REVISED RESTORATION PLAN FOR THE CLARK FORK RIVER AQUATIC AND RIPARIAN RESOURCES

SEPTEMBER 2020 Draft

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1 Introduction and Background

This document is an update to the *State of Montana's Revised Restoration Plan for the Clark Fork River, Aquatic and Riparian Resources* (2007 Restoration Plan) (NRDP 2007). While this plan (Restoration Plan) provides additional detail for the 2007 Restoration Plan, it does not replace that plan. The injury assessment in the 2007 Restoration Plan continues to apply to this update. This update includes additional restoration actions and analysis of those actions. In 2019, the State began the process of updating the 2007 Restoration Plan by completing the *Clark Fork River Aquatic and Riparian Restoration and Prioritization Analysis* (Geum et al. 2019). Restoration priorities are based on restoration actions included in the 2007 Restoration Plan and actions identified during implementation of the integrated remediation/restoration actions in completed phases of the Clark Fork River. NRDP worked closely with Montana Fish, Wildlife and Parks (FWP) and a consultant team familiar with the UCFRB, along with review and input from the Montana Department of Environmental Quality (DEQ), to develop the following list of restoration actions in order of how they ranked based on the prioritization analysis:

- Floodplain Diversity Enhancement (within Remedy)
- Additional Revegetation (within Remedy)
- Additional Contamination Removal
- Conservation Easements (on private land)
- Short and Long Term Management/Stewardship
- Restore Streambanks Ahead of Remediation
- Land Acquisition
- Channel Relocation
- Floodplain Diversity Enhancement (outside of Remedy)
- Clark Fork River Reaches B and C Aquatic Habitat Restoration
- Remove High-risk Contaminated Sediments Ahead of Remediation
- Riparian Vegetation Expansion (outside of Remedy)
- Reach A Aquatic Habitat Enhancement
- Modification of Mainstem Clark Fork River Diversion Structures
- Upper Blackfoot Mining Complex Restoration
- Upper Blackfoot River Native Trout Restoration

The results of the prioritization analysis form the basis of this updated 2020 Restoration Plan, and those results are summarized in this document. Information in the 2007 Restoration Plan, such as descriptions of the site, injury and remedy, is included here by reference. The 2020 Restoration Plan focuses on the updated restoration actions and their relation to remedy, and is organized as follows:

- **Section 2** provides a description of the remedy.
- **Section 3** describes restoration goals.
- **Section 4** describes the methods for developing the revised Restoration Plan.
- **Section 5** describes the revised restoration actions.
- **Section 6** describes the alternatives analysis and preferred alternative.
- **Section 7** provides a summary of estimated restoration action costs for each alternative.
- **Section 8** summarizes the process for implementing the revised Restoration Plan.

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Natural resource damages under the Comprehensive Environmental Response, Compensation and Liability Act, 42 U. S. C. § 9601 *et seq.,* (CERCLA) are designed to compensate the public for injury to natural resources. As the state trustee for natural resources, the Governor of the State of Montana (State) is entitled to seek damages for "injury to, destruction of, or loss of natural resources," including the reasonable costs of assessing such injury, destruction, or loss resulting from the release of a hazardous substance (CERCLA, 42 U.S.C.§ 9607(f)). In 1995 the State issued a Restoration Determination Plan (RDP) as part of its natural resource damage assessment (NRDP 1995b). Based on information then available about projected response actions to be undertaken, the RDP quantified natural resource damages to which the State was entitled in order to restore injured natural resources in the Upper Clark Fork River Basin (UCFRB). Among other resources, the RDP identified the costs to restore the aquatic and riparian resources in and along the Clark Fork River between Warm Springs Ponds near Anaconda Montana and Bonner, Montana.

In May 2004, the Record of Decision (ROD) for the Clark Fork River Operable Unit (CFROU) (Figure 1) was released by the United States Environmental Protection Agency (EPA 2004). The ROD included a description of the response actions to be undertaken along the Clark Fork River. In light of information contained in the ROD, the State's Aquatic and Terrestrial Injury Reports (NRDP 1995a) and the Remedial Investigation and Feasibility Study (Pioneer 2002), the State supplemented the 1995 RDP with the 2007 Restoration Plan that more directly considered the remediation actions proposed by EPA. The 2008 *Consent Decree for the Clark Fork River Operable Unit and for Remaining State of Montana Clark Fork Basin Natural Resource Damage Claims* (2008 State Consent Decree) (State of Montana v. Atlantic Richfield Company 2008) and the 2008 Consent Decree for the Clark Fork River Operable Unit and for Remaining State of Montana Clark Fork Basin Natural Resource Damage Claims (United States v. Atlantic Richfield 2008) (2008 Consent Decree) (referred to collectively as the 2008 Consent Decrees) provide additional guidance including specifying methods for evaluating changes to wetland extents and functions due to cleanup actions. Remedial actions have been modified since the ROD, as described in the Explanation of Significant Differences (DEQ and EPA 2015), and now include actions originally described in the 2007 Restoration Plan.

Paragraph 25 of the 2008 Consent Decree states, "the State shall use the Clark Fork State Restoration Account solely to restore, rehabilitate, replace or acquire the equivalent of the injured natural resources as provided in the Clark Fork River Aquatic and Riparian Resources Restoration Plan." There are two categories of restoration actions described in the 2008 Consent Decrees and the Superfund Memorandum of Agreement for the Clark Fork Site and discussed in this Plan: restoration actions and restoration in lieu of remedy. Restoration actions are actions that are separate from the restoration in lieu of remedy actions, which are the performance of remedial actions identified in the ROD and ESD that are also intended to restore injured natural resources in the Clark Fork Site. The 2020 Restoration Plan outlines how the categories of restoration actions restore, rehabilitate, replace or acquire the equivalent of the injured natural resources, thus meeting the requirements of the 2008 Consent Decrees. Restoration actions that are not intended to replace remedial action do not require approval by DEQ and EPA. Restoration in lieu of remedy are actions that either replace or enhance remedial action and are intended to jump start or enhance recovery of the injured resources. These actions are subject to review and approval by DEQ and EPA and may be implemented before or in conjunction with remedial actions. The 2020 Restoration Plan evaluates some actions that are intended to restore the

injured natural resources more quickly than they could be approved and performed as restoration in lieu of remedy. Although there is some overlap between the two types of restoration actions, a key distinction is that approved "restoration in lieu of remedy" actions allow for a monetary accounting that credits the restoration fund for the remediation which would have otherwise been performed. NRDP primarily will be performing the actions in this Plan as restoration using the Clark Fork State Restoration Account and not restoration in lieu of remedy. However, both restoration actions and restoration in lieu of remedy actions are intended to meet the goals and objectives of this Plan.

All restoration actions on private land will only be implemented in conjunction with willing landowners and are subject to the review and approval of the landowner.

At the time of the 2008 Consent Decrees for the CFROU, the funding received to implement the CFROU Record of Decision and the 2007 Restoration Plan was not sufficient to implement all remedy and restoration actions. Instead, the 2008 Consent Decrees recognized that DEQ and NRDP would need to integrate available resources in order for the State of Montana to successfully and effectively complete the requirements of CFROU ROD and 2007 Restoration Plan. The 2020 Restoration Plan maintains the 2007 allocation of $2.5 million to restoration of bull trout and westslope cutthroat trout in the Clark Fork River drainage at the Upper Blackfoot River to decrease the time needed for trout populations to recover. The 2020 Restoration Plan also evaluates alternatives and provides a method for allocating the limited natural resource damages received in the 2008 Consent Decrees.

In addition to documents supporting and responding to the ROD, other documents have been developed since mainstem Clark Fork River cleanup activities began in earnest in 2012-2013, to guide combined remediation and restoration efforts and provide a framework for evaluating their performance. These documents include a summary of Clark Fork River Reach A geomorphology and hydrology (CDM and AGI 2013), the *Clark Fork River Operable Unit Reach A, Geomorphology and Vegetation Monitoring Plan: Clark Fork Site* (Geum and AGI 2015), the 2016 5-year review (USEPA 2016), and the *Clark Fork River Reach A Design Approach* (CDM et al. 2016). Therefore, there is a need to update restoration actions and priorities for the Clark Fork River mainstem, and this document is intended to fill that need.

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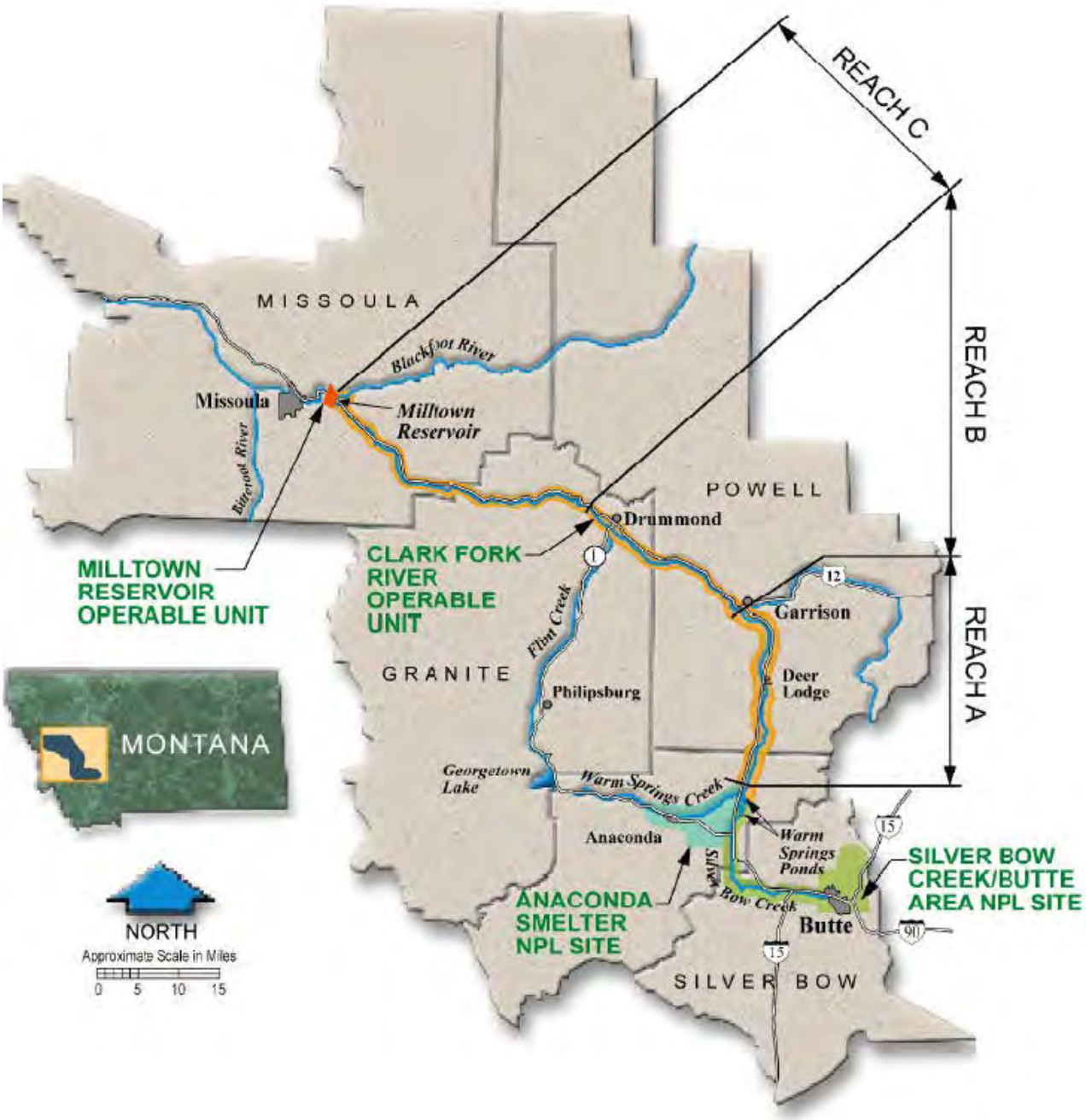

Figure 1. Clark Fork River Operable Unit (map courtesy of EPA).

2 Description of Remedy

This revised Restoration Plan assumes that remedial actions will continue as described in the Explanation of Significant Differences (DEQ and EPA 2015) and the *Clark Fork River Reach A Design Approach* (CDM et al. 2016). The main components of the remedial action in previously completed phases (1, 2, 5, 6, 15 and 16) included:

Removal of tailings/impacted soils that meet any of the following conditions:

1. Arsenic levels exceed the human health standard in the surface interval (620 ppm).
2. The sum of Contaminants of Concern (COCs) (As, Cd, Cu, Pb, Zn) exceeds 1,400 mg/kg (parts per million) and any of the following:
    - The deepest metals-contaminated interval of soil (per the 1,400 mg/kg threshold) is deeper than 24 inches,
    - The contamination lies within the Channel Migration Zone (CMZ) regardless of depth (CMZ is defined by applying pre-project 90th percentile reach scale migration rate to allow 100 years of movement and includes high risk avulsion hazard zones),
    - Arsenic exceeds the human health standard at the surface (620 ppm) and the deepest metals contaminated interval of soil (per the 1,400 mg/kg threshold) is shallower than 24 inches, or
    - In areas where floodplain connectivity is desired, removal may occur where the deepest metals contaminated interval of soil (per the 1,400 mg/kg threshold) is shallower than 24 inches if removing the material would result in the surface being hydrologically connected (0.5 feet above the 2-year water surface elevation (Q2), or lower).
3. Limited areas outside the CMZ where contaminated material is present and removing it will result in a more constructible remedial project.
4. Areas of unique native vegetation may be preserved and contamination left in place.

In addition, the following criteria are generally applied to floodplain grading and revegetation of remediated areas:

- The floodplain is re-built to the approximately Q2 return flow elevation at the streambanks and gradually slopes to existing ground.
- Between 0.5 and 1.5 feet of vegetative growth media are placed on the floodplain surface depending on location.
- Floodplain features including point bars, side channels, wetlands, secondary channels, oxbow wetlands, etc. are incorporated into the grading. Where these features occur naturally, they are re-built or preserved where feasible.
- The surface of the floodplain is treated with roughness (non-uniform topography) and woody debris.
- The surface of the floodplain is revegetated using native seed and other plant materials.
- Where uncontaminated floodplain surfaces form channel banks, they are left unmodified, regardless of height or erosion potential.

Figure 2 and Figure 3 show examples of criteria that determined remediation extents and floodplain reconstruction in previously completed phases.

