



Suzanne Steab <suzannesteab@utah.gov>

## Re: South Fork Quitchupah Creek Riparian Monitoring

**Lisa Reinhart** <lreinhart@utah.gov>  
 To: "Hamilton, Rob -FS" <rhamilton@fs.fed.us>  
 Cc: Suzanne Steab <suzannesteab@utah.gov>

Tue, Jun 16, 2015 at 9:42 AM

They should be attached. Let me know if there is any trouble opening them up. If you want the hard copies, I can go back to the files and see if I can find them. I figured you would probably want them digital anyway.

Lisa

Lisa Reinhart  
 Environmental Scientist  
 Utah Coal Program  
 Division of Oil, Gas, and Mining  
 (801) 538-5437, (801) 359-3940 (Fax)

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On Mon, Jun 15, 2015 at 1:36 PM, Hamilton, Rob -FS <rhamilton@fs.fed.us> wrote:

Lisa – After looking through our files, I can't find the 2012 and 2013 Monitoring Reports. If you would please e-mail them to me that would be great. Thanks!



**Rob Hamilton**  
 Minerals Program Manager

**Forest Service**

**Fishlake National Forest**

p: [435-896-1022](tel:435-896-1022)  
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**Caring for the land and serving people**

**From:** Lisa Reinhart [mailto:[lreinhart@utah.gov](mailto:lreinhart@utah.gov)]  
**Sent:** Monday, June 15, 2015 11:44 AM

**To:** Hamilton, Rob -FS

**Subject:** South Fork Quitchupah Creek Riparian Monitoring

Rob,

Pursuant to the Mining and Reclamation Plan for the Sufco Mine, I am providing your office with a copy of the riparian monitoring report required by their permit to mine. According to their permit, surveys are conducted two times a year prior to mining (2012) and then two times a year for the first two years (2013 & 2014) and the fifth year following undermining (2018).

I presume you received the reports for 2012 and 2013 but please let me know if you do not have them and I can send them again.

I have reviewed the reports and nothing looks startling to me and we don't expect another report until 2018. We will provide you with that report as well.

Please let me know if anything in the reports is concerning to you and we can address any issues.

Thanks,

Lisa Reinhart

Environmental Scientist

Utah Coal Program

Division of Oil, Gas, and Mining

(801) 538-5437, (801) 359-3940 (Fax)

Web site: <http://ogm.utah.gov>

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**2 attachments**



**August and October 2012.pdf**

3464K



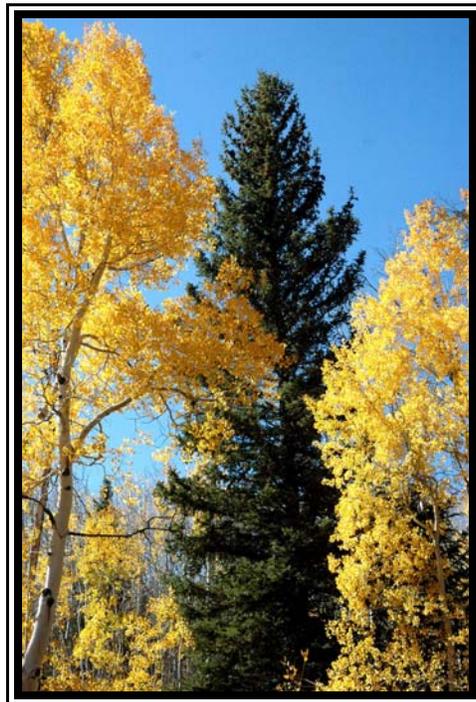
**July and October 2013.pdf**

3917K

**RIPARIAN PLANT COMMUNITY  
MONITORING IN SELECTED REACHES:  
SOUTH FORK QUITCHUPAH CREEK**

**August & October  
2012**

**FOR THE  
SUFCO MINE  
SEVIER COUNTY, UTAH**



Aspen & spruce trees at the study area

*Prepared by*

**MT. NEBO SCIENTIFIC, INC.**

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*for*

CANYON FUEL COMPANY, LLC  
SUFCO MINE  
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March 2013



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# Introduction

The SUFCO Coal Mine is planning to expand their underground operations near and below some reaches of the South Fork Quitchupah Creek. The riparian plant communities supported along the creek will be monitored for possible impacts that could be caused by mine-related subsidence. These studies will be conducted before, during, and after the mining takes place. This document includes the results of quantitative and qualitative vegetation sampling in several locations within and outside the subsidence zones. The results include two sample periods in 2012 – August and October.

## The Study Areas

The South Fork Quitchupah Creek study area is located at the southern end of the Wasatch Plateau, a subprovince of the Colorado Plateau physiographic province. It also lies within Sevier County, Utah west of the town of Emery, and is located within the boundaries of the USDA National Forest property. Quitchupah Creek and its forks are tributaries to Muddy Creek which converges with the Dirty Devil River and ultimately drains into the Colorado River. Geology of the study area is within the Cretaceous strata of the Mesa Verde Group. The sample sites lie within the Price River Formation below the North Horn Formation. The lowest study site, however, is near the contact zone between the Price River Formation and the cliff-forming Castlegate Sandstone. Elevation of the study area is between 8,200 ft to 8,400 ft above sea level.

A variety of biological and other resource information can be studied to evaluate and characterize riparian complexes including vegetation, geology, channel morphology, aquatic biology, soils, and stream flow. The primary focus of this study was on vegetation to provide baseline and followup data by monitoring the riparian communities adjacent to South Fork Quitchupah Creek. Regular monitoring will be conducted to provide data to determine long term trends, natural variability and benchmark information including the possible impacts on the riparian plant communities from mining beneath the creek and nearby springs.

To be consistent with other riparian studies for the mine, this study primarily employed vegetation monitoring methods described by the USDA Forest Service (described later). The design of this study was not to provide data that could show subtle changes to community structure and species composition as a result of *minor* changes to the riparian habitat. Rather, the study was designed to make year-to-year comparisons in an attempt to document *major* impacts to the plant communities along the stream due to catastrophic events, such as loss of water and habitat from the effects of subsidence caused from underground mining.

## Methods

### Sample Station Placement

A field visit to the site was initially conducted by a team of representatives from the SUFCO Mine, USDA Forest Service, Bureau of Land Management, State of Utah (Division of Water Rights and Division of Oil, Gas & Mining), Petersen Hydrologic and Mt. Nebo Scientific. The study area was delineated at that time. The general zones for the future subsidence and areas adjacent to them were visited. Potential sample locations for vegetation and water quality were addressed by the team in the field. The final sample locations were chosen later, some of them beyond subsidence zones with the idea that those areas could be used in the future as “controls”, or areas that will *not* be impacted by mining-related subsidence, and can be used to compare those areas that have.

Qualitative and quantitative data were recorded at the sample stations along South Fork Quitchupah Creek. Line transects were placed at the stations. Locations and extent of the transects were semi-permanently marked using numbered and flagged wooden stakes and 12-inch metal rods. GPS coordinates were recorded at the stations. With some modifications, the vegetation monitoring methods of the studies were based on those described by the USDA Forest Service manual for a “*Level III Riparian Area Evaluation*” (*Integrated Riparian Evaluation Guide*, March 1992).

Geomorphological stream channel data outlined in the Forest Service protocol were not recorded as part of this study because scientists for the SUFCO Mine have conducted other

studies that will suffice for this information. Additionally, soils information through the Natural Resources Conservation Service (NRCS) was not available for the study area.

### Qualitative Data

The *RIPARIAN COMPLEX DATA SHEET* shown on Table 1 lists the qualitative and quantitative data that has been, and will continue to be, collected at each sample station.

Photographic stations for documentation and future comparisons have also been established at each sample location. A sample location map has been included in this report.

### Quantitative Data

As mentioned, USDA Forest Service protocol was employed as a model to drive the study plan for data collection. *Community Type Cover* is one method to record cover in the Forest Service Level III protocol. At the sample locations, transect lines have been placed across (or perpendicular to) the stream channel. By design, the line transects vary in lengths which are based on several factors. Although sometimes limited by topographical features, the intent was to make the transects long enough to cover

**TABLE 1: RIPARIAN COMPLEX DATA SHEET**

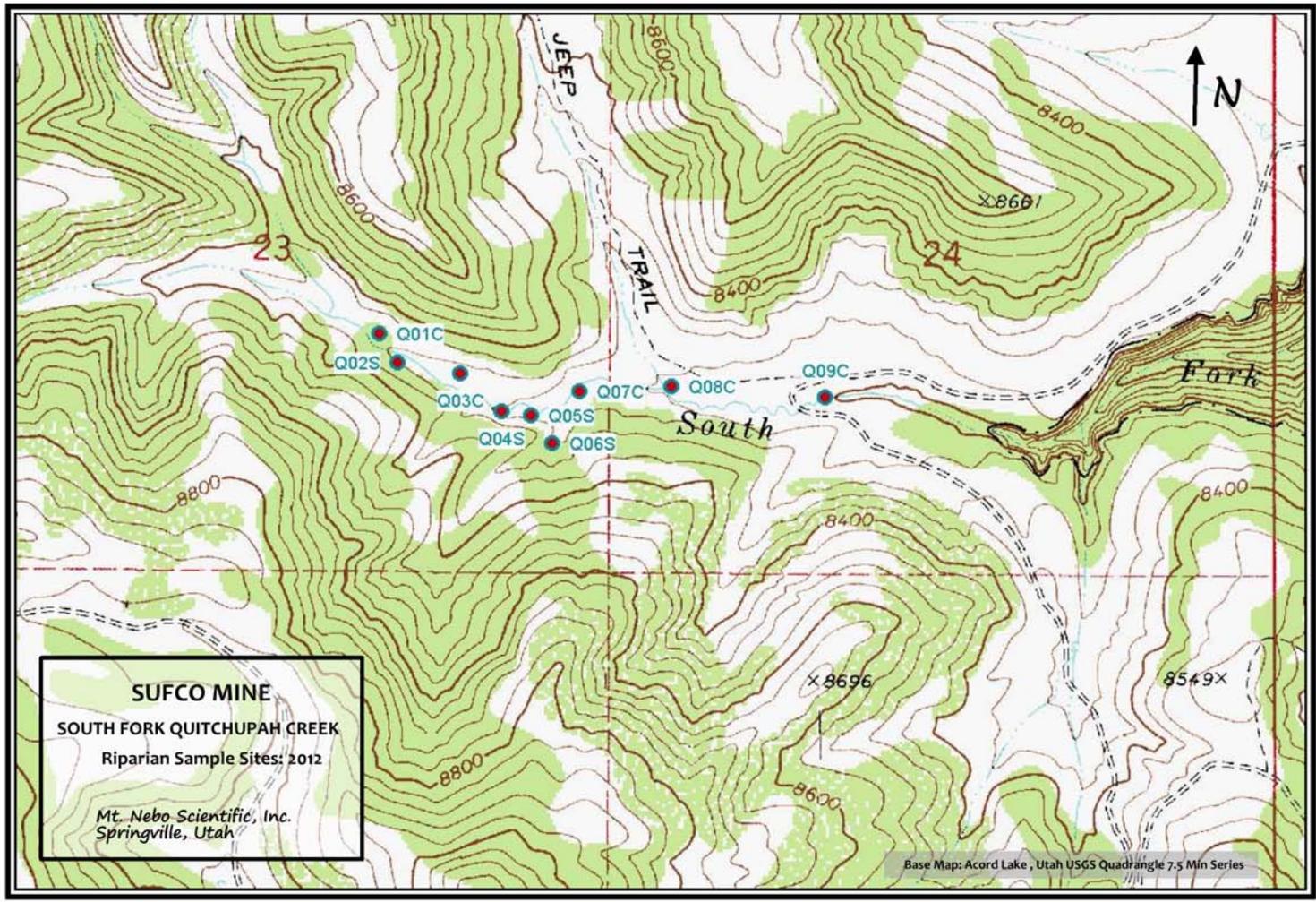
CLIENT:  
SAMPLE NUMBER:  
WATERBODY NAME:  
LOCATION:  
DATE:  
OBSERVER(S):  
QUAD NAME:  
GEOLOGIC PARENT MATERIAL:  
STREAM ASPECT:  
STREAM GRADIENT:  
ELEVATION: .  
SIZE OF COMPLEX:  
ADJACENT UPLAND VEGETATION (looking downstream)  
Left: Right:  
VEGETATIVE DESCRIPTION (Dominance by Community Types)  
COMMUNITY SUCCESSIONAL STAGE:  
APPARENT FORAGE TREND:  
ESTIMATED FORAGE PRODUCTION:  
BEAVER ACTIVITY:  
EROSION RATING:  
PHOTOGRAPH TAKEN:  
LAND USE ACTIVITIES THAT COULD INFLUENCE RIPARIAN AREA:  
SPECIES OBSERVED:  
POOL ATTRIBUTES  
    % area in pools:  
    % pool area made up of pools > 2' deep:  
AQUATIC VEGETATION  
    % streambed with filamentous algae:  
    % stream margin with rooted aquatic:  
BANK TYPE & VEGETATION OVERHANG  
    % bank length undercut (<90°):  
    % bank length gently sloping (>135°):  
    % bank length with overhanging vegetation:  
BANK CONDITION (bankfull area only)  
    % bank length vegetated, stable:  
    % bank length unvegetated, stable:  
    % bank length vegetated, unstable:  
    % bank length unvegetated, unstable:  
NOTES:  
QUANTITATIVE DATA SUMMARY:  
PHOTOGRAPHIC DOCUMENTATION:

the entire stream, its riparian communities, plus an additional 10 ft on each side of the stream to record the adjacent upland communities. Monitoring the total extent of the riparian plant communities including some upland community data should provide information about possible increases or decreases in the riparian communities relative to the adjacent upland communities.

Once the transects were placed, the line-intercept method was employed to measure the extent of each major riparian plant community. The plant communities have been named by the dominant two plant species. If only one species dominated the community by a wide margin, the plant community was named by this single species. When appropriate, community data have been separated on the right and left side of the creek – these references mean “river-left” and “river-right”, *as characterized by looking downstream*. Because there were no well defined creek channels within the transect lines of the springs, the riparian/wetland vegetation data were not separated in this manner. Finally, each sample site was numbered sequentially and by the hydrologic type. For example, **Q01C** refers to the creek name (Quitcupah), station number (01), hydrologic type (channel). Accordingly, **Q02S** is a spring site rather than a creek channel.

## Results

A map showing the sample station locations is shown on the following page. Sample results are shown for each site on the data sheets provided in this report. Each sheet includes qualitative and quantitative data recorded as well as photographic documentation.



# SECTION 1

## RIPARIAN COMPLEX DATA SHEETS

for the

AUGUST 2012  
SAMPLE PERIOD



RIPARIAN COMPLEX DATA SHEET

August 2012

CLIENT: *Canyon Fuel Company, SUFCO Mine*

SAMPLE NUMBER: *Q01C*

WATERBODY NAME: *South Fork Quitchupah Creek*

LOCATION: *Southern Wasatch Plateau, Utah*

DATE: *August 8-9, 2012*

OBSERVER(S): *P. Collins*

USGS QUAD 7.5 MINUTE MAP: *Acord Lakes, Utah*

GEOLOGIC PARENT MATERIAL: *Price River Formation*

STREAM ASPECT: *East (120°)*

STREAM GRADIENT: *1-2°*

ELEVATION: *8,335 ft*

SIZE OF COMPLEX: *(see quantitative data)*

ADJACENT UPLAND VEGETATION (looking downstream)

Left: *Snowberry/Sagebrush/Grass* Right: *Aspen*

VEGETATIVE DESCRIPTION (Dominance by Community Types)

Community Name	% of Complex
<i>(refer to quantitative data results for this information)</i>	

COMMUNITY SUCCESSIONAL STAGE: *Mid (tree saplings present)*

APPARENT FORAGE TREND: *Stable*

ESTIMATED FORAGE PRODUCTION: *600 lbs/acre*

BEAVER ACTIVITY: *no*

EROSION RATING (1=negligible; 2=slight; 3=moderate; 4=slight; 5=extreme): *3*

PHOTOGRAPH TAKEN: *Yes*

LAND USE ACTIVITIES THAT COULD INFLUENCE RIPARIAN AREA: *Mining, grazing, hunting, cattle, wildlife and recreation.*

SPECIES OBSERVED:

Trees	Shrubs	Forbs	Grasses (or grasslike)
<i>Populus tremuloides</i>	<i>Artemisia tridentata</i>	<i>Achillea millefolium</i>	<i>Juncus arcticus</i>
<i>Salix boothii</i>	<i>Rosa woodsii</i>	<i>Taraxacum officinale</i>	<i>Juncus longistylis</i>
	<i>Symphoricarpos oreophilus</i>		<i>Poa pratensis</i>

POOL ATTRIBUTES

% area in pools: *0*

% pool area made up of pools > 2' deep: *0*

AQUATIC VEGETATION

% streambed with filamentous algae: *50 (left)*

% stream margin with rooted aquatic: *25 (short Booth's willow)*

BANK TYPE & VEGETATION OVERHANG

% bank length undercut (<90°): *0*

% bank length gently sloping (>135°): *0*

% bank length with overhanging vegetation: *0*

BANK CONDITION

% bank length vegetated, stable: *85*

% bank length unvegetated, stable: *5*

% bank length vegetated, unstable: *5*

% bank length unvegetated, unstable: *5*

NOTES:

*1) A stream channel sample area.*

*2) This is a good creek channel monitoring site. It is outside the cattle trail and readily monitored.*

*3) Probably a good "control" site (outside the subsidence zone).*

## DATA SUMMARY

### **Q01C: Cover by plant community types in the South Fork Quitchupah Creek drainage (August 2012).**

<b>USDA Forest Service Protocol (1992)</b>			
	LEFT	RIGHT	TOTALS
<b>UPLAND VEGETATION</b>			
<i>Symphoricarpos oreophilus/Artemisia tridentata/Poa pratensis</i>	10.00		
<i>Poa pratensis/Taraxacum officinale</i>		10.00	20.00
<b>RIPARIAN VEGETATION</b>			
<u>Dominant Woody Species</u>			
<i>Salix boothii</i>	0.50		
<u>Dominant Herbaceous Species</u>			
<i>Juncus arcticus/Juncus longistylis</i>	3.00		
<i>Carex nebrascensis/Juncus arcticus</i>		5.00	8.50
<b>TOTAL COVER (Upland Species)</b>			20.00
<b>TOTAL COVER (Riparian Species)</b>			8.50
<b>ROCK (channel)</b>			0.00
<b>WATER (channel)</b>			1.50
<b>BAREGROUND (channel)</b>			0.00
<b>LITTER</b>			0.00
<b>MOSS</b>			0.00
<b>TOTAL COVER</b>			<b>30.00</b>

## PHOTOGRAPHIC DOCUMENTATION



Q01C

**RIPARIAN COMPLEX DATA SHEET**

**August 2012**

CLIENT: *Canyon Fuel Company, SUFCO Mine*

SAMPLE NUMBER: **Q025**

WATERBODY NAME: *South Fork Quitchupah Creek*

LOCATION: *Southern Wasatch Plateau, Utah*

DATE: *August 8-9, 2012*

OBSERVER(S): *P. Collins*

USGS QUAD 7.5 MINUTE MAP: *Acord Lakes, Utah*

GEOLOGIC PARENT MATERIAL: *Price River Formation*

STREAM ASPECT: *E; Flow is NE (50°)*

STREAM GRADIENT: *1-2°*

ELEVATION: *8,330 ft*

SIZE OF COMPLEX: *(see quantitative data)*

ADJACENT UPLAND VEGETATION (looking downstream)

Left: *Aspen*

Right: *Aspen*

VEGETATIVE DESCRIPTION (Dominance by Community Types)

Community Name	% of Complex
<i>(refer to quantitative data results for this information)</i>	

COMMUNITY SUCCESSIONAL STAGE: *Mid*

APPARENT FORAGE TREND: *Decreasing (ground cover was mud and vegetation)*

ESTIMATED FORAGE PRODUCTION: *300 lbs/acre*

BEAVER ACTIVITY: *no*

EROSION RATING (1=negligible; 2=slight; 3=moderate; 4=slight; 5=extreme): **2**

PHOTOGRAPH TAKEN: *Yes*

LAND USE ACTIVITIES THAT COULD INFLUENCE RIPARIAN AREA: *Mining, grazing (cattle & wildlife), hunting, recreation.*

SPECIES OBSERVED:

Trees	Shrubs	Forbs	Grasses (or grasslike)
<i>Picea pungens</i>	<i>Ribes sp.</i>	<i>Achillea millefolium</i>	<i>Agrostis stolonifera</i>
<i>Populus tremuloides</i>	<i>Symphoricarpos oreophilus</i>	<i>Equisetum arvense</i>	<i>Carex nebrascensis</i>
		<i>Ranunculus cymbalaria</i>	<i>Poa pratensis</i>
		<i>Taraxacum officinale</i>	

POOL ATTRIBUTES

% area in pools: *50*  
 % pool area made up of pools > 2' deep: *0*

AQUATIC VEGETATION

% streambed with filamentous algae: *0*  
 % stream margin with rooted aquatic: *0*

BANK TYPE & VEGETATION OVERHANG

% bank length undercut (<90°): *0*  
 % bank length gently sloping (>135°): *100*  
 % bank length with overhanging vegetation: *0*

BANK CONDITION

% bank length vegetated, stable: *35*  
 % bank length unvegetated, stable: *75*  
 % bank length vegetated, unstable: *30*  
 % bank length unvegetated, unstable: *20*

NOTES:

- 1) *This is a spring area.*
- 2) *Cattle hoof-prints were common in the vegetation here thus decreasing the living cover.*
- 3) *Probably a good "control" site (outside the subsidence zone).*

## DATA SUMMARY

### **Q02S: Cover by plant community types in the South Fork Quitchupah Creek drainage (August 2012).**

<b>USDA Forest Service Protocol (1992)</b>			
	LEFT	RIGHT	TOTALS
<b>UPLAND VEGETATION</b>			
<i>Poa pratensis</i> / <i>Achillea millefolium</i>	10.00		
<i>Geranium richardsonii</i> / <i>Poa pratensis</i>		10.00	20.00
<b>RIPARIAN VEGETATION</b>			
<u>Dominant Woody Species</u>			
<u>Dominant Herbaceous Species</u>			
<i>Carex nebrascensis</i> / <i>Agrostis stolonifera</i> / <i>Ranunculus cymbalaria</i>			13.00
<b>TOTAL COVER (Upland Species)</b>			20.00
<b>TOTAL COVER (Riparian Species)</b>			13.00
<b>ROCK (channel)</b>			0.00
<b>WATER (channel)</b>			0.00
<b>BAREGROUND (channel)</b>			0.00
<b>LITTER</b>			0.00
<b>MOSS</b>			0.00
<b>TOTAL COVER</b>			<b>33.00</b>

## PHOTOGRAPHIC DOCUMENTATION



Q02S

**RIPARIAN COMPLEX DATA SHEET**

**August 2012**

CLIENT: *Canyon Fuel Company, SUFCO Mine*

SAMPLE NUMBER: **Q03C**

WATERBODY NAME: *South Fork Quitchupah Creek*

LOCATION: *Southern Wasatch Plateau, Utah*

DATE: *August 8-9, 2012*

OBSERVER(S): *P. Collins*

USGS QUAD 7.5 MINUTE MAP: *Acord Lakes, Utah*

GEOLOGIC PARENT MATERIAL: *Price River Formation*

STREAM ASPECT: *E (90°)*

STREAM GRADIENT: *1-2°*

ELEVATION: *8,310 ft*

SIZE OF COMPLEX: *(see quantitative data)*

ADJACENT UPLAND VEGETATION (looking downstream)

Left: *Sagebrush/Grass*

Right: *Aspen*

VEGETATIVE DESCRIPTION (Dominance by Community Types)

Community Name	% of Complex
<i>(refer to quantitative data results for this information)</i>	

COMMUNITY SUCCESSIONAL STAGE: *Mid- (tree saplings present)*

APPARENT FORAGE TREND: *Stable*

ESTIMATED FORAGE PRODUCTION: *850 lbs/acre*

BEAVER ACTIVITY: *no*

EROSION RATING (1=negligible; 2=slight; 3=moderate; 4=slight; 5=extreme): **3**

PHOTOGRAPH TAKEN: *Yes*

LAND USE ACTIVITIES THAT COULD INFLUENCE RIPARIAN AREA: *Mining, grazing (cattle & wildlife), hunting, recreation.*

SPECIES OBSERVED:

Trees	Shrubs	Forbs	Grasses (or grasslike)
<i>Populus tremuloides</i>	<i>Artemisia tridentata</i>	<i>Aster sp.</i>	<i>Agrostis stolonifera</i>
	<i>Rosa woodsii</i>	<i>Equisetum arvense</i>	<i>Juncus arcticus</i>
	<i>Salix boothii</i>	<i>Taraxacum officinale</i>	<i>Juncus longistylis</i>

POOL ATTRIBUTES

% area in pools: *0*  
 % pool area made up of pools > 2' deep: *0*

AQUATIC VEGETATION

% streambed with filamentous algae: *0*  
 % stream margin with rooted aquatic: *0*

BANK TYPE & VEGETATION OVERHANG

% bank length undercut (<90°): *50 on rt side; lf side vertical*  
 % bank length gently sloping (>135°): *0*  
 % bank length with overhanging vegetation: *0*

BANK CONDITION

% bank length vegetated, stable: *90*  
 % bank length unvegetated, stable: *2.5*  
 % bank length vegetated, unstable: *2.5*  
 % bank length unvegetated, unstable: *5.0*

NOTES:

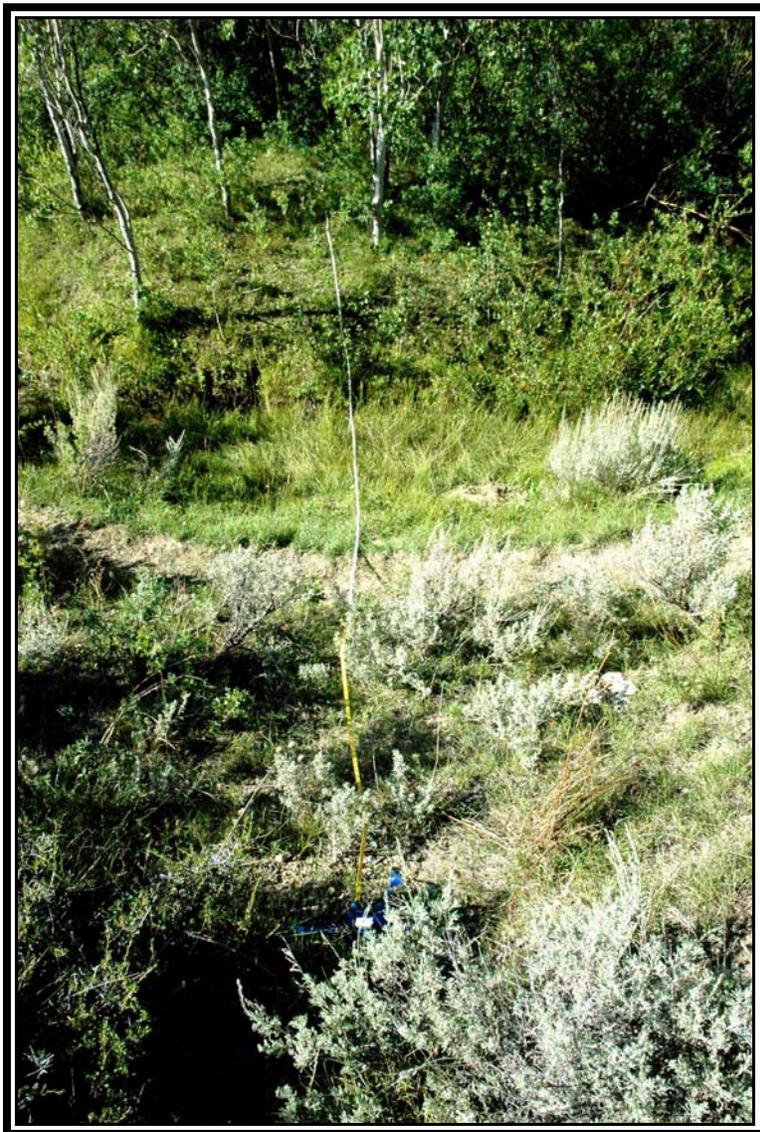
- 1) *This is a channel area.*
- 2) *A good control station; outside current subsidence plans.*
- 3) *It seems like a sample was needed here, but this may be more difficult to monitor as accurately due to the topography. The narrow channel sites are more straight-forward to monitor than this type of area.*
- 4) *Interestingly, the adjacent aspen understory (that was considered upland) had more wiregrass present. This may be a function of the shade prolonging snowmelt.*
- 5) *This wiregrass area should be noted during each sample period.*

