Prioritization of Areas in the Upper Clark Fork River Basin for Fishery Enhancement

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January 2018

Draft

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Background and Purpose

This document is an update to a prioritization plan originally developed in 2011. These plans were developed by the State of Montana, through a joint effort by the Department of Fish Wildlife and Parks (FWP) and the Natural Resource Damage Program (NRDP), to help guide the State's fishery restoration efforts in the Upper Clark Fork River Basin (UCFRB) that are being funded by natural resource damage settlement funds. In 2008, the State concluded its third and final settlement of its natural resource damage litigation against ARCO for injuries to natural resources in the UCFRB caused by the release of hazardous substances from past mining and mineral processing activities by ARCO and its predecessors.[1] The injured Silver Bow Creek and the Upper Clark Fork River mainstem fisheries were the focus of the state's aquatic resources damage claim in this lawsuit. This plan integrates with and builds on the state's remediation and restoration efforts that have been or will be conducted along the mainstems of Silver Bow Creek between Butte and Warm Springs Ponds and the Upper Clark Fork River between Warm Springs Ponds and Garrison with dedicated settlement funds to these mainstem areas. It identifies the most important stream areas in the Basin to focus fishery habitat protection and enhancement efforts to augment the mainstem remediation and restoration efforts already conducted or planned.

The primary objective of the state's aquatic restoration efforts in the UCFRB funded with natural resource damage settlement funds is to restore fishery resources and associated angling opportunities in Silver Bow Creek and the Clark Fork River to the baseline condition that would exist absent the release of hazardous substances from historic mining and smelting activities in the Butte and Anaconda areas. The secondary objective is to replace lost fish and angling opportunity off-site when on-site (mainstem) restoration is not possible or not cost-effective. Off-site locations considered in this document include tributaries to Silver Bow Creek and the Clark Fork River above the confluence with the Blackfoot River. Restoration of fisheries relies on effective cleanup of metals contamination along the mainstems. Without this, enhanced biological and physical conditions will not achieve significant benefits. There are instances, however, when off-site replacement activities may be more cost-effective than on-site restoration activities. This is especially true where fish populations use the tributaries for their entire life cycle including spawning, rearing and refugia. Where fish from populations use the mainstem for part of their life cycle, enhancement of these populations will depend on a healthy Clark Fork River or Silver Bow Creek. Addressing important tributary habitats, in combination with mainstem habitats, can accomplish further recovery of the mainstem fisheries than would otherwise occur with restoration activities confined to mainstem or tributary areas alone. A combination of restoration activities on the mainstems and replacement activities in priority tributary areas will enhance the river ecosystems and fisheries in the UCFRB in the most beneficial and cost-effective manner.

[1] Background information on this litigation is available from the NRDP's website at: http://doj.mt.gov/lands/naturalresource/

This document is intended to direct collaborative efforts by the state and other entities to areas of the UCFRB that are most likely to contribute to fishery goals. It also serves to identify areas to avoid. In effect, it directs habitat protection and enhancement efforts where they will be more biologically and cost effective, rather than driven by the opportunity for a project, which often results in secondary consideration of fishery goals. Further resource assessment, project identification, and project proposal development can be targeted to the identified priority areas, allowing for more effective funding decisions and project development than would otherwise occur without this prioritization. This prioritization process is a parallel and complimentary effort to the terrestrial resource prioritization effort also being conducted by FWP and NRDP.

We do not provide project-level priorities. Instead, when encountered, we noted habitat degradation. Further assessment is needed to determine if the degradation is a limiting factor to a fishery, how the degradation should be addressed, and the feasibility and cost of project implementation.

The document first addresses mainstem priorities (Section A) and second, tributary priorities (Section B). It next describes strategies for habitat protection and enhancement (Section C) and fishery management (Section D) to best accomplish these mainstem and tributary priorities. The remaining sections address important considerations to the prioritization process (Section E), monitoring (Section F), and public participation (Section J).

Revision of the 2011 Prioritization Plan

The original prioritization plan (FWP and NRDP, 2011) was based on the understanding of fishery conditions at that time, recognizing that there would be gaps in population and habitat data. In preparation for the original prioritization plan, significant efforts were made to assess and inventory fish populations and habitat quality throughout the UCFRB (see Mainstem Priorities and Prioritization sections for assessment methods). The 2011 document recognized that these efforts were not exhaustive and ongoing assessments and reprioritization would be needed. Furthermore, the success of tributary restoration activities are largely dependent on the progress of cleanup activities in the mainstems of Silver Bow Creek and the Clark Fork River and several cleanup efforts have been completed or initiated since the 2011 plan was written.

This updated prioritization plan builds upon the FWP and NRDP, 2011 document. The goals, prioritization process, and prioritization ranks of most areas from the 2011 plan remain largely intact. However, significant additional fishery assessments have been conducted since 2011, including fish population surveys and a recruitment study based on otolith microchemistry. This document takes into account those studies by adding prioritization information for six areas that had not been assessed prior to the 2011 plan and changes in priority for 12 areas that were reassessed since the 2011 plan. These revisions were also made recognizing the importance of certain tributaries as major sources of trout recruitment to the mainstem. Priority ranking for all areas, including changes from the 2011 priority plan can be found in Table 2. This document also includes updated information about the progress of remediation and restoration activities in Silver Bow Creek and Clark Fork River mainstems.

A. Mainstem Priorities

Restoring the mainstem fisheries of the Clark Fork River and Silver Bow Creek is the primary focus of the state's aquatic restoration efforts in the UCFRB. The Silver Bow Creek and Upper Clark Fork River mainstems areas are the focus of remediation and restoration activities that have been or will be funded with dedicated, site-specific settlement funds. The bullets below summarize these activities, which are mainly focused on reducing metals contamination in the floodplain, and associated dedicated funding.

- Silver Bow Creek: Pursuant to the 1999 settlement/consent decree that provided $80 million, plus interest, in funding for remediation of Silver Bow Creek, the Montana Department of Environmental Quality (DEQ) has conducted remedial actions along the creek corridor. DEQ's remediation work primarily involved excavation of tailings and related impacted soils from the floodplain of Silver Bow Creek and reconstruction of the stream channel and floodplain. This remediation was completed in the summer of 2015 and removed an estimated 5.8 million cy of tailings and 24 stream miles have been reconstructed. Restoration activities that enhance the fish and wildlife habitat along the creek were conducted in coordination with the remediation work via natural resource damage grants totaling $15.5 million to the Greenway Service District for the Silver Bow Creek Greenway project. These restoration activities enhanced fisheries habitat by augmenting riparian vegetation and instream aquatic habitat. The Greenway project also involved the development of a passive-use recreational corridor along Silver Bow Creek that will enhance public fishing access. In addition to the completed remediation and restoration activities along the mainstem of Silver Bow Creek, the planned remediation of the upgradient Butte Priority Soils Operable Unit site entails surface water runoff collection and treatment activities that will improve the aquatic resources of Silver Bow Creek.

- Clark Fork River: The 2008 settlement/consent decree provided the state with $95 million, plus interest, for the remediation of the Upper Clark Fork River and $26.7 million, plus interest, for the restoration of the Upper Clark Fork River. The DEQ is conducting the remediation activities that primarily involve removal of contaminated tailings from areas generally devoid of vegetation, treatment of other contaminated soils, with lime and deep tilling, and stream bank reconstruction, primarily in Reach A from Warm Springs Ponds to Garrison. The NRDP is conducting restoration activities that are integrated with the remediation and enhanced fishery habitat primarily through the removal of additional tailings and enhanced riparian vegetation management (suppling additional organic matter, grasses, trees, and shrubs). The state's Restoration Plan also provides for acquisitions/easements in the upper Clark Fork River riparian zone, when feasible based on landowner agreements, as well as opportunities for instream flow enhancement. The state anticipates remediation and restoration work of the Upper Clark Fork River to be completed in the next 20 years.

