

4.0 TARGET RESTORATION AREAS

Consistent with the Work Plan objectives, the results of the characterization are to serve as a basis for identification of areas that would benefit from restoration. The current level of injury in the 11-mile reach has been characterized relative to the conditions in the Arkansas River and its floodplain upstream of California Gulch, as well as other areas. The characterization provides an understanding of the cause of the injuries by identifying the current sources of hazardous substances and the pathways for exposure. Therefore, the characterization provides adequate information for the logical progression to identify target restoration areas. Target restoration areas include source areas as well as impacted resources.

The sources contributing metals to the surface and groundwaters of the California Gulch drainage are being addressed through CERCLA response actions and are beyond the scope of this effort. It is recognized that restoration measures within the 11-mile reach will not restore surface water quality and will only provide limited benefit to the aquatic biological resources of the Arkansas River without additional metals-loading control measures in the sources to California Gulch. Any level of improvement in the quality of surface and groundwater leaving California Gulch will be beneficial in terms of the recovery of the services provided by the surface water, groundwater, and biological resources of the Arkansas River floodplain within the 11-mile reach.

Aside from the impacts of poor water quality due to metals loading from California Gulch, the primary source of injury within the 11-mile reach are the numerous discrete floodplain deposits of mine-waste. These deposits have resulted in direct injury to the underlying soil and floodplain vegetation, and pose a pathway for exposure of terrestrial wildlife. Even though not directly resulting in an injury to the surface water resources and aquatic biota, pathways for floodplain mine-waste deposits to contribute metals to the surface and groundwater systems exist. Key factors in evaluating the current and future potential for individual mine-waste deposits to contribute metals to the surface and shallow groundwater system are the potential for erosion and the metals concentration of each deposit. These factors were considered along with the defined injuries to soils and plants and the potential direct exposure of wildlife when identifying target restoration areas. Applying these considerations, mine-waste deposits have been systematically identified for restoration.

Another mining impact identified in the characterization report is elevated metals concentrations in surficial floodplain soils peripheral to the mine-waste deposits. Although defined injuries could not be directly linked to the presence of metals in these soils, in certain settings they may have the potential to impact the health of livestock. Further study would be required to assess the role of elevated metals concentrations on livestock. Such studies would involve evaluation of the ranching practices utilized by

landowners (e.g., irrigation practices, feeding, and use of nutritional supplements) in conjunction with additional livestock health and environmental data. Conduct of the appropriate studies would require several years. Also considering the relationship of the concerns to agricultural practices, it is not clear as to whether the potential effects to livestock would be assessed as an injury to natural resources. Given the level of uncertainty surrounding both the technical information and the applicability of restoration to an agricultural setting, floodplain soils have not been included as a target restoration area.

At the direction of the parties overseeing the execution of the Work Plan, natural resource areas that would benefit from restoration measures due to impacts other than from mining have also been identified. As discussed specifically for Reaches 2, 3, and 4, flow augmentation and grazing may have negative impacts on the conditions of the river and riparian zone. Although the impact to stream productivity cannot be quantified, restoration measures aimed at improving the quality of instream habitat and riparian vegetation would be beneficial and would enhance resource restoration associated with any improvement in the water quality of the Arkansas River.

The following provides a description of those areas and resource components targeted for development of restoration alternatives. Restoration objectives will be provided along with additional details on the target areas as part of the upcoming Restoration Alternatives Report.

4.1 Mine-Waste Deposits

Based on the site characterization information, it is evident that the different characteristics of the individual mine-waste deposits should be considered when developing restoration alternatives. An understanding of these characteristics may also be important when prioritizing the need for restoration at some point in the future. For these reasons, a methodology to classify the mine-waste deposits was developed. USEPA has conducted physical and chemical analyses of the mine-waste deposits within the 11-mile reach. This information was used to serve as a starting point for the classification analysis. The primary criteria for the classification system are:

- Erosion Potential - As defined by distance from or contact with the active channel based on a review of recent aerial photographs and available reports.
- Vegetation Cover – Based on review of recent aerial photography and limited site reconnaissance.