## DATA SUMMARY

### Q03C: Cover by plant community types in the South Fork Quitchupah Creek drainage (August 2012).

<b>USDA Forest Service Protocol (1992)</b>			
	LEFT	RIGHT	TOTALS
<b>UPLAND VEGETATION</b>			
<i>Artemisia tridentata/Elymus salinus</i>	10.00		
<i>Populus tremuloides/Juncus arcticus</i>		10.00	
			20.00
<b>RIPARIAN VEGETATION</b>			
<u>Dominant Woody Species</u>			
<u>Dominant Herbaceous Species</u>			
<i>Juncus arcticus</i>	8.00		
<i>Juncus arcticus/Equisetum arvense</i>		7.00	
			15.00
<b>TOTAL COVER (Upland Species)</b>			20.00
<b>TOTAL COVER (Riparian Species)</b>			15.00
<b>ROCK (channel)</b>			0.00
<b>WATER (channel)</b>			2.00
<b>BAREGROUND (channel)</b>			0.00
<b>LITTER</b>			0.00
<b>MOSS</b>			0.00
<b>TOTAL COVER</b>			<b>37.00</b>

## PHOTOGRAPHIC DOCUMENTATION



Q03C

**RIPARIAN COMPLEX DATA SHEET**

**August 2012**

CLIENT: *Canyon Fuel Company, SUFCO Mine*

SAMPLE NUMBER: *Q045*

WATERBODY NAME: *South Fork Quitchupah Creek*

LOCATION: *Southern Wasatch Plateau, Utah*

DATE: *August 8-9, 2012*

OBSERVER(S): *P. Collins*

USGS QUAD 7.5 MINUTE MAP: *Acord Lakes, Utah*

GEOLOGIC PARENT MATERIAL: *Price River Formation*

STREAM ASPECT: *E [but flow here was N (340°)]*

STREAM GRADIENT: *1-2°*

ELEVATION: *8,310 ft*

SIZE OF COMPLEX: *(see quantitative data)*

ADJACENT UPLAND VEGETATION (looking downstream)

Left: *Aspen*

Right: *Aspen/Blue Spruce/Willow*

VEGETATIVE DESCRIPTION (Dominance by Community Types)

Community Name	% of Complex
<i>(refer to quantitative data results for this information)</i>	

COMMUNITY SUCCESSIONAL STAGE: *Late*

APPARENT FORAGE TREND: *Stable*

ESTIMATED FORAGE PRODUCTION: *700 lbs/acre*

BEAVER ACTIVITY: *no*

EROSION RATING (1=negligible; 2=slight; 3=moderate; 4=slight; 5=extreme): **3**

PHOTOGRAPH TAKEN: *Yes*

LAND USE ACTIVITIES THAT COULD INFLUENCE RIPARIAN AREA: *Mining, grazing (cattle & wildlife), hunting, recreation.*

SPECIES OBSERVED:

Trees	Shrubs	Forbs	Grasses (or grasslike)
<i>Picea pungens</i>	<i>Rosa woodsii</i>	<i>Achillea millefolium</i>	<i>Eleocharis palustris</i>
<i>Populus tremuloides</i>	<i>Salix boothii</i>	<i>Equisetum arvense</i>	<i>Hordeum jubatum</i>
		<i>Geranium richardsonii</i>	<i>Juncus arcticus</i>
			<i>Juncus longistylis</i>
			<i>Poa pratensis</i>

POOL ATTRIBUTES

% area in pools: *100*  
 % pool area made up of pools > 2' deep: *0*

AQUATIC VEGETATION

% streambed with filamentous algae: *0*  
 % stream margin with rooted aquatic: *0*

BANK TYPE & VEGETATION OVERHANG

% bank length undercut (<90°):  
 % bank length gently sloping (>135°): *100*  
 % bank length with overhanging vegetation: *50*

BANK CONDITION

% bank length vegetated, stable: *70*  
 % bank length unvegetated, stable: *0*  
 % bank length vegetated, unstable: *20*  
 % bank length unvegetated, unstable: *10*

NOTES:

- 1) *This is a spring area.*
- 2) *A good control station; outside current subsidence plans.*
- 3) *This spring has a narrow band of water at this sample period, but it is obviously influenced by more water other times as suggested by the lateral extent of the riparian/wetland vegetation and wet soils.*
- 4) *The spring site had several zones of vegetation based on the different water regimes.*
- 5) *Nebraska sedge and spike rush zones seemed to be the wettest areas with a width of 14 ft.*
- 6) *There was a lot of impact from cattle trampling here.*

## DATA SUMMARY

### **Q04S: Cover by plant community types in the South Fork Quitchupah Creek drainage (August 2012).**

<b>USDA Forest Service Protocol (1992)</b>			
	LEFT	RIGHT	TOTALS
<b>UPLAND VEGETATION</b>			
<i>Symphoricarpos oreophilus/Populus tremuloides</i>	10.00		
<i>Picea pungens/Salix boothii</i>		10.00	
			20.00
<b>RIPARIAN VEGETATION</b>			
<u>Dominant Woody Species</u>			
<u>Dominant Herbaceous Species</u>			
<i>Carex nebrascensis/Hordeum jubatum</i>			7.00
<i>Eleocharis palustris/Ranunculus cymbalaria</i>			8.00
<i>Eleocharis palustris/Agrostis stolonifera</i>			11.00
<b>TOTAL COVER (Upland Species)</b>			20.00
<b>TOTAL COVER (Riparian Species)</b>			26.00
<b>ROCK (channel)</b>			0.00
<b>WATER (channel)</b>			0.00
<b>BAREGROUND (channel)</b>			0.00
<b>LITTER</b>			0.00
<b>MOSS</b>			0.00
<b>TOTAL COVER</b>			<b>46.00</b>

## PHOTOGRAPHIC DOCUMENTATION



Q04S

**RIPARIAN COMPLEX DATA SHEET**

**August 2012**

CLIENT: *Canyon Fuel Company, SUFCO Mine*

SAMPLE NUMBER: **Q055**

WATERBODY NAME: *South Fork Quitchupah Creek*

LOCATION: *Southern Wasatch Plateau, Utah*

DATE: *August 8-9, 2012*

OBSERVER(S): *P. Collins*

USGS QUAD 7.5 MINUTE MAP: *Acord Lakes, Utah*

GEOLOGIC PARENT MATERIAL: *Price River Formation*

STREAM ASPECT: *E; flow here was 30°*

STREAM GRADIENT: *1-2°*

ELEVATION: *8,294 ft*

SIZE OF COMPLEX: *(see quantitative data)*

ADJACENT UPLAND VEGETATION (looking downstream)

Left: *Blue Spruce/Willow*

Right: *Blue Spruce/Aspen*

VEGETATIVE DESCRIPTION (Dominance by Community Types)

Community Name	% of Complex
<i>(refer to quantitative data results for this information)</i>	

COMMUNITY SUCCESSIONAL STAGE: *Late*

APPARENT FORAGE TREND: *Stable*

ESTIMATED FORAGE PRODUCTION: *800 lbs/acre*

BEAVER ACTIVITY: *no*

EROSION RATING (1=negligible; 2=slight; 3=moderate; 4=slight; 5=extreme): *3 (due to cattle)*

PHOTOGRAPH TAKEN: *Yes*

LAND USE ACTIVITIES THAT COULD INFLUENCE RIPARIAN AREA: *Mining, grazing (cattle & wildlife), hunting, recreation.*

SPECIES OBSERVED:

Trees	Shrubs	Forbs	Grasses (or grasslike)
<i>Picea pungens</i>	<i>Salix boothii</i>	<i>Equisetum arvense</i>	<i>Agrostis stolonifera</i>
<i>Pinus flexilis</i>	<i>Symphoricarpos oreophilus</i>	<i>Geranium richardsonii</i>	<i>Carex nebrascensis</i>
<i>Populus tremuloides</i>		<i>Ranunculus cymbalaria</i>	

POOL ATTRIBUTES

% area in pools: *100*  
 % pool area made up of pools > 2' deep: *0*

AQUATIC VEGETATION

% streambed with filamentous algae: *0*  
 % stream margin with rooted aquatic: *0*

BANK TYPE & VEGETATION OVERHANG

% bank length undercut (<90°): *0*  
 % bank length gently sloping (>135°): *100*  
 % bank length with overhanging vegetation: *20*

BANK CONDITION

% bank length vegetated, stable: *60*  
 % bank length unvegetated, stable: *0*  
 % bank length vegetated, unstable: *20 (cattle impacts)*  
 % bank length unvegetated, unstable: *20*

NOTES:

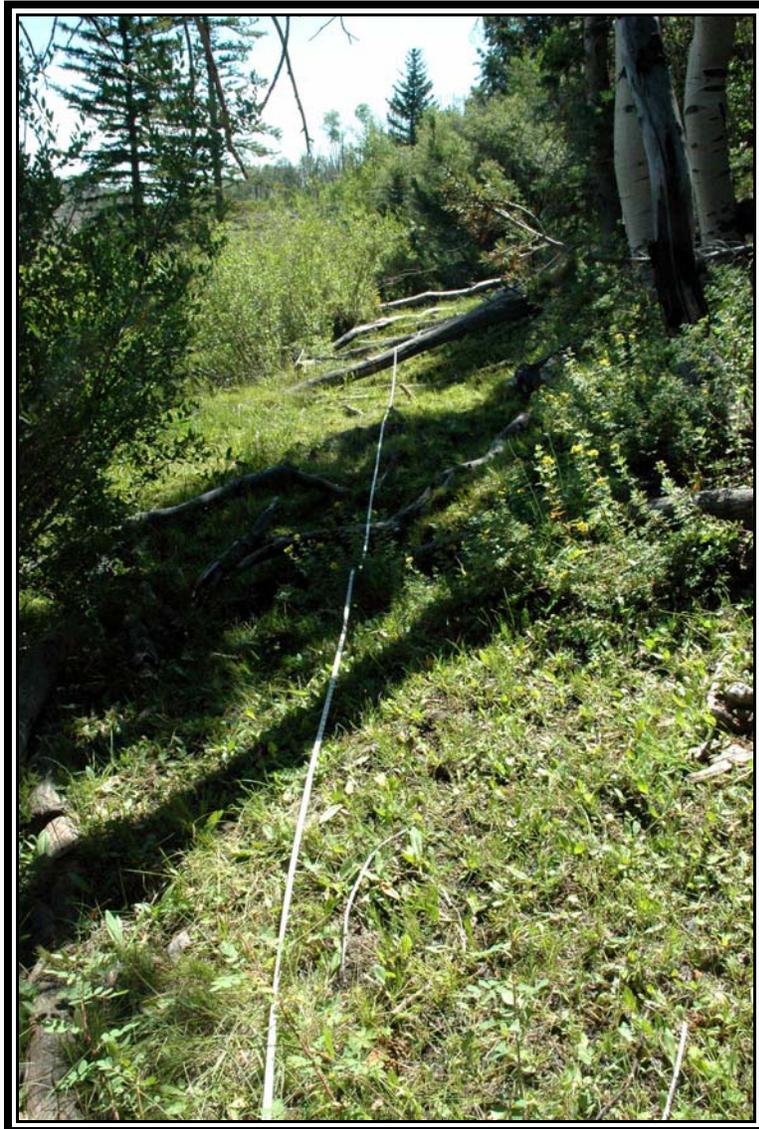
- 1) *This is a well-defined spring area.*
- 2) *A good control station; it is just outside current subsidence plans.*
- 3) *When the transect tape was placed, it formed a "U" shape to measure. This tape was placed 4 ft from the upland bank for 73 ft of riparian/spring vegetation.*
- 4) *About 50% of the transect tape length had water present, the remainder was wet and muddy.*
- 5) *There was a lot of impact from cattle trampling here.*

## DATA SUMMARY

### **Q05S: Cover by plant community types in the South Fork Quitchupah Creek drainage (August 2012).**

<b>USDA Forest Service Protocol (1992)</b>			
	LEFT	RIGHT	TOTALS
<b>UPLAND VEGETATION</b>			
<i>Salix boothii/Picea pungens</i>	10.00		
<i>Picea pungens/Populus tremuloides</i>		10.00	
			20.00
<b>RIPARIAN VEGETATION</b>			
<u>Dominant Woody Species</u>			
<u>Dominant Herbaceous Species</u>			
<i>Carex nebrascensis/Agrostis stolonifera/Ranunculus cymbalaria</i>			73.00
<b>TOTAL COVER (Upland Species)</b>			20.00
<b>TOTAL COVER (Riparian Species)</b>			73.00
<b>ROCK (channel)</b>			0.00
<b>WATER (channel)</b>			0.00
<b>BAREGROUND (channel)</b>			0.00
<b>LITTER</b>			0.00
<b>MOSS</b>			0.00
<b>TOTAL COVER</b>			<b>93.00</b>

## PHOTOGRAPHIC DOCUMENTATION



Q05S

**RIPARIAN COMPLEX DATA SHEET**

**August 2012**

CLIENT: *Canyon Fuel Company, SUFCO Mine*

SAMPLE NUMBER: **Q065**

WATERBODY NAME: *South Fork Quitchupah Creek*

LOCATION: *Southern Wasatch Plateau, Utah*

DATE: *August 8-9, 2012*

OBSERVER(S): *P. Collins*

USGS QUAD 7.5 MINUTE MAP: *Acord Lakes, Utah*

GEOLOGIC PARENT MATERIAL: *Price River Formation*

STREAM ASPECT: *E [but flow here was N (330°)]*

STREAM GRADIENT: *1-2°*

ELEVATION: *8,313 ft*

SIZE OF COMPLEX: *(see quantitative data)*

ADJACENT UPLAND VEGETATION (looking downstream)

Left: *Meadow*

Right: *Meadow*

VEGETATIVE DESCRIPTION (Dominance by Community Types)

Community Name	% of Complex
<i>(refer to quantitative data results for this information)</i>	

COMMUNITY SUCCESSIONAL STAGE: *Late*

APPARENT FORAGE TREND: *Stable*

ESTIMATED FORAGE PRODUCTION: *300 lbs/acre*

BEAVER ACTIVITY: *no*

EROSION RATING (1=negligible; 2=slight; 3=moderate; 4=slight; 5=extreme): **3** *(cattle impact)*

PHOTOGRAPH TAKEN: *Yes*

LAND USE ACTIVITIES THAT COULD INFLUENCE RIPARIAN AREA: *Mining, grazing (cattle & wildlife), hunting, recreation.*

SPECIES OBSERVED:

Trees	Shrubs	Forbs	Grasses (or grasslike)
<i>Populus tremuloides</i>	<i>Ribes sp</i>	<i>Equisetum arvense</i>	<i>Agrostis stolonifera</i>
	<i>Salix boothii</i>	<i>Taraxacum officinale</i>	<i>Poa pratensis</i>

POOL ATTRIBUTES

% area in pools: *100*  
 % pool area made up of pools > 2' deep: *0*

AQUATIC VEGETATION

% streambed with filamentous algae: *0*  
 % stream margin with rooted aquatic: *0*

BANK TYPE & VEGETATION OVERHANG

% bank length undercut (<90°): *0*  
 % bank length gently sloping (>135°): *100*  
 % bank length with overhanging vegetation: *25*

BANK CONDITION

% bank length vegetated, stable: *25*  
 % bank length unvegetated, stable: *0*  
 % bank length vegetated, unstable: *30 (cattle impacts)*  
 % bank length unvegetated, unstable: *45*

NOTES:

- 1) *Only measured obvious, well-defined spring area.*
- 2) *Left side measured to bank (3 ft).*
- 3) *Sample station was located within current planned subsidence zone.*

## DATA SUMMARY

### **Q06S: Cover by plant community types in the South Fork Quitchupah Creek drainage (August 2012).**

<b>USDA Forest Service Protocol (1992)</b>			
	LEFT	RIGHT	TOTALS
<b>UPLAND VEGETATION</b>			
<i>Populus tremuloides/Salix boothii</i>	3.00		
<i>Symphoricarpos oreophilus/Grasses</i>		9.00	12.00
<b>RIPARIAN VEGETATION</b>			
<u>Dominant Woody Species</u>			
<u>Dominant Herbaceous Species</u>			
<i>Agrostis stolonifera</i>			8.00
<b>TOTAL COVER (Upland Species)</b>			12.00
<b>TOTAL COVER (Riparian Species)</b>			8.00
<b>ROCK (channel)</b>			0.00
<b>WATER (channel)</b>			0.00
<b>BAREGROUND (channel)</b>			0.00
<b>LITTER</b>			0.00
<b>MOSS</b>			0.00
<b>TOTAL COVER</b>			<b>20.00</b>

## PHOTOGRAPHIC DOCUMENTATION



Q06S

**RIPARIAN COMPLEX DATA SHEET**

**August 2012**

CLIENT: *Canyon Fuel Company, SUFCO Mine*

SAMPLE NUMBER: **Q07C**

WATERBODY NAME: *South Fork Quitchupah Creek*

LOCATION: *Southern Wasatch Plateau, Utah*

DATE: *August 8-9, 2012*

OBSERVER(S): *P. Collins*

USGS QUAD 7.5 MINUTE MAP: *Acord Lakes, Utah*

GEOLOGIC PARENT MATERIAL: *Price River Formation*

STREAM ASPECT: *E [but flow here was N (5°)]*

STREAM GRADIENT: *2-3°*

ELEVATION: *8,285 ft*

SIZE OF COMPLEX: *(see quantitative data)*

ADJACENT UPLAND VEGETATION (looking downstream)

Left: *Meadow*

Right: *Meadow*

VEGETATIVE DESCRIPTION (Dominance by Community Types)

Community Name	% of Complex
<i>(refer to quantitative data results for this information)</i>	

COMMUNITY SUCCESSIONAL STAGE: *Mid-*

APPARENT FORAGE TREND: *Stable*

ESTIMATED FORAGE PRODUCTION: *1,000 lbs/acre*

BEAVER ACTIVITY: *no*

EROSION RATING (1=negligible; 2=slight; 3=moderate; 4=slight; 5=extreme): *1*

PHOTOGRAPH TAKEN: *Yes*

LAND USE ACTIVITIES THAT COULD INFLUENCE RIPARIAN AREA: *Mining, grazing (cattle & wildlife), hunting, recreation.*

SPECIES OBSERVED:

Trees	Shrubs	Forbs	Grasses (or grasslike)
	<i>Rosa woodsii</i>		<i>Agrostis stolonifera</i>
	<i>Salix boothii</i>		<i>Carex nebrascensis</i>
			<i>Hordeum jubatum</i>
			<i>Poa pratensis</i>

POOL ATTRIBUTES

% area in pools: *0*  
 % pool area made up of pools > 2' deep: *0*

AQUATIC VEGETATION

% streambed with filamentous algae: *0*  
 % stream margin with rooted aquatic: *0*

BANK TYPE & VEGETATION OVERHANG

% bank length undercut (<90°): *50 (rt side)*  
 % bank length gently sloping (>135°): *100 incised (18") channel*  
 % bank length with overhanging vegetation:

BANK CONDITION

% bank length vegetated, stable: *95*  
 % bank length unvegetated, stable: *7*  
 % bank length vegetated, unstable: *2*  
 % bank length unvegetated, unstable: *2*

NOTES:

- 1) *This site is in the middle of a meadow.*
- 2) *Right side: the upland area was obvious as seen by upland vegetation. It was mostly dominated by Poa pratensis (although this is now considered a facultative wetland species). On this side the riparian community was measured where Carex nebrascensis began.*
- 3) *Left side: the riparian community was measured beginning in the meadow (where the stake would be easily found later) and ended at the channel bank. The entire meadow, however, had some wetland species. In this meadow there were patches that were dominated by Hordeum jubatum.*
- 4) *This site is within the current planned subsidence zone.*

## DATA SUMMARY

### **Q07C: Cover by plant community types in the South Fork Quitchupah Creek drainage (August 2012).**

<b>USDA Forest Service Protocol (1992)</b>			
	LEFT	RIGHT	TOTALS
<b>UPLAND VEGETATION</b>	10.00		
<i>Poa pratensis/Achillea millefolium</i>		10.00	
<i>Poa pratensis/Achillea millefolium</i>			20.00
<b>RIPARIAN VEGETATION</b>			
<u>Dominant Woody Species</u>			
<i>Rosa woodsii</i>	7.00		
<u>Dominant Herbaceous Species</u>			
<i>Carex nebrascensis</i>	8.00	10.50	
<i>Carex nebrascensis/Hordeum jubatum</i>	8.00		
			33.50
<b>TOTAL COVER (Upland Species)</b>			20.00
<b>TOTAL COVER (Riparian Species)</b>			33.50
<b>ROCK (channel)</b>			0.00
<b>WATER (channel)</b>			1.50
<b>BAREGROUND (channel)</b>			0.00
<b>LITTER</b>			0.00
<b>MOSS</b>			0.00
<b>TOTAL COVER</b>			<b>55.00</b>

## PHOTOGRAPHIC DOCUMENTATION



Q07C

**RIPARIAN COMPLEX DATA SHEET**

**August 2012**

CLIENT: *Canyon Fuel Company, SUFCO Mine*

SAMPLE NUMBER: *Q08C*

WATERBODY NAME: *South Fork Quitchupah Creek*

LOCATION: *Southern Wasatch Plateau, Utah*

DATE: *August 8-9, 2012*

OBSERVER(S): *P. Collins*

USGS QUAD 7.5 MINUTE MAP: *Acord Lakes, Utah*

GEOLOGIC PARENT MATERIAL: *Price River Formation*

STREAM ASPECT: *E (flow here was 140°)*

STREAM GRADIENT: *2-3°*

ELEVATION: *8,253 ft*

SIZE OF COMPLEX: *(see quantitative data)*

ADJACENT UPLAND VEGETATION (looking downstream)

Left: *Sagebrush/Grass*

Right: *Aspen/Snowberry*

VEGETATIVE DESCRIPTION (Dominance by Community Types)

Community Name	% of Complex
<i>(refer to quantitative data results for this information)</i>	

COMMUNITY SUCCESSIONAL STAGE: *Mid-*

APPARENT FORAGE TREND: *Stable*

ESTIMATED FORAGE PRODUCTION: *1,000 lbs/acre*

BEAVER ACTIVITY: *no*

EROSION RATING (1=negligible; 2=slight; 3=moderate; 4=slight; 5=extreme): *1*

PHOTOGRAPH TAKEN: *Yes*

LAND USE ACTIVITIES THAT COULD INFLUENCE RIPARIAN AREA: *Mining, grazing (cattle & wildlife), hunting, recreation.*

SPECIES OBSERVED:

Trees	Shrubs	Forbs	Grasses (or grasslike)
<i>Populus tremuloides</i>	<i>Artemisia tridentata</i>	<i>Trifolium sp.</i>	<i>Agrostis stolonifera</i>
	<i>Salix boothii</i>		<i>Carex nebrascensis</i>
			<i>Juncus arcticus</i>

POOL ATTRIBUTES

% area in pools: *0*  
 % pool area made up of pools > 2' deep: *0*

AQUATIC VEGETATION

% streambed with filamentous algae: *0*  
 % stream margin with rooted aquatic: *0*

BANK TYPE & VEGETATION OVERHANG

% bank length undercut (<90°): *0*  
 % bank length gently sloping (>135°): *100 but above the incised (18") channel; vertical from water to bank with no undercutting.*  
 % bank length with overhanging vegetation:

BANK CONDITION

% bank length vegetated, stable: *95*  
 % bank length unvegetated, stable: *7*  
 % bank length vegetated, unstable: *0*  
 % bank length unvegetated, unstable: *4*

NOTES:

- 1) This site had a straightforward area to monitor the riparian zone. The station went from low water to a low terrace, then a high terrace and finally to the aspen forest.*
- 2) This site is within the current planned subsidence zone.*

## DATA SUMMARY

### Q08C: Cover by plant community types in the South Fork Quitchupah Creek drainage (August 2012).

<b>USDA Forest Service Protocol (1992)</b>			
	LEFT	RIGHT	TOTALS
<b>UPLAND VEGETATION</b>			
<i>Artemisia tridentata/Grasses</i>	10.00		
<i>Populus tremuloides/Symphoricarpos oreophilus</i>		10.00	
			20.00
<b>RIPARIAN VEGETATION</b>			
<u>Dominant Woody Species</u>			
<i>Rosa woodsii</i>			
<u>Dominant Herbaceous Species</u>			
<i>Carex nebrascensis</i>	6.00	15.00	
<i>Juncus arcticus</i>	2.00		
			23.00
<b>TOTAL COVER (Upland Species)</b>			20.00
<b>TOTAL COVER (Riparian Species)</b>			23.00
<b>ROCK (channel)</b>			0.00
<b>WATER (channel)</b>			1.00
<b>BAREGROUND (channel)</b>			0.00
<b>LITTER</b>			0.00
<b>MOSS</b>			0.00
<b>TOTAL COVER</b>			<b>44.00</b>

## PHOTOGRAPHIC DOCUMENTATION



Q08C

**RIPARIAN COMPLEX DATA SHEET**  
**August 2012**

CLIENT: *Canyon Fuel Company, SUFCO Mine*

SAMPLE NUMBER: **Q09C**

WATERBODY NAME: *South Fork Quitchupah Creek*

LOCATION: *Southern Wasatch Plateau, Utah*

DATE: *August 8-9, 2012*

OBSERVER(S): *P. Collins*

USGS QUAD 7.5 MINUTE MAP: *Acord Lakes, Utah*

GEOLOGIC PARENT MATERIAL: *Near the contact between the Price River Formation and the Castlegate Sandstone*

STREAM ASPECT: *E*

STREAM GRADIENT: *2-3°*

ELEVATION: *8,253 ft*

SIZE OF COMPLEX: *(see quantitative data)*

ADJACENT UPLAND VEGETATION (looking downstream)

Left: *Sagebrush/Grass*

Right: *Sagebrush/Grass*

VEGETATIVE DESCRIPTION (Dominance by Community Types)

Community Name	% of Complex
<i>(refer to quantitative data results for this information)</i>	

COMMUNITY SUCCESSIONAL STAGE: *Mid-*

APPARENT FORAGE TREND: *Stable*

ESTIMATED FORAGE PRODUCTION: *500 lbs/acre*

BEAVER ACTIVITY: *no*

EROSION RATING (1=negligible; 2=slight; 3=moderate; 4=slight; 5=extreme): *1*

PHOTOGRAPH TAKEN: *Yes*

LAND USE ACTIVITIES THAT COULD INFLUENCE RIPARIAN AREA: *Mining, grazing (cattle & wildlife), hunting, recreation.*

SPECIES OBSERVED:

Trees	Shrubs	Forbs	Grasses (or grasslike)
	<i>Artemisia tridentata</i>	<i>Trifolium sp.</i>	<i>Agrostis stolonifera</i>
	<i>Rosa woodsii</i>		<i>Juncus arcticus</i>
	<i>Salix boothii</i>		<i>Poa pratensis</i>

POOL ATTRIBUTES

% area in pools: *0*  
 % pool area made up of pools > 2' deep: *0*

AQUATIC VEGETATION

% streambed with filamentous algae: *0*  
 % stream margin with rooted aquatic: *0*

BANK TYPE & VEGETATION OVERHANG

% bank length undercut (<90°): *100 on both sides of the channel.*  
 % bank length gently sloping (>135°): *100 but above the incised (24") channel.*  
 % bank length with overhanging vegetation: *Herbaceous*

BANK CONDITION

% bank length vegetated, stable: *90*  
 % bank length unvegetated, stable: *0*  
 % bank length vegetated, unstable: *2*  
 % bank length unvegetated, unstable: *3*

NOTES:

- 1) *This site had a straightforward area to monitor the riparian zone.*
- 2) *This site is within the current planned subsidence zone.*

## DATA SUMMARY

### Q09C: Cover by plant community types in the South Fork Quitchupah Creek drainage (August 2012).

<b>USDA Forest Service Protocol (1992)</b>			
	LEFT	RIGHT	TOTALS
<b>UPLAND VEGETATION</b>	9.00		
<i>Artemisia tridentata/Grasses</i>		10.00	
<i>Artemisia tridentata/Grasses</i>			19.00
<b>RIPARIAN VEGETATION</b>			
<u>Dominant Woody Species</u>			
<u>Dominant Herbaceous Species</u>			
<i>Carex nebrascensis/Agrostis stolonifera/Ranunculus cymbalaria</i>	13.00		
<i>Agrostis stolonifera</i>		2.00	
			15.00
<b>TOTAL COVER (Upland Species)</b>			19.00
<b>TOTAL COVER (Riparian Species)</b>			15.00
<b>ROCK (channel)</b>			0.00
<b>WATER (channel)</b>			2.00
<b>BAREGROUND (channel)</b>			0.00
<b>LITTER</b>			0.00
<b>MOSS</b>			0.00
<b>TOTAL COVER</b>			<b>36.00</b>