In addition to looking to the tributaries to help restore mainstem fisheries (see next section), we looked at what additional measures along the mainstems, beyond those already conducted or planned and funded described above, were needed to restore the Clark Fork River and Silver Bow Creek fisheries. Major habitat needs include cleanup of metals pollution, reducing nutrient loading, and increasing

instream flows. Of these three needs, increasing instream flows was identified as a priority for this program. Improving tributary habitat alone will not be enough to restore the mainstem fishery if the habitat in the mainstem is degraded. Furthermore, instream flow is beneficial in many ways. Besides being the basic component of fish habitat, water also aids in the moderation of water temperature and dilutes nutrient and metals loads, each being critical to improving trout habitat in the UCFRB. Other aspects of habitat for the mainstems, such as riparian enhancement and protection and fish passage at irrigation structures, are not addressed in this prioritization. Further progress on the mainstem remediation and restoration activities is needed to fully understand the need for or value of such projects.

Minimum flow needs were addressed by the Upper Clark Fork Steering Committee (2006). Using FWP's wetted perimeter analyses, minimum flow targets were established for portions of the mainstem Clark Fork River that regularly have very low flows. The area from the confluence of Warm Springs Creek to Deer Lodge was identified and target minimum flows of 40 cfs at Galen and 90 cfs at Deer Lodge were established. The need for water is primarily in the summer between July and September. Using this recommendation, the state proposed a 50 cfs flow augmentation in the Clark Fork River from Galen to Deer Lodge in its Clark Fork Restoration Plan (NRDP, 2007). Although a similar analysis has not been conducted to determine minimum flow needs on Silver Bow Creek, we know that increased base flow could greatly improve the ability of Silver Bow Creek to support trout populations.

Instream flow projects are of highest priority in reaches where water quantity is considered inadequate for supporting a healthy fish population. Therefore, the area of the Clark Fork from Warm Springs Creek to Deer Lodge is emphasized. Instream flow outside of this area on the mainstem Clark Fork River or on Silver Bow Creek could also be a priority and should be assessed case-by-case. Furthermore, the addition of cold, clean water to the mainstems from tributaries could provide significant improvement in mainstem fishery habitat depending on the quantity, timing, and distance the water remains in the river or creek channel. Potential future instream flow projects on both the Clark Fork River and Silver Bow Creek are recognized as Priority 1 or Priority 2 in Table 2 of this plan.

B. Prioritization of Tributaries

In anticipation of the completion of the state's natural resource damage lawsuit, the FWP and NRDP began a basin-wide assessment of UCFRB tributaries in 2007. We initiated this assessment to identify where aquatic restoration efforts in the Basin tributaries could best augment the restoration work completed or planned for the mainstem of Silver Bow Creek from Butte to Warm Springs Ponds and the Upper Clark Fork River between Warm Springs Ponds and Garrison Junction (Reach A). Prior to these assessments, little information was available regarding fishery resources in UCFRB tributaries, and what knowledge existed was of limited scope.

This prioritization uses information obtained from assessments of fish populations, riparian condition and stream habitat quality conducted in 2007 and 2008 in tributary streams to the Upper Clark Fork River from Deer Creek near Bonner to Blacktail Creek, a tributary to Silver Bow Creek near Butte (FWP,

2008 and FWP, 2009). Additional assessments of tributary fish populations have been ongoing, many of which have provided data on streams that were not assessed prior to the 2011 prioritization plan (see Table 2 and Status of Other Sites section for streams added since 2011). In addition, this prioritization relies on an assessment of fishery habitat conditions in eight tributaries (Workman, 2009) and a planning effort completed by the NRDP in 2005 to prioritize restoration of natural resources in the Silver Bow Creek watershed (NRDP, 2005). Surveys of irrigation structures were conducted in the Upper Clark Fork drainage to assess effects on native fishes (FWP, 2010) and an entrainment study was conducted on a large irrigation structure in the Flint Creek watershed (FWP, 2016). Annual population estimates have been conducted at six sites on the mainstem of the Upper Clark Fork River for the last 8-10 years (FWP 2018).

A basin-wide radio telemetry study (FWP, 2008 and Mayfield and McMahon, 2010) was conducted in 2009-2011 to help identify important resource areas and limiting factors for mainstem trout populations. An otolith microchemistry project was initiated in 2016 to complement the telemetry study by identifying important sources of trout recruitment to the mainstem (FWP 2018).

Fishery Goals for Tributary Prioritization

This tributary prioritization was undertaken to communicate where opportunities for fishery habitat protection and enhancement activities should be pursued in the UCFRB tributaries to best achieve one or more of the following fishery goals (see map #1):

1) Restore the mainstem trout fishery by improving recruitment of fish from tributaries;
2) Replace lost trout angling in the mainstem by improving trout populations in tributaries; and
3) Maintain or improve native trout populations in the UCFRB to preserve rare and diverse gene pools, and improve the diversity and resiliency of the trout fishery.

These goals are not mutually exclusive. Progress towards meeting one goal will often contribute towards another. For example, improving tributary fisheries (goal 2) will often improve mainstem fisheries (goal 1) and vice versa. Conversely, progress towards any goal will not be to the detriment of another. For example, efforts to improve recreational fishing (goals 1 and 2) will not be to the detriment of native trout populations (goal 3). Maintaining or improving native trout populations (goal 3) is not independent of other goals. For example, native westslope cutthroat trout provide angling opportunity as well. We recognize that protecting native fish besides just native trout is important, too. However, we use native trout as a surrogate for native fish communities because they serve as indicator species and we have limited information regarding other fishes. Finally, although enhancement of trout populations is the focus of these goals, trout are likely to be a good indicator for other aquatic resources, such as aquatic insects.

Tributary Assessment Methods

Trout populations were surveyed in the tributaries to assess the value of the fisheries for meeting the goals of the program. More specifically, surveys provided information such as fish species composition, distribution, abundance and size composition. Trout populations vary between streams and often within a stream, so extensive sampling was needed to characterize the Basin's tributary fisheries. This information allowed us to evaluate the value of an area for providing fish to the mainstems, providing a fishery on its own, and as a native trout fishery.

Field survey methods for the Upper Clark Fork River tributaries are described in the data summary reports (FWP, 2008 and 2009). In short, most fish population surveys included single pass electrofishing at sites along the length of each tributary. Trout population estimates were completed at some sites to better quantify fish numbers and begin trend monitoring. The Silver Bow Creek assessment (NRDP, 2005) involved the compilation of available fishery population and habitat information but did not involve the collection of new field data. Qualitative riparian and instream habitat assessments were completed following procedures developed by the NRCS (NRCS, 2005). Important habitat features and watershed conditions, including factors affecting fish and their habitat (e.g., fish passage barriers and water quantity and temperature) were also noted. In total, over 295 sites in more than 158 areas were surveyed. Workman (2009) provides another assessment of eight select tributaries. His assessment methods differed from the larger effort but overlapped in some areas. Several tributaries have been surveyed more than once and at different sites since the original surveys. Data from the more recent surveys have not all been summarized in reports, but in some cases these data resulted in a change prioritization (Table 2). In addition, data from some tributaries that were not surveyed in the initial assessments has been collected and incorporated into this plan.