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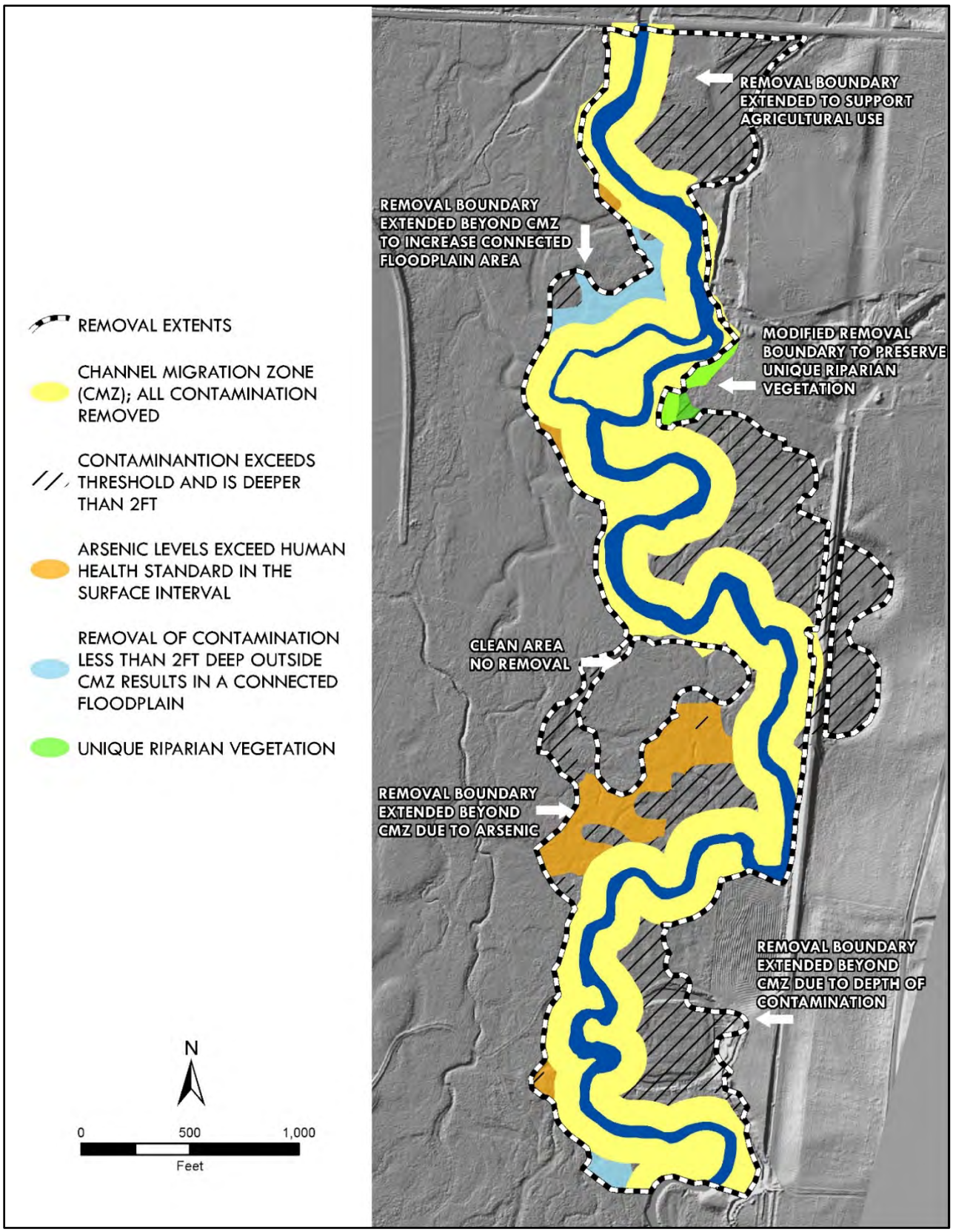

Figure 2. Typical scenario: Contamination removal extents based on remediation and restoration design criteria

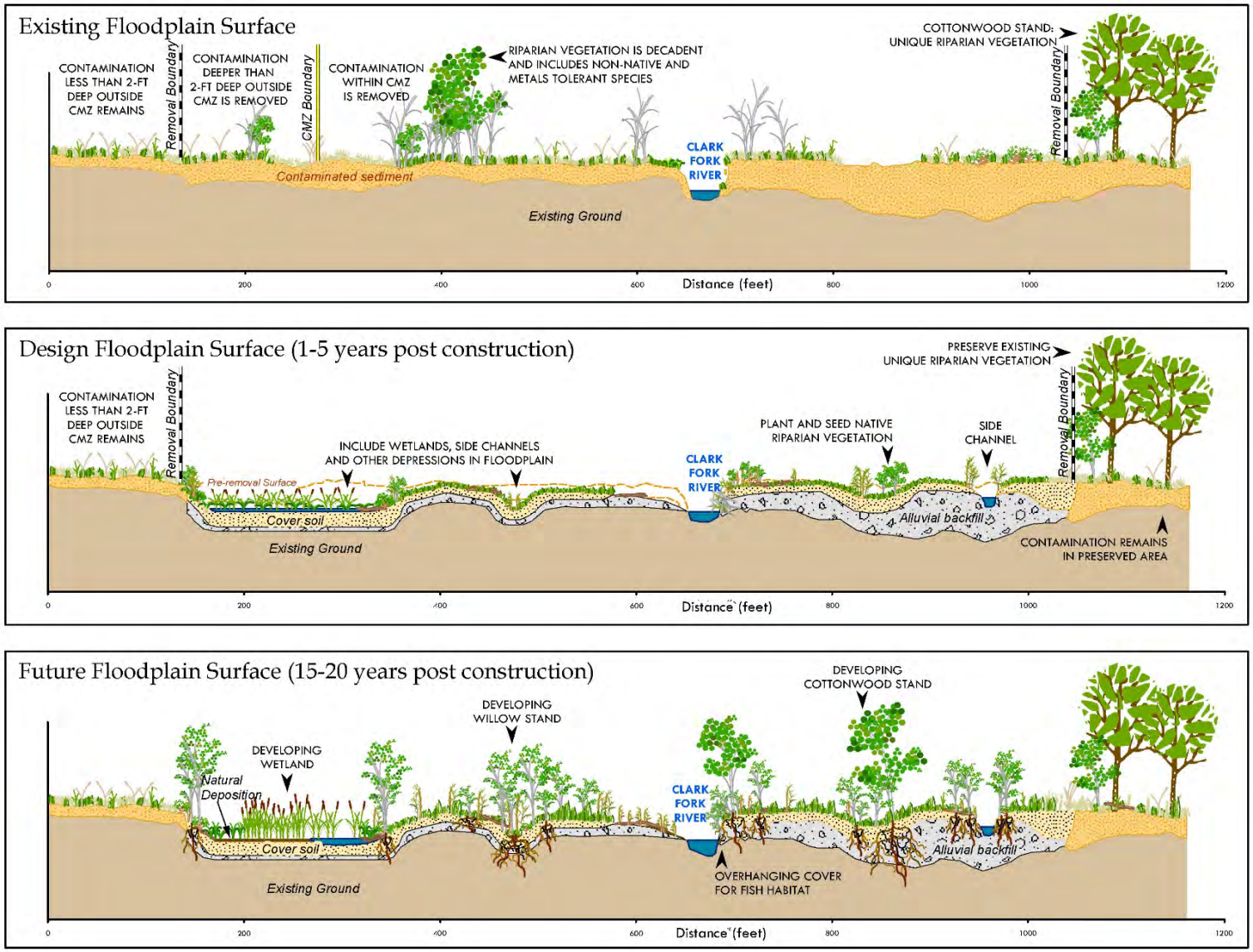

Figure 3. Floodplain surface prior to remediation and restoration, design floodplain surface and future floodplain surface

3 Restoration Goals and Objectives

This 2020 Restoration Plan builds on the remedy actions discussed in Section 2. To accomplish this, restoration actions focus on complementing and supplementing remedy's ability to address factors that limit river and floodplain ecosystem health (limiting factors), and therefore the ability of the ecosystem to return to baseline conditions, which are described in the 2007 Restoration Plan. In the context of this revised Restoration Plan, restoration goals are broad categories. These categories include: the importance of various characteristics of the natural ecosystem and working landscape including aquatic habitat and terrestrial habitat; ecosystem resilience; cost-effectiveness and sustainability of restoration actions; and the economic value of working lands. Goals and objectives in this plan are unchanged from the 2007 Restoration Plan, except where clarified as shown in brackets, and include:

1. Restore aquatic resources in the Clark Fork River to baseline conditions. Objectives include:
   a. Improve water quality and reduce the rate of accumulation of metals and arsenic in bed sediments.
   b. [Improve natural processes to] restore in-stream habitat within the Clark Fork River and its tributaries to support the complete life history strategy of salmonids and other native fishes.
   c. Improve floodplain stability to reduce sediment erosion into the Clark Fork River and reduce migration of metals and arsenic to the stream.
2. Restore terrestrial habitat to baseline conditions along the riparian zones and floodplains of the Clark Fork River. Objectives include:
   a. Restore cover and diversity of vegetation within the floodplain and riparian zone to baseline conditions.
   b. Restore habitat complexity of the floodplain to approximate baseline conditions, as estimated by reference stream assessments.
   c. Improve floodplain stability through planting of dense stands of willows and shrubs.
3. Offset the residual effects from hazardous substances that are not eliminated from the aquatic system to flora and fauna.
   a. [Improve natural processes to] restore in-stream habitat within the Clark Fork River and its tributaries to support the complete life history strategy of salmonids and other fishes.
   b. Improve water quality within the Clark Fork River and its tributaries to support the complete life history strategy of salmonids and other fishes.
   c. Improve water quantity within the Clark Fork River and its tributaries to support the complete life history strategy of salmonids and other fishes.
4. Maximize the long-term beneficial effects and cost-effectiveness of restoration activities.
   a. Coordinate restoration activities with remediation to generate cost savings.
   b. Develop and implement a plan to preserve, protect, and manage the restored riparian floodplain corridor.
5. Improve natural aesthetic values of the Clark Fork River.
   a. Develop a productive, restored river and floodplain ecosystem to improve natural aesthetics, similar to baseline conditions, and based on reference sites.

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This 2020 Restoration Plan is intended to be a framework that helps guide expenditure of restoration funds based on a rational analysis of which restoration actions meet legal and technical criteria. Therefore, objectives are not quantified specifically in this plan; rather, once specific restoration projects are identified, this framework would be used to set measurable objectives. It is useful to think of restoration objectives in terms of limiting factors, or factors that limit the ability of the ecosystem to return to baseline conditions. Limiting factors can be linked to goals, and this linkage can be used to further articulate project-specific, quantified objectives. For example, a site-specific restoration project might include objectives such as: *construct a fish screen at one diversion structure and improve 1,000 feet of ditch*; or *remove 3,500 cubic yards of contaminated material from a 2.3 acre area, resulting in 2.3 acres of floodplain that connects with Clark Fork River surface flows at the 2 year return flow and supports expansion of native riparian shrubs through natural colonization*. In this way, specific restoration actions can be tied to the limiting factors they address, and these factors in turn can be linked to broader restoration goals. Restoration limiting factors and constraints identified during the Restoration Plan update process (Geum et al. 2019) are described below. Table 1 shows the linkages among goals, limiting factors and restoration actions.

3.1 Restoration Limiting Factors

Limiting factors in the Clark Fork River mainstem ecosystem are problems that can be addressed through restoration and management actions. The following list of significant limiting factors was identified during the Restoration Plan update process (Geum et al. 2019) and includes but is not limited to:

- Metals contaminated floodplain, streambanks, and channel bed;
- Low base stream flow;
- Water temperature (elevated summer temperatures);
- Water quality, including elevated nutrients and metals;
- Lack of floodplain connectivity;
- Lack of woody vegetation cover on streambanks and associated increased streambank erosion;
- Fish passage (diversion structures);
- Lack of aquatic habitat (limited pools, wood, woody vegetation); and
- Lack of terrestrial/riparian habitat.

These are factors that can be addressed by restoration actions in order to restore the mainstem Clark Fork River towards baseline conditions. Factors that cannot be addressed through restoration actions are considered to be constraints on restoration.

3.2 Restoration Constraints

Several factors will influence the effectiveness of restoration actions implemented in the UCFRB. These factors cannot be addressed by restoration actions evaluated in this document but are key constraints to effective restoration along the mainstem Clark Fork River. Other restoration and management actions outside the scope of this plan may be able to address some or all of these constraints. Constraints include but are not limited to:

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- The effects of Warm Springs Ponds including discharge water with low pH, elevated temperatures in late summer, and elevated arsenic discharges from early summer through fall, dampening of the hydrograph above the Q10 flow, and causing periodic spikes in metals concentrations in the aquatic system.
- Nutrient sources that are contributing to elevated nitrogen and phosphorous and leading to *Cladophora* algae blooms.
- Aerial deposition of arsenic in upland areas.
- Uncertain future land management of remediated/restored areas.
- Infrastructure such as bridges, railroad, and roads.
- Recognition that all metals contamination within the Clark Fork River floodplain and streambed will not be removed or remediated, resulting in continued impact to water quality, river sediments, riparian and aquatic health.
- Over allocation of water rights within the UCFRB.
- Finite available funding for restoration.

The restoration goals described in this section are all inter-related and each are affected by overlapping subsets of limiting factors, as shown in Table 1. The restoration actions described in the next sections are intended to address the limiting factors in the UCFRB, beyond what can be addressed by remedy, and move the ecosystem and working landscape closer to baseline conditions.

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Table 1. Relationship among Restoration Plan goals, limiting factors and restoration actions.

Restoration Goals	Related Limiting Factors	Potential Restoration Actions to Address Limiting Factors
Restore aquatic resources in the Clark Fork River to baseline conditions	• Metals contaminated floodplain, streambanks, and channel bed • Lack of woody vegetation cover on streambanks and associated increased streambank erosion • Fish passage (diversion structures) • Lack of aquatic habitat (limited pools, wood and woody vegetation) • Low base stream flow • Water temperature (elevated summer temperatures) • Water quality, including elevated nutrients and metals	• Additional contamination removal • Remove high-risk contaminated sediments ahead of remediation • Channel relocation • Clark Fork River Reach A aquatic habitat enhancement • Clark Fork River Reaches B and C aquatic habitat restoration • Restore streambanks ahead of remediation • Modification of mainstem Clark Fork River diversion structures
Restore terrestrial habitat to baseline conditions along the riparian zones and floodplains of the Clark Fork River	• Lack of terrestrial/riparian habitat • Metals contaminated floodplain, streambanks, and channel bed • Lack of floodplain connectivity • Lack of woody vegetation cover on streambanks and associated increased streambank erosion	• Floodplain diversity enhancement (within Remedy) • Additional revegetation (within Remedy) • Additional contamination removal • Remove high-risk contaminated sediments ahead of remediation • Floodplain diversity enhancement (outside Remedy) • Riparian vegetation expansion (outside Remedy) • Land acquisition
Offset the residual effects from hazardous substances that are not eliminated from the aquatic and riparian systems to flora and fauna	• Water quality, including elevated nutrients and metals • Metals contaminated floodplain, streambanks, and channel bed • Lack of woody vegetation cover on streambanks and associated increased streambank erosion • Lack of aquatic habitat (limited pools, wood and woody vegetation) • Lack of terrestrial/riparian habitat • Low base stream flow • Water temperature (elevated summer temperatures) • Water quality, including elevated nutrients and metals	• Floodplain diversity enhancement (within Remedy) • Additional revegetation (within Remedy) • Additional contamination removal • Land acquisition • Clark Fork River Reach A aquatic habitat enhancement • Clark Fork River Reaches B and C aquatic habitat restoration • Floodplain diversity enhancement (outside Remedy) • Riparian vegetation expansion (outside Remedy)
Maximize the long-term beneficial effects and cost-effectiveness of restoration activities.	• All limiting factors	All restoration actions in this plan were selected based on a set of criteria that indicated favorable benefits relative to costs. Integrate restoration actions with remedial actions to the extent possible.

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Restoration Goals	Related Limiting Factors	Potential Restoration Actions to Address Limiting Factors
Improve natural aesthetic values of the Clark Fork River	• Lack of aquatic habitat (limited pools, wood and woody vegetation) • Lack of terrestrial/riparian habitat • Metals contaminated floodplain, streambanks, and channel bed • Lack of woody vegetation cover on streambanks and associated increased streambank erosion • Low base stream flow	• All restoration actions

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4 Restoration Plan Methods

This 2020 Restoration Plan assumes that remedial actions will continue as described in the *Explanation of Significant Differences* (DEQ and EPA 2015) and the *Clark Fork River Reach A Design Approach* (CDM et al. 2016), summarized in Section 2 above. Restoration actions were developed during the Restoration Plan update process (Geum et al. 2019) by compiling actions for the Clark Fork River mainstem included in other restoration documents, and actions that have been identified during implementation of the integrated remediation/restoration actions in Phase 1, Phase 2, Phase 5, Phase 6, Phase 15, and Phase 16. The list of draft restoration actions was then considered by NRDP, FWP, DEQ, and the consultant team. Once the list of restoration actions had been identified, actions were assigned a priority tier and then ranked based on criteria developed by NRDP, FWP and the consultant team. The priority tiers and ranking criteria are summarized below and described in detail in Geum et al. (2019).

4.1 Restoration Priority Tiers

Restoration actions identified for this revised Restoration Plan fall into three priority tiers, including:

- Tier I: Actions directly integrated with remediation actions in the CFROU (i.e. remediation/restoration actions).
- Tier II: Actions occur within the CFROU, but do not directly contribute to remediation of contamination in the CFROU. Actions may benefit or enhance the remedial actions.
- Tier III: Actions do not occur in the CFROU, but have been previously determined as high priorities for restoration.

Table 2 lists the restoration actions identified for the CFROU and identifies which priority tier each action falls into. 'Maintenance, Monitoring, and Evaluation' were originally included as restoration actions, but were removed from the evaluation and prioritization because they are required actions under the ROD.

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Table 2. Upper Clark Fork River restoration actions and priority tier for each action.