## PHOTOGRAPHIC DOCUMENTATION



Q09C

# SECTION 2

## RIPARIAN COMPLEX DATA SHEETS

for the

OCTOBER 2012  
SAMPLE PERIOD



**RIPARIAN COMPLEX DATA SHEET**

**October 2012**

CLIENT: *Canyon Fuel Company, SUFCO Mine*

SAMPLE NUMBER: *Q01C*

WATERBODY NAME: *South Fork Quitchupah Creek*

LOCATION: *Southern Wasatch Plateau, Utah*

DATE: *October 2, 2012*

OBSERVER(S): *P. Collins*

USGS QUAD 7.5 MINUTE MAP: *Acord Lakes, Utah*

GEOLOGIC PARENT MATERIAL: *Price River Formation*

STREAM ASPECT: *East (120°)*

STREAM GRADIENT: *1-2°*

ELEVATION: *8,335 ft*

SIZE OF COMPLEX: *(see quantitative data)*

ADJACENT UPLAND VEGETATION (looking downstream)

Left: *Snowberry/Sagebrush/Grass*                      Right: *Aspen*

VEGETATIVE DESCRIPTION (Dominance by Community Types)

Community Name	% of Complex
<i>(refer to quantitative data results for this information)</i>	

COMMUNITY SUCCESSIONAL STAGE: *Mid (tree saplings present)*

APPARENT FORAGE TREND: *Stable*

ESTIMATED FORAGE PRODUCTION: *600 lbs/acre*

BEAVER ACTIVITY: *no*

EROSION RATING (1=negligible; 2=slight; 3=moderate; 4=slight; 5=extreme): **3**

PHOTOGRAPH TAKEN: *Yes*

LAND USE ACTIVITIES THAT COULD INFLUENCE RIPARIAN AREA: *Mining, grazing, hunting, cattle, wildlife and recreation.*

SPECIES OBSERVED:

Trees	Shrubs	Forbs	Grasses (or grasslike)
<i>Populus tremuloides</i>	<i>Artemisia tridentata</i>	<i>Achillea millefolium</i>	<i>Juncus arcticus</i>
<i>Salix boothii</i>	<i>Rosa woodsii</i>	<i>Taraxacum officinale</i>	<i>Poa pratensis</i>
	<i>Symphoricarpos oreophilus</i>		

POOL ATTRIBUTES

% area in pools: *0*  
 % pool area made up of pools > 2' deep: *0*

AQUATIC VEGETATION

% streambed with filamentous algae: *50 (left)*  
 % stream margin with rooted aquatic: *0*

BANK TYPE & VEGETATION OVERHANG

% bank length undercut (<90°): *0*  
 % bank length gently sloping (>135°): *0*  
 % bank length with overhanging vegetation: *25 (short Booth's willows)*

BANK CONDITION

% bank length vegetated, stable: *90*  
 % bank length unvegetated, stable: *2.5*  
 % bank length vegetated, unstable: *2.5*  
 % bank length unvegetated, unstable: *5*

NOTES:

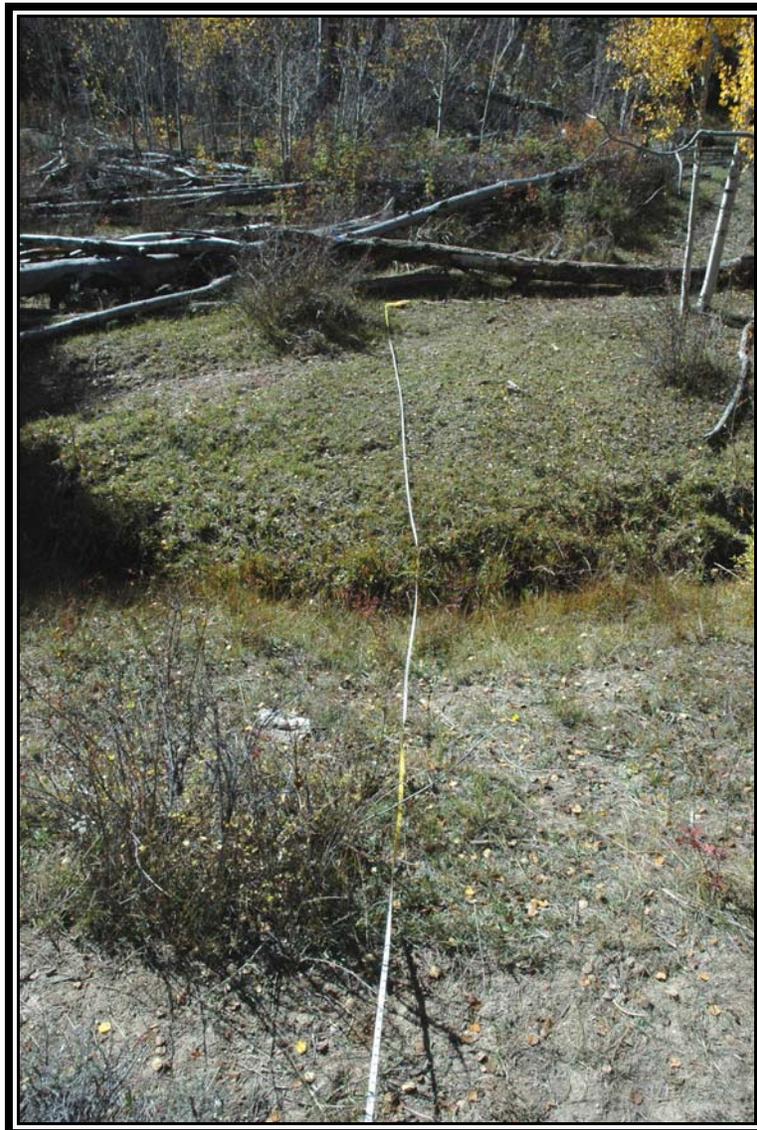
- 1) *A stream channel sample area.*
- 2) *This is a good creek channel monitoring site. It is outside the cattle trail and readily monitored.*
- 3) *Probably a good "control" site (outside the subsidence zone).*

## DATA SUMMARY

### Q01C: Cover by plant community types in the South Fork Quitchupah Creek drainage (October 2012).

<b>USDA Forest Service Protocol (1992)</b>			
	LEFT	RIGHT	TOTALS
<b>UPLAND VEGETATION</b>			
<i>Symphoricarpos oreophilus/Artemisia tridentata/Poa pratensis</i>	10.00		
<i>Poa pratensis/Taraxacum officinale</i>		10.00	20.00
<b>RIPARIAN VEGETATION</b>			
<u>Dominant Woody Species</u>			
<i>Salix boothii</i>	0.50		
<u>Dominant Herbaceous Species</u>			
<i>Juncus arcticus</i>	3.00		
<i>Carex nebrascensis/Agrostis stolonifera/Ranunculus cymbalaria</i>		5.00	8.50
<b>TOTAL COVER (Upland Species)</b>			20.00
<b>TOTAL COVER (Riparian Species)</b>			8.50
<b>ROCK (channel)</b>			0.00
<b>WATER (channel)</b>			1.50
<b>BAREGROUND (channel)</b>			0.00
<b>LITTER</b>			0.00
<b>MOSS</b>			0.00
<b>TOTAL COVER</b>			<b>30.00</b>

## PHOTOGRAPHIC DOCUMENTATION



Q01C

**RIPARIAN COMPLEX DATA SHEET**  
**October 2012**

CLIENT: *Canyon Fuel Company, SUFCO Mine*

SAMPLE NUMBER: **Q025**

WATERBODY NAME: *South Fork Quitchupah Creek*

LOCATION: *Southern Wasatch Plateau, Utah*

DATE: *October 2, 2012*

OBSERVER(S): *P. Collins*

USGS QUAD 7.5 MINUTE MAP: *Acord Lakes, Utah*

GEOLOGIC PARENT MATERIAL: *Price River Formation*

STREAM ASPECT: *E; Flow is NE (50°)*

STREAM GRADIENT: *1-2°*

ELEVATION: *8,330 ft*

SIZE OF COMPLEX: *(see quantitative data)*

ADJACENT UPLAND VEGETATION (looking downstream)

Left: *Aspen*

Right: *Aspen*

VEGETATIVE DESCRIPTION (Dominance by Community Types)

Community Name	% of Complex
<i>(refer to quantitative data results for this information)</i>	

COMMUNITY SUCCESSIONAL STAGE: *Mid*

APPARENT FORAGE TREND: *Decreasing (ground cover was mud and vegetation)*

ESTIMATED FORAGE PRODUCTION: *300 lbs/acre*

BEAVER ACTIVITY: *no*

EROSION RATING (1=negligible; 2=slight; 3=moderate; 4=slight; 5=extreme): **2**

PHOTOGRAPH TAKEN: *Yes*

LAND USE ACTIVITIES THAT COULD INFLUENCE RIPARIAN AREA: *Mining, grazing (cattle & wildlife), hunting, recreation.*

SPECIES OBSERVED:

Trees	Shrubs	Forbs	Grasses (or grasslike)
<i>Picea pungens</i>	<i>Ribes sp.</i>	<i>Achillea millefolium</i>	<i>Agrostis stolonifera</i>
<i>Populus tremuloides</i>	<i>Symphoricarpos oreophilus</i>	<i>Equisetum arvense</i>	<i>Carex nebrascensis</i>
		<i>Ranunculus cymbalaria</i>	<i>Poa pratensis</i>
		<i>Taraxacum officinale</i>	

POOL ATTRIBUTES

% area in pools: *100*  
 % pool area made up of pools > 2' deep: *0*

AQUATIC VEGETATION

% streambed with filamentous algae: *0*  
 % stream margin with rooted aquatic: *0*

BANK TYPE & VEGETATION OVERHANG

% bank length undercut (<90°): *0*  
 % bank length gently sloping (>135°): *100*  
 % bank length with overhanging vegetation: *0*

BANK CONDITION

% bank length vegetated, stable: *35*  
 % bank length unvegetated, stable: *75*  
 % bank length vegetated, unstable: *30*  
 % bank length unvegetated, unstable: *20*

NOTES:

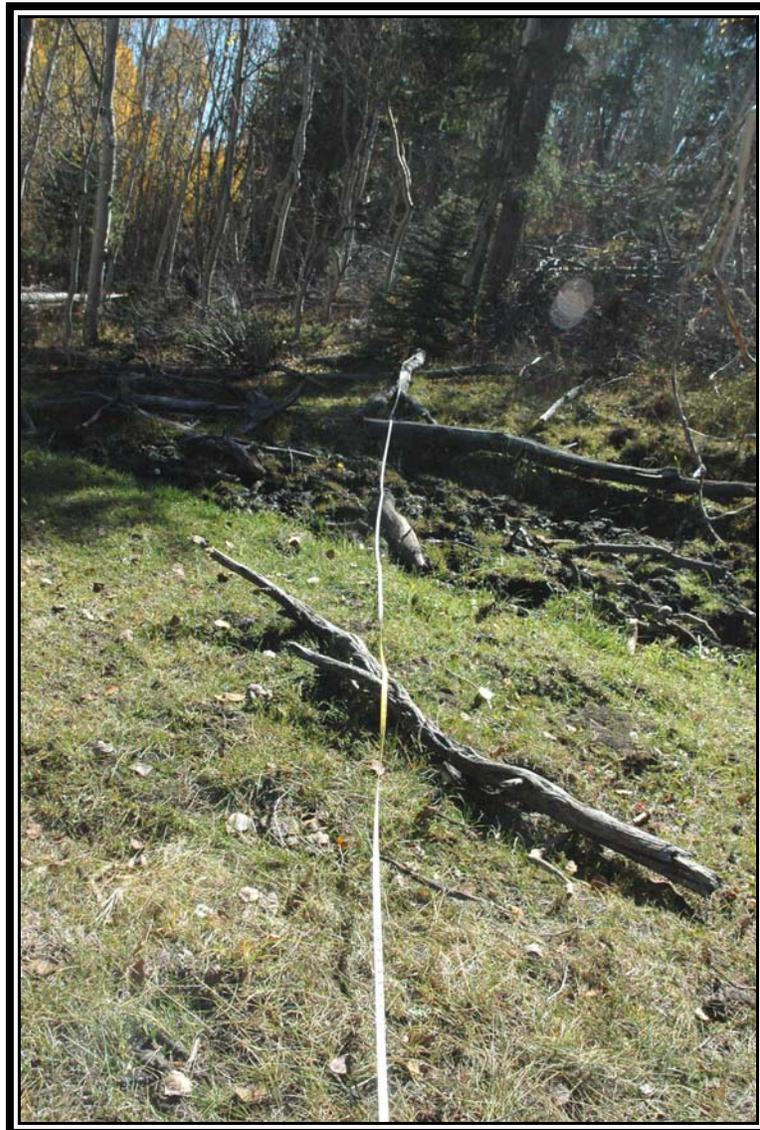
- 1) *This is a spring area.*
- 2) *Probably a good "control" site (outside the subsidence zone).*
- 3) *Cattle hoof-prints were common in the vegetation here thus decreasing the living cover.*
- 4) *The Bank Condition represents both the bank and wet areas (refer to the photograph).*
- 5) *Most of the riparian vegetation had water surrounding it, or 9.0 ft out of 13.5 ft.*

## DATA SUMMARY

### **Q02S: Cover by plant community types in the South Fork Quitchupah Creek drainage (October 2012).**

<b>USDA Forest Service Protocol (1992)</b>			
	LEFT	RIGHT	TOTALS
<b>UPLAND VEGETATION</b>			
<i>Poa pratensis/Achillea millefolium</i>	9.50		
<i>Geranium richardsonii/Poa pratensis</i>		10.00	
			19.50
<b>RIPARIAN VEGETATION</b>			
<u>Dominant Woody Species</u>			
<u>Dominant Herbaceous Species</u>			
<i>Ranunculus cymbalaria/Agrostis stolonifera</i>			
<i>Carex nebrascensis/Agrostis stolonifera/Ranunculus cymbalaria</i>			13.50
<b>TOTAL COVER (Upland Species)</b>			19.50
<b>TOTAL COVER (Riparian Species)</b>			13.50
<b>ROCK (channel)</b>			0.00
<b>WATER (channel)</b>			0.00
<b>BAREGROUND (channel)</b>			0.00
<b>LITTER</b>			0.00
<b>MOSS</b>			0.00
<b>TOTAL COVER</b>			<b>33.00</b>

## PHOTOGRAPHIC DOCUMENTATION



Q02S

**RIPARIAN COMPLEX DATA SHEET**  
**October 2012**

CLIENT: *Canyon Fuel Company, SUFCO Mine*

SAMPLE NUMBER: **Q03C**

WATERBODY NAME: *South Fork Quitchupah Creek*

LOCATION: *Southern Wasatch Plateau, Utah*

DATE: *October 2, 2012*

OBSERVER(S): *P. Collins*

USGS QUAD 7.5 MINUTE MAP: *Acord Lakes, Utah*

GEOLOGIC PARENT MATERIAL: *Price River Formation*

STREAM ASPECT: *E (90°)*

STREAM GRADIENT: *1-2°*

ELEVATION: *8,310 ft*

SIZE OF COMPLEX: *(see quantitative data)*

ADJACENT UPLAND VEGETATION (looking downstream)

Left: *Sagebrush/Grass*

Right: *Aspen*

VEGETATIVE DESCRIPTION (Dominance by Community Types)

Community Name	% of Complex
<i>(refer to quantitative data results for this information)</i>	

COMMUNITY SUCCESSIONAL STAGE: *Mid (tree saplings present)*

APPARENT FORAGE TREND: *Stable*

ESTIMATED FORAGE PRODUCTION: *850 lbs/acre*

BEAVER ACTIVITY: *no*

EROSION RATING (1=negligible; 2=slight; 3=moderate; 4=slight; 5=extreme): *3 (on river bank near the water)*

PHOTOGRAPH TAKEN: *Yes*

LAND USE ACTIVITIES THAT COULD INFLUENCE RIPARIAN AREA: *Mining, grazing (cattle & wildlife), hunting, recreation.*

SPECIES OBSERVED:

Trees	Shrubs	Forbs	Grasses (or grasslike)
<i>Populus tremuloides</i>	<i>Artemisia tridentata</i>	<i>Aster sp.</i>	<i>Agrostis stolonifera</i>
	<i>Rosa woodsii</i>	<i>Equisetum arvense</i>	<i>Juncus arcticus</i>
	<i>Salix spp.</i>	<i>Taraxacum officinale</i>	<i>Juncus longistylis</i>

POOL ATTRIBUTES

% area in pools: *0*  
 % pool area made up of pools > 2' deep: *0*

AQUATIC VEGETATION

% streambed with filamentous algae: *0*  
 % stream margin with rooted aquatic: *0*

BANK TYPE & VEGETATION OVERHANG

% bank length undercut (<90°): *50 on rt side; lf side vertical*  
 % bank length gently sloping (>135°): *0*  
 % bank length with overhanging vegetation: *0*

BANK CONDITION

% bank length vegetated, stable: *90*  
 % bank length unvegetated, stable: *2.5*  
 % bank length vegetated, unstable: *2.5*  
 % bank length unvegetated, unstable: *5*

NOTES:

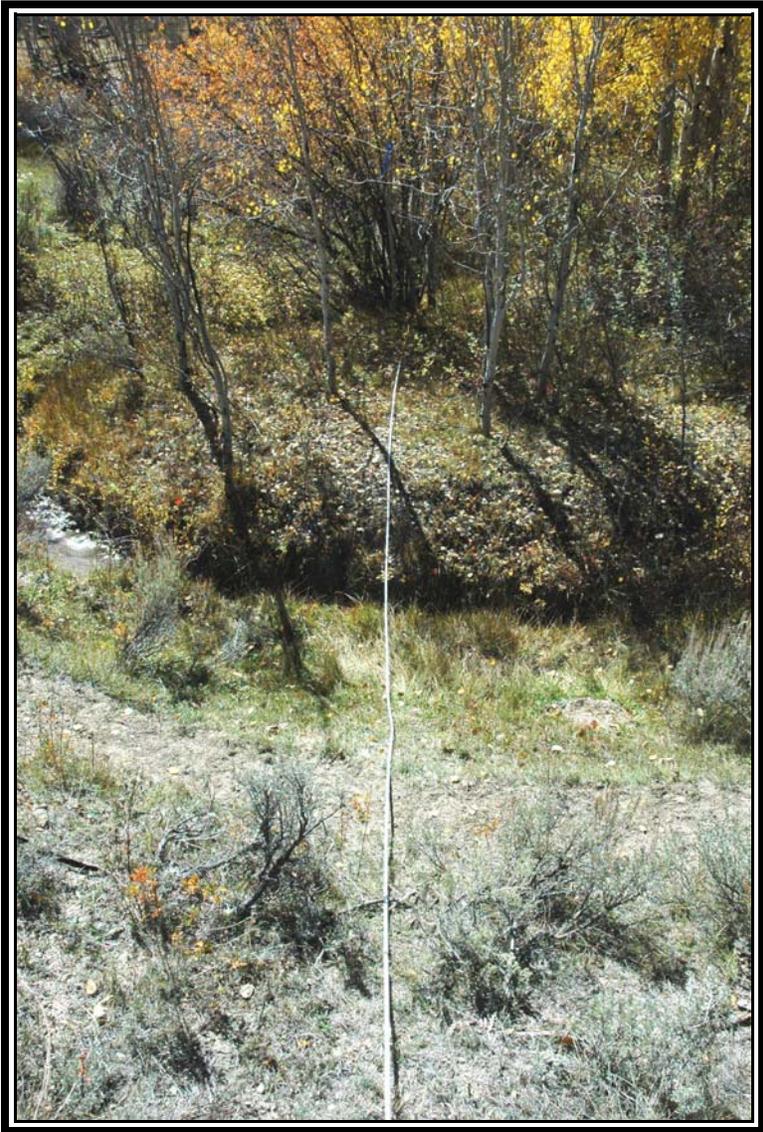
- 1) *This is a channel area.*
- 2) *A good control station; outside current subsidence plans.*
- 3) *It seems like we needed a sample here, but this may be more difficult to monitor as accurately due to the topography. The narrow channel sites are more straight-forward to monitor than this type.*
- 4) *Interestingly, the adjacent aspen understory (that I considered upland) had more wiregrass present. This may be a function of the shade prolonging snowmelt.*
- 5) *This wiregrass area should be noted during each sample period.*

## DATA SUMMARY

### Q03C: Cover by plant community types in the South Fork Quitchupah Creek drainage (October 2012).

<b>USDA Forest Service Protocol (1992)</b>			
	LEFT	RIGHT	TOTALS
<b>UPLAND VEGETATION</b>			
<i>Artemisia tridentata/Elymus salinus</i>	9.50		
<i>Populus tremuloides/Juncus arcticus</i>		10.00	
			19.50
<b>RIPARIAN VEGETATION</b>			
<u>Dominant Woody Species</u>			
<u>Dominant Herbaceous Species</u>			
<i>Juncus arcticus/Poa pratensis</i>	4.50	3.50	
<i>Juncus arcticus</i>		6.00	
			14.00
<b>TOTAL COVER (Upland Species)</b>			19.50
<b>TOTAL COVER (Riparian Species)</b>			14.00
<b>ROCK (channel)</b>			0.00
<b>WATER (channel)</b>			1.50
<b>BAREGROUND (channel)</b>			0.00
<b>LITTER</b>			0.00
<b>MOSS</b>			0.00
<b>TOTAL COVER</b>			<b>35.00</b>

PHOTOGRAPHIC DOCUMENTATION



Q03C

**RIPARIAN COMPLEX DATA SHEET**  
**October 2012**

CLIENT: *Canyon Fuel Company, SUFCO Mine*

SAMPLE NUMBER: **Q045**

WATERBODY NAME: *South Fork Quitchupah Creek*

LOCATION: *Southern Wasatch Plateau, Utah*

DATE: *October 2, 2012*

OBSERVER(S): *P. Collins*

USGS QUAD 7.5 MINUTE MAP: *Acord Lakes, Utah*

GEOLOGIC PARENT MATERIAL: *Price River Formation*

STREAM ASPECT: *E [but flow here was N (340°)]*

STREAM GRADIENT: *1-2°*

ELEVATION: *8,310 ft*

SIZE OF COMPLEX: *(see quantitative data)*

ADJACENT UPLAND VEGETATION (looking downstream)

Left: *Aspen*

Right: *Aspen/Blue Spruce/Willow*

VEGETATIVE DESCRIPTION (Dominance by Community Types)

Community Name	% of Complex
<i>(refer to quantitative data results for this information)</i>	

COMMUNITY SUCCESSIONAL STAGE: *Late*

APPARENT FORAGE TREND: *Stable*

ESTIMATED FORAGE PRODUCTION: *700 lbs/acre*

BEAVER ACTIVITY: *no*

EROSION RATING (1=negligible; 2=slight; 3=moderate; 4=slight; 5=extreme): **3**

PHOTOGRAPH TAKEN: *Yes*

LAND USE ACTIVITIES THAT COULD INFLUENCE RIPARIAN AREA: *Mining, grazing (cattle & wildlife), hunting, recreation.*

SPECIES OBSERVED:

Trees	Shrubs	Forbs	Grasses (or grasslike)
<i>Picea pungens</i>	<i>Rosa woodsii</i>	<i>Achillea millefolium</i>	<i>Eleocharis palustris</i>
<i>Populus tremuloides</i>	<i>Salix boothii</i>	<i>Equisetum arvense</i>	<i>Hordeum jubatum</i>
		<i>Geranium richardsonii</i>	<i>Juncus arcticus</i>
			<i>Juncus longistylis</i>
			<i>Poa pratensis</i>

POOL ATTRIBUTES

% area in pools: *100*  
 % pool area made up of pools > 2' deep: *0*

AQUATIC VEGETATION

% streambed with filamentous algae: *0*  
 % stream margin with rooted aquatic: *0*

BANK TYPE & VEGETATION OVERHANG

% bank length undercut (<90°):  
 % bank length gently sloping (>135°): *100*  
 % bank length with overhanging vegetation: *50*

BANK CONDITION

% bank length vegetated, stable: *40*  
 % bank length unvegetated, stable: *0*  
 % bank length vegetated, unstable: *20*  
 % bank length unvegetated, unstable: *40*

NOTES:

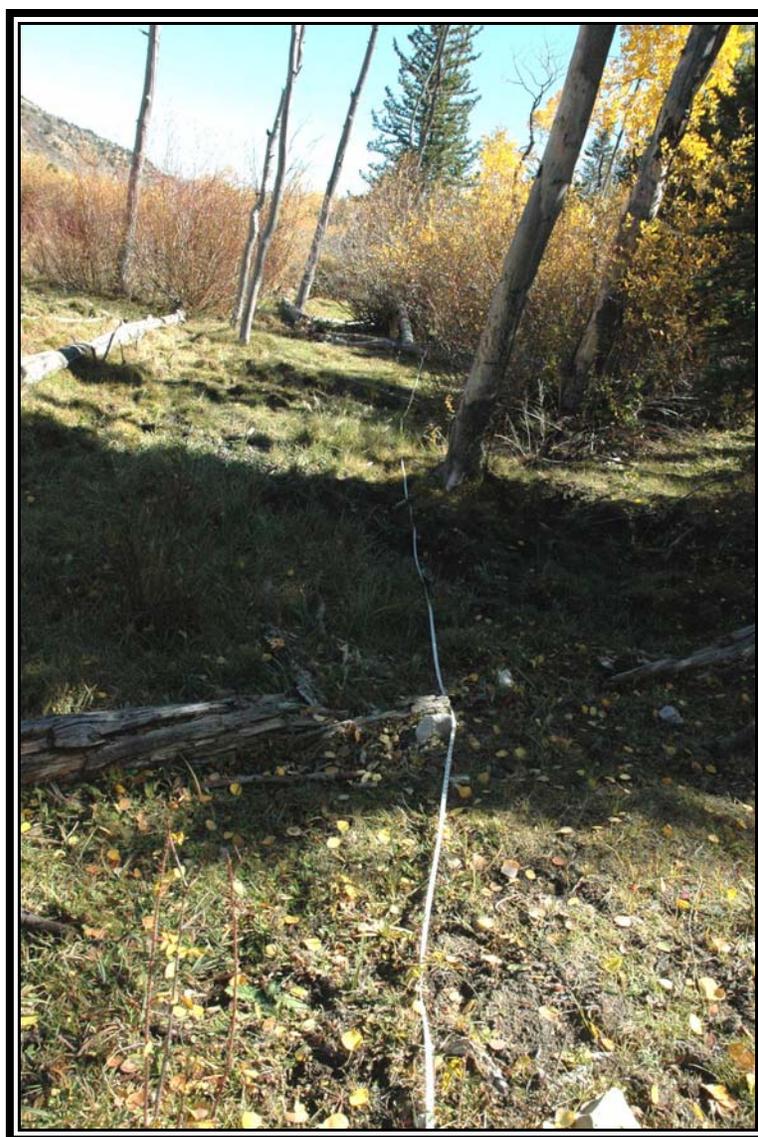
- 1) *This is a spring area.*
- 2) *A good control station; outside current subsidence plans.*
- 3) *The riparian/wetland areas appeared to have more water for this sample period when compared to August 2012. The notes in the August report suggested it may vary.*
- 4) *The spring site had several zones of vegetation based on the different water regimes.*
- 5) *Nebraska sedge and spike rush zones seemed to be the wettest areas.*
- 6) *There was a lot of impact from cattle trampling here. Because of this some areas had a high living cover value (e.g. 90%), whereas other areas were low (e.g. 30%), so a 60% value was given above.*
- 7) *Not quite sure why August total was 46 ft; there was more upland and riparian vegetation this sample period (check and make appropriate adjustments next visit).*

## DATA SUMMARY

### **Q04S: Cover by plant community types in the South Fork Quitchupah Creek drainage (October 2012).**

<b>USDA Forest Service Protocol (1992)</b>			
	LEFT	RIGHT	TOTALS
<b>UPLAND VEGETATION</b>			
<i>Symphoricarpos oreophilus/Populus tremuloides</i>	10.00		
<i>Picea pungens/Salix boothii</i>		16.00	
			26.00
<b>RIPARIAN VEGETATION</b>			
<u>Dominant Woody Species</u>			
<u>Dominant Herbaceous Species</u>			
<i>Carex nebrascensis/Hordeum jubatum</i>			10.00
<i>Eleocharis palustris/Ranunculus cymbalaria</i>			15.00
<i>Carex nebrascensis</i>			5.00
<b>TOTAL COVER (Upland Species)</b>			26.00
<b>TOTAL COVER (Riparian Species)</b>			30.00
<b>ROCK (channel)</b>			0.00
<b>WATER (channel)</b>			0.00
<b>BAREGROUND (channel)</b>			0.00
<b>LITTER</b>			0.00
<b>MOSS</b>			0.00
<b>TOTAL COVER</b>			<b>56.00</b>

## PHOTOGRAPHIC DOCUMENTATION



Q04S

**RIPARIAN COMPLEX DATA SHEET**

**October 2012**

CLIENT: *Canyon Fuel Company, SUFCO Mine*

SAMPLE NUMBER: **Q055**

WATERBODY NAME: *South Fork Quitchupah Creek*

LOCATION: *Southern Wasatch Plateau, Utah*

DATE: *October 2, 2012*

OBSERVER(S): *P. Collins*

USGS QUAD 7.5 MINUTE MAP: *Acord Lakes, Utah*

GEOLOGIC PARENT MATERIAL: *Price River Formation*

STREAM ASPECT: *E; flow here was 30°*

STREAM GRADIENT: *1-2°*

ELEVATION: *8,294 ft*

SIZE OF COMPLEX: *(see quantitative data)*

ADJACENT UPLAND VEGETATION (looking downstream)