Assessments were also made based on the telemetry study (Mayfield and McMahon, 2010), which identified potential spawning locations of brown trout and westslope cutthroat trout and provided information about life histories. An otolith microchemistry project (FWP 2018) quantified the contribution of potential tributary and mainstem spawning areas to the mainstem brown trout population, thereby identifying important sources of trout recruitment.

Tributary Prioritization Methodology

Using the fishery and habitat assessment information, the state prioritized tributary areas through three main steps: 1) valuation of the current fishery of each area; 2) valuation of the potential benefits of habitat protection and enhancement projects in an area; and 3) determination of priority areas based on applying NRDP policy preferences to the results of steps 1 and 2 (see FWP and NRDP, 2010 for summaries of information used for valuations of each tributary area). Values considered how important an area is to achieving the three fishery goals from a biological standpoint. Professional judgment was necessary because the quantity and quality of the data varied between locations. However, we did standardize and calibrate our judgment to provide comparable ratings across the Basin.

Step 1. Valuation of the current fishery

We evaluated the current condition of each tributary fishery with regard to the three fishery goals. The goals address the Upper Clark Fork River and the Silver Bow Creek mainstem fisheries separately and equally since currently they are discreet fisheries due to the configuration of Warm Springs Ponds. To standardize this evaluation, we considered the following attributes of the trout populations (see Table 1 also).

1) **Value as a Recruitment/Restoration Fishery for the Upper Clark Fork River or Silver Bow Creek**:

Species Present: Trout species present in a tributary stream or reach. This considers the propensity for a species to migrate from a tributary and use the Upper Clark Fork River or Silver Bow Creek, as well as a species' relative value to anglers (i.e., size, species composition, and catchability).

Fish Density/Number of Fish Produced: The relative number of trout present in a tributary stream or reach that are potentially available for recruitment to the Upper Clark Fork River or Silver Bow Creek.

Connectivity with the Upper Clark Fork River or Silver Bow Creek: The ability of juvenile and adult trout to migrate between a stream or reaches and the Upper Clark Fork River or Silver Bow Creek.

Documented Source of Recruitment: Identified in the otolith microchemistry study as a major source of trout recruitment to the mainstem. These are streams that provide a significant proportion of the trout present in mainstem trout populations.

2) Value as a Tributary/Replacement Fishery:

Recreational Species Present: Trout species available to anglers in a stream or reach. This considers important characteristics of a species to anglers, such as size and catchability, and diversity of species.

Fish Density: The relative number of fish available to anglers in a stream or reach.

Fish Size: The average and maximum size of trout available to anglers in a stream or reach.

Recruitment to non Upper Clark Fork River or Silver Bow Creek Fishery: The importance of the tributary or reach in providing trout to a stream fishery other than the Upper Clark Fork River or Silver Bow Creek. In other words, if a stream or reach is not important itself as a sport fishery, does it provide trout recruitment for another water body (e.g., tributaries to Warm Springs Creek or Rock Creek)?

3) Value as a Native Fishery:

Native Species Present: Trout species present in a stream or reach that are indigenous to the region. This considers the presence of bull trout and westslope cutthroat trout and their genetic status. For the purposes of this initial prioritization, we used native trout as an indicator of health of the native fish assemblage, assuming that trout species were the most likely to be affected.

Competitor and/or Hybridizing Species Present: Trout species present in a stream or reach that are not indigenous to the region, and that could potentially compete or hybridize with native trout species. This considers the presence and abundance of brown trout, rainbow trout, brook trout, and hybrid individuals formed when these species spawn with native trout species.

Demographics and Connectivity: The size and age structure of the population in a stream or stream reach, and the tendency of individuals within the population to migrate. In addition, the ability of juvenile and adult fish to move to and from the subject stream or reach provided the population exhibits a migratory behavior.

The current value of trout populations in tributary streams or stream reaches was rated as very high, high, medium, low, or very low. The ratings were relative to other fisheries, not a rating of potential for a stream or stream reach. For instance, a very high rating does not indicate that a stream has reached its potential. We standardized current fishery value ratings, by goal, as shown in Table 1. The Tributary Area Summaries[2] indicate these fishery population attributes and the resulting original fishery value ratings for each area. Additions and changes to the original Tributary Area Summaries are highlighted in Table 2.

Step 2. Valuation of Habitat Protection and Enhancement

We next judged the value of protecting or enhancing fishery habitat in tributary areas using results of the current fishery valuation and habitat assessments. We define protection and enhancement as follows: Protection is the act of maintaining the fishery value of the area, typically through protection of the habitat; and enhancement is the act of improving the fishery value of the area, typically through restoring watershed processes and improvement of the habitat.

Habitat assessments were used to evaluate habitat quality and security associated with fish populations. They are defined as follows:

Habitat Quality: A qualitative evaluation of a stream or reach having the necessary physical components to allow trout to carry out their natural life cycle and support viable populations.

Habitat Security: A qualitative evaluation of whether a stream or reach is vulnerable to ongoing or future habitat degradation based on land use and ownership.

Factors affecting fish habitat were identified when encountered. However, habitat assessments were not comprehensive and often limited to site-specific evaluations and done with incomplete knowledge of watershed-wide conditions. As a result, some areas only have a description of the habitat whereas others have more detail on processes causing habitat degradation and possible limiting factors to the fishery. Habitat security was largely based on land ownership and the protection it may provide from habitat degradation. Easement information was not researched.

[2] *Upper Clark Fork River Basin Tributary Area Summaries, May 2010*, Montana FWP

Each area was assigned a protection and enhancement value rating for each of the three goals. This rating reflected the value that a habitat project could have in helping achieve the fishery goals and was based on available information. In general, we assumed that the value of enhancing fish populations was reflected by the current fishery value. We varied from current fishery value in some instances: 1) Where there was evidence that habitat enhancement or protection could significantly enhance the current value (e.g., there were identified limiting factors), 2) There was possible future degradation of the fishery (e.g., residential development or hybridization appears imminent), or 3) Habitat protection was of higher or lower value than the current value (e.g., lands were either highly developable or much less developable because of public land ownership). We made no assumption about the opportunity to implement projects; therefore our rating does not address the availability or quality of specific projects. Ratings were very high, high, medium, low, or very low. The Rating Summaries (FWP and NRDP, 2010) indicate the habitat quality and security attributes and the habitat protection and enhancement value rating for each goal in each tributary area.

Step 3. Prioritization of tributary areas

Step 3 started with the narrowing down of potential tributary priority areas to only those areas that had a habitat protection and enhancement priority rating of very high or high for one or more of the three fishery goals. Of the 189 tributary areas considered, 115 met this criterion. We next incorporated the priority for restoration of injured resources that is reflected in NRDP program policy and criteria[3] using the methodology indicated below. This resulted in the identification of 77 priority areas, which were categorized from 1 to 4; with 1 being the highest priority and 4 the lowest (table 2 and map 3). All 77 areas listed are priority areas and seeking protection and enhancement projects in these areas is encouraged. Another 25 areas need more thorough assessment and prioritization is pending (see list at the end of this document and map 3). The remaining 87 areas are not considered to be a priority. The prioritization process factored in the following three preferences:

1) Projects that occur in Reach A of the Upper Clark Fork River (from headwaters to the confluence with the Little Blackfoot River) and Silver Bow Creek, then Reach B of the Upper Clark Fork River (from below the Little Blackfoot River to just below the confluence with Flint Creek) and lastly Reach C of the Upper Clark Fork River (from below the confluence with Flint Creek to above the confluence with the Blackfoot River). Reach A and Silver Bow Creek includes the mainstems and drainage of Silver Bow Creek and the Upper Clark Fork River to below the confluence with the Little Blackfoot River. (See map 2)

2) Projects that help achieve fishery goals 1 and 2 (see page 5): restoration of the mainstem fisheries by improving recruitment to the mainstem from tributaries, and replacing lost angling opportunities in the mainstem by improving angling in the tributaries.