	Priority Tier		
Restoration Action	**I**	**II**	**III**
Floodplain Diversity Enhancement (within Remedy)	■		
Additional Revegetation (within Remedy)	■		
Additional Contamination Removal	■		
Conservation Easements	■		
Short and Long Term Management/Stewardship	■		
Restore Streambanks Ahead of Remediation	■		
Land Acquisition	■		
Channel Relocation		■	
Floodplain Diversity Enhancement (outside of Remedy)		■	
Clark Fork River Reaches B and C Aquatic Habitat Restoration		■	
Remove High-risk Contaminated Sediments Ahead of Remediation	■		
Riparian Vegetation Expansion (outside of Remedy)		■	
Reach A Aquatic Habitat Enhancement		■	
Modification of Mainstem Clark Fork River Diversion Structures		■	
Upper Blackfoot Mining Complex Restoration			■
Upper Blackfoot River Native Trout Restoration			■

4.2 Restoration Action Ranking and Scoring

Restoration actions were ranked (1) according to which Priority Tier they were assigned (level one), and (2) based on a set of specific ranking categories (level two). These categories are listed below, and detailed descriptions of ranking categories, criteria and results can be found in *Clark Fork River Aquatic and Riparian Restoration and Prioritization Analysis* (Geum et al. 2019). Level two ranking categories included:

- Technical Feasibility
- Ecological Benefit
- Biological Benefit (Aquatic)
- Biological Benefit (Terrestrial)
- Adverse Environmental Impacts
- Recovery Period
- Federal, State, Tribal Policies, Rules, and Laws
- Adverse Socioeconomic Impacts
- Data Gaps
- Proximity to Other Restoration or Remediation Actions
- Benefit to Completed Restoration or Remediation Actions
- Risks to Completed Restoration or Remediation Actions
- Benefits Multiple Resources
- Cost-effectiveness
- Benefit:Cost

For each restoration action, each level two evaluation category could receive a score of 0 (low), 0.5 (moderate) or 1 (high). Scores for each level two evaluation category were totaled and added to the

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level one score where Priority Tier I actions received a score of 1 and Priority Tier II actions received a score of 0. Results are summarized in Figure 4. This ranking shows that actions directly supporting remedy and benefiting multiple resources scored higher, while actions that benefit only one resource such as aquatic habitat enhancement scored lower. However, in the context of a particular project, any of these restoration actions could be included if they can contribute to achieving the Restoration Plan goals by addressing limiting factors.

It is important to note that the priority tiers and rankings are not intended to guide selection of one restoration action over another, but rather to provide a way to communicate each restoration action's contribution to addressing limiting factors and restoring baseline conditions. Any restoration action described in this revised Restoration Plan may be selected when site-specific restoration projects are identified. As specific restoration projects are developed, the priority tiers and ranking criteria provide a consistent and repeatable way to consider risks, uncertainties, impacts and the benefit: cost relationship for restoration actions in the context of a specific project.

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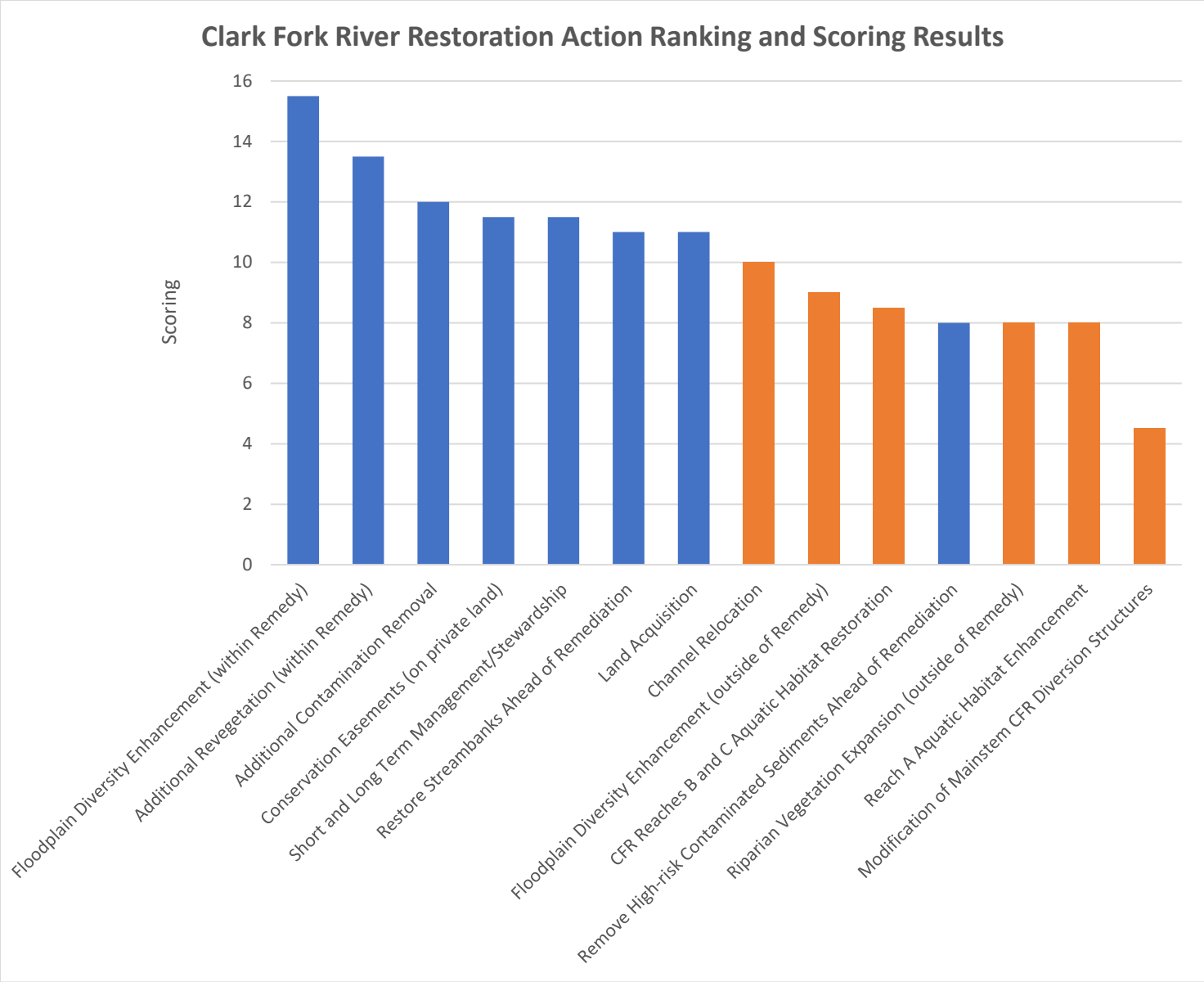

Figure 4. Restoration actions ranking and scoring results. Restoration actions colored blue are Tier I and restoration actions colored orange are Tier II.

5 Description of Restoration Actions

Restoration actions included in this revised Restoration Plan are described and illustrated on the following pages. All actions are geographically constrained to Reach A of the CFROU except for Reaches B and C Aquatic Habitat Restoration, Upper Blackfoot Mining Complex Restoration and Upper Blackfoot River Native Trout Restoration. For each restoration action, a description of the restoration action and examples of the types of restoration treatments, or other efforts, that may be implemented under that action are provided. Costs and quantities were estimated during the prioritization analysis (Geum et al. 2019). A summary of the assumptions used to quantify each restoration action is provided in the following sections and described in more detail in Geum et al. 2019. Because detailed investigations have only been completed for a portion of Reach A, there are significant data gaps and therefore insufficient information to anticipate exact quantities and costs for each restoration action. Therefore, quantities reported in this section were estimated to provide a general sense of the scale of the opportunity available to implement each restoration action within the CFROU. Costs were developed based on known costs of work that has been completed in recent years in western Montana, and are reported as broad ranges. As noted above, any restoration actions on private land will only be implemented in conjunction with willing landowners and are subject to the review and approval of the landowner.

Restoration actions where (Within Remedy) is included in the title of the action may include any areas where contamination removal is occurring, whether that is associated with Remedy or areas of additional removal completed by Restoration. In Geum et. al (2019), these restoration actions included (Within Remedy or Contamination Removal Areas) as part of their title.

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5.1 Restoration Action: Floodplain Diversity Enhancement (Within Remedy)

PRIORITY TIER	ESTIMATED QUANTITY	ESTIMATED COST
Tier I (Directly supports remedy)	16 acres	<$1 million

5.1.1 Restoration Action Description

This action includes increasing or enhancing the diversity of reconstructed floodplains within or immediately adjacent to areas where remedial actions are completed. Floodplain diversity enhancement would be completed in areas where contamination removal is occurring, whether that is associated with remedial actions or areas of additional removal completed as restoration actions. Increasing floodplain habitat diversity would improve floodplain connectivity and associated water storage and release, and provide suitable areas for riparian vegetation and wetlands. Examples of floodplain diversity enhancement include:

- Restore, enhance, or protect existing floodplain features such as wetlands, side channels, or oxbows.
- Create additional floodplain features such as wetlands, side channels, distributary flow channels, or oxbows.
- Diversify floodplain topography.
- Lower floodplain surfaces to increase connectivity.

5.1.2 Estimated Quantity and Cost of Restoration Action

The estimated quantity of this restoration action was determined by extrapolating costs for floodplain diversity features in CFROU phases completed through 2016 to an estimated removal extent for phases that have not yet been completed. This resulted in an estimated total of 16 acres of floodplain diversity features that would be constructed within Reach A. The estimated cost is based on typical cost per constructed wetland and side channel per foot construction cost. Costs associated with this treatment include, but are not limited to, excavation and grading, import and placement of growth media, fencing, and construction of floodplain roughness, including buried wood placement and microtopography. Costs are estimated to be less than $1 million when applied to all unremediated phases in Reach A.

5.1.3 Limiting Factors Addressed by the Restoration Action

Metals contaminated floodplain, streambanks and channel bed	
Low base stream flow	
Water temperature (elevated summer temperatures)	✓
Water quality, including elevated nutrients (resulting in algae blooms) from unknown sources and Warm Springs Ponds (low pH, metals, and arsenic)	✓
Lack of floodplain connectivity	✓
Lack of woody vegetation cover on streambanks and associated increased streambank erosion	✓
Fish passage (diversion structures)	
Lack of aquatic habitat (limited pools, wood, woody vegetation)	
Lack of terrestrial/riparian habitat	✓

Figure 5 shows an example of the Floodplain Diversity Enhancement (Within Remedy) restoration action.

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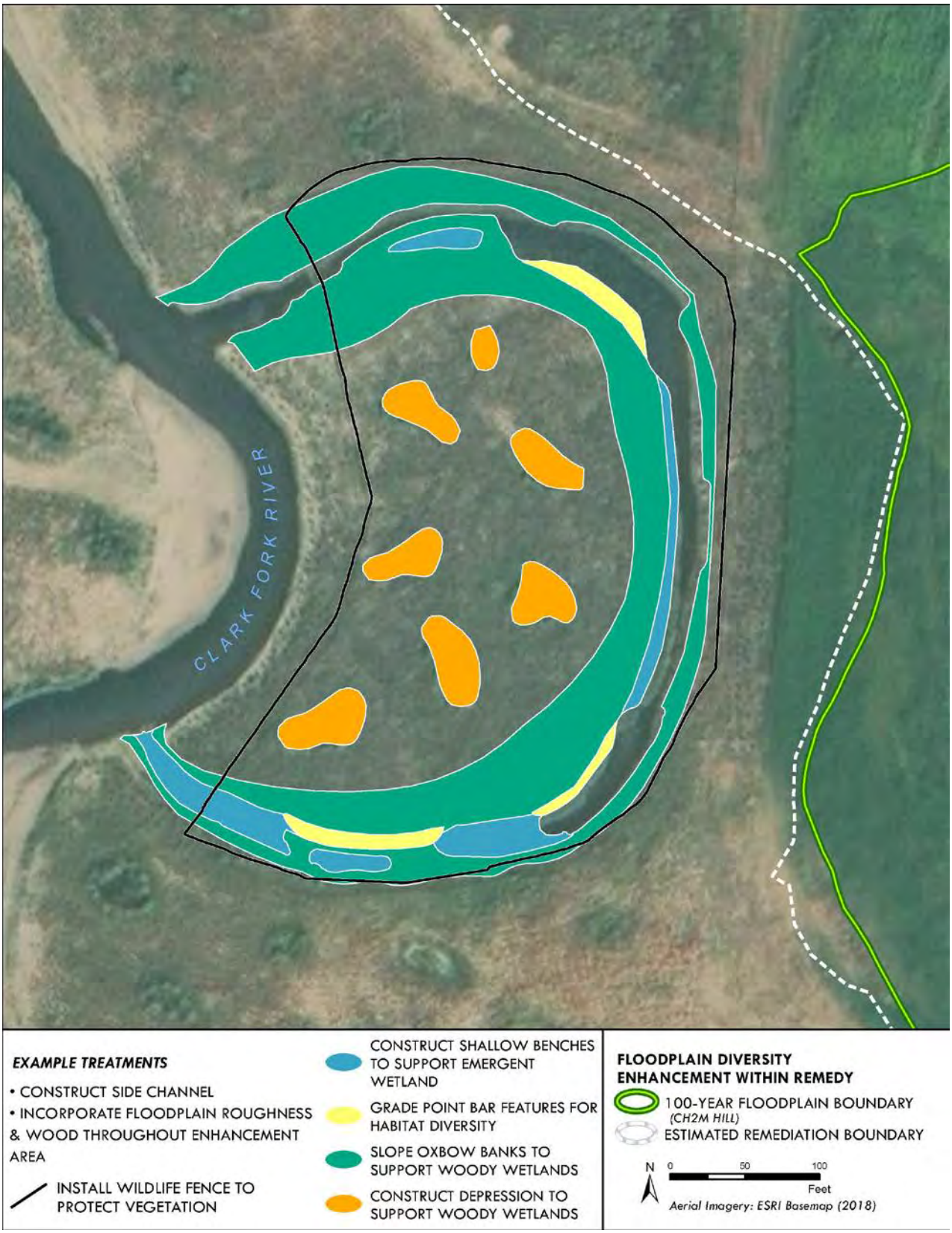

Figure 5. Example treatments that may apply within the Floodplain Diversity Enhancement Within Remedy restoration action.

5.2 Restoration Action: Additional Revegetation (Within Remedy)

PRIORITY TIER	ESTIMATED QUANTITY	ESTIMATED COST
Tier I (Directly supports remedy)	75 acres	$1 Million to $5 Million

5.2.1 Restoration Action Description

This action includes additional revegetation activities that are beyond what remedial actions are expected to complete. Additional revegetation would be implemented in areas where contamination removal is occurring, whether that is associated with remedial actions or areas of additional removal completed through restoration actions. In some cases, such as the example shown in Figure 6, this restoration action would be implemented in conjunction with the Floodplain Diversity Enhancement action described above. Additional revegetation actions associated with Remedy or contamination removal areas could include:

- Planting more plants, additional species, or larger size plants;
- Adding additional species to seed mixes to increase diversity;
- Installing other vegetation enhancement treatments such as pre-vegetated wetland sod mats; and
- Establishing cottonwood and willow stands from seed.

5.2.2 Estimated Quantity and Cost of Restoration Action

Within Reach A, approximately 1,500 acres remain to be remediated. To develop a cost estimate for additional revegetation, it was assumed that five percent of this area (75 acres) would receive additional revegetation treatments. Specific costs include purchase and installation of nursery plants, diverse native seed mixes, custom seed collection and labor-intensive seeding and site maintenance to promote plant establishment. At an estimated cost of $30,000 per acre for additional revegetation, the total cost of the Additional Revegetation restoration action is estimated to be between $1 million and $5 million when applied to all unremediated phases in Reach A.

5.2.3 Limiting Factors Addressed by the Restoration Action

Metals contaminated floodplain, streambanks and channel bed	
Low base stream flow	
Water temperature (elevated summer temperatures)	
Water quality, including elevated nutrients (resulting in algae blooms) from unknown sources and Warm Springs Ponds (low pH, metals, and arsenic)	
Lack of floodplain connectivity	
Lack of woody vegetation cover on streambanks and associated increased streambank erosion	✓
Fish passage (diversion structures)	
Lack of aquatic habitat (limited pools, wood, woody vegetation)	✓
Lack of terrestrial/riparian habitat	✓

Figure 6 shows an example of the Additional Revegetation (Within Remedy) restoration action.

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Figure 6. Example treatments that may apply within the Additional Revegetation within Remedy restoration action.

5.3 Restoration Action: Additional Contamination Removal

PRIORITY TIER	ESTIMATED QUANTITY	ESTIMATED COST
Tier I (Directly supports remedy)	77 acres	> $5 Million

5.3.1 Restoration Action Description

This action includes removing contamination that would not be removed by remedial actions. The most common reason for additional contamination removals is to increase floodplain connectivity by lowering the ground surface relative to the river stage. Downstream of Deer Lodge there could be areas outside of the contamination removal extents with high concentrations, but shallow depths of contamination due to historic contaminant delivery and depositional patterns being different further downstream from the contaminated sediment sources. Removing additional contamination in these areas (outside of the channel migration zone [CMZ]) may be beneficial even if contamination where total concentrations of COCs exceed 1,400 mg/kg is less than 2 feet in depth.

5.3.2 Estimated Quantity and Cost of Restoration Action

Quantity of additional contamination removal was estimated based on the assumption that additional removal areas would be approximately five percent of the area where contaminated sediments are removed under Remedy in all remaining phases (77 acres). A removal boundary was estimated based on information developed during an analysis of Reach A geomorphology and hydrology (CDM and AGI 2013). A per acre removal cost of approximately $70,000 is based on costs from completed phases. Cost associated with this treatment include excavation of contaminated sediment and hauling sediments to a repository. Costs could potentially be $5 million or greater when applied to all unremediated phases in Reach A.

