DRAFT: Rim Country Flexible Toolbox Approach for Aquatic and Watershed Restoration Activities

The Rim Country project area encompasses over 1.2 million acres, ranging in elevation from around 4,300 to 8,850 feet and includes 11 target vegetation cover types. This project area includes stream types ranging from high gradient headwater streams, meandering meadow reaches, and low gradient depositional valleys. There are approximately 4,000 miles of stream channels, including perennial, intermittent, and ephemeral. Wetlands such as wet meadows and springs also occur, providing unique aquatic and riparian habitats. There are 411 known springs on the three national forests that are either developed or undeveloped, and occur in meadow or riparian settings. It is estimated there are up to 10 times the number of unmapped springs that are not developed in the Rim Country project area. Riparian areas include vegetation types such as herbaceous sedge/rush, willow/alder, and cottonwood/sycamore vegetation.

Conditions within these watershed aquatic systems range from relatively pristine to highly impacted. There are legacy impacts from timber management, channel modification, water developments such as springs and stock tanks, and unregulated grazing, as well as more contemporary impacts from roads, non-native species, wildfires, recreation, and off-highway vehicle use. Some of these impacts are irreversible; however, in many systems there is potential for a new functional equilibrium. In other systems, there is the opportunity for either full restoration or preventing further degradation.

In general, desired conditions are functional soil, vegetation, and water resources, consistent with their flood regime and flood potential, which provide diverse habitats. Stream channels have functioning floodplains and dissipate flood energy, as well as support connected riparian areas.

The toolbox addresses the effects of roads on watershed and aquatic systems, such as unauthorized routes and trails and stream crossings. The miles of unauthorized routes (roads or trails) within the project area are unknown, but their effects on these systems can easily be generalized. Based on current mapping, it is estimated that there are over 800 road and stream crossings in the project area. It is assumed that road crossings are generally stable on maintenance level 3 thru 5 roads (suitable for passenger cars to high degree of user comfort), and range from stable to unstable on maintenance level 1 and 2 roads (basic custodial care, i.e., closed, to open to high clearance vehicles). Existing maintenance level 1 and 2 roads which are potentially causing resource damage are addressed in the toolbox as well as maintenance level 3-5 roads which may be destabilizing streams.

Due to the size and complexity of the 1.24-million-acre Rim Country project area, and the variety and scope of the proposed activities, site-specific identification and analysis of all areas of need, or the possible combinations of restoration activities needed for each is not feasible within the necessary timeframe for Rim Country analysis. Complete baseline information on the condition of every acre is not currently available. However, there are a few categories of watershed and aquatic impairments that are common throughout the project area that may be appropriately addressed with a suite of restoration treatments, referred to as ”tools,”, with predictable effects that can be analyzed in this project.

There is a wealth of information available to help make informed decisions on what kinds of restoration tools would be appropriate for certain site conditions. Altered or degraded riparian and aquatic habitat conditions generally occur across similar landscape features. To ensure the proper tools are available to help design specific aquatic restoration projects for a variety of existing conditions, we propose to use a

flexible toolbox approach so that local prescriptive treatments can be customized to current site-specific conditions. Landscape features that affect watershed and aquatic systems and how they function include: valley width, gradient, upland and riparian cover types, slope, access, soil types, hydrology (stream or spring flow), and substrate size.

Having a suite of tools available for restoration helps account for imperfect information and adjust treatments in a variety of existing conditions, enabling project implementers to find the best solutions for a site-specific problem. Tools that might be appropriate in one area (e.g., stream type) may not be the right tool somewhere else. This flexible toolbox approach provides the ability to adapt treatments to unanticipated conditions or adapt treatments if monitoring indicates the effects of the project will differ from what was predicted in the analysis. Treatments that may cause effects potentially beyond the sideboards or limitations described in the original NEPA analysis would require subsequent NEPA analysis. Whenever possible, restoration treatments should be coordinated with other activities in the same area to create efficiencies. Restoration treatments could be incorporated into mechanical thinning contracts or stewardship agreements, or could be stand-alone projects specifically developed to address high-priority needs for comprehensive restoration.

This flexible toolbox approach applies to all action alternatives. Before carrying out aquatics and watershed restoration treatments, project leaders, specialists, and partners would look at a specific area to be treated and select the appropriate restoration tool(s). Some of the factors to be considered when designing these projects are: the extent and cause of the degraded resources, water quality issues, threatened and endangered species habitat, scenic sensitivity levels, and effects on non-forest lands. Design criteria, best management practices, and mitigation and conservation measures developed for the Rim Country Project will include and apply to the flexible toolbox.

Implementation Decision Matrix

To guide implementation of aquatics and watershed restoration treatments and assist with their prioritization, a decision matrix was developed to include in the flexible toolbox approach. The matrix gives guidance on the types of information to collect to identify the need for restoration treatments, identify potential restoration options and constraints, and prioritize projects for implementation.

