

**RIPARIAN EVALUATION AND  
JURISDICTIONAL DETERMINATION**

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**LOWER CHAPARRAL GULCH  
HUMBOLDT SMELTER SITE  
HUMBOLDT, ARIZONA**

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**November 2009  
Job No. 1631.01**

**TABLE OF CONTENTS**

INTRODUCTION AND PURPOSE ..... 1

METHODS ..... 2

    Riparian Analysis using Clark Fork River Riparian Evaluation System ..... 2

    Preliminary Jurisdictional Determination ..... 3

RESULTS ..... 4

    Historic Use of Site ..... 4

    Evaluation of Riparian Polygons ..... 5

    Preliminary Jurisdictional Determination ..... 7

SUMMARY AND CONCLUSIONS ..... 9

REFERENCES ..... 18

**LIST OF TABLES**

Table 1. Summary of Riparian Polygon Conditions ..... 10

Table 2. Summary of Wetland Conditions ..... 15

**LIST OF FIGURES**

**(figures follow text)**

Figure 1. Vicinity Map

Figure 2. Riparian Polygons

Figure 3. Riparian Polygon Classification

Figure 4. Wetland Areas and Data Points

Figure 5. Preliminary Jurisdictional Determination on Chaparral Gulch

**LIST OF APPENDICES**

Appendix A. Riparian Polygon Data Forms

Appendix B. Wetland Data Forms

Appendix C. Jurisdictional Determination Data Forms

Appendix D. Riparian Polygon Photos

Appendix E. Wetland Photos

Appendix F. Jurisdictional Determination Photos

Appendix G. Clark Fork River Riparian Evaluation System A Remedial Design Tool

## INTRODUCTION AND PURPOSE

The Iron King Mine and Humboldt Smelter Site near Dewey-Humboldt in Yavapai County, Arizona, have been identified as a single CERCLA action area by the U.S. Environmental Protection Agency (EPA), and are collectively referred to as the Iron King Mine-Humboldt Smelter Superfund Site. EA Engineering, Science, and Technology, Inc. (EA) is the prime contractor with responsibility for conducting the Remedial Investigation and Feasibility Study for the site.

In order to obtain information relevant to the determination of remedial actions, EA requested that WestLand Resources, Inc. (WestLand) provide an analysis of riparian conditions, potential jurisdictional waters of the United States, and potential wetland conditions within Lower Chaparral Gulch at the Humboldt Smelter Site (Figure 1). This report summarizes the results of that analysis.

## METHODS

### RIPARIAN ANALYSIS USING CLARK FORK RIVER RIPARIAN EVALUATION SYSTEM

Riparian conditions in Lower Chaparral Gulch were evaluated generally following the methods described in the Clark Fork River Riparian Evaluation System (EPA 2004). This procedure was developed to assess riparian systems that had been impacted by past mining and ore processing actions on the Clark Fork River of Montana. This tool is intended to assist managers in making decisions regarding cleanup and reclamation strategies. Using this tool, riparian areas, or polygons, are identified and categorized based on landscape stability, contamination severity, and plant community attributes.

The Clark Fork River Riparian Evaluation System was designed for use on a large, perennial river system in Montana. Although the evaluation system is not entirely transferrable to a relatively small, intermittent channel in Arizona (i.e., Lower Chaparral Gulch), the model still provides a useful evaluation tool for the Humboldt Smelter site. For instance, a significant aspect of the Clark Fork model is the use of tufted hairgrass (*Deschampsia caespitosa*) as an indicator species for the presence of copper tailings material in soil. Although this species occurs in Arizona, it does not occur in the vicinity of the analysis area. An analogous species was not identified for the Lower Chaparral Gulch analysis.

Application of this riparian evaluation tool begins with identification of polygons having similar conditions within the area of interest. These polygons fall into the broad categories of either streambank (and riparian corridor buffer), or contaminated soils within the historic 100-year floodplain. The streambank category is further subdivided into Class 1, Class 2, and Class 3 streambanks, with Class 3 being the highest quality and Class 1 being the lowest quality. The potentially contaminated soils on the floodplain are divided into areas of slickens (exposed concentrator tailings), impacted soils and vegetation areas, and slightly impacted soils and vegetation areas. The term “slickens” is not commonly used in the mining industry in Arizona. However, because of its common use in the Clark Fork River Riparian Evaluation System and on the data forms, we will use that term to describe areas that are composed predominately of exposed concentrator tailings on the ground surface, with little or no vegetation.

Field data forms are available to assist in the analysis and categorization of each polygon (Appendix A). These forms and the accompanying instructions provide scoring classes for a variety of variables, and the total score determines the final category. For example, a polygon with greater than 90 percent of live canopy cover would score 21 points on the vegetation variable. Canopy cover between 80 and 90 percent would get 14 points, and canopy cover between 70 and 80 percent would get 7 points. A polygon with less than 70 percent cover would receive zero points on the vegetation variable. Note, therefore, that just because a particular polygon scores a “zero” for vegetation, it does not mean that that polygon supports no vegetation. It simply means that the polygon supports less than 70 percent cover of vegetation.

Within the Humboldt Smelter site, riparian polygons were identified along Chaparral Gulch from the point of entry on the west boundary of the smelter site downstream to the confluence with the Agua Fria

River. These polygon shapes were initially based on an evaluation of recent aerial photographs of the site, with onsite verification and subsequent adjustment of boundaries.

Because the concept of “streambank” varies considerably between the perennial Clark Fork River and the intermittent to ephemeral Lower Chaparral Gulch, those polygons that contained the main channel of Lower Chaparral Gulch were evaluated as both streambanks and as floodplain soils in order to provide a more accurate assessment of these areas. In addition, the channel of Lower Chaparral Gulch has been impacted to a greater or lesser degree throughout the smelter site and down to the confluence with the Agua Fria River. As such, the analysis of floodplain soils is likely to provide more useful information regarding future actions on this site.

## **PRELIMINARY JURISDICTIONAL DETERMINATION**

### **Wetlands**

Jurisdictional wetlands are considered “special aquatic sites” under the Clean Water Act, and specific methods are used in their identification and delineation. Although a formal jurisdictional wetlands determination is not required for the site as part of a permitting effort, the presence and quality of wetland conditions is anticipated to inform decisions regarding reclamation methods. The wetland evaluation completed for Lower Chaparral Gulch was based on the triple-parameter approach defined by the U. S. Army Corps of Engineers (Environmental Laboratory 1987) along with supplementary information on delineation of wetlands in the arid western states (Environmental Laboratory 2006). Using these procedures, potential wetland conditions were identified in several locations in the channel and floodplain of Chaparral Gulch, and standard Wetland Determination Forms were completed in each of these locations (Appendix B). Corresponding data forms were completed for adjacent upland areas. These data forms document the conditions of vegetation, soils, and hydrology at the point of analysis. Positive indicators are generally required for all three parameters for an area to be identified as a wetland.

### **Intermittent Chaparral Gulch**

Although the reclamation of the Humboldt Smelter site is a CERCLA action and not subject to Section 404 permit requirements, an analysis of potential waters of the U.S. within the analysis area has been completed to provide additional information for any decisions regarding site reclamation. The jurisdictional determination (JD) completed for this evaluation includes Lower Chaparral Gulch from the west boundary of the Humboldt Smelter site downstream to its confluence with the Agua Fria River.

The lateral boundaries of jurisdictional waters are indicated by the ordinary high-water mark (OHWM), identified by the presence of one or more of the following characteristics: a well-defined channel as indicated by an incision or scour line, debris line, change in substrate, water stains on bedrock, or the presence of xeroriparian or riparian vegetation. Identification of OHWM utilized aerial photograph interpretation and field reconnaissance. During the field effort, data point locations were determined using a Trimble GPS with an accuracy of less than 1.0 meter. At each point, data were recorded on channel width and conditions, and photographs were taken to document each point (Appendix C).

## RESULTS

### HISTORIC USE OF SITE

The Humboldt Smelter site is located in the town of Humboldt, Arizona, approximately 0.6 mile east of State Route (SR) 69. At least two smelters have operated on this site. The Val Verde Smelter was constructed in the 1880s on land that was originally patented as a mill site in 1879 (Pape 1987). This smelter was destroyed by fire in 1904, but it was rebuilt and enlarged as the Humboldt Smelter in 1906. This smelter was active until 1922, but with decreasing production from local mines, the smelter operated only intermittently from 1922 until being shut down in 1927. The smelter was rehabilitated in 1929 and operated again from 1930 until its final shutdown in 1937 (Pape 1987). Based on the presence of concentrator tailings in several locations around the site, it is likely that at least one, and probably two, mill/concentrator facilities operated on this site at some time during its history.

At some time during this history, a stone and concrete dam was constructed at a narrow point with exposed bedrock in Chaparral Gulch. An aerial photographic analysis of this site shows that this dam was present in 1940 (EPA 2008). The text accompanying this photograph (EPA 2008) identifies the tailings area in the small tributaries on the north side of Chaparral Gulch. It also states that the tailings dams have been breached, although the breaches are not obvious and there appears to have been relatively little downslope movement of tailings. The area above the stone and concrete dam is vegetated with what appears to be a cottonwood/willow riparian forest. The portion of Chaparral Gulch near the western boundary of the smelter site contains no significant riparian vegetation. Likewise, no significant riparian zone is apparent in Chaparral Gulch below the dam. The head of Chaparral Gulch is in the Bradshaw Mountains, approximately 9.3 miles upstream from the smelter site.

By 1953, the breaches in the tailings dam are more apparent, and there has been some downslope movement of tailings. However, the area above the stone and concrete dam is still a riparian forest. In January 1964, there was additional movement of tailings, which is now encroaching on the riparian forest above the dam. There is still no apparent riparian zone along Chaparral Gulch at the west edge of the property or below the dam.

On March 23, 1964, there was a significant failure of a tailings impoundment at the Iron King Mine, about 1.4 miles upstream (west) from the Humboldt Smelter Site. It was believed that most of the material from this failure was trapped at an old railroad berm west of SR-69, but as much as 5,000 tons could have gone beyond that point and down to the Agua Fria River (Kento 1964). The 1970 photo shows relatively little change from the 1964 photo, but it is likely that some of the material from this tailings impoundment failure was distributed along lower Chaparral Gulch. The 1970 photo also indicates that there may be somewhat more encroachment of tailings from the old impoundment on the north side of Chaparral Gulch at the Humboldt Smelter site. However, by 1973, there appears to have been more movement of tailings into the gulch, with a subsequent thinning of the riparian forest above the stone and concrete dam. The riparian zone below the dam shows significant growth between the 1970 and 1973

photos. Two small stands of riparian vegetation in the minor tributary channels on the north side of Chaparral Gulch are beginning to develop in the 1973 photo.

In the 1980 photo, there appears to have been significant movement of sediments and/or tailings into the area above the stone and concrete dam, with a very noticeable loss of riparian vegetation. It is likely that the much of the sediment filling in this basin was derived from higher regions in the Bradshaw Mountains and was transported by major flood events in Chaparral Gulch. The extensive amounts of gravel in the sediments observed on site could not have been derived from tailings material alone, and the on-site tailings impoundment appears to have been too small to account for the volume of material observable in the basin in the 1980 photo. In addition, interbedded layers of tailings and sediments are exposed in some eroded banks along the current channel. The two small riparian stands on the north side of the gulch show additional growth from the 1973 photo. The portion of Chaparral Gulch at the western boundary of the property is showing the development of a riparian gallery forest of cottonwoods and willows.

By 1992, the riparian area above the stone and concrete dam is gone, except for a small remnant near the main channel. The basin above the dam is completely filled with sediment, likely interlayered natural sediments and tailings. The riparian vegetation near the west edge of the site and on the north side of Chaparral Gulch shows continued growth. The smelter site was nearly in its current condition by this time. The final photograph in this sequence, taken in 2003, shows additional growth in the two riparian stands on the north side of Chaparral Gulch and in the riparian zone along the west edge of the site. In addition, a small stand of riparian vegetation has become established along the channel above the dam.

With regard to plant communities, the Humboldt Smelter site is near the ecotone between the Great Plains Grasslands and Interior Chaparral biotic communities, as described by Brown (1982) and Pase and Brown (1982). Sonoran Riparian Deciduous Forest (Minckley and Brown 1982) is now present in some areas along Chaparral Gulch, particularly in the canyon bottom below the dam and on the west edge of the smelter site.

The main area of tailings currently affecting Lower Chaparral Gulch was deposited behind a small dam that blocked two small tributaries on the north side of the gulch. As noted above, this dam failed sometime before 1953, and possibly before 1940, allowing tailings to be washed into the basin behind the stone and concrete dam in Lower Chaparral Gulch. An older, but much smaller, source of tailings in Lower Chaparral Gulch appears to be from two old pipes above the confluence with the Agua Fria River. No attempt was made to locate the origin of these pipes, but they are assumed to have originated at a former concentrator facility near the Humboldt Smelter.

## **EVALUATION OF RIPARIAN POLYGONS**

A total of 26 riparian polygons were identified in Lower Chaparral Gulch (Figure 2). Locations, conditions, and brief descriptions of each of these polygons are provided in Table 1. Data forms for each of these polygons are included in Appendix A and photos are provided in Appendix D. These areas include nine polygons of impacted or slightly impacted soils, eight polygons of slickens (tailings), and nine streambank polygons. Because of the significant geomorphological and hydrological differences

between the Clark Fork River and Lower Chaparral Gulch, all nine of the streambank polygons were also evaluated as contaminated soils/slickens, with eight of the polygons comprising impacted or slightly impacted soils, and one being slickens. For ease of evaluation, these riparian polygons have been color-coded to distinguish areas of slickens, impacted soils, and slightly impacted soils (Figure 3). None of the polygons are identified as streambank in this figure to facilitate evaluation of, and comparison between, polygons.

Four streambank polygons (21, 22, 23, and 24) are located downstream from the old stone and concrete dam. The upper two of these polygons (23 and 24) appear to have perennial water flow originating from saturated sediments above the dam. These polygons have good stands of riparian vegetation, and wetland conditions are continuous from the toe of the dam to the lower end of polygon 23. These polygons show some evidence of impact from the tailings, but the dense aquatic vegetation (cattails, bulrush, and rushes) may provide some water quality improvement function. Based on the review of historic aerial photographs, this riparian zone appears to be a relatively recent development (within the last 30 to 40 years). The growth of this riparian vegetation appears to coincide with the sediment filling above the dam, which could provide stormwater storage capacitance and relatively slow, constant release below the dam.

The two lowest polygons in Chaparral Gulch (21 and 22) have been impacted by tailings, with two discharge pipes on the north side of polygon 22. These polygons have relatively little vegetation and no perennial surface flow.

All other riparian polygons are located above the old dam, and most of these (excluding polygon 20) occur on top of the sediments and tailings filling the basin. Five streambank polygons (20, 18, 12, 5, and 1, moving downstream from the west boundary to the dam) are present above the dam. Quality of these streambank polygons varies dramatically from the cottonwood/willow riparian forest of Polygon 20 to highly impacted areas in eroded channels in sediments and/or tailings. Some of the larger cottonwood trees in Polygon 20 show multiple layers or roots produced by the trees in response to sedimentation events that deposit at least a foot of material at the base of the trees. Vegetation is sparse in some of these other polygons, especially Polygons 12 and 18. Polygons 1 and 5 have stands of relatively young cottonwoods and willows, which apparently developed after the last phase of sedimentation.

Seven riparian polygons (2, 4, 7, 9, 10, 11, 25, and 26) above the dam are categorized as slickens, with exposed tailings covering most or all of these polygons. Polygons 25 and 26 are located downslope from the old tailings impoundment in the tributaries north of Chaparral Gulch. These polygons show the most obvious impact of tailings from the breaches in the old tailings dam. Additional areas of tailings are exposed in the other polygons, and it appears that the fill behind the masonry dam is likely to include interlayered deposits of tailings and sediments from different flooding and erosion events.

The remaining nine riparian polygons (3, 6, 8, 13, 14, 15, 16, 17, and 19) above the old masonry dam are categorized as impacted soils areas or slightly impacted soils areas. These polygons include some areas of riparian vegetation found at the interface between the basin-fill sediments and the adjacent slopes north and south of the basin (polygons 3, 6, and 13). Several of these polygons (8, 14, 17, and 19) are dominated by big sacaton (*Sporobolus wrightii*), a tall bunch grass that is common and widespread across

Arizona. Two polygons (15 and 16) are located on tributaries on the north side of Chaparral Gulch below the old tailings dam. These polygons are dominated by riparian trees, including cottonwood, willow, and tamarisk.

## PRELIMINARY JURISDICTIONAL DETERMINATION

Wetland conditions were identified in seven separate areas in the Lower Chaparral Gulch vicinity, as shown on Figure 4. One wetland is present in the channel of Chaparral Gulch below the old masonry dam. Four smaller wetlands are present in the main or parallel channels above the dam. The remaining two wetlands are at the toe of the slope on the south side of the sediment-filled basin above the dam.

### Wetland Conditions in Chaparral Gulch

Wetland conditions were found in five distinct areas along the Chaparral Gulch drainage channel. One of these areas (Wetland A) is below the old masonry dam, and the other four (Wetlands B, C, D, and F) are located along the channel above the dam. Data forms for all wetlands and adjacent upland areas are included in Appendix B. Photos of these areas are provided in Appendix E. Locations, conditions, and brief descriptions of each of these wetlands are provided in Table 2. Identified wetland areas and data point locations are shown on Figure 4.

Wetland A is located on the channel of Chaparral Gulch below the old masonry dam (Data Form 1). This forested wetland appears to have the greatest diversity of vegetation and probably provides the most significant ecological functions. Based on the historical photos (EPA 2008), this area was probably not a wetland before sediments filled the basin above the dam to provide storage capacitance that now allows a slow, constant release of water from the toe of the dam. At the lower end of Wetland A, the surface flow sinks into the sediments of Chaparral Gulch, and it is no longer able to support the riparian or wetland vegetation. Vegetation in this wetland is dominated by Goodding willow (*Salix gooddingii*), Fremont cottonwood (*Populus fremontii*), broadleaf cattail (*Typha latifolia*), American bulrush (*Schoenoplectus americanus*), softstem bulrush (*Schoenoplectus tabernaemontani*), and Mexican rush (*Juncus mexicanus*). Given its location and structure, this wetland may improve the quality of water released from the dam prior to the confluence with the Agua Fria River. Based on a visual evaluation of the water in this channel, it appears that the dense aquatic vegetation is functioning to remove sediments from the flow. Water at the outlet from the dam is discolored with entrained sediments (Photos D-47 and D-48), but the water appears to have no sediments at the downstream end of the wetland. It is unknown at this time whether the vegetation would act to remove dissolved material from this water. The upland area adjacent to this wetland is primarily interior chaparral, with the shrub density dependant on the slope aspect (Data Form 2).

Wetlands B, C, D, and F are all relatively small areas of scrub-shrub and emergent wetlands along the main or side channels of Chaparral Gulch above the old masonry dam (Data Forms 3, 5, 7, and 11). Because these wetlands are on top of the sediments, there is no possibility that they existed in their current condition prior to the filling of this basin. Other wetlands may have existed in the drainage bottom prior to sedimentation, but they are no longer extant. Hydrology in these wetlands appears to be supported

by storage of ephemeral flow in Chaparral Gulch, confined by layers in the sediments with low permeability. Based on the historical photographs (EPA 2008), these wetlands have been in existence less than 30 years, and there has been insufficient time for the development of normal wetland soil stratification. Dominant plant species in these wetlands include Goodding willow, Fremont cottonwood, red willow (*Salix laevigata*), broadleaf cattail, and Mexican rush. Upland areas adjacent to these wetlands include bare areas of sediment with virtually no vegetation and interior chaparral and Great Plains grasslands on the relatively undisturbed slopes above the sediment-filled basin (Data Forms 4, 6, 8, and 12).

### **Wetland Conditions in Other Areas**

The remaining two wetlands (Wetlands E and G) are located on the south side of the sediment-filled basin, adjacent to the relatively undisturbed south slope of Chaparral Gulch. As these wetlands are at the boundary between the top of the sediments and the undisturbed slope, it is unlikely that they existed prior to the filling of this basin. Prior to sedimentation, these locations were most likely a dry side slope of the canyon. Hydrology in these sites appears to be storage of slope runoff in the sediments, probably confined by less permeable layers. In Wetland G, the runoff is concentrated in a small drainage channel that feeds directly into the wetland. Based on the historical photographs (EPA 2008), these wetlands have been in existence less than 30 years, and there has been insufficient time for the development of normal wetland soil stratification. Vegetation in Wetland E is dominated by Fremont cottonwood, red willow, broadleaf cattail, and Mexican rush (Data Form 9). Wetland G is dominated by Mexican rush, with single trees of red willow and Fremont cottonwood (Data Form 13). Upland vegetation adjacent to these wetlands includes sediments in the basin and interior chaparral and Great Plains grasslands on the south slope (Data Forms 10 and 14).

### **Intermittent Chaparral Gulch**

The areas determined by WestLand to meet the criteria for potential waters are delineated on the attached aerial photograph with red lines and yellow hatching (Figure 5). WestLand evaluated Lower Chaparral Gulch from the west boundary of the Humboldt Smelter site downstream to the confluence with the Agua Fria River for potential waters of the United States. Photos of this jurisdictional determination are provided in Appendix F.

## **SUMMARY AND CONCLUSIONS**

The Clark Fork River Riparian Evaluation System was developed to categorize degrees of impact in a part of Montana that has been heavily impacted by past mining and ore processing activities. With minor modifications, it appears to be a useful tool for describing conditions of the riparian area and floodplain of Chaparral Gulch at the Humboldt Smelter Site. Twenty-six riparian polygons were identified on this sites, including nine streambank polygons, nine polygons of impacted or slightly impacted soils, and eight polygons of slickens (exposed tailings). The streambank polygons have also been categorized as as follows: three polygons of slightly impacted soils, five polygons of impacted soils, and one polygon of slickens. Identification and analysis of these polygons is intended to provide additional information for the development of a plan for remedial actions on the site. Most of these polygons were identified on a land surface that did not exist before 1973. It appears that multiple flood events over a period of about 20 years created the sediment surface that is present today. The highest quality riparian polygons at the present time are Polygons 23 and 24, in the channel below the dam, and Polygon 20 at the west edge of the site.

Wetland conditions on the Humboldt Smelter site were identified using the triple-parameter method as described in the 1987 Corps of Engineers Manual (Environmental Laboratory 1987) and the 2006 supplement for the arid west region (Environmental Laboratory 2006). Seven wetland areas were identified, including a large continuous wetland in the canyon bottom below the old masonry dam, four small wetlands in the channels of Chaparral Gulch above the dam, and two small wetlands at the toe of the slope on the south side of the sediment-filled basin. Based on our review of the historic aerial photographs (EPA 2008), it is unlikely that any of the wetlands above the dam could have existed prior to 1973. The original land surface in this area appeared to support a cottonwood-willow riparian zone that is now buried in sediments.

Based on an analysis of these same photos, the wetland on the channel below the dam did not exist in its present form prior to 1970. No large riparian trees are evident in this reach of Chaparral Gulch until 1973, when a few trees are obvious. The 1980 and 1992 photos of this area are not high resolution, but it appears that the riparian zone is developing during this period. By 2003, this zone had attained most of its current growth of riparian trees. This area now appears to be the highest quality wetland on the property. The development of this wetland and riparian zone appears to correlate with the filling of the basin above the dam with sediments. The porosity of these sediments may provide a storage volume for floodwaters that may then be released slowly and continuously at the base of the dam. Removal of the dam would likely result in the loss of this water source and the loss of this wetland.

**Table 1. Summary of Riparian Polygon Conditions**

Polygon Number	Polygon Type	Polygon Centroid Locations*	Polygon Scores**	General Description	Ecological Value
1	Streambank Class 3/ Impacted Soils Area	Easting: 386815  Northing: 3817308	Physical Integrity: 33/39  Community Integrity: 21/21  Contamination Severity: 9/25	Dense area of trees around channels of Chaparral Gulch on sediment fill above old dam. Dominant vegetation includes Fremont cottonwood, Goodding willow, and tamarisk. Soils heavily impacted by lead and arsenic. Includes Wetland Areas B and C. Photos D-1 and D-2.	Potential cover, nesting, and foraging areas for a variety of birds and mammals. Potential value limited by relatively small size and surrounding impacted areas.
2	Slickens	Easting: 386817  Northing: 3817337	Physical Integrity: -  Community Integrity: -  Contamination Severity: -	Area heavily impacted by tailings and other sediment flows. No vegetation. Efflorescent salts widely visible. High concentrations of lead and arsenic. Photos D-3 and D-4.	Virtually no ecological value.
3	Slightly Impacted Soils Area	Easting: 386832  Northing: 3817356	Physical Integrity: -  Community Integrity: 14/21  Contamination Severity: 22/25	Narrow zone of riparian vegetation at toe of slope on north side of sediment fill above dam. Photos D-5 and D-6.	Potential cover, nesting, and foraging habitat for a variety of birds and mammals. Provides buffer between impacted soils and slickens and relatively undisturbed hillside.
4	Slickens	Easting: 386776  Northing: 3817391	Physical Integrity: -  Community Integrity: -  Contamination Severity: -	Area heavily impacted by tailings and other sediment flows. Very sparse vegetation. Efflorescent salts widely visible. Driftwood and stumps indicate former wooded area that was overwhelmed by sediment flows. High concentrations of lead and arsenic. Photos D-7 and D-8.	Virtually no ecological value.
5	Streambank Class 2/ Impacted Soils Area	Easting: 386756  Northing: 3817377	Physical Integrity: 26/39  Community Integrity: 14/21  Contamination Severity: 15/22	Narrow riparian zone of young Goodding willow, red willow, and Fremont cottonwood along main channel of Chaparral Gulch across sediment filled basin behind dam. Some cattails present. Includes Wetland Area D. Photos D-9 and D-10.	Potential cover, nesting, and foraging areas for a variety of birds and mammals. Potential value limited by surrounding impacted areas.

**Table 1. Summary of Riparian Polygon Conditions**

Polygon Number	Polygon Type	Polygon Centroid Locations*	Polygon Scores**	General Description	Ecological Value
6	Impacted Soils Area	Eastung: 386769  Northing: 3817331	Physical Integrity: -  Community Integrity: 0/21  Contamination Severity: 3/15	Narrow zone of emergent vegetation on south edge of sediment basin, dominated by Mexican rush. Includes Wetland E. Photos D-11 and D-12.	Potential cover, nesting, and foraging habitat for a variety of birds and mammals. Provides buffer between sediment basin and relatively undisturbed hillside.
7	Slickens	Eastung: 386727  Northing: 3817379	Physical Integrity: -  Community Integrity: -  Contamination Severity: -	Area heavily impacted by tailings and sediment flows, between channel of Chaparral Gulch and sacaton area. Virtually no vegetation. Efflorescent salts widespread. High levels of lead and arsenic in surface sediments. Photos 13 and 14.	Virtually no ecological value.
8	Impacted Soils Area	Eastung: 386609  Northing: 3817432	Physical Integrity: -  Community Integrity: 0/21  Contamination Severity: 13/15	Area dominated by big sacaton, with a few willows, cottonwoods, and Mexican rush at toe of slope on south edge of sediment basin. High levels of lead and arsenic in surface sediments. Includes Wetland Area G. Photos 15 and 16.	Minimal ecological values.
9	Slickens	Eastung: 386524  Northing: 3817507	Physical Integrity: -  Community Integrity: -  Contamination Severity: -	Small area with very little vegetation, between larger areas of sacaton, near south edge of sediment basin. Impacted by ATV traffic. Photos 17 and 18.	Virtually no ecological value.
10	Slickens	Eastung: 386634  Northing: 3817457	Physical Integrity: -  Community Integrity: -  Contamination Severity: -	Area with virtually no vegetation, between sacaton and main channel of Chaparral Gulch. May represent overflow channel in exceptional storm events. Very high levels of lead and arsenic in sediments. Photos D-19 and D-20.	Virtually no ecological value.
11	Slickens	Eastung: 386696  Northing: 3817443	Physical Integrity: -  Community Integrity: -  Contamination Severity: -	Virtually no vegetation, between area of sacaton and main channel of Chaparral Gulch. High levels of lead and arsenic. Photos D-21 and D-22.	Virtually no ecological value.

**Table 1. Summary of Riparian Polygon Conditions**

Polygon Number	Polygon Type	Polygon Centroid Locations*	Polygon Scores**	General Description	Ecological Value
12	Streambank Class 3/ Impacted Soils Area	Eastings: 386649  Northing: 3817482	Physical Integrity: 3/39  Community Integrity: 0/21  Contamination Severity: 5/27	Main channel of Chaparral Gulch, located between several areas of slickens or impacted soils. Some vegetation along channel includes red willow, Goodding's willow, Fremont cottonwood, and tamarisk. High levels of lead and arsenic. Photos D-23 and D-24.	Low quality cover, nesting, and foraging areas for some birds and mammals. Potential value limited by surrounding impacted areas.
13	Impacted Soils Area.	Eastings: 386740  Northing: 3817445	Physical Integrity: -  Community Integrity: 14/21  Contamination Severity: 12/15	Narrow zone of riparian vegetation at toe of slope on north side of sediment fill above dam. Vegetation includes willows, cottonwoods, tamarisk, and Mexican rush. Photos D-25 and D-26.	Potential cover, nesting, and foraging habitat for a variety of birds and mammals. Provides buffer between impacted soils and slickens and relatively undisturbed hillside.
14	Impacted Soils Area.	Eastings: 386633  Northing: 3817477	Physical Integrity: -  Community Integrity: 0/21  Contamination Severity: 15/15	Narrow strip of sacaton between main channel and slickens in possible overflow channel. Photos D-27 and D-28.	Minimal ecological value.
15	Slightly Impacted Soils Area	Eastings: 386627  Northing: 3817515	Physical Integrity: -  Community Integrity: 21/21  Contamination Severity: 15/15	Small patch of riparian vegetation on small tributary channel between tailings areas. Dominated by tamarisk, with some cottonwoods and willows. Photos D-29 and D-30.	Potential cover, nesting, and foraging areas for a variety of birds and mammals. Potential value limited by surrounding impacted areas.
16	Slightly Impacted Soils Area	Eastings: 386554  Northing: 3817565	Physical Integrity: -  Community Integrity: 21/21  Contamination Severity: 15/15	Another, smaller patch of riparian vegetation on small tributary channel adjacent to tailings areas. Dominated by tamarisk, with some mature willows. Photos D-31 and D-32.	Potential cover, nesting, and foraging areas for a variety of birds and mammals. Potential value limited by surrounding impacted areas.
17	Impacted Soils Area	Eastings: 386500  Northing: 3817605	Physical Integrity: -  Community Integrity: 0/21  Contamination Severity: 17/25	Area of sacaton and bare soil on north side of main channel of Chaparral Gulch. High levels of lead and arsenic in sediments. Photos D-33 and D-34.	Minimal ecological value.

**Table 1. Summary of Riparian Polygon Conditions**

Polygon Number	Polygon Type	Polygon Centroid Locations*	Polygon Scores**	General Description	Ecological Value
18	Streambank Class 1/ Impacted Soils Area	Eastings: 386510  Northing: 3817576	Physical Integrity: 6/39  Community Integrity: 0/21  Contamination Severity: 15/15	Main channel of Chaparral Gulch from edge of trees to initial point of tailings impact. Very little vegetation. Erosion in channel is more vertical than lateral. Photos D-35 and D-36.	Primary ecological function is transporting stormwater during heavy rainfall events.
19	Impacted Soils Area	Eastings: 386499  Northing: 3817550	Physical Integrity: -  Community Integrity: 0/21  Contamination Severity: 15/25	Westernmost area of sacaton in sediment basin. Very high levels of lead and arsenic. Crossed by old roadway now used by ATV traffic. Photos D-37 and D-48.	Minimal ecological value.
20	Streambank Class 3/ Slightly Impacted Soils Area	Eastings: 386439  Northing: 3817659	Physical Integrity: 33/39  Community Integrity: 21/21  Contamination Severity: 15/25	Large stand of cottonwoods and tamarisk along main channel of Chaparral Gulch, at upper end of sediment basin. High levels of lead and arsenic. Photos D-39 and D-40.	Potential cover, nesting, and foraging areas for a variety of birds and mammals.
21	Streambank Class 1/ Impacted Soils Area	Eastings: 387073  Northing: 3817097	Physical Integrity: 12/39  Community Integrity: 0/21  Contamination Severity: 9/15	Lower end of Chaparral Gulch at confluence with Agua Fria River. Dominant plants include Goodding's willow, Fremont cottonwood, red willow, tamarisk, and Russian olive, sparsely distributed. Photos D-41 and D-42.	Potential cover, nesting, and foraging areas for a variety of birds and mammals. Value enhanced by proximity to perennial water in Agua Fria River, but reduced by proximity to tailings.
22	Streambank Class 1/ Slickens	Eastings: 387026  Northing: 3817076	Physical Integrity: 0/39  Community Integrity: -  Contamination Severity: -	Area of tailings, apparently deposited through two pipes on north side of Chaparral Gulch. Area also includes main channel of Chaparral Gulch. Channel is ephemeral in this reach. High levels of lead and arsenic. Photos D-43 and D-44.	Primary ecological function is transporting stormwater during heavy rainfall events.
23	Streambank Class 3/ Slightly impacted soils area	Eastings: 386936  Northing: 3817118	Physical Integrity: 39/39	Middle reach of Chaparral Gulch below dam. Includes part of Wetland A and stream flow that may be perennial. Vegetation dominated by Fremont cottonwood, Goodding's willow, cattails and bulrush. Photos D-45 and D-46.	Potential cover, nesting, and foraging areas for a variety of birds and mammals. Probably improves quality of water moving down Chaparral Gulch.

**Table 1. Summary of Riparian Polygon Conditions**

Polygon Number	Polygon Type	Polygon Centroid Locations*	Polygon Scores**	General Description	Ecological Value
24	Streambank Class 3/ Impacted Soils Area	Easting: 386876  Northing: 3817240	Physical Integrity: 39/39  Community Integrity: 21/21  Contamination Severity: 19/25	Upper reach of Chaparral Gulch immediately below dam. Includes part of Wetland A and stream flow that may be perennial. Vegetation dominated by Fremont cottonwood, Goodding's willow, cattails, bulrush, and Mexican rush. High levels of lead and arsenic. Photos D-47 and D-48.	Potential cover, nesting, and foraging areas for a variety of birds and mammals. Probably improves quality of water emerging from toe of dam.
25	Slickens	Easting: 386650  Northing: 3817515	Physical Integrity: -  Community Integrity: -  Contamination Severity: -	Area of tailings, apparently deposited following failure of tailings dam in tributary of Chaparral Gulch. No vegetation. Photos D-49 and D-50.	Virtually no ecological value.
26	Slickens	Easting: 386594  Northing: 3817548	Physical Integrity: -  Community Integrity: -  Contamination Severity: -	Area of tailings, apparently deposited following failure of tailings dam in tributary of Chaparral Gulch. No vegetation. Photos D-51 and D-52.	Virtually no ecological value.

\* UTM, Zone 12S, NAD 27.

\*\* Scores are presented as actual score over total possible. Lower scores indicate greater degrees of impact. Physical integrity scores apply only to streambank polygons. No scores apply to slickens polygons. Additional information is provided in the Clark Fork River Riparian Evaluation System A Remedial Design Tool, Appendix G.

Table 2. Summary of Wetland Conditions

Wetland	Wetland Class (NWI classification)	Wetland Data Point Location*	Wetland Indicators	General Description and Hydrology	Ecological Value
A	R3SB/PFO1	Northing: 3817228  Easting: 386888	Vegetation: Dominance Test = 60% Prevalence Index = 1.83  Soil: Stratified layers, low chroma  Hydrology: Surface water and saturation	High quality forested riparian wetlands downstream from old dam. Vegetation dominated by Goodding willow, red willow, Fremont cottonwood, cattail, bulrush, and Mexican rush. Wetland conditions include almost all of riparian corridor. Water supply from drain below dam appears to be perennial, with large storage volume in sediments above dam. Conditions prior to dam construction are unknown. Photos E-1 and E-2.	Potential shelter, water supply, nesting or den sites, and foraging areas for a variety of wildlife species. Potential to improve quality of water from above dam prior to delivery to Agua Fria River.
B	PSS1	Northing: 3817292  Easting: 386841	Vegetation: Dominance Test = 75% Prevalence Index = 2.36  Soil: Too young for development of characteristic conditions.  Hydrology: Saturation in adjacent channel	Small scrub-shrub wetland immediately above old dam, on main channel of Chaparral Gulch, dominated by red willow and Fremont cottonwood. Water supply appears to be from intermittent flow through the channel that may be trapped by less permeable layers in the sediments. Photos E-3 and E-4.	Potential shelter, water supply, nesting or den sites, and foraging areas for a variety of wildlife species.
C	PSS1/PEM1	Northing: 3817280  Easting: 386829	Vegetation: Dominance Test = 100% Prevalence Index = 1.85  Soil: Too young for development of characteristic conditions.  Hydrology: Seasonal saturation inferred from dense hydrophytic vegetation.	Small scrub-shrub and emergent wetland immediately above old dam, on south channel of Chaparral Gulch. Vegetation is dominated by red willow, Goodding willow, Fremont cottonwood, and Mexican rush. Water supply appears to be from intermittent flow through the channel and runoff from the south slope that may be trapped by less permeable layers in the sediments. Photos E-5 and E-6.	Potential shelter, water supply, nesting or den sites, and foraging areas for a variety of wildlife species.

**Table 2. Summary of Wetland Conditions**

Wetland	Wetland Class (NWI classification)	Wetland Data Point Location*	Wetland Indicators	General Description and Hydrology	Ecological Value
D	PSS1/PEM1	Northing: 3817353  Easting: 386783	Vegetation: Dominance Test = 80% Prevalence Index = 1.88  Soil: Too young for development of characteristic conditions.  Hydrology: Saturation to surface	Small scrub-shrub and emergent wetland in low area in intermittent channel of Chaparral Gulch, in sediment deposit upstream from old dam. Common plants include red willow and Fremont willow, with some cattails. Water source appears to be accumulated water from intermittent flow in porous sediments along channel above dam. Less permeable layers in the sediments may act as confining layers. Photos E-7 and E-8.	Potential shelter, water supply, nesting or den sites, and foraging areas for a variety of wildlife species.
E	PEM1/PSS1	Northing: 3817330  Easting: 386770	Vegetation: Dominance Test = 80% Prevalence Index = 2.11  Soil: Too young for development of characteristic conditions.  Hydrology: Saturation at -2”.	Small emergent and scrub-shrub wetland on southern edge of sediment deposit upstream from old concrete-masonry dam. Common plant species include red willow, Fremont cottonwood, and Mexican rush. Water source appears to be accumulated water in porous sediments from surface runoff from south slope of Chaparral Gulch. Less permeable layers in the sediments may act as confining layers. Photos E-9 and E-10.	Potential shelter, water supply, nesting or den sites, and foraging areas for a variety of wildlife species.
F	R4UB1/PSS1/ PEM1	Northing: 3817398  Easting: 386716	Vegetation: Dominance Test = 80% Prevalence Index = 1.61  Soil: Too young for development of characteristic conditions.  Hydrology: Saturation to surface	Small scrub-shrub and emergent wetland in intermittent channel in sediment deposit, about 600 ft upstream from old dam. Common plant species include red willow, Goodding willow, and cattail. Water source appears to be accumulated water in porous sediments from intermittent flow in Chaparral Gulch. Less permeable layers in the sediments may act as confining layers. Photos E-11 and E-12.	Potential shelter, water supply, nesting or den sites, and foraging areas for a variety of wildlife species.

**Table 2. Summary of Wetland Conditions**

Wetland	Wetland Class (NWI classification)	Wetland Data Point Location*	Wetland Indicators	General Description and Hydrology	Ecological Value
G	PEM1	Northing: 3817404  Easting: 386600	Vegetation: Dominance Test = 80% Prevalence Index = 1.13  Soil: Too young for development of characteristic conditions.  Hydrology: Seasonal saturation inferred from dense hydrophytic vegetation.	Small emergent wetland on south edge of sediment basin, at mouth of channel from south slope. Vegetation is dominated by Mexican rush, with individual red willow and Fremont cottonwoods near margin. Water source appears to be accumulated water in porous sediments from slope runoff. Less permeable layers in the sediments may act as confining layers. Photos E-13 and E-14.	Potential shelter, water supply, nesting or den sites, and foraging areas for a variety of wildlife species.

\* UTM, Zone 12S, NAD 27.