[3] The priority for restoration of injured resources is reflected in several of the funding criteria for NRDP projects specified in the UCFRB Restoration Plan Procedures and Criteria (NRDP, 2007).

3) Projects that protect or enhance high quality, native trout populations and those known to use the mainstems.

To address preferences 1 and 2, the prioritization of areas was further filtered to emphasize areas in Reach A and Silver Bow Creek that meet fishery goals 1 and 2. As such, areas in Reaches B and C and areas that contributed ONLY to the native fish goal (fishery goal 3) were de-emphasized. Preference was for areas that addressed fishery goals 1 AND 2 or that were identified as major sources of trout recruitment to the mainstem during the otolith microchemistry project, then areas that addressed goals 1 OR 2 combined with goal 3, and least for goal 3 (see map 3 and Table 2).

Preference for fishery projects in tributaries to up-river reaches of the Clark Fork is based on the belief that more of the Upper Clark Fork fishery will benefit from projects higher in the drainage. This area also has had most of the ecosystem damage, so projects in upper reaches are more likely to directly address damaged fishery resource. Also, we originally believed that trout spawned in tributaries higher in the drainage are more likely to contribute angling opportunity in the Upper Clark Fork than trout spawned in the tributaries lower in the drainage. Although Silver Bow Creek tributaries and tributaries to Reach A of the Clark Fork River do receive preference, a recent microchemistry project indicated the importance of local tributary sources of trout recruitment, particularly in Reaches B and C. Results of this study showed that most of the brown trout in Reach B recruit from Gold Creek (a tributary that enters the Clark Fork River in Reach B). Similarly, most of the brown trout in Reach C come from Flint and Rock creeks, which both enter the Clark Fork River near Reach C. Therefore, the prioritization criteria were revised to emphasize local sources of recruitment farther downstream in the UCFRB, while still giving highest priorities to tributaries in Reach A and Silver Bow Creek.

Prioritizing projects in areas that address both goals 1 and 2 are preferred until it is more certain how well the Upper Clark Fork River and Silver Bow Creek can support a trout fishery. It is acknowledged that the primary goal is to restore these mainstem fisheries. Hedging towards areas that provide both a local, tributary fishery and recruitment to the mainstem fisheries, however, reduces the risk of doing projects that are of limited benefit if increased recruitment of young trout to the mainstem fisheries proves in excess of what the habitat can support.

Included as priorities for goal 3 are areas with viable bull trout and westslope cutthroat trout populations that typically have higher densities of fish and diverse life histories including biological connection (i.e., migration to and from) with the mainstem waters. These areas provide habitat for native trout, recruitment of native trout to mainstem waters, and/or angling opportunity in the tributary itself. Thus, the prioritization of areas ranking very high in goal 3 and at least high in goals 1 or 2 were increased in this revision. This change was deemed necessary because these areas are thought to be the most important for future protection and recovery of native trout throughout the UCFRB. In addition, some of the higher quality areas with limited connectivity with the mainstem continue to have priority throughout the basin due to their importance as native fish strongholds. More specifically, the complex of streams in upper Warm Springs (including Storm Lake, Barker, W.F. Warm Springs, Twin Lakes Creeks) and Harvey Creek were given preference. These areas are unique in that they are physically isolated by a barrier or distance. We hope that giving priority to such areas contributes to the persistence of native

fish populations by maintaining sources of genetic diversity. Areas with a) no bull trout or with a bull trout population of questionable viability (e.g., rare abundance or hybridized) and b) genetically pure westslope cutthroat trout populations with low density, or higher density but not connected to the mainstems received less emphasis.

C. Strategy for Habitat Protection and Enhancement

This prioritization methodology was developed to direct efforts to particular areas and to communicate a strategy for habitat protection and enhancement. This will ensure that the location and approach of a project is appropriate. Following advice of Roni et al. (2002) and also Frissell (1997), efforts should, in order of importance:

1) Focus on protecting areas with intact, high-quality habitats that have significant fishery value.

2) Reconnect fragmented, high-quality habitats that will help achieve fishery goals.

3) Focus on restoring hydrologic, sediment transport, and riparian condition that promote overall natural stream processes, such as improving instream water quantity, road decommissioning, and changes in land use practices.

4) Improve instream habitat through structures or channel reconstruction.

These priorities could occur concurrently. For example, protecting and enhancing critical habitats is key to reaching goals and securing them for the future. This is sound biologically and financially by protecting the best fisheries, enhancing habitat that is likely to reap greater benefit, and securing the financial investment in habitat from future degradation. In addition, the site- and drainage-specific nature of restoration work must accommodate flexibility in applying priorities based on the spatial and biological context of each project. For example, a small area of habitat protected to maintain a fishery may be of less importance than a large area that has had flows improved and a fishery greatly enhanced. Therefore, in this instance, protection of a small area is less beneficial to fishery goals than restoring the hydrologic condition. Instream habitat enhancement is less important and reserved for situations where immediate habitat or function is necessary, or more natural habitat development is unlikely to occur. Passive development of habitat is encouraged. For example, protecting vegetation and letting it grow and develop into mature plants that provide shade and cover is often more effective than installing in-stream structures.

Besides of the remediation of the metals in the floodplain that has been or will be conducted on the mainstems with dedicated settlement funds, the State considers the most beneficial and cost-effective enhancement projects consonant with the priorities indicated above are those that improve instream flows, fish passage, and riparian condition via passive methods such as fencing or changes in land management.

D. Strategies for Fishery Management

The primary goal for the Silver Bow Creek and Clark Fork River fisheries is to restore trout populations and associated angling opportunity. This section identifies the more specific fishery management goals for trout populations and species composition for the mainstem fisheries. These goals are derived from the program-specific restoration goals specified in the State's previous remediation and restoration plans (NRDP 2005 and 2007; DEQ and NRDP (2010) and also derived from FWP's broader management directive to provide diverse, quality angling opportunities with an emphasis on conserving remaining native fishes. Both the program-specific goals and the broader fishery management goals, and their assumptions, play an important role in understanding prioritization strategies reflected in this document.

The Clark Fork River restoration plan (NRDP, 2007) has a goal for the Clark Fork River that restores a fishery with the following characteristics:

1. Salmonid fish density similar to healthy reference streams
2. High species diversity (e.g., at least three species of salmonids, and representation of other families of fishes).
3. Fish age structure that indicates suitable reproduction, and
4. Species composition that does not reflect only metals tolerant species.

In addition, the Clark Fork River and its tributaries should support inter-connected migratory populations of salmonids and native fishes.

The Silver Bow Creek Watershed Restoration Plan (NRDP, 2005) has a fishery goal of a viable, self-sustaining fish community in which native species are maintained and restored where practicable. This Plan, as well as the States' integration remediation and restoration comprehensive monitoring plan for Silver Bow Creek (DEQ and NRDP, 2010) further specify indicators of a healthy fishery for evaluation of the success of remediation and restoration that generally mirror the same four characteristics as listed above for the Clark Fork River.

Mainstem Trout Populations

Throughout the approximately 150 miles of river, we expect that trout greater than seven inches should range from 500 to 1,500 per mile after the cleanup of metals contamination and barring other significant limiting factors such as very low water quantity or pollution. Variable habitat conditions, trout recruitment from tributaries, or other factors are expected to influence trout numbers to a lesser degree. This range is based on about 1,000 to 1,400 trout per mile in comparable sections of the Little Blackfoot River, Rock Creek and Flint Creek, a range of about 500 to 1,800 trout per mile in the Bitterroot River, and about 400 to 750 trout per mile in the Blackfoot River. Looking at past estimates in the Clark Fork River below Warm Springs Ponds suggests that numbers as high as about 2,000 trout per

mile are possible, but we consider this inflated because the high productivity of the Warm Springs Ponds system creates extra food for trout in this short segment of river.