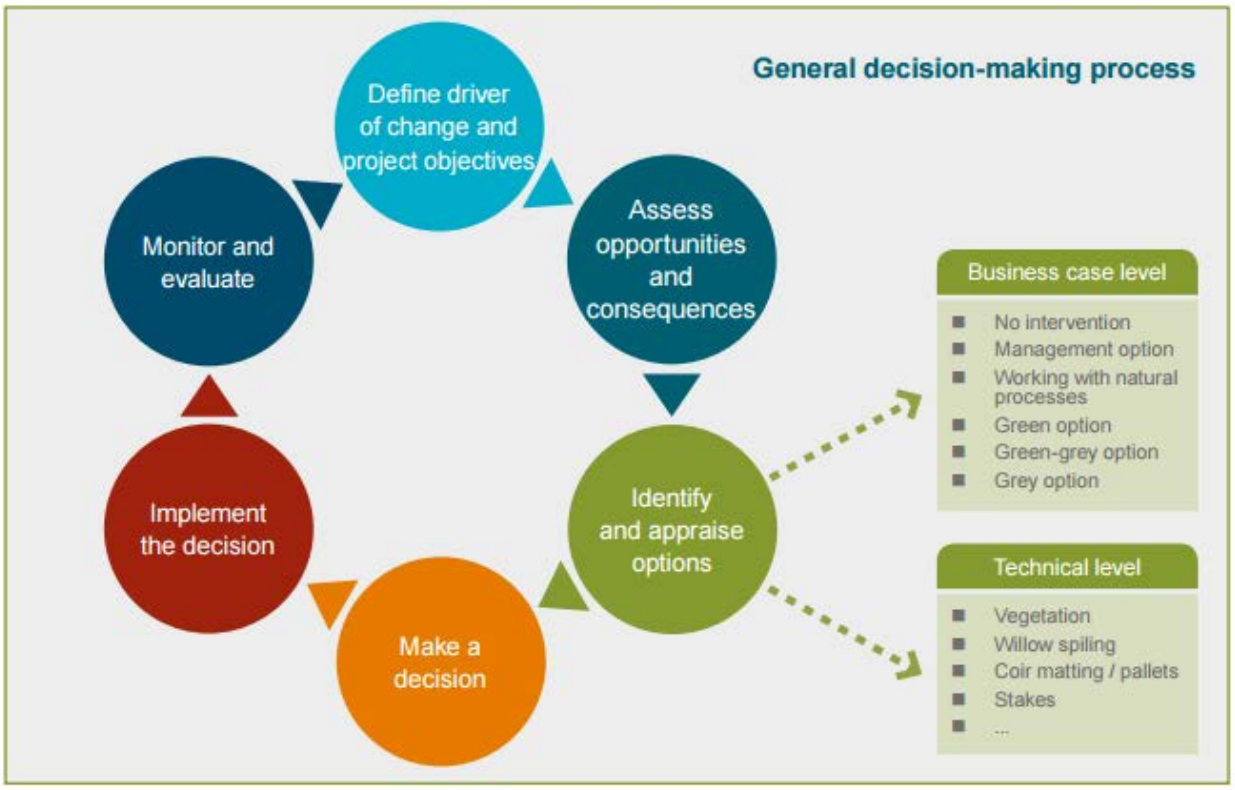

Figure 1. General decision-making process (Roca, et al. 2017)

Define driver of change and project objectives: The first step is identifying potential sites where restoration activities may be needed. Once sites are determined, information is needed to determine the existing baseline conditions and to understand any underlying causes of degradation. A baseline will need to be identified for the activity site using existing conditions and potentially reference reaches if the site is degraded. The baseline for the site is what all restoration options should be assessed against to provide a basis for comparison. Understanding the drivers of change or causes of degradation is necessary to define the best approach and reach the most appropriate solution. The baseline should account for existing condition and drivers of change. In turn, objectives for the restoration activities in relation to improving the baseline condition should be determined.

Key Information that may be needed:

- Site reconnaissance: IDT, partners, stakeholders walk the potential project area to identify areas of concern and potential causes.
    - Landforms (valley type (transport vs. depositional reaches), relic channels, floodplains, very old trees, distinct reach breaks.
    - Occurrence of excess erosion or deposition, loss or change in species composition or density (plant or animal).
    - Signs of manipulation (berms, ditches, skid roads, landings, unusually flat surfaces, hummocks, old or unauthorized roads, infrastructure, etc.)
- Research the history of an area.
    - Historic aerial photos

    - USFS photo archives, local historical societies, universities
    - Prior reports and local knowledge
    - Try to piece together what happened to cause the degradation.
- Characterize the past, current, and likely future trajectory of the area (e.g. SEM or Rosgen stream type, spring type, riparian successional stage, or Proper Functioning Condition).
- Assessment and inventory:
    - Valley and channel types (valley and channel gradients, entrenchment ratio, width to depth ration, sinuosity)
    - Hydrology (flood, low flow, bankfull, regional curves, channel bed material, roughness).
    - Sediment inputs (roads, fires, other land ownership, banks)
    - Riparian habitat and condition (existing, potential, and function)
    - Habitat connectivity (aquatic, terrestrial)
    - Forest resources (terrestrial and aquatic species, rare plants, weeds, etc…)
    - Springs Ecosystem Assessment Protocol (SEAP) evaluation (Springs Stewardship Institute).
- Determine potential cause(s) of the problem (I.e. human activity, animals, past management, or natural processes). Whenever feasible, manage the cause of the problem rather than its symptoms.
- Determine the baseline of the system to adequately assess all restoration treatments.
- Identify any drivers likely to affect the system over its lifetime (e.g. growth, climate change).