## REFERENCES

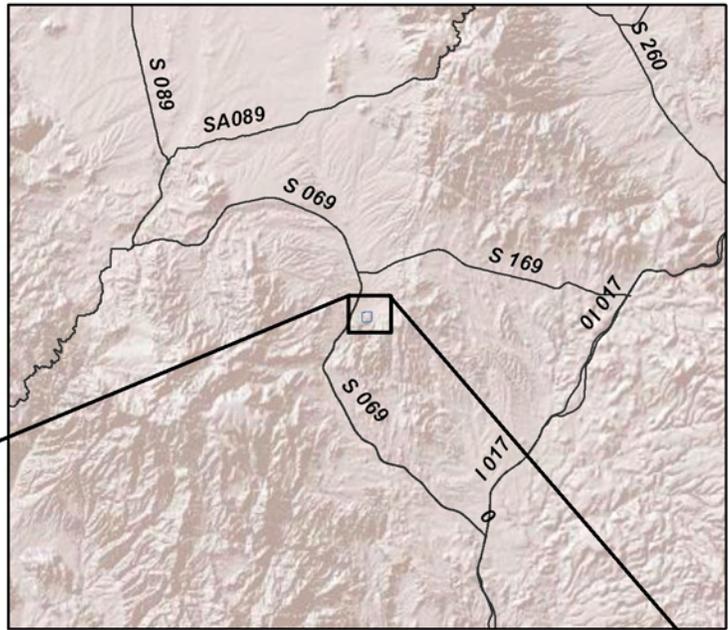
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## **FIGURES**



CENTRAL YAVAPAI COUNTY



Approximate Scale 1" = 10 Miles



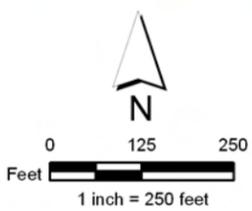
T.13N.,R.1E. Portion of Sections 14 & 23  
Yavapai County, Arizona  
Mayer USGS 7.5' Quadrangle





T.13N.,R.1E. Portion of Sections 14 & 23  
 Yavapai County, Arizona  
 Photo Source: Provided by client

  
**WestLand Resources, Inc.**  
 Engineering and Environmental Consultants



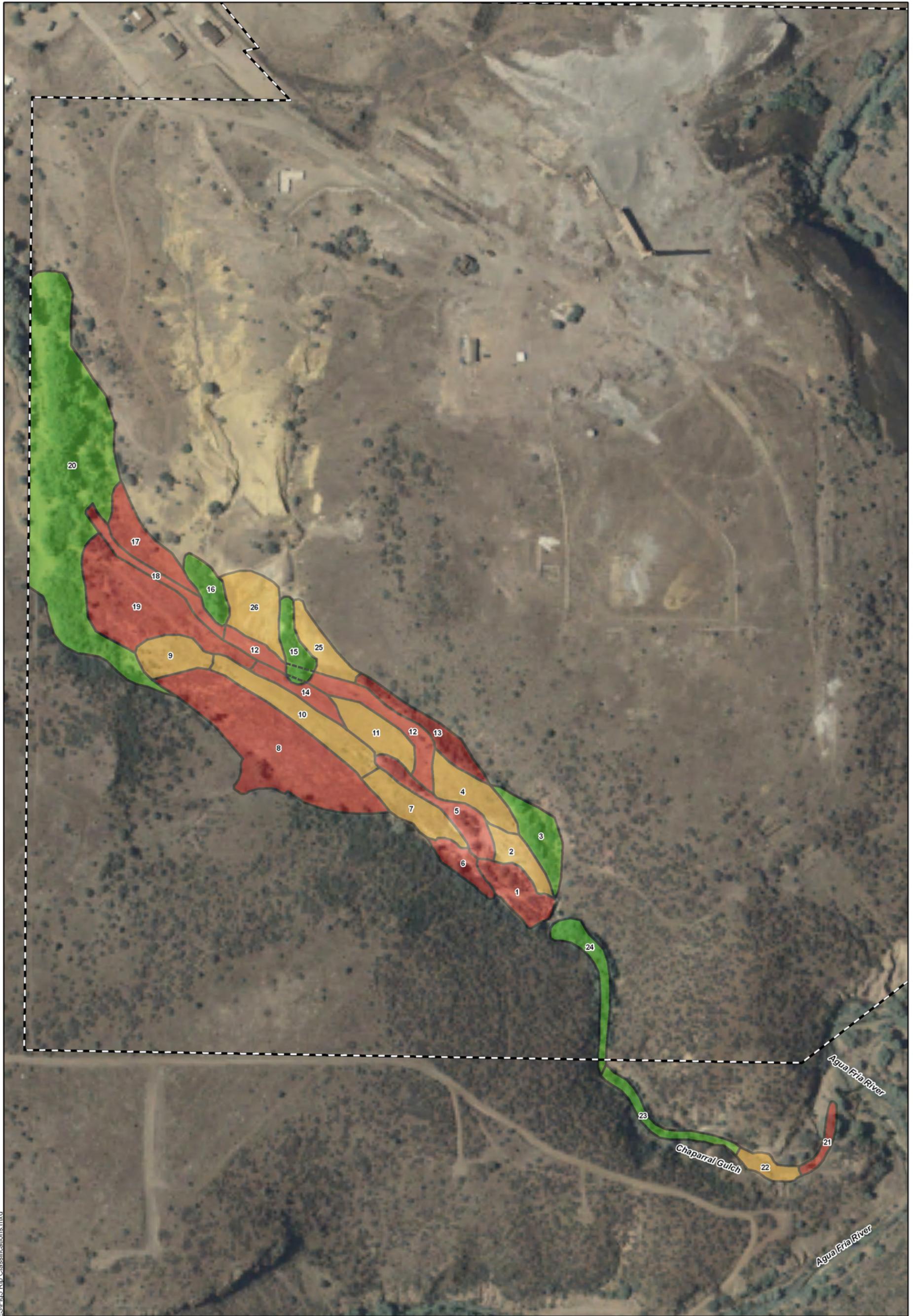
**Legend**

-  Humboldt Smelter
-  Riparian Polygon Boundary

**Lower Chaparral Gulch  
 Humboldt Smelter Site**

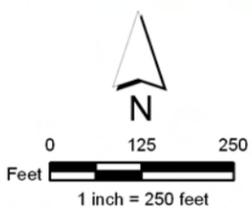
Riparian Polygons

Figure 2



T.13N.,R.1E. Portion of Sections 14 & 23  
 Yavapai County, Arizona  
 Photo Source: Provided by client

**WestLand Resources, Inc.**  
 Engineering and Environmental Consultants



**Legend**

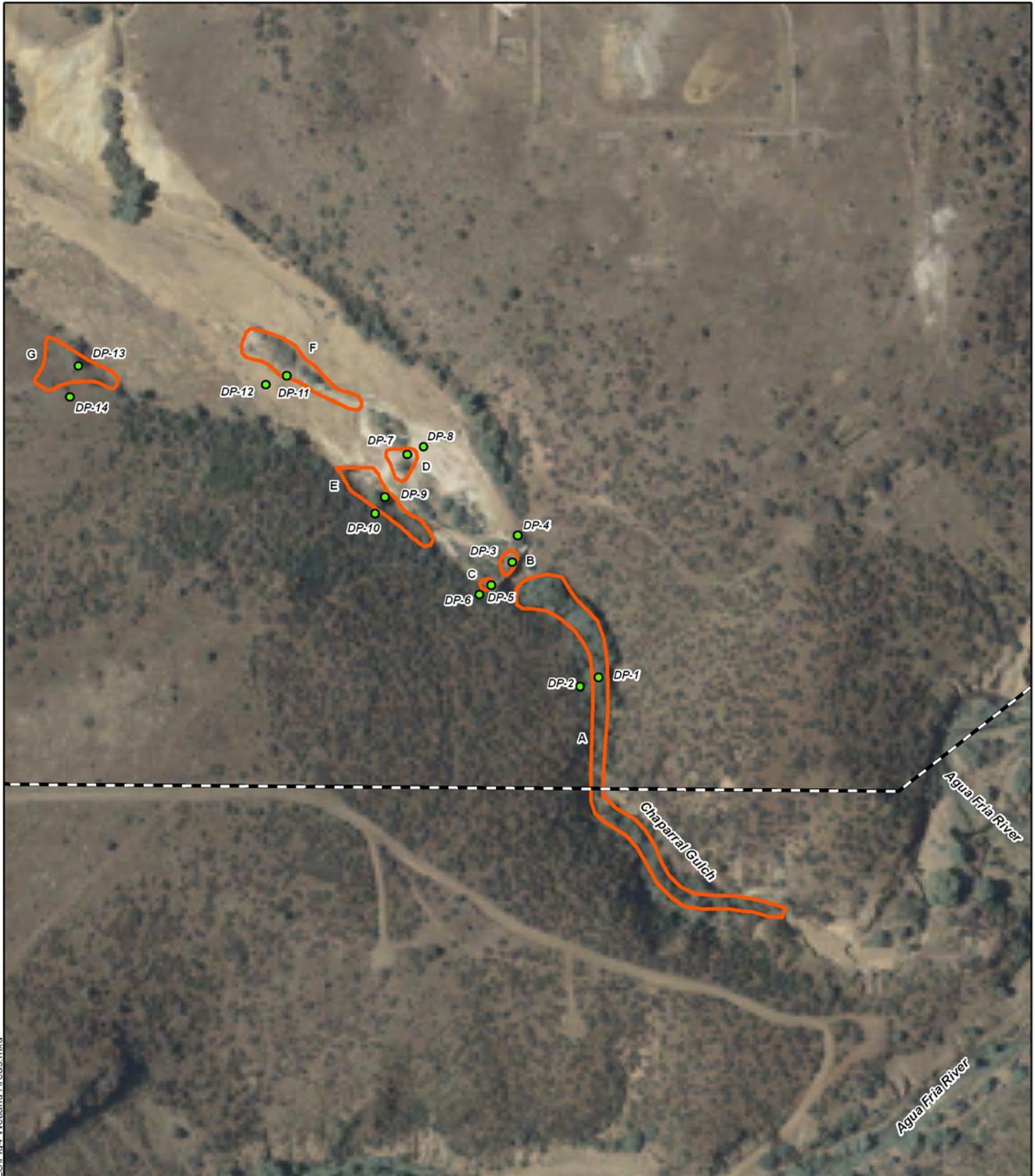
-  Humboldt Smelter
-  Impacted Soils
-  Slickens
-  Slightly Impacted Soils

**Lower Chaparral Gulch  
 Humboldt Smelter Site**

Riparian Polygon Classification

Figure 3

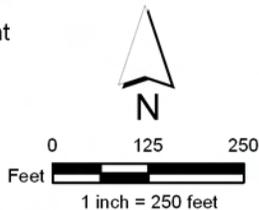
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T.13N.,R.1E. Portion of Sections 14 & 23  
 Yavapai County, Arizona  
 Photo Source: Provided by client

  
**WestLand Resources, Inc.**  
 Engineering and Environmental Consultants



**Legend**

-  Humboldt Smelter
-  Wetland Boundary
-  Wetland Data Point

**Lower Chaparral Gulch  
 Humboldt Smelter Site**

Wetland Areas and Data Points

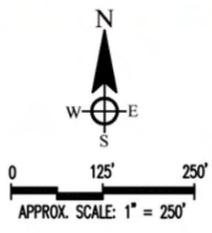
Figure 4



DWG FullPath: M:\projects\1631.01\REPORT FIGURES\Fig5 Prelim JD.dwg

T.13N., R.1E. Portion of Sections 14 & 23  
 Yavapai County, Arizona  
 Photo Source: Provided by client

**WestLand Resources Inc.**  
 Engineering and Environmental Consultants  
 4001 E. Paradise Falls Drive  
 Tucson, Az 85712 (520) 208-9888



**Legend**

- Humboldt Smelter
- Ordinary High Water
- Jurisdictional Waters of the U.S.
- Photo Direction
- Data Point Number  
Width

**Lower Chaparral Gulch  
 Humboldt Smelter Site**  
 Preliminary Jurisdiction Determination  
 Figure 5

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## **APPENDIX A**

**RIPARIAN  
POLYGON  
DATA  
FORMS**

CFR RipES Scoring Form for Streambank and Riparian Corridor Buffer Polygons

Data Record No.: P-1

Streambank Class: CLASS 3

This streambank polygon lies within this (these) soil polygon(s): P2 ; P6 ; \_\_\_\_\_

**ADMINISTRATIVE DATA**

- A1. Field data collected by: B LINDENLOUB T. STRONG
- A2. Funding Agency/Organization: EPA
- A3. Year: 2009 A4. Date field data collected: 8/18/09 A5. Observers: \_\_\_\_\_
- A6. Landowner: \_\_\_\_\_
- A7. Weather: CLEAR, SLIGHT BREEZE - 75°F

**LOCATION DATA**

- B1. County/Municipal District: YAVAPAI Co.
- B2. Location: HUMBOLDT SMELTER SITE
- B3. Land Legal Description: 1/4 1/4 Sec: SE ; 1/4 Sec: NW; Sec: 23 ; Township (NS): 13N ; Range (EW): 1E
- B4a. UTM coordinates of polygon UPSTREAM END: Easting: 386782 ; Northing: 3817336 ; Zone: 12S, NAD 27
- B4b. UTM coordinates of polygon DOWNSTREAM END: Easting: 386841 ; Northing: 3817285 ; Zone: 12S, NAD 27
- B4c. UTM coordinates of any other point of interest in the polygon: East: \_\_\_\_\_ ; North: \_\_\_\_\_ ; Zone: \_\_\_\_\_
- B4d. Comments: \_\_\_\_\_
- B5. Quad map(s): \_\_\_\_\_ ; \_\_\_\_\_

**SITE CHARACTERISTIC DATA**

**Physical Properties**

- C1. Evidence of high groundwater? (Yes/No): YES, PERCHED
- C2. Drainage ditch(es) present? (Yes/No): NO
- C3. Irrigation ditch(es) present? (Yes/No): NO
- C4. Has the polygon been tilled? (Yes/No): NO
- C5. Proximity of tilling to CFB: \_\_\_\_\_ meters; \_\_\_\_\_ feet

**GENERAL COMMENTS**

DENSE AREA OF TREES UPSTREAM FROM CONCRETE DAM  
DOMINANT PLANTS - COTTONWOOD, GOODING WILLOW, TAMARISK, CATTAIL

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_



CFR RipES Data Form for Impacted Soils Area Polygons  
and for Slightly Impacted Soils Area Polygons  
(Not for Use on Slickens Areas)

Data Record No.:

P-1

Category of Soils Impact: IMPACTED SOILS AREA

Does this polygon area contain any length of streambank? (Yes/No): YES

If Yes, give the Streambank Buffer Polygon record number(s) P-1 ; \_\_\_\_\_ ; \_\_\_\_\_

**ADMINISTRATIVE DATA**

A1. Field data collected by: B LINDENBAUM T. STANIC

A2. Funding Agency/Organization: EPA

A3. Year: 2009 A4. Date field data collected: 8/18/09 A5. Observers: \_\_\_\_\_

A6. Landowner: \_\_\_\_\_

A7. Weather: CLEAR, SLIGHT BREEZE, 27.5°F

**LOCATION DATA**

B1. County/Municipal District: YAMAGUCHI

B2. Location: HUMBOLDT SMELTER

B3. Land Legal Description: 1/4 1/4 Sec: SE ; 1/4 Sec: NW ; Sec: 29 ; Township (NS): 13N ; Range (EW): 1E

B4. UTM coordinates of the polygon centroid: Easting: 386815 ; Northing: 3817308 ; Zone: 12S

B5. Quad map(s): \_\_\_\_\_ ; \_\_\_\_\_

**SITE CHARACTERISTIC DATA**

**Physical Properties**

C1. Evidence of high groundwater? (Yes/No): YES PERCHED

C2. Drainage ditch(es) present? (Yes/No): No

C3. Irrigation ditch(es) present? (Yes/No): No

C4. Has the polygon been tilled? (Yes/No): No

C5. Proximity of tilling to GFR: \_\_\_\_\_ meters; \_\_\_\_\_ feet

**Geo-Chemical Properties**

C6. Average pH: \_\_\_\_\_

C7. Average <sup>Pb</sup> ~~copper~~ concentration (ppm): 2460

C8. Average arsenic concentration (ppm): 1200

C9. Metal salts present on surface? (Yes/No/NA): No

**NOTE: Answer "NA" ONLY when wet conditions may have dissolved salts from the surface.**

**GENERAL COMMENTS**

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**SOIL PIT COMPOSITE DATA**

	Easting (X)	Northing (Y)	Zone	Total Copper (ppm)	Total Arsenic (ppm)	Composite Pit pH	Pit ID No.
Pit 1:							
Pit 2:							
Pit 3:							
Pit 4:							
Pit 5:							

**INDIVIDUAL SOIL SAMPLE DATA**

Pit #	Sample Bag No.	Depth (in.)	Sample Description	<sup>Pb</sup> <del>Copper</del> (ppm)	Arsenic (ppm)	pH
45J-534			SURFACE SEDIMENTS	2460	1200	



# CFR RipES Data Form for Slickens Area Polygons

Data Record No.: P-2

Does this polygon area contain any length of streambank? (Yes/No): YES

If Yes, give the Streambank Buffer Polygon record number(s): P1 ; \_\_\_\_\_ ; \_\_\_\_\_

## ADMINISTRATIVE DATA

- A1. Field data collected by: B. LINDEN LAUB T. STRONG  
A2. Funding Agency/Organization: EP A  
A3. Year: 2009 A4. Date field data collected: 8/18/09 A5. Observers: \_\_\_\_\_  
A6. Landowner: \_\_\_\_\_  
A7. Weather: CLEAR, CALM ~80°F

## LOCATION DATA

- B1. County/Municipal District: YAVAPAI  
B2. Location: HUMBOLDT SMELTER SITE  
B3. Land Legal Description: 1/4 1/4 Sec: SE ; 1/4 Sec: NW ; Sec: 23 ; Township (NS): 13N ; Range (EW): 1E  
B4. UTM coordinates of the polygon centroid: Easting: 386817 ; Northing: 3817337 ; Zone: 12S, NAD27  
B5. Quad map(s): \_\_\_\_\_ ; \_\_\_\_\_

## SITE CHARACTERISTIC DATA

### Physical Properties

- C1. Evidence of high groundwater? (Yes/No): No  
C2. Drainage ditch(es) present? (Yes/No): No  
C3. Irrigation ditch(es) present? (Yes/No): No  
C4. Has the polygon been tilled? (Yes/No): No  
C5. Proximity of tilling to CFR: \_\_\_\_\_ meters; \_\_\_\_\_ feet

### Geo-Chemical Properties

- C6. Average pH: \_\_\_\_\_  
C7. Average ~~copper~~ <sup>PL</sup> concentration (ppm): 822  
C8. Average arsenic concentration (ppm): 682  
C9. Metal salts present on surface? (Yes/No/NA): YES

**NOTE: Answer "NA" ONLY when wet conditions may have dissolved salts from the surface.**

## GENERAL COMMENTS

AREA OF BARE SOIL BETWEEN P-1 AND NORTH SLOPE  
NO VEGETATION

**SOIL PIT COMPOSITE DATA**

Data Record No.: P-2

	Easting (X)	Northing (Y)	Zone	Total Copper (ppm)	Total Arsenic (ppm)	Composite Pit pH	Pit ID No.
Pit 1:							
Pit 2:							
Pit 3:							
Pit 4:							
Pit 5:							

**INDIVIDUAL SOIL SAMPLE DATA**

Pit #	Sample Bag No.	Depth (in.)	Sample Description	<sup>Pb</sup> <del>Copper</del> (ppm)	Arsenic (ppm)	pH
H5J-535			SURFACE SEDIMENTS	822	682	



CFR RipES Data Form for Impacted Soils Area Polygons  
and for Slightly Impacted Soils Area Polygons  
(Not for Use on Slickens Areas)

Data Record No.: P-3

Category of Soils Impact: SLIGHTLY IMPACTED SOILS AREA

Does this polygon area contain any length of streambank? (Yes/No): No

If Yes, give the Streambank Buffer Polygon record number(s) \_\_\_\_\_ ; \_\_\_\_\_ ; \_\_\_\_\_

**ADMINISTRATIVE DATA**

- A1. Field data collected by: B. LIMBELANA, T. STRONG
- A2. Funding Agency/Organization: EPA
- A3. Year: 2009 A4. Date field data collected: 8/18/09 A5. Observers: \_\_\_\_\_
- A6. Landowner: \_\_\_\_\_
- A7. Weather: CLEAR, CALM, ~80°F

**LOCATION DATA**

- B1. County/Municipal District: YAVAPI
- B2. Location: HUMBOLDT SMELTER SITE
- B3. Land Legal Description: 1/4 1/4 Sec: SE ; 1/4 Sec: NW ; Sec: 23 ; Township (NS): 13N ; Range (EW): 1E
- B4. UTM coordinates of the polygon centroid: Easting: 386832 ; Northing: 3817356 ; Zone: 12S, NAD27
- B5. Quad map(s): \_\_\_\_\_ ; \_\_\_\_\_

**SITE CHARACTERISTIC DATA**

**Physical Properties**

- C1. Evidence of high groundwater? (Yes/No): No
- C2. Drainage ditch(es) present? (Yes/No): No
- C3. Irrigation ditch(es) present? (Yes/No): No
- C4. Has the polygon been tilled? (Yes/No): No
- C5. Proximity of tilling to CFR: \_\_\_\_\_ meters, \_\_\_\_\_ feet

**Geo-Chemical Properties**

- C6. Average pH: \_\_\_\_\_
- C7. Average copper concentration (ppm): \_\_\_\_\_
- C8. Average arsenic concentration (ppm): \_\_\_\_\_
- C9. Metal salts present on surface? (Yes/No/NA): \_\_\_\_\_

**NOTE: Answer "NA" ONLY when wet conditions may have dissolved salts from the surface.**

**GENERAL COMMENTS**

DOMINANT PLANTS - GOODWILL WILLOW, SQUIR SP.,  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**SOIL PIT COMPOSITE DATA**

	Easting (X)	Northing (Y)	Zone	Total Copper (ppm)	Total Arsenic (ppm)	Composite Pit pH	Pit ID No.
Pit 1:							
Pit 2:							
Pit 3:							
Pit 4:							
Pit 5:							

**INDIVIDUAL SOIL SAMPLE DATA**

Pit #	Sample Bag No.	Depth (in.)	Sample Description	<sup>Pb</sup> <del>Copper</del> (ppm)	Arsenic (ppm)	pH
H5V-102			SURFACE SEDIMENTS	17.3	1.8	



# CFR RipES Data Form for Slickens Area Polygons

Data Record No.: P-4

Does this polygon area contain any length of streambank? (Yes/No): YES

If **Yes**, give the Streambank Buffer Polygon record number(s): P5 ; \_\_\_\_\_ ; \_\_\_\_\_

## ADMINISTRATIVE DATA

- A1. Field data collected by: B. LINDENBAUM T. STRONG  
A2. Funding Agency/Organization: EPA  
A3. Year: 2009 A4. Date field data collected: 8/10/09 A5. Observers: \_\_\_\_\_  
A6. Landowner: \_\_\_\_\_  
A7. Weather: CLEAR CALM ~80°F

## LOCATION DATA

- B1. County/Municipal District: YAVAPAI  
B2. Location: HUMBOLDT SMELTER SITE  
B3. Land Legal Description: 1/4 1/4 Sec: SE ; 1/4 Sec: NW ; Sec: 23 ; Township (NS): 13 N ; Range (EW): 1 E  
B4. UTM coordinates of the polygon centroid: Easting: 386776 ; Northing: 3817391 ; Zone: 12S NAD 27  
B5. Quad map(s): \_\_\_\_\_ ; \_\_\_\_\_

## SITE CHARACTERISTIC DATA

### Physical Properties

- C1. Evidence of high groundwater? (Yes/No): No  
C2. Drainage ditch(es) present? (Yes/No): No  
C3. Irrigation ditch(es) present? (Yes/No): No  
C4. Has the polygon been tilled? (Yes/No): No  
C5. Proximity of tilling to CFR: \_\_\_\_\_ meters, \_\_\_\_\_ feet

### Geo-Chemical Properties

- C6. Average pH: \_\_\_\_\_  
C7. Average ~~copper~~<sup>Pb</sup> concentration (ppm): 326  
C8. Average arsenic concentration (ppm): 597  
C9. Metal salts present on surface? (Yes/No/NA): YES

**NOTE: Answer "NA" ONLY when wet conditions may have dissolved salts from the surface.**

## GENERAL COMMENTS

AREA OF BARE SOIL NORTH OF MAIN CHANNEL. LOTS OF DRIETWOOD, DEAD STUMPS. DOMINANT PLANTS - RUSSIAN

**SOIL PIT COMPOSITE DATA**

Data Record No.: P-4

	Easting (X)	Northing (Y)	Zone	Total Copper (ppm)	Total Arsenic (ppm)	Composite Pit pH	Pit ID No.
Pit 1:							
Pit 2:							
Pit 3:							
Pit 4:							
Pit 5:							

**INDIVIDUAL SOIL SAMPLE DATA**

Pit #	Sample Bag No.	Depth (in.)	Sample Description	<sup>Ab</sup> <del>Copper</del> (ppm)	Arsenic (ppm)	pH
HSV-113			SURFACE SEDIMENTS	455	975	
CG-17			SURFACE SEDIMENTS	198	219	



# CFR RipES Scoring Form for Streambank and Riparian Corridor Buffer Polygons

Data Record No.: P-5

Streambank Class: CLASS 2

This streambank polygon lies within this (these) soil polygon(s): P4 ; P7 ; P11

## ADMINISTRATIVE DATA

- A1. Field data collected by: T Strong, B Lindelak  
A2. Funding Agency/Organization: EPA  
A3. Year: 2009 A4. Date field data collected: 8/18/09 A5. Observers: \_\_\_\_\_  
A6. Landowner: \_\_\_\_\_  
A7. Weather: CLEAR, CALM, ~80°F.

## LOCATION DATA

- B1. County/Municipal District: YAVAPAI  
B2. Location: HUMBOLDT SMELTER SITE  
B3. Land Legal Description: ~~1/4 1/4~~ Sec: S 1/2; 1/4 Sec: NW; Sec: 23; Township (NS): 13N; Range (EW): 1E  
B4a. UTM coordinates of polygon UPSTREAM END: Easting: 386695; Northing: 3817423; Zone: 12S, NAD27  
B4b. UTM coordinates of polygon DOWNSTREAM END: Easting: 386794; Northing: 3817334; Zone: 12S, NAD27  
B4c. UTM coordinates of any other point of interest in the polygon: East: \_\_\_\_\_; North: \_\_\_\_\_; Zone: \_\_\_\_\_  
B4d. Comments: \_\_\_\_\_  
B5. Quad map(s): \_\_\_\_\_;

## SITE CHARACTERISTIC DATA

### Physical Properties

- C1. Evidence of high groundwater? (Yes/No): Yes (perched)  
C2. Drainage ditch(es) present? (Yes/No): No  
C3. Irrigation ditch(es) present? (Yes/No): No  
C4. Has the polygon been tilled? (Yes/No): No  
C5. Proximity of tilling to CFR: \_\_\_\_\_ meters; \_\_\_\_\_ feet e

## GENERAL COMMENTS

Dom veg: Goodly willow, ~~willow~~<sup>red</sup> willow, cottonwoods @ east end  
also cattail



CFR RipES Data Form for Impacted Soils Area Polygons  
and for Slightly Impacted Soils Area Polygons  
(Not for Use on Slickens Areas)

Data Record No.:

P-5

Category of Soils Impact: IMPACTED SOILS AREA

Does this polygon area contain any length of streambank? (Yes/No): YES

If Yes, give the Streambank Buffer Polygon record number(s) P4 ; P7 ; P11

**ADMINISTRATIVE DATA**

A1. Field data collected by: T. STRONG, B. LINDENLAUB

A2. Funding Agency/Organization: E.P.A.

A3. Year: 2009 A4. Date field data collected: 8/18/09 A5. Observers: \_\_\_\_\_

A6. Landowner: \_\_\_\_\_

A7. Weather: CLEAR, CALM, ~80°F

**LOCATION DATA**

B1. County/Municipal District: YAVAPI

B2. Location: HUMBOLDT SMELTER SITE

B3. Land Legal Description: ~~1/4~~ 1/4 Sec: S 1/2 ; 1/4 Sec: NW ; Sec: 23 ; Township (NS): 13N ; Range (EW): 1E

B4. UTM coordinates of the polygon centroid: Easting: 386756 ; Northing: 3817377 ; Zone: 12S, NAD27

B5. Quad map(s): \_\_\_\_\_ ; \_\_\_\_\_

**SITE CHARACTERISTIC DATA**

**Physical Properties**

C1. Evidence of high groundwater? (Yes/No): Yes (perched)

C2. Drainage ditch(es) present? (Yes/No): No

C3. Irrigation ditch(es) present? (Yes/No): No

C4. Has the polygon been tilled? (Yes/No): No

C5. Proximity of tilling to CFR: \_\_\_\_\_ meters; \_\_\_\_\_ feet

**Geo-Chemical Properties**

C6. Average pH: \_\_\_\_\_

C7. Average copper concentration (ppm): 218

C8. Average arsenic concentration (ppm): 255

C9. Metal salts present on surface? (Yes/No/NA): Yes

**NOTE: Answer "NA" ONLY when wet conditions may have dissolved salts from the surface.**

**GENERAL COMMENTS**

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**SOIL PIT COMPOSITE DATA**

	Easting (X)	Northing (Y)	Zone	Total Copper (ppm)	Total Arsenic (ppm)	Composite Pit pH	Pit ID No.
Pit 1:							
Pit 2:							
Pit 3:							
Pit 4:							
Pit 5:							

**INDIVIDUAL SOIL SAMPLE DATA**

Pit #	Sample Bag No.	Depth (in.)	Sample Description	<del>Copper</del> As (ppm)	Arsenic (ppm)	pH
CG-16			SURFACE SEDIMENTS	78.9	107	
HSJ-536			SURFACE SEDIMENTS	356	403	



CFR RipES Data Form for Impacted Soils Area Polygons  
and for Slightly Impacted Soils Area Polygons  
(Not for Use on Slickens Areas)

Data Record No.:

P-6

Category of Soils Impact: IMPACTED SOILS AREA

Does this polygon area contain any length of streambank? (Yes/No): YES

If Yes, give the Streambank Buffer Polygon record number(s) P 1 ; \_\_\_\_\_ ; \_\_\_\_\_

**ADMINISTRATIVE DATA**

- A1. Field data collected by: J. Stegny & Lindenlaub  
A2. Funding Agency/Organization: EPA  
A3. Year: 2009 A4. Date field data collected: 18 Aug A5. Observers: \_\_\_\_\_  
A6. Landowner: \_\_\_\_\_  
A7. Weather: CLEAR, CALM, ~85 °F

**LOCATION DATA**

- B1. County/Municipal District: YAVAPAI  
B2. Location: HUMBOLDT SMELTER SITE  
B3. Land Legal Description: 1/4 1/4 Sec: SE ; 1/4 Sec: NW ; Sec: 23 ; Township (NS): 13 N ; Range (EW): 1 E  
B4. UTM coordinates of the polygon centroid: Easting: 386769 ; Northing: 3817331 ; Zone: 12 S, NAD27  
B5. Quad map(s): \_\_\_\_\_ ; \_\_\_\_\_

**SITE CHARACTERISTIC DATA**

**Physical Properties**

- C1. Evidence of high groundwater? (Yes/No): Yes (perched)  
C2. Drainage ditch(es) present? (Yes/No): No  
C3. Irrigation ditch(es) present? (Yes/No): No  
C4. Has the polygon been tilled? (Yes/No): No  
C5. Proximity of tilling to CFR: \_\_\_\_\_ meters; \_\_\_\_\_ feet e

**Geo-Chemical Properties**

- C6. Average pH: \_\_\_\_\_  
C7. Average copper concentration (ppm): \_\_\_\_\_  
C8. Average arsenic concentration (ppm): \_\_\_\_\_  
C9. Metal salts present on surface? (Yes/No/NA): Yes

**NOTE: Answer "NA" ONLY when wet conditions may have dissolved salts from the surface.**

**GENERAL COMMENTS**

Dom veg: cattail, Mexican rush, solitary cottonwood ? willow  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_





CFR RipES Data Form for Slickens Area Polygons

Data Record No.: P.7

Does this polygon area contain any length of streambank? (Yes/No): Yes

If **Yes**, give the Streambank Buffer Polygon record number(s): P5 ; \_\_\_\_\_ ; \_\_\_\_\_

**ADMINISTRATIVE DATA**

A1. Field data collected by: T Strong, B Linderland

A2. Funding Agency/Organization: EPA

A3. Year: 2009 A4. Date field data collected: 8/18/09 A5. Observers: \_\_\_\_\_

A6. Landowner: \_\_\_\_\_

A7. Weather: CLEAR, CALM, ~85°F

**LOCATION DATA**

B1. County/Municipal District: YAVAPI

B2. Location: HUMBOLDT SMELTER SITE

B3. Land Legal Description: ~~1/4~~ Sec: 5 1/2 ; 1/4 Sec: NW ; Sec: 23 ; Township (NS): 13 N ; Range (EW): 1 E

B4. UTM coordinates of the polygon centroid: Easting: 386727 ; Northing: 3817379 ; Zone: 12S, NAD27

B5. Quad map(s): \_\_\_\_\_ ; \_\_\_\_\_

**SITE CHARACTERISTIC DATA**

**Physical Properties**

C1. Evidence of high groundwater? (Yes/No): No

C2. Drainage ditch(es) present? (Yes/No): No

C3. Irrigation ditch(es) present? (Yes/No): No

C4. Has the polygon been tilled? (Yes/No): No

C5. Proximity of tilling to GFR: \_\_\_\_\_ meters, \_\_\_\_\_ feet

**Geo-Chemical Properties**

C6. Average pH: \_\_\_\_\_

C7. Average ~~copper~~ <sup>Pb</sup> concentration (ppm): 597

C8. Average arsenic concentration (ppm): 343

C9. Metal salts present on surface? (Yes/No/NA): Yes

**NOTE: Answer "NA" ONLY when wet conditions may have dissolved salts from the surface.**

**GENERAL COMMENTS**

No veg cover; heavy salts, particularly on east end

**SOIL PIT COMPOSITE DATA**

Data Record No.: P-7

	Easting (X)	Northing (Y)	Zone	Total Copper (ppm)	Total Arsenic (ppm)	Composite Pit pH	Pit ID No.
Pit 1:							
Pit 2:							
Pit 3:							
Pit 4:							
Pit 5:							

**INDIVIDUAL SOIL SAMPLE DATA**

Pit #	Sample Bag No.	Depth (in.)	Sample Description	<sup>As</sup> <del>Copper</del> (ppm)	Arsenic (ppm)	pH
CG-14			SURFACE SEDIMENTS	597	343	



CFR RipES Data Form for Impacted Soils Area Polygons  
and for Slightly Impacted Soils Area Polygons  
(Not for Use on Slickens Areas)

Data Record No.:

P-8

Category of Soils Impact: IMPACTED SOILS AREA

Does this polygon area contain any length of streambank? (Yes/No): No

If **Yes**, give the Streambank Buffer Polygon record number(s) \_\_\_\_\_ ; \_\_\_\_\_ ; \_\_\_\_\_

**ADMINISTRATIVE DATA**

A1. Field data collected by: T Strong, B Lindelady

A2. Funding Agency/Organization: EPA

A3. Year: 2009 A4. Date field data collected: 8/18 A5. Observers: \_\_\_\_\_

A6. Landowner: \_\_\_\_\_

A7. Weather: CLEAR, CALM, ~85°F

**LOCATION DATA**

B1. County/Municipal District: YAVAPAI

B2. Location: HUMBOLDT SMELTER SITE

B3. Land Legal Description: 1/4 1/4 Sec: SW ; 1/4 Sec: NW ; Sec: 23 ; Township (NS): 3 N ; Range (EW): 1 E

B4. UTM coordinates of the polygon centroid: Easting: 384609 ; Northing: 3817432 ; Zone: 12S, NAD 27

B5. Quad map(s): \_\_\_\_\_ ; \_\_\_\_\_

**SITE CHARACTERISTIC DATA**

**Physical Properties**

C1. Evidence of high groundwater? (Yes/No): No

C2. Drainage ditch(es) present? (Yes/No): No

C3. Irrigation ditch(es) present? (Yes/No): No

C4. Has the polygon been tilled? (Yes/No): No

C5. Proximity of tilling to CFR: \_\_\_\_\_ meters; \_\_\_\_\_ feet

**Geo-Chemical Properties**

C6. Average pH: \_\_\_\_\_

C7. Average ~~copper~~ <sup>Pb</sup> concentration (ppm): 254

C8. Average arsenic concentration (ppm): 173

C9. Metal salts present on surface? (Yes/No/NA): Yes (mineral)

**NOTE: Answer "NA" ONLY when wet conditions may have dissolved salts from the surface.**

**GENERAL COMMENTS**

Don veg - Sacaton grass, incl r limited mature willow & cottonwood on fringe at toe of slope; Mexican rush in limited moist area other: deer grass, unk grass

**SOIL PIT COMPOSITE DATA**

	Easting (X)	Northing (Y)	Zone	Total Copper (ppm)	Total Arsenic (ppm)	Composite Pit pH	Pit ID No.
Pit 1:							
Pit 2:							
Pit 3:							
Pit 4:							
Pit 5:							

**INDIVIDUAL SOIL SAMPLE DATA**

Pit #	Sample Bag No.	Depth (in.)	Sample Description	<sup>Ab</sup> <del>Copper</del> (ppm)	Arsenic (ppm)	pH
HSV-101			SURFACE SEDIMENTS	254	173	



CFR RipES Data Form for Slickens Area Polygons

Data Record No.: P-9

Does this polygon area contain any length of streambank? (Yes/No): No

If **Yes**, give the Streambank Buffer Polygon record number(s): \_\_\_\_\_ ; \_\_\_\_\_ ; \_\_\_\_\_

**ADMINISTRATIVE DATA**

- A1. Field data collected by: T Strong, B Lindensch
- A2. Funding Agency/Organization: EPA
- A3. Year: 2009 A4. Date field data collected: 18 Aug A5. Observers: \_\_\_\_\_
- A6. Landowner: \_\_\_\_\_
- A7. Weather: CLEAR SLIGHT BREEZE ~ 85°F

**LOCATION DATA**

- B1. County/Municipal District: YAVAPAI
- B2. Location: HUMBOLDT SMELTER SITE
- B3. Land Legal Description: 1/4 1/4 Sec: SW ; 1/4 Sec: NW ; Sec: 23 ; Township (NS): 13N ; Range (EW): 1E
- B4. UTM coordinates of the polygon centroid: Easting: 386524 ; Northing: 3817507 ; Zone: 12S, NAD 27
- B5. Quad map(s): \_\_\_\_\_ ; \_\_\_\_\_

**SITE CHARACTERISTIC DATA**

**Physical Properties**

- C1. Evidence of high groundwater? (Yes/No): No
- C2. Drainage ditch(es) present? (Yes/No): No
- C3. Irrigation ditch(es) present? (Yes/No): No
- C4. Has the polygon been tilled? (Yes/No): No
- C5. Proximity of tilling to CFR: \_\_\_\_\_ meters, \_\_\_\_\_ feet

**Geo-Chemical Properties**

- C6. Average pH: \_\_\_\_\_
- C7. Average copper concentration (ppm): \_\_\_\_\_
- C8. Average arsenic concentration (ppm): \_\_\_\_\_
- C9. Metal salts present on surface? (Yes/No/NA): Yes (trace)

**NOTE: Answer "NA" ONLY when wet conditions may have dissolved salts from the surface.**

**GENERAL COMMENTS**

"The Meadow" - evidence of some flow & DTR activity possibly contributing to lack of vegetation

**SOIL PIT COMPOSITE DATA**

Data Record No.: \_\_\_\_\_

	Easting (X)	Northing (Y)	Zone	Total Copper (ppm)	Total Arsenic (ppm)	Composite Pit pH	Pit ID No.
Pit 1:							
Pit 2:							
Pit 3:							
Pit 4:							
Pit 5:							

**INDIVIDUAL SOIL SAMPLE DATA**

Pit #	Sample Bag No.	Depth (in.)	Sample Description	Copper (ppm)	Arsenic (ppm)	pH
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CFR RipES Data Form for Slickens Area Polygons

Data Record No.: P-10

Does this polygon area contain any length of streambank? (Yes/No): No

If Yes, give the Streambank Buffer Polygon record number(s): ; ;

ADMINISTRATIVE DATA

- A1. Field data collected by: T Strong, B Lindenlaub
A2. Funding Agency/Organization: EPA
A3. Year: 2009 A4. Date field data collected: 18 Aug A5. Observers:
A6. Landowner:
A7. Weather: CLEAR, SLIGHT BREEZE, ~ 85°F

LOCATION DATA

- B1. County/Municipal District: YAVAPAI
B2. Location: HUMBOLDT SMELTER SITE
B3. Land Legal Description: 1/4 1/4 Sec: SW ; 1/4 Sec: NW ; Sec: 23 ; Township (NS): 13N ; Range (EW): 1E
B4. UTM coordinates of the polygon centroid: Easting: 386634 ; Northing: 3817457 ; Zone: 12S, NAD 27
B5. Quad map(s): ;

SITE CHARACTERISTIC DATA

Physical Properties

- C1. Evidence of high groundwater? (Yes/No): No
C2. Drainage ditch(es) present? (Yes/No): No
C3. Irrigation ditch(es) present? (Yes/No): No
C4. Has the polygon been tilled? (Yes/No): No
C5. Proximity of tilling to CFR: meters, feet

Geo-Chemical Properties

- C6. Average pH:
C7. Average copper concentration (ppm): 1008
C8. Average arsenic concentration (ppm): 804
C9. Metal salts present on surface? (Yes/No/NA): Yes (trace)

NOTE: Answer "NA" ONLY when wet conditions may have dissolved salts from the surface.

GENERAL COMMENTS

"Downgradient" of "The Meadow" (P-9); potential stormwater flow path in large events

**SOIL PIT COMPOSITE DATA**

Data Record No.: P-10

	Easting (X)	Northing (Y)	Zone	Total Copper (ppm)	Total Arsenic (ppm)	Composite Pit pH	Pit ID No.
Pit 1:							
Pit 2:							
Pit 3:							
Pit 4:							
Pit 5:							

**INDIVIDUAL SOIL SAMPLE DATA**

Pit #	Sample Bag No.	Depth (in.)	Sample Description	<sup>pH</sup> <del>Copper</del> (ppm)	Arsenic (ppm)	pH
HSJ-549			SURFACE SEDIMENTS	1260	1080	
HSV-114			SURFACE SEDIMENTS	755	528	



CFR RipES Data Form for Slickens Area Polygons

Data Record No.:

P-11

Does this polygon area contain any length of streambank? (Yes/No): Yes

If Yes, give the Streambank Buffer Polygon record number(s): P-12 ; \_\_\_\_\_ ; \_\_\_\_\_

ADMINISTRATIVE DATA

A1. Field data collected by: T Strong, B Lindenlaub

A2. Funding Agency/Organization: EPA

A3. Year: 2009 A4. Date field data collected: 18 Aug A5. Observers: \_\_\_\_\_

A6. Landowner: \_\_\_\_\_

A7. Weather: Clear, slight breeze, ~90°F

LOCATION DATA

B1. County/Municipal District: YAVAPAI

B2. Location: Humboldt Smelter Site

B3. Land Legal Description: 1/4 1/4 Sec: SW ; 1/4 Sec: NW ; Sec: 23 ; Township (NS): 13N ; Range (EW): 1E

B4. UTM coordinates of the polygon centroid: Easting: 386696 ; Northing: 3817443 ; Zone: 12S, NAD 27

B5. Quad map(s): \_\_\_\_\_ ; \_\_\_\_\_

SITE CHARACTERISTIC DATA

Physical Properties

C1. Evidence of high groundwater? (Yes/No): No

C2. Drainage ditch(es) present? (Yes/No): No

C3. Irrigation ditch(es) present? (Yes/No): No

C4. Has the polygon been tilled? (Yes/No): No

C5. Proximity of tilling to CFR: \_\_\_\_\_ meters; \_\_\_\_\_ feet

Geo-Chemical Properties

C6. Average pH: \_\_\_\_\_

C7. Average ~~copper~~ <sup>Pb</sup> concentration (ppm): 224

C8. Average arsenic concentration (ppm): 200

C9. Metal salts present on surface? (Yes/No/NA): Yes

NOTE: Answer "NA" ONLY when wet conditions may have dissolved salts from the surface.