- Volume of Material – Based on recent work by USEPA to map the surface area and average depth of the individual deposits.
- Average Zinc Concentration – Based on a compilation of various USEPA sampling efforts. Categories of average zinc concentrations were developed as an indication of the potential metals toxicity to plants and wildlife, and to generally characterize the potential for a deposit to contribute metals loads to the water resources. The ranges are not meant to define any specific aspect of metals loading potential or toxicity, but to serve as a general tool for prioritization when coupled with other information.

Information related to the above criteria was analyzed using a Geographic Information System (GIS), and the results were quantified using the following scoring system:

- **Vegetation Class Score:**
 - 1: > 50 percent cover
 - 2: 10-50 percent cover
 - 3: < 10 percent cover
- **Erosion Potential Score:**
 - 1: Isolated from river
 - 2: In 500-year floodplain
 - 3: In contact with Arkansas River
- **Deposit Volume:**
 - 1: < 10,000 cu. ft.
 - 2: 10,000-50,000 cu. ft.
 - 3: > 50,000 cu. ft.
- **Average Zinc Concentration:**
 - 1: < 1,000 mg/Kg Zinc
 - 2: 1,000-5,000 mg/Kg Zinc
 - 3: > 5,000 mg/Kg Zinc

A ranking of the deposits was then conducted by dividing the range of possible scores (4 to 12) into three equal categories. These categories were then identified as a high (10-12), medium (7-9), or low (4-6) priority (Table 4-1) (Figure ES-4). A detailed tabulation of the GIS analysis and additional information on the methodology is presented in Appendix H.

The results of this effort will serve as a basis for the development of alternatives for the above-described categories of mine-waste deposits. If additional information on the individual mine-waste deposits becomes available or, after development of restoration objectives, if it becomes appropriate to refine any of the prioritization criteria, an updated GIS analysis may be conducted in support of the Restoration Alternatives Report (RAR).

4.2 Riparian and Instream Habitat Improvements

Areas that would benefit from improvements in the riparian zone vegetation were initially identified based on review of data, aerial photographs, site reconnaissance, and land-use patterns. These areas appear to be predominately within Reach 3 and the most downstream portions of Reach 2, although portions of Reach 1 should also be considered. Issues related to land ownership and the ability to implement restoration measures will be considered as part of the Restoration Alternatives Report (RAR).

Portions of the stream channel within the 11-mile reach downstream of Lake Fork appear to have been altered by the deposition of soils from hydraulic mining and by augmented flows. In these areas (predominantly Reach 3), the channel appears to be broad, shallow, and therefore mainly riffle habitat. Homogeneous habitat may be a concern because it offers little cover for larger fish and does not provide holding areas for fingerling fish during runoff or periods of augmented flow. Improvements in instream habitat and riparian vegetation in these areas may provide direct benefits to the fishery and may also reduce physical stressors that can compound the effects of metals toxicity. As improvements in water quality occur, such restoration measures would mitigate the potential for physical habitat to serve as a limiting factor for further recovery of the fishery. Prior to the restoration alternatives analysis, a quantitative evaluation of stream habitat has been recommended. Such a study would provide a clearer picture of the need for instream and riparian habitat restoration measures, and will be considered in the next phase of the project.

Although not as large an issue as for riparian habitat, the topic of land ownership will also be considered in the RAR for instream habitat. The recent acquisition of approximately 5 river miles through Reach 3 and a portion of Reach 4, by the State and County, make both riparian zone and instream habitat restoration more feasible.

Finally, although not a restoration measure, the need to better control flow augmentation has been a common theme in reports and conversations with various stakeholders. Even though progress has been made, additional measures to return and maintain the system closer to natural flow patterns could enhance any restoration measures ultimately implemented. This statement is made recognizing that flow augmentation also has a positive benefit in the form of dilution of metal concentrations.

TABLES

Table 4-1

Acreage of Deposits within Each Reach and Priority Category

Reach	Priority Category			Total Acreage of All Priorities
	High	Moderate	Low	
1	13.5	0.3	4.2	18.0
2	4.1	0.3	4.9	9.3
3	11.2	1.8	24.6	37.6
Total Acreage of All Reaches	28.8	2.5	33.7	65.0