Assess opportunities, consequences, and constraints: Identifying potential consequences of current state (e.g. bank or bed erosion) and the opportunities to improve site conditions should be assessed to inform the identification of measures and their prioritization. Constraints of a potential project also need to be identified such as accessibility, nearby land ownership, and roads that cannot be moved are beneficial to determining restoration opportunities, prioritization, and potential treatments to be used. Finally, the scope of the potential activity needs to be evaluated to determine if the fit within the constraints of the NEPA.

- Promote resilient ecological functions of the system being assessed.
- Integrate approaches to seek solutions that deliver multiple benefits whilst increasing resilience.
- All feasible options should be clearly set out and described in relation to the baseline.
- Describe and assess key effects of concern to all stakeholders, both positive and negative for each restoration treatment.
- Determine restoration projects scope
    - Start big and whittle down based on process drivers.
    - Find a downstream vertical grade control (start of a canyon reach, natural nick point, etc.)
- For springs (Springs Stewardship Institute): Evaluate condition and need for spring function and species use. Develop specific goals for restoration
    - Restore the site to as nearly natural and ecologically functioning a condition as possible OR restore specific resources, characteristics or populations as desired by the manager OR restore other desired future condition of the site
    - Consider: Minimizing maintenance costs and activities

- For developed springs
    - Evaluate the water use needs and costs, irrigation schedule, and maintenance
    - Identify features to preserve in situ
    - Identify features to remove – old pipes, concrete, fencing, roads/trails, etc.
- Consider the following questions from Beechie et al. 2008:

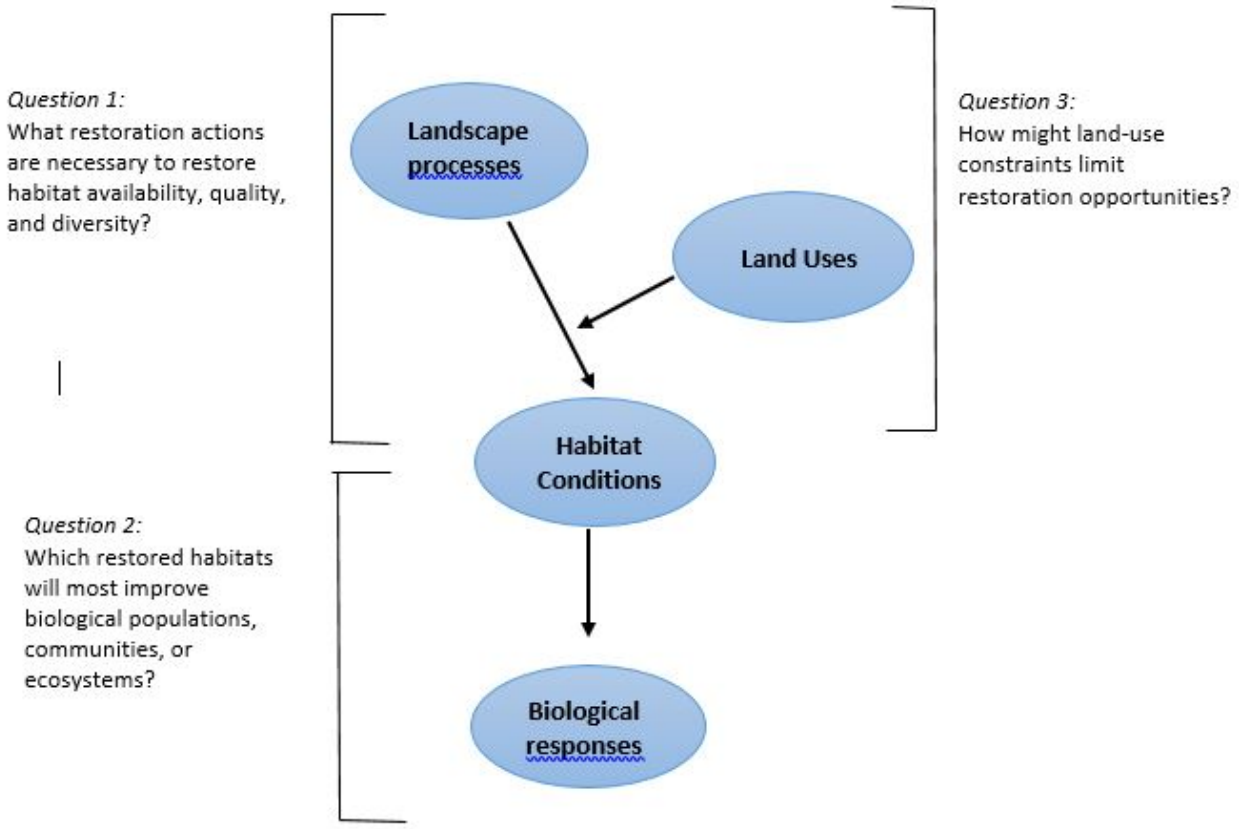

Figure 2. Diagram of conceptual linkages and questions to be addressed in assessments used to identify and prioritize restoration actions (Beechie et al. 2008).