GENERAL COMMENTS

No neg development; substrate contains more gravel on west end

*more on East end*

**SOIL PIT COMPOSITE DATA**

Data Record No.: P-11

	Easting (X)	Northing (Y)	Zone	Total Copper (ppm)	Total Arsenic (ppm)	Composite Pit pH	Pit ID No.
Pit 1:							
Pit 2:							
Pit 3:							
Pit 4:							
Pit 5:							

**INDIVIDUAL SOIL SAMPLE DATA**

Pit #	Sample Bag No.	Depth (in.)	Sample Description	<sup>Pb</sup> <del>Copper</del> (ppm)	Arsenic (ppm)	pH
H5J-551			SURFACE SEDIMENTS	224	200	



CFR RipES Data Form for Impacted Soils Area Polygons  
and for Slightly Impacted Soils Area Polygons  
(Not for Use on Slickens Areas)

Data Record No.:

P-12

Category of Soils Impact: IMPACTED SOILS AREA

Does this polygon area contain any length of streambank? (Yes/No): Yes

If **Yes**, give the Streambank Buffer Polygon record number(s) P-12 ; \_\_\_\_\_ ; \_\_\_\_\_

**ADMINISTRATIVE DATA**

- A1. Field data collected by: T Strong, B Lindenberg  
A2. Funding Agency/Organization: EPA  
A3. Year: 2009 A4. Date field data collected: 18 Aug A5. Observers: \_\_\_\_\_  
A6. Landowner: \_\_\_\_\_  
A7. Weather: CLEAR, SLIGHT BREEZE, ~ 90 °F

**LOCATION DATA**

- B1. County/Municipal District: YAVAPAI  
B2. Location: HUMBOLDT SMELTER SITE  
B3. Land Legal Description: 1/4 1/4 Sec: SW ; 1/4 Sec: NW ; Sec: 23 ; Township (NS): 13N ; Range (EW): 1E  
B4. UTM coordinates of the polygon centroid: Easting: 386649 ; Northing: 3817482 ; Zone: 12S, NAD 27  
B5. Quad map(s): \_\_\_\_\_ ; \_\_\_\_\_

**SITE CHARACTERISTIC DATA**

**Physical Properties**

- C1. Evidence of high groundwater? (Yes/No): No  
C2. Drainage ditch(es) present? (Yes/No): No  
C3. Irrigation ditch(es) present? (Yes/No): No  
C4. Has the polygon been tilled? (Yes/No): No  
C5. Proximity of tilling to CFR: \_\_\_\_\_ meters; \_\_\_\_\_ feet

**Geo-Chemical Properties**

- C6. Average pH: \_\_\_\_\_  
C7. Average ~~ppm~~ <sup>Pb</sup> concentration (ppm): 657  
C8. Average arsenic concentration (ppm): 541  
C9. Metal salts present on surface? (Yes/No/NA): Yes

**NOTE: Answer "NA" ONLY when wet conditions may have dissolved salts from the surface.**

**GENERAL COMMENTS**

**SOIL PIT COMPOSITE DATA**

	Easting (X)	Northing (Y)	Zone	Total Copper (ppm)	Total Arsenic (ppm)	Composite Pit pH	Pit ID No.
Pit 1:							
Pit 2:							
Pit 3:							
Pit 4:							
Pit 5:							

**INDIVIDUAL SOIL SAMPLE DATA**

Pit #	Sample Bag No.	Depth (in.)	Sample Description	<del>Copper</del> Pb (ppm)	Arsenic (ppm)	pH
HSV-105				657	541	



# CFR RipES Scoring Form for Streambank and Riparian Corridor Buffer Polygons

Data Record No.: P-12

Streambank Class: CLASS 3

This streambank polygon lies within this (these) soil polygon(s): P-4 ; P-11 ; P-13 ; P-14 ; P-19 ; P-25 ; P-26

## ADMINISTRATIVE DATA

- A1. Field data collected by: T Strong, B Lintalaub
- A2. Funding Agency/Organization: EPA
- A3. Year: 2009 A4. Date field data collected: 18 Aug A5. Observers: \_\_\_\_\_
- A6. Landowner: \_\_\_\_\_
- A7. Weather: CLEAR, SLIGHT BREEZE, ~90°F

## LOCATION DATA

- B1. County/Municipal District: YAVAPAI
- B2. Location: HUMBOLDT SMELTER SITE
- B3. Land Legal Description: 1/4 1/4 Sec: SW ; 1/4 Sec: NW ; Sec: 23 ; Township (NS): 13 N ; Range (EW): 1 E
- B4a. UTM coordinates of polygon UPSTREAM END: Easting: 386568 ; Northing: 3817528 ; Zone: 12 S, NAD27
- B4b. UTM coordinates of polygon DOWNSTREAM END: Easting: 386734 ; Northing: 3817398 ; Zone: 12 S, NAD27
- B4c. UTM coordinates of any other point of interest in the polygon: East: \_\_\_\_\_ ; North: \_\_\_\_\_ ; Zone: \_\_\_\_\_
- B4d. Comments: \_\_\_\_\_
- B5. Quad map(s): \_\_\_\_\_ ; \_\_\_\_\_

## SITE CHARACTERISTIC DATA

### Physical Properties

- C1. Evidence of high groundwater? (Yes/No): No
- C2. Drainage ditch(es) present? (Yes/No): No
- C3. Irrigation ditch(es) present? (Yes/No): No
- C4. Has the polygon been tilled? (Yes/No): No
- C5. Proximity of tilling to CFR: \_\_\_\_\_ meters; \_\_\_\_\_ feet

## GENERAL COMMENTS

Poorly vegetated stream channel

Dom species: willow (2 spp), cottonwood, Tanacetum, Polygonum sp

All veg w/in stream channel

Ladies thumb



CFR RipES Data Form for Impacted Soils Area Polygons  
and for Slightly Impacted Soils Area Polygons  
(Not for Use on Slickens Areas)

Data Record No.:

P-13

Category of Soils Impact: IMPACTED SOILS AREA

Does this polygon area contain any length of streambank? (Yes/No): Yes

If Yes, give the Streambank Buffer Polygon record number(s) P-12 ; \_\_\_\_\_ ; \_\_\_\_\_

**ADMINISTRATIVE DATA**

A1. Field data collected by: T Strong B Lindentauk

A2. Funding Agency/Organization: \_\_\_\_\_

A3. Year: 2009 A4. Date field data collected: 18 Aug A5. Observers: \_\_\_\_\_

A6. Landowner: \_\_\_\_\_

A7. Weather: CLEAR, SLIGHT BREEZE, ~95°F

**LOCATION DATA**

B1. County/Municipal District: YAJAPAI

B2. Location: HUMBOLDT SMELTER SITE

B3. Land Legal Description: ~~1/4~~ Sec: S 1/2 ; 1/4 Sec: NW ; Sec: 23 ; Township (NS): 13N ; Range (EW): 1E

B4. UTM coordinates of the polygon centroid: Easting: 386740 ; Northing: 3817445 ; Zone: 12S, NAD27

B5. Quad map(s): \_\_\_\_\_ ; \_\_\_\_\_

**SITE CHARACTERISTIC DATA**

**Physical Properties**

C1. Evidence of high groundwater? (Yes/No): No

C2. Drainage ditch(es) present? (Yes/No): No

C3. Irrigation ditch(es) present? (Yes/No): No

C4. Has the polygon been tilled? (Yes/No): No

C5. Proximity of tilling to CFR: \_\_\_\_\_ meters; \_\_\_\_\_ feet

**Geo-Chemical Properties**

C6. Average pH: \_\_\_\_\_

C7. Average copper concentration (ppm): \_\_\_\_\_

C8. Average arsenic concentration (ppm): \_\_\_\_\_

C9. Metal salts present on surface? (Yes/No/NA): No

**NOTE: Answer "NA" ONLY when wet conditions may have dissolved salts from the surface.**

**GENERAL COMMENTS**

Riparian stand at toe of slope  
Dec veg: willow, some Tamarisk, cottonwood, Mexican rush





CFR RipES Data Form for Impacted Soils Area Polygons  
and for Slightly Impacted Soils Area Polygons  
(Not for Use on Slickens Areas)

Data Record No.:

P-14

Category of Soils Impact: IMPACTED SOILS AREA

Does this polygon area contain any length of streambank? (Yes/No): Yes

If Yes, give the Streambank Buffer Polygon record number(s) P-12 ; \_\_\_\_\_ ; \_\_\_\_\_

**ADMINISTRATIVE DATA**

- A1. Field data collected by: T Strong, B Lindenbach  
A2. Funding Agency/Organization: EPA  
A3. Year: 2009 A4. Date field data collected: 18 Aug A5. Observers: \_\_\_\_\_  
A6. Landowner: \_\_\_\_\_  
A7. Weather: CLEAR, LIGHT BREEZE, ~95°F

**LOCATION DATA**

- B1. County/Municipal District: TAUHAHA  
B2. Location: HUMBOLDT SMELTER SITE  
B3. Land Legal Description: 1/4 1/4 Sec: SW ; 1/4 Sec: NW ; Sec: 23 ; Township (NS): 13N ; Range (EW): 1E  
B4. UTM coordinates of the polygon centroid: Easting: 386633 ; Northing: 3817477 ; Zone: 12S, NAD 27  
B5. Quad map(s): \_\_\_\_\_ ; \_\_\_\_\_

**SITE CHARACTERISTIC DATA**

**Physical Properties**

- C1. Evidence of high groundwater? (Yes/No): No  
C2. Drainage ditch(es) present? (Yes/No): No  
C3. Irrigation ditch(es) present? (Yes/No): No  
C4. Has the polygon been tilled? (Yes/No): No  
C5. Proximity of tilling to CFR: \_\_\_\_\_ meters; \_\_\_\_\_ feet

**Geo-Chemical Properties**

- C6. Average pH: \_\_\_\_\_  
C7. Average copper concentration (ppm): \_\_\_\_\_  
C8. Average arsenic concentration (ppm): \_\_\_\_\_  
C9. Metal salts present on surface? (Yes/No/NA): No

**NOTE: Answer "NA" ONLY when wet conditions may have dissolved salts from the surface.**

**GENERAL COMMENTS**

Strong gravel substrate; differentiated or other grassy areas, which are much drier material

**SOIL PIT COMPOSITE DATA**

	Easting (X)	Northing (Y)	Zone	Total Copper (ppm)	Total Arsenic (ppm)	Composite Pit pH	Pit ID No.
Pit 1:							
Pit 2:							
Pit 3:							
Pit 4:							
Pit 5:							

**INDIVIDUAL SOIL SAMPLE DATA**

Pit #	Sample Bag No.	Depth (in.)	Sample Description	Copper (ppm)	Arsenic (ppm)	pH



CFR RipES Data Form for Impacted Soils Area Polygons  
and for Slightly Impacted Soils Area Polygons  
(Not for Use on Slickens Areas)

Data Record No.:

P-15

Category of Soils Impact: SLIGHTLY IMPACTED SOILS AREA

Does this polygon area contain any length of streambank? (Yes/No): Yes

If Yes, give the Streambank Buffer Polygon record number(s) P-12 ; \_\_\_\_\_ ; \_\_\_\_\_

**ADMINISTRATIVE DATA**

- A1. Field data collected by: T Strong, B Lindentank  
A2. Funding Agency/Organization: EPA  
A3. Year: 2009 A4. Date field data collected: 18 Aug A5. Observers: \_\_\_\_\_  
A6. Landowner: \_\_\_\_\_  
A7. Weather: CLEAR, SLIGHT-BREEZE, ~95°F

**LOCATION DATA**

- B1. County/Municipal District: YAVAPAI  
B2. Location: HUMBOLDT SMELTER SITE  
B3. Land Legal Description: 1/4 1/4 Sec: SW ; 1/4 Sec: NW ; Sec: 23 ; Township (NS): 13N ; Range (EW): 1E  
B4. UTM coordinates of the polygon centroid: Easting: 386627 ; Northing: 3817515 ; Zone: 12S, NAD 27  
B5. Quad map(s): \_\_\_\_\_ ; \_\_\_\_\_

**SITE CHARACTERISTIC DATA**

**Physical Properties**

- C1. Evidence of high groundwater? (Yes/No): Maybe perched  
C2. Drainage ditch(es) present? (Yes/No): No  
C3. Irrigation ditch(es) present? (Yes/No): No  
C4. Has the polygon been tilled? (Yes/No): No  
C5. Proximity of tilling to CFR: \_\_\_\_\_ meters; \_\_\_\_\_ feet

**Geo-Chemical Properties**

- C6. Average pH: \_\_\_\_\_  
C7. Average copper concentration (ppm): \_\_\_\_\_  
C8. Average arsenic concentration (ppm): \_\_\_\_\_  
C9. Metal salts present on surface? (Yes/No/NA): Yes

**NOTE: Answer "NA" ONLY when wet conditions may have dissolved salts from the surface.**

**GENERAL COMMENTS**

One of 2 veg stands downgradient of tailings dam.  
veg: Dense tamarisk, minimal cottonwood & willow

**SOIL PIT COMPOSITE DATA**

	Easting (X)	Northing (Y)	Zone	Total Copper (ppm)	Total Arsenic (ppm)	Composite Pit pH	Pit ID No.
Pit 1:							
Pit 2:							
Pit 3:							
Pit 4:							
Pit 5:							

**INDIVIDUAL SOIL SAMPLE DATA**

Pit #	Sample Bag No.	Depth (in.)	Sample Description	Copper (ppm)	Arsenic (ppm)	pH



CFR RipES Data Form for Impacted Soils Area Polygons  
and for Slightly Impacted Soils Area Polygons  
(Not for Use on Slickens Areas)

Data Record No.:

P-16

Category of Soils Impact: SLIGHTLY IMPACTED SOILS AREA

Does this polygon area contain any length of streambank? (Yes/No): Yes

If Yes, give the Streambank Buffer Polygon record number(s) P-12 ; P-18 ;

ADMINISTRATIVE DATA

- A1. Field data collected by: T Strong, B Lindertank  
A2. Funding Agency/Organization: E. P. A  
A3. Year: 2009 A4. Date field data collected: 8/18/09 A5. Observers: \_\_\_\_\_  
A6. Landowner: \_\_\_\_\_  
A7. Weather: CLEAR, SLIGHT BREEZE, ~95°F

LOCATION DATA

- B1. County/Municipal District: YAVAPAI  
B2. Location: HUMBOLDT SMELTER SITE  
B3. Land Legal Description: 1/4 1/4 Sec: SW; 1/4 Sec: NW; Sec: 29; Township (NS): 13 N; Range (EW): 1 E  
B4. UTM coordinates of the polygon centroid: Easting: 386554; Northing: 3817565; Zone: 12S, NAD 27  
B5. Quad map(s): \_\_\_\_\_

SITE CHARACTERISTIC DATA

Physical Properties

- C1. Evidence of high groundwater? (Yes/No): Maybe perched  
C2. Drainage ditch(es) present? (Yes/No): No  
C3. Irrigation ditch(es) present? (Yes/No): No  
C4. Has the polygon been tilled? (Yes/No): No  
C5. Proximity of tilling to CFR: \_\_\_\_\_ meters; \_\_\_\_\_ feet

Geo-Chemical Properties

- C6. Average pH: \_\_\_\_\_  
C7. Average copper concentration (ppm): \_\_\_\_\_  
C8. Average arsenic concentration (ppm): \_\_\_\_\_  
C9. Metal salts present on surface? (Yes/No/NA): \_\_\_\_\_

NOTE: Answer "NA" ONLY when wet conditions may have dissolved salts from the surface.

GENERAL COMMENTS

Second (westernmost) vegetative stand downgradient of tailings dam  
Dense tamarisk, mature willow

**SOIL PIT COMPOSITE DATA**

	Easting (X)	Northing (Y)	Zone	Total Copper (ppm)	Total Arsenic (ppm)	Composite Pit pH	Pit ID No.
Pit 1:							
Pit 2:							
Pit 3:							
Pit 4:							
Pit 5:							

**INDIVIDUAL SOIL SAMPLE DATA**

Pit #	Sample Bag No.	Depth (in.)	Sample Description	Copper (ppm)	Arsenic (ppm)	pH



CFR RipES Data Form for Impacted Soils Area Polygons  
and for Slightly Impacted Soils Area Polygons  
(Not for Use on Slickens Areas)

Data Record No.:  
P-17

Category of Soils Impact: IMPACTED SOILS AREA

Does this polygon area contain any length of streambank? (Yes/No): YES

If Yes, give the Streambank Buffer Polygon record number(s) P-18 ; \_\_\_\_\_ ; \_\_\_\_\_

**ADMINISTRATIVE DATA**

- A1. Field data collected by: B. LINDENLAUB, T. STRONG  
A2. Funding Agency/Organization: EPA  
A3. Year: 2009 A4. Date field data collected: 8/18/09 A5. Observers: \_\_\_\_\_  
A6. Landowner: \_\_\_\_\_  
A7. Weather: CLEAR, BREEZY, ~90°F

**LOCATION DATA**

- B1. County/Municipal District: YAVAPAI  
B2. Location: HUMBOLDT SMELTER  
B3. Land Legal Description: ~~1/4 Sec~~ W2 ; 1/4 Sec: NW ; Sec: 23 ; Township (NS): 13 N ; Range (EW): 1E  
B4. UTM coordinates of the polygon centroid: Easting: 386500 ; Northing: 387605 ; Zone: 12S, NAD27  
B5. Quad map(s): \_\_\_\_\_ ; \_\_\_\_\_

**SITE CHARACTERISTIC DATA**

**Physical Properties**

- C1. Evidence of high groundwater? (Yes/No): No  
C2. Drainage ditch(es) present? (Yes/No): No  
C3. Irrigation ditch(es) present? (Yes/No): No  
C4. Has the polygon been tilled? (Yes/No): No  
C5. Proximity of tilling to CFR: \_\_\_\_\_ meters; \_\_\_\_\_ feet

**Geo-Chemical Properties**

- C6. Average pH: \_\_\_\_\_  
C7. Average ~~lead~~ Pb concentration (ppm): 495  
C8. Average arsenic concentration (ppm): 476  
C9. Metal salts present on surface? (Yes/No/NA): No

NOTE: Answer "NA" ONLY when wet conditions may have dissolved salts from the surface.

**GENERAL COMMENTS**

DOMINANT VEGETATION - SACATON  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**SOIL PIT COMPOSITE DATA**

	Easting (X)	Northing (Y)	Zone	Total Copper (ppm)	Total Arsenic (ppm)	Composite Pit pH	Pit ID No.
Pit 1:							
Pit 2:							
Pit 3:							
Pit 4:							
Pit 5:							

**INDIVIDUAL SOIL SAMPLE DATA**

Pit #	Sample Bag No.	Depth (in.)	Sample Description	<sup>Pb</sup> <del>Copper</del> (ppm)	Arsenic (ppm)	pH
MSJ-550			SURFACE SEDIMENTS	495	476	



# CFR RipES Scoring Form for Streambank and Riparian Corridor Buffer Polygons

Data Record No.: P-18

Streambank Class: CLASS 1

This streambank polygon lies within this (these) soil polygon(s): P-16 ; P-17 ; P-19

## ADMINISTRATIVE DATA

- A1. Field data collected by: R. LINDENLAUB, T. STRONG  
A2. Funding Agency/Organization: E.P.A.  
A3. Year: 2009 A4. Date field data collected: 8/18/09 A5. Observers: \_\_\_\_\_  
A6. Landowner: \_\_\_\_\_  
A7. Weather: CLEAR, BREEZY, ~90°F

## LOCATION DATA

- B1. County/Municipal District: YAVAPAI  
B2. Location: HUMBOLDT SMELTER  
B3. Land Legal Description: ~~1/4 Sec~~ W 1/2 ; 1/4 Sec: NW ; Sec: 23 ; Township (NS): 13 N ; Range (EW): 1 E  
B4a. UTM coordinates of polygon UPSTREAM END: Easting: 386453 ; Northing: 3817633 ; Zone: 12 S, NAD 27  
B4b. UTM coordinates of polygon DOWNSTREAM END: Easting: 386568 ; Northing: 3817528 ; Zone: 12 S, NAD 27  
B4c. UTM coordinates of any other point of interest in the polygon: East: \_\_\_\_\_ ; North: \_\_\_\_\_ ; Zone: \_\_\_\_\_  
B4d. Comments: \_\_\_\_\_  
B5. Quad map(s): \_\_\_\_\_ ; \_\_\_\_\_

## SITE CHARACTERISTIC DATA

### Physical Properties

- C1. Evidence of high groundwater? (Yes/No): No  
C2. Drainage ditch(es) present? (Yes/No): No  
C3. Irrigation ditch(es) present? (Yes/No): No  
C4. Has the polygon been tilled? (Yes/No): No  
C5. Proximity of tilling to CFR: \_\_\_\_\_ meters; \_\_\_\_\_ feet

## GENERAL COMMENTS

MAIN CHANNEL FROM EDGE OF TREES TO POINT OF TAILINGS IMPACT.  
MINIMAL LATERAL EROSION, VERTICAL EROSION IS MORE EVIDENT.  
NO DOMINANT VEGETATION.



CFR RipES Data Form for Impacted Soils Area Polygons  
and for Slightly Impacted Soils Area Polygons  
(Not for Use on Slickens Areas)

Data Record No.:  
P-18

Category of Soils Impact: IMPACTED SOILS AREA

Does this polygon area contain any length of streambank? (Yes/No): YES

If Yes, give the Streambank Buffer Polygon record number(s) P-18 ; \_\_\_\_\_ ; \_\_\_\_\_

**ADMINISTRATIVE DATA**

- A1. Field data collected by: B. LINDENLAUB, T. STRONG  
A2. Funding Agency/Organization: E.P.A.  
A3. Year: 2009 A4. Date field data collected: 8/18/09 A5. Observers: \_\_\_\_\_  
A6. Landowner: \_\_\_\_\_  
A7. Weather: CLEAR, BREEZY, ~90°F

**LOCATION DATA**

- B1. County/Municipal District: YAVAPAI  
B2. Location: HUMBOLDT SMELTER  
B3. Land Legal Description: ~~1/4 Sec~~ W 1/2; 1/4 Sec: NW; Sec: 23; Township (NS): 13N; Range (EW): 1E  
B4. UTM coordinates of the polygon centroid: Easting: 386510; Northing: 3817576; Zone: 12S, NAD27  
B5. Quad map(s): \_\_\_\_\_ ; \_\_\_\_\_

**SITE CHARACTERISTIC DATA**

**Physical Properties**

- C1. Evidence of high groundwater? (Yes/No): No  
C2. Drainage ditch(es) present? (Yes/No): No  
C3. Irrigation ditch(es) present? (Yes/No): No  
C4. Has the polygon been tilled? (Yes/No): No  
C5. Proximity of tilling to CFR: \_\_\_\_\_ meters, \_\_\_\_\_ feet

**Geo-Chemical Properties**

- C6. Average pH: \_\_\_\_\_  
C7. Average copper concentration (ppm): \_\_\_\_\_  
C8. Average arsenic concentration (ppm): \_\_\_\_\_  
C9. Metal salts present on surface? (Yes/No/NA): No

NOTE: Answer "NA" ONLY when wet conditions may have dissolved salts from the surface.

**GENERAL COMMENTS**

MAIN CHANNEL FROM EDGE OF TREES ON WEST TO POINT OF TAILINGS  
IMPACT. MINIMAL LATERAL EROSION, VERTICAL EROSION IS MORE  
EVIDENT. VIRTUALLY NO VEGETATION.

**SOIL PIT COMPOSITE DATA**

	Easting (X)	Northing (Y)	Zone	Total Copper (ppm)	Total Arsenic (ppm)	Composite Pit pH	Pit ID No.
Pit 1:							
Pit 2:							
Pit 3:							
Pit 4:							
Pit 5:							

**INDIVIDUAL SOIL SAMPLE DATA**

Pit #	Sample Bag No.	Depth (in.)	Sample Description	Copper (ppm)	Arsenic (ppm)	pH



CFR RipES Data Form for Impacted Soils Area Polygons  
and for Slightly Impacted Soils Area Polygons  
(Not for Use on Slickens Areas)

Data Record No.:  
P-19

Category of Soils Impact: IMPACTED SOILS AREA

Does this polygon area contain any length of streambank? (Yes/No): Yes

If Yes, give the Streambank Buffer Polygon record number(s) P-12 ; P-18 ; \_\_\_\_\_

**ADMINISTRATIVE DATA**

- A1. Field data collected by: B. LINDENBAUM, T. STRONG  
A2. Funding Agency/Organization: E. P. A.  
A3. Year: 2009 A4. Date field data collected: 8/18/09 A5. Observers: \_\_\_\_\_  
A6. Landowner: \_\_\_\_\_  
A7. Weather: CLEAR, BREEZY, ~ 90°F

**LOCATION DATA**

- B1. County/Municipal District: YAVAPAI  
B2. Location: HUMBOLDT SMELTER  
B3. Land Legal Description: ~~1/4 Sec~~ W 1/2 ; 1/4 Sec: NW ; Sec: 23 ; Township (NS): 13N ; Range (EW): 1E  
B4. UTM coordinates of the polygon centroid: Easting: 386499 ; Northing: 3817550 ; Zone: 12S NAD 27  
B5. Quad map(s): \_\_\_\_\_ ; \_\_\_\_\_

**SITE CHARACTERISTIC DATA**

**Physical Properties**

- C1. Evidence of high groundwater? (Yes/No): No  
C2. Drainage ditch(es) present? (Yes/No): No  
C3. Irrigation ditch(es) present? (Yes/No): No  
C4. Has the polygon been tilled? (Yes/No): No  
C5. Proximity of tilling to CFR: \_\_\_\_\_ meters; \_\_\_\_\_ feet

**Geo-Chemical Properties**

- C6. Average pH: \_\_\_\_\_  
C7. Average <sup>Pb</sup>copper concentration (ppm): 1160  
C8. Average arsenic concentration (ppm): 812  
C9. Metal salts present on surface? (Yes/No/NA): No

NOTE: Answer "NA" ONLY when wet conditions may have dissolved salts from the surface.

**GENERAL COMMENTS**

WESTERN MOST SACATON POLYGON - DOMINANT PLANTS - BIG SACATON.  
BERMUDA GRASS.

**SOIL PIT COMPOSITE DATA**

	Easting (X)	Northing (Y)	Zone	Total Copper (ppm)	Total Arsenic (ppm)	Composite Pit pH	Pit ID No.
Pit 1:							
Pit 2:							
Pit 3:							
Pit 4:							
Pit 5:							

**INDIVIDUAL SOIL SAMPLE DATA**

Pit #	Sample Bag No.	Depth (in.)	Sample Description	<del>Copper</del> Pb (ppm)	Arsenic (ppm)	pH
H5J-548			SURFACE SEDIMENTS	2120	1430	
CG-15			SURFACE SEDIMENTS	199	194	



# CFR RipES Scoring Form for Streambank and Riparian Corridor Buffer Polygons

Data Record No.: P-20

Streambank Class: CLASS 3

This streambank polygon lies within this (these) soil polygon(s): P-19 ; \_\_\_\_\_ ; \_\_\_\_\_

## ADMINISTRATIVE DATA

- A1. Field data collected by: B. CINDENLAMB, T. STRONG  
A2. Funding Agency/Organization: E.P.A.  
A3. Year: 2009 A4. Date field data collected: 8/18/09 A5. Observers: \_\_\_\_\_  
A6. Landowner: \_\_\_\_\_  
A7. Weather: CLEAR, BREEZY, ~90°F

## LOCATION DATA

- B1. County/Municipal District: YANAPAI  
B2. Location: HUMBOLDT SMELTER  
B3. Land Legal Description: ~~1/4~~ Sec: 6 1/2 ; 1/4 Sec: NW ; Sec: 23 ; Township (NS): 13 N ; Range (EW): 1 E  
B4a. UTM coordinates of polygon UPSTREAM END: Easting: 386453 ; Northing: 3817633 ; Zone: 12S NAD27  
B4b. UTM coordinates of polygon DOWNSTREAM END: Easting: 386403 ; Northing: 3817824 ; Zone: 12S NAD27  
B4c. UTM coordinates of any other point of interest in the polygon: East: \_\_\_\_\_ ; North: \_\_\_\_\_ ; Zone: \_\_\_\_\_  
B4d. Comments: \_\_\_\_\_  
B5. Quad map(s): \_\_\_\_\_ ; \_\_\_\_\_

## SITE CHARACTERISTIC DATA

### Physical Properties

- C1. Evidence of high groundwater? (Yes/No): No  
C2. Drainage ditch(es) present? (Yes/No): No  
C3. Irrigation ditch(es) present? (Yes/No): No  
C4. Has the polygon been tilled? (Yes/No): No  
C5. Proximity of filling to CFR: \_\_\_\_\_ meters; \_\_\_\_\_ feet

## GENERAL COMMENTS

WESTERMOST STAND OF COTTONWOOD AND TAMARISK, ON WESTERN BOUNDARY OF SMELTER SITE -



CFR RipES Data Form for Impacted Soils Area Polygons  
and for Slightly Impacted Soils Area Polygons  
(Not for Use on Slickens Areas)

Data Record No.:  
P-20

Category of Soils Impact: SLIGHTLY IMPACTED SOILS AREA

Does this polygon area contain any length of streambank? (Yes/No): YES

If Yes, give the Streambank Buffer Polygon record number(s) P-20 ; \_\_\_\_\_ ; \_\_\_\_\_

**ADMINISTRATIVE DATA**

- A1. Field data collected by: B. LINDEBLAND, T. STRONG  
A2. Funding Agency/Organization: E.P.A.  
A3. Year: 2009 A4. Date field data collected: 8/18/09 A5. Observers: \_\_\_\_\_  
A6. Landowner: \_\_\_\_\_  
A7. Weather: CLEAR, BREEZY, ~90°F

**LOCATION DATA**

- B1. County/Municipal District: YAVAPI  
B2. Location: HUMBOLDT SMELTER  
B3. Land Legal Description: ~~1/4 1/4~~ Sec: W 1/2 ; 1/4 Sec: NW ; Sec: 23 ; Township (NS): 13N ; Range (EW): 1E  
B4. UTM coordinates of the polygon centroid: Easting: 386439 ; Northing: 3817659 ; Zone: 12S, NAD27  
B5. Quad map(s): \_\_\_\_\_ ; \_\_\_\_\_

**SITE CHARACTERISTIC DATA**

**Physical Properties**

- C1. Evidence of high groundwater? (Yes/No): No  
C2. Drainage ditch(es) present? (Yes/No): No  
C3. Irrigation ditch(es) present? (Yes/No): No  
C4. Has the polygon been tilled? (Yes/No): No  
C5. Proximity of tilling to CFR: \_\_\_\_\_ meters; \_\_\_\_\_ feet

**Geo-Chemical Properties**

- C6. Average pH: \_\_\_\_\_  
C7. Average ~~copper~~ <sup>Pb</sup> concentration (ppm): 707  
C8. Average arsenic concentration (ppm): 645  
C9. Metal salts present on surface? (Yes/No/NA): No

NOTE: Answer "NA" ONLY when wet conditions may have dissolved salts from the surface.

**GENERAL COMMENTS**

WESTERNMOST STAND OF COTTON WOOD AND TAMARISK, AT WEST BOUNDARY OF SMELTER SITE.

**SOIL PIT COMPOSITE DATA**

	Easting (X)	Northing (Y)	Zone	Total Copper (ppm)	Total Arsenic (ppm)	Composite Pit pH	Pit ID No.
Pit 1:							
Pit 2:							
Pit 3:							
Pit 4:							
Pit 5:							

**INDIVIDUAL SOIL SAMPLE DATA**

Pit #	Sample Bag No.	Depth (in.)	Sample Description	<sup>Pb</sup> <del>Copper</del> (ppm)	Arsenic (ppm)	pH
1K-D10			SURFACE SEDIMENTS	84.7	149	
HSV-104			SURFACE SEDIMENTS	1330	1140	



# CFR RipES Scoring Form for Streambank and Riparian Corridor Buffer Polygons

Data Record No.: 921

Streambank Class: CLASS 1

This streambank polygon lies within this (these) soil polygon(s): \_\_\_\_\_ ; \_\_\_\_\_ ; \_\_\_\_\_

## ADMINISTRATIVE DATA

- A1. Field data collected by: T. Strong, L. Carney  
A2. Funding Agency/Organization: EPA  
A3. Year: 2009 A4. Date field data collected: 8-19 A5. Observers: \_\_\_\_\_  
A6. Landowner: \_\_\_\_\_  
A7. Weather: Clear, Calm ~70°

## LOCATION DATA

- B1. County/Municipal District: YAVAPAI  
B2. Location: HUMBOLDT SMELTER SITE  
B3. Land Legal Description: 1/4 1/4 Sec: NE ; 1/4 Sec: SW ; Sec: 23 ; Township (NS): 13 N ; Range (EW): 1 E  
B4a. UTM coordinates of polygon UPSTREAM END: Easting: 387052 ; Northing: 3817072 ; Zone: 12S, NAD 27  
B4b. UTM coordinates of polygon DOWNSTREAM END: Easting: 387081 ; Northing: 3817130 ; Zone: 12S, NAD 27  
B4c. UTM coordinates of any other point of interest in the polygon: East: \_\_\_\_\_ ; North: \_\_\_\_\_ ; Zone: \_\_\_\_\_  
B4d. Comments: \_\_\_\_\_  
B5. Quad map(s): \_\_\_\_\_ ; \_\_\_\_\_

## SITE CHARACTERISTIC DATA

### Physical Properties

- C1. Evidence of high groundwater? (Yes/No): Yes - confluence w/ Agua Fria  
C2. Drainage ditch(es) present? (Yes/No): NO  
C3. Irrigation ditch(es) present? (Yes/No): NO  
C4. Has the polygon been tilled? (Yes/No): No  
C5. Proximity of tilling to CFR: \_\_\_\_\_ meters; \_\_\_\_\_ feet

## GENERAL COMMENTS

Photos at confluence red Dominant Plants - Tamark Goodings willow  
Russian Olive, black willow, ~~black willow~~, Fremont cottonwood



CFR RipES Data Form for Impacted Soils Area Polygons  
and for Slightly Impacted Soils Area Polygons  
(Not for Use on Slickens Areas)

Data Record No.:

P-21

Category of Soils Impact: IMPACTED SOILS AREA

Does this polygon area contain any length of streambank? (Yes/No): YES

If Yes, give the Streambank Buffer Polygon record number(s) P-21 ; \_\_\_\_\_ ; \_\_\_\_\_

**ADMINISTRATIVE DATA**

A1. Field data collected by: T. Strong, L. Curney  
A2. Funding Agency/Organization: EPA  
A3. Year: 2009 A4. Date field data collected: 8-19 A5. Observers: \_\_\_\_\_  
A6. Landowner: \_\_\_\_\_  
A7. Weather: Clear; Calm ~72°

**LOCATION DATA**

B1. County/Municipal District: Yavapai  
B2. Location: HUMBOLDT SMELTER SITE  
B3. Land Legal Description: 1/4 1/4 Sec: NE ; 1/4 Sec: SW ; Sec: 23 ; Township (NS): 13 N ; Range (EW): 1 E  
B4. UTM coordinates of the polygon centroid: Easting: 387073 ; Northing: 3817097 ; Zone: 12 S, NAD 27  
B5. Quad map(s): \_\_\_\_\_ ; \_\_\_\_\_

**SITE CHARACTERISTIC DATA**

**Physical Properties**

C1. Evidence of high groundwater? (Yes/No): YES - confluence w/ Agua Fria  
C2. Drainage ditch(es) present? (Yes/No): No  
C3. Irrigation ditch(es) present? (Yes/No): No  
C4. Has the polygon been tilled? (Yes/No): No  
C5. Proximity of tilling to CFR: \_\_\_\_\_ meters: \_\_\_\_\_ feet

**Geo-Chemical Properties**

C6. Average pH: \_\_\_\_\_  
C7. Average copper concentration (ppm): \_\_\_\_\_  
C8. Average arsenic concentration (ppm): \_\_\_\_\_  
C9. Metal salts present on surface? (Yes/No/NA): \_\_\_\_\_

**NOTE: Answer "NA" ONLY when wet conditions may have dissolved salts from the surface.**

**GENERAL COMMENTS**

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_





# CFR RipES Scoring Form for Streambank and Riparian Corridor Buffer Polygons

Data Record No.: P-22

Streambank Class: CLASS 1

This streambank polygon lies within this (these) soil polygon(s): \_\_\_\_\_ ; \_\_\_\_\_ ; \_\_\_\_\_

## ADMINISTRATIVE DATA

- A1. Field data collected by: T. STRONG, L. CARNEY  
A2. Funding Agency/Organization: EPA  
A3. Year: 2009 A4. Date field data collected: 8/19/09 A5. Observers: \_\_\_\_\_  
A6. Landowner: \_\_\_\_\_  
A7. Weather: Clear, calm, ~70°F

## LOCATION DATA

- B1. County/Municipal District: YAVAPAI  
B2. Location: HUMBOLDT SMELTER SITE  
B3. Land Legal Description: 1/4 1/4 Sec: NE ; 1/4 Sec: SW ; Sec: 23 ; Township (NS): 13 N ; Range (EW): 1 E  
B4a. UTM coordinates of polygon UPSTREAM END: Easting: 387001 ; Northing: 3817089 ; Zone: 12S, NAD27  
B4b. UTM coordinates of polygon DOWNSTREAM END: Easting: 387052 ; Northing: 3817072 ; Zone: 12S, NAD27  
B4c. UTM coordinates of any other point of interest in the polygon: East: \_\_\_\_\_ ; North: \_\_\_\_\_ ; Zone: \_\_\_\_\_  
B4d. Comments: \_\_\_\_\_  
B5. Quad map(s): \_\_\_\_\_ ; \_\_\_\_\_

## SITE CHARACTERISTIC DATA

### Physical Properties

- C1. Evidence of high groundwater? (Yes/No): No  
C2. Drainage ditch(es) present? (Yes/No): No  
C3. Irrigation ditch(es) present? (Yes/No): No  
C4. Has the polygon been tilled? (Yes/No): No  
C5. Proximity of tilling to CFR: \_\_\_\_\_ meters, \_\_\_\_\_ feet

## GENERAL COMMENTS

ERODED CHANNEL THROUGH TAILINGS -  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_



# CFR RipES Data Form for Slickens Area Polygons

Data Record No.: P22

Does this polygon area contain any length of streambank? (Yes/No): YES

If Yes, give the Streambank Buffer Polygon record number(s): P-22 ; \_\_\_\_\_ ; \_\_\_\_\_

## ADMINISTRATIVE DATA

- A1. Field data collected by: T. Strong, L. Carney  
A2. Funding Agency/Organization: EPA  
A3. Year: 2009 A4. Date field data collected: 8-19 A5. Observers: \_\_\_\_\_  
A6. Landowner: \_\_\_\_\_  
A7. Weather: Clear, Calm 75°

## LOCATION DATA

- B1. County/Municipal District: YAVAPAI  
B2. Location: HUMBOLDT SMELTER SITE  
B3. Land Legal Description: 1/4 1/4 Sec: NE ; 1/4 Sec: SW ; Sec: 23 ; Township (NS): 13 N ; Range (EW): 1 E  
B4. UTM coordinates of the polygon centroid: Easting: 387026 ; Northing: 3817076 ; Zone: 12S, NAD27  
B5. Quad map(s): \_\_\_\_\_ ; \_\_\_\_\_

## SITE CHARACTERISTIC DATA

### Physical Properties

- C1. Evidence of high groundwater? (Yes/No): No  
C2. Drainage ditch(es) present? (Yes/No): No  
C3. Irrigation ditch(es) present? (Yes/No): No  
C4. Has the polygon been tilled? (Yes/No): No  
C5. Proximity of tilling to CFR: \_\_\_\_\_ meters; \_\_\_\_\_ feet

### Geo-Chemical Properties

- C6. Average pH: \_\_\_\_\_  
C7. Average ~~copper~~<sup>Pb</sup> concentration (ppm): 237  
C8. Average arsenic concentration (ppm): 169  
C9. Metal salts present on surface? (Yes/No/NA): YES

**NOTE: Answer "NA" ONLY when wet conditions may have dissolved salts from the surface.**

## GENERAL COMMENTS

Photos taken Dominant Plants - Tamarix, polygonum sp.  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**SOIL PIT COMPOSITE DATA**

Data Record No.: P.22

	Easting (X)	Northing (Y)	Zone	Total Copper (ppm)	Total Arsenic (ppm)	Composite Pit pH	Pit ID No.
Pit 1:							
Pit 2:							
Pit 3:							
Pit 4:							
Pit 5:							

**INDIVIDUAL SOIL SAMPLE DATA**

Pit #	Sample Bag No.	Depth (in.)	Sample Description	<sup>Pb</sup> <del>Copper</del> (ppm)	Arsenic (ppm)	pH
CG-21				237	169	



# CFR RipES Scoring Form for Streambank and Riparian Corridor Buffer Polygons

Data Record No.: P23

Streambank Class: CLASS 3

This streambank polygon lies within this (these) soil polygon(s): \_\_\_\_\_ ; \_\_\_\_\_ ; \_\_\_\_\_

## ADMINISTRATIVE DATA

- A1. Field data collected by: T. Strong, L. Carney
- A2. Funding Agency/Organization: EPA
- A3. Year: 2009 A4. Date field data collected: 8-19 A5. Observers: \_\_\_\_\_
- A6. Landowner: \_\_\_\_\_
- A7. Weather: Clear; Calm 75°

## LOCATION DATA

- B1. County/Municipal District: YAVAPAI
- B2. Location: HUMBOLDT SMELTER SITE
- B3. Land Legal Description: 1/4 1/4 Sec: NE ; 1/4 Sec: SW ; Sec: 23 ; Township (NS): 13N ; Range (EW): 1E
- B4a. UTM coordinates of polygon UPSTREAM END: Easting: 386827 ; Northing: 3817157 ; Zone: 12S, NAD27
- B4b. UTM coordinates of polygon DOWNSTREAM END: Easting: 387001 ; Northing: 3817089 ; Zone: 12S, NAD27
- B4c. UTM coordinates of any other point of interest in the polygon: East: \_\_\_\_\_ ; North: \_\_\_\_\_ ; Zone: \_\_\_\_\_
- B4d. Comments: \_\_\_\_\_
- B5. Quad map(s): \_\_\_\_\_ ; \_\_\_\_\_

## SITE CHARACTERISTIC DATA

### Physical Properties

- C1. Evidence of high groundwater? (Yes/No): ~~No~~ Yes
- C2. Drainage ditch(es) present? (Yes/No): No
- C3. Irrigation ditch(es) present? (Yes/No): NO
- C4. Has the polygon been tilled? (Yes/No): NO
- C5. Proximity of tilling to CFR: \_\_\_\_\_ meters: \_\_\_\_\_ feet

## GENERAL COMMENTS

Photos taken Dominant Plants: cattail, bulrush, POFR, SAGO  
narrow strip of wetland thru most of the length



CFR RipES Data Form for Impacted Soils Area Polygons  
and for Slightly Impacted Soils Area Polygons  
(Not for Use on Slickens Areas)

Data Record No.:

P24

Category of Soils Impact: SLIGHTLY IMPACTED

Does this polygon area contain any length of streambank? (Yes/No): YES

If Yes, give the Streambank Buffer Polygon record number(s) P-24 ; \_\_\_\_\_ ; \_\_\_\_\_

**ADMINISTRATIVE DATA**

A1. Field data collected by: T. Strong, L. Carnoy

A2. Funding Agency/Organization: EPA

A3. Year: 2009 A4. Date field data collected: 8-19 A5. Observers: \_\_\_\_\_

A6. Landowner: \_\_\_\_\_

A7. Weather: Clear; slight breeze 75°F

**LOCATION DATA**

B1. County/Municipal District: YANAPAI

B2. Location: HUMBOLDT SMELTER SITE

B3. Land Legal Description: 1/4 1/4 Sec: NE ; 1/4 Sec: SW ; Sec: 23 ; Township (NS): 13N ; Range (EW): 1E

B4. UTM coordinates of the polygon centroid: Easting: 386876 ; Northing: 3817240 ; Zone: 12S, NAD27

B5. Quad map(s): \_\_\_\_\_ ; \_\_\_\_\_

**SITE CHARACTERISTIC DATA**

**Physical Properties**

C1. Evidence of high groundwater? (Yes/No): Yes

C2. Drainage ditch(es) present? (Yes/No): No

C3. Irrigation ditch(es) present? (Yes/No): No

C4. Has the polygon been tilled? (Yes/No): NO

C5. Proximity of tilling to CFR: \_\_\_\_\_ meters: \_\_\_\_\_ feet

**Geo-Chemical Properties**

C6. Average pH: \_\_\_\_\_

C7. Average ~~copper~~<sup>As</sup> concentration (ppm): 155

C8. Average arsenic concentration (ppm): 728

C9. Metal salts present on surface? (Yes/No/NA): No

**NOTE: Answer "NA" ONLY when wet conditions may have dissolved salts from the surface.**

**GENERAL COMMENTS**

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

SOIL PIT COMPOSITE DATA

	Easting (X)	Northing (Y)	Zone	Total Copper (ppm)	Total Arsenic (ppm)	Composite Pit pH	Pit ID No.
Pit 1:							
Pit 2:							
Pit 3:							
Pit 4:							
Pit 5:							

INDIVIDUAL SOIL SAMPLE DATA

Pit #	Sample Bag No.	Depth (in.)	Sample Description	<del>Copper</del> Pb (ppm)	As (ppm)	pH
CG-19			SURFACE SEDIMENTS	167	166	
HS-3855		"	"	89.1	2,320	
DE-1		"	"	178	211	
DE-2		"	"	185	213	



CFR RipES Scoring Form for Streambank and Riparian Corridor Buffer Polygons

Data Record No.: P24

Streambank Class: CLASS 3

This streambank polygon lies within this (these) soil polygon(s): \_\_\_\_\_ ; \_\_\_\_\_ ; \_\_\_\_\_

**ADMINISTRATIVE DATA**

- A1. Field data collected by: T Strong, L. Curney
- A2. Funding Agency/Organization: EPA
- A3. Year: 2009 A4. Date field data collected: 8-19 A5. Observers: \_\_\_\_\_
- A6. Landowner: \_\_\_\_\_
- A7. Weather: Clear; slight breeze 75°F

**LOCATION DATA**

- B1. County/Municipal District: YAVAPAI
- B2. Location: HUMBOLDT SHELTER SITE
- B3. Land Legal Description: 1/4 1/4 Sec: NE ; 1/4 Sec: SW ; Sec: 23 ; Township (NS): 13N ; Range (EW): 1E
- B4a. UTM coordinates of polygon UPSTREAM END: Easting: 386843 ; Northing: 3817275 ; Zone: 12S, NAD27
- B4b. UTM coordinates of polygon DOWNSTREAM END: Easting: 386887 ; Northing: 3817157 ; Zone: 12S, NAD27
- B4c. UTM coordinates of any other point of interest in the polygon: East: \_\_\_\_\_ ; North: \_\_\_\_\_ ; Zone: \_\_\_\_\_
- B4d. Comments: \_\_\_\_\_
- B5. Quad map(s): \_\_\_\_\_ ; \_\_\_\_\_

**SITE CHARACTERISTIC DATA**

**Physical Properties**

- C1. Evidence of high groundwater? (Yes/No): Yes
- C2. Drainage ditch(es) present? (Yes/No): No
- C3. Irrigation ditch(es) present? (Yes/No): NO
- C4. Has the polygon been tilled? (Yes/No): NO
- C5. Proximity of tilling to CFR: \_\_\_\_\_ meters: \_\_\_\_\_ feet

**GENERAL COMMENTS**

Photos Dominant - Bulrush, cattail, SAGO, POFR  
at dam Mexican reed; Soft stem bulrush



# CFR RipES Data Form for Slickens Area Polygons

Data Record No.: P-25

Does this polygon area contain any length of streambank? (Yes/No): No

If **Yes**, give the Streambank Buffer Polygon record number(s): \_\_\_\_\_ ; \_\_\_\_\_ ; \_\_\_\_\_

## ADMINISTRATIVE DATA

- A1. Field data collected by: T. STONE, L. CARNEY  
A2. Funding Agency/Organization: EPA  
A3. Year: 2009 A4. Date field data collected: 8/20/09 A5. Observers: \_\_\_\_\_  
A6. Landowner: \_\_\_\_\_  
A7. Weather: CLEAR, CALM, ~90°F

## LOCATION DATA

- B1. County/Municipal District: YAVAPAI  
B2. Location: HUMBOLDT SMELTER  
B3. Land Legal Description: 1/4 1/4 Sec: SE ; 1/4 Sec: NW ; Sec: 23 ; Township (NS): 13 N ; Range (EW): 1 E  
B4. UTM coordinates of the polygon centroid: Easting: 386650 ; Northing: 3817575 ; Zone: 12S NA 27  
B5. Quad map(s): \_\_\_\_\_ ; \_\_\_\_\_

## SITE CHARACTERISTIC DATA

### Physical Properties

- C1. Evidence of high groundwater? (Yes/No): No  
C2. Drainage ditch(es) present? (Yes/No): No  
C3. Irrigation ditch(es) present? (Yes/No): No  
C4. Has the polygon been tilled? (Yes/No): No  
C5. Proximity of tilling to CFR: \_\_\_\_\_ meters; \_\_\_\_\_ feet

### Geo-Chemical Properties

- C6. Average pH: \_\_\_\_\_  
C7. Average copper concentration (ppm): \_\_\_\_\_  
C8. Average arsenic concentration (ppm): \_\_\_\_\_  
C9. Metal salts present on surface? (Yes/No/NA): \_\_\_\_\_

**NOTE: Answer "NA" ONLY when wet conditions may have dissolved salts from the surface.**

## GENERAL COMMENTS

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**SOIL PIT COMPOSITE DATA**

Data Record No.: P-25

	Easting (X)	Northing (Y)	Zone	Total Copper (ppm)	Total Arsenic (ppm)	Composite Pit pH	Pit ID No.
Pit 1:							
Pit 2:							
Pit 3:							
Pit 4:							
Pit 5:							

**INDIVIDUAL SOIL SAMPLE DATA**

Pit #	Sample Bag No.	Depth (in.)	Sample Description	Copper (ppm)	Arsenic (ppm)	pH
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CFR RipES Data Form for Slickens Area Polygons

Data Record No.: P-26

Does this polygon area contain any length of streambank? (Yes/No): Yes

If Yes, give the Streambank Buffer Polygon record number(s): P-12 ; ;

ADMINISTRATIVE DATA

- A1. Field data collected by: T. Strong, L. Carney
A2. Funding Agency/Organization: EPA
A3. Year: 2009 A4. Date field data collected: 8/20/09 A5. Observers:
A6. Landowner:
A7. Weather: Clear, calm, ~90°F.

