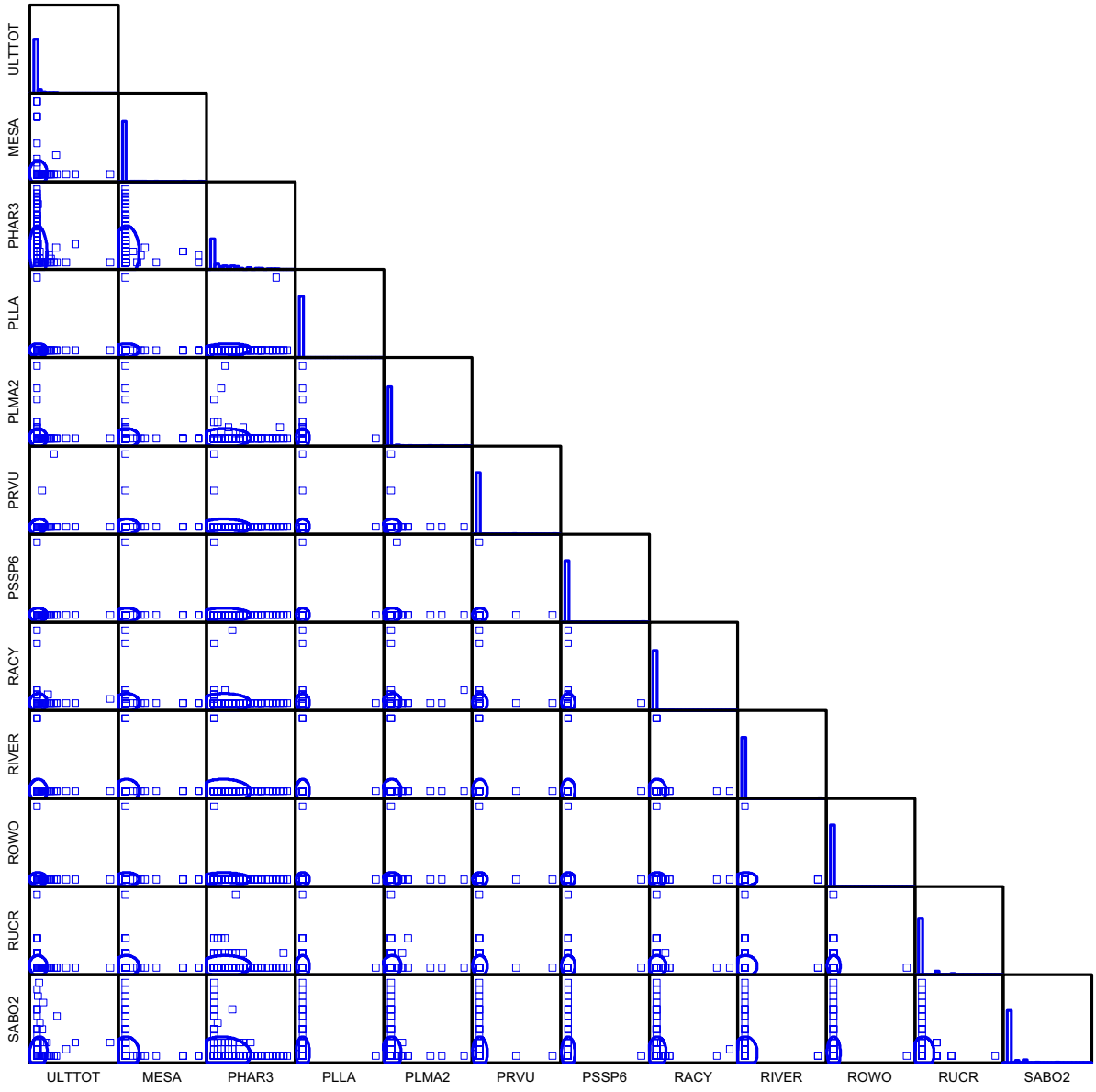
CANU4
CAREX
CIAR4
CIDO
CIVU
COCA5
ELAN
ELPA3
EPCI
EQAR
EUOC4


ULTTOT
GEMA4
GRSQ
HOJU
JUAR4
JUARL
JUCO2
JUEN
JUTO
MEAL12
MEAR4
MELU


ULTTOT
MESA
PHAR3
PLLA
PLMA2
PRVU
PSSP6
RACY
RIVER
ROWO
RUCR
SABO2

APPENDIX 5.3 UTE LADIES'-TRESSES QUADRATS AND *P* VALUES

Species	Scientific Name	P-value
VEGCOV	Total vegetal cover	0.001
BGTOT	Bare ground areal cover	0.018
ROCK	Rock areal cover	<0.001
LITTER	Litter areal cover	0.622
FORB	Forb species	0.01
GRAM	Graminoid species	0.001
GRASS	Grass species	0.054
WLGRAM	Non-grass graminoid	0.479
WOOD	Woody plant	<0.001
INVAS	Non-native plants	<0.001
ACMI2	*Achillea millefolium*	0.775
AGGI2	*Agrostis gigantea*	0.002
ALIN2	*Alnus incana*	0.247
BEOC2	*Betula occidentalis*	0.599
BG	Bare ground	0.002
BRIN2	*Bromus inermis*	0.06
CAAU3	*Carex aurea*	0.247
CALAA	*Carex lasiocarpa* var. *americana*	<0.001
CALU7	*Carex luzulina*	0.06
CAMI13	*Castilleja minor*	0.356
CAMIM6	*Castilleja minor* ssp. *minor*	0.775
CANE2	*Carex nebrascensis*	0.247
CANU4	*Carduus nutans*	0.247
CAREX	*Carex species*	0.367
CIAR4	*Cirsium arvense*	0.456
CIDO	*Cicuta douglasii*	0.017
CIVU	*Cirsium vulgare*	0.565
COCA5	*Conyza canadensis*	0.462
ELAN	*Elaeagnus angustifolia*	0.775
ELPA3	*Eleocharis palustris*	<0.001
EPCI	*Epilobium ciliatum*	0.599
EQAR	*Equisetum arvense*	0.005
EUOC4	*Euthamia occidentalis*	0.002
GEMA4	*Geum macrophyllum*	0.506
GRSQ	*Grindelia squarrosa*	0.247
HOJU	*Hordeum jubatum*	0.775
JUARR	*Juncus arcticus*	<0.001
JUCO2	*Juncus confusus*	<0.001
JUEN	*Juncus ensifolius*	0.037
JUTO	*Juncus torreyi*	0.24
MEAL12	*Melilotus alba*	0.569
MEAR4	*Mentha arvensis*	0.365
MELU	*Medicago lupulina*	0.002
MESA	*Medicago sativa*	0.326
PHAR3	*Phalaris arundinacea*	0.092
PLLA	*Plantago lanceolata*	0.775
PLMA2	*Plantago major*	0.484
PRVU	*Prunella vulgaris*	0.06
PSSP6	*Pseudoroegneria spicata*	0.247
RACY	*Ranunculus cymbalaria*	0.532
RIVER	River	<0.001
ROWO	*Rosa woodsii*	0.247
RUCR	*Rumex crispus*	0.011
SABO2	*Salix boothii*	0.008
SAEX	*Salix exigua*	0.008
SALU	*Salix lucida*	0.003
SCAM6	*Schoenoplectus americanus*	0.247
SCPR4	*Schedonorus pratensis*	0.054
SOAR2	*Sonchus arvensis*	<0.001
SOCA6	*Solidago canadensis*	0.039
SPDI6	*Spiranthes diluvialis*	<0.001
SYEA2	*Symphyotrichum eatonii*	<0.001
TAOF	*Taraxacum officinale*	0.775