5.3.3 Limiting Factors Addressed by the Restoration Action

Metals contaminated floodplain, streambanks and channel bed	✓
Low base stream flow	
Water temperature (elevated summer temperatures)	
Water quality, including elevated nutrients (resulting in algae blooms) from unknown sources and Warm Springs Ponds (low pH, metals, and arsenic)	✓
Lack of floodplain connectivity	✓
Lack of woody vegetation cover on streambanks and associated increased streambank erosion	
Fish passage (diversion structures)	
Lack of aquatic habitat (limited pools, wood, woody vegetation)	
Lack of terrestrial/riparian habitat	✓

Figure 7 shows an example of the Additional Contamination Removal restoration action.

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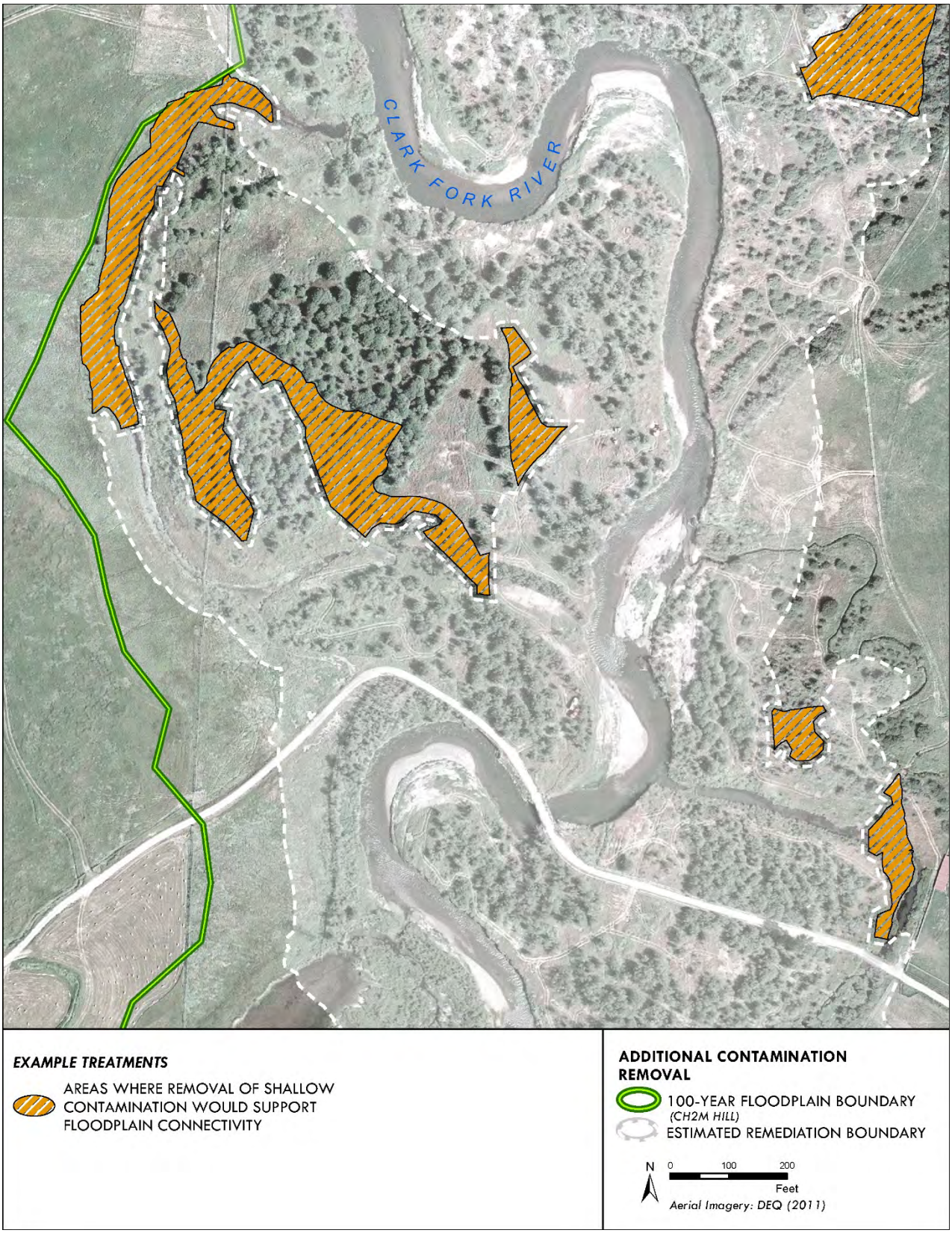

Figure 7. Example application of Additional Contamination Removal restoration action.

5.4 Restoration Action: Conservation Easements

PRIORITY TIER	ESTIMATED QUANTITY	ESTIMATED COST
Tier I (Directly supports remedy)	834 acres	< $1 Million

5.4.1 Restoration Action Description

This action includes placing conservation easements on lands that will remain in private ownership. A conservation easement is a voluntary legal agreement between a landowner and a land trust or government agency that permanently limits uses of the land in order to protect its conservation values (definition from Land Trust Alliance). There are numerous types of conservation easements and organizations that hold and manage easements. For purposes of CFROU restoration, conservation easements would not allow development, would require grazing management, and would require the adoption of a riparian protection or buffer zone. Another potential type of easement that could apply to the CFROU is a channel migration easement (CME) where a landowner voluntarily limits their right to armor river banks or prevent channel movement within a defined channel migration zone (CMZ), allowing for natural river migration over time.

5.4.2 Estimated Quantity and Cost of Restoration Action

Potential conservation easement costs were estimated using average costs of recently completed conservation easements in the UCFRB. This average cost of $720/acre was applied to private and public parcels of land that intersect a 100 ft buffer on both sides of the Clark Fork River in Reach A, excluding National Park Service lands. Other areas may be included if needed to establish a conservation easement. Parcels that include this buffer on both sides of the river would be high value conservation easement acquisitions because this zone overlaps the areas where combined remediation and restoration efforts are most concentrated. Costs are estimated to be less than $1 million when applied to areas that meet these criteria in Reach A and that are not currently protected by conservation easements.

5.4.3 Limiting Factors Addressed by the Restoration Action

Metals contaminated floodplain, streambanks and channel bed	
Low base stream flow (including dewatering due to irrigation)	
Water temperature (elevated summer temperatures)	
Water quality, including elevated nutrients (resulting in algae blooms) from unknown sources and Warm Springs Ponds (low pH, metals, and arsenic)	✓
Lack of floodplain connectivity	✓
Lack of woody vegetation cover on streambanks and associated increased streambank erosion	✓
Fish passage (diversion structures)	
Lack of aquatic habitat (limited pools, wood, woody vegetation)	
Lack of terrestrial/riparian habitat	✓

Figure 8 shows an example of an existing conservation easement along the Clark Fork River in Reach A.

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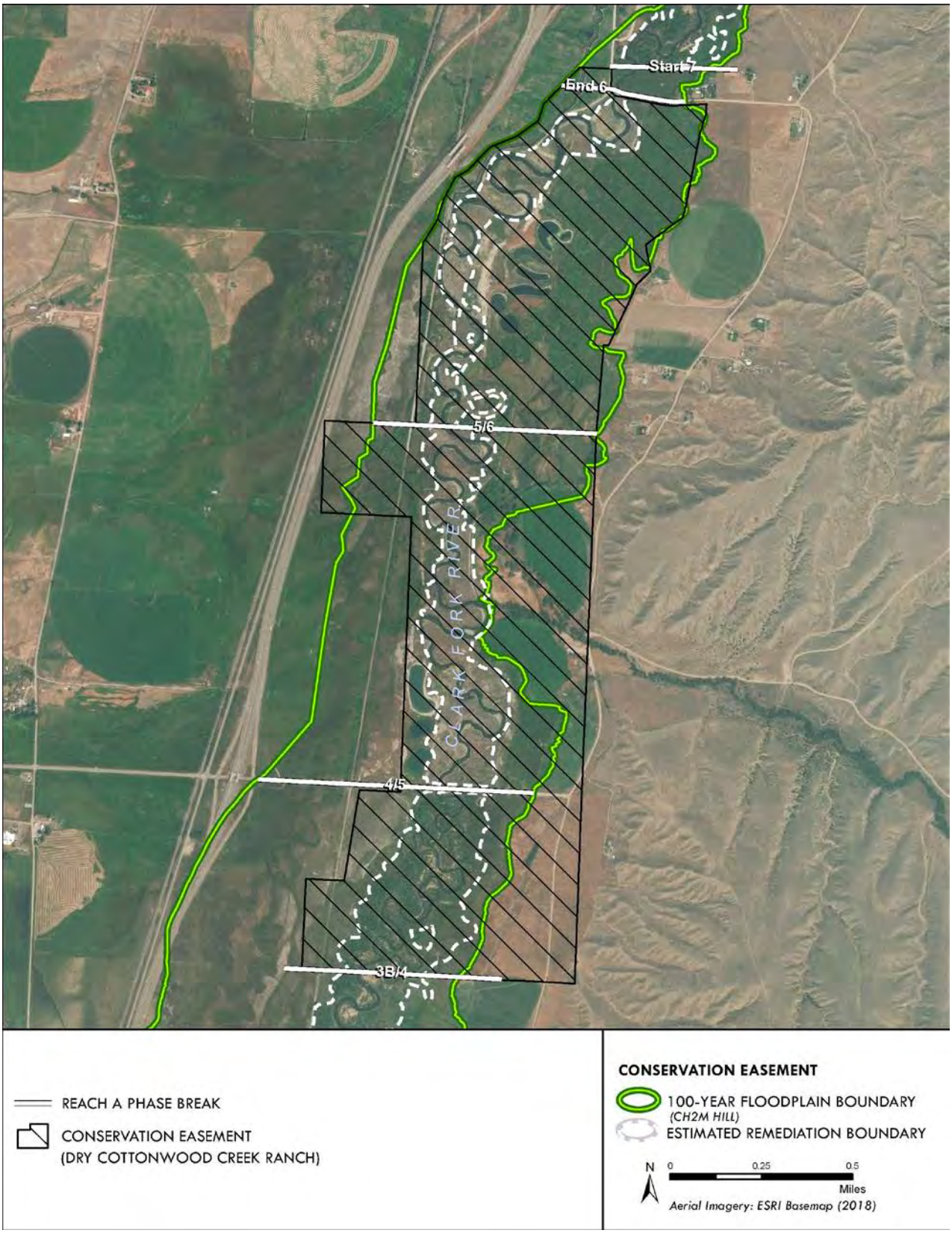

Figure 8. Example of a Conservation Easement restoration action.

5.5 Restoration Action: Short and Long Term Management/Stewardship

PRIORITY TIER	ESTIMATED QUANTITY	ESTIMATED COST
Tier I (Directly supports remedy)	1,543 acres	$1 Million to $5 Million

5.5.1 Restoration Action Description

This action includes implementing management and stewardship actions in all phases after remediation and restoration actions are completed to establish and protect a riparian buffer along the mainstem Clark Fork River. This will prolong the protection of remediated areas beyond the Landowner Best Management Plans required by the ROD, or protect areas outside of remediation. These actions could also protect existing high quality habitats such as wetlands. Specific management and stewardship actions could include:

- Prepare and implement land management plans for areas outside of Remedy;
- Establish lease agreements for areas outside of Remedy where restoration actions are completed or extend remediation lease agreements to prevent undesirable land uses within restoration areas for a specified length of time, or establish other incentive programs;
- Install riparian fencing to protect a riparian buffer or CMZ in grazed areas;
- Conduct weed control beyond Remedy obligations;
- Implement grazing management (off-stream water sources, grazing strategies); and
- Develop and support partnerships with organizations that can work directly with landowners to promote stewardship of restored lands.

5.5.2 Estimated Quantity and Cost of Restoration Action

Estimated costs of management and stewardship actions were developed based on two percent of average combined remediation and restoration costs for currently completed phases. This calculated number was compared to estimated costs for typical stewardship actions described above, converted to a per acre cost of approximately $2,000, and applied to all phases in Reach A. Total estimated costs of management and stewardship actions is between $1 million and $5 million.

5.5.3 Limiting Factors Addressed by the Restoration Action

Metals contaminated floodplain, streambanks and channel bed	
Low base stream flow (including dewatering due to irrigation)	
Water temperature (elevated summer temperatures)	✓
Water quality, including elevated nutrients (resulting in algae blooms) from unknown sources and Warm Springs Ponds (low pH, metals, and arsenic)	✓
Lack of floodplain connectivity	✓
Lack of woody vegetation cover on streambanks and associated increased streambank erosion	✓
Fish passage (diversion structures)	
Lack of aquatic habitat (limited pools, wood, woody vegetation)	
Lack of terrestrial/riparian habitat	✓

Figure 9 shows an example of a potential riparian management zone as a long-term stewardship action.

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Figure 9. Example treatment that may apply within the Short & Long term Management / Stewardship restoration action.

5.6 Restoration Action: Restore Streambanks Ahead of Remediation

PRIORITY TIER	ESTIMATED QUANTITY	ESTIMATED COST
Tier I (Directly supports remedy)	113,700 linear feet	> $5 Million

5.6.1 Restoration Action Description

This action includes re-building streambanks prior to DEQ remediating the adjacent floodplain. The purpose of this action is to reduce the amount of contaminated sediment entering the river due to bank erosion in the near term, and allow bank vegetation to begin to establish and expand earlier than would happen with the remediation schedule. Restoring streambanks ahead of remediation could also reduce the need for qualified streambank contractors to complete the work as part of remediation, and allow for some remedial infrastructure to be established ahead of remedy. This action only includes areas that would eventually be treated as part of remedy. The action would include removing contamination from a 50ft buffer along the entire river channel within the remediation footprint, and installing streambank treatments currently being used for integrated remediation/restoration in the CFROU. This action also includes, but is not limited to, other actions that would achieve bank stabilization objectives.

5.6.2 Estimated Quantity and Cost of Restoration Action

Costs and quantities are estimated assuming a 50-foot buffer of contaminated sediment is removed in association with streambank restoration, and that material is stockpiled on site. Streambank treatment types would be similar to the most recent remedial design. This restoration action would only be applied in uncompleted phases upstream of Deer Lodge where contaminated streambanks are most common. Costs are estimated to be approximately $136 per linear foot of streambank, including streambank construction and removal of the 50 ft contaminated sediment buffer. Total cost of restoring streambanks ahead of remediation in all uncompleted phases would be greater than $5 million.

5.6.3 Limiting Factors Addressed by the Restoration Action

Metals contaminated floodplain, streambanks and channel bed	✓
Low base stream flow (including dewatering due to irrigation)	
Water temperature (elevated summer temperatures)	
Water quality, including elevated nutrients (resulting in algae blooms) from unknown sources and Warm Springs Ponds (low pH, metals, and arsenic)	✓
Lack of floodplain connectivity	✓
Lack of woody vegetation cover on streambanks and associated increased streambank erosion	✓
Fish passage (diversion structures)	
Lack of aquatic habitat (limited pools, wood, woody vegetation)	✓
Lack of terrestrial/riparian habitat	✓

Figure 10 shows an example of the Restore Streambanks Ahead of Remediation restoration action.