LOCATION DATA

- B1. County/Municipal District: YAVAPAI
B2. Location: Humboldt Smelter
B3. Land Legal Description: 1/4 1/4 Sec: SE ; 1/4 Sec: NW ; Sec: 23 ; Township (NS): 13N ; Range (EW): 1E
B4. UTM coordinates of the polygon centroid: Easting: 386594 ; Northing: 3817548 ; Zone: 12S, NAD 27
B5. Quad map(s):

SITE CHARACTERISTIC DATA

Physical Properties

- C1. Evidence of high groundwater? (Yes/No): No
C2. Drainage ditch(es) present? (Yes/No): No
C3. Irrigation ditch(es) present? (Yes/No): No
C4. Has the polygon been tilled? (Yes/No): No
C5. Proximity of tilling to CFR: meters: feet

Geo-Chemical Properties

- C6. Average pH:
C7. Average copper concentration (ppm):
C8. Average arsenic concentration (ppm):
C9. Metal salts present on surface? (Yes/No/NA):

NOTE: Answer "NA" ONLY when wet conditions may have dissolved salts from the surface.

GENERAL COMMENTS

Blank lines for general comments.

**SOIL PIT COMPOSITE DATA**

Data Record No.: P-26

	Easting (X)	Northing (Y)	Zone	Total Copper (ppm)	Total Arsenic (ppm)	Composite Pit pH	Pit ID No.
Pit 1:							
Pit 2:							
Pit 3:							
Pit 4:							
Pit 5:							

**INDIVIDUAL SOIL SAMPLE DATA**

Pit #	Sample Bag No.	Depth (in.)	Sample Description	Copper (ppm)	Arsenic (ppm)	pH
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**APPENDIX B**

**WETLAND  
DATA  
FORMS**

## WETLAND DETERMINATION DATA FORM — Arid West Region

Project/Site: Humboldt Smelter City/County: Yavapai Sampling Date: 8/19/09  
 Applicant/Owner: E.P..A. State: AZ Sampling Point: DP-1  
 Investigator(s): T. Strong, L. Carney Section, Township, Range: Sec. 23, T13N, R1E  
 Landform (hillslope, terrace, etc.): Drainage bottom Local relief (concave, convex, none): None Slope (%): 2%  
 Subregion (LRR): LRR D Lat: 34.492253 Long: -112.232653 Datum: NAD-27  
 Soil Map Unit Name: Springerville-Cabezon Complex NWI classification: Non-hydric

Are climatic / hydrologic conditions on the site typical for this time of year? Yes  No  (If no, explain in Remarks.)  
 Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes  No   
 Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS — Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Hydric Soil Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Wetland Hydrology Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	<b>Is the Sampled Area within a Wetland?</b> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
---	---

Remarks: Wetland A. Bottom of Chaparral Gulch, downstream from old concrete-masonry dam. Discharge from base of dam appears to maintain perennial flow in this part of the Gulch. Positive indicators for all parameters.

### VEGETATION

<u>Tree Stratum</u> (Use scientific names.)	Absolute % Cover	Dominant	Indicator Species?	Status	
1. <u>Salix gooddingii</u>	70	Yes		OBL	
2. _____					
3. _____					
4. _____					
Total Cover:	70				
<u>Sapling/Shrub Stratum</u>					
1. _____					
2. _____					
3. _____					
4. _____					
5. _____					
Total Cover:					
<u>Herb Stratum</u>					
1. <u>Typha latifolia</u>	30	Yes		OBL	
2. <u>Schoenoplectus tabernaemontani</u>	15	Yes		OBL	
3. <u>Melilotus alba</u>	15	Yes		FACU	
4. <u>Lolium pratense</u>	20	Yes		UPL	
5. <u>Xanthium strumarium</u>	<1	No		NI	
6. <u>Helianthus annuus</u>	<1	No		FAC-	
7. <u>Schoenoplectus americanus</u>	<2	No		OBL	
s. _____					
Total Cover:	80				
<u>Woody Vine Stratum</u>					
1. _____					
2. _____					
Total Cover:					
% Bare Ground in Herb Stratum <u>&lt;20</u> % Cover of Biotic Crust _____					

**Dominance Test worksheet:**  
 Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)  
 Total Number of Dominant Species Across All Strata: 5 (B)  
 Percent of Dominant Species That Are OBL, FACW, or FAC: 60 (NB)

**Prevalence Index worksheet:**  
 Total % Cover of: \_\_\_\_\_ Multiply by: \_\_\_\_\_  
 OBL species 115 x 1 = 115  
 FACW species \_\_\_\_\_ x 2 = \_\_\_\_\_  
 FAC species \_\_\_\_\_ x 3 = \_\_\_\_\_  
 FACU species 15 x 4 = 60  
 UPL species 20 x 5 = 100  
 Column Totals: 150 (A) 275 (B)  
 Prevalence Index B/A = 1.83

**Hydrophytic Vegetation Indicators:**  
 Dominance Test is >50%  
 Prevalence Index is less than 3.0  
 \_\_\_ Morphological Adaptations' (Provide supporting data in Remarks or on a separate sheet)  
 \_\_\_ Problematic Hydrophytic Vegetation' (Explain)

'Indicators of hydric soil and wetland hydrology must be present.'

**Hydrophytic Vegetation Present?** Yes  No

Remarks:  
 Vegetation dominated by obligate wetland species.



## WETLAND DETERMINATION DATA FORM — Arid West Region

Project/Site: Humboldt Smelter City/County: Yavapai Sampling Date: 8/19/09  
 Applicant/Owner: E.P.A. State: AZ Sampling Point: DP-2  
 Investigator(s): T. Strong, L. Carney Section, Township, Range: Sec. 23, T13N, R1E  
 Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): Convex Slope (%): 50%  
 Subregion (LRR): LRR D Lat: 34.492206 Long: -112.232764 Datum: NAD-27  
 Soil Map Unit Name: Springerville-Cabezon Complex NWI classification: Non-hydric

Are climatic / hydrologic conditions on the site typical for this time of year? Yes  No  (If no, explain in Remarks.)  
 Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes  No   
 Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS — Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Hydric Soil Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Wetland Hydrology Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	<b>Is the Sampled Area within a Wetland?</b> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
Remarks: Site is on east-facing slope above Chaparral Gulch, downstream from old concrete, masonry dam. No positive indicators for any parameter.	

### VEGETATION

<u>Tree Stratum</u> (Use scientific names.)	Absolute % Cover	Dominant	Indicator Species?	Status	
1. <u>Quercus emoryi</u>	5	Yes		UPL	
2. _____					
3. _____					
4. _____					
Total Cover:	5				
<u>Sapling/Shrub Stratum</u>					
1. <u>Quercus turbinella</u>	10	Yes		UPL	
2. <u>Arctostaphylos pungens</u>	50	Yes		UPL	
3. <u>Rhus trilobata</u>	<2	No		NI	
4. _____					
5. _____					
Total Cover:					
<u>Herb Stratum</u>					
1. <u>Poa annua</u>	<5	No		FAC-	
2. _____					
3. _____					
4. _____					
5. _____					
6. _____					
7. _____					
8. _____					
Total Cover:	<5				
<u>Woody Vine Stratum</u>					
1. _____					
2. _____					
Total Cover:					
% Bare Ground in Herb Stratum <u>&gt;90</u>		% Cover of Biotic Crust _____			

**Dominance Test worksheet:**  
 Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)  
 Total Number of Dominant Species Across All Strata: 2 (B)  
 Percent of Dominant Species That Are OBL, FACW, or FAC: 0 (NB)

**Prevalence Index worksheet:**  
 Total % Cover of: \_\_\_\_\_ Multiply by: \_\_\_\_\_  
 OBL species \_\_\_\_\_ x 1 = \_\_\_\_\_  
 FACW species \_\_\_\_\_ x 2 = \_\_\_\_\_  
 FAC species \_\_\_\_\_ x 3 = \_\_\_\_\_  
 FACU species \_\_\_\_\_ x 4 = \_\_\_\_\_  
 UPL species \_\_\_\_\_ x 5 = \_\_\_\_\_  
 Column Totals: \_\_\_\_\_ (A) \_\_\_\_\_ (B)  
 Prevalence Index B/A = \_\_\_\_\_

**Hydrophytic Vegetation Indicators:**  
 Dominance Test is >50%  
 Prevalence Index is less than 3.0  
 Morphological Adaptations' (Provide supporting data in Remarks or on a separate sheet)  
 Problematic Hydrophytic Vegetation' (Explain)

'Indicators of hydric soil and wetland hydrology must be present.'

**Hydrophytic Vegetation Present?** Yes  No

Remarks:  
 Vegetation dominated by upland species.



## WETLAND DETERMINATION DATA FORM — Arid West Region

Project/Site: Humboldt Smelter City/County: Yavapai Sampling Date: 8/19/09  
 Applicant/Owner: E.P.A. State: AZ Sampling Point: DP-3  
 Investigator(s): T. Strong, L. Carney Section, Township, Range: Sec. 23, T13N, R1E  
 Landform (hillslope, terrace, etc.): Drainage bottom Local relief (concave, convex, none): Flat Slope (%): 2%  
 Subregion (LRR): LRR D Lat: 34.492828 Long: -112.233178 Datum: NAD-27  
 Soil Map Unit Name: Springerville-Cabazon Complex NWI classification: Non-hydric

Are climatic / hydrologic conditions on the site typical for this time of year? Yes  No  (If no, explain in Remarks.)  
 Are Vegetation Yes, Soil Yes, or Hydrology Yes significantly disturbed? Are "Normal Circumstances" present? Yes  No   
 Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS — Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Hydric Soil Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Wetland Hydrology Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	<b>Is the Sampled Area within a Wetland?</b> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
---	---

Remarks: Wetland B. Data point is in bottom of Chaparral Gulch, just upstream from old concrete, masonry dam. Water source appears to be accumulated water in porous sediments behind dam. Less permeable layers in the sediments may act as confining layers. Positive indicators for all parameters.

### VEGETATION

<u>Tree Stratum</u> (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status	<b>Dominance Test worksheet:</b>
1. <i>Salix laevigata</i>	50	Yes	FACW	Number of Dominant Species That Are OBL, FACW, or FAC: <u>3</u> (A)  Total Number of Dominant Species Across All Strata: <u>4</u> (B)  Percent of Dominant Species That Are OBL, FACW, or FAC: <u>75%</u> (NB)
2. <i>Populus fremontii</i>	20	Yes	FACW	
3. _____				
4. _____				
Total Cover: <u>70</u>				
<u>Sapling/Shrub Stratum</u>				<b>Prevalence Index worksheet:</b> Total % Cover of: _____ Multiply by: _____ OBL species _____ x 1 = _____ FACW species <u>90</u> x 2 = <u>180</u> FAC species _____ x 3 = _____ FACU species <u>20</u> x 4 = <u>80</u> UPL species _____ x 5 = _____ Column Totals: <u>110</u> (A) <u>260</u> (B)  Prevalence Index B/A = <u>2.36</u>
1. <i>Tamarix</i> sp.	10	Yes	NI	
2. _____				
3. _____				
4. _____				
Total Cover: <u>10</u>				
<u>Herb Stratum</u>				<b>Hydrophytic Vegetation Indicators:</b> <input checked="" type="checkbox"/> Dominance Test is >50% <input checked="" type="checkbox"/> Prevalence Index is less than 3.0 ___ Morphological Adaptations' (Provide supporting data in Remarks or on a separate sheet) ___ Problematic Hydrophytic Vegetation' (Explain)  'Indicators of hydric soil and wetland hydrology must be present.  <b>Hydrophytic Vegetation Present?</b> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
1. <i>Juncus mexicanus</i>	20	Yes	FACW	
2. <i>Melilotus alba</i>	20	Yes	FACU+	
3. _____				
4. _____				
5. _____				
6. _____				
7. _____				
8. _____				
Total Cover: <u>40</u>				
<u>Woody Vine Stratum</u>				
1. _____				
2. _____				
Total Cover: _____				
% Bare Ground in Herb Stratum <u>60</u>				
% Cover of Biotic Crust _____				

Remarks:  
Vegetation dominated by hydrophytic species.



## WETLAND DETERMINATION DATA FORM — Arid West Region

Project/Site: Humboldt Smelter City/County: Yavapai Sampling Date: 8/19/09  
 Applicant/Owner: E.P.A. State: AZ Sampling Point: DP-4  
 Investigator(s): T. Strong, L. Carney Section, Township, Range: Sec. 23, T13N, R1E  
 Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): Convex Slope (%): 50%  
 Subregion (LRR): LRR D Lat: 34.492964 Long: -112.233144 Datum: NAD-27  
 Soil Map Unit Name: Springerville-Cabezon Complex NWI classification: Non-hydric

Are climatic / hydrologic conditions on the site typical for this time of year? Yes  No  (If no, explain in Remarks.)  
 Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes  No   
 Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS — Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Hydric Soil Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Wetland Hydrology Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	<b>Is the Sampled Area within a Wetland?</b> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
Remarks: Data point is north of Wetland B, in sediments near the north side of Chaparral Gulch, upstream from old concrete, masonry dam. No positive indicators for any parameter.	

### VEGETATION

<u>Tree Stratum</u> (Use scientific names.)	Absolute % Cover	Dominant	Indicator Species?	Status	
1. <u>Tamarix sp.</u>	30	Yes		NI	
2. _____					
3. _____					
4. _____					
Total Cover:	30				
<u>Sapling/Shrub Stratum</u>					
1. <u>Cercocarpus montanus</u>	<5	Yes		UPL	
2. <u>Fraxinus anomala</u>	<5	Yes		UPL	
3. _____					
4. _____					
5. _____					
Total Cover:	<10				
<u>Herb Stratum</u>					
1. <u>Bouteloua curtipendula</u>	10	Yes		UPL	
2. <u>Solanum elaeagnifolium</u>	10	Yes		UPL	
3. <u>Melilotus alba</u>	10	Yes		FACU+	
4. <u>Juncus mexicana</u>	<5	No		FACW	
5. <u>Pascopyrum smithii</u>	<5	No		FAC-	
6. <u>Poa annua</u>	<1	No		FAC-	
7. _____					
8. _____					
Total Cover:	40				
<u>Woody Vine Stratum</u>					
1. _____					
2. _____					
Total Cover:					
% Bare Ground in Herb Stratum <u>&gt;60</u>		% Cover of Biotic Crust _____			

**Dominance Test worksheet:**  
 Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)  
 Total Number of Dominant Species Across All Strata: 6 (B)  
 Percent of Dominant Species That Are OBL, FACW, or FAC: 0 (NB)

**Prevalence Index worksheet:**  
 Total % Cover of: \_\_\_\_\_ Multiply by: \_\_\_\_\_  
 OBL species \_\_\_\_\_ x 1 = \_\_\_\_\_  
 FACW species \_\_\_\_\_ x 2 = \_\_\_\_\_  
 FAC species \_\_\_\_\_ x 3 = \_\_\_\_\_  
 FACU species \_\_\_\_\_ x 4 = \_\_\_\_\_  
 UPL species \_\_\_\_\_ x 5 = \_\_\_\_\_  
 Column Totals: \_\_\_\_\_ (A) \_\_\_\_\_ (B)  
 Prevalence Index B/A = \_\_\_\_\_

**Hydrophytic Vegetation Indicators:**  
 Dominance Test is >50%  
 Prevalence Index is less than 3.0  
 Morphological Adaptations' (Provide supporting data in Remarks or on a separate sheet)  
 Problematic Hydrophytic Vegetation' (Explain)

'Indicators of hydric soil and wetland hydrology must be present.'

**Hydrophytic Vegetation Present?** Yes  No

Remarks:  
 Vegetation dominated by upland species.



## WETLAND DETERMINATION DATA FORM — Arid West Region

Project/Site: Humboldt Smelter City/County: Yavapai Sampling Date: 8/19/20  
 Applicant/Owner: E.P..A. State: AZ Sampling Point: DP-5  
 Investigator(s): T. Strong, L. Carney Section, Township, Range: Sec. 23, T13N, R1E  
 Landform (hillslope, terrace, etc.): Drainage bottom Local relief (concave, convex, none): Flat Slope (%): 2%  
 Subregion (LRR): LRR D Lat: 34.492714 Long: -112.233303 Datum: NAD-27  
 Soil Map Unit Name: Springerville-Cabezon Complex NWI classification: Non-hydric

Are climatic / hydrologic conditions on the site typical for this time of year? Yes  No  (If no, explain in Remarks.)  
 Are Vegetation Yes, Soil Yes, or Hydrology Yes significantly disturbed? Are "Normal Circumstances" present? Yes  No   
 Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS — Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Hydric Soil Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Wetland Hydrology Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	<b>Is the Sampled Area within a Wetland?</b> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
Remarks: Wetland C. Data point is in bottom of Chaparral Gulch, near south end of old concrete, masonry dam, south of Wetland B. Water source appears to be accumulated water in porous sediments behind dam. Less permeable layers in the sediments may act as confining layers.	

### VEGETATION

	Absolute % Cover	Dominant Species?	Indicator Status	
<b>Tree Stratum</b> (Use scientific names.)				
1. <i>Salix gooddingii</i>	20	Yes	OBL	
2. <i>Populus fremontii</i>	20	Yes	FACW	
3. <i>Salix laevigata</i>	10	Yes	FACW	
4. _____				
Total Cover:	50			
<b>Sapling/Shrub Stratum</b>				
1. <i>Amorpha fruticosa</i>	<5	No	FACW+	
2. _____				
3. _____				
4. _____				
5. _____				
Total Cover:	10			
<b>Herb Stratum</b>				
1. <i>Juncus mexicanus</i>	60	Yes	FACW	
2. <i>Typha latifolia</i>	10	Yes	OBL	
3. <i>Melilotus alba</i>	<5	No	FACU-	
4. _____				
5. _____				
6. _____				
7. _____				
8. _____				
Total Cover:	70			
<b>Woody Vine Stratum</b>				
1. _____				
2. _____				
Total Cover:				
% Bare Ground in Herb Stratum <u>60</u>		% Cover of Biotic Crust _____		

**Dominance Test worksheet:**  
 Number of Dominant Species That Are OBL, FACW, or FAC: 5 (A)  
 Total Number of Dominant Species Across All Strata: 5 (B)  
 Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (NB)

**Prevalence Index worksheet:**

	Total % Cover of:	Multiply by:
OBL species	30	x 1 = 30
FACW species	95	x 2 = 190
FAC species		x 3 =
FACU species	5	x 4 = 20
UPL species		x 5 =
Column Totals:	130 (A)	240 (B)
Prevalence Index		B/A = <u>1.85</u>

**Hydrophytic Vegetation Indicators:**  
 Dominance Test is >50%  
 Prevalence Index is less than 3.0  
 Morphological Adaptations' (Provide supporting data in Remarks or on a separate sheet)  
 Problematic Hydrophytic Vegetation' (Explain)

'Indicators of hydric soil and wetland hydrology must be present.'

**Hydrophytic Vegetation Present?** Yes  No

Remarks:  
 Vegetation is heavily dominated by hydrophytic species.

**SOIL**

Sampling Point: DP-5

<b>Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)</b>								
Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type <sup>1</sup>	Loc <sup>2</sup>		
0-10	10YR4/4						Sandy silt	
10-18	10YR4/4	90	5YR4/6	10			Sandy silt	

## WETLAND DETERMINATION DATA FORM — Arid West Region

Project/Site: Humboldt Smelter City/County: Yavapai Sampling Date: 8/19/09  
 Applicant/Owner: E.P.A. State: AZ Sampling Point: DP-6  
 Investigator(s): T. Strong, L. Carney Section, Township, Range: Sec. 23, T13N, R1E  
 Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): Convex Slope (%): 50%  
 Subregion (LRR): LRR D Lat: 34.492667 Long: -112.233378 Datum: NAD-27  
 Soil Map Unit Name: Springerville-Cabezon Complex NWI classification: Non-hydric

Are climatic / hydrologic conditions on the site typical for this time of year? Yes  No  (If no, explain in Remarks.)  
 Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes  No   
 Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS — Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Hydric Soil Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Wetland Hydrology Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	<b>Is the Sampled Area within a Wetland?</b> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
Remarks: Data point is south of Wetland C, on slope of Chaparral Gulch, upstream from old concrete, masonry dam. No positive indicators for any parameter.	

### VEGETATION

<u>Tree Stratum</u> (Use scientific names.)	Absolute % Cover	Dominant	Indicator Species?	Status	
1. <u><i>Quercus emoryi</i></u>	70	Yes		UPL	
2. _____					
3. _____					
4. _____					
Total Cover:	70				
<u>Sapling/Shrub Stratum</u>					
1. <u><i>Rhus trilobata</i></u>	<5	No		NI	
2. <u><i>Ribes aureum</i></u>	<5	No		FACW	
3. _____					
4. _____					
5. _____					
Total Cover:	<10				
<u>Herb Stratum</u>					
1. <u><i>Juncus mexicanus</i></u>	15	Yes		FACW	
2. <u><i>Verbascum thapsus</i></u>	<1	No		UPL	
3. <u>Grass sp.</u>	<5	No			
4. _____					
5. _____					
6. _____					
7. _____					
8. _____					
Total Cover:	<20				
<u>Woody Vine Stratum</u>					
1. _____					
2. _____					
Total Cover:					
% Bare Ground in Herb Stratum <u>&gt;80</u>		% Cover of Biotic Crust _____			

**Dominance Test worksheet:**  
 Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)  
 Total Number of Dominant Species Across All Strata: 2 (B)  
 Percent of Dominant Species That Are OBL, FACW, or FAC: 50 (NB)

**Prevalence Index worksheet:**  
 Total % Cover of: \_\_\_\_\_ Multiply by: \_\_\_\_\_  
 OBL species \_\_\_\_\_ x 1 = \_\_\_\_\_  
 FACW species 15 x 2 = 30  
 FAC species \_\_\_\_\_ x 3 = \_\_\_\_\_  
 FACU species \_\_\_\_\_ x 4 = \_\_\_\_\_  
 UPL species 80 x 5 = 400  
 Column Totals: 95 (A) 430 (B)  
 Prevalence Index B/A = 4.53

**Hydrophytic Vegetation Indicators:**  
 Dominance Test is >50%  
 Prevalence Index is less than 3.0  
 Morphological Adaptations' (Provide supporting data in Remarks or on a separate sheet)  
 Problematic Hydrophytic Vegetation' (Explain)

'Indicators of hydric soil and wetland hydrology must be present.'

**Hydrophytic Vegetation Present?** Yes  No

Remarks:  
 Vegetation is dominated by upland species.



## WETLAND DETERMINATION DATA FORM — Arid West Region

Project/Site: Humboldt Smelter City/County: Yavapai Sampling Date: 8/20/09  
 Applicant/Owner: E.P..A. State: AZ Sampling Point: DP-7  
 Investigator(s): T. Strong, L. Carney Section, Township, Range: Sec. 23, T13N, R1E  
 Landform (hillslope, terrace, etc.): Intermittent channel Local relief (concave, convex, none): Concave Slope (%): 2%  
 Subregion (LRR): LRR D Lat: 34.493367 Long: -112.233814 Datum: NAD-27  
 Soil Map Unit Name: Springerville-Cabezon Complex NWI classification: Non-hydric

Are climatic / hydrologic conditions on the site typical for this time of year? Yes  No  (If no, explain in Remarks.)  
 Are Vegetation Yes, Soil Yes, or Hydrology Yes significantly disturbed? Are "Normal Circumstances" present? Yes  No   
 Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS — Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Hydric Soil Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Wetland Hydrology Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	<b>Is the Sampled Area within a Wetland?</b> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
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Remarks: Wetland D. Data point is in low area in intermittent channel of Chaparral Gulch, in sediment deposit upstream from old concrete-masonry dam. Water source appears to be accumulated water in porous sediments along channel above dam. Less permeable layers in the sediments may act as confining layers. Positive indicators for all parameters.

### VEGETATION

<u>Tree Stratum</u> (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status																	
1. <u>Salix gooddingii</u>	20	Yes	OBL	<b>Dominance Test worksheet:</b> Number of Dominant Species That Are OBL, FACW, or FAC: <u>4</u> (A)  Total Number of Dominant Species Across All Strata: <u>5</u> (B)  Percent of Dominant Species That Are OBL, FACW, or FAC: <u>80%</u> (NB)																
2. _____																				
3. _____																				
4. _____																				
Total Cover: <u>20</u>																				
<u>Sapling/Shrub Stratum</u>																				
1. <u>Salix laevigata</u>	10	Yes	FACW	<b>Prevalence Index worksheet:</b> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; text-align: right;">Total % Cover of:</td> <td style="width: 50%; text-align: left;">Multiply by:</td> </tr> <tr> <td>OBL species <u>36</u></td> <td>x 1 = <u>36</u></td> </tr> <tr> <td>FACW species <u>10</u></td> <td>x 2 = <u>20</u></td> </tr> <tr> <td>FAC species _____</td> <td>x 3 = _____</td> </tr> <tr> <td>FACU species <u>10</u></td> <td>x 4 = <u>40</u></td> </tr> <tr> <td>UPL species <u>3</u></td> <td>x 5 = <u>15</u></td> </tr> <tr> <td>Column Totals: <u>59</u> (A)</td> <td><u>111</u> (B)</td> </tr> <tr> <td colspan="2" style="text-align: center;">Prevalence Index B/A = <u>1.88</u></td> </tr> </table>	Total % Cover of:	Multiply by:	OBL species <u>36</u>	x 1 = <u>36</u>	FACW species <u>10</u>	x 2 = <u>20</u>	FAC species _____	x 3 = _____	FACU species <u>10</u>	x 4 = <u>40</u>	UPL species <u>3</u>	x 5 = <u>15</u>	Column Totals: <u>59</u> (A)	<u>111</u> (B)	Prevalence Index B/A = <u>1.88</u>	
Total % Cover of:	Multiply by:																			
OBL species <u>36</u>	x 1 = <u>36</u>																			
FACW species <u>10</u>	x 2 = <u>20</u>																			
FAC species _____	x 3 = _____																			
FACU species <u>10</u>	x 4 = <u>40</u>																			
UPL species <u>3</u>	x 5 = <u>15</u>																			
Column Totals: <u>59</u> (A)	<u>111</u> (B)																			
Prevalence Index B/A = <u>1.88</u>																				
2. _____																				
3. _____																				
4. _____																				
5. _____																				
Total Cover: <u>10</u>																				
<u>Herb Stratum</u>																				
1. <u>Typha latifolia</u>	<5	Yes	OBL	<b>Hydrophytic Vegetation Indicators:</b> <input checked="" type="checkbox"/> Dominance Test is >50% <input type="checkbox"/> Prevalence Index is less than 3.0 <input type="checkbox"/> Morphological Adaptations' (Provide supporting data in Remarks or on a separate sheet) <input type="checkbox"/> Problematic Hydrophytic Vegetation' (Explain)  'Indicators of hydric soil and wetland hydrology must be present.  <b>Hydrophytic Vegetation Present?</b> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>																
2. <u>Polygonum punctatum</u>	10	Yes	OBL																	
3. <u>Melilotus alba</u>	10	Yes	FACU																	
4. <u>Elymus elymoides</u>	1	No	UPL																	
5. <u>Heterotheca subaxillaris</u>	2	No	UPL																	
6. <u>Schoenoplectus americanus</u>	1	No	OBL																	
7. _____																				
8. _____																				
9. _____																				
Total Cover: <u>25</u>																				
<u>Woody Vine Stratum</u>																				
1. _____																				
2. _____																				
Total Cover: _____																				
% Bare Ground in Herb Stratum <u>75</u>		% Cover of Biotic Crust _____																		

Remarks:  
Vegetation is dominated by hydrophytic species.



## WETLAND DETERMINATION DATA FORM — Arid West Region

Project/Site: Humboldt Smelter City/County: Yavapai Sampling Date: 8/20/09  
 Applicant/Owner: E.P.A. State: AZ Sampling Point: DP-8  
 Investigator(s): T. Strong, L. Carney Section, Township, Range: Sec. 23, T13N, R1E  
 Landform (hillslope, terrace, etc.): Drainage bottom Local relief (concave, convex, none): Flat Slope (%): 0%  
 Subregion (LRR): LRR D Lat: 34.493408 Long: -112.233717 Datum: NAD-27  
 Soil Map Unit Name: Springerville-Cabazon Complex NWI classification: Non-hydric

Are climatic / hydrologic conditions on the site typical for this time of year? Yes  No  (If no, explain in Remarks.)  
 Are Vegetation Yes, Soil Yes, or Hydrology Yes significantly disturbed? Are "Normal Circumstances" present? Yes  No   
 Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS — Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Hydric Soil Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Wetland Hydrology Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	<b>Is the Sampled Area within a Wetland?</b> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
Remarks: Data point is on bare sediment deposited upstream from old concrete, masonry dam. No positive indicators for any parameter.	

### VEGETATION

<u>Tree Stratum</u> (Use scientific names.) 1. _____ 2. _____ 3. _____ 4. _____ Total Cover: _____	<b>Absolute Dominant Indicator % Cover Species? Status</b> _____ _____ _____ _____	<b>Dominance Test worksheet:</b> Number of Dominant Species That Are OBL, FACW, or FAC: <u>0</u> (A) Total Number of Dominant Species Across All Strata: <u>0</u> (B) Percent of Dominant Species That Are OBL, FACW, or FAC: <u>NA</u> (NB)
<u>Sapling/Shrub Stratum</u> 1. _____ 2. _____ 3. _____ 4. _____ 5. _____ Total Cover: _____	_____ _____ _____ _____ _____	<b>Prevalence Index worksheet:</b> Total % Cover of: _____ Multiply by: _____ OBL species _____ x 1 = _____ FACW species _____ x 2 = _____ FAC species _____ x 3 = _____ FACU species _____ x 4 = _____ UPL species _____ x 5 = _____ Column Totals: _____ (A) _____ (B) Prevalence Index B/A = _____
<u>Herb Stratum</u> 1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____ 7. _____ 8. _____ Total Cover: _____	_____ _____ _____ _____ _____ _____ _____	<b>Hydrophytic Vegetation Indicators:</b> ___ Dominance Test is >50% ___ Prevalence Index is less than 3.0 ___ Morphological Adaptations' (Provide supporting data in Remarks or on a separate sheet) ___ Problematic Hydrophytic Vegetation' (Explain)
<u>Woody Vine Stratum</u> 1. _____ 2. _____ Total Cover: _____	_____ _____	'Indicators of hydric soil and wetland hydrology must be present.'
% Bare Ground in Herb Stratum _____ % Cover of Biotic Crust _____	_____ _____	<b>Hydrophytic Vegetation Present?</b> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>

Remarks:  
 No vegetation is present.

**SOIL**

Sampling Point: DP-8

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)								
Depth (inches)	Matrix		Redox Features			Texture	Remarks	
	Color (moist)	%	Color (moist)	%	Type <sup>1</sup>			Loc <sup>2</sup>
0-8	10YR4/6	60	5YR4/4	40	C	Silty sand		
8-16	7.5YR4/6					Silty sand		
>16	2.5Y5/3	60				Silty sand		

<sup>1</sup>Type: C=Concentration, D=Depletion, RM=Reduced Matrix. <sup>2</sup>Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)			Indicators for Problematic Hydric Soils <sup>3</sup> :
<input type="checkbox"/> Histosol (A1)	<input type="checkbox"/> Sandy Redox (S5)	<input type="checkbox"/> 1 cm Muck (A9) (LRR C)	
<input type="checkbox"/> Histic Epipedon (A2)	<input type="checkbox"/> Stripped Matrix (S6)	<input type="checkbox"/> 2 cm Muck (A10) (LRR B)	
<input type="checkbox"/> Black Histic (A3)	<input type="checkbox"/> Loamy Mucky Mineral (F1)	<input type="checkbox"/> Reduced Vertic (F18)	
<input type="checkbox"/> Hydrogen Sulfide (A4)	<input type="checkbox"/> Loamy Gleyed Matrix (F2)	<input type="checkbox"/> Red Parent Material (TF2)	
<input type="checkbox"/> Stratified Layers (A5) (LRR C)	<input type="checkbox"/> Depleted Matrix (F3)	<input type="checkbox"/> Other (Explain in Remarks)	
<input type="checkbox"/> 1 cm Muck (A9) (LRR D)	<input type="checkbox"/> Redox Dark Surface (F6)		
<input type="checkbox"/> Depleted Below Dark Surface (All)	<input type="checkbox"/> Depleted Dark Surface (F7)		
<input type="checkbox"/> Thick Dark Surface (A12)	<input type="checkbox"/> Redox Depressions (F8)		
<input type="checkbox"/> Sandy Mucky Mineral (81)	<input type="checkbox"/> Vernal Pools (F9)		
<input type="checkbox"/> Sandy Gleyed Matrix (S4)			

<sup>3</sup>Indicators of hydrophytic vegetation and wetland hydrology must be present.

<b>Restrictive Layer (if present):</b> Type: _____ Depth (inches): _____	<b>Hydric Soil Present? Yes _____ No <input checked="" type="checkbox"/></b>
--	--

Remarks: Point is in a bare area that appears to be a recent sediment deposit. Stratification is probably due to different depositional events rather than soil development.

**HYDROLOGY**

Wetland Hydrology Indicators:	Secondary Indicators (2 or more required)
<u>Primary Indicators (any one indicator is sufficient)</u> <input type="checkbox"/> Surface Water (A1) <input type="checkbox"/> Salt Crust (B11) <input type="checkbox"/> High Water Table (A2) <input type="checkbox"/> Biotic Crust (B12) <input type="checkbox"/> Saturation (A3) <input type="checkbox"/> Aquatic Invertebrates (B13) <input type="checkbox"/> Water Marks (B1) (Nonriverine) <input type="checkbox"/> Hydrogen Sulfide Odor (C1) <input type="checkbox"/> Sediment Deposits (B2) (Nonriverine) <input type="checkbox"/> Oxidized Rhizospheres along Living Roots (C3) <input type="checkbox"/> Drift Deposits (B3) (Nonriverine) <input type="checkbox"/> Presence of Reduced Iron (C4) <input type="checkbox"/> Surface Soil Cracks (B6) <input type="checkbox"/> Recent Iron Reduction in Plowed Soils (C6) <input type="checkbox"/> Inundation Visible on Aerial Imagery (B7) <input type="checkbox"/> Other (Explain in Remarks) <input type="checkbox"/> Water-Stained Leaves (B9)	<input type="checkbox"/> Water Marks (B1) (Riverine) <input type="checkbox"/> Sediment Deposits (B2) (Riverine) <input type="checkbox"/> Drift Deposits (B3) (Riverine) <input type="checkbox"/> Drainage Patterns (B10) <input type="checkbox"/> Dry-Season Water Table (C2) <input type="checkbox"/> Thin Muck Surface (C7) <input type="checkbox"/> Crayfish Burrows (C8) <input type="checkbox"/> Saturation Visible on Aerial Imagery (C9) <input type="checkbox"/> Shallow Aquitard (D3) <input type="checkbox"/> FAC-Neutral Test (D5)

<b>Field Observations:</b> Surface Water Present? Yes _____ No <input checked="" type="checkbox"/> Depth (inches): _____ Water Table Present? Yes _____ No <input checked="" type="checkbox"/> Depth (inches): _____ Saturation Present? Yes <input checked="" type="checkbox"/> No _____ Depth (inches): <u>16"</u>	<b>Wetland Hydrology Present? Yes _____ No <input checked="" type="checkbox"/></b>
---	--

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: No saturation within 12" of surface. Subsoil saturation may be related to low permeability of some sediment layers behind dam..

## WETLAND DETERMINATION DATA FORM — Arid West Region

Project/Site: Humboldt Smelter City/County: Yavapai Sampling Date: 8/20/09  
 Applicant/Owner: E.P..A. State: AZ Sampling Point: DP-9  
 Investigator(s): T. Strong, L. Carney Section, Township, Range: Sec. 23, T13N, R1E  
 Landform (hillslope, terrace, etc.): Drainage bottom Local relief (concave, convex, none): Flat Slope (%): 0%  
 Subregion (LRR): LRR D Lat: 34.493156 Long: -112.23395 Datum: NAD-27  
 Soil Map Unit Name: Springerville-Cabazon Complex NWI classification: Non-hydric

Are climatic / hydrologic conditions on the site typical for this time of year? Yes  No  (If no, explain in Remarks.)  
 Are Vegetation Yes, Soil Yes, or Hydrology Yes significantly disturbed? Are "Normal Circumstances" present? Yes  No   
 Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS — Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Hydric Soil Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Wetland Hydrology Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	<b>Is the Sampled Area within a Wetland?</b> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
Remarks: Wetland E. Data point is on southern edge of sediment deposit upstream from old concrete-masonry dam. Water source appears to be accumulated water in porous sediments from surface runoff from south slope of Chaparral Gulch. Less permeable layers in the sediments may act as confining layers. Positive indicators for all parameters.	

### VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status																	
1. <i>Salix laevigata</i>	10	Yes	FACW	<b>Dominance Test worksheet:</b> Number of Dominant Species That Are OBL, FACW, or FAC: <u>4</u> (A)  Total Number of Dominant Species Across All Strata: <u>5</u> (B)  Percent of Dominant Species That Are OBL, FACW, or FAC: <u>80%</u> (NB)																
2. <i>Populus fremontii</i>	10	Yes	FACW																	
3. _____																				
4. _____																				
Total Cover: <u>20</u>																				
<b>Sapling/Shrub Stratum</b>																				
1. <i>Fraxinus anomala</i>	<1	No	UPL	<b>Prevalence Index worksheet:</b> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">Total % Cover of:</td> <td style="width: 50%;">Multiply by:</td> </tr> <tr> <td>OBL species <u>5</u></td> <td>x 1 = <u>5</u></td> </tr> <tr> <td>FACW species <u>50</u></td> <td>x 2 = <u>100</u></td> </tr> <tr> <td>FAC species <u>4</u></td> <td>x 3 = <u>12</u></td> </tr> <tr> <td>FACU species <u>1</u></td> <td>x 4 = <u>4</u></td> </tr> <tr> <td>UPL species <u>2</u></td> <td>x 5 = <u>10</u></td> </tr> <tr> <td>Column Totals: <u>62</u> (A)</td> <td><u>131</u> (B)</td> </tr> <tr> <td colspan="2" style="text-align: center;">Prevalence Index B/A = <u>2.11</u></td> </tr> </table>	Total % Cover of:	Multiply by:	OBL species <u>5</u>	x 1 = <u>5</u>	FACW species <u>50</u>	x 2 = <u>100</u>	FAC species <u>4</u>	x 3 = <u>12</u>	FACU species <u>1</u>	x 4 = <u>4</u>	UPL species <u>2</u>	x 5 = <u>10</u>	Column Totals: <u>62</u> (A)	<u>131</u> (B)	Prevalence Index B/A = <u>2.11</u>	
Total % Cover of:	Multiply by:																			
OBL species <u>5</u>	x 1 = <u>5</u>																			
FACW species <u>50</u>	x 2 = <u>100</u>																			
FAC species <u>4</u>	x 3 = <u>12</u>																			
FACU species <u>1</u>	x 4 = <u>4</u>																			
UPL species <u>2</u>	x 5 = <u>10</u>																			
Column Totals: <u>62</u> (A)	<u>131</u> (B)																			
Prevalence Index B/A = <u>2.11</u>																				
2. <i>Tamarix</i> sp.	5	Yes	NI																	
3. _____																				
4. _____																				
5. _____																				
Total Cover: <u>5</u>																				
<b>Herb Stratum</b>																				
1. <i>Typha latifolia</i>	5	Yes	OBL	<b>Hydrophytic Vegetation Indicators:</b> <input checked="" type="checkbox"/> Dominance Test is >50% <input type="checkbox"/> Prevalence Index is less than 3.0 <input type="checkbox"/> Morphological Adaptations' (Provide supporting data in Remarks or on a separate sheet) <input type="checkbox"/> Problematic Hydrophytic Vegetation' (Explain)																
2. <i>Juncus mexicana</i>	30	Yes	FACW																	
3. <i>Poa annua</i>	3	No	FAC-																	
4. <i>Pascopyrum smithii</i>	<1	No	FAC-																	
5. <i>Eragrostis intermedia</i>	<1	No	UPL																	
6. <i>Muhlenbergia rigens</i>	<1	No	FACU																	
7. _____																				
8. _____																				
9. _____																				
Total Cover: <u>40</u>																				
<b>Woody Vine Stratum</b>																				
1. _____				'Indicators of hydric soil and wetland hydrology must be present.																
2. _____																				
Total Cover: _____				<b>Hydrophytic Vegetation Present?</b> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>																
% Bare Ground in Herb Stratum <u>60</u> % Cover of Biotic Crust _____																				

Remarks:  
 Vegetation is dominated by hydrophytic species.



## WETLAND DETERMINATION DATA FORM — Arid West Region

Project/Site: Humboldt Smelter City/County: Yavapai Sampling Date: 8/20/09  
 Applicant/Owner: E.P.A. State: AZ Sampling Point: DP-10  
 Investigator(s): T. Strong, L. Carney Section, Township, Range: Sec. 23, T13N, R1E  
 Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): Convex Slope (%): 40%  
 Subregion (LRR): LRR D Lat: 34.493069 Long: -112.234008 Datum: NAD-27  
 Soil Map Unit Name: Springerville-Cabezon Complex NWI classification: Non-hydric

Are climatic / hydrologic conditions on the site typical for this time of year? Yes  No  (If no, explain in Remarks.)  
 Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes  No   
 Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS — Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Hydric Soil Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Wetland Hydrology Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	<b>Is the Sampled Area within a Wetland?</b> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
Remarks: Data point is on natural hillslope above sediments deposited upstream from old concrete, masonry dam. No positive indicators for any parameter.	

### VEGETATION

<u>Tree Stratum</u> (Use scientific names.)	Absolute Dominant	Indicator	Status	
1. _____	_____	_____	_____	_____
2. _____	_____	_____	_____	_____
3. _____	_____	_____	_____	_____
4. _____	_____	_____	_____	_____
Total Cover: _____				
<u>Sapling/Shrub Stratum</u>				
1. <u>Quercus turbinella</u>	90	Yes	UPL	
2. <u>Fraxinus anomala</u>	9	Yes	UPL	
3. <u>Rhus trilobata</u>	1	No	NI	
4. _____	_____	_____	_____	
5. _____	_____	_____	_____	
Total Cover: <u>100</u>				
<u>Herb Stratum</u>				
1. <u>Juncus mexicana</u>	2	No	FACW	
2. _____	_____	_____	_____	
3. _____	_____	_____	_____	
4. _____	_____	_____	_____	
5. _____	_____	_____	_____	
6. _____	_____	_____	_____	
7. _____	_____	_____	_____	
8. _____	_____	_____	_____	
Total Cover: <u>2</u>				
<u>Woody Vine Stratum</u>				
1. _____	_____	_____	_____	
2. _____	_____	_____	_____	
Total Cover: _____				
% Bare Ground in Herb Stratum <u>98</u>	% Cover of Biotic Crust _____			

**Dominance Test worksheet:**  
 Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)  
 Total Number of Dominant Species Across All Strata: 2 (B)  
 Percent of Dominant Species That Are OBL, FACW, or FAC: NA (NB)

**Prevalence Index worksheet:**  
 Total % Cover of: \_\_\_\_\_ Multiply by: \_\_\_\_\_  
 OBL species \_\_\_\_\_ x 1 = \_\_\_\_\_  
 FACW species \_\_\_\_\_ x 2 = \_\_\_\_\_  
 FAC species \_\_\_\_\_ x 3 = \_\_\_\_\_  
 FACU species \_\_\_\_\_ x 4 = \_\_\_\_\_  
 UPL species \_\_\_\_\_ x 5 = \_\_\_\_\_  
 Column Totals: \_\_\_\_\_ (A) \_\_\_\_\_ (B)  
 Prevalence Index B/A = \_\_\_\_\_

**Hydrophytic Vegetation Indicators:**  
 Dominance Test is >50%  
 Prevalence Index is less than 3.0  
 Morphological Adaptations' (Provide supporting data in Remarks or on a separate sheet)  
 Problematic Hydrophytic Vegetation' (Explain)

'Indicators of hydric soil and wetland hydrology must be present.'

**Hydrophytic Vegetation Present?** Yes  No

Remarks:  
 Vegetation is dominated by upland species.



## WETLAND DETERMINATION DATA FORM — Arid West Region

Project/Site: Humboldt Smelter City/County: Yavapai Sampling Date: 8/20/09  
 Applicant/Owner: E.P.A. State: AZ Sampling Point: DP-11  
 Investigator(s): T. Strong, L. Carney Section, Township, Range: Sec. 23, T13N, R1E  
 Landform (hillslope, terrace, etc.): Drainage bottom Local relief (concave, convex, none): Flat Slope (%): 0%  
 Subregion (LRR): LRR D Lat: 34.493761 Long: -112.234547 Datum: NAD-27  
 Soil Map Unit Name: Springerville-Cabezon Complex NWI classification: Non-hydric

Are climatic / hydrologic conditions on the site typical for this time of year? Yes  No  (If no, explain in Remarks.)  
 Are Vegetation Yes, Soil Yes, or Hydrology Yes significantly disturbed? Are "Normal Circumstances" present? Yes  No   
 Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS — Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Hydric Soil Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Wetland Hydrology Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	<b>Is the Sampled Area within a Wetland?</b> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
Remarks: Wetland F. Data point is in intermittent channel in sediment deposit, about 600 ft. upstream from old concrete-masonry dam. Water source appears to be accumulated water in porous sediments from intermittent flow in Chaparral Gulch. Less permeable layers in the sediments may act as confining layers. Positive indicators for all parameters.	