Left: *Blue Spruce/Willow*

Right: *Blue Spruce/Aspen*

VEGETATIVE DESCRIPTION (Dominance by Community Types)

Community Name	% of Complex
<i>(refer to quantitative data results for this information)</i>	

COMMUNITY SUCCESSIONAL STAGE: *Late*

APPARENT FORAGE TREND: *Stable*

ESTIMATED FORAGE PRODUCTION: *800 lbs/acre*

BEAVER ACTIVITY: *no*

EROSION RATING (1=negligible; 2=slight; 3=moderate; 4=slight; 5=extreme): *4 (due to cattle)*

PHOTOGRAPH TAKEN: *Yes*

LAND USE ACTIVITIES THAT COULD INFLUENCE RIPARIAN AREA: *Mining, grazing (cattle & wildlife), hunting, recreation.*

SPECIES OBSERVED:

Trees	Shrubs	Forbs	Grasses (or grasslike)
<i>Picea pungens</i>	<i>Salix boothii</i>	<i>Equisetum arvense</i>	<i>Agrostis stolonifera</i>
<i>Pinus flexilis</i>	<i>Symphoricarpos oreophilus</i>	<i>Geranium richardsonii</i>	<i>Carex nebrascensis</i>
<i>Populus tremuloides</i>		<i>Ranunculus cymbalaria</i>	

POOL ATTRIBUTES

% area in pools: *100*  
 % pool area made up of pools > 2' deep: *0*

AQUATIC VEGETATION

% streambed with filamentous algae: *0*  
 % stream margin with rooted aquatic: *0*

BANK TYPE & VEGETATION OVERHANG

% bank length undercut (<90°): *0*  
 % bank length gently sloping (>135°): *100*  
 % bank length with overhanging vegetation: *20*

BANK CONDITION

% bank length vegetated, stable: *60*  
 % bank length unvegetated, stable: *0*  
 % bank length vegetated, unstable: *20 (due to cattle)*  
 % bank length unvegetated, unstable: *20*

NOTES:

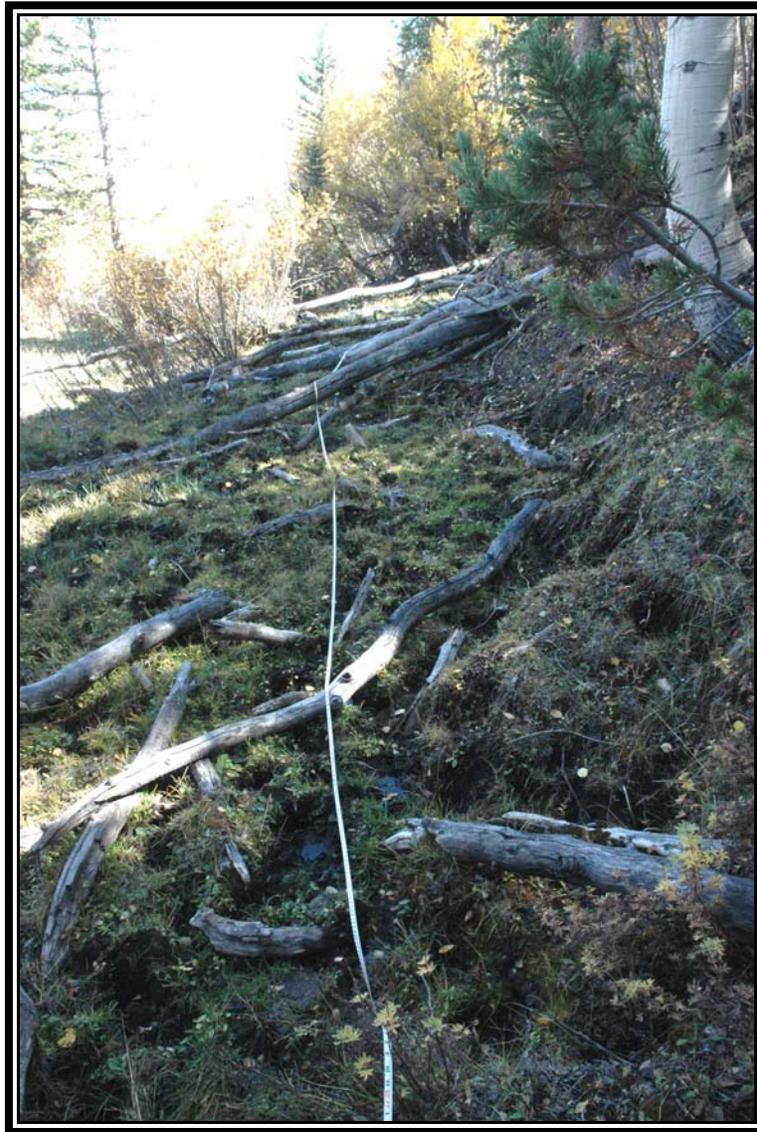
- 1) *This is a well-defined spring area.*
- 2) *A good control station; it is just outside current subsidence plans.*
- 3) *When I used placed the transect tape, it formed a "U" shape to measure. This tape was placed 4 ft from the upland bank for 73 ft of riparian/spring vegetation.*
- 4) *For this sample period, the water area comprised the entire 38 ft out of the 73 ft mentioned above.*
- 5) *There was a lot of impact from cattle trampling at the site.*

## DATA SUMMARY

### **Q05S: Cover by plant community types in the South Fork Quitchupah Creek drainage (October 2012).**

<b>USDA Forest Service Protocol (1992)</b>			
	LEFT	RIGHT	TOTALS
<b>UPLAND VEGETATION</b>			
<i>Salix boothii/Picea pungens</i>	10.00		
<i>Picea pungens/Populus tremuloides</i>		10.00	
			20.00
<b>RIPARIAN VEGETATION</b>			
<u>Dominant Woody Species</u>			
<u>Dominant Herbaceous Species</u>			
<i>Carex nebrascensis/Agrostis stolonifera/Ranunculus cymbalaria</i>			73.00
<b>TOTAL COVER (Upland Species)</b>			20.00
<b>TOTAL COVER (Riparian Species)</b>			73.00
<b>ROCK (channel)</b>			0.00
<b>WATER (channel)</b>			0.00
<b>BAREGROUND (channel)</b>			0.00
<b>LITTER</b>			0.00
<b>MOSS</b>			0.00
<b>TOTAL COVER</b>			<b>93.00</b>

## PHOTOGRAPHIC DOCUMENTATION



Q05S

**RIPARIAN COMPLEX DATA SHEET**

**October 2012**

CLIENT: *Canyon Fuel Company, SUFCO Mine*

SAMPLE NUMBER: **Q065**

WATERBODY NAME: *South Fork Quitchupah Creek*

LOCATION: *Southern Wasatch Plateau, Utah*

DATE: *October 2, 2012*

OBSERVER(S): *P. Collins*

USGS QUAD 7.5 MINUTE MAP: *Acord Lakes, Utah*

GEOLOGIC PARENT MATERIAL: *Price River Formation*

STREAM ASPECT: *E [but flow here was N (330°)]*

STREAM GRADIENT: *1-2°*

ELEVATION: *8,313 ft*

SIZE OF COMPLEX: *(see quantitative data)*

ADJACENT UPLAND VEGETATION (looking downstream)

Left: *Meadow*

Right: *Meadow*

VEGETATIVE DESCRIPTION (Dominance by Community Types)

Community Name	% of Complex
<i>(refer to quantitative data results for this information)</i>	

COMMUNITY SUCCESSIONAL STAGE: *Late*

APPARENT FORAGE TREND: *Stable*

ESTIMATED FORAGE PRODUCTION: *300 lbs/acre*

BEAVER ACTIVITY: *no*

EROSION RATING (1=negligible; 2=slight; 3=moderate; 4=slight; 5=extreme): **3** *(cattle impact)*

PHOTOGRAPH TAKEN: *Yes*

LAND USE ACTIVITIES THAT COULD INFLUENCE RIPARIAN AREA: *Mining, grazing (cattle & wildlife), hunting, recreation.*

SPECIES OBSERVED:

Trees	Shrubs	Forbs	Grasses (or grasslike)
<i>Populus tremuloides</i>	<i>Ribes sp</i>	<i>Equisetum arvense</i>	<i>Agrostis stolonifera</i>
	<i>Salix boothii</i>	<i>Taraxacum officinale</i>	<i>Poa pratensis</i>

POOL ATTRIBUTES

% area in pools: *100*  
 % pool area made up of pools > 2' deep: *0*

AQUATIC VEGETATION

% streambed with filamentous algae: *0*  
 % stream margin with rooted aquatic: *0*

BANK TYPE & VEGETATION OVERHANG

% bank length undercut (<90°): *0*  
 % bank length gently sloping (>135°): *100*  
 % bank length with overhanging vegetation: *25*

BANK CONDITION

% bank length vegetated, stable: *10*  
 % bank length unvegetated, stable: *0*  
 % bank length vegetated, unstable: *10*  
 % bank length unvegetated, unstable: *80 (cattle impact)*

NOTES:

- 1) *Only measured obvious, well-defined spring area.*
- 2) *Left side measured to bank (3 ft).*
- 3) *Cattle had a greater impact this sample period compared to the earlier period this year.*
- 4) *Riparian/wetland vegetation was measured in the spring channel only.*
- 5) *There was 8 ft of this vegetation in the water/hooftprint area.*
- 6) *Sample station was located within current planned subsidence zone.*

## DATA SUMMARY

### **Q06S: Cover by plant community types in the South Fork Quitchupah Creek drainage (October 2012).**

<b>USDA Forest Service Protocol (1992)</b>			
	LEFT	RIGHT	TOTALS
<b>UPLAND VEGETATION</b>			
<i>Populus tremuloides/Salix boothii</i>	3.00		
<i>Symphoricarpos oreophilus/Grasses</i>		9.00	12.00
<b>RIPARIAN VEGETATION</b>			
<u>Dominant Woody Species</u>			
<u>Dominant Herbaceous Species</u>			
<i>Agrostis stolonifera</i>			8.00
<b>TOTAL COVER (Upland Species)</b>			12.00
<b>TOTAL COVER (Riparian Species)</b>			8.00
<b>ROCK (channel)</b>			0.00
<b>WATER (channel)</b>			0.00
<b>BAREGROUND (channel)</b>			0.00
<b>LITTER</b>			0.00
<b>MOSS</b>			0.00
<b>TOTAL COVER</b>			<b>20.00</b>

PHOTOGRAPHIC DOCUMENTATION



Q06S

**RIPARIAN COMPLEX DATA SHEET**

**October 2012**

CLIENT: *Canyon Fuel Company, SUFCO Mine*

SAMPLE NUMBER: *Q07C*

WATERBODY NAME: *South Fork Quitchupah Creek*

LOCATION: *Southern Wasatch Plateau, Utah*

DATE: *October 4, 2012*

OBSERVER(S): *P. Collins*

USGS QUAD 7.5 MINUTE MAP: *Acord Lakes, Utah*

GEOLOGIC PARENT MATERIAL: *Price River Formation*

STREAM ASPECT: *E [but flow here was N (5°)]*

STREAM GRADIENT: *2-3°*

ELEVATION: *8,285 ft*

SIZE OF COMPLEX: *(see quantitative data)*

ADJACENT UPLAND VEGETATION (looking downstream)

Left: *Meadow*

Right: *Meadow*

VEGETATIVE DESCRIPTION (Dominance by Community Types)

Community Name	% of Complex
<i>(refer to quantitative data results for this information)</i>	

COMMUNITY SUCCESSIONAL STAGE: *Mid-*

APPARENT FORAGE TREND: *Stable*

ESTIMATED FORAGE PRODUCTION: *1,000 lbs/acre*

BEAVER ACTIVITY: *no*

EROSION RATING (1=negligible; 2=slight; 3=moderate; 4=slight; 5=extreme): *1*

PHOTOGRAPH TAKEN: *Yes*

LAND USE ACTIVITIES THAT COULD INFLUENCE RIPARIAN AREA: *Mining, grazing (cattle & wildlife), hunting, recreation.*

SPECIES OBSERVED:

Trees	Shrubs	Forbs	Grasses (or grasslike)
	<i>Rosa woodsii</i>		<i>Agrostis stolonifera</i>
	<i>Salix boothii</i>		<i>Carex nebrascensis</i>
			<i>Hordeum jubatum</i>
			<i>Poa pratensis</i>

POOL ATTRIBUTES

% area in pools: *0*  
 % pool area made up of pools > 2' deep: *0*

AQUATIC VEGETATION

% streambed with filamentous algae: *0*  
 % stream margin with rooted aquatic: *0*

BANK TYPE & VEGETATION OVERHANG

% bank length undercut (<90°): *50 (all on right side)*  
 % bank length gently sloping (>135°): *100 incised (18") channel*  
 % bank length with overhanging vegetation:

BANK CONDITION

% bank length vegetated, stable: *95*  
 % bank length unvegetated, stable: *1*  
 % bank length vegetated, unstable: *2*  
 % bank length unvegetated, unstable: *2*

NOTES:

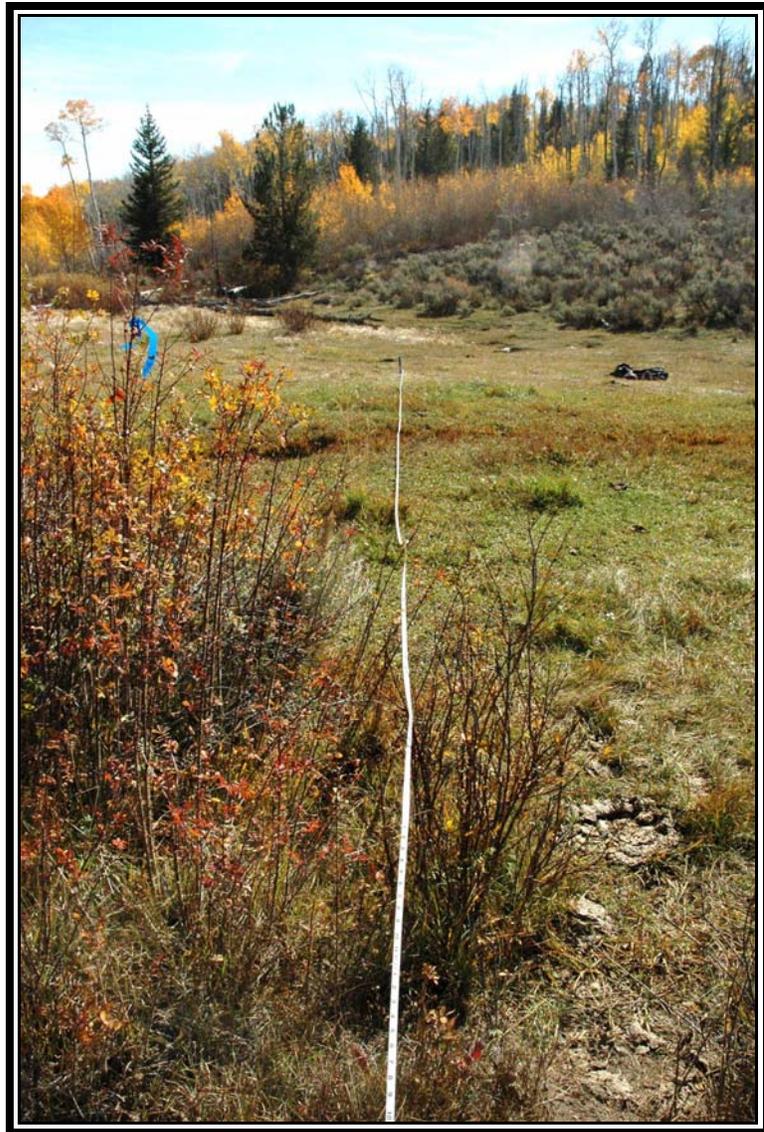
- 1) *This site is in the middle of a meadow.*
- 2) *Right side: the upland area was obvious as seen by upland vegetation. It was mostly dominated by Poa pratensis (although this is now considered a facultative wetland species). On this side the riparian community was measured where Carex nebrascensis began.*
- 3) *Left side: the riparian community was measured beginning in the meadow (where the stake would be easily found later) and ended at the channel bank. The entire meadow, however, had some wetland species. In this meadow there were patches that were dominated by Hordeum jubatum.*
- 4) *This site is within the current planned subsidence zone.*

## DATA SUMMARY

### **Q07C: Cover by plant community types in the South Fork Quitchupah Creek drainage (October 2012).**

<b>USDA Forest Service Protocol (1992)</b>			
	LEFT	RIGHT	TOTALS
<b>UPLAND VEGETATION</b>	10.00		
<i>Poa pratensis/Achillea millefolium</i>		10.00	
<i>Poa pratensis/Achillea millefolium</i>			20.00
<b>RIPARIAN VEGETATION</b>			
<u>Dominant Woody Species</u>			
<i>Rosa woodsii</i>	7.00		
<u>Dominant Herbaceous Species</u>			
<i>Carex nebrascensis</i>	8.00	10.50	
<i>Carex nebrascensis/Hordeum jubatum</i>	8.00		
			33.50
<b>TOTAL COVER (Upland Species)</b>			20.00
<b>TOTAL COVER (Riparian Species)</b>			33.50
<b>ROCK (channel)</b>			0.00
<b>WATER (channel)</b>			1.50
<b>BAREGROUND (channel)</b>			0.00
<b>LITTER</b>			0.00
<b>MOSS</b>			0.00
<b>TOTAL COVER</b>			<b>55.00</b>

## PHOTOGRAPHIC DOCUMENTATION



Q07C

**RIPARIAN COMPLEX DATA SHEET**

**October 2012**

CLIENT: *Canyon Fuel Company, SUFCO Mine*

SAMPLE NUMBER: *Q08C*

WATERBODY NAME: *South Fork Quitchupah Creek*

LOCATION: *Southern Wasatch Plateau, Utah*

DATE: *October 4, 2012*

OBSERVER(S): *P. Collins*

USGS QUAD 7.5 MINUTE MAP: *Acord Lakes, Utah*

GEOLOGIC PARENT MATERIAL: *Price River Formation*

STREAM ASPECT: *E (flow here was 140°)*

STREAM GRADIENT: *2-3°*

ELEVATION: *8,253 ft*

SIZE OF COMPLEX: *(see quantitative data)*

ADJACENT UPLAND VEGETATION (looking downstream)

Left: *Sagebrush/Grass*

Right: *Aspen/Snowberry*

VEGETATIVE DESCRIPTION (Dominance by Community Types)

Community Name	% of Complex
<i>(refer to quantitative data results for this information)</i>	

COMMUNITY SUCCESSIONAL STAGE: *Mid-*

APPARENT FORAGE TREND: *Stable*

ESTIMATED FORAGE PRODUCTION: *1,000 lbs/acre*

BEAVER ACTIVITY: *no*

EROSION RATING (1=negligible; 2=slight; 3=moderate; 4=slight; 5=extreme): *1 (banks)*

PHOTOGRAPH TAKEN: *Yes*

LAND USE ACTIVITIES THAT COULD INFLUENCE RIPARIAN AREA: *Mining, grazing (cattle & wildlife), hunting, recreation.*

SPECIES OBSERVED:

Trees	Shrubs	Forbs	Grasses (or grasslike)
<i>Populus tremuloides</i>	<i>Artemisia tridentata</i>	<i>Trifolium sp.</i>	<i>Agrostis stolonifera</i>
	<i>Salix boothii</i>		<i>Carex nebrascensis</i>
			<i>Juncus arcticus</i>

POOL ATTRIBUTES

% area in pools: *0*  
 % pool area made up of pools > 2' deep: *0*

AQUATIC VEGETATION

% streambed with filamentous algae: *0*  
 % stream margin with rooted aquatic: *0*

BANK TYPE & VEGETATION OVERHANG

% bank length undercut (<90°): *0*  
 % bank length gently sloping (>135°): *100 but above the incised (18") channel; vertical from water to bank with no undercutting.*  
 % bank length with overhanging vegetation:

BANK CONDITION

% bank length vegetated, stable: *95*  
 % bank length unvegetated, stable: *1*  
 % bank length vegetated, unstable: *0*  
 % bank length unvegetated, unstable: *4*

NOTES:

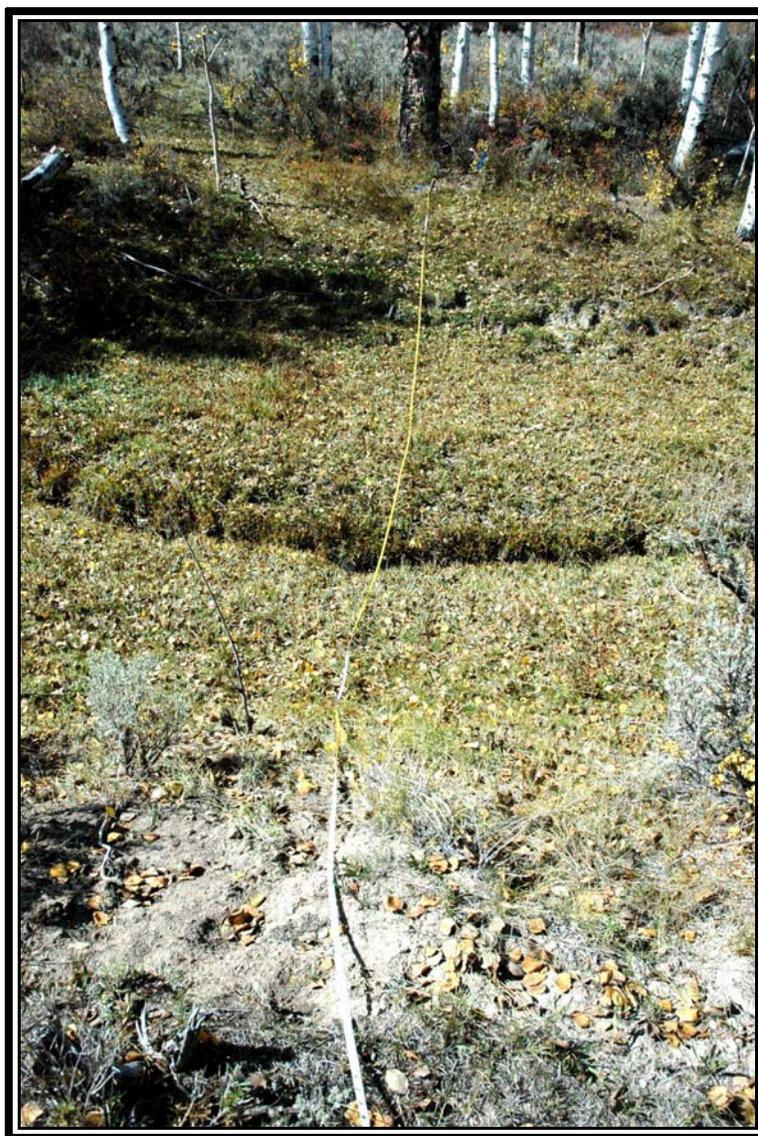
- 1) *This site had a straightforward area to monitor the riparian zone. The station went from low water to a low terrace, then a high terrace and finally to the aspen forest.*
- 2) *This site is within the current planned subsidence zone.*

## DATA SUMMARY

### **Q08C: Cover by plant community types in the South Fork Quitchupah Creek drainage (October 2012).**

<b>USDA Forest Service Protocol (1992)</b>			
	LEFT	RIGHT	TOTALS
<b>UPLAND VEGETATION</b>			
<i>Artemisia tridentata/Grasses</i>	10.00		
<i>Populus tremuloides/Symphoricarpos oreophilus</i>		10.00	20.00
<b>RIPARIAN VEGETATION</b>			
<u>Dominant Woody Species</u>			
<i>Rosa woodsii</i>			
<u>Dominant Herbaceous Species</u>			
<i>Carex nebrascensis</i>	3.00	15.00	
<i>Carex nebrascensis/Agrostis stolonifera/Ranunculus cymbalaria</i>	5.00		23.00
<b>TOTAL COVER (Upland Species)</b>			20.00
<b>TOTAL COVER (Riparian Species)</b>			23.00
<b>ROCK (channel)</b>			0.00
<b>WATER (channel)</b>			1.00
<b>BAREGROUND (channel)</b>			0.00
<b>LITTER</b>			0.00
<b>MOSS</b>			0.00
<b>TOTAL COVER</b>			<b>44.00</b>

## PHOTOGRAPHIC DOCUMENTATION



Q08C

**RIPARIAN COMPLEX DATA SHEET**  
**October 2012**

CLIENT: *Canyon Fuel Company, SUFCO Mine*

SAMPLE NUMBER: **Q09C**

WATERBODY NAME: *South Fork Quitchupah Creek*

LOCATION: *Southern Wasatch Plateau, Utah*

DATE: *October 4, 2012*

OBSERVER(S): *P. Collins*

USGS QUAD 7.5 MINUTE MAP: *Acord Lakes, Utah*

GEOLOGIC PARENT MATERIAL: *Near the contact between the Price River Formation and the Castlegate Sandstone*

STREAM ASPECT: *E*

STREAM GRADIENT: *2-3°*

ELEVATION: *8,253 ft*

SIZE OF COMPLEX: *(see quantitative data)*

ADJACENT UPLAND VEGETATION (looking downstream)

Left: *Sagebrush/Grass*

Right: *Sagebrush/Grass*

VEGETATIVE DESCRIPTION (Dominance by Community Types)

Community Name	% of Complex
<i>(refer to quantitative data results for this information)</i>	

COMMUNITY SUCCESSIONAL STAGE: *Mid-*

APPARENT FORAGE TREND: *Stable*

ESTIMATED FORAGE PRODUCTION: *500 lbs/acre*

BEAVER ACTIVITY: *no*

EROSION RATING (1=negligible; 2=slight; 3=moderate; 4=slight; 5=extreme): *1*

PHOTOGRAPH TAKEN: *Yes*

LAND USE ACTIVITIES THAT COULD INFLUENCE RIPARIAN AREA: *Mining, grazing (cattle & wildlife), hunting, recreation.*

SPECIES OBSERVED:

Trees	Shrubs	Forbs	Grasses (or grasslike)
	<i>Artemisia tridentata</i>	<i>Trifolium sp.</i>	<i>Agrostis stolonifera</i>
	<i>Rosa woodsii</i>		<i>Juncus arcticus</i>
	<i>Salix boothii</i>		<i>Poa pratensis</i>

POOL ATTRIBUTES

% area in pools: *0*

% pool area made up of pools > 2' deep: *25*

AQUATIC VEGETATION

% streambed with filamentous algae: *0*

% stream margin with rooted aquatic: *0*

BANK TYPE & VEGETATION OVERHANG

% bank length undercut (<90°): *100 on both sides of the channel.*

% bank length gently sloping (>135°): *100 but above the incised (24" wide) channel.*

% bank length with overhanging vegetation: *(herbaceous only)*

BANK CONDITION

% bank length vegetated, stable: *90*

% bank length unvegetated, stable: *0*

% bank length vegetated, unstable: *2*

% bank length unvegetated, unstable: *3*

NOTES:

1) *This site had a straightforward area to monitor the riparian zone.*

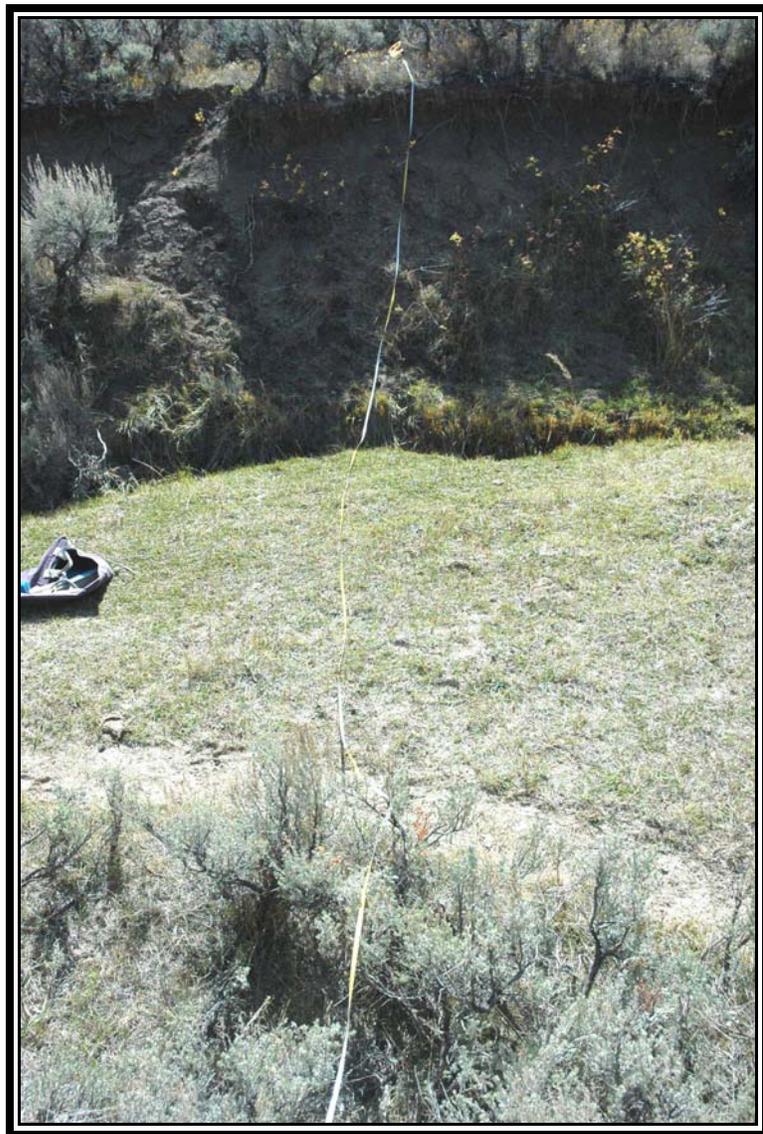
2) *This site is within the current planned subsidence zone.*

## DATA SUMMARY

### Q09C: Cover by plant community types in the South Fork Quitchupah Creek drainage (October 2012).

<b>USDA Forest Service Protocol (1992)</b>			
	LEFT	RIGHT	TOTALS
<b>UPLAND VEGETATION</b>	9.00		
<i>Artemisia tridentata/Grasses</i>		11.00	
<i>Artemisia tridentata/Grasses</i>			20.00
<b>RIPARIAN VEGETATION</b>			
<u>Dominant Woody Species</u>			
<u>Dominant Herbaceous Species</u>			
<i>Carex nebrascensis/Agrostis stolonifera/Ranunculus cymbalaria</i>	13.50	1.00	
			14.50
<b>TOTAL COVER (Upland Species)</b>			20.00
<b>TOTAL COVER (Riparian Species)</b>			14.50
<b>ROCK (channel)</b>			0.00
<b>WATER (channel)</b>			1.50
<b>BAREGROUND (channel)</b>			0.00
<b>LITTER</b>			0.00
<b>MOSS</b>			0.00
<b>TOTAL COVER</b>			<b>36.00</b>

## PHOTOGRAPHIC DOCUMENTATION



Q09C

RIPARIAN PLANT COMMUNITY  
MONITORING IN SELECTED REACHES:  
SOUTH FORK QUITCHUPAH CREEK  
July & October  
2013

FOR THE  
SUFCO MINE  
SEVIER COUNTY, UTAH



*Prepared by*

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March 2014



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# Introduction

The SUFCO Coal Mine has expanded their underground operations near and below some reaches of the South Fork Quitchupah Creek. The riparian plant communities supported along the creek have been and will continue to be monitored for possible impacts that could be caused by mine-related subsidence. These studies are conducted before, during, and after the mining takes place. This document includes the results of quantitative and qualitative vegetation sampling in several locations within and outside the subsidence zones. The results include two sample periods in 2013 – July and October. Two additional sample stations were added to the October sample period.