Identify and appraise options: A number of potential options should be considered and appraised in order to provide a robust basis upon which to make a decision on how to move forward. All feasible options and flexible tools should be assessed and clearly described in relation to the baseline (no action) to provide decision makers and partners all the necessary information to base their decisions.

In addition, effects of all options should be described and assessed. This includes effects of concern to all stakeholders, both positive and negative. Effects should be screened for relevance and significance and can be assessed qualitatively or quantitatively where enough information is available to support the assessment.

In summarizing the results of the options, costs and benefits should be aggregated across relevant categories to provide a consistence basis for assessment. Comparisons should be consistent and any uncertainties should also be described and addressed.

- Can the restoration treatment meet and fulfill the objectives for the project?

- What are the chances of success?
- Does it address the causes rather than the symptoms?
- Consider the consequences of taking no action, assess the risks, costs, and benefits of implementing each option.

No Treatment: allows the natural adjustment of a system and therefore is the most sustainable. Should be applied when natural processes are likely to constitute a natural solution to the problem and the system has the ability to adjust (all processes functioning and no anthropogenic constraints).

Management Option(s)/Restoration Activities: Based on addressing the causes of the problem. This option involves restoration treatments to improve existing conditions.

Restoration activities should be developed and prioritized at the forest and district level in collaboration with partners.

Prioritization:

Four primary considerations could be used to prioritize locations and timing of aquatic and watershed restoration activities: watershed condition framework, corresponding vegetation restoration activities, partner interest, and presence of federally-listed or candidate species.

Activities that may be identified within a proposed vegetation treatment area include, but are not limited to: thinning conifers along and within riparian areas, restoring incised channels, riparian planting, removing/obliterating unauthorized routes, and/or putting in drainage and closing level 1 system roads after all treatments are completed.

Prioritization of aquatic and watershed restoration projects will depend upon multiple site specific factors. Therefore, we list considerations when prioritizing activities rather than requirements.

Table 1. Considerations for prioritizing where and when treatments are implemented.

Watershed Condition Framework	Areas or activities within existing Watershed Restoration Action Plans can increase opportunities to move watersheds into a higher condition class. Maintaining or improving watershed condition where feasible should be taken into consideration.
Vegetation restoration activities within the area.	Incorporating aquatic and watershed restoration activities in an area with other restoration treatments whenever possible is one way to create efficiencies with heavy equipment and personnel.
Partner Interest	Projects that already have partners or interested partners, particularly if funding is available, should be considered.
Presence of federally listed or candidate species	The presence of these species and improving their habitat could increase the prioritization of a project over a site that had none present.
Wet meadows, cienegas, and other similar habitats.	These habitat types store water in upper watersheds and maintain baseflow to other aquatic habitats. They also cool water and can provide for lower stream water

	temperatures. Maintaining and improving these areas can have great downstream beneficial effects.
Higher in the watershed vs. lower	Restoration in upper watersheds can have beneficial effects downstream such as reduced sedimentation, maintaining baseflow, and cooling stream temperatures. They will have a larger range of beneficial effects than projects lower in a watershed.
Issues that are new, easily treated, or could quickly spread.	Newer issues have not yet caused that much damage; restoration treatments of these are more cost and time effective as well as preventing more degradation. Projects such as these are 'low-hanging fruit' when compared to larger or more widespread issues. In addition, new infestations of noxious weeds or aquatic invasive plants are easier to treat early rather than after they spread.
Force account, contracted, and partner implementation	All three categories have merit, but may have differing financial or oversight costs. These should be considered differently amongst options and assessed. Prioritization may depend upon which category a project occurs in when weighed against work load, capacity, and financial considerations.
Process versus form-based projects	Projects that enhance habitat, but do not restore the processes that create habitat are considered form-based. These types of projects can require more maintenance than projects that restore the processes that create and maintain habitat. Projects that restore processes may be more of a priority than those that address a specific issue rather than the larger problem.

Implementation of the treatment:

Consultation and Implementation:

Pre-implementation surveys will be conducted for Endangered Species Act and sensitive species, rare plants, invasive species, and cultural resources. If federally-listed, rare, or sensitive species, or cultural sites, are found during pre-implementation surveys or during activity implementation, the appropriate mitigation will be incorporated into activity design. Any cultural resource findings will be coordinated with the State Historical Preservation Office.