The average trout per mile for Silver Bow Creek and the Clark Fork River should be about 1,000 trout per mile. The average number of trout per mile in 2016 on the Clark Fork River was 238, less than one-quarter of 1,000 trout per mile. This is consistent with Hillman et al. (1995) and Hillman and Chapman (1995), who found the trout in the Clark Fork River to be 5 to 6 times below that expected and no trout in Silver Bow Creek. In 2016, trout population estimates conducted at six sections of Silver Bow Creek Ranged from 0-207 trout per mile with most sections supporting less than 30 trout per mile. Several sections of Silver Bow Creek still do not have enough trout to reliably calculate population estimates.

Fishery Management in the Silver Bow Creek

In reaching the goal of maintaining and restoring native trout in Silver Bow Creek, there are challenges and opportunities. Silver Bow Creek has only become hospitable to trout recently, and it still has major factors limiting establishment of a productive mainstem fishery. Cleanup has reduced metals contamination, but very low dissolved oxygen (DO) levels and high ammonia resulting from nutrient loading (primarily from Butte waste water treatment plant) have limited fish distribution and numbers in portions of the creek above Browns Gulch (Naughton and Gresswell 2010). The Butte waste water treatment plant was recently upgraded, and early data shows an improvement in water quality in Silver Bow Creek relative to ammonia presence and DO. Nutrients continue to be an issue however. In addition, the mainstem water temperature warms to levels stressful to trout. German Gulch is a significant source of westslope cutthroat trout to the mainstem, but is threatened by mining wastes at the Beal Mine that have not been sufficiently managed to protect water quality. Interestingly, these challenges also provide an opportunity. Currently, brown trout are not present in Silver Bow Creek and rainbow trout are very low in number. Brook trout are common in the tributaries of Silver Bow Creek, but are not very abundant in much of the mainstem. The reduced number of competing and hybridizing trout species provides a unique opportunity for Silver Bow Creek; that is, it is possible to maintain a mainstem fishery that is dominated by westslope cutthroat trout. In order to pursue this management direction, construction of a fish barrier in Silver Bow Creek downstream of German Gulch was completed in 2014. The barrier was strategically located to allow westslope cutthroat trout to move between important spawning habitat in German Gulch and the mainstem of Silver Bow Creek.

Fishery Management for the Clark Fork River

Currently, the Clark Fork River trout fishery is, for the most part, dominated by brown trout from Warm Springs Creek to Rock Creek, and trout densities are lower than expected due to metals contamination. Above Flint Creek, recent sampling has shown that about 99% of the trout in the Clark Fork are brown trout. Westslope cutthroat trout and rainbow trout are rare and bull trout are largely absent from the upper reaches of the Clark Fork River. Farther downstream, near the confluence with Rock Creek, the trout fishery is more diverse with rainbow trout and westslope cutthroat trout combined making up about half of the trout population. Bull trout are also occasionally sampled in this portion of the Clark Fork River. However, trout densities between Rock Creek and Flint Creek are exceptionally low.

Throughout the upper Clark Fork River, we would expect that 5-10% of the fishery being bull trout and cutthroat trout to be an optimistic but realistic expectation; though having a higher proportion would be encouraged if our expectation turns out to be too conservative.

High mortality of adult fish in the Clark Fork River (Mayfield and McMahon 2010), and a paucity of young trout are indicative of the effects of metals loading in the Clark Fork (Luoma et al. 2008), which still experiences acute and chronic toxicity conditions (PBSJ 2010). Brown trout are more tolerant to metals toxicity than rainbow trout (Luoma et al. 2008) and bull trout (Hansen et al. 2002) and likely more tolerant than westslope cutthroat trout. In addition, and similar to Silver Bow Creek, there may be significant water quality degradation from nutrient loading resulting in high ammonia and low dissolved oxygen.

We expect that brown trout will continue to be the dominant trout species in the Clark Fork River after cleanup efforts are complete. This is based on their present abundance, and that habitat conditions post cleanup will likely favor them. High water temperatures and the low elevation large river system habitat tend to benefit brown trout. Currently, even brown trout with their higher tolerance to the disturbed habitat are experiencing high mortality rates (Mayfield and McMahon 2010, FWP 2015). Another indicator that brown trout are likely to remain dominant is that they dominate in tributaries with higher quality habitat. The Little Blackfoot River, Flint Creek and Rock Creek have colder water and much less mining impacts, but are also dominated by brown trout. In addition, we are seeing an expansion of brown trout in the region (e.g., in the Bitterroot River and Rock Creek drainages) suggesting a broader, maybe climate influenced, trend towards more brown trout, especially with ecosystems that have been disturbed as with the UCFRB. Nevertheless, what is found in these tributaries is not independent of the conditions of the Clark Fork and we do see a more diverse fishery moving downstream coinciding with the dilution effect of the tributaries. Therefore, we are hopeful that the Clark Fork will become more suitable for other species of trout, and native trout in particular, with the remediation of metals contamination and restoration of habitat.

Protecting and enhancing native trout populations and their habitat in the tributaries is important to allow for the improvement of native trout populations in the Clark Fork River. The general strategy is to protect viable populations, and increase abundance and distribution where possible, particularly those known to be biologically connected to the Clark Fork River. Populations should be distributed throughout the drainage and have cold, clean, complex and connected habitat, preferably with little threat of invasion or current dominance by non-native trout. Improving these habitat and biological characteristics are important protection and enhancement measures.

E. Important Considerations

This prioritization process is specific to the tributaries of the Upper Clark Fork River and Silver Bow Creek in the UCFRB, and for instream flow in Silver Bow Creek and Clark Fork River mainstems. It does not address specific fishery habitat enhancement and protection needs that occur within the floodplain corridors of the mainstem Silver Bow Creek or Upper Clark Fork River. The Silver Bow Creek and Upper Clark Fork River mainstem fisheries were the focus of the state's aquatic resource claims in its natural

resource damage lawsuit and are the focus of restoration efforts addressed by other restoration planning and implementation processes.[4] This process identifies where work in tributary areas and where instream flow projects for the mainstems should be focused to best augment the integrated remediation and restoration work that has been or will be completed in the floodplain corridor of Silver Bow Creek and the Upper Clark Fork River.

Although this document identifies areas where to focus efforts, it does not constitute any predetermination of the merits of funding a particular fishery restoration project. For example, a potential project in a Priority 1 area may or may not be a worthwhile funding prospect depending on whether it appropriately and cost-effectively addresses the factor(s) that limit the fishery in that particular area and on the relationship of the project costs compared to its benefits.

Our general view of the effect of prioritization is to encourage beneficial projects in the higher priority areas (priorities 1 and 2) by providing planning and significant cost-share of NRD settlement funds for development and implementation. For lower priority areas (priorities 3 and 4), project development and implementation would best involve significant cost-share from other funding sources. Obviously, with all else equal, higher priority projects will outcompete lower ones in terms of funds and timing. Project specific costs and benefits will likely create considerable variability in cost-share ratios and funding amounts.

We did not prioritize areas that do not have important fisheries but may be of other value such as a supply of cold, clean water or habitats used for migration. Furthermore, priority areas only reflect the location of the fishery, but factors outside the area may be affecting the fishery. Therefore, projects outside of identified priority areas may be worth exploring as long as there is a link to conditions that affect the fishery. For example, watershed processes, such as sediment budgets, are influenced by factors beyond the identified, local fishery, or where a migration barrier to fish using a priority area is found outside that area.