## The Study Areas

The South Fork Quitchupah Creek study area is located at the southern end of the Wasatch Plateau, a subprovince of the Colorado Plateau physiographic province. It also lies within Sevier County, Utah west of the town of Emery, and is located within the boundaries of the USDA National Forest property. Quitchupah Creek and its forks are tributaries to Muddy Creek which converges with the Dirty Devil River and ultimately drains into the Colorado River. Elevations of the sample stations fall between 7,700 ft and 8,400 ft above sea level. Geology of the study area is within the Cretaceous strata of the Mesa Verde Group. The upper sample sites lie below the North Horn Formation and are within the Price River Formation. The next lower sites are near the contact zone between the Price River Formation and the cliff-forming Castlegate Sandstone. Continuing downstream there is one site that is located at the contact between Castlegate Sandstone and the Blackhawk Formation. Finally, the lowest site was established in the Blackhawk Formation.

A variety of biological and other resource information can be studied to evaluate and characterize riparian complexes including vegetation, geology, channel morphology, aquatic biology, soils, and stream flow. The primary focus of this study was on vegetation to provide baseline and followup data by monitoring the riparian communities adjacent to South Fork Quitchupah Creek. Regular monitoring will be conducted to provide data to determine long term trends, natural variability and benchmark information including the possible impacts on

the riparian plant communities from mining beneath the creek and nearby springs.

To be consistent with other riparian studies for the mine, this study primarily employed vegetation monitoring methods described by the USDA Forest Service (described later). The design of this study was not to provide data that could show subtle changes to community structure and species composition as a result of *minor* changes to the riparian habitat. Rather, the study was designed to make year-to-year comparisons in an attempt to document *major* impacts to the plant communities along the stream due to catastrophic events, such as loss of water and habitat from the effects of subsidence caused from underground mining.

## Methods

### Sample Station Placement

A field visit to the site was initially conducted by a team of representatives from the SUFCO Mine, USDA Forest Service, Bureau of Land Management, Utah Division of Water Rights and Utah Division of Oil, Gas & Mining, Petersen Hydrologic and Mt. Nebo Scientific. The study area was delineated at that time. The general zones for the future subsidence and areas adjacent to them were visited. Potential sample locations for vegetation and water quality were addressed by the team in the field. The final sample locations were chosen later, some of them beyond subsidence zones with the idea that those areas could be used in the future as “controls”, or areas that will *not* be impacted by mining-related subsidence, and can be used to compare those areas that may have been impacted.

Qualitative and quantitative data were recorded at the sample stations along South Fork Quitcupah Creek. Line transects were placed at the stations. Locations and extent of the transects were semi-permanently marked using numbered and flagged wooden stakes and 12-inch metal rods. GPS coordinates were recorded at the stations. With some modifications, the vegetation monitoring methods of the studies were based on those described by the USDA Forest Service manual for a “*Level III Riparian Area Evaluation*” (*Integrated Riparian Evaluation Guide*, March 1992).

Geomorphological stream channel data outlined in the Forest Service protocol were not recorded as part of this study because scientists for the SUFCO Mine have conducted other studies that will suffice for that information. Additionally, soils information through the Natural Resources Conservation Service (NRCS) was not available for the study area.

Qualitative Data

The *RIPARIAN COMPLEX DATA SHEET* shown on Table 1 lists the qualitative and quantitative data that have been, and will continue to be, collected at each sample station.

Photographic stations for documentation and future comparisons have also been established at each sample location. A sample location map has been included in this report.

Quantitative Data

As mentioned, USDA Forest Service protocol was employed as a model to drive the study plan for data collection. *Community Type Cover* is one method to record cover in the Forest Service Level III protocol. At the sample locations, transect lines have been placed across (or perpendicular to) the stream channel. By design, the line transects vary in lengths which are based on several factors. Although sometimes limited by

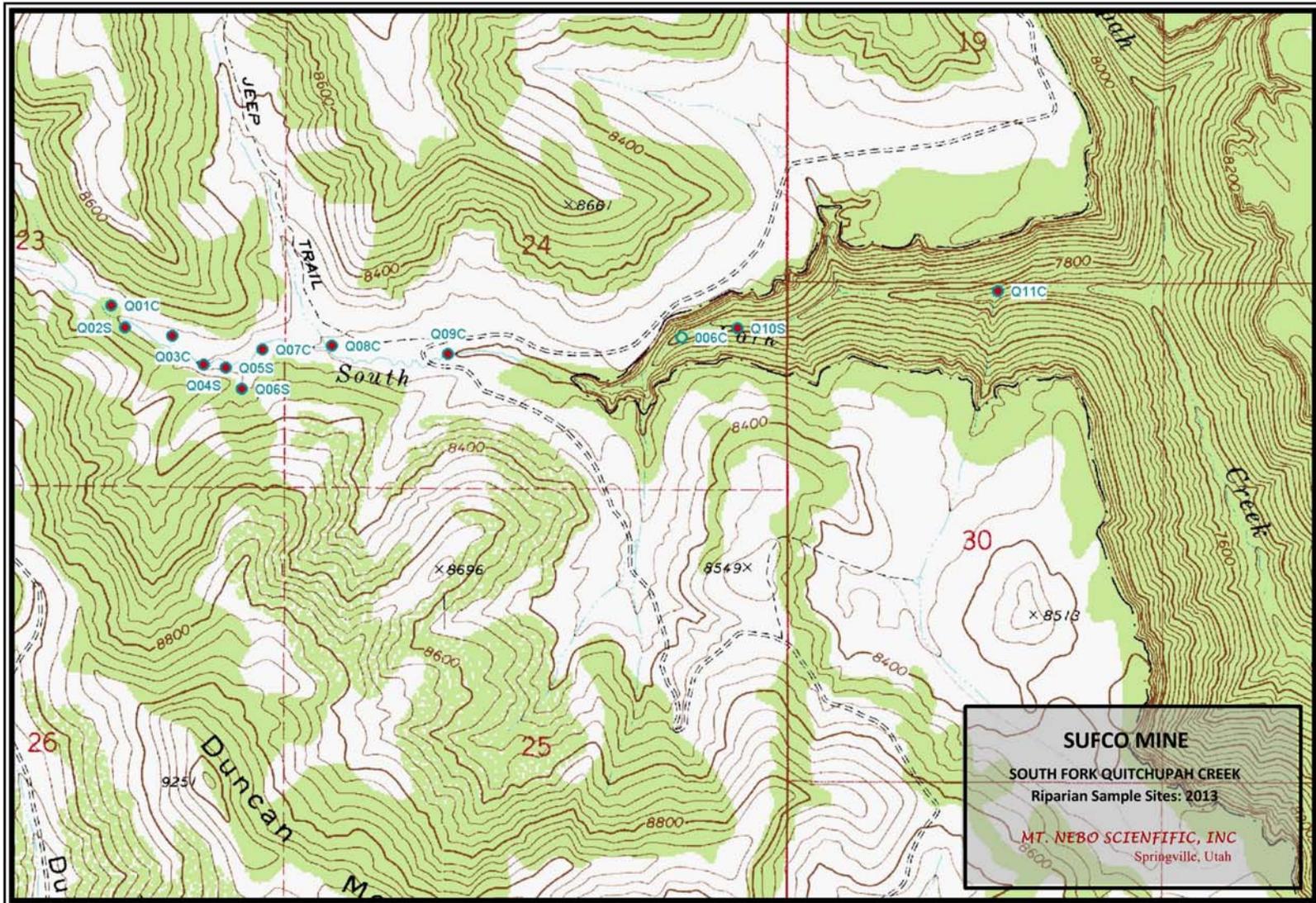
<b>TABLE 1: RIPARIAN COMPLEX DATA SHEET</b>	
CLIENT:	
SAMPLE NUMBER:	
WATERBODY NAME:	
LOCATION:	
DATE:	
OBSERVER(S):	
QUAD NAME:	
GEOLOGIC PARENT MATERIAL:	
STREAM ASPECT:	
STREAM GRADIENT:	
ELEVATION: .	
SIZE OF COMPLEX:	
ADJACENT UPLAND VEGETATION (looking downstream)	
Left:	Right:
VEGETATIVE DESCRIPTION (Dominance by Community Types)	
COMMUNITY SUCCESSIONAL STAGE:	
APPARENT FORAGE TREND:	
ESTIMATED FORAGE PRODUCTION:	
BEAVER ACTIVITY:	
EROSION RATING:	
PHOTOGRAPH TAKEN:	
LAND USE ACTIVITIES THAT COULD INFLUENCE RIPARIAN AREA:	
SPECIES OBSERVED:	
POOL ATTRIBUTES	
	% area in pools:
	% pool area made up of pools > 2' deep:
AQUATIC VEGETATION	
	% streambed with filamentous algae:
	% stream margin with rooted aquatic:
BANK TYPE & VEGETATION OVERHANG	
	% bank length undercut (<90°):
	% bank length gently sloping (>135°):
	% bank length with overhanging vegetation:
BANK CONDITION (bankfull area only)	
	% bank length vegetated, stable:
	% bank length unvegetated, stable:
	% bank length vegetated, unstable:
	% bank length unvegetated, unstable:
NOTES:	
QUANTITATIVE DATA SUMMARY:	
PHOTOGRAPHIC DOCUMENTATION:	

topographical features, the intent was to make the transects long enough to cover the entire stream, its riparian communities, plus an additional 10 ft on each side of the stream to record the adjacent upland communities. Monitoring the total extent of the riparian plant communities including some upland community data should provide information about possible increases or decreases in the riparian communities relative to the adjacent upland communities.

Once the transects were placed, the line-intercept method was employed to measure the extent of each major riparian plant community. The plant communities have been named by the dominant two plant species. If only one species dominated the community by a wide margin, the plant community was named by this single species. When appropriate, community data have been separated on the right and left side of the creek – these references mean “river-left” and “river-right”, *as characterized by looking downstream*. Because there were no well defined creek channels within the transect lines of the springs, the riparian/wetland vegetation data were not separated in this manner. Finally, each sample site was numbered sequentially and by the hydrologic type. For example, **Q01C** refers to the creek name (Quitcupah), station number (01), hydrologic type (channel). Accordingly, **Q02S** is a spring site rather than a creek channel.

## Results

A map showing the sample station locations is shown on the following page. Sample results are shown for each site on the data sheets provided in this report. Each sheet includes qualitative and quantitative data recorded as well as photographic documentation.

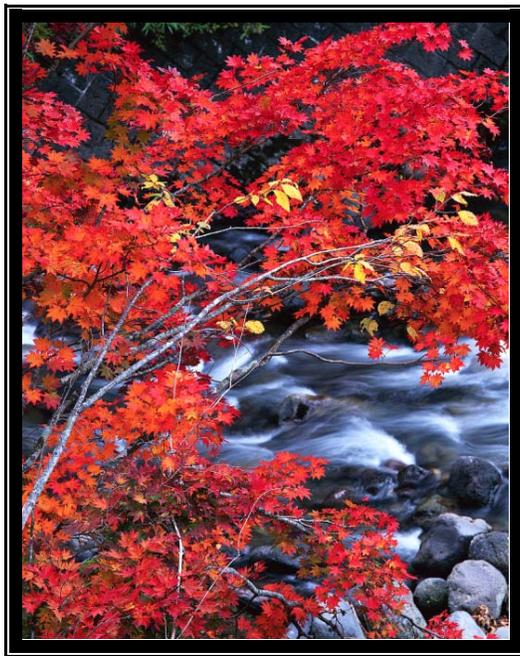


# SECTION A

## RIPARIAN COMPLEX DATA SHEETS

for the

JULY 2013  
SAMPLE PERIOD



**RIPARIAN COMPLEX DATA SHEET**  
**July 2013**

CLIENT: *Canyon Fuel Company, SUFCO Mine*

SAMPLE NUMBER: *Q01C*

WATERBODY NAME: *South Fork Quitchupah Creek*

LOCATION: *Southern Wasatch Plateau, Utah*

DATE: *July 24-25, 2013*

OBSERVER(S): *P. Collins*

USGS QUAD 7.5 MINUTE MAP: *Acord Lakes, Utah*

GEOLOGIC PARENT MATERIAL: *Price River Formation*

STREAM ASPECT: *East (120°)*

STREAM GRADIENT: *1-2°*

ELEVATION: *8,335 ft*

SIZE OF COMPLEX: *(see quantitative data)*

ADJACENT UPLAND VEGETATION (looking downstream)

Left: *Snowberry/Sagebrush/Grass*                      Right: *Aspen*

VEGETATIVE DESCRIPTION (Dominance by Community Types)

Community Name	% of Complex
<i>(refer to quantitative data results for this information)</i>	

COMMUNITY SUCCESSIONAL STAGE: *Mid (tree saplings present)*

APPARENT FORAGE TREND: *Stable*

ESTIMATED FORAGE PRODUCTION: *500 lbs/acre*

BEAVER ACTIVITY: *no*

EROSION RATING (1=negligible; 2=slight; 3=moderate; 4=slight; 5=extreme): *3*

PHOTOGRAPH TAKEN: *Yes*

LAND USE ACTIVITIES THAT COULD INFLUENCE RIPARIAN AREA: *Mining, grazing, hunting, cattle, wildlife and recreation.*

SPECIES OBSERVED:

Trees	Shrubs	Forbs	Grasses (or grasslike)
<i>Populus tremuloides</i>	<i>Artemisia tridentata</i>	<i>Achillea millefolium</i>	<i>Juncus arcticus</i>
<i>Salix boothii</i>	<i>Rosa woodsii</i>	<i>Taraxacum officinale</i>	<i>Poa pratensis</i>
	<i>Symphoricarpos oreophilus</i>		

POOL ATTRIBUTES

% area in pools: *0*  
 % pool area made up of pools > 2' deep: *0*

AQUATIC VEGETATION

% streambed with filamentous algae: *50 (left)*  
 % stream margin with rooted aquatic: *0*

BANK TYPE & VEGETATION OVERHANG

% bank length undercut (<90°): *0*  
 % bank length gently sloping (>135°): *0*  
 % bank length with overhanging vegetation: *25 (short Booth's willows)*

BANK CONDITION

% bank length vegetated, stable: *80*  
 % bank length unvegetated, stable: *10*  
 % bank length vegetated, unstable: *0*  
 % bank length unvegetated, unstable: *10*

NOTES:

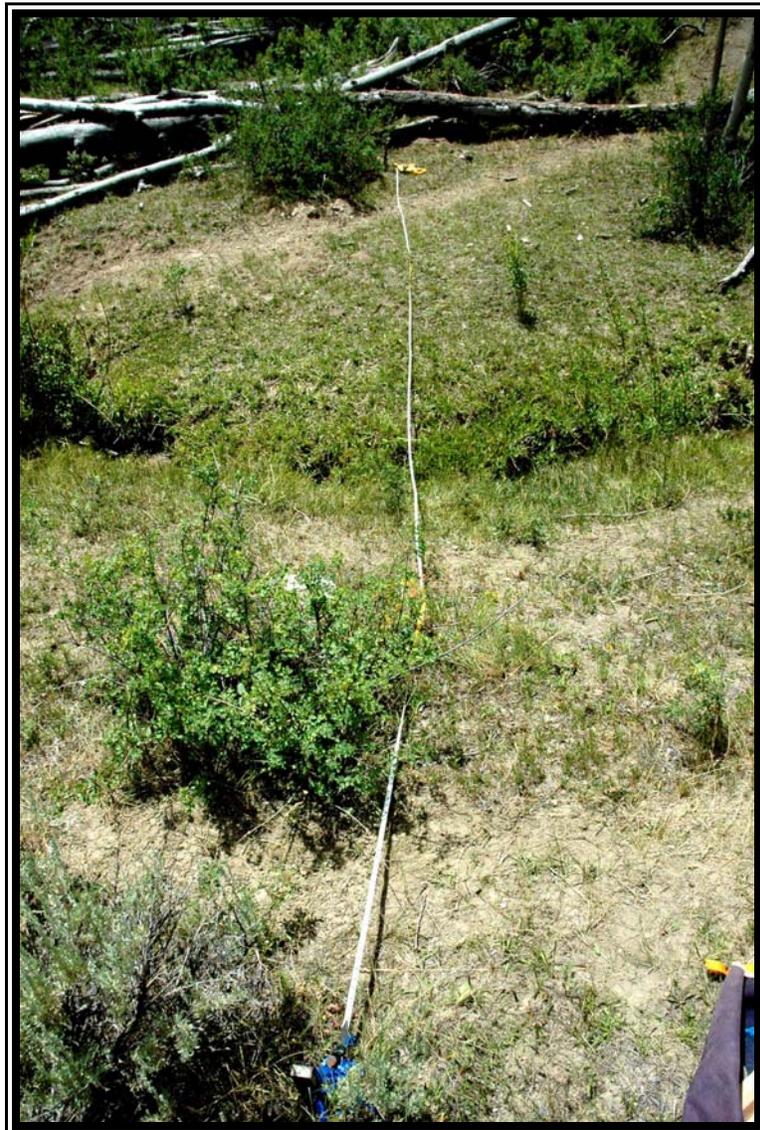
- 1) This is a good creek channel monitoring site. It is outside the cattle trail and readily monitored.*
- 2) Probably a good "control" site (outside the subsidence zone).*
- 3) There was quite a bit of cattle use noticed this sample period.*

## DATA SUMMARY

### **Q01C: Cover by plant community types in the South Fork Quitchupah Creek drainage (July 2013).**

<b>USDA Forest Service Protocol (1992)</b>			
	LEFT	RIGHT	TOTALS
<b>UPLAND VEGETATION</b>			
<i>Symphoricarpos oreophilus/Artemisia tridentata/Poa pratensis</i>	9.50		
<i>Poa pratensis/Taraxacum officinale</i>		10.00	19.50
<b>RIPARIAN VEGETATION</b>			
<u>Dominant Woody Species</u>			
<i>Salix boothii</i>	0.50		
<u>Dominant Herbaceous Species</u>			
<i>Juncus arcticus/Rosa woodsii</i>	3.50		
<i>Carex nebrascensis/Juncus arcticus</i>		5.00	9.00
<b>TOTAL COVER (Upland Species)</b>			19.50
<b>TOTAL COVER (Riparian Species)</b>			9.00
<b>ROCK (channel)</b>			0.00
<b>WATER (channel)</b>			1.50
<b>BAREGROUND (channel)</b>			0.00
<b>LITTER</b>			0.00
<b>MOSS</b>			0.00
<b>TOTAL COVER</b>			<b>30.00</b>

## PHOTOGRAPHIC DOCUMENTATION



Q01C

**RIPARIAN COMPLEX DATA SHEET**  
**July 2013**

CLIENT: *Canyon Fuel Company, SUFCO Mine*

SAMPLE NUMBER: **Q025**

WATERBODY NAME: *South Fork Quitchupah Creek*

LOCATION: *Southern Wasatch Plateau, Utah*

DATE: *July 24-25, 2013*

OBSERVER(S): *P. Collins*

USGS QUAD 7.5 MINUTE MAP: *Acord Lakes, Utah*

GEOLOGIC PARENT MATERIAL: *Price River Formation*

STREAM ASPECT: *E; Flow is NE (50°)*

STREAM GRADIENT: *1-2°*

ELEVATION: *8,330 ft*

SIZE OF COMPLEX: *(see quantitative data)*

ADJACENT UPLAND VEGETATION (looking downstream)

Left: *Aspen*

Right: *Aspen*

VEGETATIVE DESCRIPTION (Dominance by Community Types)

Community Name	% of Complex
<i>(refer to quantitative data results for this information)</i>	

COMMUNITY SUCCESSIONAL STAGE: *Mid*

APPARENT FORAGE TREND: *Decreasing (ground cover was mud and vegetation)*

ESTIMATED FORAGE PRODUCTION: *300 lbs/acre*

BEAVER ACTIVITY: *no*

EROSION RATING (1=negligible; 2=slight; 3=moderate; 4=severe; 5=extreme): *Inside of spring =3; outside=4.*

PHOTOGRAPH TAKEN: *Yes*

LAND USE ACTIVITIES THAT COULD INFLUENCE RIPARIAN AREA: *Mining, grazing (cattle & wildlife), hunting, recreation.*

SPECIES OBSERVED:

Trees	Shrubs	Forbs	Grasses (or grasslike)
<i>Picea pungens</i>	<i>Ribes sp.</i>	<i>Achillea millefolium</i>	<i>Agrostis stolonifera</i>
<i>Populus tremuloides</i>	<i>Symphoricarpos oreophilus</i>	<i>Equisetum arvense</i>	<i>Carex nebrascensis</i>
		<i>Ranunculus cymbalaria</i>	<i>Poa pratensis</i>
		<i>Taraxacum officinale</i>	

POOL ATTRIBUTES

% area in pools: *100*  
 % pool area made up of pools > 2' deep: *0*

AQUATIC VEGETATION

% streambed with filamentous algae: *0*  
 % stream margin with rooted aquatic: *0*

BANK TYPE & VEGETATION OVERHANG

% bank length undercut (<90°): *0*  
 % bank length gently sloping (>135°): *100*  
 % bank length with overhanging vegetation: *0*

BANK CONDITION

	<u>Center</u>	<u>Side</u>
% bank length vegetated, stable:	<i>35</i>	<i>60</i>
% bank length unvegetated, stable:	<i>15</i>	<i>20</i>
% bank length vegetated, unstable:	<i>30</i>	<i>5</i>
% bank length unvegetated, unstable:	<i>20</i>	<i>15</i>

NOTES:

- 1) *This is a spring area.*
- 2) *Probably a good "control" site (outside the subsidence zone).*
- 3) *There were lots of cattle hoof-prints (disturbance).*
- 4) *The Bank Condition represents both the bank and wet areas (refer to the photograph).*
- 5) *The center of the spring was comprised of about 1/2 water and 1/2 mud.*

## DATA SUMMARY

### Q02S: Cover by plant community types in the South Fork Quitchupah Creek drainage (July 2013).

<b>USDA Forest Service Protocol (1992)</b>			
	LEFT	RIGHT	TOTALS
<b>UPLAND VEGETATION</b>			
<i>Poa pratensis</i> / <i>Achillea millefolium</i>	10.00		
<i>Geranium richardsonii</i> / <i>Poa pratensis</i>		8.00	
			18.00
<b>RIPARIAN VEGETATION</b>			
<u>Dominant Woody Species</u>			
<u>Dominant Herbaceous Species</u>			
<i>Ranunculus cymbalaria</i> / <i>Agrostis stolonifera</i>		6.00	
<i>Carex nebrascensis</i> / <i>Ranunculus cymbalaria</i>	1.00		
			7.00
<b>TOTAL COVER (Upland Species)</b>			18.00
<b>TOTAL COVER (Riparian Species)</b>			7.00
<b>ROCK (channel)</b>			0.00
<b>WATER (channel)</b>			4.00
<b>BAREGROUND (channel)</b>			4.00
<b>LITTER</b>			0.00
<b>MOSS</b>			0.00
<b>TOTAL COVER</b>			<b>33.00</b>

## PHOTOGRAPHIC DOCUMENTATION



Q02S

**RIPARIAN COMPLEX DATA SHEET**  
**July 2013**

CLIENT: *Canyon Fuel Company, SUFCO Mine*

SAMPLE NUMBER: **Q03C**

WATERBODY NAME: *South Fork Quitchupah Creek*

LOCATION: *Southern Wasatch Plateau, Utah*

DATE: *July 24-25, 2013*

OBSERVER(S): *P. Collins*

USGS QUAD 7.5 MINUTE MAP: *Acord Lakes, Utah*

GEOLOGIC PARENT MATERIAL: *Price River Formation*

STREAM ASPECT: *E (90°)*

STREAM GRADIENT: *1-2°*

ELEVATION: *8,310 ft*

SIZE OF COMPLEX: *(see quantitative data)*

ADJACENT UPLAND VEGETATION (looking downstream)

Left: *Sagebrush/Grass*

Right: *Aspen*

VEGETATIVE DESCRIPTION (Dominance by Community Types)

Community Name	% of Complex
<i>(refer to quantitative data results for this information)</i>	

COMMUNITY SUCCESSIONAL STAGE: *Mid (tree saplings present)*

APPARENT FORAGE TREND: *Stable*

ESTIMATED FORAGE PRODUCTION: *800 lbs/acre*

BEAVER ACTIVITY: *no*

EROSION RATING (1=negligible; 2=slight; 3=moderate; 4=severe; 5=extreme): *3 (on river bank near the water)*

PHOTOGRAPH TAKEN: *Yes*

LAND USE ACTIVITIES THAT COULD INFLUENCE RIPARIAN AREA: *Mining, grazing (cattle & wildlife), hunting, recreation.*

SPECIES OBSERVED:

Trees	Shrubs	Forbs	Grasses (or grasslike)
<i>Populus tremuloides</i>	<i>Artemisia tridentata</i>	<i>Aster sp.</i>	<i>Agrostis stolonifera</i>
	<i>Rosa woodsii</i>	<i>Equisetum arvense</i>	<i>Juncus arcticus</i>
	<i>Salix spp.</i>	<i>Taraxacum officinale</i>	<i>Juncus longistylis</i>

POOL ATTRIBUTES

% area in pools: *0*  
 % pool area made up of pools > 2' deep: *0*

AQUATIC VEGETATION

% streambed with filamentous algae: *0*  
 % stream margin with rooted aquatic: *0*

BANK TYPE & VEGETATION OVERHANG

% bank length undercut (<90°): *50 on rt side; 100 lf side just above water level. The water level may dictate different results here.*  
 % bank length gently sloping (>135°): *0*  
 % bank length with overhanging vegetation: *0*

BANK CONDITION

% bank length vegetated, stable: *90*  
 % bank length unvegetated, stable: *2.5*  
 % bank length vegetated, unstable: *2.5*  
 % bank length unvegetated, unstable: *5*

NOTES:

- 1) *This is a channel site.*
- 2) *A good control station; outside current subsidence plans.*
- 3) *It seems like we needed a sample here, but this may be more difficult to monitor as accurately due to the topography. The narrow channel sites are more straight-forward to monitor than this type.*
- 4) *Interestingly, the adjacent aspen understory (that I considered upland) had more wiregrass present. This may be a function of the shade prolonging snowmelt.*
- 5) *This wiregrass area should be noted during each sample period.*
- 6) *Therefore on the right side, it is difficult to separate the upland from the riparian.*