Validation and Collaboration Period:
Activities will include written specific activity descriptions and associated design criteria. The Implementation Checklist (Appendix D of the EIS, and stand-alone Implementation Plan) will be used to ensure each activity is consistent with the Rim Country analysis and within the scope of the decision.

Pre-project notification will be reported to all required regulatory agencies at least 60 days prior to implementation of the activity.

Monitor and evaluate: The effects are monitored in order to appraise them against initial objectives of the project. The information should be used to ensure the project is with the assumptions, analysis and biological opinion for the project. It should also be used to inform future restoration treatment decisions on maintenance and adaptive management.

Restoration treatments in the flexible toolbox:

The first set of tables below describe existing conditions and resource concerns for general types of aquatic systems in the toolbox. The second set of tables list the restoration tools grouped by the general set of resource concerns they address.

Springs:

Existing Condition (what, where, how much?)	Resource Issues and Concerns	See Tools for:
Surface flow affected by climate change, alteration of the source or outflow, springbox, diversion or piping.	Reduced surface and subsurface flows from human induces diversions, piping and alterations reduce habitat for aquatic, wetland and riparian obligate species; plants and animals.	Improving spring outflows
Channeling or degraded outflow channels are reducing surface and subsurface flow.	Reduced surface and subsurface flows reduce habitat for aquatic, wetland and riparian obligate species; plants and animals.	Improving spring outflows and/or form and function of stream channels and floodplains
Invasive or noxious plants are present and competing with native vegetation.	Native plants are outcompeted or overtaken, habitat degraded, loss or decline of native species.	Improving native riparian or aquatic vegetation
Developed spring is splitting flow from a failing springbox, diversion or piping.	Diversion of flow above the water right is dewatering the outflow and associated wetlands.	Improving spring outflows
Riparian or aquatic vegetation is affected by recreation or overgrazing.	Loss or decline of native and/or rare wetland, riparian, and aquatic plant species. Reduction or loss of habitat.	Improving native riparian or aquatic vegetation
User created trails or roads are affecting wetland and associated vegetation.	Loss or decline of native and/or rare wetland, riparian, and aquatic plant species. Soil compaction and potentially altered surface or subsurface flows. Reduction or loss of habitat.	Improving road or trail interactions
Spring is being encroached by upland species.	Loss or decline of native and/or rare wetland, riparian, and aquatic plant species. Reduction or loss of habitat.	Improving native riparian or aquatic vegetation

Wetlands (marshes, potholes, wet meadows, and natural ponds):

Existing Condition (what, where, how much?)	Resource Issues and Concerns	See Tools for:
Wetland is affected by invasive plant species	Loss or decline of native and/or rare wetland, riparian, and aquatic plant species. Reduction or loss of habitat.	Improving native riparian or aquatic vegetation
Encroachment by upland species.	Encroachment is identified as an indicator of lowered water table, loss or decline of native and/or rare wetland, riparian, and aquatic plant species.	Improving native riparian or aquatic vegetation
Vegetation may be affected by excessive herbivory, unauthorized routes, etc.	Loss or decline of native and/or rare wetland, riparian, and aquatic plant species. Soil compaction and potentially altered surface or subsurface flows. Reduction or loss of habitat.	Improving native riparian or aquatic vegetation

Existing Condition (what, where, how much?)	Resource Issues and Concerns	See Tools for:
Evidence of incision, slumping, or other such issues that are draining the wetland.	Reduced surface and subsurface flows draining the wetlands, narrowing or loss of wetland, riparian, and aquatic plant species. Reduction or loss of habitat.	Improving form and function of stream channels and floodplains
Poorly located or user created roads and trails causing soil disturbance, erosion.	Streams or wetlands have increased sedimentation, increased erosion, and loss or degraded vegetation from user created trails.	Improving road or trail interactions

Xeric meadows:

Existing Condition (what, where, how much?)	Resource Issues and Concerns	See Tools for:
Native vegetation is affected by invasive plant species	Loss or decline of native plant species. Reduction or loss of habitat.	Improving native riparian or aquatic vegetation
Encroachment by upland species.	Encroachment is an indicator of lowered water table, loss or decline of native and/or rare wetland, riparian, and aquatic plant species.	Improving native riparian or aquatic vegetation
Vegetation may be affected by excessive herbivory, unauthorized routes, OHV use, camping, etc.	Loss or decline of native plant species and ground cover. Soil compaction and potentially altered surface or subsurface flows. Reduction or loss of habitat.	Improving native riparian or aquatic vegetation
Evidence of incision, slumping, or other such issues that are draining the wetland.	Reduced surface and subsurface flows draining the wetlands, narrowing or loss of wetland, riparian, and aquatic plant species. Reduction or loss of habitat.	Improving form and function of stream channels and floodplains
Poorly located or user created roads and trails causing soil disturbance, erosion.	Increased sedimentation, erosion, and accelerated peak flows from user created roads or trails.	Improving road or trail interactions

Unneeded Roads and Unauthorized Routes:

Existing Condition (what, where, how much?)	Resource Issues and Concerns	See Tools for:
Poorly located or user created roads and trails causing soil disturbance, erosion and soil compaction.	Soil compaction and erosion.	Improving road or trail interactions
	Confinement of stream channel, degradation of wetlands, erosion into aquatic habitats, draining of wetlands, channel widening.	