Our current understanding of UCFRB tributary and mainstem fishery conditions forms the basis of this prioritization process. This understanding continues to improve as additional fishery assessments are completed. The recently completed otolith microchemistry project documented the importance of certain tributaries for the recruitment of trout to the mainstem Clark Fork River. This study also indicated that the Little Blackfoot River was providing far less recruitment than would be expected given it has high densities of brown trout and the number of brown trout that moved from the mainstem into the Little Blackfoot River to spawn during the telemetry study. The exact reason the Little Blackfoot River is underperforming in terms of recruitment is not fully understood at this time, but entrainment into irrigation systems is known to be a source of mortality for trout moving downstream in tributaries to the Clark Fork River (Mayfield and McMahon 2010, FWP 2016). Trout are also known to spawn in the upper reaches of the mainstem Clark Fork River, but the combination of metals contamination, high water temperatures, and questionable water quality released from the Warm Springs Ponds contribute

[4] Summary information on these other restoration efforts that are completed, planned or underway for Silver Bow Creek and the Upper Clark Fork River (Reach A) is available on the NRDP website at: http://doj.mt.gov/lands/naturalresource.

to high fish mortality rates in these reaches. As we continue to study potential limiting factors such as entrainment, metals contamination, and water quantity and quality, our understanding of condition of UCFRB fisheries and the relative importance of areas for fisheries restoration in the Basin may change. Thus, the priorities listed in this document should be reevaluated and updated every 2-5 years.

F. Monitoring

We consider monitoring to be critical for successful fishery restoration. Long-term monitoring and evaluation is needed so that management strategies can be changed if fishery goals are not being achieved. Much fishery monitoring is already occurring in the basin. The state recently completed a three year basin-wide monitoring project that will provide important baseline data. The state has also conducted fishery monitoring as part of the integrated remediation and restoration of the Milltown Superfund site and fishery management program for FWP. In addition to basin-wide monitoring, it is expected that a monitoring plan that investigates select restoration projects will be developed to evaluate the cost-effectiveness and biological benefits of NRD restoration program.

G. Public Participation

In January 2018 the state produced a draft of this document, which will be subject to a 30 day public comment period. These public comments will be summarized and reflected in the final document.

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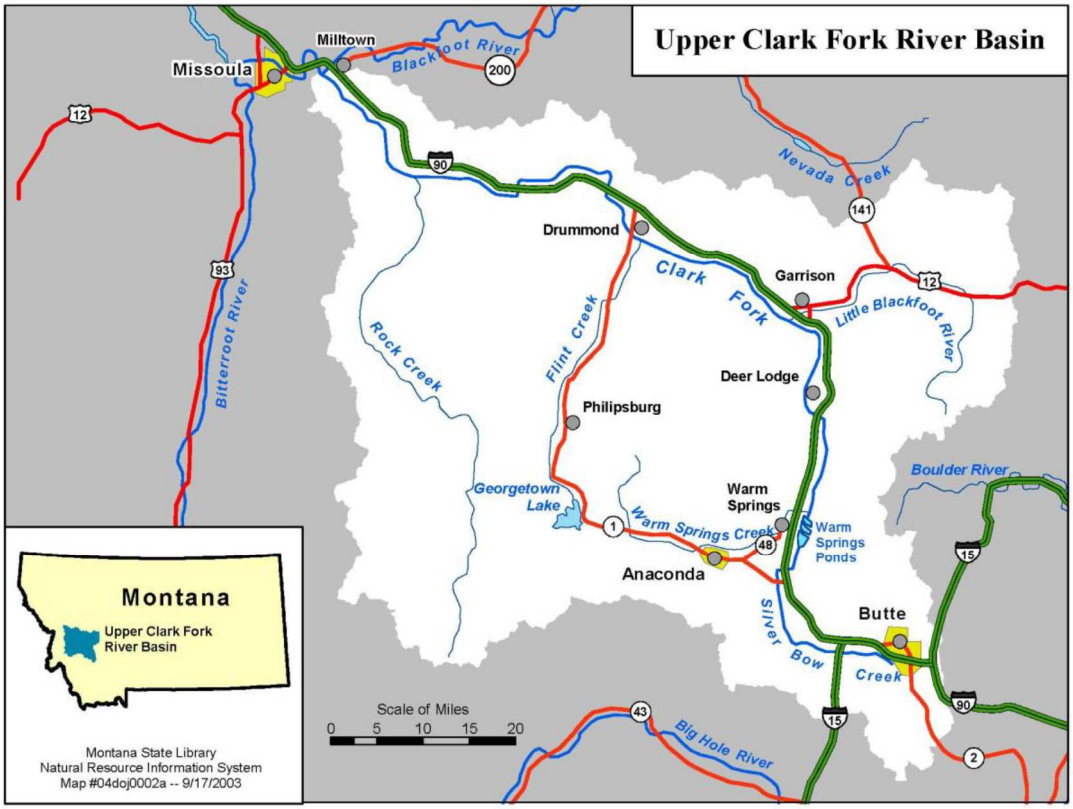
Map 1


Upper Clark Fork River Basin
Missoula
Milltown
Blackfoot River
200
12
90
93
Bitterroot River
Nevada Creek
141
Drummond
Clark Fork
Garrison
Little Blackfoot River
Rock Creek
Flint Creek
Deer Lodge
Philipsburg
Boulder River
Georgetown Lake
Warm Springs
Warm Springs Creek
1
48
Warm Springs Ponds
Anaconda
15
Butte
Silver Bow Creek
Scale of Miles
0 5 10 15 20
43
Big Hole River
2
Montana
Upper Clark Fork River Basin
Montana State Library
Natural Resource Information System
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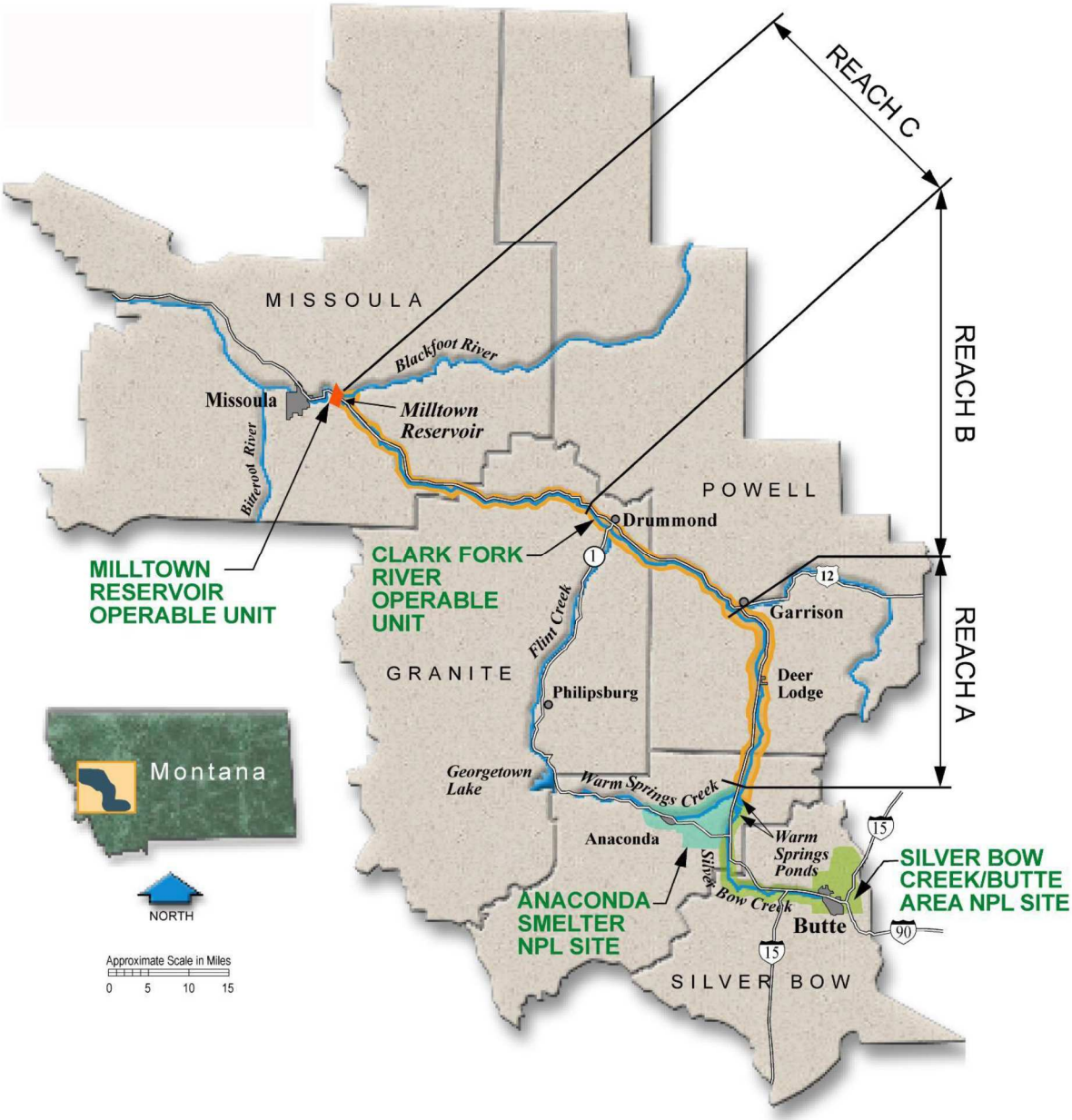
Map 2