## DATA SUMMARY

### Q03C: Cover by plant community types in the South Fork Quitchupah Creek drainage (July 2013).

<b>USDA Forest Service Protocol (1992)</b>			
	LEFT	RIGHT	TOTALS
<b>UPLAND VEGETATION</b>			
<i>Artemisia tridentata/Elymus salinus</i>	10.00		
<i>Populus tremuloides/Juncus arcticus</i>		13.00	
			23.00
<b>RIPARIAN VEGETATION</b>			
<u>Dominant Woody Species</u>			
<u>Dominant Herbaceous Species</u>			
<i>Juncus arcticus</i>	6.50	4.00	
			10.50
<b>TOTAL COVER (Upland Species)</b>			23.00
<b>TOTAL COVER (Riparian Species)</b>			10.50
<b>ROCK (channel)</b>			0.00
<b>WATER (channel)</b>			1.50
<b>BAREGROUND (channel)</b>			0.00
<b>LITTER</b>			0.00
<b>MOSS</b>			0.00
<b>TOTAL COVER</b>			<b>35.00</b>

## PHOTOGRAPHIC DOCUMENTATION



Q03C

**RIPARIAN COMPLEX DATA SHEET**  
**July 2013**

CLIENT: *Canyon Fuel Company, SUFCO Mine*

SAMPLE NUMBER: *Q045*

WATERBODY NAME: *South Fork Quitchupah Creek*

LOCATION: *Southern Wasatch Plateau, Utah*

DATE: *July 24-25, 2013*

OBSERVER(S): *P. Collins*

USGS QUAD 7.5 MINUTE MAP: *Acord Lakes, Utah*

GEOLOGIC PARENT MATERIAL: *Price River Formation*

STREAM ASPECT: *E [but flow here was N (340°)]*

STREAM GRADIENT: *1-2°*

ELEVATION: *8,310 ft*

SIZE OF COMPLEX: *(see quantitative data)*

ADJACENT UPLAND VEGETATION (looking downstream)

Left: *Aspen*

Right: *Aspen/Blue Spruce/Willow*

VEGETATIVE DESCRIPTION (Dominance by Community Types)

Community Name	% of Complex
<i>(refer to quantitative data results for this information)</i>	

COMMUNITY SUCCESSIONAL STAGE: *Late*

APPARENT FORAGE TREND: *Stable*

ESTIMATED FORAGE PRODUCTION: *700 lbs/acre*

BEAVER ACTIVITY: *no*

EROSION RATING (1=negligible; 2=slight; 3=moderate; 4=severe; 5=extreme): *3*

PHOTOGRAPH TAKEN: *Yes*

LAND USE ACTIVITIES THAT COULD INFLUENCE RIPARIAN AREA: *Mining, grazing (cattle & wildlife), hunting, recreation.*

SPECIES OBSERVED:

Trees	Shrubs	Forbs	Grasses (or grasslike)
<i>Picea pungens</i>	<i>Rosa woodsii</i>	<i>Achillea millefolium</i>	<i>Eleocharis palustris</i>
<i>Populus tremuloides</i>	<i>Salix boothii</i>	<i>Equisetum arvense</i>	<i>Hordeum jubatum</i>
		<i>Geranium richardsonii</i>	<i>Juncus arcticus</i>
			<i>Juncus longistylis</i>
			<i>Poa pratensis</i>

POOL ATTRIBUTES

% area in pools: *100*  
 % pool area made up of pools > 2' deep: *0*

AQUATIC VEGETATION

% streambed with filamentous algae: *0*  
 % stream margin with rooted aquatic: *0*

BANK TYPE & VEGETATION OVERHANG

% bank length undercut (<90°): *0*  
 % bank length gently sloping (>135°): *100*  
 % bank length with overhanging vegetation: *50*

BANK CONDITION

% bank length vegetated, stable: *55*  
 % bank length unvegetated, stable: *0*  
 % bank length vegetated, unstable: *75*  
 % bank length unvegetated, unstable: *30*

NOTES:

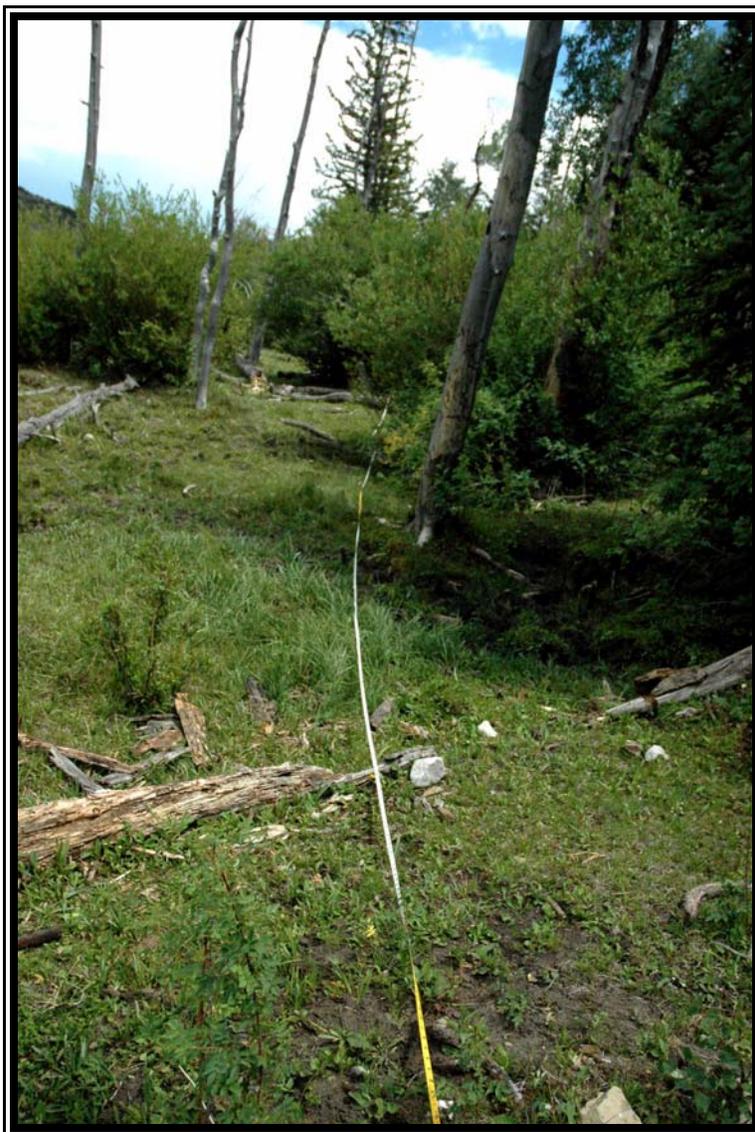
- 1) *This is a spring area.*
- 2) *It is a good control station; outside current subsidence plans.*
- 3) *The spring was mostly dry in July 2013. There was a 7 ft diameter area of mud in the middle where it had received heavy cattle pressure.*
- 4) *The spring site had several zones of vegetation based on the different water regimes.*
- 5) *Nebraska sedge and spike rush zones seemed to be the wettest areas.*
- 6) *There was a lot of impact from cattle trampling here. Because of this some areas had a high living cover value, whereas other areas were low.*
- 7) *There was almost no water this period - about 4 hoof prints had some water in them.*

## DATA SUMMARY

### **Q04S: Cover by plant community types in the South Fork Quitchupah Creek drainage (July 2013).**

<b>USDA Forest Service Protocol (1992)</b>			
	LEFT	RIGHT	TOTALS
<b>UPLAND VEGETATION</b>			
<i>Symphoricarpos oreophilus/Populus tremuloides</i>	9.00		
<i>Picea pungens/Salix boothii</i>		10.00	
			19.00
<b>RIPARIAN VEGETATION</b>			
<u>Dominant Woody Species</u>			
<u>Dominant Herbaceous Species</u>			
<i>Carex nebrascensis/Hordeum jubatum</i>			
<i>Eleocharis palustris/Ranunculus cymbalaria</i>		25.00	
<i>Carex nebrascensis</i>	8.00		
			33.00
<b>TOTAL COVER (Upland Species)</b>			19.00
<b>TOTAL COVER (Riparian Species)</b>			33.00
<b>ROCK (channel)</b>			0.00
<b>WATER (channel)</b>			4.00
<b>BAREGROUND (channel)</b>			0.00
<b>LITTER</b>			0.00
<b>MOSS</b>			0.00
<b>TOTAL COVER</b>			<b>56.00</b>

## PHOTOGRAPHIC DOCUMENTATION



Q04S

**RIPARIAN COMPLEX DATA SHEET**  
**July 2013**

CLIENT: *Canyon Fuel Company, SUFCO Mine*

SAMPLE NUMBER: *Q055*

WATERBODY NAME: *South Fork Quitchupah Creek*

LOCATION: *Southern Wasatch Plateau, Utah*

DATE: *July 24-25, 2013*

OBSERVER(S): *P. Collins*

USGS QUAD 7.5 MINUTE MAP: *Acord Lakes, Utah*

GEOLOGIC PARENT MATERIAL: *Price River Formation*

STREAM ASPECT: *E; flow here was 30°*

STREAM GRADIENT: *1-2°*

ELEVATION: *8,294 ft*

SIZE OF COMPLEX: *(see quantitative data)*

ADJACENT UPLAND VEGETATION (looking downstream)

Left: *Blue Spruce/Willow*

Right: *Blue Spruce/Aspen*

VEGETATIVE DESCRIPTION (Dominance by Community Types)

Community Name	% of Complex
<i>(refer to quantitative data results for this information)</i>	

COMMUNITY SUCCESSIONAL STAGE: *Late*

APPARENT FORAGE TREND: *Stable*

ESTIMATED FORAGE PRODUCTION: *700 lbs/acre*

BEAVER ACTIVITY: *no*

EROSION RATING (1=negligible; 2=slight; 3=moderate; 4=severe; 5=extreme): *4 (due to cattle)*

PHOTOGRAPH TAKEN: *Yes*

LAND USE ACTIVITIES THAT COULD INFLUENCE RIPARIAN AREA: *Mining, grazing (cattle & wildlife), hunting, recreation.*

SPECIES OBSERVED:

Trees	Shrubs	Forbs	Grasses (or grasslike)
<i>Picea pungens</i>	<i>Salix boothii</i>	<i>Equisetum arvense</i>	<i>Agrostis stolonifera</i>
<i>Pinus flexilis</i>	<i>Symphoricarpos oreophilus</i>	<i>Geranium richardsonii</i>	<i>Carex nebrascensis</i>
<i>Populus tremuloides</i>		<i>Ranunculus cymbalaria</i>	

POOL ATTRIBUTES

% area in pools: *0*  
 % pool area made up of pools > 2' deep: *0*

AQUATIC VEGETATION

% streambed with filamentous algae: *0*  
 % stream margin with rooted aquatic: *0*

BANK TYPE & VEGETATION OVERHANG

% bank length undercut (<90°): *0*  
 % bank length gently sloping (>135°): *100*  
 % bank length with overhanging vegetation: *20*

BANK CONDITION

% bank length vegetated, stable: *55*  
 % bank length unvegetated, stable: *5*  
 % bank length vegetated, unstable: *20 (due to cattle)*  
 % bank length unvegetated, unstable: *20*

NOTES:

- 1) *This is a well-defined spring area.*
- 2) *A good control station; it is just outside current subsidence plans.*
- 3) *When I placed the transect tape, it formed a "U" shape to measure. This tape was placed 4 ft from the upland bank for 72 ft of riparian/spring vegetation.*
- 4) *For this sample period, the water area comprised the entire 38 ft out of the 72 ft mentioned above.*
- 5) *There was a lot of impact from cattle trampling at the site.*
- 6) *There was vegetation and mud present in the spring at the transect line (no water).*

## DATA SUMMARY

### **Q05S: Cover by plant community types in the South Fork Quitchupah Creek drainage (July 2013).**

<b>USDA Forest Service Protocol (1992)</b>			
	LEFT	RIGHT	TOTALS
<b>UPLAND VEGETATION</b>			
<i>Salix boothii/Picea pungens</i>	10.00		
<i>Picea pungens/Populus tremuloides</i>		11.00	
			21.00
<b>RIPARIAN VEGETATION</b>			
<u>Dominant Woody Species</u>			
<u>Dominant Herbaceous Species</u>			
<i>Carex nebrascensis/Agrostis stolonifera/Ranunculus cymbalaria</i>	36.00	36.00	
			72.00
<b>TOTAL COVER (Upland Species)</b>			21.00
<b>TOTAL COVER (Riparian Species)</b>			72.00
<b>ROCK (channel)</b>			0.00
<b>WATER (channel)</b>			0.00
<b>BAREGROUND (channel)</b>			0.00
<b>LITTER</b>			0.00
<b>MOSS</b>			0.00
<b>TOTAL COVER</b>			<b>93.00</b>

## PHOTOGRAPHIC DOCUMENTATION



Q05S

**RIPARIAN COMPLEX DATA SHEET**  
**July 2013**

CLIENT: *Canyon Fuel Company, SUFCO Mine*

SAMPLE NUMBER: **Q065**

WATERBODY NAME: *South Fork Quitchupah Creek*

LOCATION: *Southern Wasatch Plateau, Utah*

DATE: *July 24-25, 2013*

OBSERVER(S): *P. Collins*

USGS QUAD 7.5 MINUTE MAP: *Acord Lakes, Utah*

GEOLOGIC PARENT MATERIAL: *Price River Formation*

STREAM ASPECT: *E [but flow here was N (330°)]*

STREAM GRADIENT: *1-2°*

ELEVATION: *8,313 ft*

SIZE OF COMPLEX: *(see quantitative data)*

ADJACENT UPLAND VEGETATION (looking downstream)

Left: *Meadow*

Right: *Meadow*

VEGETATIVE DESCRIPTION (Dominance by Community Types)

Community Name	% of Complex
<i>(refer to quantitative data results for this information)</i>	

COMMUNITY SUCCESSIONAL STAGE: *Late*

APPARENT FORAGE TREND: *Stable*

ESTIMATED FORAGE PRODUCTION: *300 lbs/acre*

BEAVER ACTIVITY: *no*

EROSION RATING (1=negligible; 2=slight; 3=moderate; 4=severe; 5=extreme): *4 (cattle impact)*

PHOTOGRAPH TAKEN: *Yes*

LAND USE ACTIVITIES THAT COULD INFLUENCE RIPARIAN AREA: *Mining, grazing (cattle & wildlife), hunting, recreation.*

SPECIES OBSERVED:

Trees	Shrubs	Forbs	Grasses (or grasslike)
<i>Populus tremuloides</i>	<i>Ribes sp</i>	<i>Equisetum arvense</i>	<i>Agrostis stolonifera</i>
	<i>Salix boothii</i>	<i>Taraxacum officinale</i>	<i>Poa pratensis</i>

POOL ATTRIBUTES

% area in pools: *100*  
 % pool area made up of pools > 2' deep: *0*

AQUATIC VEGETATION

% streambed with filamentous algae: *0*  
 % stream margin with rooted aquatic: *0*

BANK TYPE & VEGETATION OVERHANG

% bank length undercut (<90°): *0*  
 % bank length gently sloping (>135°): *100*  
 % bank length with overhanging vegetation: *25*

BANK CONDITION

% bank length vegetated, stable: *15*  
 % bank length unvegetated, stable: *0*  
 % bank length vegetated, unstable: *10*  
 % bank length unvegetated, unstable: *75 (cattle impact)*

NOTES:

- 1) *Only measured obvious, well-defined spring area.*
- 2) *Left side measured to bank (3 ft).*
- 3) *Cattle had a great impact for this sample period. Therefore the riparian vegetation was almost all located on the sides of the spring channel (see photo).*
- 4) *Riparian/wetland vegetation was measured in the spring channel only.*
- 5) *There was 7 ft in the center of the spring with water in hoof prints (<10% cover here).*
- 6) *The sample station was located within current planned subsidence zone.*

## DATA SUMMARY

### **Q06S: Cover by plant community types in the South Fork Quitchupah Creek drainage (July 2013).**

#### **USDA Forest Service Protocol (1992)**

	LEFT	RIGHT	TOTALS
<b>UPLAND VEGETATION</b>			
<i>Populus tremuloides/Salix boothii</i> <i>Symphoricarpos oreophilus/Grasses</i>	3.00	5.00	8.00
<b>RIPARIAN VEGETATION</b>			
<u>Dominant Woody Species</u>			
<u>Dominant Herbaceous Species</u>			
<i>Agrostis stolonifera</i>	2.50	2.50	5.00
<b>TOTAL COVER (Upland Species)</b>			8.00
<b>TOTAL COVER (Riparian Species)</b>			5.00
<b>ROCK (channel)</b>			0.00
<b>WATER (channel)</b>			0.00
<b>BAREGROUND (channel)</b>			7.00
<b>LITTER</b>			0.00
<b>MOSS</b>			0.00
<b>TOTAL COVER</b>			<b>20.00</b>

## PHOTOGRAPHIC DOCUMENTATION



Q06S

**RIPARIAN COMPLEX DATA SHEET**  
**July 2013**

CLIENT: *Canyon Fuel Company, SUFCO Mine*

SAMPLE NUMBER: **Q07C**

WATERBODY NAME: *South Fork Quitchupah Creek*

LOCATION: *Southern Wasatch Plateau, Utah*

DATE: *July 24-25, 2013*

OBSERVER(S): *P. Collins*

USGS QUAD 7.5 MINUTE MAP: *Acord Lakes, Utah*

GEOLOGIC PARENT MATERIAL: *Price River Formation*

STREAM ASPECT: *E [but flow here was N (5°)]*

STREAM GRADIENT: *2-3°*

ELEVATION: *8,285 ft*

SIZE OF COMPLEX: *(see quantitative data)*

ADJACENT UPLAND VEGETATION (looking downstream)

Left: *Meadow*

Right: *Meadow*

VEGETATIVE DESCRIPTION (Dominance by Community Types)

Community Name	% of Complex
<i>(refer to quantitative data results for this information)</i>	

COMMUNITY SUCCESSIONAL STAGE: *Mid-*

APPARENT FORAGE TREND: *Stable*

ESTIMATED FORAGE PRODUCTION: *1,100 lbs/acre*

BEAVER ACTIVITY: *no*

EROSION RATING (1=negligible; 2=slight; 3=moderate; 4=severe; 5=extreme): *1*

PHOTOGRAPH TAKEN: *Yes*

LAND USE ACTIVITIES THAT COULD INFLUENCE RIPARIAN AREA: *Mining, grazing (cattle & wildlife), hunting, recreation.*

SPECIES OBSERVED:

Trees	Shrubs	Forbs	Grasses (or grasslike)
	<i>Rosa woodsii</i>	<i>Achillea millefolium</i>	<i>Agrostis stolonifera</i>
	<i>Salix boothii</i>	<i>Trifolium sp.</i>	<i>Carex nebrascensis</i>
			<i>Hordeum jubatum</i>
			<i>Poa pratensis</i>

POOL ATTRIBUTES

% area in pools: *0*  
 % pool area made up of pools > 2' deep: *0*

AQUATIC VEGETATION

% streambed with filamentous algae: *0*  
 % stream margin with rooted aquatic: *0*

BANK TYPE & VEGETATION OVERHANG

% bank length undercut (<90°): *50 (all on right side)*  
 % bank length gently sloping (>135°): *100 incised (18") channel*  
 % bank length with overhanging vegetation:

BANK CONDITION

% bank length vegetated, stable: *95*  
 % bank length unvegetated, stable: *2.5*  
 % bank length vegetated, unstable: *0*  
 % bank length unvegetated, unstable: *2.5*

NOTES:

- 1) *This site is in the middle of a meadow.*
- 2) *Right side: This area looked different than the last sample period. This side had little upland vegetation (some foxtail barley). It was mostly all riparian vegetation with more Nebraska sedge this period. I think these communities are dynamic and can show year-to-year differences based on water regimes. For example, I think in the dryer years different species are more prominent for cover and production and the same for the wetter years. There may also be variations from season to season. I am sampling somewhat earlier this year compared to 2012.*
- 3) *Left side: The riparian community was measured beginning in the meadow (where the stake would be easily found later) and ended at the channel bank. The entire meadow, however, had some wetland species.*

- 4) This site is within the current planned subsidence zone
- 5) There was cattle at the site when I was sampling

## DATA SUMMARY

### **Q07C: Cover by plant community types in the South Fork Quitchupah Creek drainage (July 2013).**

<b>USDA Forest Service Protocol (1992)</b>			
	LEFT	RIGHT	TOTALS
<b>UPLAND VEGETATION</b>	0.00		
<i>Poa pratensis/Achillea millefolium</i>		0.00	
<i>Poa pratensis/Achillea millefolium</i>			0.00
<b>RIPARIAN VEGETATION</b>			
<u>Dominant Woody Species</u>			
<i>Rosa woodsii</i>	7.50		
<u>Dominant Herbaceous Species</u>			
<i>Carex nebrascensis/Poa pratensis</i>		10.50	
<i>Carex nebrascensis</i>	24.00	10.00	
<i>Juncus arcticus</i>	2.00		33.50
<b>TOTAL COVER (Upland Species)</b>			0.00
<b>TOTAL COVER (Riparian Species)</b>			54.00
<b>ROCK (channel)</b>			0.00
<b>WATER (channel)</b>			1.00
<b>BAREGROUND (channel)</b>			0.00
<b>LITTER</b>			0.00
<b>MOSS</b>			0.00
<b>TOTAL COVER</b>			<b>55.00</b>

## PHOTOGRAPHIC DOCUMENTATION



Q07C

**RIPARIAN COMPLEX DATA SHEET**  
**July 2013**

CLIENT: *Canyon Fuel Company, SUFCO Mine*

SAMPLE NUMBER: *Q08C*

WATERBODY NAME: *South Fork Quitchupah Creek*

LOCATION: *Southern Wasatch Plateau, Utah*

DATE: *July 24-25, 2013*

OBSERVER(S): *P. Collins*

USGS QUAD 7.5 MINUTE MAP: *Acord Lakes, Utah*

GEOLOGIC PARENT MATERIAL: *Price River Formation*

STREAM ASPECT: *E (flow here was 140°)*

STREAM GRADIENT: *2-3°*

ELEVATION: *8,253 ft*

SIZE OF COMPLEX: *(see quantitative data)*

ADJACENT UPLAND VEGETATION (looking downstream)

Left: *Sagebrush/Grass*

Right: *Aspen/Snowberry*

VEGETATIVE DESCRIPTION (Dominance by Community Types)

Community Name	% of Complex
<i>(refer to quantitative data results for this information)</i>	

COMMUNITY SUCCESSIONAL STAGE: *Mid*

APPARENT FORAGE TREND: *Stable*

ESTIMATED FORAGE PRODUCTION: *1,000 lbs/acre*

BEAVER ACTIVITY: *no*

EROSION RATING (1=negligible; 2=slight; 3=moderate; 4=severe; 5=extreme): *1 (banks)*

PHOTOGRAPH TAKEN: *Yes*

LAND USE ACTIVITIES THAT COULD INFLUENCE RIPARIAN AREA: *Mining, grazing (cattle & wildlife), hunting, recreation.*

SPECIES OBSERVED:

Trees	Shrubs	Forbs	Grasses (or grasslike)
<i>Populus tremuloides</i>	<i>Artemisia tridentata</i>	<i>Trifolium sp.</i>	<i>Agrostis stolonifera</i>
	<i>Salix boothii</i>		<i>Carex nebrascensis</i>
			<i>Juncus arcticus</i>

POOL ATTRIBUTES

% area in pools: *0*  
 % pool area made up of pools > 2' deep: *0*

AQUATIC VEGETATION

% streambed with filamentous algae: *0*  
 % stream margin with rooted aquatic: *0*

BANK TYPE & VEGETATION OVERHANG

% bank length undercut (<90°): *0*  
 % bank length gently sloping (>135°): *100 but above the incised (18") channel; vertical from water to bank with no undercutting.*  
 % bank length with overhanging vegetation:

BANK CONDITION

% bank length vegetated, stable: *95*  
 % bank length unvegetated, stable: *1*  
 % bank length vegetated, unstable: *0*  
 % bank length unvegetated, unstable: *4*

NOTES:

- 1) *This site had a straightforward area to monitor the riparian zone. The station went from low water to a low terrace, then a high terrace and finally to the aspen forest.*
- 2) *This site is within the current planned subsidence zone.*

## DATA SUMMARY

### **Q08C: Cover by plant community types in the South Fork Quitchupah Creek drainage (July 2013).**

<b>USDA Forest Service Protocol (1992)</b>			
	LEFT	RIGHT	TOTALS
<b>UPLAND VEGETATION</b>			
<i>Artemisia tridentata/Grasses</i>	10.00		
<i>Populus tremuloides/Symphoricarpos oreophilus</i>		11.00	
			21.00
<b>RIPARIAN VEGETATION</b>			
<u>Dominant Woody Species</u>			
<i>Rosa woodsii</i>			
<u>Dominant Herbaceous Species</u>			
<i>Carex nebrascensis</i>	3.00	14.00	
<i>Carex nebrascensis/Agrostis stolonifera/Ranunculus cymbalaria</i>	5.00		
			22.00
<b>TOTAL COVER (Upland Species)</b>			21.00
<b>TOTAL COVER (Riparian Species)</b>			22.00
<b>ROCK (channel)</b>			0.00
<b>WATER (channel)</b>			1.00
<b>BAREGROUND (channel)</b>			0.00
<b>LITTER</b>			0.00
<b>MOSS</b>			0.00
<b>TOTAL COVER</b>			<b>44.00</b>

## PHOTOGRAPHIC DOCUMENTATION



Q08C

**RIPARIAN COMPLEX DATA SHEET**  
**July 2013**

CLIENT: *Canyon Fuel Company, SUFCO Mine*

SAMPLE NUMBER: **Q09C**

WATERBODY NAME: *South Fork Quitchupah Creek*

LOCATION: *Southern Wasatch Plateau, Utah*

DATE: *July 24-25, 2013*

OBSERVER(S): *P. Collins*

USGS QUAD 7.5 MINUTE MAP: *Acord Lakes, Utah*

GEOLOGIC PARENT MATERIAL: *Near the contact between the Price River Formation and the Castlegate Sandstone*

STREAM ASPECT: *E*

STREAM GRADIENT: *2-3°*

ELEVATION: *8,253 ft*

SIZE OF COMPLEX: *(see quantitative data)*

ADJACENT UPLAND VEGETATION (looking downstream)

Left: *Sagebrush/Grass*

Right: *Sagebrush/Grass*

VEGETATIVE DESCRIPTION (Dominance by Community Types)

Community Name	% of Complex
<i>(refer to quantitative data results for this information)</i>	

COMMUNITY SUCCESSIONAL STAGE: *Mid*

APPARENT FORAGE TREND: *Stable*

ESTIMATED FORAGE PRODUCTION: *400 lbs/acre*

BEAVER ACTIVITY: *no*

EROSION RATING (1=negligible; 2=slight; 3=moderate; 4=severe; 5=extreme): *1*

PHOTOGRAPH TAKEN: *Yes*

LAND USE ACTIVITIES THAT COULD INFLUENCE RIPARIAN AREA: *Mining, grazing (cattle & wildlife), hunting, recreation.*

SPECIES OBSERVED:

Trees	Shrubs	Forbs	Grasses (or grasslike)
	<i>Artemisia tridentata</i>	<i>Trifolium sp.</i>	<i>Agrostis stolonifera</i>
	<i>Rosa woodsii</i>		<i>Juncus arcticus</i>
	<i>Salix boothii</i>		<i>Poa pratensis</i>

POOL ATTRIBUTES

% area in pools: *0*  
 % pool area made up of pools > 2' deep: *0*

AQUATIC VEGETATION

% streambed with filamentous algae: *0*  
 % stream margin with rooted aquatic: *0*

BANK TYPE & VEGETATION OVERHANG

% bank length undercut (<90°): *100 on both sides of the channel.*  
 % bank length gently sloping (>135°): *100 but above the incised (24" wide) channel.*  
 % bank length with overhanging vegetation: *(herbaceous only)*

BANK CONDITION

% bank length vegetated, stable: *90*  
 % bank length unvegetated, stable: *0*  
 % bank length vegetated, unstable: *2*  
 % bank length unvegetated, unstable: *3*

NOTES:

- 1) *This site had a straightforward area to monitor the riparian zone.*
- 2) *This site is within the current planned subsidence zone.*
- 3) *The riparian species composition seemed to be different from the previous sample period - it was dominated by different species. I noticed the same thing at Q07C (see the notes I wrote there).*