Existing Condition (what, where, how much?)	Resource Issues and Concerns	See Tools for:
Stream or wetland damage due to poorly located or user created roads within the floodplain, wet meadow, spring outflow, or other such wetland habitats.	Concentration of flows that were originally spread across a wide area via drainage capture by ditching or berms.	Improving road or trail interactions and/or form and function of stream channels and floodplains
Need for frequent maintenance that affects aquatic resources.	Effects to active channel or flood plain dimension that alters function (energy dissipation or sediment transport).	Improving road or trail interactions and/or form and function of stream channels and floodplains Improving road or trail interactions and/or form and function of stream channels and floodplains

Road and Stream or Wetland Crossings:

Existing Condition (what, where, how much?)	Resource Issues and Concerns	See Tools for:
Road crossings are increasing sedimentation to streams, springs, wet meadows, and other wetlands.	Increased sedimentation to aquatic systems degrading spawning habitat, reducing macroinvertebrate and algae food base,	Improving road or trail interactions and/or form and function of stream channels and floodplains
Roads and associated stream crossings are changing the character of flow across the landscape, such as concentrating flows into a culvert.	Alteration of flows/hydrology within a stream valley is causing channel incision.	Improving road or trail interactions and/or form and function of stream channels and floodplains
Road crossings are causing stream widening geomorphic changes to stream channels.	Roads may cause widening of channels which can cause increased stream temperatures, alterations to the channel, and degraded stream habitat. Undersize culverts may cause an increase in stream velocity causing scour and downcutting.	Improving road or trail interactions and/or form and function of stream channels and floodplains
Road crossing geometry is impairing sediment transport capacity and competency.	Alteration of sediment transport is causing long-term aggradation/degradation of the stream channel.	Improving road or trail interactions and/or form and function of stream channels and floodplains
Aquatic organism passage is completely or partially impeded due to lack of stream flow, perched culverts, degraded culverts or other such issues.	Aquatic organisms cannot pass part or all of the time impeding migration, genetic flow, distribution, and access to refuge habitats	Improving road or trail interactions and/or form and function of stream channels and floodplains

Streams (Channels, Floodplains and Riparian):

Existing Condition (what, where, how much?)	Resource Issues and Concerns	See Tools for:
Stream habitat complexity is lacking in relation to all aquatic species life stages (e.g. rearing and juvenile habitat). • Most stream habitat is riffles or runs with little to no pool habitat and pool cover. Pool to riffle ratio is low. • Large woody debris and recruitment is not present to create instream habitat complexity and cover. • Spawning habitat for various species (i.e. clean gravel bars, clean sand) are lacking. • Stream substrate is compacted or becoming cemented (i.e., tightly packed). Stream substrate is covered in fine sediment above natural levels.	Aquatic species need a variety of habitats to complete their life cycle. • Pool habitat is critical for resting habitat and thermal refugia for many species of fish • Lack of large woody debris contributes to poor stream habitat diversity. • Spawning habitat is essential to maintaining fish populations. • Cemented substrate affects habitat availability for small bodied fish, macroinvertebrate habitat, and spawning habitat.	Improving form and function of stream channels and floodplains
Stream temperatures are high or reaching thermal tolerance of aquatic species.	Many aquatic species in the southwest are living at the edge of their thermal tolerance, drought conditions or warming temperatures may make habitats unsuitable.	Improving form and function of stream channels and floodplains and/or native riparian or aquatic vegetation
Stream has or is currently incising and no longer connects with its floodplain or historic channels. Streambanks are incised or laterally stable, and/or historic channels are abandoned.	Floodplain connection is critical for maintaining stream geomorphic function, stream habitat diversity, recharge of groundwater sources, and maintenance of riparian vegetation. Laterally stable banks are causing high erosion and sedimentation rates that alter aquatic and riparian habitat quality. Sediment transport is also affected. Historic channels provide habitat for varying ages classes of species, dissipate flood flows, provide riparian and aquatic habitat.	Improving form and function of stream channels and floodplains
Stream is confined; it has been straightened or confined.	Artificially confined streams may not function properly. Confinement may cause incision or other issues due to changes in stream power and sediment transport. These areas often have issues during flood flows. Overly wide streams may lack pools and habitat diversity and have higher stream temperatures than streams with a lower	Improving form and function of stream channels and floodplains