### VEGETATION

<u>Tree Stratum</u> (Use scientific names.)	Absolute % Cover	Dominant Indicator	Species?	Status	
1. <u>Salix laevigata</u>	30	Yes		FACW	
2. _____					
3. _____					
4. _____					
Total Cover:	30				
<u>Sapling/Shrub Stratum</u>					
1. <u>Salix gooddingii</u>	15	Yes		OBL	
2. _____					
3. _____					
4. _____					
5. _____					
Total Cover:	15				
<u>Herb Stratum</u>					
1. <u>Typha latifolia</u>	20	Yes		OBL	
2. <u>Elymus elymoides</u>	2	No		UPL	
3. <u>Poa annua</u>	1	No		FAC-	
4. <u>Melilotus alba</u>	1	No		FAC-	
5. _____					
6. _____					
7. _____					
8. _____					
Total Cover:	25				
<u>Woody Vine Stratum</u>					
1. _____					
2. _____					
Total Cover:					
% Bare Ground in Herb Stratum <u>75</u> % Cover of Biotic Crust _____					

**Dominance Test worksheet:**  
 Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)  
 Total Number of Dominant Species Across All Strata: 3 (B)  
 Percent of Dominant Species That Are OBL, FACW, or FAC: 80% (NB)

**Prevalence Index worksheet:**

Total % Cover of:		Multiply by:		
OBL species	35	x 1 =	35	
FACW species	30	x 2 =	60	
FAC species	2	x 3 =	6	
FACU species		x 4 =		
UPL species	2	x 5 =	10	
Column Totals:	69	(A)	111	(B)

Prevalence Index B/A = 1.61

**Hydrophytic Vegetation Indicators:**  
 Dominance Test is >50%  
 Prevalence Index is less than 3.0  
 Morphological Adaptations' (Provide supporting data in Remarks or on a separate sheet)  
 Problematic Hydrophytic Vegetation' (Explain)

'Indicators of hydric soil and wetland hydrology must be present.'

**Hydrophytic Vegetation Present?** Yes  No

Remarks:  
 Vegetation is dominated by hydrophytic species.



## WETLAND DETERMINATION DATA FORM — Arid West Region

Project/Site: Humboldt Smelter City/County: Yavapai Sampling Date: 8/20/09  
 Applicant/Owner: E.P.A. State: AZ Sampling Point: DP-12  
 Investigator(s): T. Strong, L. Carney Section, Township, Range: Sec. 23, T13N, R1E  
 Landform (hillslope, terrace, etc.): Drainage bottom Local relief (concave, convex, none): Flat Slope (%): 0%  
 Subregion (LRR): LRR D Lat: 34.493717 Long: -112.234675 Datum: NAD-27  
 Soil Map Unit Name: Springerville-Cabazon Complex NWI classification: Non-hydric

Are climatic / hydrologic conditions on the site typical for this time of year? Yes  No  (If no, explain in Remarks.)  
 Are Vegetation Yes, Soil Yes, or Hydrology Yes significantly disturbed? Are "Normal Circumstances" present? Yes  No   
 Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS — Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Hydric Soil Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Wetland Hydrology Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	<b>Is the Sampled Area within a Wetland?</b> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
Remarks: Data point is south of Wetland F on bare sediment deposited upstream from old concrete, masonry dam. No positive indicators for any parameter.	

### VEGETATION

<u>Tree Stratum</u> (Use scientific names.)	Absolute Dominant Indicator	% Cover	Species?	Status	
1. _____	_____	_____	_____	_____	
2. _____	_____	_____	_____	_____	
3. _____	_____	_____	_____	_____	
4. _____	_____	_____	_____	_____	
Total Cover: _____					
<u>Sapling/Shrub Stratum</u>					
1. _____	_____	_____	_____	_____	
2. _____	_____	_____	_____	_____	
3. _____	_____	_____	_____	_____	
4. _____	_____	_____	_____	_____	
5. _____	_____	_____	_____	_____	
Total Cover: _____					
<u>Herb Stratum</u>					
1. _____	_____	_____	_____	_____	
2. _____	_____	_____	_____	_____	
3. _____	_____	_____	_____	_____	
4. _____	_____	_____	_____	_____	
5. _____	_____	_____	_____	_____	
6. _____	_____	_____	_____	_____	
7. _____	_____	_____	_____	_____	
8. _____	_____	_____	_____	_____	
Total Cover: _____					
<u>Woody Vine Stratum</u>					
1. _____	_____	_____	_____	_____	
2. _____	_____	_____	_____	_____	
Total Cover: _____					
% Bare Ground in Herb Stratum _____		% Cover of Biotic Crust _____			

**Dominance Test worksheet:**  
 Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)  
 Total Number of Dominant Species Across All Strata: 0 (B)  
 Percent of Dominant Species That Are OBL, FACW, or FAC: NA (NB)

**Prevalence Index worksheet:**  
 Total % Cover of: \_\_\_\_\_ Multiply by: \_\_\_\_\_  
 OBL species \_\_\_\_\_ x 1 = \_\_\_\_\_  
 FACW species \_\_\_\_\_ x 2 = \_\_\_\_\_  
 FAC species \_\_\_\_\_ x 3 = \_\_\_\_\_  
 FACU species \_\_\_\_\_ x 4 = \_\_\_\_\_  
 UPL species \_\_\_\_\_ x 5 = \_\_\_\_\_  
 Column Totals: \_\_\_\_\_ (A) \_\_\_\_\_ (B)  
 Prevalence Index B/A = \_\_\_\_\_

**Hydrophytic Vegetation Indicators:**  
 Dominance Test is >50%  
 Prevalence Index is less than 3.0  
 Morphological Adaptations' (Provide supporting data in Remarks or on a separate sheet)  
 Problematic Hydrophytic Vegetation' (Explain)

'Indicators of hydric soil and wetland hydrology must be present.'

**Hydrophytic Vegetation Present?** Yes  No

Remarks:  
 No vegetation is present.



## WETLAND DETERMINATION DATA FORM — Arid West Region

Project/Site: Humboldt Smelter City/County: Yavapai Sampling Date: 8/20/09  
 Applicant/Owner: E.P.A. State: AZ Sampling Point: DP-13  
 Investigator(s): T. Strong, L. Carney Section, Township, Range: Sec. 23, T13N, R1E  
 Landform (hillslope, terrace, etc.): Drainage bottom Local relief (concave, convex, none): Flat Slope (%): 0%  
 Subregion (LRR): LRR D Lat: 34.493808 Long: -112.235811 Datum: NAD-27  
 Soil Map Unit Name: Springerville-Cabazon Complex NWI classification: Non-hydric

Are climatic / hydrologic conditions on the site typical for this time of year? Yes  No  (If no, explain in Remarks.)  
 Are Vegetation Yes, Soil Yes, or Hydrology Yes significantly disturbed? Are "Normal Circumstances" present? Yes  No   
 Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS — Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Hydric Soil Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Wetland Hydrology Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	<b>Is the Sampled Area within a Wetland?</b> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
Remarks: Wetland G. Data point is in sediment deposit, at mouth of intermittent channel on south slope above sediments. Water source appears to be accumulated water in porous sediments from slope runoff. Less permeable layers in the sediments may act as confining layers. Positive indicators for all parameters.	

### VEGETATION

<u>Tree Stratum</u> (Use scientific names.)	Absolute Dominant Indicator % Cover	Species?	Status																	
1. <i>Salix laevigata</i>	5	Yes	FACW	<b>Dominance Test worksheet:</b> Number of Dominant Species That Are OBL, FACW, or FAC: <u>3</u> (A)  Total Number of Dominant Species Across All Strata: <u>3</u> (B)  Percent of Dominant Species That Are OBL, FACW, or FAC: <u>80%</u> (NB)																
2. <i>Populus fremontii</i>	5	Yes	FACW																	
3. _____																				
4. _____																				
Total Cover:	<u>10</u>																			
<u>Sapling/Shrub Stratum</u>																				
1. <i>Fraxinus anomala</i>	<1	No	UPL	<b>Prevalence Index worksheet:</b> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">Total % Cover of:</td> <td style="width: 50%;">Multiply by:</td> </tr> <tr> <td>OBL species <u>100</u></td> <td>x 1 = <u>100</u></td> </tr> <tr> <td>FACW species <u>10</u></td> <td>x 2 = <u>20</u></td> </tr> <tr> <td>FAC species _____</td> <td>x 3 = _____</td> </tr> <tr> <td>FACU species _____</td> <td>x 4 = _____</td> </tr> <tr> <td>UPL species <u>1</u></td> <td>x 5 = <u>5</u></td> </tr> <tr> <td>Column Totals: <u>111</u> (A)</td> <td><u>125</u> (B)</td> </tr> <tr> <td colspan="2" style="text-align: center;">Prevalence Index B/A = <u>1.13</u></td> </tr> </table>	Total % Cover of:	Multiply by:	OBL species <u>100</u>	x 1 = <u>100</u>	FACW species <u>10</u>	x 2 = <u>20</u>	FAC species _____	x 3 = _____	FACU species _____	x 4 = _____	UPL species <u>1</u>	x 5 = <u>5</u>	Column Totals: <u>111</u> (A)	<u>125</u> (B)	Prevalence Index B/A = <u>1.13</u>	
Total % Cover of:	Multiply by:																			
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Prevalence Index B/A = <u>1.13</u>																				
2. _____																				
3. _____																				
4. _____																				
5. _____																				
Total Cover:	<u>&lt;1</u>																			
<u>Herb Stratum</u>																				
1. <i>Juncus mexicana</i>	100	Yes	OBL	<b>Hydrophytic Vegetation Indicators:</b> <input checked="" type="checkbox"/> Dominance Test is >50% <input type="checkbox"/> Prevalence Index is less than 3.0 <input type="checkbox"/> Morphological Adaptations' (Provide supporting data in Remarks or on a separate sheet) <input type="checkbox"/> Problematic Hydrophytic Vegetation' (Explain)																
2. _____																				
3. _____																				
4. _____																				
5. _____																				
6. _____																				
7. _____																				
Total Cover:	<u>100</u>																			
<u>Woody Vine Stratum</u>																				
1. _____				'Indicators of hydric soil and wetland hydrology must be present.																
2. _____																				
Total Cover:	_____																			
% Bare Ground in Herb Stratum <u>0</u>	% Cover of Biotic Crust _____			<b>Hydrophytic Vegetation Present?</b> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>																

Remarks:  
 Vegetation is dominated by hydrophytic species. Area of dense rush, supported by channelized flow from south hillslope.



## WETLAND DETERMINATION DATA FORM — Arid West Region

Project/Site: Humboldt Smelter City/County: Yavapai Sampling Date: 8/20/09  
 Applicant/Owner: E.P.A. State: AZ Sampling Point: DP-14  
 Investigator(s): T. Strong, L. Carney Section, Township, Range: Sec. 23, T13N, R1E  
 Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): Concave Slope (%): 40%  
 Subregion (LRR): LRR D Lat: 34.49365 Long: -112.235858 Datum: NAD-27  
 Soil Map Unit Name: Springerville-Cabezon Complex NWI classification: Non-hydric

Are climatic / hydrologic conditions on the site typical for this time of year? Yes  No  (If no, explain in Remarks.)  
 Are Vegetation No, Soil No, or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes  No   
 Are Vegetation No, Soil No, or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS — Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Hydric Soil Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Wetland Hydrology Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	<b>Is the Sampled Area within a Wetland?</b> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
---	---

Remarks: Data point is on natural hillslope above Wetland G. No positive indicators for any parameter.

### VEGETATION

<p><b>Tree Stratum</b> (Use scientific names.)</p> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 80%;"></th> <th style="width: 10%;">Absolute Dominant</th> <th style="width: 10%;">Indicator</th> <th style="width: 10%;">Status</th> </tr> </thead> <tbody> <tr><td>1. _____</td><td>_____</td><td>_____</td><td>_____</td></tr> <tr><td>2. _____</td><td>_____</td><td>_____</td><td>_____</td></tr> <tr><td>3. _____</td><td>_____</td><td>_____</td><td>_____</td></tr> <tr><td>4. _____</td><td>_____</td><td>_____</td><td>_____</td></tr> <tr><td colspan="4" style="text-align: right;">Total Cover: _____</td></tr> </tbody> </table> <p><b>Sapling/Shrub Stratum</b></p> <table style="width: 100%; border-collapse: collapse;"> <tbody> <tr><td>1. <u>Celtis laevigata</u></td><td style="text-align: center;">5</td><td style="text-align: center;">Yes</td><td style="text-align: center;">FACU</td></tr> <tr><td>2. <u>Fraxinus anomala</u></td><td style="text-align: center;">5</td><td style="text-align: center;">Yes</td><td style="text-align: center;">UPL</td></tr> <tr><td>3. _____</td><td>_____</td><td>_____</td><td>_____</td></tr> <tr><td>4. _____</td><td>_____</td><td>_____</td><td>_____</td></tr> <tr><td>5. _____</td><td>_____</td><td>_____</td><td>_____</td></tr> <tr><td colspan="4" style="text-align: right;">Total Cover: <u>100</u></td></tr> </tbody> </table> <p><b>Herb Stratum</b></p> <table style="width: 100%; border-collapse: collapse;"> <tbody> <tr><td>1. <u>Bouteloua curtipendula</u></td><td style="text-align: center;">40</td><td style="text-align: center;">Yes</td><td style="text-align: center;">UPL</td></tr> <tr><td>2. <u>Grass sp.</u></td><td style="text-align: center;">2</td><td style="text-align: center;">No</td><td>_____</td></tr> <tr><td>3. _____</td><td>_____</td><td>_____</td><td>_____</td></tr> <tr><td>4. _____</td><td>_____</td><td>_____</td><td>_____</td></tr> <tr><td>5. _____</td><td>_____</td><td>_____</td><td>_____</td></tr> <tr><td>6. _____</td><td>_____</td><td>_____</td><td>_____</td></tr> <tr><td>7. _____</td><td>_____</td><td>_____</td><td>_____</td></tr> <tr><td>8. _____</td><td>_____</td><td>_____</td><td>_____</td></tr> <tr><td colspan="4" style="text-align: right;">Total Cover: <u>2</u></td></tr> </tbody> </table> <p><b>Woody Vine Stratum</b></p> <table style="width: 100%; border-collapse: collapse;"> <tbody> <tr><td>1. _____</td><td>_____</td><td>_____</td><td>_____</td></tr> <tr><td>2. _____</td><td>_____</td><td>_____</td><td>_____</td></tr> <tr><td colspan="4" style="text-align: right;">Total Cover: _____</td></tr> </tbody> </table> <p>% Bare Ground in Herb Stratum <u>98</u> % Cover of Biotic Crust _____</p>		Absolute Dominant	Indicator	Status	1. _____	_____	_____	_____	2. _____	_____	_____	_____	3. _____	_____	_____	_____	4. _____	_____	_____	_____	Total Cover: _____				1. <u>Celtis laevigata</u>	5	Yes	FACU	2. <u>Fraxinus anomala</u>	5	Yes	UPL	3. _____	_____	_____	_____	4. _____	_____	_____	_____	5. _____	_____	_____	_____	Total Cover: <u>100</u>				1. <u>Bouteloua curtipendula</u>	40	Yes	UPL	2. <u>Grass sp.</u>	2	No	_____	3. _____	_____	_____	_____	4. _____	_____	_____	_____	5. _____	_____	_____	_____	6. _____	_____	_____	_____	7. _____	_____	_____	_____	8. _____	_____	_____	_____	Total Cover: <u>2</u>				1. _____	_____	_____	_____	2. _____	_____	_____	_____	Total Cover: _____				<p><b>Dominance Test worksheet:</b></p> Number of Dominant Species That Are OBL, FACW, or FAC: <u>0</u> (A) Total Number of Dominant Species Across All Strata: <u>3</u> (B) Percent of Dominant Species That Are OBL, FACW, or FAC: <u>NA</u> (NB)
	Absolute Dominant	Indicator	Status																																																																																														
1. _____	_____	_____	_____																																																																																														
2. _____	_____	_____	_____																																																																																														
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Remarks:  
Vegetation is dominated by upland species.



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**APPENDIX C**

**JURISDICTIONAL  
DETERMINATION  
DATA  
FORMS**

Project Name: Humboldt Smelter  
 Client: \_\_\_\_\_  
 Stream Order and Drainage ID: \_\_\_\_\_

Date: 8/19/09  
 Field Worker: T. Strong, L. Carney  
 Camera: Toms

		Drainage Condition and Indicators	Photo ID U/D	Comments
Data Point:	1	Average side slopes: <u>(1:1)</u> or less, 2:1, 3:1, 4:1 or greater (Circle one) <input checked="" type="checkbox"/> Bed and Banks <input checked="" type="checkbox"/> OHWM List numeric codes from footnote: <u>1, 2, 3, 5, 7</u> <input type="checkbox"/> Discontinuous OHWM (Explain)	14	Distinct bed bank water flow
Width:	2'			
Depth:	3"			
Data Point:	2	Average side slopes: <u>(1:1)</u> or less, 2:1, 3:1, 4:1 or greater (Circle one) <input checked="" type="checkbox"/> Bed and Banks <input checked="" type="checkbox"/> OHWM List numeric codes from footnote: <u>1, 2, 3, 5, 7</u> <input type="checkbox"/> Discontinuous OHWM (Explain)	24 3D	" ↓ "
Width:	3'			
Depth:	3"			
Data Point:	3	Average side slopes: <u>(1:1)</u> or less, 2:1, 3:1, 4:1 or greater (Circle one) <input checked="" type="checkbox"/> Bed and Banks <input checked="" type="checkbox"/> OHWM List numeric codes from footnote: <u>1, 2, 3, 5, 7</u> <input type="checkbox"/> Discontinuous OHWM (Explain)	44 5D	" ↓ "
Width:	5'			
Depth:	3"			
Data Point:	4	Average side slopes: <u>(1:1)</u> or less, 2:1, 3:1, 4:1 or greater (Circle one) <input checked="" type="checkbox"/> Bed and Banks <input checked="" type="checkbox"/> OHWM List numeric codes from footnote: <u>1, 2, 3, 5, 7</u> <input type="checkbox"/> Discontinuous OHWM (Explain)	64 7D	" ↓ "
Width:	1.5'			
Depth:	3"			
Data Point:	5	Average side slopes: <u>(1:1)</u> or less, 2:1, 3:1, 4:1 or greater (Circle one) <input checked="" type="checkbox"/> Bed and Banks <input checked="" type="checkbox"/> OHWM List numeric codes from footnote: <u>1, 2</u> <input type="checkbox"/> Discontinuous OHWM (Explain)	84 9D	End of wet land a channel narrows soil damp (was <sup>water</sup> flowing in am)
Width:	1'			
Depth:	2"			
Data Point:	6	Average side slopes: <u>(1:1)</u> or less, 2:1, 3:1, 4:1 or greater (Circle one) <input checked="" type="checkbox"/> Bed and Banks <input checked="" type="checkbox"/> OHWM List numeric codes from footnote: <u>2, 5, 7</u> <input type="checkbox"/> Discontinuous OHWM (Explain)	104 11D	Rocky bottom, small channel cut banks Dry wash
Width:	2'			
Depth:	1"			
Data Point:	7	Average side slopes: <u>(1:1)</u> or less, 2:1, 3:1, 4:1 or greater (Circle one) <input checked="" type="checkbox"/> Bed and Banks <input checked="" type="checkbox"/> OHWM List numeric codes from footnote: <u>2, 5, 7</u> <input type="checkbox"/> Discontinuous OHWM (Explain)	124 13D	channel widens rocky bottom
Width:	5'			
Depth:	2"			
Data Point:	8	Average side slopes: <u>(1:1)</u> or less, 2:1, 3:1, 4:1 or greater (Circle one) <input checked="" type="checkbox"/> Bed and Banks <input checked="" type="checkbox"/> OHWM List numeric codes from footnote: <u>2, 5, 7</u> <input type="checkbox"/> Discontinuous OHWM (Explain)	144 15D	where dry wash converges aqua frig
Width:	9'			
Depth:	2"			
Data Point:		Average side slopes: 1:1 or less, 2:1, 3:1, 4:1 or greater (Circle one) <input type="checkbox"/> Bed and Banks <input type="checkbox"/> OHWM List numeric codes from footnote: _____ <input type="checkbox"/> Discontinuous OHWM (Explain)		
Width:				
Depth:				

- Numeric codes for OHWM indicators:**
- |  |   |  |
|--|---|--|
| 1. Clear, natural line impressed on the bank | 6. Abrupt change in plant community                 | 11. Scour                                      |
| 2. Changes in soil character                 | 7. Debris   | 12. Multiple observed or predicted flow events |
| 3. Shelving                                  | 8. Destruction of terrestrial vegetation            | 13. Sediment deposition                        |
| 4. Vegetation matted down, bent, or absent   | 9. Presence of high tide line (wrack line)          | 14. Water Staining                             |
| 5. Leaf litter disturbed or washed away      | 10. Sediment sorting (well-sorted or poorly-sorted) | 15. Other (Explain)                            |

Project Name: Humboldt Smelter  
 Client: \_\_\_\_\_  
 Stream Order and Drainage ID: \_\_\_\_\_

Date: 8/20/09  
 Field Worker: L. Carney, T Strong  
 Camera: Tom's Pentax

	Drainage Condition and Indicators	Photo ID U/D	Comments
Data Point: <u>9</u> Width: <u>6'</u> Depth: <u>2"</u>	Average side slopes: <u>(1:1)</u> or less, 2:1, 3:1, 4:1 or greater (Circle one) <input checked="" type="checkbox"/> Bed and Banks <input checked="" type="checkbox"/> OHWM List numeric codes from footnote: <u>2, 3, 4, 5, 7</u> <input type="checkbox"/> Discontinuous OHWM (Explain)	14 20	Upstream view Downstream view towards dam Silty/sandy bottom (side channel)
Data Point: <u>10</u> Width: <u>4'</u> Depth: <u>2"</u>	Average side slopes: <u>(1:1)</u> or less, 2:1, 3:1, 4:1 or greater (Circle one) <input checked="" type="checkbox"/> Bed and Banks <input checked="" type="checkbox"/> OHWM List numeric codes from footnote: <u>2, 3, 4, 5, 7</u> <input type="checkbox"/> Discontinuous OHWM (Explain)	34 40	Main channel Downstream view towards dam Sandy/silty bottom
Data Point: <u>11</u> Width: <u>6'</u> Depth: <u>2"</u>	Average side slopes: <u>(1:1)</u> or less, 2:1, 3:1, 4:1 or greater (Circle one) <input checked="" type="checkbox"/> Bed and Banks <input checked="" type="checkbox"/> OHWM List numeric codes from footnote: <u>2, 3, 4, 5, 7</u> <input type="checkbox"/> Discontinuous OHWM (Explain)	54 60	" ↓ "
Data Point: <u>12</u> Width: <u>3'</u> Depth: <u>2"</u>	Average side slopes: <u>(1:1)</u> or less, 2:1, 3:1, 4:1 or greater (Circle one) <input checked="" type="checkbox"/> Bed and Banks <input checked="" type="checkbox"/> OHWM List numeric codes from footnote: <u>2, 3, 4, 5, 7</u> <input type="checkbox"/> Discontinuous OHWM (Explain)	74 80	side channel upstream view - water pods cattails are growing concentrated sheet flow upstream
Data Point: <u>13</u> Width: <u>8.5'</u> Depth: <u>2"</u>	Average side slopes: <u>(1:1)</u> or less, 2:1, 3:1, 4:1 or greater (Circle one) <input checked="" type="checkbox"/> Bed and Banks <input checked="" type="checkbox"/> OHWM List numeric codes from footnote: <u>2, 3, 4, 5, 7</u> <input type="checkbox"/> Discontinuous OHWM (Explain)	94 100	of pooling area - no distinct channel main channel downstream view of channel split
Data Point: <u>14</u> Width: <u>&lt; 18"</u> Depth: <u>1"</u>	Average side slopes: <u>(1:1)</u> or less, 2:1, 3:1, 4:1 or greater (Circle one) <input checked="" type="checkbox"/> Bed and Banks <input checked="" type="checkbox"/> OHWM List numeric codes from footnote: <u>2, 7</u> <input type="checkbox"/> Discontinuous OHWM (Explain)	114 120	side channel upstream view of channel ending in sheet flow
Data Point: <u>15</u> Width: <u>3'</u> Depth: <u>2"</u>	Average side slopes: <u>(1:1)</u> or less, 2:1, 3:1, 4:1 or greater (Circle one) <input checked="" type="checkbox"/> Bed and Banks <input checked="" type="checkbox"/> OHWM List numeric codes from footnote: <u>2, 4, 5, 7</u> <input type="checkbox"/> Discontinuous OHWM (Explain)	134 140	main channel distinct bed/bank cut bank - one side
Data Point: <u>16</u> Width: <u>6'</u> Depth: <u>2"</u>	Average side slopes: <u>(1:1)</u> or less, 2:1, 3:1, 4:1 or greater (Circle one) <input checked="" type="checkbox"/> Bed and Banks <input checked="" type="checkbox"/> OHWM List numeric codes from footnote: <u>2, 4, 5, 7</u> <input type="checkbox"/> Discontinuous OHWM (Explain)	154 160	" ↓ "
Data Point: <u>17</u> Width: <u>8'</u> Depth: <u>2"</u>	Average side slopes: <u>(1:1)</u> or less, 2:1, 3:1, 4:1 or greater (Circle one) <input checked="" type="checkbox"/> Bed and Banks <input checked="" type="checkbox"/> OHWM List numeric codes from footnote: <u>2, 4, 5, 7</u> <input type="checkbox"/> Discontinuous OHWM (Explain)	174 180	" ↓ " side channel branches

- Numeric codes for OHWM indicators:
- |  |   |  |
|--|---|--|
| 1. Clear, natural line impressed on the bank | 6. Abrupt change in plant community                 | 11. Scour                                      |
| 2. Changes in soil character                 | 7. Debris   | 12. Multiple observed or predicted flow events |
| 3. Shelving                                  | 8. Destruction of terrestrial vegetation            | 13. Sediment deposition                        |
| 4. Vegetation matted down, bent, or absent   | 9. Presence of high tide line (wrack line)          | 14. Water Staining                             |
| 5. Leaf litter disturbed or washed away      | 10. Sediment sorting (well-sorted or poorly-sorted) | 15. Other (Explain)                            |

Project Name: Humboldt Smelter  
 Client: \_\_\_\_\_  
 Stream Order and Drainage ID: \_\_\_\_\_

Date: 8/20/09  
 Field Worker: L. Carney, T. Strong  
 Camera: Tom's Pentax

		Drainage Condition and Indicators	Photo ID U/D	Comments
Data Point:	<u>18</u>	Average side slopes: <u>1:1</u> or less, 2:1, 3:1, 4:1 or greater (Circle one) <input checked="" type="checkbox"/> Bed and Banks <input checked="" type="checkbox"/> OHWM List numeric codes from footnote: <u>2</u>	194 200	small tributary to main channel
Width:	<u>1.5'</u>			
Depth:	<u>1"</u>	<input type="checkbox"/> Discontinuous OHWM (Explain)		
Data Point:	<u>19</u>	Average side slopes: <u>1:1</u> or less, 2:1, 3:1, 4:1 or greater (Circle one) <input type="checkbox"/> Bed and Banks <input type="checkbox"/> OHWM List numeric codes from footnote: <u>2, 5, 7</u>	214 220 23	↓ " ↓
Width:	<u>3'</u>			
Depth:	<u>2"</u>	<input type="checkbox"/> Discontinuous OHWM (Explain)		overall view (tamarisk)
Data Point:	<u>20</u>	Average side slopes: <u>1:1</u> or less, 2:1, 3:1, 4:1 or greater (Circle one) <input type="checkbox"/> Bed and Banks <input type="checkbox"/> OHWM List numeric codes from footnote: <u>2, 5, 7</u>	244 250	↓ main channel sandy bottom/cutbanks
Width:	<u>7'</u>			
Depth:	<u>2"</u>	<input type="checkbox"/> Discontinuous OHWM (Explain)		
Data Point:	<u>21</u>	Average side slopes: <u>1:1</u> or less, 2:1, 3:1, 4:1 or greater (Circle one) <input checked="" type="checkbox"/> Bed and Banks <input checked="" type="checkbox"/> OHWM List numeric codes from footnote: <u>2, 5, 7</u>	264 270	↓
Width:	<u>5'</u>			
Depth:	<u>2"</u>	<input type="checkbox"/> Discontinuous OHWM (Explain)		
Data Point:	<u>22</u>	Average side slopes: <u>1:1</u> or less, 2:1, 3:1, 4:1 or greater (Circle one) <input checked="" type="checkbox"/> Bed and Banks <input type="checkbox"/> OHWM List numeric codes from footnote: <u>2, 5, 7</u>	284 290	Channel splits distinct bed/bank
Width:	<u>8'</u>			
Depth:	<u>2"</u>	<input type="checkbox"/> Discontinuous OHWM (Explain)		
Data Point:	<u>23</u>	Average side slopes: <u>1:1</u> or less, 2:1, 3:1, 4:1 or greater (Circle one) <input checked="" type="checkbox"/> Bed and Banks <input type="checkbox"/> OHWM List numeric codes from footnote: <u>2, 5, 7</u>	304 310	Distinct channel photos @ property boundary
Width:	<u>6'</u>			
Depth:	<u>2"</u>	<input type="checkbox"/> Discontinuous OHWM (Explain)		
Data Point:	<u>24</u>	Average side slopes: <u>1:1</u> or less, 2:1, 3:1, 4:1 or greater (Circle one) <input checked="" type="checkbox"/> Bed and Banks <input checked="" type="checkbox"/> OHWM List numeric codes from footnote: <u>2, 5, 7</u>	324 330	side channel ↓
Width:	<u>3'</u>			
Depth:	<u>2"</u>	<input type="checkbox"/> Discontinuous OHWM (Explain)		
Data Point:	<u>25</u>	Average side slopes: <u>1:1</u> or less, 2:1, 3:1, 4:1 or greater (Circle one) <input checked="" type="checkbox"/> Bed and Banks <input checked="" type="checkbox"/> OHWM List numeric codes from footnote: <u>2, 5, 7</u>	344 350	↓ sandy bottom photos at property boundary
Width:	<u>2'</u>			
Depth:	<u>2"</u>	<input type="checkbox"/> Discontinuous OHWM (Explain)		
Data Point:		Average side slopes: 1:1 or less, 2:1, 3:1, 4:1 or greater (Circle one) <input type="checkbox"/> Bed and Banks <input type="checkbox"/> OHWM List numeric codes from footnote: _____		
Width:				
Depth:		<input type="checkbox"/> Discontinuous OHWM (Explain)		

- Numeric codes for OHWM indicators:**
- |  |   |  |
|--|---|--|
| 1. Clear, natural line impressed on the bank | 6. Abrupt change in plant community                 | 11. Scour                                      |
| 2. Changes in soil character                 | 7. Debris   | 12. Multiple observed or predicted flow events |
| 3. Shelving                                  | 8. Destruction of terrestrial vegetation            | 13. Sediment deposition                        |
| 4. Vegetation matted down, bent, or absent   | 9. Presence of high tide line (wrack line)          | 14. Water Staining                             |
| 5. Leaf litter disturbed or washed away      | 10. Sediment sorting (well-sorted or poorly-sorted) | 15. Other (Explain)                            |

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**APPENDIX D**

**RIPARIAN  
POLYGON  
PHOTOS**



**PHOTO D-1.** Riparian Polygon 1. Streambank Class 3. Main channel of Chaparral Gulch above masonry dam.



**PHOTO D-2.** Riparian Polygon 1. Streambank Class 3. North edge of P-2, looking southeast toward masonry dam.



**PHOTO D-3.** Riparian Polygon 2. Slickens. View to northwest from southeast end.



**PHOTO D-4.** Riparian Polygon 2. Slickens. South edge of polygon, looking southeast toward old masonry dam.



**PHOTO D-5.** Riparian Polygon 3. Slightly impacted soils area. Northeast edge, looking to northwest, adjacent to natural hill slope on north side of Chaparral Gulch.



**PHOTO D-6.** Riparian Polygon 3. Slightly impacted soils area. Southwest edge, looking to northwest.



**PHOTO D-7.** Riparian Polygon 4. Slickens. Looking to northwest from southeast end.



**PHOTO D-8.** Riparian Polygon 4. Slickens. Looking to southeast from northwest end.



**PHOTO D-9.** Riparian Polygon 5. Streambank Class 2. Looking northwest along main channel of Chaparral Gulch.



**PHOTO D-10.** Riparian Polygon 5. Streambank Class 2. Looking southeast along southwest edge of polygon.



**PHOTO D-11.** Riparian Polygon 6. Impacted soils area. View from northwest end looking southeast.



**PHOTO D-12.** Riparian Polygon 6. Impacted soils area. View of south edge of polygon from southeast end looking northwest.



**PHOTO D-13.** Riparian Polygon 7. Slickens. Looking northwest from southeast end.



**PHOTO D-14.** Riparian Polygon 7. Slickens. Looking southeast from northwest end.



**PHOTO D-15.** Riparian Polygon 8. Impacted soils area. View looking northwest from southeast end. Dense sacaton stand.



**PHOTO D-16.** Riparian Polygon 8. Impacted soils area. View looking southeast from northwest end.



**PHOTO D-17.** Riparian Polygon 9. Slickens. View looking east from west end.



**PHOTO D-18.** Riparian Polygon 9. Slickens. View looking northwest from southeast side. Some ATV tracks visible in foreground.



**PHOTO D-19.** Riparian Polygon 10. Slickens. View looking northwest from southeast end.



**PHOTO D-20.** Riparian Polygon 10. Slickens. View looking southeast from northwest end.



**PHOTO D-21.** Riparian Polygon 11. Slickens. View looking northwest from southeast end.



**PHOTO D-22.** Riparian Polygon 11. Slickens. View looking southeast from northwest end.



**PHOTO D-23.** Riparian Polygon 12. Streambank Class 3. View looking northwest (upstream) from southeast end.



**PHOTO D-24.** Riparian Polygon 12. Streambank Class 3. View looking southeast (downstream) from near center of polygon.



**PHOTO D-25.** Riparian Polygon 13. Impacted soils area. View looking northwest from near center of polygon.



**PHOTO D-26.** Riparian Polygon 13. Impacted soils area. View looking southeast from near center of polygon.



**PHOTO D-27.** Riparian Polygon 14. Impacted soils area. View looking northwest from southeast end of open sacaton stand.



**PHOTO D-28.** Riparian Polygon 14. Impacted soils area. View looking southeast from northwest end of open sacaton stand.



**PHOTO D-29.** Riparian Polygon 15. Slightly impacted soils area. Small stand of riparian trees, view of east edge from south.



**PHOTO D-30.** Riparian Polygon 15. Slightly impacted soils area. Small stand of riparian trees, view of west edge from northwest.



**PHOTO D-31.** Riparian Polygon 16. Slightly impacted soils area. Small stand of riparian trees, view of east edge from southeast corner.



**PHOTO D-32.** Riparian Polygon 16. Slightly impacted soils area. Small stand of riparian trees, view of southwest edge from northwest.



**PHOTO D-33.** Riparian Polygon 17. Impacted soils area. View west-northwest from southeast corner of open sacaton stand.



**PHOTO D-34.** Riparian Polygon 17. Impacted soils area. View southeast from north end of open sacaton stand.



**PHOTO D-35.** Riparian Polygon 18. Streambank Class 1 and Impacted soils area. View southeast (downstream) from near center.



**PHOTO D-36.** Riparian Polygon 18. Streambank Class 1 and Impacted soils area. View northwest (upstream) from near center.



**PHOTO D-37.** Riparian Polygon 19. Impacted soils area. View looking southeast from west edge of polygon.



**PHOTO D-38.** Riparian Polygon 19. Impacted soils area. View looking west along old roadway now used by ATVs.



**PHOTO D-39.** Riparian Polygon 20. Streambank Class 3 and Slightly impacted soils area. View upstream on main channel of Chaparral Gulch from southeast end. Note multiple layers of exposed roots in eroded bank.



**PHOTO D-40.** Riparian Polygon 20. Streambank Class 3 and Slightly impacted soils area. View looking south along west edge of Humboldt Smelter site.



**PHOTO D-41.** Riparian Polygon 21. Streambank Class 1 and Impacted soils area. View south (upstream) from near confluence with Agua Fria River.



**PHOTO D-42.** Riparian Polygon 21. Streambank Class 1 and Impacted soils area. View north (downstream) from south end of polygon.



**PHOTO D-43.** Riparian Polygon 22. Streambank Class 3 and Slickens. View west (upstream) from east end. Note stratified tailings and sediments in eroded banks.



**PHOTO D-44.** Riparian Polygon 22. Streambank Class 3 and Slickens. View of north bank from near midpoint of polygon. Note two discharge pipes on bank and tailings in foreground.



**PHOTO D-45.** Riparian Polygon 23. Streambank Class 3. View of northeast edge and adjacent slope looking northwest from east end of polygon.



**PHOTO D-46.** Riparian Polygon 23. Streambank Class 3. View looking southeast (downstream) from northwest end of polygon.



**PHOTO D-47.** Riparian Polygon 24. Streambank Class 3 and impacted soils area. View of old stone and concrete dam at upstream end of polygon, showing discharge point at base of dam.



**PHOTO D-48.** Riparian Polygon 24. Streambank Class 3 and impacted soils area. View south (downstream) from near midpoint of polygon. Note discoloration of water from mineral content.



**PHOTO D-49.** Riparian Polygon 25. Slickens. Looking northwest from south end of polygon.



**PHOTO D-50.** Riparian Polygon 25. Slickens. Looking southeast from north end of polygon.



**PHOTO D-51.** Riparian Polygon 26. Slickens. View looking north from southeast corner of polygon.



**PHOTO D-52.** Riparian Polygon 26. Slickens. View looking northwest from south edge of polygon.

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**APPENDIX E**

**WETLAND  
PHOTOS**



**PHOTO E-1.** Data Point 1. Wetland A. Perennial stream and palustrine forested wetland. Note cattails and bulrush.



**PHOTO E-2.** Data Point 2. Upland adjacent to Wetland A. Interior chaparral, with oak and manzanita.



**PHOTO E-3.** Data Point 3. Wetland B. Palustrine scrub-shrub wetland in channel above old masonry dam.



**PHOTO E-4.** Data Point 4. Upland adjacent to Wetland B. Sediment fill near northeast end of old masonry dam.



**PHOTO E-5.** Data Point 5. Wetland C. Palustrine scrub-shrub and emergent wetland in south channel above old masonry dam. Note Mexican rush and cattails.



**PHOTO E-6.** Data Point 6. Upland adjacent to Wetland C. Interior chaparral on slope south of Chaparral Gulch.



**PHOTO E-7.** Data Point 7. Wetland D. Palustrine scrub-shrub and emergent wetland in main channel of Chaparral Gulch, upstream from Wetlands B and C. Note willows and cattails.



**PHOTO E-8.** Data Point 8. Upland adjacent to Wetland D. Floodplain sediments on north side of channel.



**PHOTO E-9.** Data Point 9. Wetland E. Palustrine emergent and scrub-shrub wetland south of Wetland D, at toe of south slope of Chaparral Gulch. Note dense stand of Mexican rush.



**PHOTO E-10.** Data Point 10. Upland adjacent to Wetland E. Interior chaparral on south slope of Chaparral Gulch.



**PHOTO E-11.** Wetland F. Palustrine scrub-shrub and emergent wetland in intermittent channel upstream from Wetland D. Note cattails and willows.



**PHOTO E-12.** Upland adjacent to Wetland F. Floodplain sediments on south side of channel.



**PHOTO E-13.** Data Point 13. Wetland G. Palustrine emergent wetland at mouth of small tributary to Chaparral Gulch from the south slope. Note dense Mexican rush.



**PHOTO E-14.** Data Point 14. Upland adjacent to Wetland G. Grassland and interior chaparral on south slope above Chaparral Gulch.

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**APPENDIX F**

**JURISDICTIONAL  
DETERMINATION  
PHOTOS**



Photo F-1. Data Point 1 Upstream view – 2 ft.



Photo F-2. Data Point 2 Downstream view – 3 ft.



Photo F-3. Data Point 3 Upstream view – 5 ft.



Photo F-4. Data Point 4 Downstream view – 1.5 ft.



Photo F-5. Data Point 5 Upstream view – 1 ft.



Photo F-6. Data Point 6 Downstream view – 2 ft.



Photo F-7. Data Point 7 Upstream view – 5 ft.



Photo F-8. Data Point 8 Downstream view – 9 ft.



Photo F-9. Data Point 9 Upstream view – 6 ft.



Photo F-10. Data Point 10 Downstream view – 4 ft.



Photo F-11. Data Point 11 Upstream view – 6 ft.



Photo F-12. Data Point 12 Downstream view – 3 ft.



Photo F-13. Data Point 13 Upstream view – 8.5 ft.



Photo F-14. Data Point 14 Downstream view – <1.5 ft.



Photo F-15. Data Point 15 Upstream view – 3 ft.



Photo F-16. Data Point 16 Downstream view – 6 ft.



Photo F-17. Data Point 17 Upstream view – 8 ft.



Photo F-18. Data Point 18 Downstream view – 1.5 ft.



Photo F-19. Data Point 19 Upstream view – 3 ft.



Photo F-20. Data Point 20 Downstream view – 7 ft.



Photo F-21. Data Point 21 Upstream view – 5 ft.



Photo F-22. Data Point 22 Downstream view – 8 ft.



Photo F-23. Data Point 23 Upstream view – 6 ft.



Photo F-24. Data Point 24 Downstream view – 3 ft .



Photo F-25. Data Point 25 Upstream view – 2 ft.