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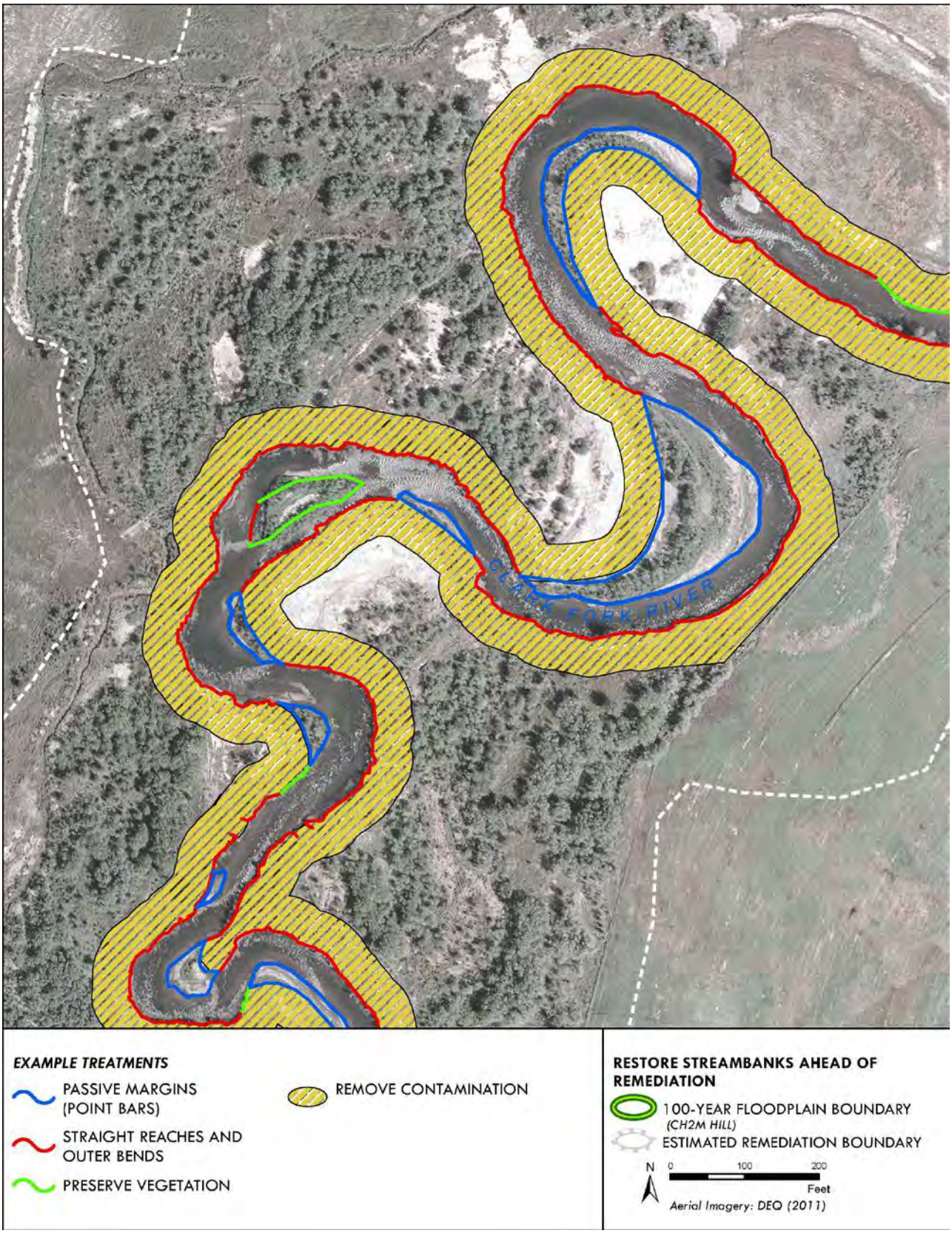

Figure 10. Example treatments that may apply within the Restore Streambanks Ahead of Remediation restoration action.

5.7 Restoration Action: Land Acquisition

PRIORITY TIER	ESTIMATED QUANTITY	ESTIMATED COST
Tier I (Directly supports remedy)	1,896 acres	$1 Million to $5 Million

5.7.1 Restoration Action Description

This action includes acquiring land that will remain in state ownership and be managed as conservation land in perpetuity, emphasizing natural river function and habitat objectives. Because of these shifts in land management, this action would indirectly address limiting factors related to water quality, floodplain function and riparian vegetation.

5.7.2 Estimated Quantity and Cost of Restoration Action

Estimated cost is based on the average per acre purchase price ($1,555 per acre) of recent land acquisitions in Reach A. Criteria for potential land purchases include: land must include the 100-year floodplain, parcels must be greater than 30 acres in size, and parcels must include a portion of the main Clark Fork River channel. Costs are estimated to be between $1 million and $5 million when applied to the approximate 1,896 acres that meet these criteria in Reach A.

5.7.3 Limiting Factors Addressed by the Restoration Action

Metals contaminated floodplain, streambanks and channel bed	
Low base stream flow (including dewatering due to irrigation)	✓
Water temperature (elevated summer temperatures)	
Water quality, including elevated nutrients (resulting in algae blooms) from unknown sources and Warm Springs Ponds (low pH, metals, and arsenic)	✓
Lack of floodplain connectivity	
Lack of woody vegetation cover on streambanks and associated increased streambank erosion	✓
Fish passage (diversion structures)	
Lack of aquatic habitat (limited pools, wood, woody vegetation)	✓
Lack of terrestrial/riparian habitat	✓

Figure 11 shows an example of a completed land acquisition in Reach A.

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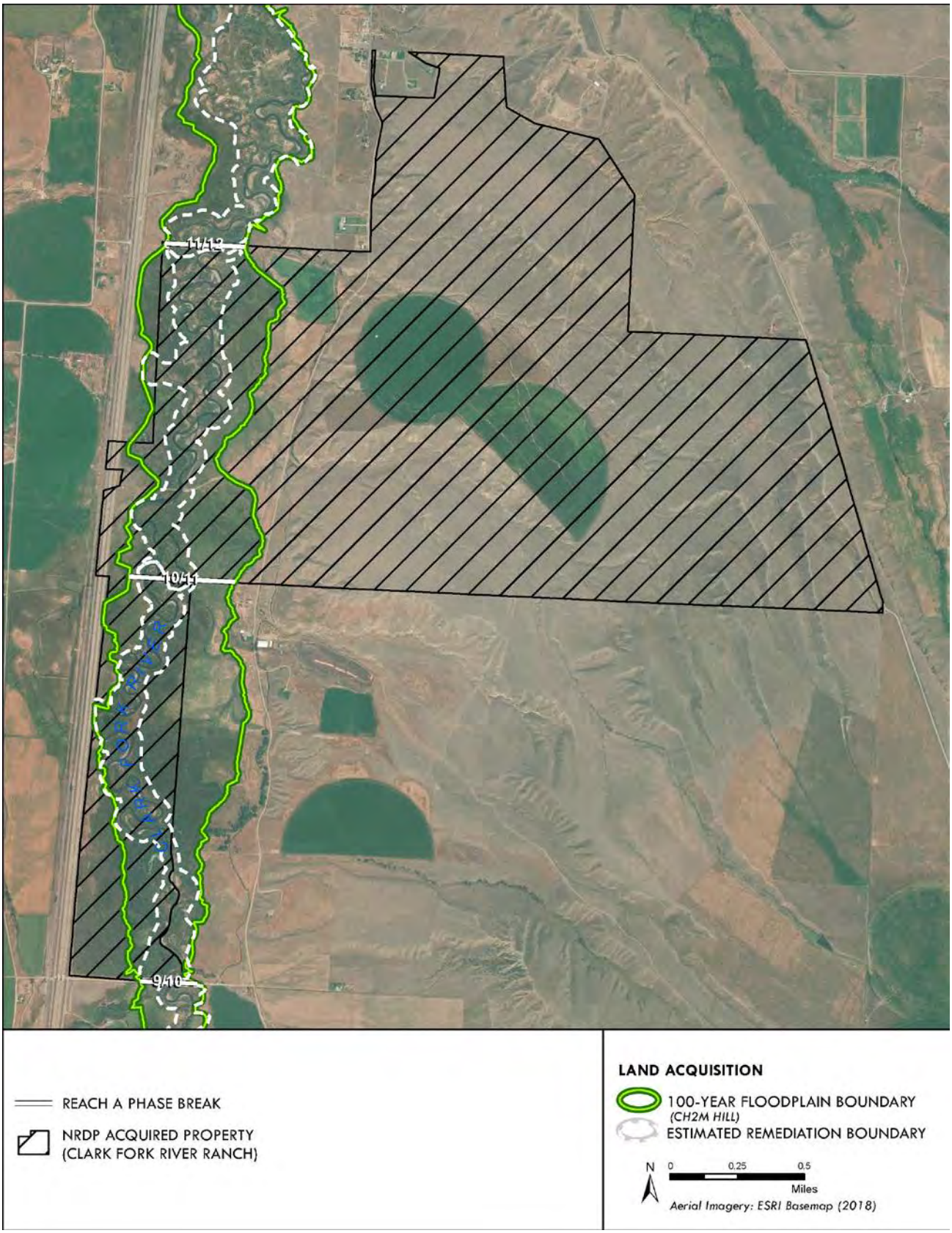

Figure 11. Example of the Land Acquisition restoration action.

5.8 Restoration Action: Channel Relocation

PRIORITY TIER	ESTIMATED QUANTITY	ESTIMATED COST
Tier II (Does not directly support remedy)	28,750 linear feet	$1 Million to $5 Million

5.8.1 Restoration Action Description

This action includes relocating the main Clark Fork River channel from its current location when current channel conditions do not support river and ecological function. An example of a channel relocation action is in Phase 7 where the current channel is eroding into a steep terrace on the west side of the valley bottom. While channel relocation also occurs as part of remediation actions where channel instability would jeopardize remediation, those types of channel relocation are not considered part of this action. Constructing new channels would address several limiting factors because this would present opportunities to design specific habitat features and channel geometries, and improve connectivity between the river and floodplain.

5.8.2 Estimated Quantity and Cost of Restoration Action

To estimate costs and quantities for this action, examples of opportunities for channel relocation were identified within Reach A using aerial imagery. Because a channel relocation design has already been developed for Phase 7, this estimated cost of $172 per linear foot was applied to the 28,750 linear feet of channel relocation opportunity identified as a restoration action, for a total potential cost between $1 million and $5 million in Reach A.

5.8.3 Limiting Factors Addressed by the Restoration Action

Metals contaminated floodplain, streambanks and channel bed	✓
Low base stream flow	
Water temperature (elevated summer temperatures)	✓
Water quality, including elevated nutrients (resulting in algae blooms) from unknown sources and Warm Springs Ponds (low pH, metals, and arsenic)	✓
Lack of floodplain connectivity	✓
Lack of woody vegetation cover on streambanks and associated increased streambank erosion	✓
Fish passage (diversion structures)	
Lack of aquatic habitat (limited pools, wood, woody vegetation)	✓

Figure 12 shows an example of a Channel Relocation restoration action that has already been designed in Phase 7.

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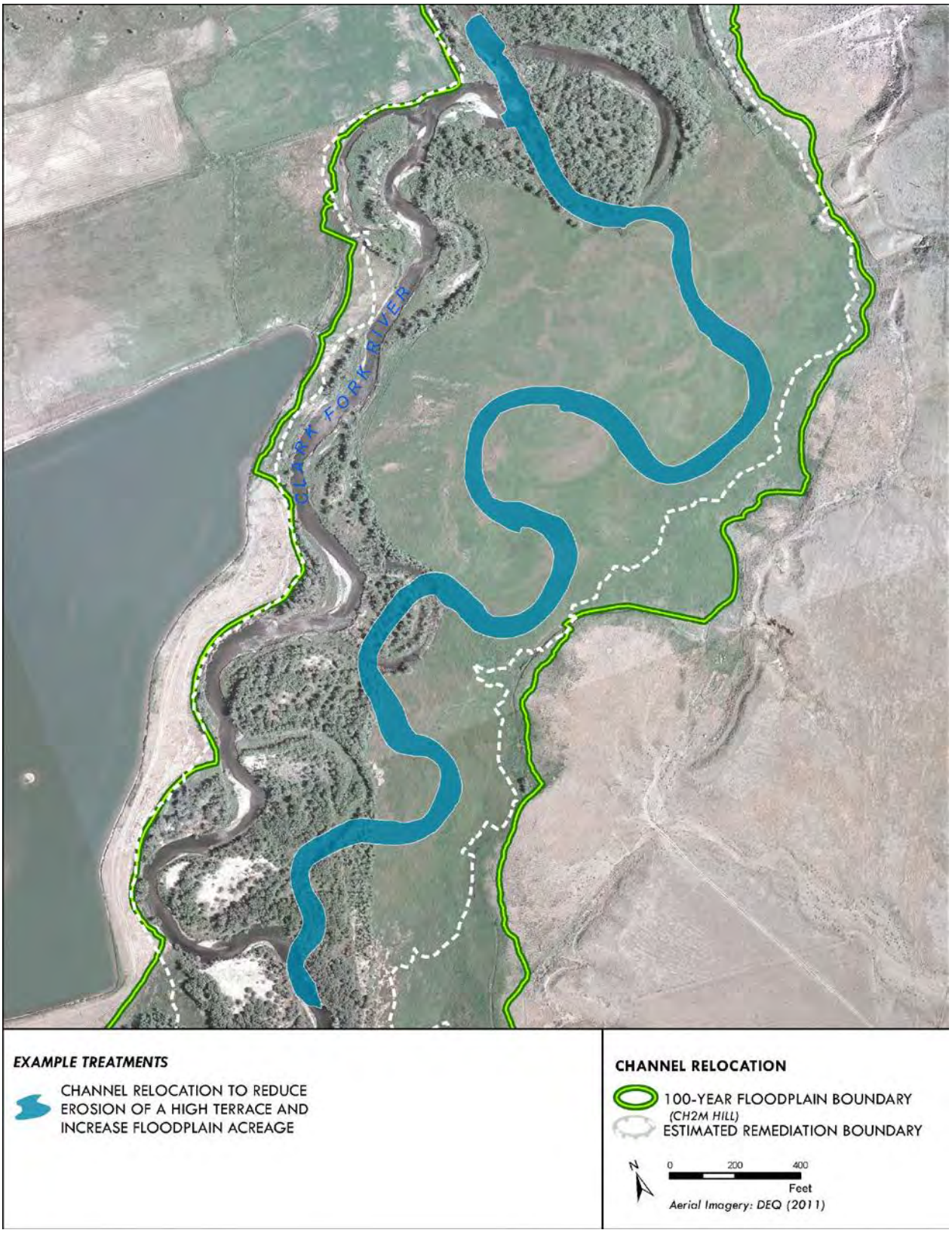

Figure 12. Example of the Channel Relocation restoration action.

5.9 Restoration Action: Floodplain Diversity Enhancement (Outside of Remedy)

PRIORITY TIER	ESTIMATED QUANTITY	ESTIMATED COST
Tier II (Does not directly support remedy)	All remaining Phases	$1 Million to $5 Million

5.9.1 Restoration Action Description

This action includes increasing or enhancing the diversity of floodplains in areas where contamination removal does not occur. Floodplain diversity enhancement includes creation of new features through surface excavation. It does not include active revegetation of these newly constructed features; those actions are covered under Restoration Action 12. Riparian Vegetation Expansion (Outside Remedy). Specific examples of floodplain diversity enhancement include:

- Diversify floodplain topography
- Create wetlands, side channels, distributary flow channels, oxbows, etc.
- Restore degraded or drained wetlands (i.e. in irrigated areas)
- Restore and/or reconnect tributary confluences
- Lower floodplain surfaces to restore connectivity and increase the potential for natural riparian vegetation expansion

5.9.2 Estimated Quantity and Cost of Restoration Action

Costs were based on the assumption that floodplain diversity enhancement could be done in all 22 phases of Reach A. For each phase, costs are based on an example suite of treatments including five acres of wetlands, three acres of floodplain microtopography including wood and roughness, 1,000 linear feet of side channel construction, and 3,000 feet of fencing to protect wetlands and other important habitats. The total per phase cost estimate for these treatments is approximately $80,000 resulting in a total potential cost of between $1 million and $5 million in Reach A.

5.9.3 Limiting Factors Addressed by the Restoration Action

Metals contaminated floodplain, streambanks and channel bed	✓
Low base stream flow (including dewatering due to irrigation)	
Water temperature (elevated summer temperatures)	
Water quality, including elevated nutrients (resulting in algae blooms) from unknown sources and Warm Springs Ponds (low pH, metals, and arsenic)	✓
Lack of floodplain connectivity	✓
Lack of woody vegetation cover on streambanks and associated increased streambank erosion	
Fish passage (diversion structures)	
Lack of aquatic habitat (limited pools, wood, woody vegetation)	
Lack of terrestrial/riparian habitat	✓

Figure 13 shows an example of the Floodplain Diversity Enhancement (Outside of Remedy) restoration action where a historic side channel could be reactivated.

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Figure 13. Example of treatments that may apply within the Floodplain Diversity Enhancement Outside of Remedy restoration action.

5.10 Restoration Action: CFR Reaches B and C Aquatic Habitat Restoration

PRIORITY TIER	ESTIMATED QUANTITY	ESTIMATED COST
Tier II (Does not directly support remedy)	10 percent of Reaches B and C	> $5 Million

5.10.1 Restoration Action Description

This action includes addressing limiting factors in Reaches B and C of the CFROU. Within Reaches B and C, the Flint Creek to Rock Creek reach is a priority area. Additional study of the Flint Creek to Rock Creek Reach of the UCFRB is covered under the Restoration Plans (NRDP 2019). This restoration action includes elements that may improve aquatic habitat in these sections of the mainstem Clark Fork River. Additional actions may be identified. Actions needed to improve aquatic habitat in these sections of Reaches B and C include:

- Rip-rap removal/replacement/revegetation
- Riparian vegetation protection
- Riparian vegetation enhancement
- In-stream habitat enhancement (pool formation + cover)
- Channel Migration Zone (CMZ) recovery
- Remove floodplain constrictions (i.e. old railroad berms)

5.10.2 Estimated Quantity and Cost of Restoration Action

Within Reaches B and C, the length of existing riprap has been inventoried and a CMZ has been identified (AGI and DTM 2016). Costs for this Restoration Action are based on removing 50% of existing riprap and revegetating 100% of riprapped areas. Costs also assume 10% of the CMZ would be planted and 10% of the priority river length would receive riparian fencing, streambank restoration and aquatic habitat features for a total potential cost of greater than $5 million.