TRRE3	*Trifolium repens*	0.524
TYLA	*Typha latifolia*	0.599
UNKNOWN	Unknown	0.101
VEAN2	*Veronica anagallis-aquatica*	0.054
VETH	*Verbascum thapsus*	0.775

APPENDIX 5.4 PIEZOMETER DATA

sample	site	colony #	well #	real world elevation (feet)	adjusted groundwater surface elevation
6-Jun	below MO	25	1	4993.0766	4994.09779
26-Jul	below MO	25	1		4993.47779
4-Aug	below MO	25	1	4992.8601	4993.41779
16-Aug	below MO	25	1	4992.97	4993.33779
4-Oct	below MO	25	1	4992.9201	4993.11779
26-Nov	below MO	25	1	4993.2001	4992.89779
6-Jun	below MO	25	2	4993.0766	4993.85308
26-Jul	below MO	25	2		4993.28308
4-Aug	below MO	25	2	4992.8601	4993.23308
16-Aug	below MO	25	2	4992.97	4993.17308
4-Oct	below MO	25	2	4992.9201	4992.96308
26-Nov	below MO	25	2	4993.2001	4992.81308
6-Jun	below MO	25	3	4993.0766	4993.53663
26-Jul	below MO	25	3		4993.09663
4-Aug	below MO	25	3	4992.8601	4993.00663
16-Aug	below MO	25	3	4992.97	4992.96663
4-Oct	below MO	25	3	4992.9201	4992.78663
26-Nov	below MO	25	3	4993.2001	4992.66663
6-Jun	DFC	10A	1	5174.0367	5172.98667
26-Jul	DFC	10A	1		5172.68667
4-Aug	DFC	10A	1	5173.282745	5172.65667
16-Aug	DFC	10A	1	5173.072745	5172.64667
4-Oct	DFC	10A	1	5173.032745	5172.60667
26-Nov	DFC	10A	1	5172.972745	5172.60667
6-Jun	DFC	10A	2	5173.36	5172.25295
26-Jul	DFC	10A	2	5172.44	5171.87295
4-Aug	DFC	10A	2	5172.370015	5171.87295
16-Aug	DFC	10A	2	5172.380015	5171.87295
4-Oct	DFC	10A	2	5172.290015	5171.89295
26-Nov	DFC	10A	2		5171.92295
6-Jun	DFC	10A	3	5172.45	5171.73303
26-Jul	DFC	10A	3		5171.37303
4-Aug	DFC	10A	3	5171.79336	5171.37303
16-Aug	DFC	10A	3	5171.84336	5171.37303
4-Oct	DFC	10A	3	5171.79336	5171.37303
26-Nov	DFC	10A	3	5171.67336	5171.38303
6-Jun	OX	35	1	5002.93	5003.389781
26-Jul	OX	35	1	5002.8	5003.114781
4-Aug	OX	35	1	5002.654486	5003.114781
16-Aug	OX	35	1	5002.634486	5003.114781
4-Oct	OX	35	1	5002.524486	5003.114781
26-Nov	OX	35	1	5002.524486	5003.114781
6-Jun	OX	35	2	5002.179093	5002.119093
26-Jul	OX	35	2		5001.989093
4-Aug	OX	35	2	5001.801403	5001.959093
16-Aug	OX	35	2	5001.851403	5001.929093
4-Oct	OX	35	2	5001.721403	5001.889093
26-Nov	OX	35	2	5001.701403	5001.859093
6-Jun	OX	35	3	5002.521	5002.650915
26-Jul	OX	35	3	5002.401	5002.570915
4-Aug	OX	35	3	5002.364135	5002.590915
16-Aug	OX	35	3	5002.374135	5002.540915
4-Oct	OX	35	3	5002.264135	5002.480915
26-Nov	OX	35	3	5002.244135	5002.460915