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## **APPENDIX G**

**CLARK FORK  
RIVER  
RIPARIAN  
EVALUATION  
SYSTEM  
A REMEDIAL  
DESIGN TOOL**

***CLARK FORK RIVER RIPARIAN EVALUATION SYSTEM  
A REMEDIAL DESIGN TOOL***

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**Clark Fork River Operable Unit  
Milltown Reservoir Sediments NPL Site**

**Prepared By:**

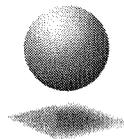


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**April 2004**

## TABLE OF CONTENTS

PREFACE .....	1
INTRODUCTION .....	2
Brief Site Background.....	2
Brief Site History.....	2
Remedial Investigation.....	2
Feasibility Study .....	3
Record of Decision for the Clark Fork River Operable Unit .....	3
CLARK FORK RIVER RIPARIAN EVALUATION SYSTEM (CFR RipES).....	3
Purpose .....	3
Data Quality Objectives.....	4
Step 1. State the Problem.....	5
Step 2. Identify the Decision.....	5
Step 3. Identify the Inputs to the Decision .....	5
Step 4. Define the Study Boundaries.....	6
Step 5. Develop a Decision Rule .....	6
Step 6. Specify Tolerable Limits on Decision Errors .....	6
Step 7. Optimize the Design .....	7
Data Measurement Objectives .....	7
Precision .....	7
Accuracy .....	7
Representativeness.....	7
Completeness.....	8
Comparability.....	8
CFR RipES Structure .....	8
Streambank and Riparian Corridor Buffer .....	8
Streambank Categories .....	9
Class 1 streambanks.....	9
Class 2 streambanks.....	9
Class 3 streambanks.....	9
Special Cases .....	13
Tributary streams.....	13
Secondary channels of the Clark Fork River .....	13
Historic 100-Year Floodplain Contaminated Soils.....	13
Slickens (exposed tailings).....	13
Impacted soils and vegetation areas .....	17
Slightly impacted soils and vegetation areas .....	18
CFR RipES Application.....	20
Miscellaneous Site Types.....	23
CFR RipES Process and Integration with Remedial Design.....	24
CLARK FORK RIVER RIPARIAN EVALUATION SYSTEM (CFR RipES) FOR STREAMBANK CORRIDOR BUFFER POLYGONS.....	27
Polygon Delineation Criteria .....	27
Field Form.....	27
Live Vegetation and Streambank Integrity .....	27
Overall Scoring .....	29

CLARK FORK RIVER RIPARIAN EVALUATION SYSTEM (CFR RipES) FOR SLICKENS (EXPOSED TAILINGS) POLYGONS .....	30
Polygon Delineation Criteria .....	30
Field Form.....	30
CLARK FORK RIVER RIPARIAN EVALUATION SYSTEM (RipES) FOR IMPACTED SOILS AND VEGETATION AREAS POLYGONS AND SLIGHTLY IMPACTED SOILS AND VEGETATIO AREAS POLYGONS .....	31
Polygon Delineation Criteria .....	31
Field Form.....	31
Live Vegetation Integrity.....	31
Contamination Severity .....	32
Overall Scoring .....	34
LITERATURE CITED .....	35

### LIST OF TABLES

Table 1. Preliminary remedial action (RA) codes for major CFR RipES polygon categories .....	23
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### LIST OF FIGURES

Figure 1. Typical Clark Fork River Class 1 streambank .....	10
Figure 2. Clark Fork River Class 1 streambank adjacent to a slickens area (exposed tailings).....	10
Figure 3. Typical Clark Fork River Class 2 streambank .....	11
Figure 4. Highly eroding Clark Fork River Class 2 streambank .....	11
Figure 5. Well-vegetated, stable Clark Fork River Class 3 streambank .....	12
Figure 6. Clark Fork River Class 3 streambank with visible tailings and appropriate deep, binding, woody vegetation.....	12
Figure 7. Clark Fork River slickens area (exposed tailings).....	14
Figure 8. Clark Fork River slickens (exposed tailings) surrounded by pioneer species such as tufted hairgrass ( <i>Deschampsia cespitosa</i> ) and redtop ( <i>Agrostis stolonifera</i> ) .....	15
Figure 9. Clark Fork River slickens (exposed tailings) showing metals salts on the soil surface following a dry period. ....	15
Figure 10. Clark Fork River slickens area (exposed tailings) showing extensive areas of metal salts along with less than 25 percent vegetative canopy cover .....	16
Figure 11. Clark Fork River slickens area (exposed tailings) showing some metal salts, less than 25 percent vegetative cover, and tufted hairgrass ( <i>Deschampsia cespitosa</i> ) along the perimeter .....	16
Figure 12. Example of a Clark Fork River impacted soils and vegetation area. ....	17
Figure 13. Example of a Clark Fork River impacted soils and vegetation area in foreground surrounded by a stand of water birch ( <i>Betula occidentalis</i> ) and willows .....	18
Figure 14. Example of a Clark Fork River slightly impacted soils and vegetation area used as a cattle pasture .....	19
Figure 15. Hay meadow containing a Clark Fork River slightly impacted soils and vegetation area .....	19
Figure 16. Generalized key for categorizing CFR RipES polygons.....	20

Figure 17. Polygon characterization within the historic 100-year floodplain ..... 21

Figure 18. CFR RipES polygon characterization for streambank and riparian  
corridor buffer polygons ..... 22

**APPENDICES**

Appendix A: Notes on unusual aspects of the presence of tufted hairgrass  
(*Deschampsia cespitosa*) in the Upper Clark Fork River Valley ..... 38

Appendix B: Logic matrix (dichotomous key) for deciding when to remove  
or keep a preferred woody plant..... 42

Appendix C: CFR RipES Field Form for Streambank and Riparian Corridor  
Buffer polygons..... 45

Appendix D: CFR RipES Field Form for Slickens (exposed tailings polygons)..... 46

Appendix E: CFR RipES Field Form for Impacted Soils and Vegetation Areas  
polygons and Slightly Impacted Soils and Vegetation Areas polygons..... 47

BOI041100002.DOC

## PREFACE

The Clark Fork River Riparian Evaluation System (CFR RipES) is a decision-making tool, that allows the *Record of Decision* requirements to be implemented on a site-specific, refined, and definitive basis. The purpose of CFR RipES is to provide a data predicated design tool to identify and categorize polygons (delineated areas of land) based on landscape stability, contamination severity, and plant community attributes within the Clark Fork River OU.

CFR RipES was first described in a draft document in December of 2000 (RRU and RWRP). At the time of writing, several remedial alternatives were under consideration as eventually described in the *Feasibility Study* (ARCO 2002) for the CFR OU. Since December of 2000, the *Feasibility Study* was completed, the *Proposed Plan* (EPA 2002) describing the preferred cleanup strategy has been distributed for public comment.

An iterative process of successive drafts since 2000 of CFR RipES have been made by the authors as they gained more understanding of the nuances of questions that it needed to answer, and of the physical complexities of contaminant distribution on the floodplain and the different ways these are ecologically expressed. Additional fieldwork was conducted in the fall of 2002, and in the spring of 2003, the CFR RipES was applied to multiple locations within the CFR OU to calibrate and validate the system. In late August of 2003, the CFR RipES system was field demonstrated to a group of people representing landowners, state and federal agencies, and representatives of environmental advocacy organizations. This document describes CFR RipES that is congruent with remedial action goals, objectives, and requirements specified in the *Record of Decision*.

This document integrates the streambank and riparian corridor buffer concept, sets standards for classification of streambanks (Class 1, 2, or 3) as a function of physical stability and phytotoxicity, defines slickens (exposed tailings), defines impacted soils and vegetation areas, and defines slightly impacted soils and vegetation areas. This document also integrates data and information generated during fieldwork in 2002 and 2003, as well as comments received from the people during the August 2003 field demonstrations. It is noted that scoring categories, point allocations, and discriminatory thresholds have been greatly modified from the December 2000 document. New decision matrices have also been developed to reflect the remedy as described in the CFR OU *Record of Decision*.

## INTRODUCTION

### **Brief Site Background**

Mining for gold, silver, and especially copper began in the late 19th Century in the Butte-Silver Bow Creek area. Milling and smelting of these ores produced vast wealth and concurrently a variety of wastes including mine and process waters and contaminated tailings that were released into Silver Bow Creek. These wastes contained elevated levels of several metals and arsenic, as well as the acid producing mineral pyrite. These wastes were fluvially transported downstream and into the Clark Fork River. Transport rates varied depending on flow conditions caused by precipitation patterns. Large flood events, particularly in 1908, distributed the metal bearing wastes along the entire Upper Clark Fork River floodplain. Sedimentation ponds constructed at Warm Springs in 1918 and 1959 altered the amount and type of wastes reaching the Upper Clark Fork River. Contaminated tailings and sediments reaching the river after construction of the ponds were due to fluvial redistribution of deposited wastes in the river, contributions from other tributaries, and from occasional overflows and failures at the ponds. Mining wastes from the Old Works Smelters in Anaconda were also transported via Warm Springs Creek and other creeks into the Upper Clark Fork River.

In addition to fluvial deposition of contaminated tailings within the historic 100-year floodplain, agricultural fields were irrigated with water from the Clark Fork River that at times contained enriched concentrations of metals in the dissolved form and as suspended sediment. In some instances irrigation ditches overflowed or were breached, flooding fields down gradient of the ditches with river water. Soils in these irrigated fields now contain elevated concentrations of metals and arsenic resulting from these historic irrigation practices. The irrigated fields are located on terraces above the influence of metals and arsenic impacts associated with flood deposition, thus the mechanism of contaminant transport is fundamentally different for irrigated fields compared to impacted areas within the floodplain.

### **Brief Site History**

The Clark Fork River Operable Unit (CFR OU) of the Milltown Reservoir/Clark Fork River Superfund Site was placed on the National Priorities List in 1984. The CFR OU is defined as "surface water, bed sediments, tailings, impacted soils, ground water, aquatic resources, terrestrial resources, irrigation ditches and related tailings deposits, and air located within and adjacent to the historic 100-year floodplain of the Clark Fork River" (EPA 1995). The CFR OU extends from the confluence of the old Silver Bow Creek channel and the re-constructed Mill-Willow Bypass some 120 miles to the upstream end of the Milltown Reservoir Operable Unit. A Remedial Investigation defining the nature and extent of contamination was completed (ARCO 1998). This investigation summarized the results of numerous existing environmental studies of impacted media and collected additional data to evaluate risk to human health and the environment and to develop and evaluate remedial alternatives. The Remedial Investigation process also included Treatability Studies designed to evaluate some potential alternatives, and both Human (EPA 1998a, addendum by Syracuse [2001]) and Ecological (EPA 1999, EPA 2001a) Risk Assessments to quantify threats to human health and environmental receptors. Studies addressing geomorphic stability and mass balance loading were also done (ARCO 2000a). A *Feasibility Study* (ARCO 2002) describing and evaluating remedial alternatives was prepared, and EPA issued a *Proposed Plan* describing the preferred alternative in August 2002. A *Record of Decision* defining the selected remedy for the CFR OU is being published by EPA, which this CFR RipES document accompanies.

## **Remedial Investigation**

The EPA released for general distribution the Clark Fork River *Remedial Investigation* Final Draft Report in August 1998 (ARCO). This report characterized the nature and extent of contamination within the OU. The *Remedial Investigation* contains a description of the site conceptual model; characterization of soil/tailings, groundwater and surface water, streambed sediments, and biological resources; and fate and transport of contaminants from sources to receptors.

## **Feasibility Study**

The Public Review Draft *Feasibility Study* Report was prepared by ARCO Environmental Remediation Limited (AERL) and submitted to EPA in March 2002. This document used data and information from the *Remedial Investigation* and the *Human Health Risk Assessment* and the *Ecological Risk Assessment* to identify, screen, and evaluate remedial alternatives that will reduce or eliminate environmental and human health risks. Eight primary alternatives and ancillary sub-alternatives were evaluated in detail. These analyses addressed how each alternative meets the following CERCLA criteria: overall protection of human health and the environment; compliance with applicable or relevant and appropriate requirements; long term effectiveness and permanence; short term effectiveness; cost; reduction of toxicity, mobility and volume through treatment; implementability; State (Montana) acceptance; and community acceptance.

## **Record of Decision for the Clark Fork River Operable Unit**

The *Record of Decision* (EPA 2004) presents the selected remedy, which is described there in Part 2, Sections 13.2 and 13.3. The role and function of this CFR RipES tool, which is being issued as a companion document to the *Record of Decision*, is described in Section 13.6.1 of Part 2 the *Record of Decision*. The *Record of Decision* recognizes CFR RipES as the design tool for identifying and categorizing areas for remedial action.

The *Record of Decision* identifies five main categories of area for remedial action and the general priority and preference for the type of action to be implemented in each. A sixth category called "slightly impacted soils and vegetation areas" is added; thereby accounting for all of the land within the historic 100-year floodplain, since tailings contamination is found throughout the historic 100-year floodplain. These areas (defined in the *Record of Decision* and later in the document) are:

### **Streambank and Riparian Corridor Buffer**

- Class 1 Streambanks
- Class 2 Streambanks
- Class 3 Streambanks

### **Historic 100-Year Floodplain Contaminated Soils**

- Slickens (exposed tailings)
- Impacted Soils and Vegetation Areas
- Slightly Impacted Soils and Vegetation Areas

## **CLARK FORK RIVER RIPARIAN EVALUATION SYSTEM (CFR RipES)**

### **Purpose**

Scientists from the Riparian and Wetland Research Program (University of Montana) and the Reclamation Research Unit (Montana State University) initially developed a riparian evaluation system (RipES) for the CFR OU (RRU and RWRP 2000).

CFR RipES is a tool that allows the *Record of Decision* requirements to be implemented on a site specific, refined, and definitive basis. The purpose of CFR RipES is to provide a data predicated decision tool to identify and categorize polygons (delineated areas of land) based on landscape stability, contamination severity, and plant community attributes within the CFR OU. CFR RipES will make classifications and determine actions consistent with the standards set forth in the *Record of Decision*. The system contains the following elements:

- Definitions and scoring for three types of soils polygons and three types of streambank and riparian corridor buffer polygons;
- A 100 percent accounting of all areas in the historic 100-year floodplain within the CFR OU among the three types of soil polygons in Reach A and portions of Reach B;
- Numerical components with threshold scores that distinguish the severity of contamination of the floodplain soils, and thresholds that separate streambank riparian corridor buffer polygons into three classes; and
- A process for identification of data and information required to complete remedial designs for each polygon.

The numerical portion of the system is based upon the Land Reclamation Evaluation System (LRES) developed for the Anaconda Smelter NPL Site (EPA 1998b, CDM and RRU 1999, and ARCO 2000b), and the Riparian and Wetland Health Assessment protocols (Hansen and others 2000), which are used extensively in the western United States and Canada. The health assessment protocols (Hansen and others 2000), upon which the numerical evaluation of the ecological aspect of CFR RipES is based, were initiated in 1986 in a series of iterative steps wherein inter-disciplinary teams of natural resource professionals and scientists collaborated using the Delphi Method or Expert Opinion Method (Delbecq and others 1975, Schuster and others 1985) to write, field-test, and refine the protocols.

After the CFR RipES concept and initial format was officially accepted, a formalized and systematic field test and statistical analysis of it was conducted to finalize the design and prove the effectiveness and utility in practice. The authors wrote and received EPA approval of a Sampling and Analysis Plan in early 2003 (RRU and BRI 2003a) and conducted field sampling and testing during the summer of 2003. This further sampling and testing allowed adjustment of the formats, question item weighting, and discriminatory thresholds to achieve optimum differentiation among the pertinent types of streambank and soil polygon. Subsequent statistical analysis shows the tool to be useful and effective, as intended (RRU and BRI 2003b).

This document describes the CFR RipES system in relation to the CERCLA RD/RA process and the CERCLA RD/RA process. It builds on the initial RipES document (RRU and RWRP 2000) and integrates the thinking and rationale supporting the selected remedy as stated in the *Record of Decision*. CFR RipES will also be used to evaluate land reclamation designs, evaluate post-action effectiveness, and in monitoring and maintenance programs for reclaimed areas.

### **Data Quality Objectives**

A Sampling and Analysis Plan was prepared to guide the validation of the CFR RipES system (RRU and BRI 2003a). As part of the Plan, the Data Quality Objectives process was integrated. This process provides a systematic planning tool based on the scientific method (APHA 1998). The process documents the criteria for defensible decision-making before an environmental data collection activity begins. The DQO process specifies project decisions, the data quality required to support those decisions, specific data types needed, data collection requirements, and analytical techniques necessary to generate the specified data quality. The process also ensures that the resources required to generate

the data are justified. The DQO process (EPA 1994) consists of seven steps of which the output from each step influences the choices that will be made later in the process. These steps include:

- State the problem;
- Identify decisions and actions;
- Identify inputs;
- Identify spatial and temporal limits;
- Develop a decision rule;
- Specify limits on decision errors; and
- Optimize design for collection.

*Step 1. State the Problem*—The problem was to devise a systematic way to identify areas (polygons) within Reach A and limited portions of Reach B of the CFR OU that require remediation to address effects of contamination from mining and smelting wastes, and to place these areas (polygons) into categories that determine appropriate remedial action(s), all in a manner consistent with the CFR OU *Record of Decision*.

*Step 2. Identify the Decision*—During development of the CFR RipES several questions were identified that are to be answered in order to classify streambank polygons, exposed tailings areas, and impacted and slightly impacted soils and vegetation areas. These questions included:

- What information and data are required to characterize streambanks as Class 1, 2, or 3?
- What characteristics (chemical, physical, and biological) define slickens (exposed tailings)?
- What characteristics (chemical, physical, and biological) define impacted soils and vegetation areas?
- What characteristics (chemical, physical, and biological) define slightly impacted soils and vegetation areas?
- How should streambank stability and contamination severity be evaluated for streambank polygons?
- How should ecological dysfunction and contamination severity be evaluated for floodplain contaminated tailings/soils polygons?
- How will the system be calibrated so that categorization and classification effectively separate polygons with different levels of dysfunction?
- How are the CFR RipES threshold scores developed?
- How are data gaps identified for a site or polygon?
- What data and information are required on a polygon-by-polygon basis to support remedial design?

*Step 3. Identify the Inputs to the Decision*—Informational variables required to answer the major questions posed above are:

- **Streambank and riparian corridor buffer polygon**—In order to categorize streambanks the following information and data are required for a polygon: (1) percent of the polygon with live plant canopy cover other than tufted hairgrass, (2) the completeness of the canopy of live, deep-binding, woody species in the polygon, and (3) the percent of the streambank length in the polygon that exhibits active lateral cutting. The minimum mapping unit of these polygons is 20 linear feet of streambank with a maximum length of 500 ft. These parameters are assessed using the CFR RipES Field Form for Streambank and Riparian Corridor Buffer Polygons. Threshold scores discriminate streambanks into three categories (e.g., Class 1, 2, or 3 streambank).
- **Slickens (exposed tailings) polygon**—In order to identify an area as a slickens, the following information and data are required for a polygon: (1) percent of the polygon with live plant

canopy cover, (2) whether there is tufted hairgrass (*Deschampsia cespitosa*) present, (3) whether efflorescent metal salts are visible on the soil surface during dry periods. The minimum mapping unit for slickens polygons is 400 square feet. Areas smaller than 400 square feet that have slickens characteristics are included within impacted soils and vegetation area polygons.

- **Impacted soils and vegetation area and slightly impacted soils and vegetation area polygons** – In order to distinguish between an impacted soils and vegetation area and a slightly impacted soils and vegetation area, the following information and data are required for a polygon: (1) percent of the polygon with live plant canopy cover other than tufted hairgrass, (2) the amount of any tufted hairgrass present, (3) the percent of the area that is bare ground caused by tailings, (4) the depth and concentration of contamination, (5) the depth integrated soil pH, and (6) whether efflorescent metal salts are visible on the soil surface during dry periods. These parameters are assessed using the CFR RipES Data Form for Impacted Soils Area Polygons and for Slightly Impacted Soils Area Polygons. A threshold score discriminates polygons into the two categories. The minimum mapping unit for these polygons is 400 square feet.
- **Additional quantitative environmental data** – Additional data on a polygon-by-polygon basis will be required. One of the main data gaps identified is the lack of contamination severity information, specifically concentrations of the COCs (copper is used as a surrogate for all COCs), depth of contamination, depth to groundwater, and pH of the materials. Filling these data gaps will be necessary so that preliminary remedial actions can be assigned to a polygon. Additional data to support remedial design include acid base account, nutrient status of the newly constructed root zone, quality and quantity of imported materials, and others. See Part 2, Section 13.6, 13.7, and 13.8 of the *Record of Decision*.

**Step 4. Define the Study Boundaries** – Spatial boundaries of the CFR RipES evaluation encompass Reach A and limited portions of Reach B of the CFR OU. The temporal boundaries of the CFR RipES process begin with field use of the system and end when remedial designs are approved by the agencies.

**Step 5. Develop a Decision Rule** – The parameters of interest are those parameters scored during the field data collection. CFR RipES threshold levels were determined during the late 2002 field season and the summer of 2003, as the system was validated and calibrated. Validation of the threshold levels was made during the summer of 2003 and adjustments were made. Threshold scores are used to distinguish streambank categories or classes, and to identify impacted soils and vegetation sites that require remedial action and slightly impacted soils and vegetation areas that receive no action (or only monitoring). Areas with extensive exposed tailings (e.g., slickens) will all require remedial action, and therefore are not further categorized by a threshold score.

The scoring protocols will be used to categorize each polygon. In general, the lower the site score, the higher the intensity of action that may be required. There will be target levels (cutoffs) for different remedial action intensities, but the type of remedial action required on a specific polygon will ultimately be determined during the remedial design phase of the CERCLA process. Field and analytical information collected during the CFR RipES process will be vital in making design decisions. The CFR RipES score and supplemental descriptive information will be used during design, in concert with other design considerations (refer to Section 13.6.1.1 of the *Record of Decision*).

**Step 6. Specify Tolerable Limits on Decision Errors** – Tolerable limits on decision errors are built into the CFR RipES system. Most parameters scored on the field scoring system forms include a range for the parameter measured. For example, less than 25 percent canopy cover, or a range of contamination

levels in the soil profile. These ranges are meant to envelop the limits on the decision errors made by field personnel and specify the tolerable limits on field decision errors.

The point system was designed with a lack of flexibility in order to increase scoring precision (i.e. repeatability) by limiting the effect of variability among observers. Although there is a range of values for each category of some parameters, the field observer must assign that range only one score. Intermediate values within the ranges do not translate to an intermediate score. This limitation of choices minimizes inter-observer variability.

Spatial heterogeneity in terms of contamination levels as well as the expressions of phytotoxicity within vegetation communities is apparent along the Clark Fork River. It is the goal of the CFR RipES system to be able to precisely and accurately score polygons in Reach A of the Clark Fork River. Precision is the ability of trained and experienced field personnel to repeatedly score a polygon with a variation in the overall score of less than  $\pm 5$  percent at the threshold value(s). The goal for bias is also  $\pm 5$  percent at the threshold value(s). Accuracy of arsenic and copper determinations will be determined by analyzing standard reference materials, field replicates, and field blanks inserted into the sample queue at a five percent rate.

**Step 7. Optimize the Design**—The data collection design specified in the field scoring was optimized during the field validation and calibration portion of this work in the late fall of 2002 and summer of 2003. One aspect of CFR RipES that optimizes the design is its capability for incorporating new analytical data into the scoring system as such data become available. The system utilizes previously collected data in the evaluation process to eliminate redundancy of data collection. Finally, the system increases field worker efficiency with the pre-assessment preparation. This preparation part of the system gives field personnel available information, pertinent to the field survey, on and attached to aerial photographs of sites for CFR RipES evaluation (refer to Section 13.6.1.1 of the *Record of Decision*).

### **Data Measurement Objectives**

The field Quality Assurance program was designed in accordance with EPA's Guidance for the Data Quality Objectives Process (EPA 1994, 1998c).

Precision, accuracy, representativeness, completeness, and comparability (PARCC) parameters are indicators of data quality. PARCC goals were established for the calibration and validation of the CFR RipES system as part of the Sampling and Analysis Plan (RRU and BRI 2003a). The Data Summary Report (RRU and BRI 2003b) provides detailed results of the following QA/QC assessments:

**Precision**—Field duplicate samples, for the determination of pH and total copper and arsenic, were collected to provide a measure of the contribution to overall variability of field-related sources. Contribution of laboratory-related sources to overall variability is measured through various laboratory Quality Control samples, specifically XRF laboratory duplicates and laboratory splits. The acceptable RPD limits for field duplicates are less than 35 percent for soil. Chemical analytical data were validated for precision using field duplicates, and laboratory duplicates and splits. Acceptance windows for XRF precision are functions of both the analyte and the concentration. These are defined in the XRF LAP document (Ashe 1995). See Data Summary Report (RRU and BRI 2003b) for results.

**Accuracy**—Accuracy is the degree of agreement of a measurement with an accepted reference or true value, and is a measure of the bias in a system. Accuracy of this program was based on the results of National Institute of Standards and Technology Standard Reference Material samples inserted into the sample stream at the rate of 5 percent. Laboratory accuracy was based on the results of LCS analysis.

The detection limits specified in the XRF LAP (Ashe 1995) were sufficient to meet the needs of this project for each element (copper and arsenic) of interest. Refer to the Sampling and Analysis Plan and the Data Summary Report (RRU and BRI 2003a, 2003b).

**Representativeness** – This parameter was achieved through: a) careful, informed selection of sampling sites within each polygon, b) selection of testing parameters and methods that adequately define and characterize the extent of possible contamination and meet the required parameter reporting limits, c) proper gathering and handling of samples to avoid interference and prevent contamination and loss, and d) collection of a sufficient number of samples to allow for polygon characterization. It is acknowledged that defining the spatial distribution of the contaminants within a CFR RipES polygon is a very difficult task. The intent of the CFR RipES system validation sampling and analysis effort was to gain some additional conceptual understanding of the depth of contamination and the horizontal variation. These data will be most useful in determining sampling schemes that might be used during full-scale remedial design.

**Completeness** – Completeness is a measure of the amount of usable data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions. Those data that are validated and need no qualification (CFR Enforcement Quality Data), or are qualified as estimated data (CFR Screening Quality Data), are considered usable. Rejected data are not considered usable. Completeness was calculated following data evaluation (refer to Data Summary Report (RRU and BRI 2003b)). For the validation of CFR RipES, the completeness goal of 90 percent was exceeded for total copper and arsenic, as well as field pH determinations. The goal for XRF copper and arsenic data is enforcement quality data was also met (RRU and BRI 2003b).

**Comparability** – Consistency in the acquisition, handling, and analysis of samples is necessary for comparing results. Where appropriate, the results of analyses obtained can be compared with the results obtained in previous CFR Remedial Investigation studies. Standard US EPA analytical methods and QC, as well as those specified in the CFR SSI documents were used to ensure comparability of results with other analyses performed in a similar manner.

The Data Quality Assessments process (EPA 1998c) was used to evaluate the generated data in terms of meeting the stated Data Quality Objectives and in terms of meeting the measurement goals for accuracy, precision, representativeness, completeness, and comparability (refer to Data Summary Report).

### **CFR RipES Structure**

Areas within the Upper Clark Fork River floodplain are classified for purposes of determining specific remedial actions based on landscape stability, contamination, and plant community dysfunction. Of first concern are those areas most in jeopardy of being eroded into the river channel. The CFR OU is divided into smaller units of land, called *polygons*, delineated and classified as candidates for the various kinds of remediation as described in the *Record of Decision*.

Four major types of site are defined below for the purpose of identifying areas for the various remedial actions:

1. Streambank and riparian corridor buffer;
2. Slicken areas (exposed tailings);
3. Impacted soils and vegetation areas; and
4. Slightly impacted soils and vegetation areas.

Other miscellaneous site types are also identified (i.e., irrigation ditches, contaminated upland areas, tributary streams, etc.). Remedial actions for these miscellaneous site types are discussed in Part 2, Section 13.6.1 of the *Record of Decision*. Characteristics of the major types of sites and remedial actions for each type are provided below.

### **Streambank and Riparian Corridor Buffer**

The streambank and riparian corridor buffer is a zone of approximately 50 feet in width on each side of the river that may vary in width, depending on site specific conditions. For example, a severely eroding outer streambank may require more than 50 feet while on inside banks with point bars and along straight reaches of the stream where the erosive forces are minimal, the corridor may be less.

The streambank and riparian corridor buffer is delineated by measuring from the “bankfull” stage on each side of the stream out a flexible or variable distance (see preceding paragraph) *OR* where the historic 100-year floodplain elevation is reached. In other words, areas outside the historic 100-year floodplain are not included in the streambank and riparian corridor buffer. In cases where high banks are reached, the buffer will be narrower. Bankfull flow for the Clark Fork River at Deer Lodge has been calculated to be about 1,900 cfs (Griffin and Smith 2001). This equates to approximately a 7-year flood event. At this stage, the flow begins to spill out of the channel and disperse onto the floodplain.

The approximate 50 foot streambank and riparian corridor buffer zone on each side of the river will be broken into preliminary polygons based on live vegetative canopy cover, canopy cover of deep, binding, woody vegetation, and/or lengths of streambank erosion. The minimum mapping unit of these polygons is 20 linear feet of streambank with a maximum length of 500 feet. Polygon units will not cross land-ownership boundaries. These polygon units will be scored using the CFR RipES Field Form for Streambank and Riparian Corridor Buffer Polygons, thereby classifying streambanks into one of three categories designated as Class 1, 2, or 3 streambanks.

### **Streambank Categories**

***Class 1 streambanks*** – Phytotoxic conditions exist as demonstrated by an inability of the active channel areas to support and sustain significant amounts of woody and herbaceous vegetation. Streambanks are actively eroding and are significant contributors of contaminant release to the river (Fig. 1 and 2). Remedial actions for this class include removal of phytotoxic materials and revegetation with deep, binding, woody vegetation. These actions will be implemented from a line at the lateral extent of inundation at bankfull stage out to approximately 50 feet from that line. Specific actions at a Class 1 Streambank will be determined in accordance with *Record of Decision* specifications and after consideration of design factors. Design factors include: depth of removal (this is not necessarily the same as depth of contamination), depth to the water surface, depth to groundwater, current streambank stability, current vegetation status, infrastructure (bridges, culverts, etc.), surface drainage, future land use, BMPs, and others.

***Class 2 streambanks*** – These streambanks demonstrate some current woody and herbaceous vegetation, but are contaminated, unstable, and eroding (Fig. 3 and 4). Remedial actions for this class include supplemental revegetation and planting of deep, binding, woody vegetation. Reconfiguration of the streambanks may require minor removal or *in-situ* treatment. Design factors include current streambank stability, current vegetation status, infrastructure, surface drainage, future land use, BMPs, and others.

***Class 3 streambanks*** – These streambanks are contaminated but they may have varying amounts of deep, binding, woody vegetation holding the streambank in place (Fig. 5 and 6). Remedial actions

possible for these areas include no action or minor actions to enhance woody vegetation within the buffer corridor and/or BMPs. Design factors are: current vegetation status, current streambank stability, knowledge of underlying contamination, and current and future land use.

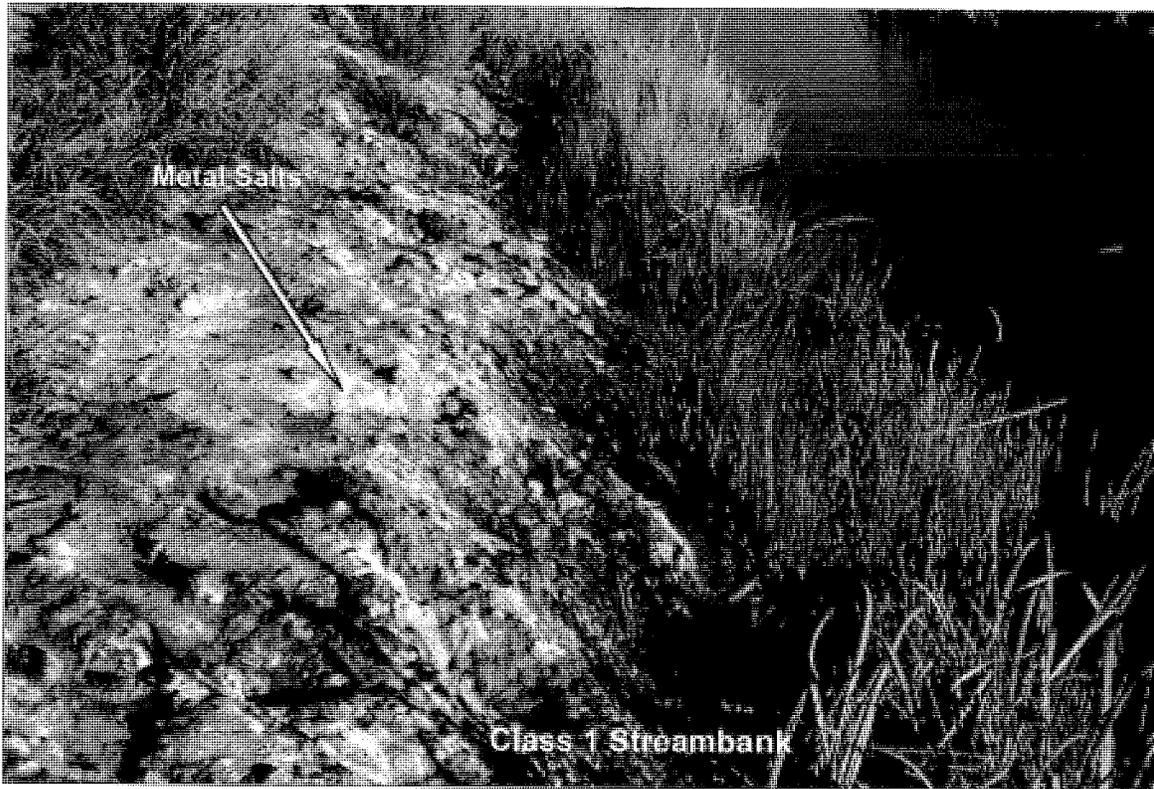


Figure 1. Typical Clark Fork River Class 1 streambank

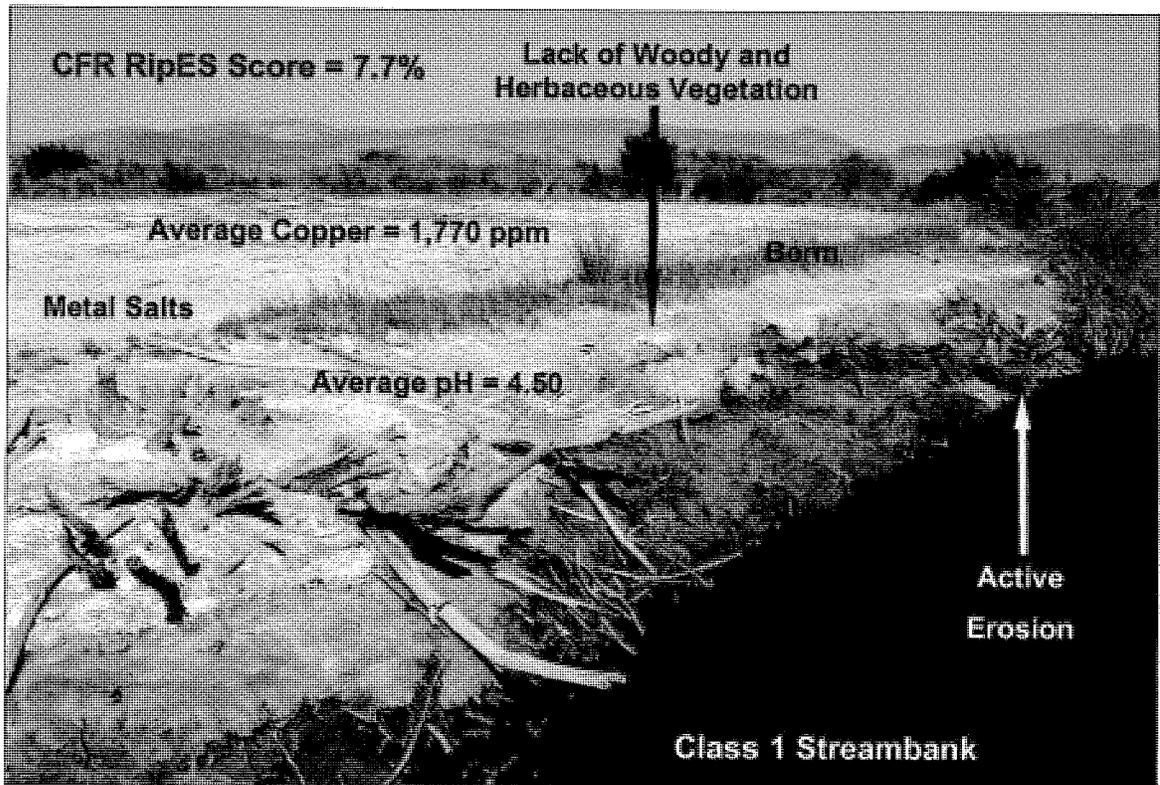


Figure 2. Clark Fork River Class 1 streambank adjacent to a slickens area (exposed tailings)



Figure 3. Typical Clark Fork River Class 2 streambank

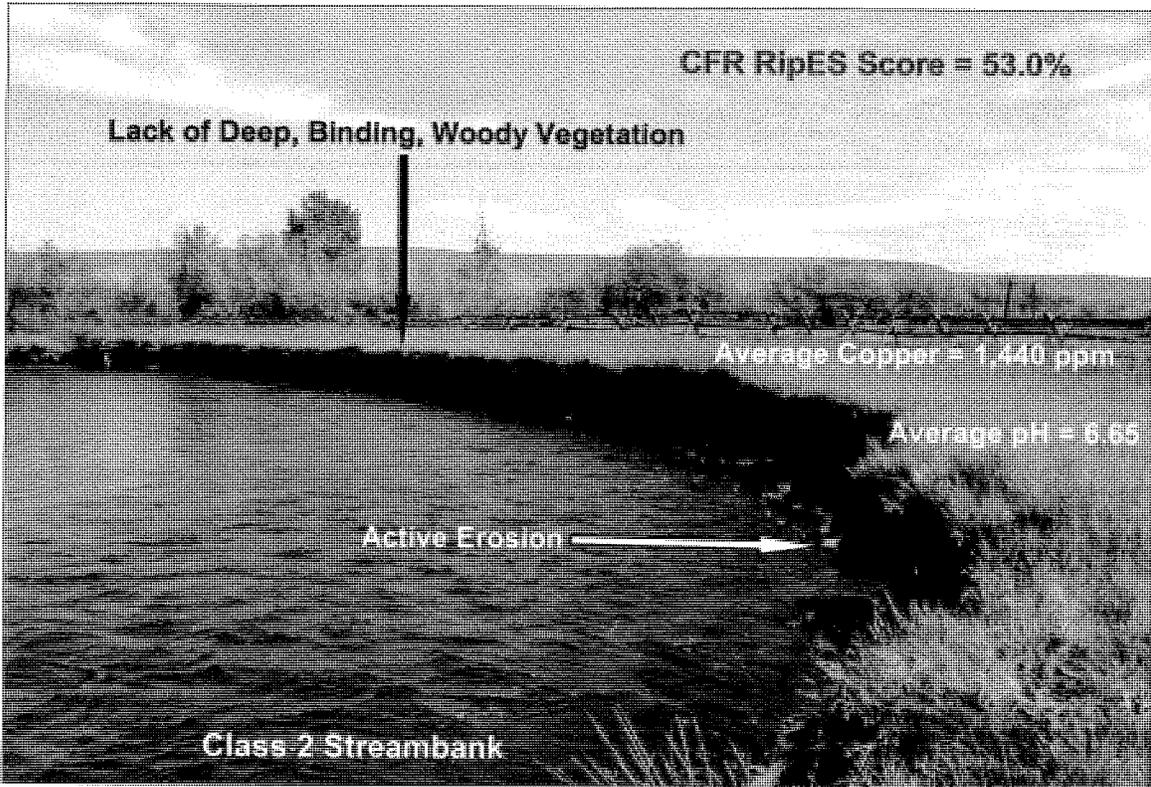


Figure 4. Highly eroding Clark Fork River Class 2 streambank

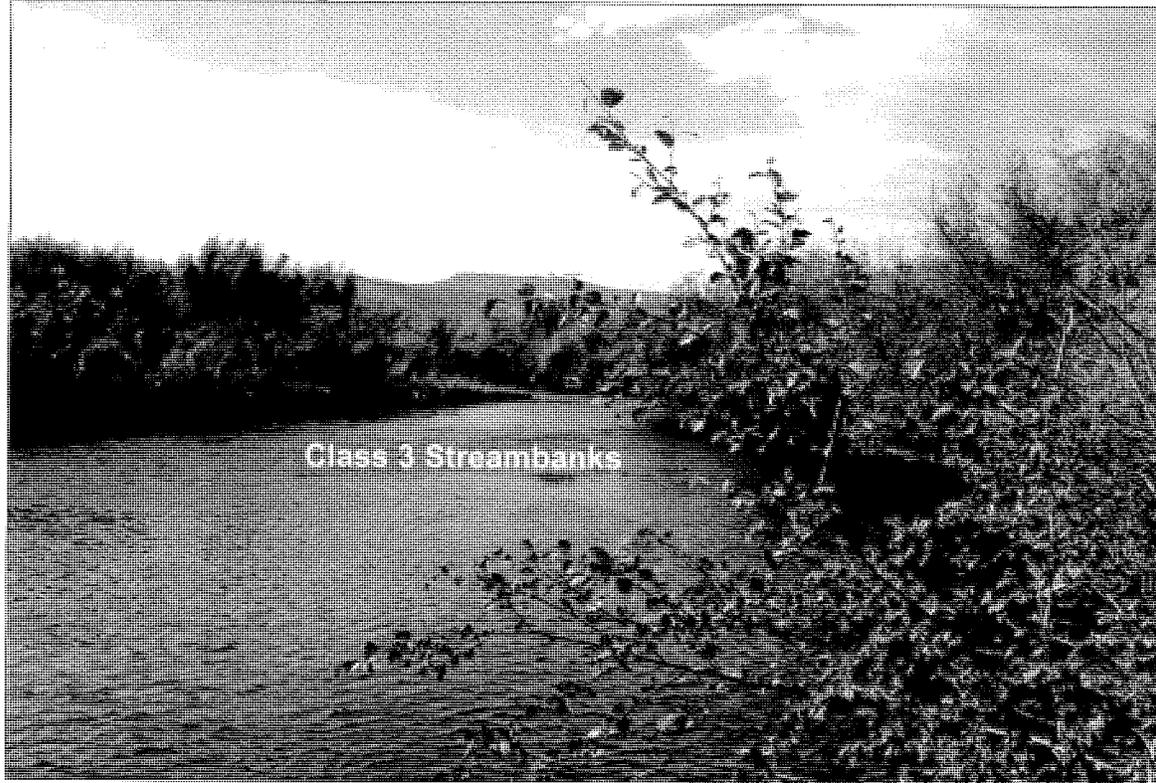


Figure 5. Well-vegetated, stable Clark Fork River Class 3 streambanks

CFR RipES Score = 100%

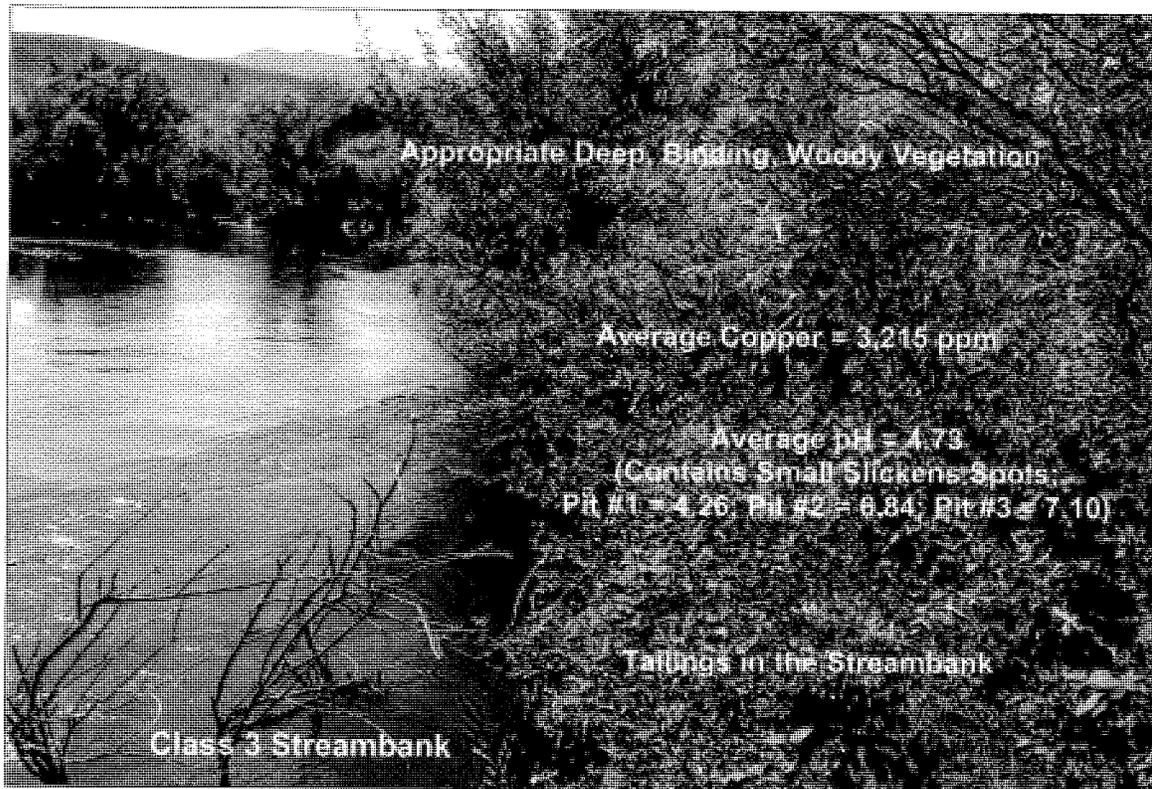


Figure 6. Clark Fork River Class 3 streambank with visible tailings and appropriate deep, binding, woody vegetation

### Special Cases

Streambank and riparian corridor buffer polygons will be delineated for evaluation and classification for appropriate remedial actions on sites beyond the main channel of the Clark Fork River within the OU. These are tributary streams and secondary channels of the Clark Fork River.

**Tributary streams**—Tributaries within the CFR OU (e.g., Lost Creek, Warm Springs Creek, Dutchman Creek, Racetrack Creek, Cottonwood Creek, and others) may have transported contaminants from other NPL sites in the basin, or may have been contaminated during depositional flood events from the Clark Fork River. Tributaries having perennial flow will be protected with a streambank buffer 25 feet wide within the CFR OU, unless this width extends outside the historic 100-year floodplain of the Clark Fork River.

**Secondary channels of the Clark Fork River**—Also of concern are secondary channels forming islands on the Clark Fork River floodplain. Secondary channels with perennial flow throughout their length and having connection to the main channel of the river at both ends will also be protected with a flexible or variable streambank and riparian corridor buffer of 25 ft, unless this width extends outside the historic 100-year floodplain of the Clark Fork River.

### Historic 100-Year Floodplain Contaminated Soils

Contaminated soils within the historic 100-year floodplain may consist of:

- Slickens (exposed tailings);
- Impacted soils and vegetation; and
- Slightly impacted soils and vegetation.

*Slickens (exposed tailings)* – These areas generally lack vegetation and present a principal waste in the Clark Fork River OU, along with Class 1 Streambanks. Estimated in the RI/FS at about 167 acres, but possibly up to 250 acres, in Reach A. These slickens areas are contamination-caused, mostly-bare ground. Scattered throughout Reach A, the areas number in the hundreds, are usually a fraction of an acre in size, and are too toxic to support most vegetation or soil organisms. These areas are usually easy to recognize. Remedial action for most of these areas is removal, except as described below. Removal of slickens areas adjacent to an active channel is part of the streambank remedial action.