5.10.3 Limiting Factors Addressed by the Restoration Action

Metals contaminated floodplain, streambanks and channel bed	
Low base stream flow (including dewatering due to irrigation)	
Water temperature (elevated summer temperatures)	
Water quality, including elevated nutrients (resulting in algae blooms) from unknown sources and Warm Springs Ponds (low pH, metals, and arsenic)	✓
Lack of floodplain connectivity	✓
Lack of woody vegetation cover on streambanks and associated increased streambank erosion	✓
Fish passage (diversion structures)	
Lack of aquatic habitat (limited pools, wood, woody vegetation)	✓
Lack of terrestrial/riparian habitat	✓

Figure 14 shows examples of the CFR Reaches B and C Aquatic Habitat restoration action.

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Figure 14. Example of treatments that may apply within the Clark Fork River Reaches B & C Aquatic Habitat restoration action.

5.11 Restoration Action: Remove High Risk Contaminated Sediments Ahead of Remediation

PRIORITY TIER	ESTIMATED QUANTITY	COST
Tier I (Directly supports remedy)	15 acres	< $1 Million

5.11.1 Restoration Action Description

This action includes removing high risk contaminated sediments in currently unremediated phases in Reach A prior to remedial actions. This action also includes, but is not limited to, actions that would stabilize sediments in place or achieves the same objectives, such as installation of straw wattles or other erosion control materials. High risk areas include those where contaminated sediment is likely to enter the aquatic system in the near future. This action directly supports remedy because it removes or stabilizes contaminated material that would be removed by remedy. For the purpose of this Restoration Plan, these areas were defined as slickens documented in the Record of Decision where the Clark Fork River channel has intercepted these slickens based on recent aerial imagery. These areas are distributed throughout Reach A. As part of this action, contaminated sediment will be stockpiled temporarily at a nearby location outside of the 100-year floodplain and then later transported to a designated repository such as Opportunity Ponds once the remedial action is under way for that phase.

5.11.2 Estimated Quantity and Cost of Restoration Action

Based on the criteria described above, an estimated total of 15 acres (46,800 cubic yards) of high risk contaminated sediment remains within Reach A. Of this area, approximately 2,500 linear feet is along the streambank and would require streambank reconstruction after contamination removal. Cost associated with this treatment include coordination and construction of site access and reclamation; excavation of contaminated sediment and backfilling with clean, imported sediment; temporary cover of stockpiled contaminated sediment; reconstruction of streambanks; revegetation and erosion control. Costs are estimated to be less than $1 million when applied to all unremediated phases in Reach A.

5.11.3 Limiting Factors Addressed by the Restoration Action

Metals contaminated floodplain, streambanks and channel bed	✓
Low base stream flow (including dewatering due to irrigation)	
Water temperature (elevated summer temperatures)	
Water quality, including elevated nutrients (resulting in algae blooms) from unknown sources and Warm Springs Ponds (low pH, metals, and arsenic)	✓
Lack of floodplain connectivity	✓
Lack of woody vegetation cover on streambanks and associated increased streambank erosion	
Fish passage (diversion structures)	
Lack of aquatic habitat (limited pools, wood, woody vegetation)	
Lack of terrestrial/riparian habitat	✓

Figure 15 shows an example of the Remove High Risk Contaminated Sediments restoration action.

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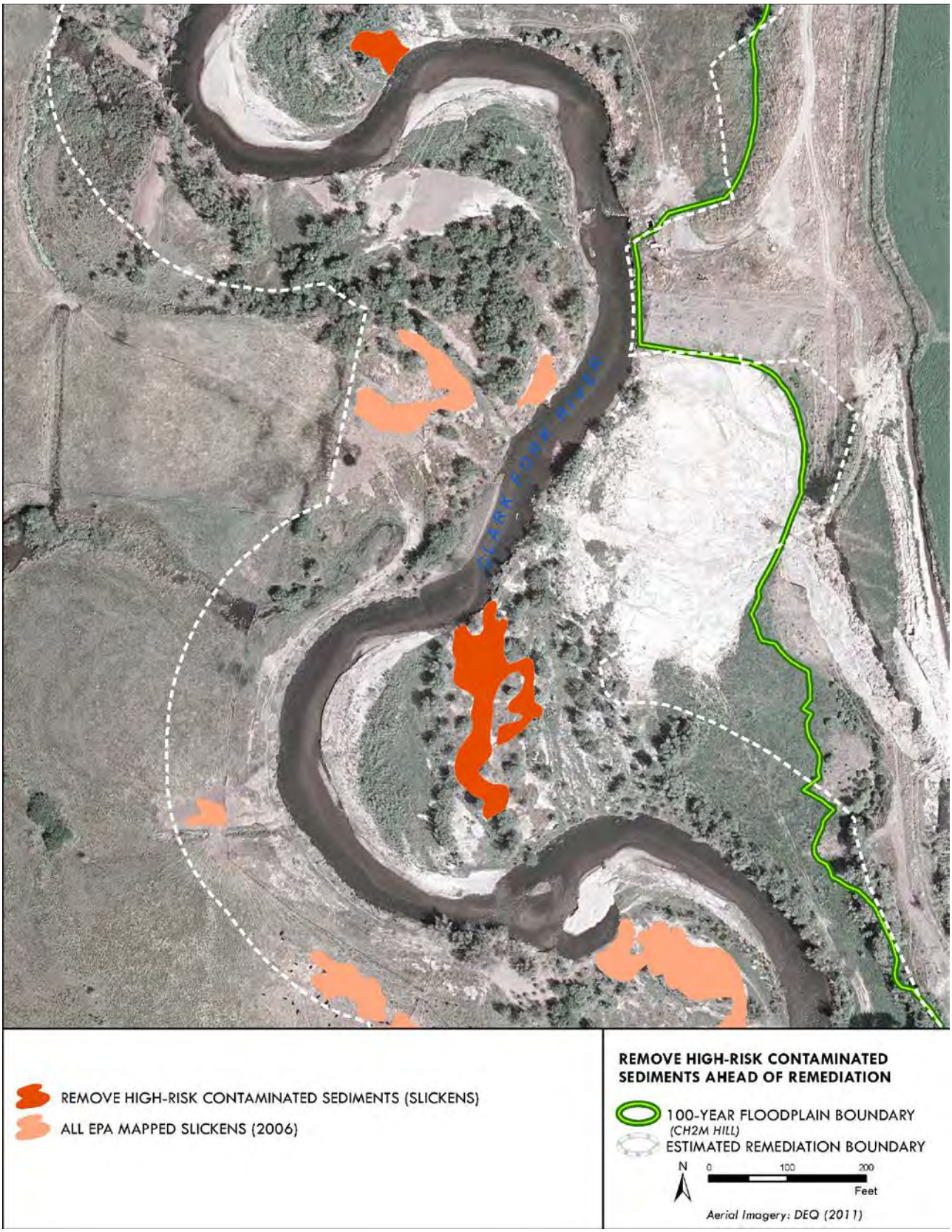

Figure 15. Example of the Remove High-Risk Contaminated Sediments Ahead of Remediation restoration action.

5.12 Restoration Action: Riparian Vegetation Expansion (Outside of Remedy)

PRIORITY TIER	ESTIMATED QUANTITY	ESTIMATED COST
Tier II (Does not directly support remedy)	526 acres	> $5 Million

5.12.1 Restoration Action Description

This action includes expanding the riparian buffer within the Clark Fork River floodplain. These actions would apply to areas outside of those treated by Remedy actions, or any areas outside of contamination removal boundaries where woody vegetation cover or native vegetation diversity could be increased. This action includes numerous revegetation activities, some examples include:

- Revegetation (planting, seeding, etc.)
- Planted riparian vegetation protection
- Restore and revegetate eroding, clean streambanks

5.12.2 Estimated Quantity and Cost of Restoration Action

Within Reach A, 3,511 acres are present outside of the estimated remedial boundary and within the 100-year floodplain. Assuming 15% (526 acres) of this area was revegetated at an average cost of $11,500 per acre, the total potential cost of Riparian Vegetation Expansion (Outside Remedy) is estimated to be greater than $5 million in Reach A. Costs for revegetation, associated plant protection and streambank treatments are based on actual costs and levels of effort from currently completed Phases.

5.12.3 Limiting Factors Addressed by the Restoration Action

Metals contaminated floodplain, streambanks and channel bed	
Low base stream flow (including dewatering due to irrigation)	
Water temperature (elevated summer temperatures)	
Water quality, including elevated nutrients (resulting in algae blooms) from unknown sources and Warm Springs Ponds (low pH, metals, and arsenic)	✓
Lack of floodplain connectivity	
Lack of woody vegetation cover on streambanks and associated increased streambank erosion	
Fish passage (diversion structures)	
Lack of aquatic habitat (limited pools, wood, woody vegetation)	
Lack of terrestrial/riparian habitat	✓

Figure 16 shows an example of the Riparian Vegetation Expansion (Outside Remedy) restoration action.

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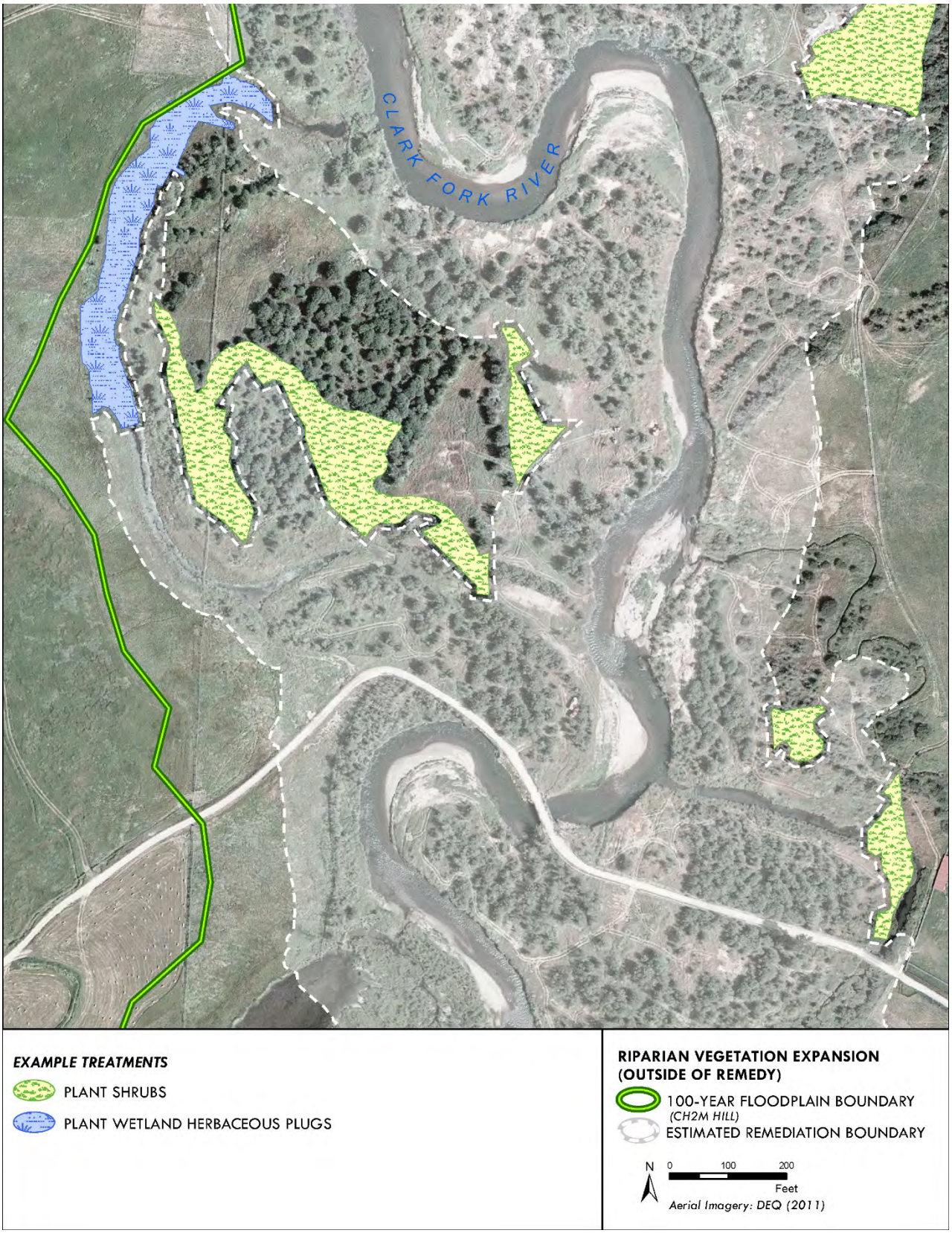

Figure 16. Example of treatments that may apply within the Riparian Vegetation Expansion Outside of Remedy restoration action.

5.13 Restoration Action: Reach A Aquatic Habitat Enhancement

PRIORITY TIER	ESTIMATED QUANTITY	ESTIMATED COST
Tier II (Does not directly support remedy)	9 miles	$1 Million to $5 Million

5.13.1 Restoration Action Description

This action includes enhancement of aquatic habitat in Reach A, including these example treatments:

- Increase overhanging woody cover along banks using woody debris of varying sizes and morphological character
- Increase woody debris in channel to promote scour and cover elements (i.e. mimic large willow clump recruitment to channel
- Enhance or construct side channels
- Modify channel geometry (i.e. narrowing the channel)
- Enhance and/or reconnect tributaries within the 100-year floodplain to the mainstem
- Create or enhance backwater habitat (i.e. alcoves)
- Enhance split flow channel features (i.e. bifurcation treatments at the head of islands)

5.13.2 Estimated Quantity and Cost of Restoration Action

Costs and quantities are based on the assumption that 20 percent of the 45 total miles of Clark Fork River in Reach A would be restored using the suite of treatments described above. An example suite of treatments within a mile of river might include 20 mid-channel habitat features, 5 woody debris structures placed at the head of islands, 5 backwater enhancement treatments, 500 feet of tributary confluence restoration and 1,050 feet of mainstem channel narrowing. Based on this example, the per mile cost would be approximately $155,000 per mile for a total cost of between $1 million and $5 million in Reach A.

5.13.3 Limiting Factors Addressed by the Restoration Action

Metals contaminated floodplain, streambanks and channel bed	
Low base stream flow (including dewatering due to irrigation)	
Water temperature (elevated summer temperatures)	✓
Water quality, including elevated nutrients (resulting in algae blooms) from unknown sources and Warm Springs Ponds (low pH, metals, and arsenic)	✓
Lack of floodplain connectivity	✓
Lack of woody vegetation cover on streambanks and associated increased streambank erosion	
Fish passage (diversion structures)	
Lack of aquatic habitat (limited pools, wood, woody vegetation)	✓
Lack of terrestrial/riparian habitat	

Figure 17 shows examples of Aquatic Habitat Enhancement treatments that could be applied in Reach A.