Existing Condition (what, where, how much?)	Resource Issues and Concerns	See Tools for:
Stream width and depth ratio is not functioning properly.	width depth ratio. Conversely, confined streams may be overly narrow.	Improving form and function of stream channels and floodplains
Hydrologic cycles are altered leading to reduced flood flows, or increased frequency of high flows (e.g. post fire flooding).	Aquatic species need various hydrologic cycles to complete their life cycles. Flood flows are essential for maintaining properly functioning stream channels.	Improving form and function of stream channels and floodplains
Streams and associated floodplains are not dissipating flood water energy causing damage to streambanks. Meander pattern altered.	Altered channel roughness or meander pattern is causing excessive erosion, limiting energy dissipation from high flows, changes to channel morphology, altering stream habitat and floodplains.	Improving form and function of stream channels and floodplains
Water quality is poor due to turbidity, sedimentation, or other factors other than temperature.	Poor water quality can alter macroinvertebrate and fish assemblages to more disturbance tolerant species. It can also alter primary or secondary productivity leading to changes in food availability.	Improving form and function of stream channels and floodplains
Large woody debris is not present in channels or wetlands to reduce stream energy, provide cover, and create complex habitat.	Lack of large woody debris recruitment to streams reduces roughness, cover, and habitat complexity.	Improving form and function of stream channels and floodplains
Riparian communities are not functioning at potential to support geomorphic and biotic needs of the aquatic community. • Leaf litter from riparian vegetation (allochthonous material) is lacking. • Existing riparian woody vegetation is lacking or out competed by conifers. • Floodplain vegetation has converted to upland species. • Riparian area is narrowing.	Riparian communities (both woody and herbaceous) are essential to the health of instream aquatic systems. • Organic matter (leaves) provide nutrients and food source for macroinvertebrates, prey species for fish. • Loss or decline of riparian vegetation, stream shade, and bank stability. • Riparian vegetation aids in flood resilience, dissipation of flows (roughness), large woody debris and bank stability for stream systems. • Narrowing riparian area could indicate reduced water table, disconnected floodplain, or other constraints leading to loss of bank stability, shade, large woody debris, and possibly reduced flows.	Improving form and function of stream channels and floodplains and/or improving native riparian vegetation

Flexible Toolbox: Tools described by general type of resource issues or concerns they may address.

Tools for Improving Native Riparian or Aquatic Vegetation:

Tools	Resource Issues or Concerns Addressed
Removing tree(s), tree canopy, or shrub encroachment of upland species with hand thinning, mechanical thinning or prescribed fire.	Loss or decline of wetland, riparian, or aquatic plant species. Indicators of drying that can be associated with past land management practices
Remove and manage noxious or invasive plants using hand methods or herbicides as described in forest weed management plans.	Loss or decline of native and/or rare wetland, riparian, and aquatic plant species. Protection or restoration of existing native biodiversity, erosion control, wildlife forage and habitat.
Plant native aquatic or riparian plant species by hand or mechanically, including seeding.	Loss or decline of native and/or rare wetland, riparian, and aquatic plant species, increased bank stability and leaf litter.
Protect and promote existing native aquatic or riparian plant species. Site protection or fencing, which could be for seasonal restrictions, temporary restrictions, or year round. Install fencing, jack straw, remove/relocate roads or trails, create defined trails for recreation management using manual or mechanical tools.	Promote plant growth and vigor, reduce erosion and sediment inputs to aquatic systems, remove of riparian or aquatic stressors. Reduce ungulate grazing, OHV effects, created trails, and dispersed camping causing resource damage. Reduce erosion, bank instability
Prescribed burning.	Natural disturbance leading to regeneration of riparian plant species, reduction in fuel loading and fuel corridors.

Tools for Improving Spring Outflows:

Tools	Resource Issues or Concerns Addressed
Remove spring development and restore natural spring function.	Spring developed for irrigation or livestock that is no longer needed and federal water rights exist. Restoring natural spring function and flow.
Split flow in developed springs to allow water above existing water rights to be released to spring outflows. Hand methods for fixing springboxes, piping, or diversions to split spring flow.	Drying of spring outflow, reduced aquatic and riparian vegetation, reduced habitat, spring not functioning properly
Improve or remove spring boxes and other infrastructure, using excavation, shovels, trackhoes, jackhammers, concrete saws.	Capture or diversion of flows from their historic paths.

Tools for improving road or trail interactions with stream courses, springs, or other wetlands:

Tools	Resource Issues or Concerns Addressed
Obliterate roads restoring natural contours and vegetation using mechanical roads treatments.	For existing roads causing resource damage such as confining a stream, draining wetlands, loss or degradation of riparian or aquatic vegetation and habitat.
Close and restore unauthorized roads, trails, and dispersed camping areas using mechanical roads treatments.	For unauthorized roads, trails or recreational effects causing resource damage such as confining a stream, draining wetlands, loss or degradation of riparian or aquatic vegetation and habitat.
Install waterbars or drainage and blocking entrances on unauthorized roads or trails using mechanical roads treatments.	For unauthorized roads, trails or recreational effects causing resource damage such as confining a stream, draining wetlands, loss or degradation of riparian or aquatic vegetation and habitat.
Closing ML 1 roads after use for restoration treatments, remove culverts, reestablish road drainage, remove unstable fill, pull back shoulders, and scatter slash using mechanical roads treatments.	Erosion, sedimentation, degradation or loss of vegetation from ML 1 roads.
Armor downstream culvert outlets using mechanical roads treatments.	Increased erosion and scouring downstream of culverts, bank instability, and channel downcutting.
Upsizing culverts using mechanical roads treatments.	Streams scouring around culverts and over roads, increased erosion to streams or wetlands, reduced aquatic organism passage from road culverts.
Installing or adding culverts or culvert arrays using mechanical roads treatments.	Loss of stream connectivity, channel width, erosion and sedimentation to streams, channelization and increased channel width due to roads.
Maintaining Aquatic Organism Passage where it exists if road work needed. – Install bridge, replace culvert, or remove crossing using mechanical roads treatments.	Decreased fish passage, habitat access, passage of high flows and bedload, and decreased channel complexity from road culverts.
Install hardened low water crossings or fords (rock, concrete slab, concrete planks, concrete blocks, geocell fords, and vented fords on existing ML1 and ML2 roads needed for mechanical offerings using mechanical roads treatments.	Loss or degradation of riparian vegetation, channel widening, increased erosion, sedimentation to aquatic habitats, increased bank instability from roads crossing streams or wetlands.
Install and replace bridges on ML1 and ML2 roads needed for mechanical offerings using mechanical roads treatments.	Decreased aquatic and wildlife passage through culverts or under exiting bridges, deposition of stream bedload upstream of culverts, high flows are scouring channel and floodplain upstream, log jams are forming upstream of culverts or bridges.
Restore downstream channels affected by road crossings using mechanical roads treatments.	Channel widening, erosion and sedimentation downstream of a road crossing.
Close or relocate ML1 and ML2 roads needed for mechanical offerings causing resource damage to springs, wetlands or streams using mechanical roads treatments.	Reduce sedimentation and erosion, improve vegetation, restore stream banks, restore and improve aquatic and terrestrial habitat.

Tools	Resource Issues or Concerns Addressed
Developing footpath(s) on existing trails to prevent further erosion using hand or mechanical treatments.	Streams, springs, or wetlands have increased sedimentation, increased erosion, and loss or degraded vegetation from user created trails.

Tools for improving the form and function of stream channels and floodplains:

Tools	Resource Issues or Concerns Addressed
Large woody debris, log Structures, log jams, yarding trees. Tree falling, transport and placement of trees and root wads from somewhere else, yarding over trees, helicopter wood, mechanical installation.	Floodplain connection is critical for maintaining stream geomorphic function, stream habitat diversity, recharge of groundwater sources, and maintenance of riparian vegetation. Sediment transport is also affected. Lack of large woody debris recruitment to streams for reduces roughness, cover, and habitat complexity.
Weirs and Beaver Dam Analogs (BDAs) installed by hand or mechanical methods.	Floodplain connection is critical for maintaining stream geomorphic function, stream habitat diversity, recharge of groundwater sources, and maintenance of riparian vegetation. Sediment transport is also affected.
Wicker, log and rock wires, vanes, or baffles, brush bundles and root wads using various methods and installed by hand or mechanically.	Lack of channel roughness or meanders is causing excessive erosion, changes to channel morphology, altering stream habitat and floodplains.
Boulder and log deflectors using mechanized installation.	Lack of channel roughness or meanders is causing excessive erosion, changes to channel morphology, altering stream habitat and floodplains.
Hand girdling trees to provide for future large woody debris stream input.	Lack of large woody debris recruitment to streams for reduces roughness, cover, and habitat complexity.
Restoring meanders or adding stream length by induced meandering, recontouring the channel, plug and pond, other similar methods mechanically.	Artificially confined streams may not function properly. Confinement may cause incision or other issues due to increased stream power and sediment transport. These areas often have issues during flood flows. .
Channel reconstruction or realignment using mechanical treatments.	Floodplain connection is critical for maintaining stream geomorphic function, stream habitat diversity, recharge of groundwater sources, and maintenance of riparian vegetation. Sediment transport is also affected.
Flood plain creation, widening, or laying back incised stream banks using mechanical treatments.	Floodplain connection is critical for maintaining stream geomorphic function, stream habitat diversity, recharge of groundwater sources, and maintenance of riparian vegetation. Sediment transport is also affected

Tools	Resource Issues or Concerns Addressed
Removing instream stock tanks and replacing with guzzlers, drinkers, etc. in the uplands using mechanical treatments	Restore channel width, sediment, flow, and water source for downstream areas.
Zuni bowls, one rock dams or other similar methods using mechanical or hand treatments.	Slow overland flow or stream flow in small channels, reduce erosion and sedimentation.
Reconnection of historic side channels that should be functioning using mechanical treatments.	Floodplain connection is critical for maintaining stream geomorphic function, stream habitat diversity, recharge of groundwater sources, and maintenance of riparian vegetation. Sediment transport is also affected.
Maintenance of existing structures using manual or mechanical treatments.	Structures that stabilize banks, create instream cover and channel roughness, etc. from the CCC era forward currently exist on the landscape.

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