Slickens (exposed tailings) (Fig. 7, 8, 9, 10, and 11), are characterized as follows:

1. Because of phytotoxic condition, these areas are generally devoid of vegetation, supporting less than 25 percent live plant canopy cover.
2. Tufted hairgrass (*Deschampsia cespitosa*) is present, if there is any live vegetation (See Appendix A for a discussion of the special indicator value of this species).
3. Efflorescent metal salts are visible on the soil surface during dry periods.

Slickens (exposed tailings) and underlying contaminated soil which meet these criteria will be removed, with a limited exception. For the exception to occur, all of the following criteria as defined by CFR RipES must be met:

- The slickens area is small - less than 400 square feet;
- The contamination is less than 2 feet deep;
- The contamination is widely dispersed or separated by vegetation;
- The contamination is contiguous with impacted soils and vegetation areas that will be treated in place; and
- The area is not too wet or otherwise unable to be treated effectively.

Slickens that are less than 400 square feet and less than 2 feet in depth and not too wet will be treated *in-situ* if they are next to or contained within an impacted soils and vegetation area that is designated to be treated *in-situ*. These small slickens within or next to areas to be treated *in-situ* will be removed if they are thicker than 2 feet or too wet to treat.

Isolated, small slickens areas (less than 400 square feet) that are not contiguous with impacted soils and vegetation areas will not be removed in most cases. These areas are too small to bring in removal equipment without significant destruction of the surrounding unimpacted areas. *In-situ* treatment will be done in these areas where practicable. These areas will also not be mapped under the CFR RipES protocols.

Often there will be areas of slickens interspersed with areas of woody vegetation. On sites that will receive remedial treatment by removal of contaminated soil or of *in-situ* treatment, some woody plants will necessarily be affected. The desired option is to leave as many as possible of certain “preferred woody plant species” in place that are already growing on the floodplain within the CFR OU. This will be accomplished by working around them whenever practicable and whenever the overall goals of the project can still be achieved by doing so. Woody vegetation patches within a large general area of slickens area can often be separated as smaller polygons of more healthy vegetation from the more severe slickens area polygons.

When a decision must be made whether to remove or keep a particular shrub or patch of shrubs in question, the dichotomous key provided in Appendix B will serve as the logical matrix.

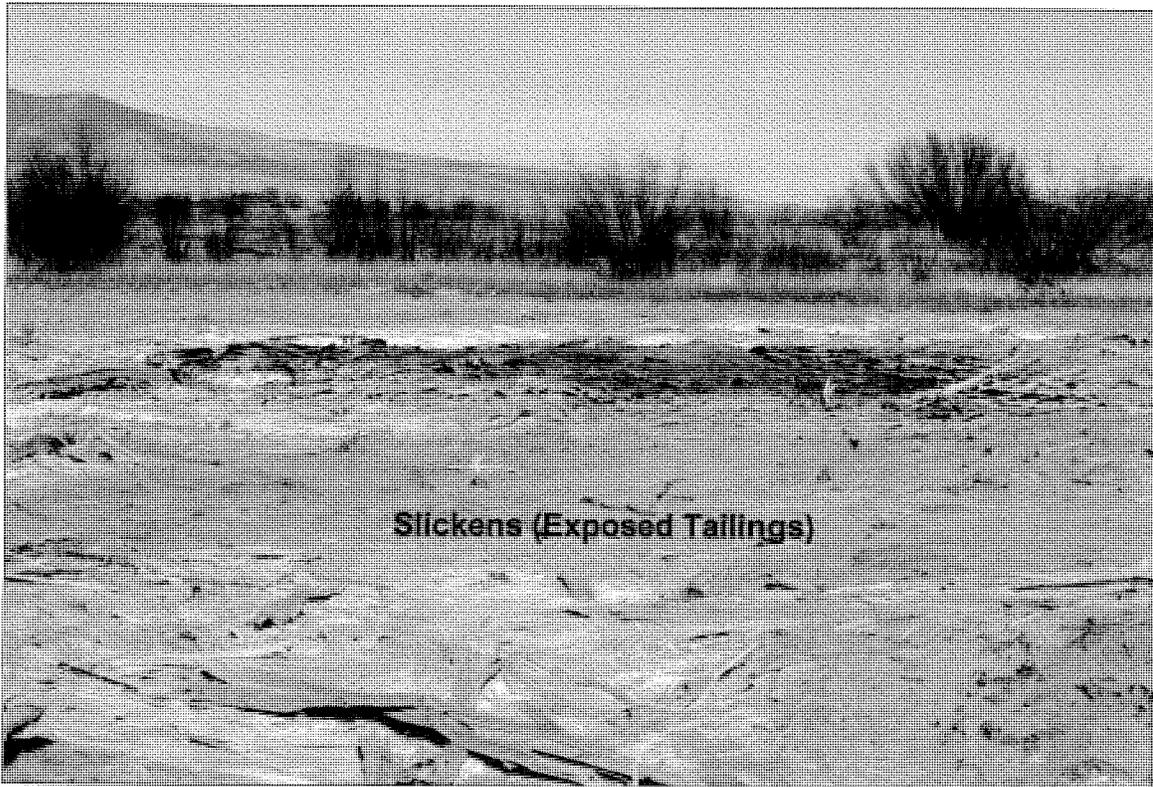


Figure 7. Clark Fork River slickens area (exposed tailings)

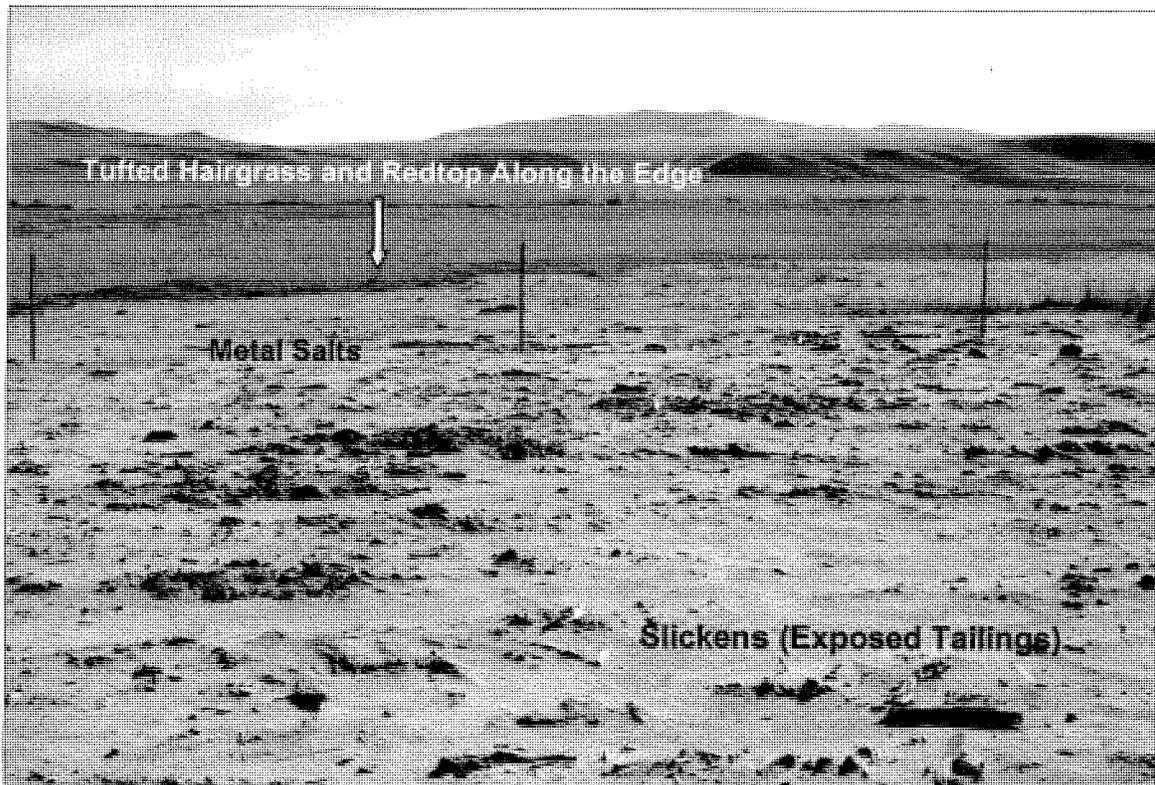


Figure 8. Clark Fork River slickens (exposed tailings) surrounded by pioneer species such as tufted hairgrass (*Deschampsia cespitosa*) and redtop (*Agrostis stolonifera*)

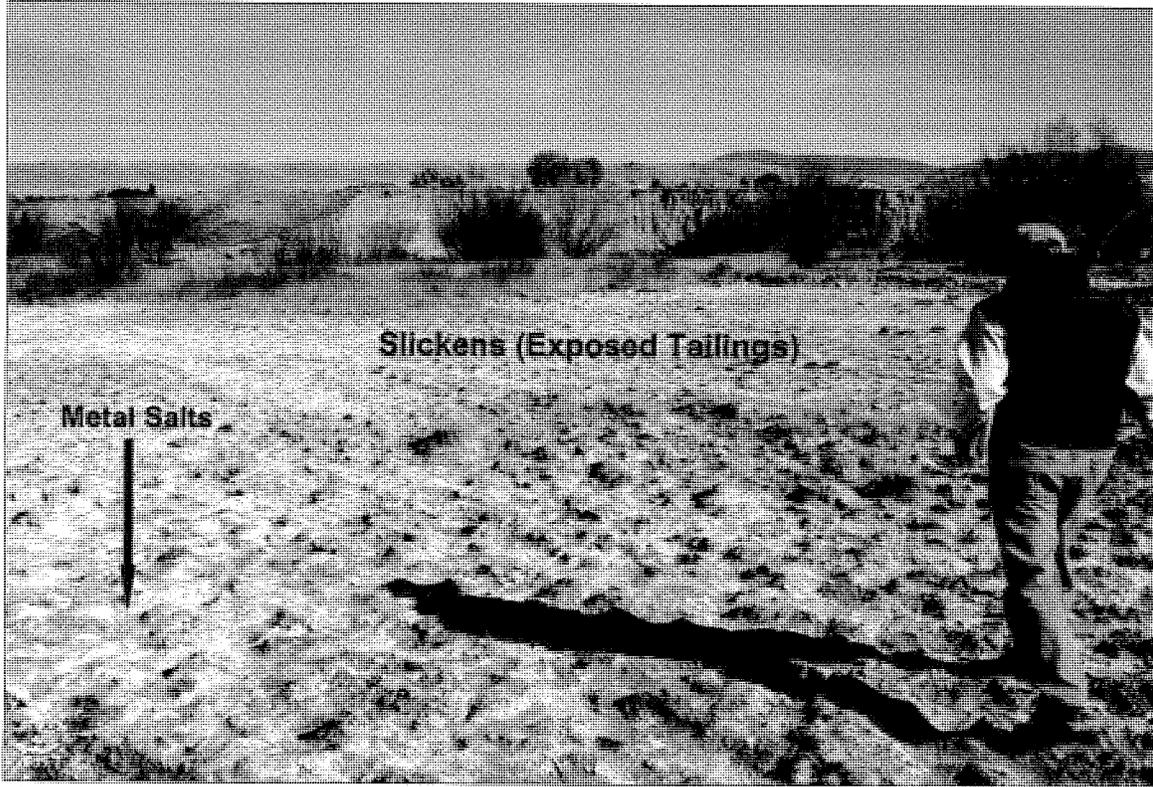


Figure 9. Clark Fork River slickens (exposed tailings) showing metal salts on the soil surface following a dry period

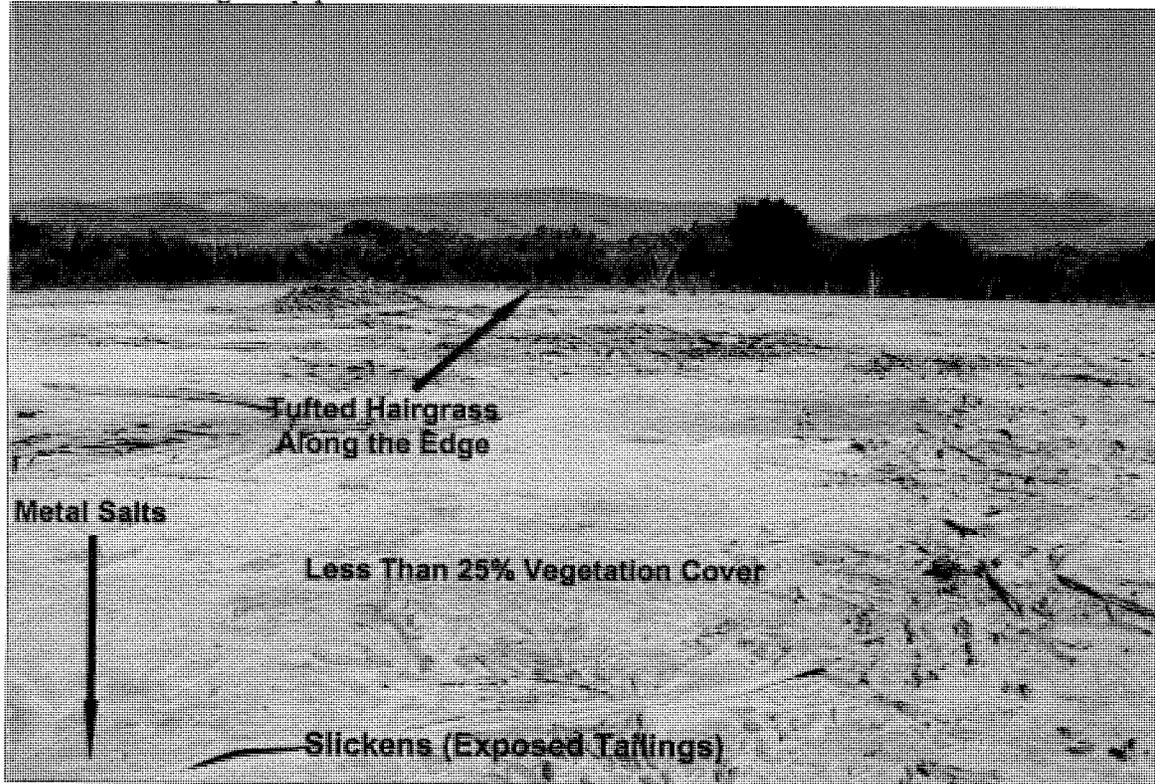
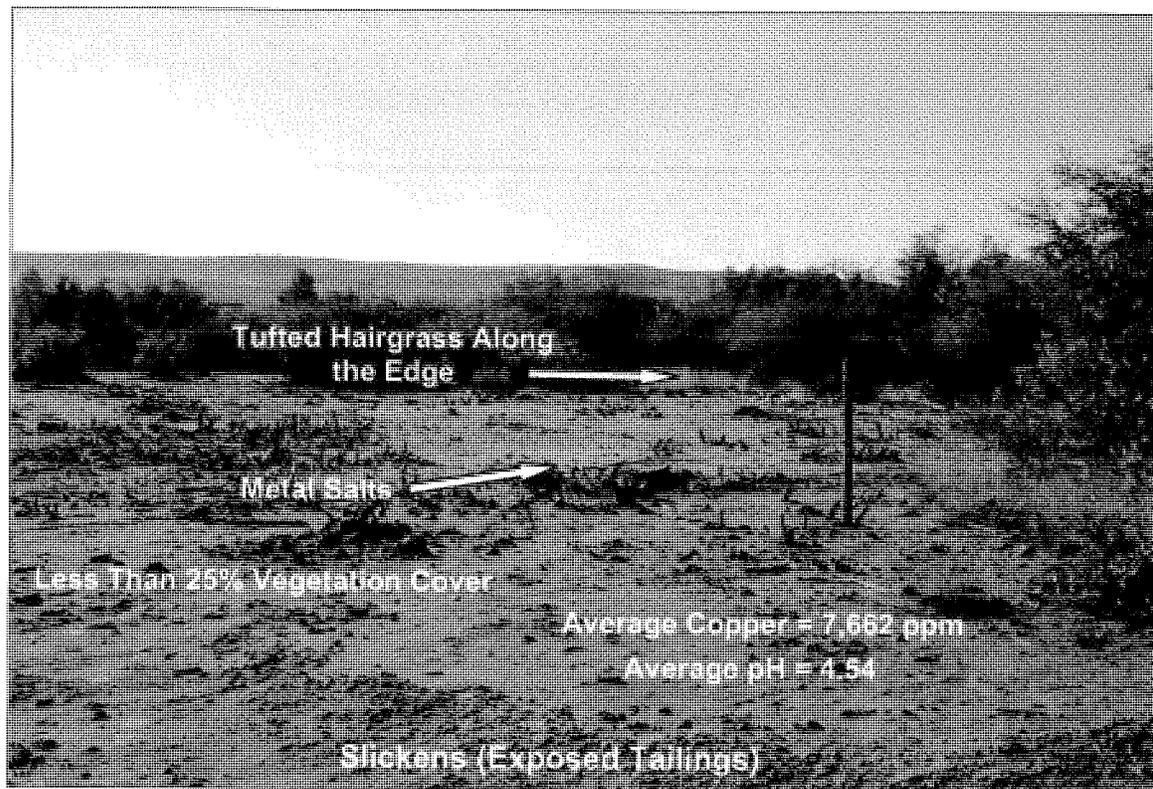


Figure 10. Clark Fork River slickens area (exposed tailings) showing extensive areas of metal salts along with less than 25 percent vegetative canopy cover



**Figure 11.** Clark Fork River slickens area (exposed tailings) showing some metal salts, less than 25 percent vegetative canopy cover, and tufted hairgrass (*Deschampsia cespitosa*) along the perimeter

**Impacted soils and vegetation areas** – These sparsely vegetated areas amount to everything between slickens and slightly impacted soils and vegetation areas (Fig. 12 and 13). Impacted soils and vegetation areas will generally be treated *in-situ*, unless the tailings and impacted soils in a given area extend more than 2 feet below ground surface. In that case, the tailings and impacted soils will be removed. Other impacted soils and vegetation areas that are too wet for implementation of *in-situ* treatment techniques will also be removed. Old river channels (oxbows) and wetlands will be evaluated using CFR RipES. If they have high quality vegetation and score 75 percent or more on CFR RipES, they will not be remediated. If they have impacted vegetation and soils, and the contaminated tailings and soils are deeper than 2 feet, or the soil is too wet; they will be removed and replaced in a manner that re-establishes a productive and healthy wetland. If the tailings and contaminated soils are less than 2 feet deep in an old oxbow channel, and it is not too wet, the area will be treated *in-situ*.

Impacted soils and vegetation areas are characterized as follows:

1. The degree of phytotoxicity in these areas is quite variable, but they do sustain at least 25 percent live plant canopy cover.
2. Tufted hairgrass (*Deschampsia cespitosa*) has greater than 1 percent canopy cover.
3. Efflorescent metal salts may be visible on the soil surface during dry periods.
4. Small, individual areas of exposed tailings (that appear as small slickens) may be present.
5. Concentrations of COCs within the soil profile exceed the geometric mean values for unimpacted soils for Reach A of the CFR OU. Copper is used as a surrogate for the COCs; soils with copper concentrations exceeding 300 ppm within the profile are considered impacted by mining-related activities.
6. The minimum polygon size is 400 square feet.

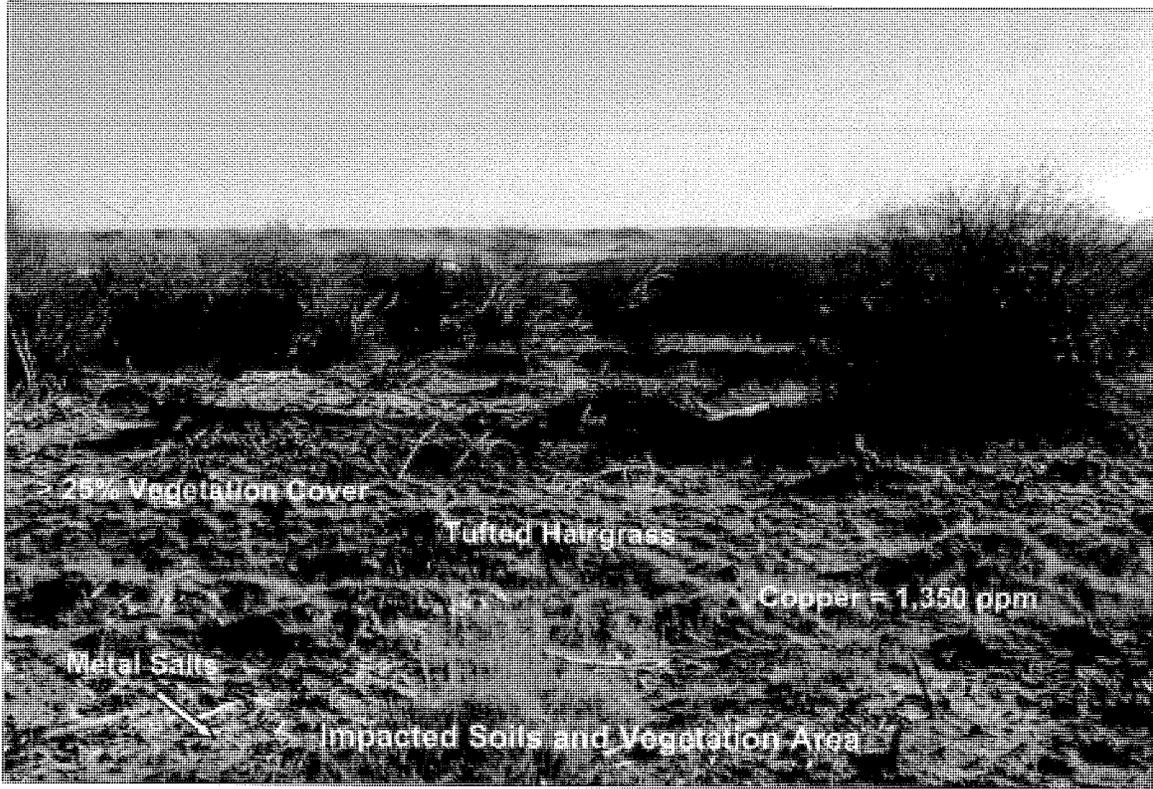


Figure 12. Example of a Clark Fork River impacted soils and vegetation area

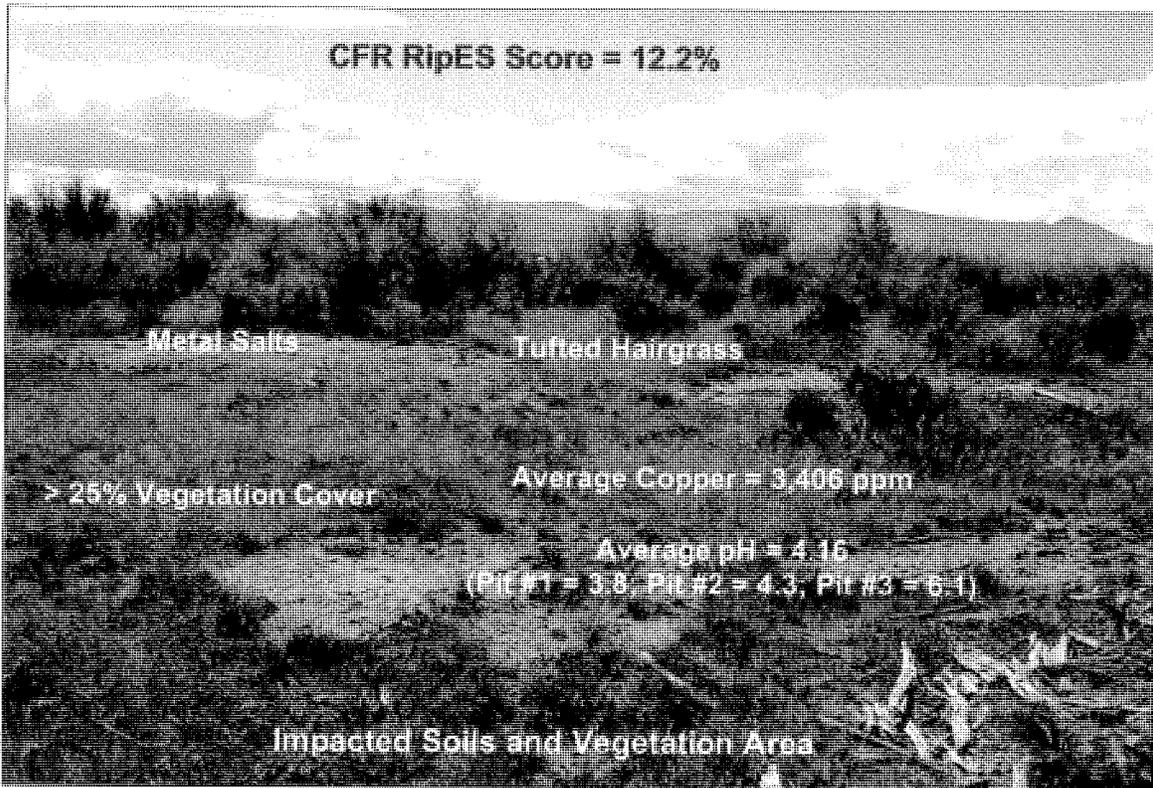
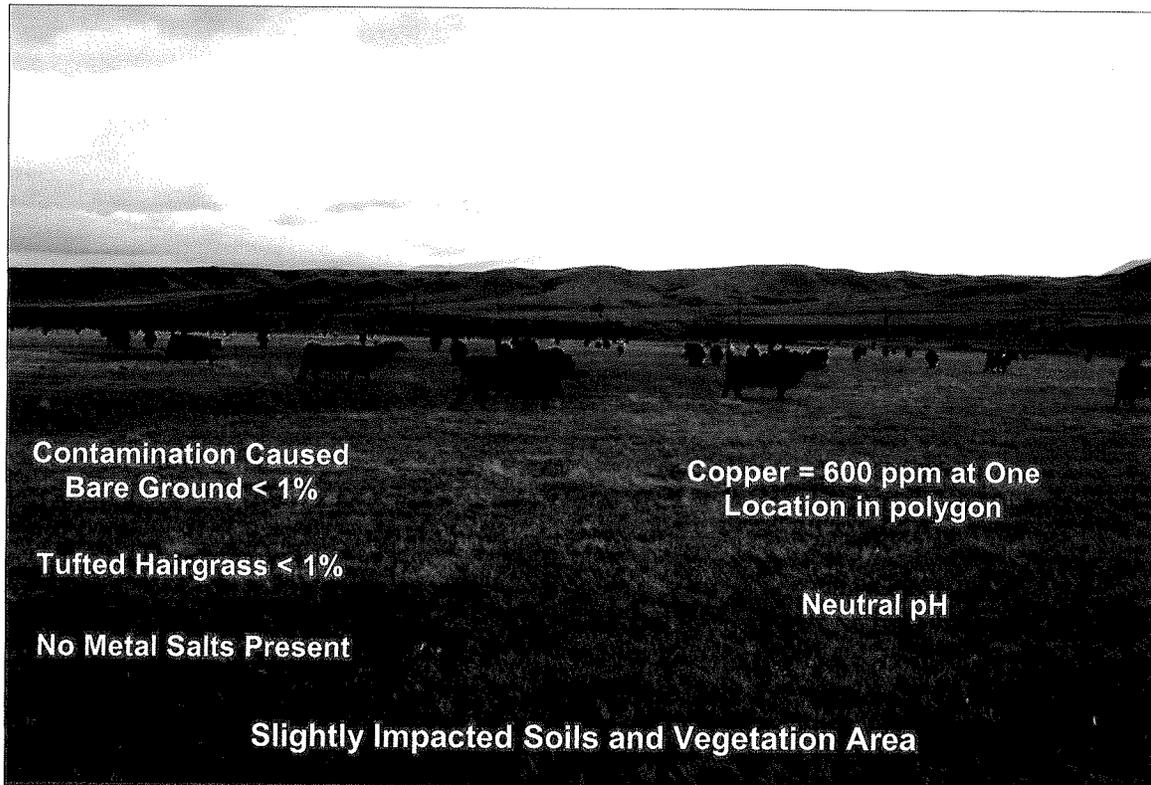


Figure 13. Example of a Clark Fork River impacted soils and vegetation area in foreground surrounded by a stand of water birch (*Betula occidentalis*) and willows

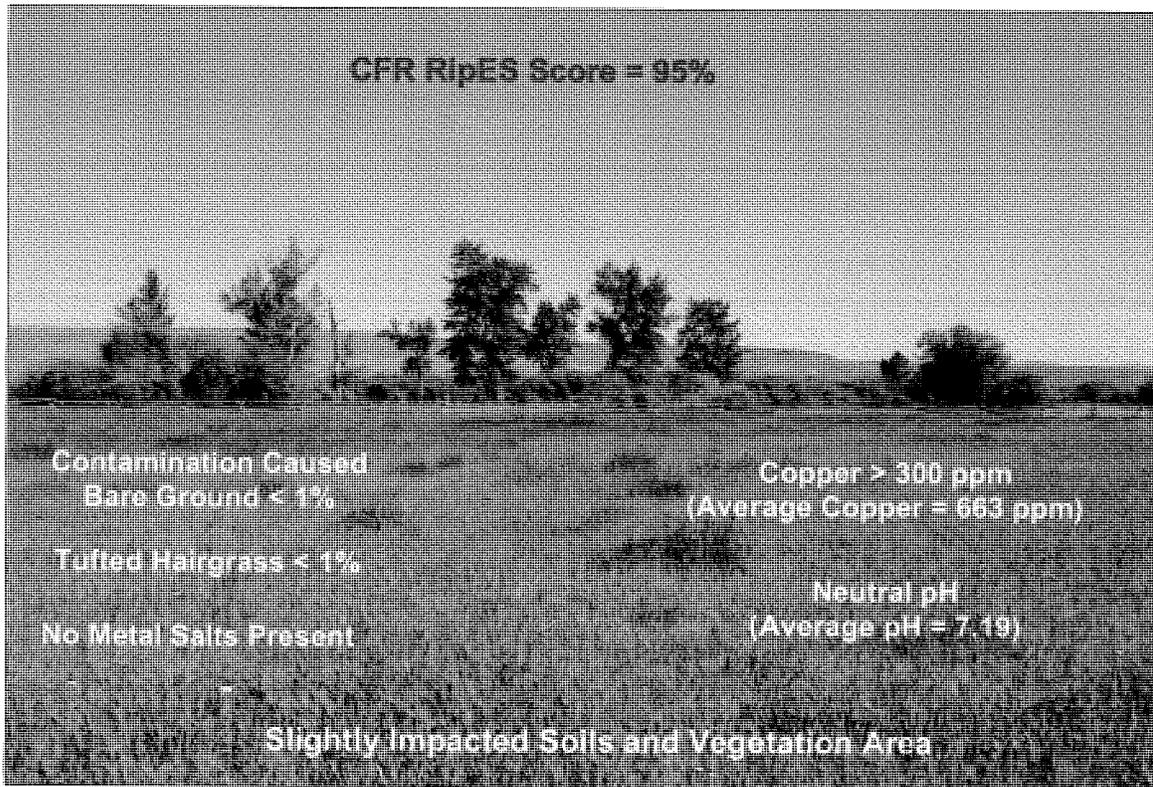
**Slightly impacted soils and vegetation areas** – These areas do not meet the characteristics or definitions of streambank and riparian corridor buffer, slickens (exposed tailings), or impacted soils and vegetation area. They are generally well vegetated and display no visible evidence of contamination from tailings, although the soil may contain copper contamination above 300 ppm (Fig. 14 and 15). Remedial actions for these areas are no action, or BMPs and ICs.

Slightly impacted soils and vegetation areas characterized as follows:

1. The area expresses no evidence of phytotoxicity and has less than 1 percent bare ground caused by contaminated tailings.
2. Tufted hairgrass (*Deschampsia cespitosa*) has less than 1 percent canopy cover.
3. No efflorescent metal salts are visible on the soil surface during dry periods.
4. Concentrations of COCs within the soil profile exceed the geometric mean values for unimpacted soils for Reach A of the CFR OU. Copper is used as a surrogate for the COCs; soils with copper concentrations exceeding 300 ppm within the profile are considered impacted by mining-related activities.



**Figure 14.** Example of a Clark Fork River slightly impacted soils and vegetation area used as a cattle pasture



**Figure 15.** Hay meadow containing a Clark Fork River slightly impacted soils and vegetation area

**CFR RipES Application**

The characterizations of contaminated soils above will account for the majority of land within the CFR OU that is to be considered for remedy. (CFR RipES is not applicable to the historically irrigated upland areas. Historically irrigated lands will be evaluated for human health risks and remediated if necessary.) After a polygon has been delineated using the delineation criteria described above, application of the flow-chart keys in Figures 16, 17, and 18 will provide the correct classification, and Table 1 will indicate the correct subset of remedial actions from which to draw the remedial design. Also refer to Part 2 Section 13.6 of the *Record of Decision*.

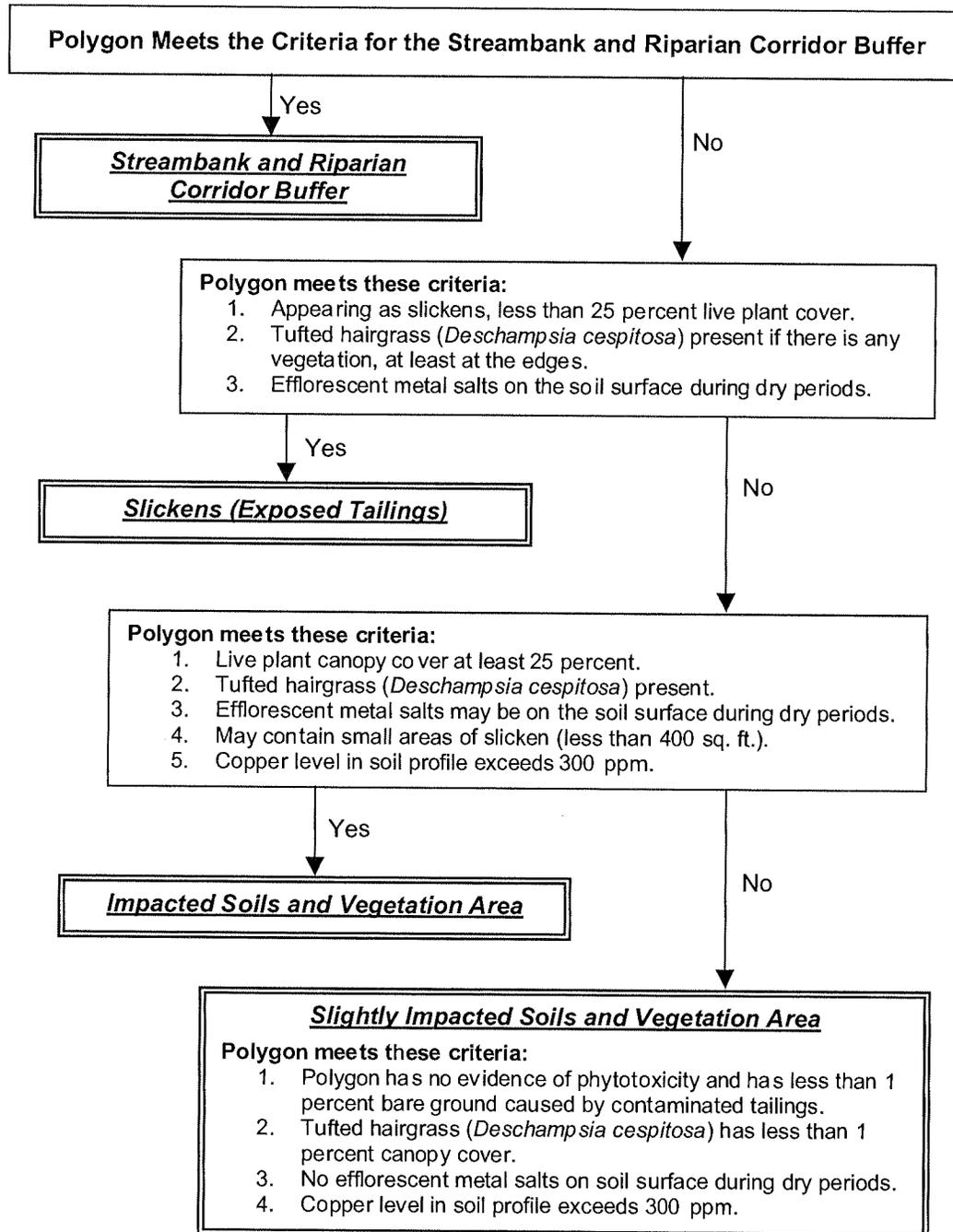


Figure 16. Generalized key for categorizing CFR RipES polygons

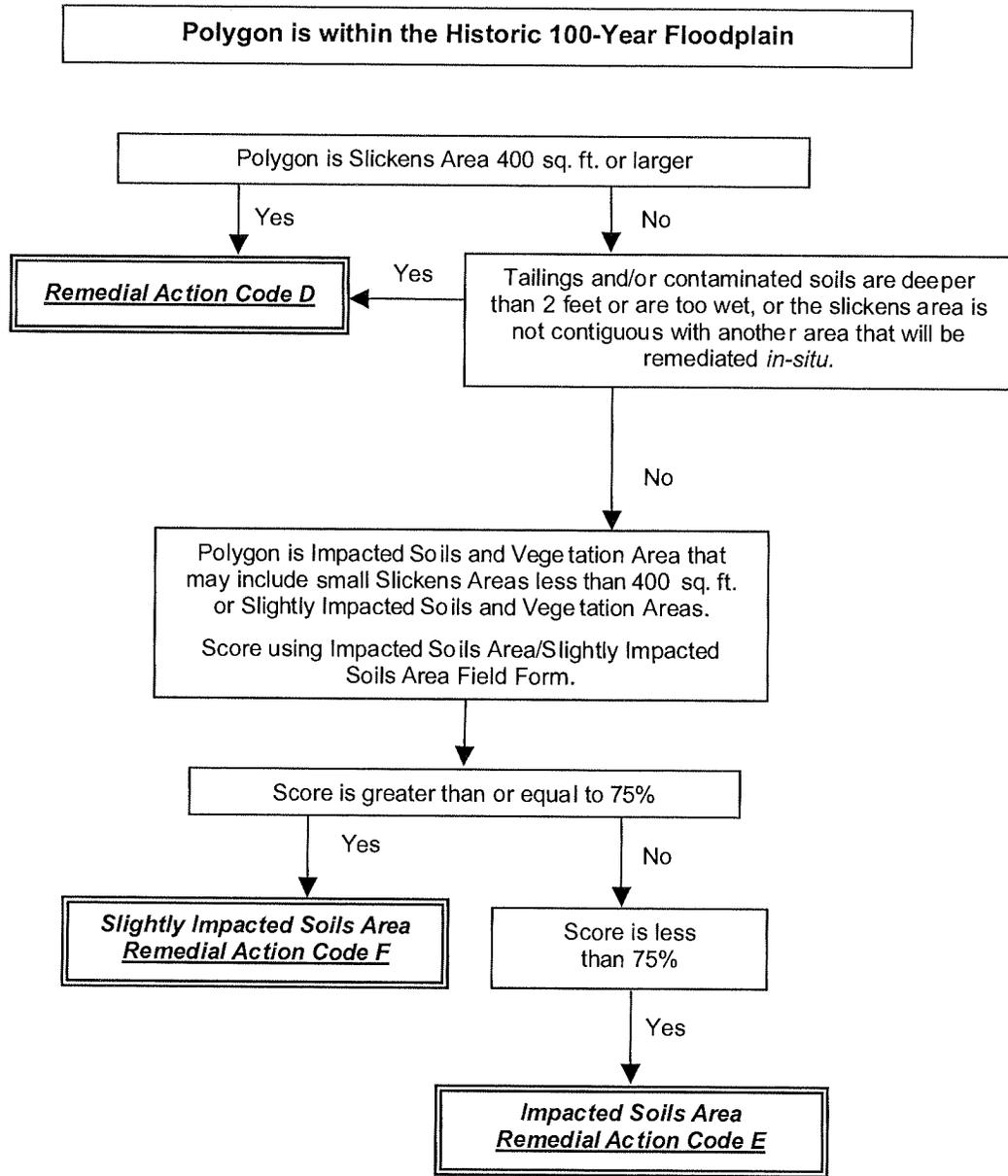


Figure 17. Polygon characterization within the historic 100-year floodplain

Polygon is within the Streambank and Riparian Corridor Buffer

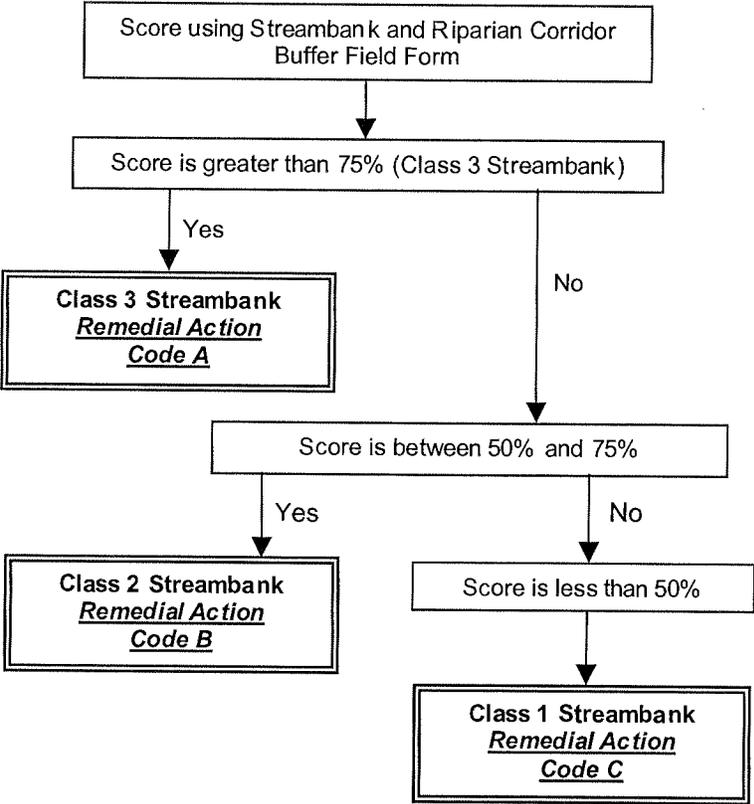


Figure 18. CFR RipES polygon characterization for streambank and riparian corridor buffer polygons

**Table 1.** Preliminary remedial action (RA) codes for major CFR RipES polygon categories

CFR RipES Polygon Category	RA Code	Preliminary Remedial Action Recommendations <sup>1</sup>
Class 3 Streambank	A	Remedial actions include no action or minor actions to enhance vegetation within the buffer corridor and/or BMPs.
Class 2 Streambank	B	Polygons with Class 2 streambanks will receive remedial actions intended to secure streambank stability through establishment of appropriate deep, binding, woody vegetation. Remedial actions may include reconfiguration of the banks, minor removal/ replacement and/or in-place treatment of contaminated materials, followed by supplemental planting of deep, binding, woody vegetation and revegetation with appropriate herbaceous species and BMPs.
Class 1 Streambank	C	Class 1 streambanks will receive treatment(s) chosen from a set of remedial actions depending upon site-specific characteristics. Remedial actions for this class include removal of phytotoxic materials and revegetation with deep, binding, woody vegetation and an understory of appropriate herbaceous species. BMPs.
Slickens (Exposed Tailings)	D	Remedial action for most of these areas is removal, with the exception as noted previously. Removal of slickens areas adjacent to active channel are part of the streambank remedial actions. BMPs and ICs.
Impacted Soils and Vegetation Areas	E	Impacted soils and vegetation areas will generally be treated <i>in-situ</i> , with two exceptions: 1) when the tailings and contaminated soils in a given area extend more than 2 feet below ground surface (In which case, all of the material will be removed.), and 2) when the tailings and contaminated soils are in a saturated condition which makes <i>in-situ</i> treatment impracticable (In which case, the contaminated material will be excavated). Old river channels in the floodplain will be addresses as described previously. BMPs and ICs.
Slightly Impacted Soils and Vegetation Areas	F	Remedial actions are no action, or BMPs.

<sup>1</sup>Data gaps need to be identified in order to define remedial action(s) and to satisfy initial remedial design specifications. These may include pH, concentrations of COCs in the soil profile, depth to permanent groundwater level, thickness of contaminated materials, acid-base account, organic matter level, and others.

### Miscellaneous Site Types

There are several landscape areas or features that may contain contaminated materials by having one of the following:

1. Conveyed contaminated waters, i.e., drainage ditches;
2. Contaminated through historical irrigation, i.e., current or abandoned ditches; and
3. Subsequent separation of the historic 100-year floodplain from the present FEMA 100-year floodplain by human structures such as highways and railroads.

These areas, with the exception of historically irrigated fields (which will be evaluated under the human health component), are to be considered in the remedial design. If this consideration shows soil contamination above action levels or impacted soils and vegetation communities, appropriate remediation will be designed for these areas.