REACH C
REACH B
REACH A
MISSOULA
Blackfoot River
Missoula
Milltown Reservoir
Bitterroot River
POWELL
Drummond
MILLTOWN RESERVOIR OPERABLE UNIT
CLARK FORK RIVER OPERABLE UNIT
Flint Creek
Garrison
GRANITE
Philipsburg
Deer Lodge
Montana
Georgetown Lake
Warm Springs Creek
Anaconda
Warm Springs Ponds
SILVER BOW CREEK/BUTTE AREA NPL SITE
ANACONDA SMELTER NPL SITE
Silver Bow Creek
Butte
SILVER BOW
NORTH
Approximate Scale in Miles
0 5 10 15

[

Table 1. Criteria for rating the value of trout fisheries in relation to the three fishery goals for the Upper Clark Fork River and Silver Bow Creek tributaries.

	Current value				
Goal	**Very high**	**High**	**Medium**	**Low**	**Very low**
1) Restore the mainstem trout fishery, including westslope cutthroat trout and bull trout, by improving recruitment of trout from tributaries.	Presence of migratory adults, high density of adults and juveniles, and connectivity with the mainstem	Moderate density of native trout or high density of other trout, with connectivity intact. Typically in a smaller drainage.	Moderate to high density of fish with an unknown contribution of fish to the mainstem because of habitat impairment or distance to the mainstem.	Primarily stream resident population with limited recruitment. Most often has an upstream fish passage barrier or is a long distance from the mainstem.	No known recruitment to the mainstem or no trout.
2) Replace lost angling in the mainstem by improving trout fisheries in tributaries.	Large tributaries with excellent existing fisheries.	Moderate sized streams with a good fishery, or a significant contributor of trout to another good to excellent tributary fishery.	Tributary with moderate to high density of smaller fish, or a minor contributor to another good to excellent tributary fishery.	Very limited trout fishery due to low number of trout or stream too small for angling.	No trout fishery.
3) Maintain or improve native fish populations in the Upper Clark Fork River drainage.	Bull trout population is viable*, or very productive westslope cutthroat population with diverse life histories. Non-natives are not present or in very low number.	Bull trout present but viability is questionable, or westslope cutthroat trout population not hybridized (no introgression) and viable. Native trout dominate.	Bull trout not present or population is not viable, or westslope cutthroat trout <10% hybridized, or pure with questionable viability. Non-native trout are common.	No bull trout are present, westslope cutthroat trout are present at low densities, not viable, or are heavily hybridized (>10%).	No native trout present.

*A viable population is one that has moderate to high densities with multiple age classes indicating frequent, successful reproduction.

Table 2. Priority areas for protection and enhancement in the Upper Clark Fork River Basin, including Silver Bow Creek (SBC). Red print identifies proposed changes to Table 2.

Priority	Criteria	Areas
1	Reach A & SBC, at least High in Goal 1 and 2, Very High in Goal 1, 2 or 3	Browns Gulch German Gulch Racetrack Cr. - Lower Little Blackfoot R. - Lower Warm Springs Cr. - Lower Warm Springs Cr. - Upper
	Reach A & SBC, Very High in Goal 3 & geographically distributed & isolated	Basin Creek – Upper[1] Storm Lake Cr. Barker Cr. WF Warm Springs Cr. Twin Lakes Cr.
	Mainstem instream flow	Clark Fork R. above Deer Lodge
2	Reach A & SBC, High in Both Goal 1 and 2	Baggs Cr. Beefstraight Cr. Blacktail Cr. Cottonwood Cr. – Lower Cottonwood Cr. – Upper Dog Cr. Foster Cr. Lost Cr. - Lower Mill Cr. - Lower Snowshoe Cr. - Lower Spotted Dog Cr. - Lower Willow Cr. Trout Creek (Little Blackfoot R)[2] Little Blackfoot R. - Upper
	Reach A & SBC, High in Goals 1 or 2, Very High in Goal 3	O'Neil Cr.[1]
	Reach B and C, Very High in Goal 1 and 2, or documented major recruitment source by otolith microchemistry	Flint Cr. - Lower Flint Cr. - Upper Gold Cr. – Lower[*] Rock Creek (Clinton)[*]
	Reach B, High in both Goal 1 and 2, Very High in Goal 3	Boulder Cr.
	Reach B or C, Very High in Goal 3 & geographically distributed & isolated	Harvey Cr.
	Mainstem Clark Fork River and SBC instream flow	Areas other than priority 1, including SBC
3	Reach A & SBC, High for Goals 1 or 2	Alaska Gulch American Gulch Basin Cr. – Lower Dempsey Cr. – Lower[2] Dry Cottonwood Creek[2] Flume Gulch Racetrack – Upper Tin Cup Joe Cr.[1] Yankee Doodle Cr. – Upper[1]
	Reach B, High for Goals 1 and 2	Douglas Cr. - Lower Trout Cr. (Flint) Rock Creek (Garrison) – Lower[1]
	Reach C, High or Very High in Goals 1 or 2, Very High in Goal 3	Deer Cr. Ross Fork Rock Cr. MF Rock Cr.