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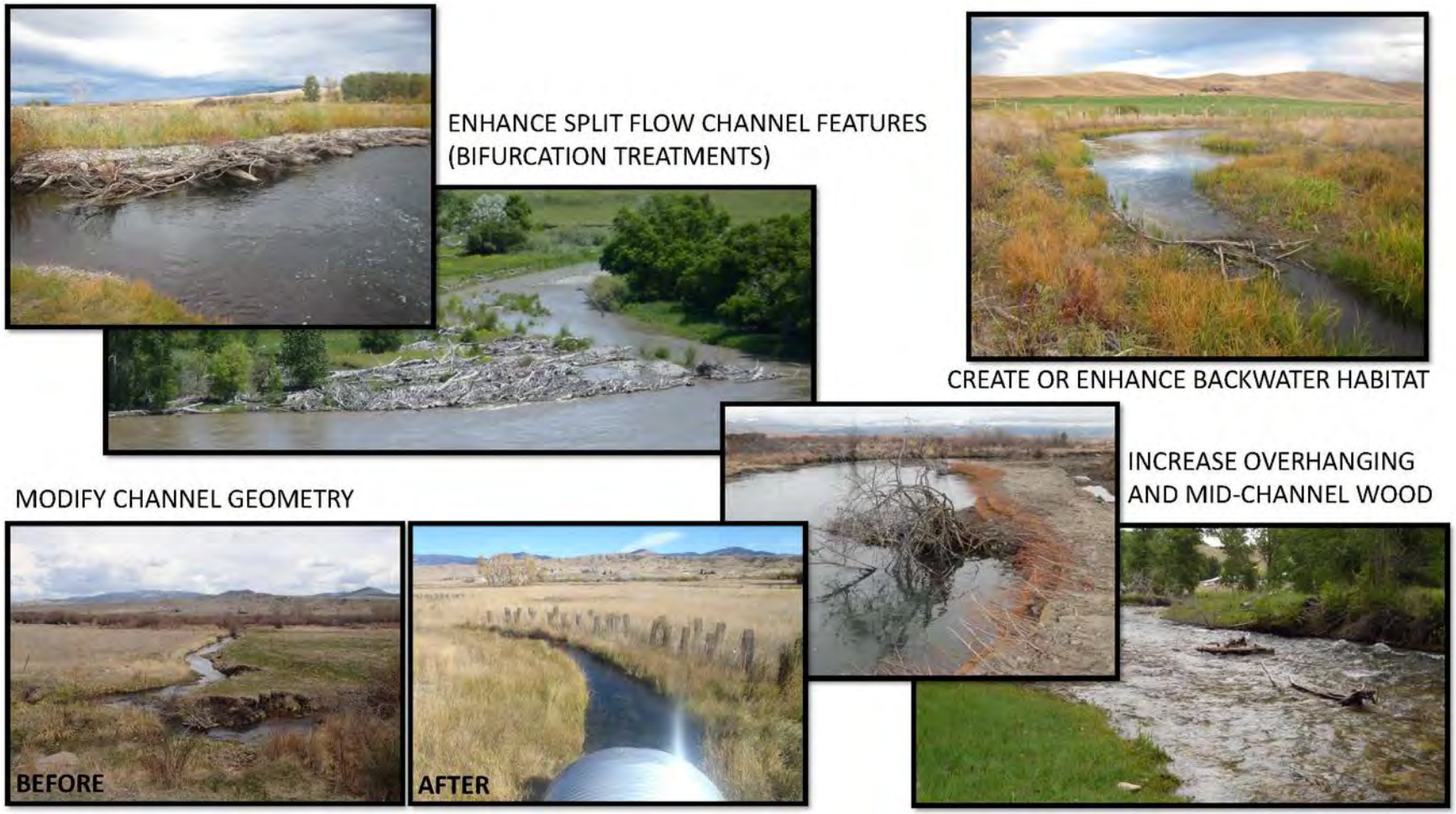

Figure 17. Examples of treatments that may apply within the Reach A Aquatic Habitat Enhancement Restoration Treatments restoration action.

5.14 Restoration Action: Modification of Mainstem Clark Fork River Diversion Structures

PRIORITY TIER	ESTIMATED QUANTITY	ESTIMATED COST
Tier II (Does not directly support remedy)	6 diversions, 6 ditches and 2 pumps	$1 Million to $5 Million

5.14.1 Restoration Action Description

This action includes modifying mainstem diversions that pose a risk to aquatic species movement or river function. Any structure that is a passage barrier, entrainment risk, or alters river function is included in this action. These actions would occur on diversions in Reach A with one diversion at Beavertail identified in Reach B. Actions may include, but are not limited to:

- Removal and replacement of structure;
- Retro-fitting of structure to allow passage of fish and increased floater safety;
- Installation of fish screens in ditches; and
- Installation of stream gauges.

5.14.2 Estimated Quantity and Cost of Restoration Action

Quantities and costs were estimated based on an existing inventory of diversion structures and ditches needing improvement for fish passage. A total of six diversion structures, six ditches and 2 pumps require retrofitting or repair. The total cost for these structures in Reach A (plus one diversion located in Reach B) is estimated to be between $1 million and $5 million.

5.14.3 Limiting Factors Addressed by the Restoration Action

Metals contaminated floodplain, streambanks and channel bed	
Low base stream flow (including dewatering due to irrigation)	
Water temperature (elevated summer temperatures)	
Water quality, including elevated nutrients (resulting in algae blooms) from unknown sources and Warm Springs Ponds (low pH, metals, and arsenic)	
Lack of floodplain connectivity	
Lack of woody vegetation cover on streambanks and associated increased streambank erosion	
Fish passage (diversion structures)	✓
Lack of aquatic habitat (limited pools, wood, woody vegetation)	
Lack of terrestrial/riparian habitat	

Figure 18 shows locations of existing diversions along the Upper Clark Fork River.

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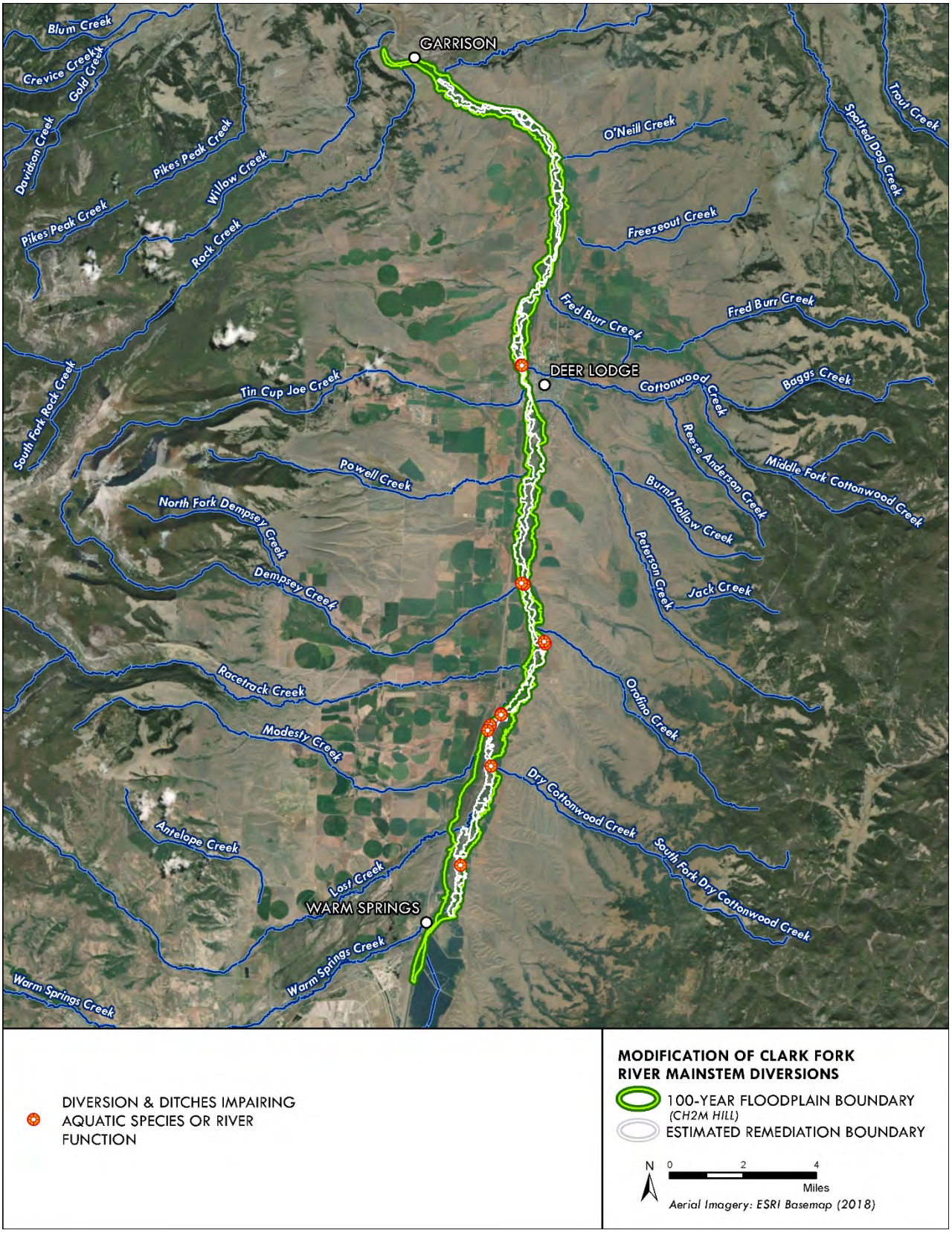

Figure 18. Approximate locations of Clark Fork River Diversions (source: Clark Fork Coalition) that would be the focus of the Modification of Clark Fork River Mainstem Diversions restoration action.

5.15 Restoration Action: Upper Blackfoot Mining Complex Restoration (Tier III)

Funds for this restoration action have already been allocated based on the State's 2007 Restoration Plan. To support completing restoration work to promote native trout along the Blackfoot River and tributaries east of Lincoln, Montana, up to $2,000,000 has been assigned to cover a portion of the project costs.

5.16 Restoration Action: Upper Blackfoot River Native Trout Restoration (Tier III)

In order to support native trout restoration efforts in the North Fork Blackfoot River, $500,000 has been assigned to support Montana Fish, Wildlife and Park efforts in this drainage.

5.17 Coordination of Remediation and Restoration

Within the CFROU, NRDP is responsible for planning, implementing, maintaining and monitoring restoration and DEQ is responsible for planning, implementing, maintaining and monitoring remediation. In the context of CERCLA, restoration actions that are integrated with remediation actions result in cost-effective actions that are also often quicker to address damaged resources. When a proposed action is being considered, NRDP and DEQ will work together, with input from FWP, to determine whether there are opportunities to integrate restoration and remediation. Once it is determined whether an action falls under remediation or restoration, the action will be evaluated as to whether it can be an integrated action between remedy and restoration. In the context of this updated Restoration Plan, all Tier 1 restoration actions likely will be integrated with remedy because they occur in the same location as remedy and will directly affect how remedial actions are designed and implemented. Similarly, most aspects of remediation have the potential to affect Tier 1 restoration actions, so it will be necessary for NRDP and DEQ to coordinate during every stage of planning and design. Many of the Tier 2 restoration actions identified in this plan can also be integrated with remedy, particularly when there are opportunities to implement actions under the same construction contract being used for a remedial action, or where a restoration action might influence how a remedial action is designed. In practice, because remediation actions are being implemented on a phase by phase basis in the CFROU, NRDP and DEQ will begin coordination at the earliest stages of the design process within each phase. As such, restoration actions will be identified during site investigations and integrated with remedial actions during development of preliminary design plans for future phases of remediation.

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6 Alternatives Analysis

Three alternatives were considered by NRDP as part of developing this Restoration Plan update, and the alternatives are defined based on the Priority Tiers described above. Because restoration funding has already been allocated to Priority Tier III restoration actions they are not included in this analysis. Alternative 1 is no action, Alternative 2 includes Tier I restoration actions, and Alternative 3 includes both Tier I and Tier II restoration actions. Table 3 shows which restoration actions are included in each alternative.

Table 3. Restoration actions within each Alternative (shaded cells are included in the alternatives).

Restoration Action	Alternative 1 (No Action)	Alternative 2	Alternative 3
Floodplain Diversity Enhancement (within Remedy)			
Additional Revegetation (within Remedy)			
Additional Contamination Removal			
Conservation Easements (on private land)			
Short and Long Term Management/Stewardship			
Restore Streambanks Ahead of Remediation			
Land Acquisition			
Channel Relocation			
Floodplain Diversity Enhancement (outside of Remedy)			
CFR Reaches B and C Aquatic Habitat Restoration			
Remove High-risk Contaminated Sediments Ahead of Remediation			
Riparian Vegetation Expansion (outside of Remedy)			
Reach A Aquatic Habitat Enhancement			
Modification of Mainstem CFR Diversion Structures			

The three alternatives are defined and considered as follows:

Alternative 1. Alternative 1 includes no restoration actions. Under this scenario, completion of remedy actions would be expected to provide long term benefits through the removal of contaminants. However, overall recovery towards baseline would be limited and expected to occur over a significant timeframe. Alternative 1 would not achieve the revised Restoration Plan goals described in Section 3 within an acceptable timeframe.

Alternative 2. Alternative 2 includes implementing only Tier I restoration actions, which are those directly integrated with remediation actions in the Clark Fork River Operable Unit. Alternative 2 would integrate the restoration funds with remedy funds focusing on floodplain contamination removal known

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to be the most significant limiting factor to fish populations in the UCFRB. Because of this lesser footprint, the level of effort and therefore cost would be less than Alternative 3 (Table 5), which includes both Tier I and Tier II restoration actions. Further, concentrating available restoration funds on actions directly associated with remedy has the potential to make remedy more effective overall. However, while less costly than and potentially benefitting remedy more than Alternative 3, Alternative 2 would only partially address revised Restoration Plan goals described in Section 3, mainly because the spatial extent of restoration actions would be limited by the footprint of remedial actions and aquatic habitat would not be addressed.

Alternative 3. Alternative 3 includes implementing Tier I and Tier II restoration actions. Alternative 3 would most fully address revised Restoration Plan goals described in Section 3. By expanding the spatial extent of restoration actions beyond the remedial action footprint, it would be possible to restore aquatic and terrestrial habitat more comprehensively, effectively moving the aquatic and riparian ecosystem closer to baseline condition than would be possible under Alternative 2. A more comprehensive suite of restoration actions would result in a more resilient aquatic and riparian ecosystem which is critically important given that residual contamination will be present after remediation and restoration actions have been completed. Finally, because the UCFRB is a working landscape where both agricultural production and recreational fishing are fundamentally important to the local economy, limiting restoration to the remedial footprint would not address residual negative effects on the local community as effectively as expanding the spatial extents of restoration work.

The alternatives considered in this restoration plan were evaluated based on the U.S. Department of Interior criteria in 43 C.F.R. § 11.82:

- **Technical Feasibility.** Under this criterion, the State evaluates the degree to which an alternative employs well-known and accepted technologies and the likelihood that the alternative will achieve its objectives. Application of this criterion focuses on an evaluation of the alternatives' relative technological feasibility.
- **Relationship of Expected Costs to Expected Benefits.** Under this criterion, the State examines whether an alternative's costs are commensurate with the benefits it provides. In doing so, the State will need to determine the costs associated with the alternative, and the benefits that would result from the action.
- **Cost-effectiveness.** Under this criterion, the State evaluates whether the alternative accomplishes its goal in the least costly way possible.
- **Results of Response Actions.** Under this criterion, the State considers the results or anticipated results of response actions underway, or anticipated, in the CFROU.
- **Potential for Additional Injury from any Proposed Action**, **Human Health and Safety** and **Adverse Environmental Impact.** Under these criteria, the State weighs whether, and to what degree, the alternative will result in adverse impacts to the physical and human environment. Specifically, the State will evaluate significant adverse impacts, which could arise from the alternative, short- or long-term, direct or indirect, including those that involve resources that are not the focus of the project.
- **Recovery Period and Potential for Natural Recovery.** Under this criterion, the State evaluates the merits of the alternative in light of whether the resource is able to recover naturally and, if a resource can recover naturally (i.e., without human intervention), how long that will take. (The

term "recovery" refers to the time it will take an injured natural resource to recover to its "baseline," i.e., pre-injury condition.)

- **Federal, State, and Tribal Policies, Rules and Laws.** Under this criterion, the State considers the degree to which the alternative is consistent with applicable policies of the State of Montana and applicable policies of the federal government and Tribes (to the extent the State is aware of those policies and believes them to be applicable and meritorious). In addition, projects must be implemented in compliance with applicable laws and rules, including the 2008 Consent Decrees. As part of the evaluation of this criterion, the State assesses whether the alternative would potentially interfere, overlap, or partially overlap with the restoration work covered under current or planned consent decrees or restoration plans.
- **Resources of Special Interest to the Tribes and DOI**. Pursuant to the State's Memorandum of Agreement (MOA) with the Department of Interior and Confederated Salish and Kootenai Tribes (Tribes), the State is to pay particular attention to natural resources of special interest to the Tribes and/or DOI, including attention to natural resources of special environmental, recreational, commercial, cultural, historic, or religious significance to either the Tribes or the United States. The MOA also provides for the State to pay particular attention to "Tribal Cultural Resources" or "Tribal Religious Sites," as those terms are defined in the MOA.

To be consistent with the evaluation categories of restoration actions referenced in Section 4, NRDP evaluated the DOI criteria as they relate to level two categories from Geum et. al (2019) as shown in Table 4.

Each of the three alternatives was evaluated to select a preferred alternative. Alternatives were assigned a single "+" when they are able to meet criteria within an evaluation category. If one Alternative is best able to meet criteria within an evaluation category, it is assigned a second "+," resulting in "++." Notes in Table 4 explain the rationale for these assignments. Ultimately, the preferred alternative was selected based on the logic described in the narrative above.