## DATA SUMMARY

### Q09C: Cover by plant community types in the South Fork Quitchupah Creek drainage (July 2013).

<b>USDA Forest Service Protocol (1992)</b>			
	LEFT	RIGHT	TOTALS
<b>UPLAND VEGETATION</b>	10.00		
<i>Artemisia tridentata/Grasses</i>		11.00	
<i>Artemisia tridentata/Grasses</i>			21.00
<b>RIPARIAN VEGETATION</b>			
<u>Dominant Woody Species</u>			
<u>Dominant Herbaceous Species</u>			
<i>Poa pratensis/Juncus arcticus</i>	13.00		
<i>Equisetum arvensis/Poa pratensis</i>		1.00	
			14.00
<b>TOTAL COVER (Upland Species)</b>			21.00
<b>TOTAL COVER (Riparian Species)</b>			14.00
<b>ROCK (channel)</b>			0.00
<b>WATER (channel)</b>			1.00
<b>BAREGROUND (channel)</b>			0.00
<b>LITTER</b>			0.00
<b>MOSS</b>			0.00
<b>TOTAL COVER</b>			<b>36.00</b>

## PHOTOGRAPHIC DOCUMENTATION



Q09C

# SECTION B

## RIPARIAN COMPLEX DATA SHEETS

for the

OCTOBER 2013  
SAMPLE PERIOD



**RIPARIAN COMPLEX DATA SHEET**  
**October 2013**

CLIENT: *Canyon Fuel Company, SUFCO Mine*

SAMPLE NUMBER: *Q01C*

WATERBODY NAME: *South Fork Quitchupah Creek*

LOCATION: *Southern Wasatch Plateau, Utah*

DATE: *October 1-2, 2013*

OBSERVER(S): *P. Collins*

USGS QUAD 7.5 MINUTE MAP: *Acord Lakes, Utah*

GEOLOGIC PARENT MATERIAL: *Price River Formation*

STREAM ASPECT: *East (120°)*

STREAM GRADIENT: *1-2°*

ELEVATION: *8,335 ft*

SIZE OF COMPLEX: *(see quantitative data)*

ADJACENT UPLAND VEGETATION (looking downstream)

Left: *Snowberry/Sagebrush/Grass*                      Right: *Aspen*

VEGETATIVE DESCRIPTION (Dominance by Community Types)

Community Name	% of Complex
<i>(refer to quantitative data results for this information)</i>	

COMMUNITY SUCCESSIONAL STAGE: *Mid (tree saplings present)*

APPARENT FORAGE TREND: *Unstable (this had been flooded)*

ESTIMATED FORAGE PRODUCTION: *50 lbs/acre*

BEAVER ACTIVITY: *no*

EROSION RATING (1=negligible; 2=slight; 3=moderate; 4=slight; 5=extreme): *5*

PHOTOGRAPH TAKEN: *Yes*

LAND USE ACTIVITIES THAT COULD INFLUENCE RIPARIAN AREA: *Mining, grazing (cattle & wildlife), hunting and recreation*

SPECIES OBSERVED:

Trees	Shrubs	Forbs	Grasses (or grasslike)
<i>Populus tremuloides</i>	<i>Artemisia tridentata</i>	<i>Achillea millefolium</i>	<i>Carex nebrascensis</i>
<i>Salix boothii</i>	<i>Rosa woodsii</i>	<i>Taraxacum officinale</i>	<i>Juncus arcticus</i>
	<i>Symphoricarpos oreophilus</i>		<i>Poa pratensis</i>

POOL ATTRIBUTES

% area in pools: *50*  
 % pool area made up of pools > 2' deep: *0*

AQUATIC VEGETATION

% streambed with filamentous algae: *50 (left)*  
 % stream margin with rooted aquatic: *0*

BANK TYPE & VEGETATION OVERHANG

% bank length undercut (<90°): *0*  
 % bank length gently sloping (>135°): *0*  
 % bank length with overhanging vegetation: *25 (short Booth's willows)*

BANK CONDITION

% bank length vegetated, stable: *10*  
 % bank length unvegetated, stable: *0*  
 % bank length vegetated, unstable: *25*  
 % bank length unvegetated, unstable: *65*

NOTES:

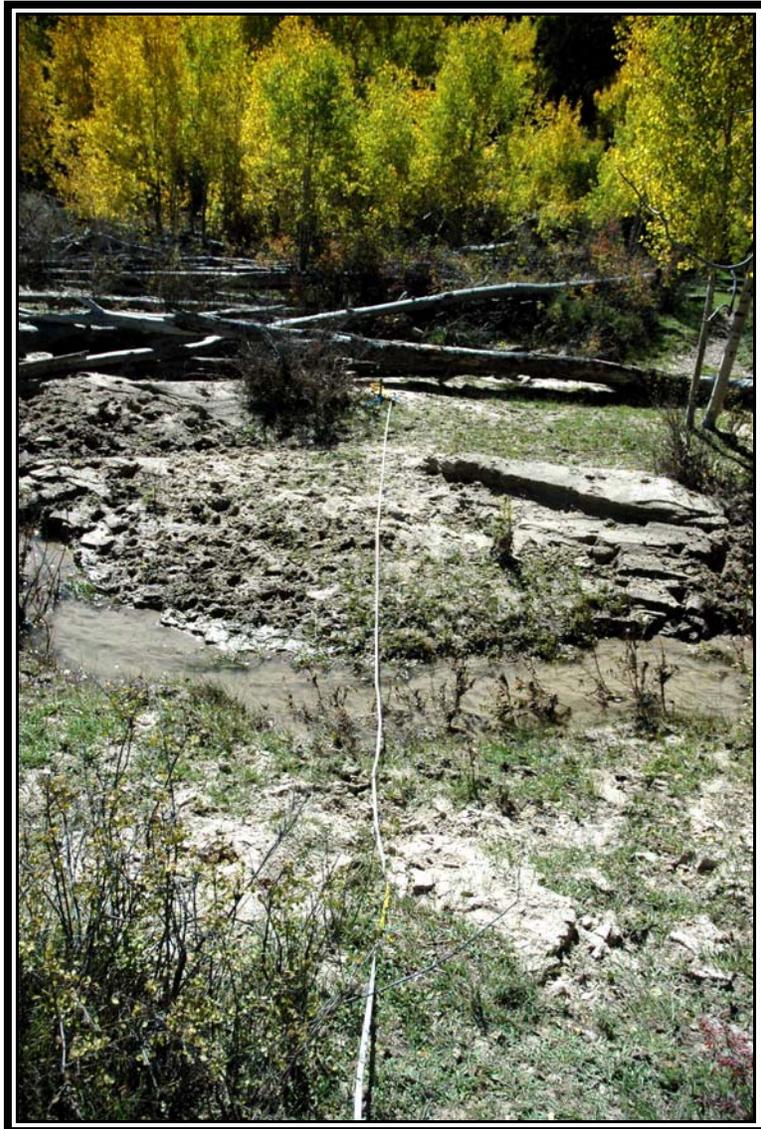
- 1) *This is a stream channel sample site.*
- 2) *This is a good creek channel monitoring site. It is outside the cattle trail and readily monitored.*
- 3) *Probably a good "control" site (outside the subsidence zone).*
- 4) *Cattle were present during this sample period.*
- 5) *All stakes were found.*
- 6) *There was evidence of a major flood here since the last sample period. The flood impacts were more depositional than erosional (see photograph). The riparian vegetation was greatly impacted.*

## DATA SUMMARY

### **Q01C: Cover by plant community types in the South Fork Quitchupah Creek drainage (October 2013).**

<b>USDA Forest Service Protocol (1992)</b>			
	LEFT	RIGHT	TOTALS
<b>UPLAND VEGETATION</b>			
<i>Symphoricarpos oreophilus/Artemisia tridentata/Poa pratensis</i>	10.00		
<i>Poa pratensis/Taraxacum officinale</i>		10.00	20.00
<b>RIPARIAN VEGETATION</b>			
<u>Dominant Woody Species</u>			
<i>Rosa woodsii</i>	0.50		
<u>Dominant Herbaceous Species</u>			
<i>Juncus arcticus</i>	1.50		
<i>Carex nebrascensis</i>		4.00	6.00
<b>TOTAL COVER (Upland Species)</b>			20.00
<b>TOTAL COVER (Riparian Species)</b>			6.00
<b>ROCK (channel)</b>			0.00
<b>WATER (channel)</b>			4.00
<b>BAREGROUND (channel)</b>			0.00
<b>LITTER</b>			0.00
<b>MOSS</b>			0.00
<b>TOTAL COVER</b>			<b>30.00</b>

## PHOTOGRAPHIC DOCUMENTATION



Q01C

**RIPARIAN COMPLEX DATA SHEET**  
**October 2013**

CLIENT: *Canyon Fuel Company, SUFCO Mine*

SAMPLE NUMBER: **Q025**

WATERBODY NAME: *South Fork Quitchupah Creek*

LOCATION: *Southern Wasatch Plateau, Utah*

DATE: *October 1-2, 2013*

OBSERVER(S): *P. Collins*

USGS QUAD 7.5 MINUTE MAP: *Acord Lakes, Utah*

GEOLOGIC PARENT MATERIAL: *Price River Formation*

STREAM ASPECT: *E; Flow is NE (50°)*

STREAM GRADIENT: *1-2°*

ELEVATION: *8,330 ft*

SIZE OF COMPLEX: *(see quantitative data)*

ADJACENT UPLAND VEGETATION (looking downstream)

Left: *Aspen*

Right: *Aspen*

VEGETATIVE DESCRIPTION (Dominance by Community Types)

Community Name	% of Complex
<i>(refer to quantitative data results for this information)</i>	

COMMUNITY SUCCESSIONAL STAGE: *Mid*

APPARENT FORAGE TREND: *Decreasing (ground cover was mud and vegetation)*

ESTIMATED FORAGE PRODUCTION: *200 lbs/acre*

BEAVER ACTIVITY: *no*

EROSION RATING (1=negligible; 2=slight; 3=moderate; 4=severe; 5=extreme): *Inside of spring =4 (in cattle tracks); outside=4*

PHOTOGRAPH TAKEN: *Yes*

LAND USE ACTIVITIES THAT COULD INFLUENCE RIPARIAN AREA: *Mining, grazing (cattle & wildlife), hunting, recreation.*

SPECIES OBSERVED:

Trees	Shrubs	Forbs	Grasses (or grasslike)
<i>Picea pungens</i>	<i>Ribes sp.</i>	<i>Achillea millefolium</i>	<i>Agrostis stolonifera</i>
<i>Populus tremuloides</i>	<i>Symphoricarpos oreophilus</i>	<i>Equisetum arvense</i>	<i>Carex nebrascensis</i>
		<i>Ranunculus cymbalaria</i>	<i>Poa pratensis</i>
		<i>Taraxacum officinale</i>	

POOL ATTRIBUTES

% area in pools: *100*  
 % pool area made up of pools > 2' deep: *0*

AQUATIC VEGETATION

% streambed with filamentous algae: *0*  
 % stream margin with rooted aquatic: *0*

BANK TYPE & VEGETATION OVERHANG

% bank length undercut (<90°): *0*  
 % bank length gently sloping (>135°): *100*  
 % bank length with overhanging vegetation: *0*

BANK CONDITION

	<u>Center</u>	<u>Side</u>
% bank length vegetated, stable:	<i>0</i>	<i>60</i>
% bank length unvegetated, stable:	<i>50</i>	<i>20</i>
% bank length vegetated, unstable:	<i>0</i>	<i>5</i>
% bank length unvegetated, unstable:	<i>50</i>	<i>15</i>

NOTES:

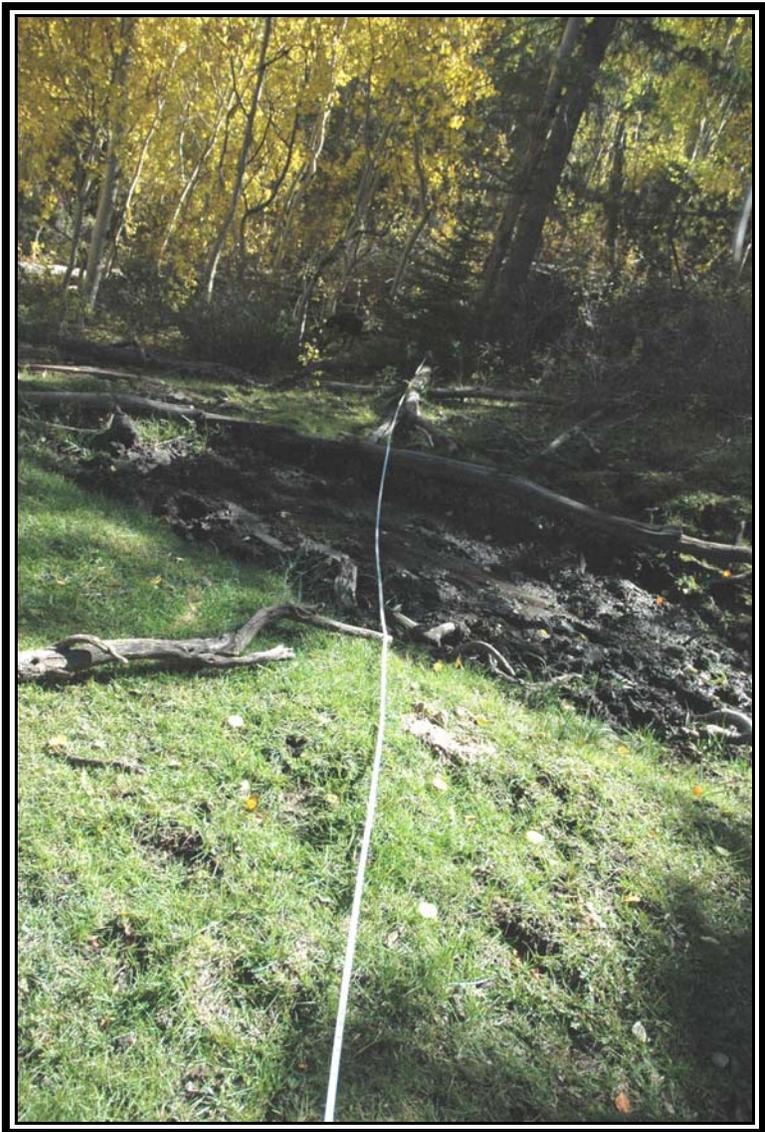
- 1) *This is a spring area.*
- 2) *Probably a good "control" site (outside the subsidence zone).*
- 3) *There were lots of cattle hoof-prints (disturbance).*
- 4) *All stakes were located.*
- 4) *The Bank Condition represents both the bank and wet areas (refer to the photograph).*
- 5) *Lots of cattle impact here.*
- 6) *The spring was mostly wet (muddy). There was only about 1 ft of water in the center.*

## DATA SUMMARY

### Q02S: Cover by plant community types in the South Fork Quitchupah Creek drainage (October 2013).

<b>USDA Forest Service Protocol (1992)</b>			
	LEFT	RIGHT	TOTALS
<b>UPLAND VEGETATION</b>			
<i>Poa pratensis</i> / <i>Achillea millefolium</i>	10.00		
<i>Geranium richardsonii</i> / <i>Poa pratensis</i>		8.00	
			18.00
<b>RIPARIAN VEGETATION</b>			
<u>Dominant Woody Species</u>			
<u>Dominant Herbaceous Species</u>			
<i>Ranunculus cymbalaria</i> / <i>Agrostis stolonifera</i>		6.00	
<i>Carex nebrascensis</i>	1.00		
			7.00
<b>TOTAL COVER (Upland Species)</b>			18.00
<b>TOTAL COVER (Riparian Species)</b>			7.00
<b>ROCK (channel)</b>			0.00
<b>WATER (channel)</b>			1.00
<b>BAREGROUND (channel)</b>			7.00
<b>LITTER</b>			0.00
<b>MOSS</b>			0.00
<b>TOTAL COVER</b>			<b>33.00</b>

PHOTOGRAPHIC DOCUMENTATION



Q02S

**RIPARIAN COMPLEX DATA SHEET**  
**October 2013**

CLIENT: *Canyon Fuel Company, SUFCO Mine*

SAMPLE NUMBER: **Q03C**

WATERBODY NAME: *South Fork Quitchupah Creek*

LOCATION: *Southern Wasatch Plateau, Utah*

DATE: *October 1-2, 2013*

OBSERVER(S): *P. Collins*

USGS QUAD 7.5 MINUTE MAP: *Acord Lakes, Utah*

GEOLOGIC PARENT MATERIAL: *Price River Formation*

STREAM ASPECT: *E (90°)*

STREAM GRADIENT: *1-2°*

ELEVATION: *8,310 ft*

SIZE OF COMPLEX: *(see quantitative data)*

ADJACENT UPLAND VEGETATION (looking downstream)

Left: *Sagebrush/Grass*

Right: *Aspen*

VEGETATIVE DESCRIPTION (Dominance by Community Types)

Community Name	% of Complex
<i>(refer to quantitative data results for this information)</i>	

COMMUNITY SUCCESSIONAL STAGE: *Mid (tree saplings present)*

APPARENT FORAGE TREND: *Unstable from recent flooding impact.*

ESTIMATED FORAGE PRODUCTION: *200 lbs/acre (decreased due to flooding)*

BEAVER ACTIVITY: *no*

EROSION RATING (1=negligible; 2=slight; 3=moderate; 4=severe; 5=extreme): *3 (on river bank near the water).*

PHOTOGRAPH TAKEN: *Yes*

LAND USE ACTIVITIES THAT COULD INFLUENCE RIPARIAN AREA: *Mining, grazing (cattle & wildlife), hunting, recreation.*

SPECIES OBSERVED:

Trees	Shrubs	Forbs	Grasses (or grasslike)
<i>Populus tremuloides</i>	<i>Artemisia tridentata</i>	<i>Aster sp.</i>	<i>Agrostis stolonifera</i>
	<i>Rosa woodsii</i>	<i>Equisetum arvense</i>	<i>Juncus arcticus</i>
	<i>Salix spp.</i>	<i>Taraxacum officinale</i>	

POOL ATTRIBUTES

% area in pools: *0*  
 % pool area made up of pools > 2' deep: *0*

AQUATIC VEGETATION

% streambed with filamentous algae: *0*  
 % stream margin with rooted aquatic: *0*

BANK TYPE & VEGETATION OVERHANG

% bank length undercut (<90°): *0 on both sides due to flooding.*  
 % bank length gently sloping (>135°): *0*  
 % bank length with overhanging vegetation: *0*

BANK CONDITION

% bank length vegetated, stable: *25*  
 % bank length unvegetated, stable: *0*  
 % bank length vegetated, unstable: *70*  
 % bank length unvegetated, unstable: *65*

NOTES:

- 1) *This is a channel site.*
- 2) *A good control station; outside current subsidence plans.*
- 3) *It seems like we needed a sample here, but this may be more difficult to monitor as accurately due to the topography. The narrow channel sites are more straight-forward to monitor than this type.*
- 4) *Interestingly, the adjacent aspen understory (that I considered upland) had more wiregrass present. This may be a function of the shade prolonging snow-melt. This area was covered by deposition due to floods (see below).*
- 5) *This wiregrass area should be noted during each sample period.*
- 6) *On the right side, it is difficult to separate the upland from the riparian.*
- 7) *There was evidence of a major flood here since the last sample period. The flood impacts were depositional (floodplains) and erosional (stream channel). The riparian vegetation was greatly impacted.*

## DATA SUMMARY

### **Q03C: Cover by plant community types in the South Fork Quitchupah Creek drainage (October 2013).**

<b>USDA Forest Service Protocol (1992)</b>			
	LEFT	RIGHT	TOTALS
<b>UPLAND VEGETATION</b>			
<i>Artemisia tridentata/Elymus salinus</i>	10.00		
<i>Populus tremuloides/Juncus arcticus</i>		13.00	
			23.00
<b>RIPARIAN VEGETATION</b>			
<u>Dominant Woody Species</u>			
<u>Dominant Herbaceous Species</u>			
<i>Juncus arcticus</i>	8.00	2.00	
			10.00
<b>TOTAL COVER (Upland Species)</b>			23.00
<b>TOTAL COVER (Riparian Species)</b>			10.00
<b>ROCK (channel)</b>			0.00
<b>WATER (channel)</b>			2.00
<b>BAREGROUND (channel)</b>			0.00
<b>LITTER</b>			0.00
<b>MOSS</b>			0.00
<b>TOTAL COVER</b>			<b>35.00</b>

## PHOTOGRAPHIC DOCUMENTATION



Q03C

**RIPARIAN COMPLEX DATA SHEET**  
**October 2013**

CLIENT: *Canyon Fuel Company, SUFCO Mine*

SAMPLE NUMBER: *Q045*

WATERBODY NAME: *South Fork Quitchupah Creek*

LOCATION: *Southern Wasatch Plateau, Utah*

DATE: *October 1-2, 2013*

OBSERVER(S): *P. Collins*

USGS QUAD 7.5 MINUTE MAP: *Acord Lakes, Utah*

GEOLOGIC PARENT MATERIAL: *Price River Formation*

STREAM ASPECT: *E [but flow here was N (340°)]*

STREAM GRADIENT: *1-2°*

ELEVATION: *8,310 ft*

SIZE OF COMPLEX: *(see quantitative data)*

ADJACENT UPLAND VEGETATION (looking downstream)

Left: *Aspen*

Right: *Aspen/Blue Spruce/Willow*

VEGETATIVE DESCRIPTION (Dominance by Community Types)

Community Name	% of Complex
<i>(refer to quantitative data results for this information)</i>	

COMMUNITY SUCCESSIONAL STAGE: *Late*

APPARENT FORAGE TREND: *Stable*

ESTIMATED FORAGE PRODUCTION: *700 lbs/acre*

BEAVER ACTIVITY: *no*

EROSION RATING (1=negligible; 2=slight; 3=moderate; 4=severe; 5=extreme): *3 (cattle impacts)*

PHOTOGRAPH TAKEN: *Yes*

LAND USE ACTIVITIES THAT COULD INFLUENCE RIPARIAN AREA: *Mining, grazing (cattle & wildlife), hunting, recreation.*

SPECIES OBSERVED:

Trees	Shrubs	Forbs	Grasses (or grasslike)
<i>Picea pungens</i>	<i>Rosa woodsii</i>	<i>Achillea millefolium</i>	<i>Eleocharis palustris</i>
<i>Populus tremuloides</i>	<i>Salix boothii</i>	<i>Equisetum arvense</i>	<i>Hordeum jubatum</i>
		<i>Geranium richardsonii</i>	<i>Juncus arcticus</i>
			<i>Juncus longistylis</i>
			<i>Poa pratensis</i>

POOL ATTRIBUTES

% area in pools: *100*  
 % pool area made up of pools > 2' deep: *0*

AQUATIC VEGETATION

% streambed with filamentous algae: *0*  
 % stream margin with rooted aquatic: *0*

BANK TYPE & VEGETATION OVERHANG

% bank length undercut (<90°): *0*  
 % bank length gently sloping (>135°): *100*  
 % bank length with overhanging vegetation: *50*

BANK CONDITION

% bank length vegetated, stable: *35*  
 % bank length unvegetated, stable: *0*  
 % bank length vegetated, unstable: *75*  
 % bank length unvegetated, unstable: *50*

NOTES:

- 1) *This is a spring area.*
- 2) *It is a good control station; outside current subsidence plans.*
- 3) *The spring site had several zones of vegetation based on the different water regimes.*
- 4) *Nebraska sedge and spike rush zones seemed to be the wettest areas.*
- 5) *There was a lot of impact from cattle trampling here. Because of this some areas had a higher living cover value, whereas other areas were relatively low.*
- 6) *There was much more water when compared to July when there was almost no water present - about 50% of the hoof prints had some water in them, the remainder were muddy.*

## DATA SUMMARY

### **Q04S: Cover by plant community types in the South Fork Quitchupah Creek drainage (October 2013).**

<b>USDA Forest Service Protocol (1992)</b>			
	LEFT	RIGHT	TOTALS
<b>UPLAND VEGETATION</b>			
<i>Symphoricarpos oreophilus/Populus tremuloides</i>	9.00	10.00	19.00
<b>RIPARIAN VEGETATION</b>			
<u>Dominant Woody Species</u>			
<u>Dominant Herbaceous Species</u>			
<i>Ranunculus cymbalaria/Carex nebrascensis</i>		6.00	6.00
<i>Carex nebrascensis</i>	8.00	6.00	14.00
<b>TOTAL COVER (Upland Species)</b>			19.00
<b>TOTAL COVER (Riparian Species)</b>			20.00
<b>ROCK (channel)</b>			0.00
<b>WATER (channel)</b>			9.00
<b>BAREGROUND (channel)</b>			8.00
<b>LITTER</b>			0.00
<b>MOSS</b>			0.00
<b>TOTAL COVER</b>			<b>56.00</b>

PHOTOGRAPHIC DOCUMENTATION



Q04S

**RIPARIAN COMPLEX DATA SHEET**  
**October 2013**

CLIENT: *Canyon Fuel Company, SUFCO Mine*

SAMPLE NUMBER: *Q055*

WATERBODY NAME: *South Fork Quitchupah Creek*

LOCATION: *Southern Wasatch Plateau, Utah*

DATE: *October 1-2, 2013*

OBSERVER(S): *P. Collins*

USGS QUAD 7.5 MINUTE MAP: *Acord Lakes, Utah*

GEOLOGIC PARENT MATERIAL: *Price River Formation*

STREAM ASPECT: *E; flow here was 30°*

STREAM GRADIENT: *1-2°*

ELEVATION: *8,294 ft*

SIZE OF COMPLEX: *(see quantitative data)*

ADJACENT UPLAND VEGETATION (looking downstream)

Left: *Blue Spruce/Willow*

Right: *Blue Spruce/Aspen*

VEGETATIVE DESCRIPTION (Dominance by Community Types)

Community Name	% of Complex
<i>(refer to quantitative data results for this information)</i>	

COMMUNITY SUCCESSIONAL STAGE: *Late*

APPARENT FORAGE TREND: *Stable, but cattle were making it less stable.*

ESTIMATED FORAGE PRODUCTION: *700 lbs/acre*

BEAVER ACTIVITY: *no*

EROSION RATING (1=negligible; 2=slight; 3=moderate; 4=severe; 5=extreme): *4 (due to cattle)*

PHOTOGRAPH TAKEN: *Yes*

LAND USE ACTIVITIES THAT COULD INFLUENCE RIPARIAN AREA: *Mining, grazing (cattle & wildlife), hunting, recreation.*

SPECIES OBSERVED:

Trees	Shrubs	Forbs	Grasses (or grasslike)
<i>Picea pungens</i>	<i>Salix boothii</i>	<i>Equisetum arvense</i>	<i>Agrostis stolonifera</i>
<i>Pinus flexilis</i>	<i>Symphoricarpos oreophilus</i>	<i>Geranium richardsonii</i>	<i>Carex nebrascensis</i>
<i>Populus tremuloides</i>		<i>Ranunculus cymbalaria</i>	

POOL ATTRIBUTES

% area in pools: *100*  
 % pool area made up of pools > 2' deep: *0*

AQUATIC VEGETATION

% streambed with filamentous algae: *0*  
 % stream margin with rooted aquatic: *0*

BANK TYPE & VEGETATION OVERHANG

% bank length undercut (<90°): *0*  
 % bank length gently sloping (>135°): *100*  
 % bank length with overhanging vegetation: *20*

BANK CONDITION

% bank length vegetated, stable: *55*  
 % bank length unvegetated, stable: *5*  
 % bank length vegetated, unstable: *20 (due to cattle)*  
 % bank length unvegetated, unstable: *20*

NOTES:

- 1) *This is a well-defined spring area.*
- 2) *A good control station; it is just outside current subsidence plans.*
- 3) *When I placed the transect tape, it formed a "U" shape to measure. This tape was placed 4 ft from the upland bank for 73 ft of riparian/spring vegetation.*
- 4) *For this sample period, the water area comprised about 40% of the 73 ft mentioned above.*
- 5) *There was a lot of impact from cattle trampling at the site.*
- 6) *There was vegetation and mud present in the spring at the transect line (no water was present in July, but quite a bit in October).*

## DATA SUMMARY

### Q05S: Cover by plant community types in the South Fork Quitchupah Creek drainage (October 2013).

<b>USDA Forest Service Protocol (1992)</b>			
	LEFT	RIGHT	TOTALS
<b>UPLAND VEGETATION</b>			
<i>Salix boothii/Picea pungens</i>	10.00		
<i>Picea pungens/Populus tremuloides</i>		10.00	
			20.00
<b>RIPARIAN VEGETATION</b>			
<u>Dominant Woody Species</u>			
<u>Dominant Herbaceous Species</u>			
<i>Carex nebrascensis/Agrostis stolonifera/Ranunculus cymbalaria</i>	36.50	36.50	
			73.00
<b>TOTAL COVER (Upland Species)</b>			20.00
<b>TOTAL COVER (Riparian Species)</b>			73.00
<b>ROCK (channel)</b>			0.00
<b>WATER (channel)</b>			0.00
<b>BAREGROUND (channel)</b>			0.00
<b>LITTER</b>			0.00
<b>MOSS</b>			0.00
<b>TOTAL COVER</b>			<b>93.00</b>