		WF Rock Cr. Stony Cr. Welcome Cr. Ranch Cr.
4	Reach B, High or Very High in Goal 1 or 2	Brock Cr. Warm Springs Cr. (Garrison) - Lower NF Flint Cr. Fred Burr Cr.
	Reach C, High or Very High in Goal 1 or 2	EF Rock Cr. (below dam) Butte Cabin Cr. Hogback Cr. Allen Cr.[2] Antelope Cr.[1] Cramer Cr. Crystal Cr.[2] Dirty Ike Cr.[2] Dunkleberg[2] Gillespie Cr.[2] Ryan Cr.[2] Swartz Cr. Greenough Cr. Wallace Cr[1]
	Reach A & SBC, B, or C, Very High in Goal 3	NF Lower Willow Cr.[2] SF Lower Willow Cr. Carpp Cr. Copper Cr. (Rock Cr.) EF Rock Cr. - above dam NF Rock Cr.

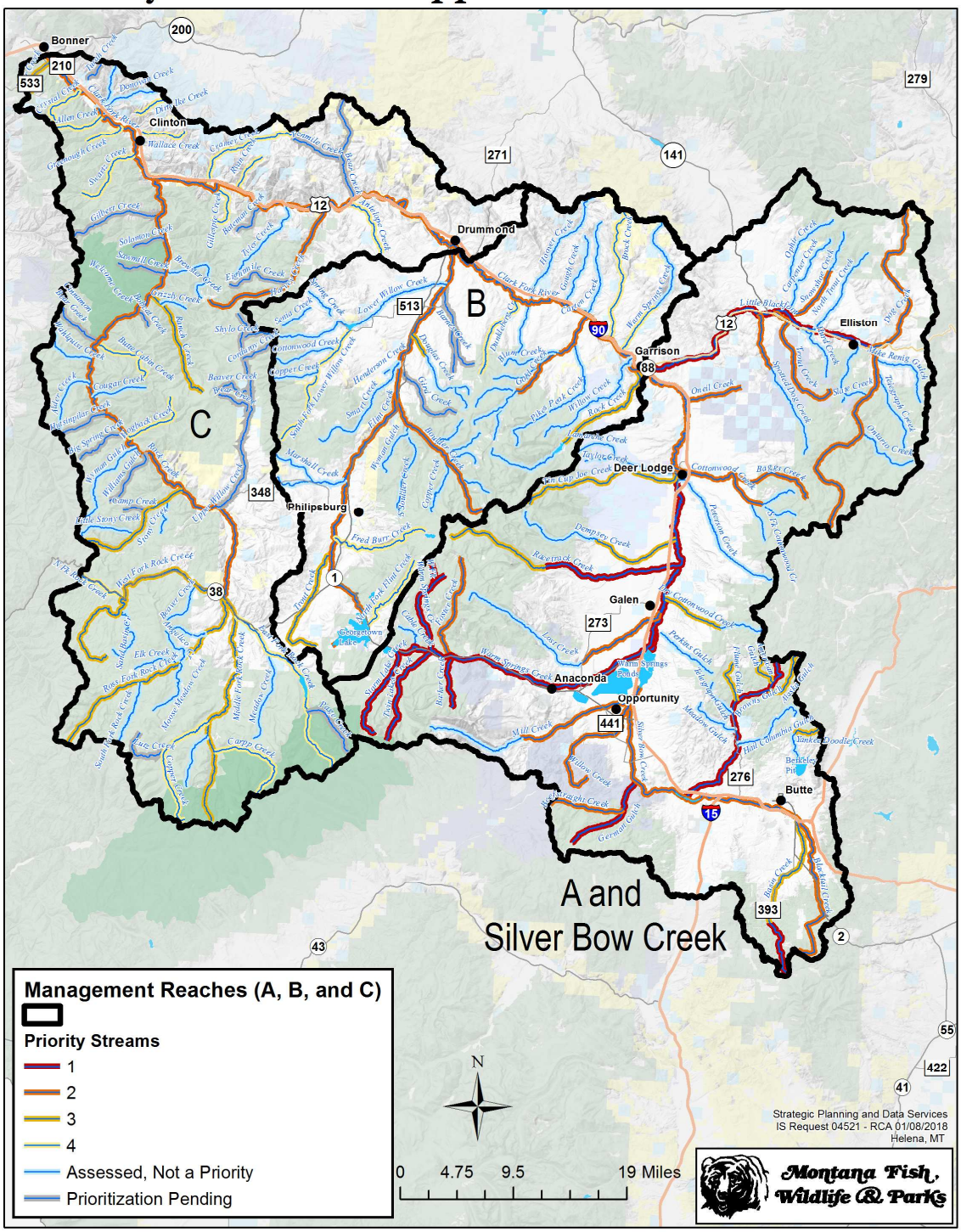
[1]Tributary had not been assessed prior to 2011 prioritization plan.

[2]Tributary was reassessed since 2011 prioritization plan.

[*]Identified as major trout recruitment source by otolith microchemistry – priority increased.

Map 3

Priority Areas in the Upper Clark Fork River Basin



STATUS OF OTHER SITES

AREAS THAT ARE NOT A PRIORITY

Alder Creek
Angelico Creek
Antelope Creek
Beaver Creek
Blum Creek
Brewster Creek
Cable Creek
Carpenter Creek - Lower
Carpenter Creek - Upper
Carten Creek
Copper Creek (Boulder)
Copper Creek (S. Fk. Lower Willow)
Cottonwood Creek (Flint Cr)
Cougar Creek
Crevice Creek
Dempsey Creek - Upper
Donovan Creek
Douglas Creek - Upper
East Fork Warm Springs Creek
Elk Creek
Elliston Creek
Gold Creek - Upper
Gough Creek
Granite Creek
Grizzly Creek
Hail Columbia Gulch
Helm Creek
Henderson Creek
Hoover Creek - Lower
Hoover Creek - Upper
Hurd Creek
Kendall Creek
Lamarche Creek
Little Gold Creek
Little Stony Creek
Lost Creek - Middle
Lost Creek - Upper
Lower Willow Creek
Marshall Creek
Meadow Creek
Meadow Gulch
Meyers Creek
Middle Fork Cottonwood Creek
Middle Fork Douglas Creek
Middle Fork Warm Springs Creek
Mike Renig Gulch
Mill Creek - Upper
Moose Gulch (Stony Cr.)
Moose Meadow Creek
North Fork Cottonwood Creek
North Fork Dry Cottonwood Creek
North Gold Creek
North Trout Creek - Lower
North Trout Creek - Upper
Ontario Creek
Ophir Creek
Perkins Creek
Perkins Gulch
Peterson Creek
Pikes Peak Creek
Princeton Gulch
Rock Creek (Garrison) - Upper
Royal Gold Creek
Sand Basin Creek
Senia Creek
Slate Creek
Smart Creek
Snowshoe Creek - Upper
South Boulder Creek
South Fork Cottonwood Creek
South Fork Douglas Creek
South Gold Creek
South Fork Marshall Creek
South Fork Rock Creek
Spotted Dog Creek - Upper
Spring Creek
Taylor Creek
Telegraph Creek
Telegraph Gulch
Tyler Creek
Wahlquist Creek
Warm Springs Creek (Garrison) - upper
West Fork Lower Willow and Mohave Cr.
Willow Creek (Garrison)
Wyman Gulch (Boulder Cr.)
Wyman Gulch (Rock Cr.)
Yankee Doodle Creek - Lower

PRIORTY PENDING

Barnes Creek
Bateman Creek
Bear Creek
Bear Creek (Upper Willow Creek)
Big Spring Creek
Bobcat Creek
Camp Creek
Cinnamon Bear Creek
Corduroy Creek
Dirty Ike Creek
Eightmile Creek
Gaskill Creek
Gilbert Creek
Gird Creek
Hutsinpilar Creek
Kendall Creek
Lutz Creek
Page Creek
Sawmill Creek
Solomon Creek
Shylo Creek
Tenmile Creek
Turah Creek
Upper Willow Creek
Williams Gulch