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Table 4. Alternatives analysis relative to 43 CFR 11.82 evaluation criteria and level two criteria from Geum et. al (2019)					
	Alternative				
Evaluation Category	**1 (No Action)**	**2**	**3**	**Notes**	**Corresponding Criteria from 43 CFR. § 11.82**
Technical Feasibility	++	+	+	No action is most feasible because it requires no additional effort beyond remedy.	Technical Feasibility
Ecological Benefit	-	+	++	Alternative 3 has most benefit because it has greatest area of effect.	Results of Response Actions
Biological Benefit (Aquatic)	-	+	++	Alternative 3 has greater benefits due to additional focus on actions in the river.	
Biological Benefit (Terrestrial)	-	+	++	Alternative 3 has most benefit because it has greatest area of effect.	
Proximity to Other Restoration or Remediation Actions	-	++	+	Alternative 2 would focus on areas more directly proximate to remediation actions.	
Benefit to Completed Restoration or Remediation Actions	-	+	++	Alternative 3 would have cumulative benefits beyond actions directly related to remediation, in particular contributing to a buffer around remediation.	
Benefits Multiple Resources	-	+	++	Alternative 3 has the most benefit because it has greatest area of effect.	
Natural Recovery Period	-	+	+	Both Alternatives 2 and 3 would have similar recovery periods.	Recovery Period and Potential for Natural Recovery
Federal, State, Tribal Policies, Rules, and Laws	-	++	+	Alternative 2 affected only by rules related to Superfund, so fewer permitting and environmental compliance needs.	Federal, State, and Tribal Policies, Rules and Laws
Adverse socioeconomic impacts	-	+	+	Alternatives 2 and 3 would each have moderate socioeconomic effects.	Human Health and Safety

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Table 4. Alternatives analysis relative to 43 CFR 11.82 evaluation criteria and level two criteria from Geum et. al (2019)					
	Alternative				
Evaluation Category	**1 (No Action)**	**2**	**3**	**Notes**	**Corresponding Criteria from 43 CFR. § 11.82**
Risks to Completed Restoration or Remediation Actions	++	+	+	Alternatives 2 and 3 each have moderate risks to completed actions. No action would not introduce risk to completed actions.	Potential for Additional Injury from any Proposed Action
Adverse Environmental Impacts	-	+	+	Both Alternatives 2 and 3 would have moderate adverse impacts. No action would impose the greatest limits on returning to baseline.	
Cost-effectiveness	++	+	+	Both Alternatives 2 and 3 would require expenditures sufficient to exhaust a finite restoration fund. No action would keep funds available to support remediation if needed.	Cost-effectiveness
Data gaps	++	++	+	Alternative 2 would require less investigation and data collection because it would affect a smaller area than Alternative 3. No action would require no additional data collection	Relationship of Expected Costs to Expected Benefits
Benefit: Cost	-	+	++	Alternatives 3 has greatest area of restoration effect relative to a finite total budget. No action would add no benefit beyond remedial action.	

- = Alternative does not address the evaluation factor.
+ = Alternative addresses the evaluation factor.
++ = Alternative best addresses the evaluation factor.

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7 Estimated Costs

Costs for each restoration action were developed using actual costs for similar restoration actions in completed phases of the CFROU, costs from similar projects in Montana, and information from FWP and other partner agencies and organizations. Assumptions used for estimating quantities are described under each restoration action in Section 5 above and in Geum et al. (2019). Costs are not intended to be interpreted as a total budget for restoration work in the CFROU because the total cost of all estimated actions would exceed available funds, and projects in some locations may be limited by landowner willingness or technical feasibility. The cost analysis was intended to put costs in broad ranges of less than $1 million, $1 million to $5 million, and greater than $5 million for purposes of prioritizing and ranking restoration actions. Table 5 provides a summary of estimated costs for each restoration action, and includes an estimated total cost range for each alternative described in Section 6.

Table 5. Total estimated costs of restoration actions by alternative.

Restoration Action	Alternative 1 (No Action)	Alternative 2	Alternative 3
Floodplain Diversity Enhancement (within Remedy)		< $1 Million	< $1 Million
Additional Revegetation (within Remedy)		$1-5 Million	$1-5 Million
Additional Contamination Removal		>$5,000,000	>$5,000,000
Conservation Easements (on private land)		< $1 Million	< $1 Million
Short and Long Term Management/Stewardship		$1-5 Million	$1-5 Million
Restore Streambanks Ahead of Remediation		>$5,000,000	>$5,000,000
Land Acquisition		$1-5 Million	$1-5 Million
Channel Relocation			$1-5 Million
Floodplain Diversity Enhancement (outside of Remedy)			$1-5 Million
CFR Reaches B and C Aquatic Habitat Restoration			>$5,000,000
Remove High-risk Contaminated Sediments Ahead of Remediation		< $1 Million	< $1 Million
Riparian Vegetation Expansion (outside of Remedy)			>$5,000,000
Reach A Aquatic Habitat Enhancement			$1-5 Million
Modification of Mainstem CFR Diversion Structures			$1-5 Million
TOTAL	**$2.5 million**	**~$10 million to > $25 million**	**~$25 million to > $50 million**

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8 Selected Alternative

Considering its relatively greater ability to meet the Restoration Plan goals, Alternative 3 is the preferred alternative. Although there are not enough funds to fully implement Alternative 3, this alternative provides the variety of actions necessary for the State to integrate restoration with remedial actions within the CFROU to most fully accomplish the Restoration Plan goals. While the primary reason for selecting Alternative 3 is that it provides a more comprehensive toolbox to achieve restoration goals described in this plan, it also better meets the evaluation factors in Table 5 as indicated by more total "+." Alternative 2 better meets several evaluation factors due to it being generally smaller and simpler in scope than Alternative 3, and because it is confined to the remediation footprint and therefore subject to more streamlined permitting and environmental compliance requirements. However, Alternative 3 better meets evaluation factors related to ecological, biological and cumulative benefits which more directly reflect the goals of this Restoration Plan. Alternative 1 addresses few of the evaluation criteria and would not achieve the goals of this restoration plan.

9 Process for Implementing the Restoration Plan

The overall goal of this revised Restoration Plan is to restore the condition of the Upper Clark Fork River and the riparian area of the floodplain to a condition more closely resembling baseline conditions. Baseline conditions represent the estimated condition of the river corridor in the absence of injuries caused by the hazardous substances released by BP-Atlantic Richfield Company and its predecessor's mining related operations. Specific revised Restoration Plan goals include:

- Restore aquatic resources in the Clark Fork River to baseline conditions.
- Restore terrestrial habitat to baseline conditions along the riparian zones and floodplains of the Clark Fork River.
- Offset the residual effects from hazardous substances that are not eliminated from the aquatic system to flora and fauna.
- Maximize the long-term beneficial effects and cost-effectiveness of restoration actions.
- Improve natural aesthetic values of the Clark Fork River.

As described in Section 8, Alternative 3 is the preferred alternative because it provides a larger variety of restoration actions that will most fully accomplish the revised Restoration Plan goals in the most effective manner. Implementation of the preferred alternative in this plan should result in noticeable recovery of aquatic and riparian resources towards a baseline condition in a shorter period of time compared to No Action or Alternative 2, which would limit restoration actions to those that directly support remedial actions. However, even with the broad range of restoration actions included in this revised Restoration Plan, the CFROU and surrounding area cannot completely return to a baseline condition due to mining waste that will remain in the channel and along the fringes of the floodplain.

This revised Restoration Plan complements the current multi-agency strategy to remediate and restore the Upper Clark Fork River watershed. The restoration actions that together make up the preferred alternative include:

- Floodplain Diversity Enhancement (within Remedy)
- Additional Revegetation (within Remedy)

- Additional Contamination Removal
- Conservation Easements (on private land)
- Short and Long Term Management/Stewardship
- Restore Streambanks Ahead of Remediation
- Land Acquisition
- Channel Relocation
- Floodplain Diversity Enhancement (outside of Remedy)
- Clark Fork River Reaches B and C Aquatic Habitat Restoration
- Remove High-risk Contaminated Sediments Ahead of Remediation
- Riparian Vegetation Expansion (outside of Remedy)
- Reach A Aquatic Habitat Enhancement
- Modification of Mainstem Clark Fork River Diversion Structures
- Upper Blackfoot Mining Complex Restoration
- Upper Blackfoot River Native Trout Restoration

Remaining restoration funding is less than the estimated total cost of the preferred alternative, thus there is an emphasis for actions that enhance and integrate with remedial action (Tier I actions). Numerous assumptions were made to estimate quantities and costs of restoration actions included in this revised Restoration Plan. Assumptions were made using the best available information, but it is inevitable that projects in some locations will be limited by landowner willingness or technical feasibility, or other limitations to implementing restoration actions will arise. Therefore, the intent of NRDP is to investigate the most significant data gaps in order to refine the estimated quantity and cost of restoration actions and develop a realistic and effective implementation planning process. Even with additional data, it is still likely that available restoration funds will be less than what would be needed to achieve estimated quantities of restoration actions within the preferred alternative. Therefore, there is a need to have a rigorous process in place by which restoration projects are evaluated to determine how and to what extent the proposed actions will address limiting factors and meet the goals and objectives set forth in this plan.

The criteria developed to evaluate and prioritize restoration actions included in this Restoration Plan will be used as the basis for evaluating restoration projects within the UCFRB as they arise. These criteria, listed below, were used as part of the Alternatives Analysis in Section 8 and are described in detail in Geum et al. (2019):

- Technical Feasibility
- Ecological Benefit
- Biological Benefit (Aquatic)
- Biological Benefit (Terrestrial)
- Adverse Environmental Impacts
- Recovery Period
- Federal, State, Tribal Policies, Rules, and Laws
- Adverse Socioeconomic Impacts
- Data Gaps
- Proximity to Other Restoration or Remediation Actions
- Benefit to Completed Restoration or Remediation Actions

- Risks to Completed Restoration or Remediation Actions
- Benefits Multiple Resources
- Cost
- Benefit: Cost

Restoration projects can come about through a variety of pathways and a consistent process is necessary to evaluate how well proposed projects will address CFROU limiting factors and make progress towards best achieving Restoration Plan goals and restoring the baseline condition (see Table 1). The process for implementing the Restoration Plan over the next 10 to 15 years is described below:

Investigate data gaps. NRDP is currently investigating significant data gaps to help refine restoration action priorities, evaluate specific restoration projects that arise, and integrate restoration actions with remedial actions. Actions to address significant data gaps include: investigating depth and extent of contamination in unremediated phases; development of a consistent hydraulic model for Reach A; and identifying high quality aquatic and riparian floodplain habitats within Reach A. NRDP, along with partner organizations, is also investigating other significant data gaps related to water quality and quantity, and effects on the aquatic ecosystem.

Identify specific restoration projects. There are multiple pathways for developing restoration projects for the CFROU that include restoration actions identified in this plan. Working closely with DEQ and FWP, NRDP will participate in the remedial design process, in particular identifying projects for Tier I restoration actions that can be integrated with remedy. Through a coordinated effort as described in Section 5.17, restoration actions will be identified during site investigations and integrated with remedial actions during development of preliminary design plans for future phases. NRDP, DEQ and FWP will participate together as the State of Montana in public meetings where preliminary designs are presented for review and comment.

Other opportunities for restoration projects will be identified during the investigation of data gaps, remedial design investigations and coordination with other entities. For example, NRDP's recent acquisition of the Clark Fork River Ranch south of Deer Lodge, Montana, presents immediate opportunities for restoration projects using restoration actions identified in this plan. In addition, restoration projects may be identified by others.

Evaluate restoration opportunities. Once specific restoration projects are identified, each project will be evaluated as described above to determine if they are suitable for implementation using restoration funds.

Develop restoration designs and bid packages. Once restoration projects are identified and evaluated, site specific designs and bid packages will be developed. For Tier I Restoration actions, designs and bid packages will be developed in concert with DEQ in cases where restoration work would be integrated with remedial work. In cases where restoration would occur independently from remedial work, NRDP will develop designs and bid packages and procure contractors to implement the work.

Complete environmental compliance. Some Tier 1 restoration actions will likely be covered under CERCLA Section 121(e), which provides, "No Federal, State, or local permit shall be required for the portion of any removal or remedial action conducted entirely onsite, where such remedial action is selected and carried out in compliance with this section." An example of such a restoration action is

"Remove High Risk Contaminated Sediments Ahead of Remediation." For these restoration actions, the substantive requirements of permits are met by following steps to ensure requirements of environmental laws are being met through Applicable or Relevant and Appropriate Requirements (ARARS) developed for projects. Some of the Tier 1 and Tier 2 actions may require separate environmental review. These reviews may include documentation and permits required by the federal Endangered Species Act (ESA), the State Historic Preservation Office (SHPO), the federal Clean Water Act (multiple federal and state agencies), the Montana Stream Protection Act (SPA) and others.

Implement restoration projects. NRDP will manage the implementation of restoration actions, and projects would be contracted according to state procurement and contracting procedures.

Complete monitoring and adaptive management. A monitoring and adaptive management plan will be developed by NRDP to specifically evaluate restoration actions described in this Restoration Plan. The monitoring plan will be organized, and appropriate monitoring protocols will be selected, to evaluate the effectiveness of restoration actions and their ability to address limiting factors identified in this Restoration Plan. Table 1 in this Restoration Plan will provide the organizing framework for the monitoring plan. Depending on the restoration project and whether it is integrated with remedy actions or other restoration actions, the monitoring plan will include protocols described in the *Upper Clark Fork River Basin Aquatic and Terrestrial Resources Restoration Plans Monitoring Plan* (Geum 2015), or protocols being used by Montana DEQ to evaluate remediation. As much as possible, the monitoring plan will be integrated with other restoration and remedy monitoring occurring in the Upper Clark Fork River Basin to limit redundancy and to promote interdisciplinary and integrated monitoring and evaluation within the UCFRB.

In summary, the process for implementing the Restoration Plan includes: investigate data gaps, identify restoration opportunities, evaluate restoration opportunities for suitability, develop restoration designs and bid packages, complete environmental compliance, implement restoration projects, and complete monitoring and adaptive management. Progress towards meeting Restoration Plan goals can be tracked at the following URL: https://dojmt.gov/lands/.

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10 References

These references are available at: https://dojmt.gov/lands/upper-clark-fork-river-basin/

Applied Geomorphology Inc. (AGI) and DTM. 2016. Clark Fork River Channel Migration Zone Mapping, Drummond to Milltown. Prepared for US Fish and Wildlife Service by Applied Geomorphology and AGI.

CDM Smith (CDM) and Applied Geomorphology Inc. (AGI). 2013. Clark Fork River Operable Unit Milltown Reservoir/Clark Fork River Superfund Site Powell, Deer Lodge, and Granite Counties Geomorphology and Hydrology of Reach A. Prepared for Department of Environmental Quality by CDM Smith and Applied Geomorphology, Inc.

CDM Smith (CDM), Applied Geomorphology, Inc. (AGI) and Geum Environmental Consulting, Inc. (Geum). 2016. Clark Fork River Reach A Design Approach. Memorandum prepared for Montana Department of Environmental Quality.

Department of Environmental Quality (DEQ) and Environmental Protection Agency (EPA). 2015. Clark Fork River Operable Unit (OU #3) Milltown Reservoir/Clark Fork River Superfund Site CERCLIS Identification Number: MTD980717565, Explanation of Significant Differences. June 2015.

Environmental Protection Agency (EPA). 2004. Record of Decision, Clark Fork River Operable Unit of the Milltown Reservoir/ Clark Fork River Superfund site. U.S. Environmental Protection Agency (US EPA), Helena, Montana, with concurrence of Montana Department of Environmental Quality (MT DEQ), Helena, Montana. April 2004.

Geum Environmental Consulting, Inc. (Geum). 2015. Draft 2012 Upper Clark Fork River Basin Aquatic Resources Restoration Plan Monitoring and Maintenance Plan. Report prepared for Montana Natural Resource Damage Program, Helena, Montana.

Geum Environmental Consulting, Inc. (Geum), Applied Geomorphology, Inc. (AGI), and Tetra Tech. 2019. Clark Fork River Aquatic and Riparian Restoration Actions and Prioritization Analysis. July 2019.

Natural Resource Damage Program (NRDP). 1995a. Aquatic Resources Injury Assessment Report State of Montana Natural Resource Damage Program Upper Clark Fork River Basin. Montana Department of Justice. January 1995.

Natural Resource Damage Program (NRDP). 1995b. State of Montana Natural Resource Damage Program Restoration Determination Plan Upper Clark Fork River Basin. Montana Department of Justice. October 1995.

Natural Resource Damage Program (NRDP). 2007. State of Montana's Revised Restoration Plan for the Clark Fork River, Aquatic and Riparian Resources. November 2007.

Natural Resource Damage Program (NRDP). 2019. Upper Clark Fork River Basin Aquatic and Terrestrial Resources Restoration Plans. Updated February 2019.

Pioneer Technical Services (Pioneer). 2002. Milltown Reservoir Sediments NPL Site, Clark Fork River Operable Unit, Public Review Draft Feasibility Study Report. Prepared for ARCO Environmental Remediation, L.L.C. (AERL).

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State of Montana v. Atlantic Richfield Company. 2008. Helena, Montana. No. CV-83-317-HLN-SEH Consent Decree.

United States v. Atlantic Richfield Company. 2008. Helena, Montana No. Civil Action No. CV89-039-BU-SHE Consent Decree.

United States Environmental Protection Agency (USEPA). 2016. Second five-year review report for the Milltown Reservoir/Clark Fork River Superfund Site. Report prepared by USEPA Region 8, Denver, Colorado.

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