## PHOTOGRAPHIC DOCUMENTATION



Q05S

**RIPARIAN COMPLEX DATA SHEET**

**October 2013**

CLIENT: *Canyon Fuel Company, SUFCO Mine*

SAMPLE NUMBER: *Q065*

WATERBODY NAME: *South Fork Quitchupah Creek*

LOCATION: *Southern Wasatch Plateau, Utah*

DATE: *October 1-2, 2013*

OBSERVER(S): *P. Collins*

USGS QUAD 7.5 MINUTE MAP: *Acord Lakes, Utah*

GEOLOGIC PARENT MATERIAL: *Price River Formation*

STREAM ASPECT: *E [but flow here was N (330°)]*

STREAM GRADIENT: *1-2°*

ELEVATION: *8,313 ft*

SIZE OF COMPLEX: *(see quantitative data)*

ADJACENT UPLAND VEGETATION (looking downstream)

Left: *Meadow*

Right: *Meadow*

VEGETATIVE DESCRIPTION (Dominance by Community Types)

Community Name	% of Complex
<i>(refer to quantitative data results for this information)</i>	

COMMUNITY SUCCESSIONAL STAGE: *Late*

APPARENT FORAGE TREND: *Semi-stable due to cattle impacts*

ESTIMATED FORAGE PRODUCTION: *400 lbs/acre*

BEAVER ACTIVITY: *no*

EROSION RATING (1=negligible; 2=slight; 3=moderate; 4=severe; 5=extreme): *4 (cattle impact)*

PHOTOGRAPH TAKEN: *Yes*

LAND USE ACTIVITIES THAT COULD INFLUENCE RIPARIAN AREA: *Mining, grazing (cattle & wildlife), hunting, recreation.*

SPECIES OBSERVED:

Trees	Shrubs	Forbs	Grasses (or grasslike)
<i>Populus tremuloides</i>	<i>Ribes sp</i>	<i>Equisetum arvense</i>	<i>Agrostis stolonifera</i>
	<i>Salix boothii</i>	<i>Taraxacum officinale</i>	<i>Poa pratensis</i>

POOL ATTRIBUTES

% area in pools: *0 (not water but it was muddy).*  
 % pool area made up of pools > 2' deep: *0*

AQUATIC VEGETATION

% streambed with filamentous algae: *0*  
 % stream margin with rooted aquatic: *0*

BANK TYPE & VEGETATION OVERHANG

% bank length undercut (<90°): *0*  
 % bank length gently sloping (>135°): *100*  
 % bank length with overhanging vegetation: *25*

BANK CONDITION

% bank length vegetated, stable: *85*  
 % bank length unvegetated, stable: *5*  
 % bank length vegetated, unstable: *0*  
 % bank length unvegetated, unstable: *15 (cattle impact)*

NOTES:

- 1) *Only measured obvious, well-defined spring area.*
- 2) *Left side measured to bank (3 ft).*
- 3) *Cattle had a great impact for this sample period. Therefore, the riparian vegetation was almost all located on the side of the spring channel.*
- 4) *Riparian/wetland vegetation was measured in the spring channel only.*
- 5) *The bank was stable, the spring was not.*
- 6) *The sample station was located within current planned subsidence zone.*

## DATA SUMMARY

### **Q06S: Cover by plant community types in the South Fork Quitchupah Creek drainage (October 2013).**

<b>USDA Forest Service Protocol (1992)</b>			
	LEFT	RIGHT	TOTALS
<b>UPLAND VEGETATION</b>			
<i>Populus tremuloides/Salix boothii</i>	3.00		
<i>Symphoricarpos oreophilus/Grasses</i>		9.00	12.00
<b>RIPARIAN VEGETATION</b>			
<u>Dominant Woody Species</u>			
<u>Dominant Herbaceous Species</u>			
<i>Agrostis stolonifera</i>	7.00	1.00	8.00
<b>TOTAL COVER (Upland Species)</b>			12.00
<b>TOTAL COVER (Riparian Species)</b>			8.00
<b>ROCK (channel)</b>			0.00
<b>WATER (channel)</b>			0.00
<b>BAREGROUND (channel)</b>			0.00
<b>LITTER</b>			0.00
<b>MOSS</b>			0.00
<b>TOTAL COVER</b>			<b>20.00</b>

## PHOTOGRAPHIC DOCUMENTATION



Q06S

**RIPARIAN COMPLEX DATA SHEET**

**October 2013**

CLIENT: *Canyon Fuel Company, SUFCO Mine*

SAMPLE NUMBER: *Q07C*

WATERBODY NAME: *South Fork Quitchupah Creek*

LOCATION: *Southern Wasatch Plateau, Utah*

DATE: *October 4, 2012*

OBSERVER(S): *P. Collins*

USGS QUAD 7.5 MINUTE MAP: *Acord Lakes, Utah*

GEOLOGIC PARENT MATERIAL: *Price River Formation*

STREAM ASPECT: *E [but flow here was N (5°)]*

STREAM GRADIENT: *2-3°*

ELEVATION: *8,285 ft*

SIZE OF COMPLEX: *(see quantitative data)*

ADJACENT UPLAND VEGETATION (looking downstream)

Left: *Meadow*

Right: *Meadow*

VEGETATIVE DESCRIPTION (Dominance by Community Types)

Community Name	% of Complex
<i>(refer to quantitative data results for this information)</i>	

COMMUNITY SUCCESSIONAL STAGE: *Mid*

APPARENT FORAGE TREND: *Stable*

ESTIMATED FORAGE PRODUCTION: *1,100 lbs/acre*

BEAVER ACTIVITY: *no*

EROSION RATING (1=negligible; 2=slight; 3=moderate; 4=severe; 5=extreme): *1*

PHOTOGRAPH TAKEN: *Yes*

LAND USE ACTIVITIES THAT COULD INFLUENCE RIPARIAN AREA: *Mining, grazing (cattle & wildlife), hunting, recreation.*

SPECIES OBSERVED:

Trees	Shrubs	Forbs	Grasses (or grasslike)
	<i>Rosa woodsii</i>	<i>Achillea millefolium</i>	<i>Agrostis stolonifera</i>
	<i>Salix boothii</i>	<i>Trifolium sp.</i>	<i>Carex nebrascensis</i>
			<i>Hordeum jubatum</i>
			<i>Poa pratensis</i>

POOL ATTRIBUTES

% area in pools: *0*  
 % pool area made up of pools > 2' deep: *0*

AQUATIC VEGETATION

% streambed with filamentous algae: *0*  
 % stream margin with rooted aquatic: *0*

BANK TYPE & VEGETATION OVERHANG

% bank length undercut (<90°): *100 now due to flooding.*  
 % bank length gently sloping (>135°): *100 incised (18") channel*  
 % bank length with overhanging vegetation: *85 (herb.)*

BANK CONDITION

% bank length vegetated, stable: *70*  
 % bank length unvegetated, stable: *10*  
 % bank length vegetated, unstable: *10*  
 % bank length unvegetated, unstable: *10*

NOTES:

- 1) *This site is in the middle of a meadow.*
- 2) *Right side: This area looked different than the last sample period. This side had little upland vegetation (some foxtail barley). Like in July the transect line was mostly all riparian vegetation with a lot Nebraska sedge. I think these communities are dynamic and can show year-to-year differences based on water regimes. For example, I think in the dryer years different species are more prominent for cover and production and the same for the wetter years.*
- 3) *Left side: The riparian community was measured beginning in the meadow (where the stake would be easily found later) and ended at the channel bank. The entire meadow, however, had some wetland species, but less cover due to flooding (see below).*
- 4) *There was evidence of a major flood here since the last sample period. The flood impacts were more depositional than erosional.*

- 5) This site is within the current planned subsidence zone
- 6) There was cattle at the site when I was sampling

## DATA SUMMARY

### **Q07C: Cover by plant community types in the South Fork Quitchupah Creek drainage (October 2013).**

<b>USDA Forest Service Protocol (1992)</b>			
	LEFT	RIGHT	TOTALS
<b>UPLAND VEGETATION</b>	0.00		
<i>Poa pratensis/Achillea millefolium</i>		0.00	
<i>Poa pratensis/Achillea millefolium</i>			0.00
<b>RIPARIAN VEGETATION</b>			
<u>Dominant Woody Species</u>			
<i>Rosa woodsii</i>	5.00		
<u>Dominant Herbaceous Species</u>			
<i>Carex nebrascensis</i>	13.50		
<i>Carex nebrascensis/Hordeum jubatum</i>			
<i>Juncus arcticus</i>	28.50	7.00	54.00
<b>TOTAL COVER (Upland Species)</b>			0.00
<b>TOTAL COVER (Riparian Species)</b>			54.00
<b>ROCK (channel)</b>			0.00
<b>WATER (channel)</b>			1.00
<b>BAREGROUND (channel)</b>			0.00
<b>LITTER</b>			0.00
<b>MOSS</b>			0.00
<b>TOTAL COVER</b>			<b>55.00</b>

PHOTOGRAPHIC DOCUMENTATION



Q07C

**RIPARIAN COMPLEX DATA SHEET**

**October 2013**

CLIENT: *Canyon Fuel Company, SUFCO Mine*

SAMPLE NUMBER: *Q08C*

WATERBODY NAME: *South Fork Quitchupah Creek*

LOCATION: *Southern Wasatch Plateau, Utah*

DATE: *October 4, 2012*

OBSERVER(S): *P. Collins*

USGS QUAD 7.5 MINUTE MAP: *Acord Lakes, Utah*

GEOLOGIC PARENT MATERIAL: *Price River Formation*

STREAM ASPECT: *E (flow here was 140°)*

STREAM GRADIENT: *2-3°*

ELEVATION: *8,253 ft*

SIZE OF COMPLEX: *(see quantitative data)*

ADJACENT UPLAND VEGETATION (looking downstream)

Left: *Sagebrush/Grass*

Right: *Aspen/Snowberry*

VEGETATIVE DESCRIPTION (Dominance by Community Types)

Community Name	% of Complex
<i>(refer to quantitative data results for this information)</i>	

COMMUNITY SUCCESSIONAL STAGE: *Early due to flooding*

APPARENT FORAGE TREND: *Stable*

ESTIMATED FORAGE PRODUCTION: *700 lbs/acre*

BEAVER ACTIVITY: *no*

EROSION RATING (1=negligible; 2=slight; 3=moderate; 4=severe; 5=extreme): *1 (banks)*

PHOTOGRAPH TAKEN: *Yes*

LAND USE ACTIVITIES THAT COULD INFLUENCE RIPARIAN AREA: *Mining, grazing (cattle & wildlife), hunting, recreation.*

SPECIES OBSERVED:

Trees	Shrubs	Forbs	Grasses (or grasslike)
<i>Populus tremuloides</i>	<i>Artemisia tridentata</i>	<i>Trifolium sp.</i>	<i>Agrostis stolonifera</i>
	<i>Salix boothii</i>		<i>Carex nebrascensis</i>
			<i>Juncus arcticus</i>

POOL ATTRIBUTES

% area in pools: *25*  
 % pool area made up of pools > 2' deep: *0*

AQUATIC VEGETATION

% streambed with filamentous algae: *0*  
 % stream margin with rooted aquatic: *25*

BANK TYPE & VEGETATION OVERHANG

% bank length undercut (<90°): *0*  
 % bank length gently sloping (>135°): *100 but above the incised (12") channel; vertical from water to bank with no undercutting.*  
 % bank length with overhanging vegetation:

BANK CONDITION

% bank length vegetated, stable: *55 (less due flooding)*  
 % bank length unvegetated, stable: *20*  
 % bank length vegetated, unstable: *5*  
 % bank length unvegetated, unstable: *20*

NOTES:

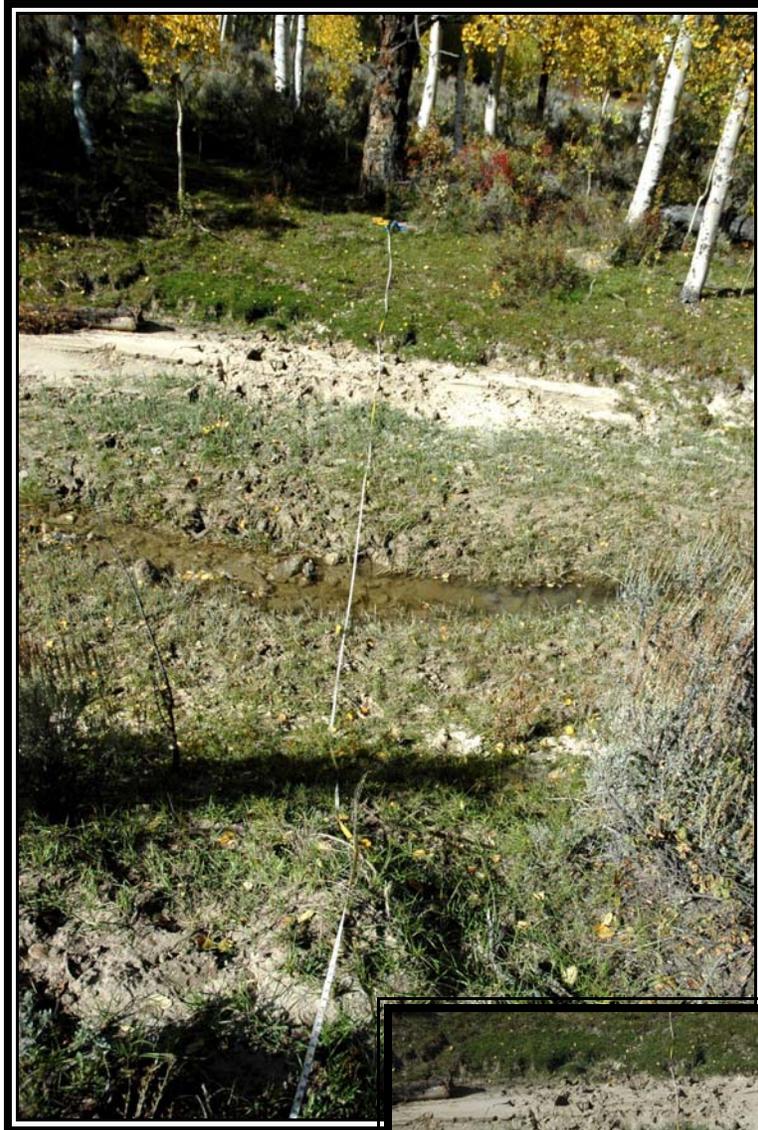
- 1) *This site had a straightforward area to monitor the riparian zone. The station went from low water to a low terrace, then a high terrace and finally to the aspen forest.*
- 2) *This site is within the current planned subsidence zone.*
- 3) *There was evidence of a major flood here since the last sample period. The flood impacts were more depositional than erosional. The riparian vegetation was greatly impacted and the living cover decreased, possibly covered over, as a result.*

## DATA SUMMARY

### Q08C: Cover by plant community types in the South Fork Quitchupah Creek drainage (October 2013).

<b>USDA Forest Service Protocol (1992)</b>			
	LEFT	RIGHT	TOTALS
<b>UPLAND VEGETATION</b>			
<i>Artemisia tridentata/Grasses</i>	10.00		
<i>Populus tremuloides/Symphoricarpos oreophilus</i>		15.00	
			25.00
<b>RIPARIAN VEGETATION</b>			
<u>Dominant Woody Species</u>			
<i>Rosa woodsii</i>			
<u>Dominant Herbaceous Species</u>			
<i>Carex nebrascensis</i>		9.50	
<i>Carex nebrascensis/Juncus arcticus</i>	6.50		
			16.00
<b>TOTAL COVER (Upland Species)</b>			25.00
<b>TOTAL COVER (Riparian Species)</b>			16.00
<b>ROCK (channel)</b>			0.00
<b>WATER (channel)</b>			3.00
<b>BAREGROUND (channel)</b>			0.00
<b>LITTER</b>			0.00
<b>MOSS</b>			0.00
<b>TOTAL COVER</b>			<b>44.00</b>

## PHOTOGRAPHIC DOCUMENTATION



Q08C



Note depositional layer

**RIPARIAN COMPLEX DATA SHEET**

**October 2013**

CLIENT: *Canyon Fuel Company, SUFCO Mine*

SAMPLE NUMBER: **Q09C**

WATERBODY NAME: *South Fork Quitchupah Creek*

LOCATION: *Southern Wasatch Plateau, Utah*

DATE: *October 1-2, 2013*

OBSERVER(S): *P. Collins*

USGS QUAD 7.5 MINUTE MAP: *Acord Lakes, Utah*

GEOLOGIC PARENT MATERIAL: *Near the contact between the Price River Formation and the Castlegate Sandstone*

STREAM ASPECT: *E*

STREAM GRADIENT: *2-3<sup>o</sup>*

ELEVATION: *8,253 ft*

SIZE OF COMPLEX: *(see quantitative data)*

ADJACENT UPLAND VEGETATION (looking downstream)

Left: *Sagebrush/Grass*

Right: *Sagebrush/Grass*

VEGETATIVE DESCRIPTION (Dominance by Community Types)

Community Name	% of Complex
<i>(refer to quantitative data results for this information)</i>	

COMMUNITY SUCCESSIONAL STAGE: *Early due to floods*

APPARENT FORAGE TREND: *Unstable*

ESTIMATED FORAGE PRODUCTION: *100 lbs/acre (less due to floods)*

BEAVER ACTIVITY: *no*

EROSION RATING (1=negligible; 2=slight; 3=moderate; 4=severe; 5=extreme): *1*

PHOTOGRAPH TAKEN: *Yes*

LAND USE ACTIVITIES THAT COULD INFLUENCE RIPARIAN AREA: *Mining, grazing (cattle & wildlife), hunting, recreation.*

SPECIES OBSERVED:

Trees	Shrubs	Forbs	Grasses (or grasslike)
	<i>Artemisia tridentata</i>	<i>Trifolium sp.</i>	<i>Agrostis stolonifera</i>
	<i>Rosa woodsii</i>		<i>Juncus arcticus</i>
	<i>Salix boothii</i>		<i>Poa pratensis</i>

POOL ATTRIBUTES

% area in pools: *0*  
 % pool area made up of pools > 2' deep: *0*

AQUATIC VEGETATION

% streambed with filamentous algae: *0*  
 % stream margin with rooted aquatic: *0*

BANK TYPE & VEGETATION OVERHANG

% bank length undercut (<90°): *Previously 100 on both sides of the channel, but the flooding filled them in.*  
 % bank length gently sloping (>135°): *100 but above the incised (18" wide) channel.*  
 % bank length with overhanging vegetation: *(herbaceous only)*

BANK CONDITION

% bank length vegetated, stable: *20*  
 % bank length unvegetated, stable: *40*  
 % bank length vegetated, unstable: *20*  
 % bank length unvegetated, unstable: *20*

NOTES:

- 1) *This site had a straightforward area to monitor the riparian zone.*
- 2) *This site is within the current planned subsidence zone.*
- 3) *Keep in mind that the transect vegetation width may be consistent, but the total living cover may have decreased within the transect zone due to flooding & deposition. This area was a good example of that .*
- 4) *The deposition may also render the area somewhat dryer.*

## DATA SUMMARY

### **Q09C: Cover by plant community types in the South Fork Quitchupah Creek drainage (October 2013).**

<b>USDA Forest Service Protocol (1992)</b>			
	LEFT	RIGHT	TOTALS
<b>UPLAND VEGETATION</b>	10.00		
<i>Artemisia tridentata/Grasses</i>		10.00	
<i>Artemisia tridentata/Grasses</i>			20.00
<b>RIPARIAN VEGETATION</b>			
<u>Dominant Woody Species</u>			
<u>Dominant Herbaceous Species</u>			
<i>Equisetum arvense/Poa pratensis</i>		2.00	
<i>Juncus arcticus</i>	12.50		
			14.50
<b>TOTAL COVER (Upland Species)</b>			20.00
<b>TOTAL COVER (Riparian Species)</b>			14.50
<b>ROCK (channel)</b>			0.00
<b>WATER (channel)</b>			1.50
<b>BAREGROUND (channel)</b>			0.00
<b>LITTER</b>			0.00
<b>MOSS</b>			0.00
<b>TOTAL COVER</b>			<b>36.00</b>

## PHOTOGRAPHIC DOCUMENTATION



Q09C



Depositional layer

**RIPARIAN COMPLEX DATA SHEET**

**October 2013**

CLIENT: *Canyon Fuel Company, SUFCO Mine*

SAMPLE NUMBER: **Q105**

WATERBODY NAME: *South Fork Quitchupah Creek*

LOCATION: *Southern Wasatch Plateau, Utah*

DATE: *October 9, 2013*

OBSERVER(S): *P. Collins, E. Petersen, R. Long*

USGS QUAD 7.5 MINUTE MAP: *Acord Lakes, Utah*

GEOLOGIC PARENT MATERIAL: *Contact of Blackhawk Fm & Castlegate Sandstone*

STREAM ASPECT: *E*

STREAM GRADIENT: *2-3°*

ELEVATION: *8,046 ft*

SIZE OF COMPLEX: *(see quantitative data)*

ADJACENT UPLAND VEGETATION (looking downstream)

Left: *Conifer*

Right: *Conifer*

VEGETATIVE DESCRIPTION (Dominance by Community Types)

Community Name	% of Complex
<i>(refer to quantitative data results for this information)</i>	

COMMUNITY SUCCESSIONAL STAGE: *Unstable*

APPARENT FORAGE TREND: *Unstable*

ESTIMATED FORAGE PRODUCTION: *100 lbs/acre*

BEAVER ACTIVITY: *No*

EROSION RATING (1=negligible; 2=slight; 3=moderate; 4=severe; 5=extreme): **5**

PHOTOGRAPH TAKEN: Yes

LAND USE ACTIVITIES THAT COULD INFLUENCE RIPARIAN AREA: Mining, grazing (cattle & wildlife), hunting, recreation.

SPECIES OBSERVED:

Trees	Shrubs	Forbs	Grasses (or grasslike)
<i>Cornus sericea</i>		<i>Equisetum arvense</i>	
<i>Populus tremuloides</i>		<i>Viola adunca</i>	
<i>Pseudotsuga menziesii</i>			
<i>Rosa woodsii</i>			

POOL ATTRIBUTES

% area in pools: 25  
 % pool area made up of pools > 2' deep: 0

AQUATIC VEGETATION

% streambed with filamentous algae: 0  
 % stream margin with rooted aquatic: 0

BANK TYPE & VEGETATION OVERHANG

% bank length undercut (<90°): 0  
 % bank length gently sloping (>135°): 75 (average)  
 % bank length with overhanging vegetation: 50 (conifers)

BANK CONDITION

	Left	Right
% bank length vegetated, stable:	10	20
% bank length unvegetated, stable:	80	80
% bank length vegetated, unstable:	0	0
% bank length unvegetated, unstable:	10	0

NOTES:

- 1) This site, also called Wedge Spring, is often measured for flow by a hydrologist.
- 2) It had rather low vegetative cover.
- 3) Water surfaced at a couple of locations.
- 4) The bottom-line is that there was not much riparian vegetation and it may be difficult to monitor. There was a great deal of horsetail on the left side with some hillside moisture influence coming in contact with the spring zone.
- 5) The spring was rather muddy and unstable from a vegetation standpoint.
- 6) Because of recent mining expansion plans, this was the first sample period for this station.

## DATA SUMMARY

### Q10S: Cover by plant community types in the South Fork Quitchupah Creek drainage (October 2013).

<b>USDA Forest Service Protocol (1992)</b>			
	LEFT	RIGHT	TOTALS
<b>UPLAND VEGETATION</b>	0.00		
<i>Conifer</i>		10.00	
<i>Conifer</i>			10.00
<b>RIPARIAN VEGETATION</b>			
<u>Dominant Woody Species</u>			
<i>Cornus sericea/Equisetum arvense</i>		7.00	
<u>Dominant Herbaceous Species</u>			
<i>Equisetum arvense</i>	22.00	22.00	
			51.00
<b>TOTAL COVER (Upland Species)</b>			10.00
<b>TOTAL COVER (Riparian Species)</b>			51.00
<b>ROCK (channel)</b>			4.00
<b>WATER (channel)</b>			4.50
<b>BAREGROUND/MUD (channel)</b>			6.50
<b>LITTER</b>			1.00
<b>MOSS</b>			0.00
<b>TOTAL COVER</b>			<b>77.00</b>

## PHOTOGRAPHIC DOCUMENTATION



Q10S



Q10S (closeup)

**RIPARIAN COMPLEX DATA SHEET**

**October 2013**

CLIENT: *Canyon Fuel Company, SUFCO Mine*

SAMPLE NUMBER: **Q11C**

WATERBODY NAME: *South Fork Quitchupah Creek*

LOCATION: *Southern Wasatch Plateau, Utah*

DATE: *October 9, 2013*

OBSERVER(S): *P. Collins, E. Petersen, R. Long*

USGS QUAD 7.5 MINUTE MAP: *Acord Lakes, Utah*

GEOLOGIC PARENT MATERIAL: *Blackhawk Fm*

STREAM ASPECT: *E*

STREAM GRADIENT: *2-3°*

ELEVATION: *7,780 ft*

SIZE OF COMPLEX: *(see quantitative data)*

ADJACENT UPLAND VEGETATION (looking downstream)

Left: *Aspen/Conifer*

Right: *Douglas Fir*

VEGETATIVE DESCRIPTION (Dominance by Community Types)

Community Name	% of Complex
(refer to quantitative data results for this information)	

COMMUNITY SUCCESSIONAL STAGE: *Early due to floods*

APPARENT FORAGE TREND: *Decreasing*

ESTIMATED FORAGE PRODUCTION: *400 lbs/acre*

BEAVER ACTIVITY: *Yes (upstream)*

EROSION RATING (1=negligible; 2=slight; 3=moderate; 4=severe; 5=extreme): **5 (see photo)**

PHOTOGRAPH TAKEN: *Yes*

LAND USE ACTIVITIES THAT COULD INFLUENCE RIPARIAN AREA: *Mining, grazing (cattle & wildlife), hunting, recreation flooding.*

SPECIES OBSERVED:

Trees	Shrubs	Forbs	Grasses (or grasslike)
<i>Abies concolor</i>	<i>Chrysothamnus nauseosus</i>	<i>Trifolium sp.</i>	<i>Agrostis stolonifera</i>
<i>Cornus sericea</i>			<i>Juncus arcticus</i>
<i>Populus tremuloides</i>			<i>Poa pratensis</i>
<i>Pseudotsuga menziesii</i>			
<i>Salix lutea?</i>			

POOL ATTRIBUTES

% area in pools: *50*  
 % pool area made up of pools > 2' deep: *0*

AQUATIC VEGETATION

% streambed with filamentous algae: *0*  
 % stream margin with rooted aquatic: *0*

BANK TYPE & VEGETATION OVERHANG

% bank length undercut (<90°): *0*  
 % bank length gently sloping (>135°): *0*  
 % bank length with overhanging vegetation: *50*

BANK CONDITION

% bank length vegetated, stable: *30*  
 % bank length unvegetated, stable: *20*  
 % bank length vegetated, unstable: *30*  
 % bank length unvegetated, unstable: *20*

NOTES:

- 1) *Because of recent mining expansion plans, this was the first sample period for this station.*
- 2) *Recent flooding appears to have greatly impacted the riparian community here.*
- 3) *This site was placed at water sampling station (called 006D).*

## DATA SUMMARY

### Q11C: Cover by plant community types in the South Fork Quitchupah Creek drainage (October 2013).

<b>USDA Forest Service Protocol (1992)</b>			
	LEFT	RIGHT	TOTALS
<b>UPLAND VEGETATION</b>			
<i>Populus tremuloides/Abies concolor</i>	6.00		
<i>Pseudotsuga menziesii</i>		2.00	
			8.00
<b>RIPARIAN VEGETATION</b>			
<u>Dominant Woody Species</u>			
<i>Cornus sericea</i>	5.00	6.00	
			11.00
<u>Dominant Herbaceous Species</u>			
<b>TOTAL COVER (Upland Species)</b>			8.00
<b>TOTAL COVER (Riparian Species)</b>			11.00
<b>ROCK (channel)</b>			6.00
<b>WATER (channel)</b>			5.00
<b>BAREGROUND (channel)</b>			0.00
<b>LITTER</b>			0.00
<b>MOSS</b>			0.00
<b>TOTAL COVER</b>			<b>30.00</b>

PHOTOGRAPHIC DOCUMENTATION



Q11C

**NOTE:** We also visited another water station upstream from Q11C (or water station 006C). This site also had the potential for establishment of another riparian monitoring station. However, the recent flooding that has been described at several other stations appeared to have nearly devastated the vegetation here. Almost all that remained were small Red-osier dogwood (*Cornus sericea*) trees (more shrub-sized) lying prostrate in the channel. Some of these trees will likely survive.

I saw no reason to monitoring this site's vegetation from year to year because it can only improve - or it is my opinion that subsidence from mining could not negatively impact this community in the future any more than the recent flooding has done (see the photographs).



To substantiate the above comments, the water monitoring station (006C) could be easily viewed from the rim of the canyon using a spotting scope or binoculars. Qualitative data could be recorded at that time if desired.

Hydrogeologist, Erik Petersen, sampling the water at station 006C



Water sampling station 006C