These miscellaneous site types are further defined as:

1. Old river channels and oxbows that may be well vegetated, but may have thick deposits of buried contaminated tailings in contact with ground water. (These sites do not meet the criteria for slickens or impacted soils and vegetation areas as defined in this document.)
2. Irrigation ditches, drainage ditches, and canals that may have conveyed contaminated waters and sediment. Irrigation ditches that conveyed historically contaminated water will be sampled through a representative sampling program to be developed to ensure that contaminate concentrations do not cause unacceptable risks to human health or the environment, as further described in Part 2, Section 13.8.3 of the *Record of Decision*.
3. Perennially or seasonally flooded wetlands that may contain contaminated sediment with hydrologic connectivity to groundwater and surface waters.
4. Contaminated areas that may be located within the historic floodplain, but outside the current Federal Emergency Management Agency (FEMA) defined floodplain. Some of these areas are separated from the main part of the floodplain by the Interstate 90, railroad berms, and other cultural structures.

These minor site types may contain much higher levels of contamination than adjacent areas because of particular historic circumstances. Removal, if feasible, will often be required. Therefore, these areas will be delineated as separate CFR RipES polygons, and evaluated accordingly for their potential need for remediation.

### **CFR RipES Process and Integration with Remedial Design**

The CFR RipES process is to be applied to all lands within the historic 100-year floodplain of the Clark Fork River. The CFR RipES process is a critical detail design component which, for a specific landowner, involves a series of steps beginning with delineation of land ownership boundaries and noting areas having similar ecological attributes on aerial photographs, and ends by delineating specific locations of slickens, impacted soils and vegetation, slightly impacted soils and vegetation and classification of Class 1, 2, and 3 streambanks. While at the property, additional design data and information will also be collected necessary to complete remedial design. It is envisioned that during remedial design, coordinated teams of ecologists and engineers will work together, with the ecologists scoring polygons and engineers surveying the polygons and both working to produce GIS maps of the landscape, and collecting samples and other required design data and information for analyses. The general remedial design data gathering process is as follows:

1. Delineate existing land ownership boundaries, irrigation ditches, and fence lines on aerial photographs.
2. Delineate preliminary polygons on aerial photography for the following soil categories (minimum mapping unit size is 400 ft<sup>2</sup>) (Note: this must account for 100 percent of the property that lies within the historic 100-year floodplain.):
  - a) Slickens (exposed tailings);
  - b) Impacted soils and vegetation areas; and
  - c) Slightly impacted soils and vegetation areas.
3. Delineate a preliminary approximately 50 foot streambank and riparian corridor buffer zone on aerial photographs along both sides of the streambank. The buffer zone extends back

approximately 50 foot from the bankfull stage on each side of the river. The actual width of the approximately 50 foot buffer zone is a function of the geomorphic characteristics of the river. For example, in those instances where the river abuts a high bank that is considered upland, the buffer zone width is reduced.

4. Conduct initial consultation with landowner about present and future management desires (e.g., grazing pasture versus alfalfa field) and any limitations to remedial design such as locations of temporary haul roads.
5. Obtain landowner approval to conduct CFR RipES of his/her property.
6. Conduct CFR RipES field reconnaissance, adjust preliminary polygon boundaries, and sample and collect data for scoring and classifying the following polygons:
  - a) Soils polygons (slickens, impacted soils and vegetation areas, and slightly impacted soils and vegetation areas); and
  - b) Streambank polygons (Class 1 Streambanks, Class 2 Streambanks, and Class 3 Streambanks).
7. Delineate the approximately 50 foot streambank and riparian corridor buffer zone into preliminary polygons based on live vegetative canopy cover and/or canopy cover of deep, binding, woody vegetation. There is a strong bias to leaving deep, binding, woody vegetation undisturbed. The minimum mapping unit of these polygons is 20 linear feet of streambank with a maximum length of 500 feet.
8. Delineate areas of deep, binding, woody vegetation outside the approximate 50 foot streambank and riparian corridor buffer zone. These represent areas where mature woody vegetation may be obtained and utilized as tipped over willows in streambank treatment types 3 and 4. There is a strong bias to leaving deep, binding, woody vegetation undisturbed.
9. Further subdivide (categorize) the streambank based on actively laterally cutting streambanks/critical shear stress areas. Assign a streambank treatment type to each subdivision. The minimum mapping unit length for this purpose is 10 linear feet of streambank. Data will be collected to determine the critical shear stresses associated with each streambank.
10. Conceptual streambank treatment designs were developed as examples for the Upper Clark Fork River and are described in Appendix B to the *Record of Decision*. The conceptual treatments are as follows:
  - a) No treatment necessary – This applies to streambanks where there is adequate deep, binding, woody vegetation already in place, and no additional work on the site is necessary.
  - b) Treatment 1 (vegetation augmentation) – This treatment requires augmenting existing deep, binding, woody vegetation with additional woody vegetation.
  - c) Treatment 2 – This treatment is for streambanks where low critical shear stresses are acting on the immediate streambank. This treatment involves the use of pre-vegetated coir roll-sod with a toe protection of fiber-rolls pre-vegetated with sandbar willow (*Salix exigua*).
  - d) Treatment 3 – This treatment is for streambanks where moderate critical shear stresses are acting on the immediate streambank. This treatment involves the use of pre-vegetated coir roll-sod with a toe protection of fiber-rolls pre-vegetated with sandbar willow (*Salix exigua*) on top of a rock roll. Also included is tipped over mature willow on a spacing that will depend on river morphology along the streambank to deflect and dissipate the energy of the stream.
  - e) Treatment 4 – This treatment is for streambanks where high critical shear stresses are acting on the immediate streambank. This treatment involves the use of pre-vegetated coir roll-sod with a toe protection of rock mattress. Also included is tipped over mature

willow on a spacing that will depend on river morphology along the streambank to deflect and dissipate the energy of the stream.

Other site-specific conditions may dictate design modifications.

11. Identify data needs to be filled to define remedial action(s) and to satisfy initial remedial design specifications. These may include pH, concentrations of COCs in the soil profile, depth to permanent groundwater level, thickness of contaminated materials, acid-base account, soil organic matter level, and others identified. Sampling will be conducted on the polygons to fulfill these gaps using a Sampling and Analysis Plan developed for the CFR OU. The intent is to sequence the CFR RipES scoring and sampling concurrently so that data are collected in an efficient manner and landowners disturbance is minimized.
12. Develop a preliminary design for the property. Components of Phase 1 preliminary design include the following:
  - Base map with layer displaying 1 foot contours;
  - Location of CFR RipES defined polygons for streambanks, slickens, impacted soils and vegetation areas, and slightly impacted soils and vegetation areas
  - Transportation corridors and existing roads;
  - Locations of temporary fences;
  - Locations of potential staging areas;
  - Locations of wetlands and irrigation and drainage ditches;
  - Locations of water access points for livestock;
  - Locations of temporary bridges;
  - Locations of vegetation that is to be removed during clearing and grubbing, and locations of salvageable vegetation that can be used during remediation; and
  - Other appropriate data and information.
13. Present preliminary remedial design and preliminary construction schedule for the property to the landowner including weed management plan, preliminary grazing management plan, BMPs, and ICs. Obtain landowner feedback.
14. Prepare revised design and preliminary construction schedule based on landowner feedback.
15. Submit to appropriate Agencies for review. Obtain agency's approval and then obtain landowner access for implementation.

## CLARK FORK RIVER RIPARIAN EVALUATION SYSTEM (CFR RipES) FOR STREAMBANK AND RIPARIAN CORRIDOR BUFFER POLYGONS

This evaluation is intended for use in the field by appropriately trained and qualified personnel. Knowledge of the local flora and of riverine channel and floodplain morphology, as well as visible indications of site contamination by metals, is required. The resulting polygon score is used to rate the degree of phytotoxic effect on site from mining-related metals contamination. Several items involve estimation of vegetation canopy cover. For these estimations, use the Daubenmire (1959) method of canopy cover estimation. This is a very efficient and reliable method for doing work of this nature, *when the observers are adequately skilled, practiced, and have calibrated their individual assessments for consistency of call*. Frequent and periodic tests and recalibration exercises are recommended for quality control.

Ocular estimation of detailed site characteristics may be difficult on large, brushy sites where visibility is limited, however extreme precision is not required. It is important to remember that the rating score is not an absolute value. The factor breakout categories and point weighting in the evaluation are based on the collective experience of an array of riparian scientists, soil scientists, range professionals, and land managers.

Each factor below is to be scored according to conditions observed within the polygon. The evaluator will estimate the parameter in question, select the appropriate scoring category, and enter that value on the field form. Do not introduce bias by using some preconceived notion of what the parameters should be.

### **Polygon Delineation Criteria**

The streambank and riparian corridor buffer is delineated by measuring from the "bankfull" stage (the lateral extent of inundation by the 1.5-year mean flood) on each side of the stream out approximately 50 feet that is flexible or variable in width, *OR* where the historic 100-year floodplain elevation is reached. In other words, areas outside the historic 100-year floodplain are not included in the streambank and riparian corridor buffer; and in cases where high banks are reached, the streambank and riparian corridor buffer will be less.

The streambank and riparian corridor buffer along each side of the river will be broken into polygon units based on three types of river planar morphology: convex curvatures (outside curves), concave curvatures (inside curves), and straight channel stretches no longer than 500 feet. A minimum mapping unit (MMU) of 20 linear feet will be used to delineate the polygons. Polygon units will not cross land-ownership boundaries.

### **Field Form**

The field form for streambank and riparian corridor buffer polygons is found in Appendix C. The field form contains questions on critical aspects of live vegetation and streambank integrity. These questions were designed to assess the impact of mine wastes to the vegetation and the streambank stability on the site.

### **Live Vegetation and Streambank Integrity**

Plant community integrity is essential for a riparian system to perform its normal functions. For example, riparian vegetation dissipates the energy of flowing water and stabilizes streambanks, thereby reducing erosion and introduction of streambank material into the channel. Riparian

vegetation also inhibits surface water transport of upland soil into the stream. These functions are particularly important during spring runoff periods and after major summer or fall rains.

Riparian vegetation also traps sediment already being carried by the stream, thereby promoting streambank building and development of new bars. These become the sites for new pioneer vegetation that further enhance system stability. Sediment retention is all the more important because excessive sediment loads reduce habitat quality for aquatic life (including fish) and destabilize the natural hydrologic regime of the system. Healthy riparian systems enhance water quality downstream by filtering out organic and chemical pollutants from the channel as well as before they reach the channel.

Appropriate riparian vegetation shields soil and water from wind, sunlight, and raindrop impact. This reduces erosion due to wind and the disruptive impact of rainfall as well as promoting ground water recharge by enhancing storm water infiltration. Vegetation canopy cover provides shade, thereby reducing water temperatures and improving aquatic habitat. Dense vegetation can reduce soil compaction by the presence of healthy root systems and by limiting accessibility of both domestic livestock and wild ungulates to sensitive sites. Although an increase in vegetation may increase evapotranspiration rates, in natural riparian systems the benefits offset this loss.

Finally, riparian areas are rich in biotic production. The presence of water and essential nutrients make these areas among the most productive sites of a landscape, especially in the arid and semi-arid western United States. Near streambank riparian vegetation produces the bulk of the organic detritus necessary to support healthy benthic communities.

Most of the factors rated in this evaluation are measured by ocular estimation. Such estimation may be difficult on large, brushy sites where visibility is limited, but extreme precision is not necessary. While the rating categories may be broad, evaluators do need to calibrate their eye with practice. It is important to remember that a rating is not an absolute value. The factor breakout groupings and point weighting in the evaluation score are based on the collective experience of an array of riparian scientists, soil scientists, range professionals, and land managers.

1. **Live vegetative canopy cover (excluding tufted hairgrass [*Deschampsia cespitosa*]).** River floodplains located in inter montane valleys of western Montana, such as the Upper Clark Fork River Valley, will under natural, undisturbed conditions have a nearly complete canopy cover of live vegetation. Lack of vegetation cover indicates severe disturbance to riparian sites. Live vegetation cover helps to stabilize banks, control nutrient cycling, reduce water velocity, provide fish cover and food, trap sediments, reduce erosion, and reduce the rate of evaporation (Platts and others 1987). Live vegetation cover is ocularly estimated using the canopy cover method described by Daubenmire (1959). Do not include the canopy cover of tufted hairgrass (*Deschampsia cespitosa*) in with live vegetative canopy cover estimates, since along the Clark Fork River this species indicates mine waste metals contamination.

**Scoring (represents 53.8 percent of total points):**

**21** = More than 90 percent of the polygon area is covered by the canopy of live plants (excluding tufted hairgrass [*Deschampsia cespitosa*]).

**14** = 80 to 90 percent of the polygon area is covered by the canopy of live plants (excluding tufted hairgrass [*Deschampsia cespitosa*]).

**7** = 70 to 80 percent of the polygon area is covered by the canopy of live plants (excluding tufted hairgrass [*Deschampsia cespitosa*]).

0 = Less than 70 percent of the polygon area is covered by the canopy of live plants (excluding tufted hairgrass [*Deschampsia cespitosa*]).

2. **Completeness of the canopy of deep, binding, woody vegetation.** Streamside vegetation stabilizes the streambank structure to the extent that it provides deep, binding roots. Species such as willows (*Salix* spp.), water birch (*Betula occidentalis*), and cottonwoods (*Populus* spp.) provide excellent protection with deep, binding root mass. **DO NOT** include shallow rooting species such as snowberry (*Symphoricarpos* spp.), rose (*Rosa* spp.), and currants/ gooseberries (*Ribes* spp.). These short statured species do not provide adequate deep, binding root mass to effectively stabilize a stream the size of the Clark Fork River.

The ability of the woody vegetation to protect the streambank and floodplain during overbank flows is directly related to the completeness of its cover over the soil surface. Estimate the percent of the area within the buffer zone polygon that is actually covered by the canopy of these deep, binding, woody species.

**Scoring (represents 23.1 percent of total points):**

9 = The canopy of deep, binding, woody plant species covers at least 80 percent of the area within the buffer zone.

6 = The canopy of deep, binding, woody plant species covers between 60 and 80 percent of the area within the buffer zone.

3 = The canopy of deep, binding, woody plant species covers between 40 and 60 percent of the area within the buffer zone.

0 = The canopy of deep, binding, woody plant species covers less than 40 percent of the area within the buffer zone.

3. **Amount of active lateral cutting of the streambank.** Record the percent of the streambank length within the polygon that is actively cutting (eroding laterally). Any cutting occurring within the past year is considered active. Cut banks with vegetation establishing are considered healing and the cutting no longer active. This is indicated by the lack of perennial plant species on the streambank face and by on-going erosion. Cutbanks with perennial plant species established are considered to be healing, and are no longer actively cutting.

**Scoring (represents 23.1 percent of total points):**

9 = No more than 5 percent of the streambank length in the polygon is actively cutting.

6 = Between 5 and 15 percent of the streambank length in the polygon is actively cutting.

3 = Between 15 and 35 percent of the streambank length in the polygon is actively cutting.

0 = More than 35 percent of the streambank length in the polygon is actively cutting.

**Overall Scoring:**

Greater than 75.0% = Class 3 Streambank

50.0%-75.0% = Class 2 Streambank

Less than 50.0% = Class 1 Streambank

## CLARK FORK RIVER RIPARIAN EVALUATION SYSTEM (CFR RipES) FOR IMPACTED SOILS AND VEGETATION AREAS POLYGONS AND SLIGHTLY IMPACTED SOILS AND VEGETATION AREA POLYGONS

This evaluation is intended for use in the field by appropriately trained and qualified personnel. Knowledge of the local flora and of riverine channel and floodplain morphology, as well as visible indications of site contamination by metals, is required. The resulting polygon score is used to rate the degree of phytotoxic effect on site from mining-related metals contamination. Several items involve estimation of vegetation canopy cover. For these estimations, use the Daubenmire (1959) method of canopy cover estimation. This is a very efficient and reliable method for doing work of this nature, *when the observers are adequately skilled, practiced, and have calibrated their individual assessments for consistency of call*. Frequent and periodic tests and recalibration exercises are recommended for quality control.

Ocular estimation of detailed site characteristics may be difficult on large, brushy sites where visibility is limited, however extreme precision is not required. It is important to remember that the rating score is not an absolute value. The factor breakout categories and point weighting in the evaluation are based on the collective experience of an array of riparian scientists, soil scientists, range professionals, and land managers.

Each factor below is to be scored according to conditions observed within the polygon. The evaluator will estimate the parameter in question, select the appropriate scoring category, and enter that value on the field form. Do not introduce bias by using some preconceived notion of what the parameters should be under different conditions or at a different time.

### **Polygon Delineation Criteria**

The CFR RipES Field Form for Impacted Soils and Vegetation Areas Polygons and Slightly Impacted Soils and Vegetation Areas Polygons is used on areas located within the historic 100-year floodplain (the area potentially containing tailings and contaminated soils). These polygons are delineated to circumscribe areas that fit the criteria defined above for sites with soils and/or vegetation impacted by mining-related metals contamination. These polygons will be further delineated using property ownership boundaries, certain landform topographic breaks, certain land use breaks (i.e., fences, roads, etc.), and other considerations as needed. A minimum mapping unit (MMU) of 400 square feet will be used to delineate the polygons.

### **Field Form**

The field form for Impacted Soils and Vegetation Area and Slightly Impacted Soils and Vegetation Area Polygons is found in Appendix E. It is comprised of two main components: live vegetation integrity (representing 54.9 percent of the total score), and contamination severity (representing 45.1 percent of the total score). Ecologists view vegetation as an integrator of the environmental factors on the landscape, and its condition reflects back to them this integration. With this in mind, the questions on the field form that pertain to the live vegetation integrity component were designed to assess the impact of mine wastes to the vegetation. Therefore, even though the field form distinguishes two main

components, both components are measuring the magnitude of mine waste impacts within the polygon.

**Live Vegetation Integrity (represents 54.9 percent of total score)**

While some land use practices may cause relatively small amounts of bare ground, only phytotoxic soil conditions normally result in large percentages of unvegetated area on natural (wild) plant communities on river floodplain sites in this region. Tufted hairgrass (*Deschampsia cespitosa*) is identified as the plant species on the Upper Clark Fork River floodplain with the greatest positive correlation to near-surface metals contamination (Riparian and Wetland Research Program 1998).

1. **Live vegetative canopy cover (excluding tufted hairgrass [*Deschampsia cespitosa*]).** River floodplains located in inter montane valleys of western Montana, such as the Upper Clark Fork River Valley, will under natural, undisturbed conditions have a nearly complete canopy cover of live vegetation. Lack of vegetation cover indicates severe disturbance to riparian sites. Live vegetation cover helps to stabilize banks, control nutrient cycling, reduce water velocity, provide fish cover and food, trap sediments, reduce erosion, and reduce the rate of evaporation (Platts and others 1987). Live vegetation cover is ocularly estimated using the canopy cover method described by Daubenmire (1959). Do not include the canopy cover of tufted hairgrass (*Deschampsia cespitosa*) in with live vegetative canopy cover estimates, since along the Clark Fork River this species indicates mine waste contamination.

**Scoring (represents 25.6 percent of total points):**

21 = More than 90 percent of the polygon area is covered by the canopy of live plants (excluding tufted hairgrass [*Deschampsia cespitosa*]).

14 = 80 to 90 percent of the polygon area is covered by the canopy of live plants (excluding tufted hairgrass [*Deschampsia cespitosa*]).

7 = 70 to 80 percent of the polygon area is covered by the canopy of live plants (excluding tufted hairgrass [*Deschampsia cespitosa*]).

0 = Less than 70 percent of the polygon area is covered by the canopy of live plants (excluding tufted hairgrass [*Deschampsia cespitosa*]).

2. **Amount of tufted hairgrass (*Deschampsia cespitosa*) present.** Tufted hairgrass (*Deschampsia cespitosa*) has been shown to correlate strongly (in non-agronomic plant communities) with the near-surface presence of contaminated tailings on the Clark Fork River floodplain (Riparian and Wetland Research Program 1998). The most phytotoxic sites (slickens) are devoid of vegetation, but with a lesser degree of contamination, tufted hairgrass is the first species found to survive (scattered, small amounts in stunted growth form). With still less concentration redtop (*Agrostis stolonifera*), sandbar willow (*Salix exigua*), water birch (*Betula occidentalis*), and Baltic rush (*Juncus balticus*) commonly are found along with the tufted hairgrass (*Deschampsia cespitosa*). On sites with very low concentrations of contaminated tailings, the tufted hairgrass is only a very small component of the plant community. On sites with no mine tailing impact, no tufted hairgrass (*Deschampsia cespitosa*) is likely to be found.

**Scoring (represents 29.3 percent of total points):**

24 = Tufted hairgrass (*Deschampsia cespitosa*) has less than 1 percent canopy cover in the polygon.

18 = Tufted hairgrass (*Deschampsia cespitosa*) represents 1 to 5 percent of the canopy cover in the polygon.

12 = Tufted hairgrass (*Deschampsia cespitosa*) represents 5 to 20 percent of the canopy cover in the polygon.

6 = Tufted hairgrass (*Deschampsia cespitosa*) represents 20 to 40 percent of the canopy cover in the polygon.

0 = Tufted hairgrass (*Deschampsia cespitosa*) represents over 40 percent of the canopy cover in the polygon.

**Contamination Severity (represents 45.1 percent of total score)**

Contaminant inputs into riparian systems from tailings and associated metal laden sediment and water (i.e. contaminated material) are responsible for ecological impacts (i.e., phytotoxicity, lack of vegetation in general, or limited species richness, impaired water quality, and detrimental effects to aquatic and terrestrial biota. Severity of contamination is measured by the extent of contaminant deposits (volume and concentration), effects to riparian vegetation (tailing-caused bare ground or sparsely vegetated areas), and risk of release of contamination to the stream by mobilization and due to proximity to the river. Contaminated material includes contaminated tailings, soil/tailing mixtures, buried alluvium, buried soil, and cover soil. These media definitions and contaminant concentrations are reported in Table 3-6 of the *Remedial Investigation* (ARCO 1998).

3. **Percent of polygon area with bare ground caused by tailings.** Bare ground is soil not covered by plants, litter or duff, downed wood, or rocks larger than 2.5 inches. Bare ground caused by tailings must be distinguished from bare ground resulting from other causes by the presence of either of two indicators of metals contamination: 1) the presence of tufted hairgrass (*Deschampsia cespitosa*) in the polygon, and 2) metal salts visible on the soil surface during periods of dry weather.

Human land uses causing bare ground, such as livestock grazing, recreation, roads, and other agricultural or industrial activities, are excluded from consideration here. Furthermore, not all bare ground represents a deterioration of riparian health. Sediment deposits by the river and other natural bare ground are also excluded. (The authors recognize that sediment deposits can be due to human activities in the watershed. However, it is difficult to train observers to make consistent calls from such criteria. Therefore, we have chosen to not use this in the evaluation system.) The evaluator is to count only the bare ground in the polygon that is attributable to metals contamination.

**Scoring (represents 14.6 percent of total points):**

12 = Less than 1 percent of the polygon is bare ground caused by tailings.

9 = 1 to 5 percent of the polygon is bare ground caused by tailings.

6 = 5 to 15 percent of the polygon is bare ground caused by tailings.

3 = 15 to 30 percent of the polygon is bare ground caused by tailings.

0 = Over 30 percent of the polygon is bare ground caused by tailings.

4. **Contamination concentration and depth (copper).** The concentration of the COCs, as well as depth of the contamination, are important considerations in selecting appropriate remedial actions. The degree to which contaminated materials impair ecosystem function is related to the depth of contaminated material present in a polygon. Infrequent and thin deposits of contaminants may be assimilated into the ecosystem without major environmental effects, whereas thick and/or spatially extensive deposits can arrest normal ecological processes. Vertical extent of contaminated material (that may include exposed tailings, contaminated soil or sediment, buried contaminated tailings, re-deposited contaminated tailings, etc.) is often difficult to estimate due to the complexity of a fluvial system such as the Upper Clark Fork River. Extensive deposits of thick tailings may abut areas lacking contamination. Analytical data are required because contamination cannot be visually determined. This is especially true where contaminated water has percolated through dark native

soil leaving no visual contaminant marker. A Sampling and Analysis Plan will be developed to specify soil sampling procedures for the CFR RipES.

The degree of impact to riparian ecosystems by contaminated material is a function of the toxicity of contaminants present and the extent of contamination above the levels at which the riparian system can attenuate or assimilate them. Five contaminants were identified as being present in the CFR OU at levels of concern for human and environmental health. Human health risk-based action levels for arsenic are not included in this score. Of the five environmental COCs (Cu, Pb, Zn, Cd, and As) at the site, copper is used as a surrogate for the group of five listed COCs.

The geometric mean value for copper concentration in unimpacted soils was defined in the *Remedial Investigation* (ARCO 1998) as 303 ppm.

**Scoring (represents 12.2 percent of total points):**

10 = Less than 300 ppm copper in the top 18 inches of the soil profile.

8 = Between 301 and 600 ppm copper in the top 18 inches of the soil profile.

6 = Between 601 and 900 ppm copper in the top 18 inches of the soil profile.

4 = Between 901 and 1,200 ppm copper in the top 18 inches of the soil profile.

2 = Between 1,201 and 1500 ppm copper in the top 18 inches of the soil profile.

0 = More than 1,501 ppm copper in the top 18 inches of the soil profile.

5. **Contamination mobility (geochemical).** Complex biogeochemical processes dictate the degree to which contaminants present in riparian corridors may be released to the environment. Principle factors controlling the release of contamination include physical and geochemical characteristics of the contaminated media. The principal physical factor controlling contaminant release is erosion that is addressed by the degree to which the riparian corridor is covered with stabilizing vegetation and the proximity of the contaminants to the stream channel. Principle geochemical factors implicated in the mobilization of contaminants are pH and the presence of readily soluble metal surface salts (efflorescent salts). Low soil pH conditions result in elevated metal levels in the soil solution and increased probability that metals will be leached deeper in the soil profile, or ultimately delivered to shallow aquifers hydraulically connected to the river.

**Scoring (represents 14.6 percent of total points):**

12 = pH of top 18 inches of the soil profile is greater than 6.5 s.u.

8 = pH of top 18 inches of the soil profile is between 5.5 and 6.5 s.u.

4 = pH of top 18 inches of the soil profile is between 4.5 and 5.5 s.u.

0 = pH of top 18 inches of the soil profile is less than 4.5 s.u.

Efflorescent metal salts commonly occur on the soil surface of barren tailing deposits and commonly express metal levels that are orders of magnitude above the bulk concentration of the underlying tailing material. The salts are transient features on the landscape, most commonly observed during periods of dry weather, appearing when contaminated waters are wicked to the soil surface and evaporated, thereby precipitating a salt. Surface salts are commonly white in color, but metal salts also may occur as brown, yellow, blue, or green coatings on the soil surface. Not all surface salts have elevated metal content, but when they do occur on contaminated material, elevated metal levels are expected.

**Scoring (represents 3.7 percent of total points):** *(If the soils are wet, efflorescent metal salts may not be visible. In that case, replace both Actual Score and Possible Score with NA.)*

- 3 = No efflorescent metal salts are present on the soil surface during dry periods.  
0 = Efflorescent metal salts are present on the soil surface during dry periods.

**Overall Scoring:**

- At least 75.0% = Slightly Impacted Soils and Vegetation Area  
Below 75.0% = Impacted Soils and Vegetation Area

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APPENDIX A

NOTES ON UNUSUAL ASPECTS OF THE PRESENCE OF TUFTED HAIRGRASS  
(*DESCHAMPSIA CESPITOSA*) IN THE UPPER CLARK FORK RIVER VALLEY

## NOTES ON UNUSUAL ASPECTS OF THE PRESENCE OF TUFTED HAIRGRASS (*DESCHAMPSIA CESPITOSA*) IN THE UPPER CLARK FORK RIVER VALLEY

### **Distribution**

Tufted hairgrass (*Deschampsia cespitosa*) is a common, native, cool season, perennial bunchgrass found in mountain and prairie grassland communities throughout the northern hemisphere (Munshower 1998). It is found in open bogs, wet meadows, streambanks, and prairie sites, as well as in the spruce/fir zone of higher elevations. It is adapted to a wide range of soils textures, including moderately saline and alkaline sites (Stubbenieck and others 1992).

Thompson and Hansen (2001, 2002) describe a tufted hairgrass (*Deschampsia cespitosa*) habitat type in the grassland regions of southeastern Alberta and southwestern Saskatchewan in moist basin sites where drought conditions on glaciated topography have brought about accumulations of alkali salts. These stands of tufted hairgrass (*Deschampsia cespitosa*) occur in strictly herbaceous communities in association with such alkaline tolerant species as inland saltgrass (*Distichlis spicata*), foxtail barley (*Hordeum jubatum*), and Baltic rush (*Juncus balticus*). Closer to the Upper Clark Fork River, similar stands of tufted hairgrass (*Deschampsia cespitosa*) (some nearly monospecific) occur in the Ninepipes-Kicking Horse area of the Flathead Indian Reservation in western Montana on glaciated prairie pothole topography. However, these occurrences of tufted hairgrass (*Deschampsia cespitosa*) differ in sites from those along the Upper Clark Fork River. Occurrence of tufted hairgrass (*Deschampsia cespitosa*) along the Upper Clark Fork River is unique in our experience by its riverine setting and by having tree or shrub species associated.

Mueggler and Stewart (1980) describe high elevation habitat types (above 6,000 ft) having tufted hairgrass (*Deschampsia cespitosa*) co-dominant with sedges or other grasses on moist southwestern Montana mountain slopes and northwestern Montana wet meadows in high valley bottoms. Kovalchik (1987) describes a tufted hairgrass (*Deschampsia cespitosa*) plant association for central Oregon that closely resembles the types described by Mueggler and Stewart (1980). In no case does any other worker in the region describe a naturally occurring community with tufted hairgrass (*Deschampsia cespitosa*) in a situation similar to the Upper Clark Fork River Valley.

**Habitat**— Tufted hairgrass (*Deschampsia cespitosa*) is extraordinary in its range of tolerance of several habitat variables. In light of this very broad ecological amplitude, it should not be surprising to find that the species is quite plastic in its responses to different phenological and environmental situations. It has been reported that a population of tufted hairgrass (*Deschampsia cespitosa*) growing on mine tailings has developed such a need for trace metals, that this population is not present on uncontaminated sites (Bonneau 2000). Tufted hairgrass (*Deschampsia cespitosa*) invades disturbed sites and is moderately aggressive on mesic, mid to higher elevation acid mine sites (Munshower 1998).

**Elevation**— Tufted hairgrass (*Deschampsia cespitosa*) occurs at elevations in North America ranging from sea level to over 14,100 ft (Walsh 1995). Hitchcock and others (1969) state that the species occurs in the Pacific Northwest from alpine ridges to moist prairies and coastal marshes.

**Moisture**— Along the moisture gradient, tufted hairgrass (*Deschampsia cespitosa*) is found on sites that range from saturated habitats along the edges of marshes and bogs, to moist areas along drainage ditches and the bottoms of prairie draws, to dry slopes at the higher elevations (Walsh 1995).

**Soil Type**— Tufted hairgrass (*Deschampsia cespitosa*) grows on a variety of soil types and textures. It is found on sandy loam, sandy clayey loam, silty loam, loam, loamy clay, and clay. It is found on gravel in Alaska, Michigan, and Utah. It occurs on granitic material in Idaho and Wyoming. It is found on peat in British Columbia and on calcareous seeps in Illinois. It grows on pumice in Oregon and on volcanic soils in Wyoming (Walsh 1995).

**Soil Chemistry**— Tufted hairgrass (*Deschampsia cespitosa*) is adapted to cool, acid sites, but is also found on somewhat alkaline soils. It has been found on soils varying from pH 3.3 on mine tailings in Ontario to pH 8.4 in central Idaho. It generally grows best in soils with pH 5.2 to 5.5. It can also tolerate saline conditions of salt marshes along the Oregon coast. Some populations of tufted hairgrass (*Deschampsia cespitosa*) have adapted to mine spoils with elevated levels of heavy metals (Walsh 1995). Many ecotypes of this species have varying genetic composition expressing specific metal and environmental tolerances (Munshower 1998).

**Grazing Response**— Tufted hairgrass (*Deschampsia cespitosa*) is a palatable forage grass for livestock and wildlife ungulates. The cover and abundance of the species will decrease under heavy grazing pressure (Hansen and others 1988, Tannas 1997, Bonneau 2000). The species is often found on disturbed sites and has been successfully used to revegetate high elevation mined sites (Hansen and others 1995; Hansen and others 1988).

We have no reported comparable occurrence of tufted hairgrass (*Deschampsia cespitosa*) elsewhere in the region to help explain its ecological position on the Upper Clark Fork River floodplain. Scientists at the University of Montana reported a strong positive correlation between tufted hairgrass (*Deschampsia cespitosa*) and the presence of tailings in the soil surface horizon (Riparian and Wetland Research Program 1998). In light of this obvious relationship and a lack of analytical inquiry into the nature of the physiological processes at work, we can only say that tufted hairgrass (*Deschampsia cespitosa*) enjoys an unexplained competitive advantage over other species on these sites where this particular suite of mine tailings has created chemical conditions phytotoxic to the normal vegetation community of the valley. Certainly, the species tolerance of acidic conditions (Walsh 1995) gives us one possible explanation.

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**APPENDIX B**

**LOGIC MATRIX (DICHOTOMOUS KEY)  
FOR DECIDING WHEN TO REMOVE OR KEEP  
A PREFERRED WOODY PLANT**

## DECIDING WHETHER TO REMOVE OR TO KEEP A PREFERRED WOODY PLANT

Because preferred woody plants occur on all kinds of sites and distribution patterns, a systematic protocol is needed for deciding when to remove and when to leave a particular plant. A dichotomous key is provided below a systematic procedure for deciding this issue on the basis of location and condition of plants.

“Preferred woody species” includes the following:

- All willow species (*Salix* spp.)
- Water birch (*Betula occidentalis*)
- Red-osier dogwood (*Cornus stolonifera*)
- Common chokecherry (*Prunus virginiana*)
- Western serviceberry (*Amelanchier alnifolia*)
- Mountain alder (*Alnus incana*)
- Black cottonwood (*Populus trichocarpa*)

### Key for Deciding Whether to Remove or to Keep a Woody Plant

**Instructions** – Read both parts of each couplet pair carefully before deciding which part is the better answer. Decide which side of the couplet pair is most nearly true (this may require a judgment call in some cases), and proceed to the next couplet indicated, until you arrive at an answer to remove or keep.

1. Woody plant is near the streambank (within 10 ft, approximately one mature shrub width) .....2
1. Woody plant is not within 10 ft of the streambank .....3
  2. Contaminated soils contiguous to the plant are being removed, **AND** visibly contaminated soil extends into the main root mass of the plant, **AND** bank stabilization Treatment 2, Treatment 3, or Treatment 4 is being implemented at this point along the bank .....**REMOVE**
  2. Contaminated soils contiguous to the plant are not being removed, **OR** visibly contaminated soil does not extend into the main root mass of the plant, **OR** bank stabilization Treatment 2, Treatment 3, or Treatment 4 is not necessary at this point along the bank ..... **KEEP**
3. Woody plant is more than 10 ft from the streambank, but is within the Streambank Riparian Buffer Zone .....4
3. Woody plant is outside the Streambank Riparian Buffer Zone .....9
  4. The area that includes the woody plant is a slickens (contaminated soil will be removed) .....5
  4. The area that includes the plant is to have impacted soils treated *in-situ* .....7
5. Woody plant is isolated (10 ft or farther from other plants of preferred woody species) .....6

5. Woody plant is not isolated (closer than 10 ft to other plants of preferred woody species; i.e., a subpolygon can be drawn around a group of preferred woody plants, including this one, to leave undisturbed within the slickens area of contaminated soil being removed)..... **KEEP**
6. Woody plant is of seedling/sapling age class **OR** is decadent (has more than 30 percent dead wood in its upper canopy).....**REMOVE**
6. Woody plant is of mature age class **AND** is not decadent (does not have more than 30 percent dead wood in its upper canopy)..... **KEEP**
7. Woody plant is isolated (10 ft or farther from other plants of preferred woody species) .....**8**
7. Woody plant is not isolated (closer than 10 ft to other plants of preferred woody species; i.e., a subpolygon can be drawn around a group of preferred woody plants, including this one, to leave undisturbed within the slickens area of contaminated soil being removed.)..... **KEEP**
8. Woody plant is of seedling/sapling age class **OR** is decadent (has more than 30 percent dead wood in its upper canopy).....**REMOVE**
8. Woody plant is of mature age class **AND** is not decadent (does not have more than 30 percent dead wood in its upper canopy)..... **KEEP**
9. Woody plant is isolated (10 ft or farther from other plants of preferred woody species) ....**REMOVE**
9. Woody plant is not isolated (closer than 10 ft to other plants of preferred woody species; i.e., a subpolygon can be drawn around a group of preferred woody plants, including this one, to leave undisturbed within the slickens area of contaminated soil being removed)..... **KEEP**

**APPENDIX C**

**CFR RipES FIELD FORM FOR  
STREAMBANK AND RIPARIAN CORRIDOR  
BUFFER POLYGONS**

# CFR RipES Scoring Form for Streambank and Riparian Corridor Buffer Polygons

Data Record No.: \_\_\_\_\_

Streambank Class: \_\_\_\_\_

This streambank polygon lies within this (these) soil polygon(s): \_\_\_\_\_ ; \_\_\_\_\_ ; \_\_\_\_\_

## ADMINISTRATIVE DATA

- A1. Field data collected by: \_\_\_\_\_
- A2. Funding Agency/Organization: \_\_\_\_\_
- A3. Year: \_\_\_\_\_ A4. Date field data collected: \_\_\_\_\_ A5. Observers: \_\_\_\_\_
- A6. Landowner: \_\_\_\_\_
- A7. Weather: \_\_\_\_\_

## LOCATION DATA

- B1. County/Municipal District: \_\_\_\_\_
- B2. Location: \_\_\_\_\_
- B3. Land Legal Description: 1/4 1/4 Sec: \_\_\_\_\_ ; 1/4 Sec: \_\_\_\_\_ ; Sec: \_\_\_\_\_ ; Township (NS): \_\_\_\_\_ ; Range (EW): \_\_\_\_\_
- B4a. UTM coordinates of polygon UPSTREAM END: Easting: \_\_\_\_\_ ; Northing: \_\_\_\_\_ ; Zone: \_\_\_\_\_
- B4b. UTM coordinates of polygon DOWNSTREAM END: Easting: \_\_\_\_\_ ; Northing: \_\_\_\_\_ ; Zone: \_\_\_\_\_
- B4c. UTM coordinates of any other point of interest in the polygon: East: \_\_\_\_\_ ; North: \_\_\_\_\_ ; Zone: \_\_\_\_\_
- B4d. Comments: \_\_\_\_\_
- B5. Quad map(s): \_\_\_\_\_ ; \_\_\_\_\_

## SITE CHARACTERISTIC DATA

### Physical Properties

- C1. Evidence of high groundwater? (Yes/No): \_\_\_\_\_
- C2. Drainage ditch(es) present? (Yes/No): \_\_\_\_\_
- C3. Irrigation ditch(es) present? (Yes/No): \_\_\_\_\_
- C4. Has the polygon been tilled? (Yes/No): \_\_\_\_\_
- C5. Proximity of tilling to CFR: \_\_\_\_\_ meters; \_\_\_\_\_ feet

## GENERAL COMMENTS

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**APPENDIX D**

**CFR RipES FIELD FORM FOR  
SLICKENS (EXPOSED TAILINGS) POLYGONS**

# CFR RipES Data Form for Slickens Area Polygons

Data Record No.: \_\_\_\_\_

Does this polygon area contain any length of streambank? (Yes/No): \_\_\_\_\_

If **Yes**, give the Streambank Buffer Polygon record number(s): \_\_\_\_\_ ; \_\_\_\_\_ ; \_\_\_\_\_

## ADMINISTRATIVE DATA

- A1. Field data collected by: \_\_\_\_\_
- A2. Funding Agency/Organization: \_\_\_\_\_
- A3. Year: \_\_\_\_\_ A4. Date field data collected: \_\_\_\_\_ A5. Observers: \_\_\_\_\_
- A6. Landowner: \_\_\_\_\_
- A7. Weather: \_\_\_\_\_

## LOCATION DATA

- B1. County/Municipal District: \_\_\_\_\_
- B2. Location: \_\_\_\_\_
- B3. Land Legal Description: 1/4 1/4 Sec: \_\_\_\_\_ ; 1/4 Sec: \_\_\_\_\_ ; Sec: \_\_\_\_\_ ; Township (NS): \_\_\_\_\_ ; Range (EW): \_\_\_\_\_
- B4. UTM coordinates of the polygon centroid: Easting: \_\_\_\_\_ ; Northing: \_\_\_\_\_ ; Zone: \_\_\_\_\_
- B5. Quad map(s): \_\_\_\_\_ ; \_\_\_\_\_

## SITE CHARACTERISTIC DATA

### Physical Properties

- C1. Evidence of high groundwater? (Yes/No): \_\_\_\_\_
- C2. Drainage ditch(es) present? (Yes/No): \_\_\_\_\_
- C3. Irrigation ditch(es) present? (Yes/No): \_\_\_\_\_
- C4. Has the polygon been tilled? (Yes/No): \_\_\_\_\_
- C5. Proximity of tilling to CFR: \_\_\_\_\_ meters; \_\_\_\_\_ feet

### Geo-Chemical Properties

- C6. Average pH: \_\_\_\_\_
- C7. Average copper concentration (ppm): \_\_\_\_\_
- C8. Average arsenic concentration (ppm): \_\_\_\_\_
- C9. Metal salts present on surface? (Yes/No/NA): \_\_\_\_\_

**NOTE: Answer "NA" ONLY when wet conditions may have dissolved salts from the surface.**

## GENERAL COMMENTS

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**SOIL PIT COMPOSITE DATA**

Data Record No.: \_\_\_\_\_

	Easting (X)	Northing (Y)	Zone	Total Copper (ppm)	Total Arsenic (ppm)	Composite Pit pH	Pit ID No.
Pit 1:							
Pit 2:							
Pit 3:							
Pit 4:							
Pit 5:							

**INDIVIDUAL SOIL SAMPLE DATA**

Pit #	Sample Bag No.	Depth (in.)	Sample Description	Copper (ppm)	Arsenic (ppm)	pH
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**APPENDIX E**

**CFR RipES FIELD FORM FOR  
IMPACTED SOILS AND VEGETATION AREA POLYGONS AND  
SLIGHTLY IMPACTED SOILS AND  
VEGETATION AREA POLYGONS**

**CFR RipES Data Form for Impacted Soils Area Polygons  
and for Slightly Impacted Soils Area Polygons  
(Not for Use on Slickens Areas)**

Data Record No.: \_\_\_\_\_

Category of Soils Impact: \_\_\_\_\_

Does this polygon area contain any length of streambank? (Yes/No): \_\_\_\_\_

If **Yes**, give the Streambank Buffer Polygon record number(s) \_\_\_\_\_ ; \_\_\_\_\_ ; \_\_\_\_\_

**ADMINISTRATIVE DATA**

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- A1. Field data collected by: \_\_\_\_\_
- A2. Funding Agency/Organization: \_\_\_\_\_
- A3. Year: \_\_\_\_\_ A4. Date field data collected: \_\_\_\_\_ A5. Observers: \_\_\_\_\_
- A6. Landowner: \_\_\_\_\_
- A7. Weather: \_\_\_\_\_

**LOCATION DATA**

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- B1. County/Municipal District: \_\_\_\_\_
- B2. Location: \_\_\_\_\_
- B3. Land Legal Description: 1/4 1/4 Sec: \_\_\_\_\_ ; 1/4 Sec: \_\_\_\_\_ ; Sec: \_\_\_\_\_ ; Township (NS): \_\_\_\_\_ ; Range (EW): \_\_\_\_\_
- B4. UTM coordinates of the polygon centroid: Easting: \_\_\_\_\_ ; Northing: \_\_\_\_\_ ; Zone: \_\_\_\_\_
- B5. Quad map(s): \_\_\_\_\_ ; \_\_\_\_\_

**SITE CHARACTERISTIC DATA**

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**Physical Properties**

- C1. Evidence of high groundwater? (Yes/No): \_\_\_\_\_
- C2. Drainage ditch(es) present? (Yes/No): \_\_\_\_\_
- C3. Irrigation ditch(es) present? (Yes/No): \_\_\_\_\_
- C4. Has the polygon been tilled? (Yes/No): \_\_\_\_\_
- C5. Proximity of tilling to CFR: \_\_\_\_\_ meters; \_\_\_\_\_ feet

**Geo-Chemical Properties**

- C6. Average pH: \_\_\_\_\_
- C7. Average copper concentration (ppm): \_\_\_\_\_
- C8. Average arsenic concentration (ppm): \_\_\_\_\_
- C9. Metal salts present on surface? (Yes/No/NA): \_\_\_\_\_

**NOTE: Answer "NA" ONLY when wet conditions may have dissolved salts from the surface.**

**GENERAL COMMENTS**

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Data Record No.: \_\_\_\_\_

**SOIL PIT COMPOSITE DATA**

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	Easting (X)	Northing (Y)	Zone	Total Copper (ppm)	Total Arsenic (ppm)	Composite Pit pH	Pit ID No.
Pit 1:							
Pit 2:							
Pit 3:							
Pit 4:							
Pit 5:							

**INDIVIDUAL SOIL SAMPLE DATA**

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Pit #	Sample Bag No.	Depth (in.)	Sample Description.	Copper (ppm)	Arsenic (ppm)	pH
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