### Goals and Associated Approaches for Stream Management Plans

This document was produced through a series of workshops in 2017 utilizing the combined input of over 50 water resources and ecology professionals in Colorado. It is meant as a starting point during the goal setting and scoping process to help SMPs refine their purpose, define tasks and estimate budgets. It is by no means a comprehensive library of questions or approaches that can be asked/used in an SMP process.

<table>
<thead>
<tr>
<th>GOALS</th>
<th>RECREATION: Fishing, Boating, Hunting etc.</th>
<th>KEY QUESTIONS</th>
<th>COMMON APPROACHES</th>
<th>INFORMATION GAINED FROM APPROACH</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Improve trout fishing experiences/ opportunities</td>
<td>What effect will future changes to flow or land use from a specific threat(s) have on sport fishing populations/experience?</td>
<td>Recreational user survey (e.g. CREEL)</td>
<td>Recreational quality—angler satisfaction as total fishing effort (TTE) and catch/unit effort (CUE)</td>
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<td>Why have sport fishing populations or the recreation experience declined over time?</td>
<td>Fish Survey (e.g., electroshock)</td>
<td>Biological—aquatic: fish per mile for baseline (snapshot) and information on species, relative distribution, abundance, &amp; size</td>
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<td>What is the current condition of recreational angling and could it be improved?</td>
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<tr>
<td>2.</td>
<td>Improve recreational boating experiences/opportunities.</td>
<td>What effect will future changes to flow or land use from a specific threat(s) have on the boating experience?</td>
<td>Recreation survey (e.g American Whitewater user and recreational flow surveys)</td>
<td>Recreational quality—Current river usage, &quot;boatable&quot; days based on flows</td>
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<td>Why has the boating recreation experience declined over time?</td>
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<td></td>
<td></td>
<td>What is the current condition of recreational boating and could it be improved?</td>
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<td>3.</td>
<td>Increase economic development potential and quality of life by increasing/improving river recreation access or experience</td>
<td>What effect will future changes to flow or land use from a specific threat(s) have on the region’s river recreation economy and/or quality of life?</td>
<td>Angler/boater expenditures and economic impact assessment (intercept; intercept-based mail follow-up; license mail survey)</td>
<td>Recreational quality—Expenditures by type of users and demographics</td>
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<td>Why has the economic impact and/or the area’s quality of life due to river conditions or access declined/stagnated over time?</td>
<td>Inventory of existing access locations, conditions, user groups</td>
<td>Recreational—Access numbers and conditions, frequency of improvements (ramps, restrooms, parking etc.)</td>
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<td>Are there opportunities to increase quality of life and/or economic returns from river-based recreation?</td>
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<td>4.</td>
<td>ECOLOGY: Instream flows, wetland or riparian plants; watershed health; wildlife (see Regulatory for federally protected species)</td>
<td>What effect will future changes in climate, water management practices or land use have on river flows?</td>
<td>Hydrologic Study (e.g., statistical analysis of flow records; indicators of Hydrologic Alteration (HAI))</td>
<td>Hydrologic—Hydrographs, flow summary (return interval, probabilities).</td>
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<td>How can we address acute/chronic low flows at a specific point in the river?</td>
<td>Habitat Surveys (e.g., Rapid assessments, Macroinvertebrate and aquatic habitat surveys; R2 Cross; PHABSIM, Instream Flow Incremental Flow, River2D)</td>
<td>Biological/geomorphic—simulation of area of habitat (in riffles) related to varying flows.</td>
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<td>What is the current condition of river flows and could they be improved?</td>
<td>Water Rights Assessment (e.g., State DSS Hydrobase tools and StateMod)</td>
<td>Social/legal—Owners represent potential project partners</td>
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<td>Where are the dry-up points in the river and how often do they occur?</td>
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<td>5.</td>
<td>Address seasonal dry-up points and low flows in the river</td>
<td>What effect will future changes in climate, water management practices or land use have on river flows?</td>
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<td>Why has native fish populations declined over time?</td>
<td>Habitat Surveys (e.g., Rapid assessments, Macroinvertebrate and aquatic habitat surveys; R2 Cross; PHABSIM, Instream Flow Incremental Flow, River2D); ecological linkages approach; environmental flows analysis</td>
<td>Biological/geomorphic—species, relative distribution, abundance, age; size; limiting factors (biological and physical, e.g., predation, water temperature, spawning gravel quality)</td>
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<td></td>
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<td>What is the current condition of native fish populations and could it be improved?</td>
<td>Flow-habitat relationships, e.g., Habitat Suitability Indices (HSI)</td>
<td>Hydrologic—flow data in relation to habitat</td>
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<tr>
<td>6.</td>
<td>Support healthy native fish habitat in river</td>
<td>What effect will future changes in climate, specific water management practices or land use have on native fish populations?</td>
<td>Vegetation inventory &amp; assessments (rapid riparian assessment, GIS desktop analyses)</td>
<td>Biological—patch locations and size, diversity of species, structure, non-native species, stand age</td>
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<td>Why have native fish populations declined over time?</td>
<td>Groundwater data analysis (e.g., hydrogeologic study of existing groundwater data, water budget estimate)</td>
<td>Hydrologic—depth to groundwater, relation to rooting zones</td>
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<td>What is the current condition of native fish populations and could it be improved?</td>
<td>Floodplain analysis (2D hydraulic modeling)</td>
<td>Hydrologic—relation of water in channel to floodplain/riparian elevations</td>
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<td>Habitat Surveys (e.g., Rapid assessments, Macroinvertebrate and aquatic habitat surveys; R2 Cross; PHABSIM, Instream Flow Incremental Flow, River2D); ecological linkages approach; environmental flows analysis</td>
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<td>7.</td>
<td>Protect or restore important wetland and riparian habitat, such as cottonwood galleries</td>
<td>What effect will future changes in climate, specific water management practices or land use have on riparian plan communities?</td>
<td>Geomorphic Assessments; Rapid Assessments (Rapid bioassessments and stream function assessments); Hydrologic and hydraulic studies (Flow analyses, Indicators of Hydrologic Alteration (HAI) hydraulic modeling:); Sediment transport</td>
<td>Geomorphic—stream channel type, reference condition</td>
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<td>Why have riparian plan communities declined over time?</td>
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<td>What is the current condition of riparian plan communities and could it be improved?</td>
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<td>8.</td>
<td>Evaluate channel stability and address problem areas</td>
<td>Will future changes in flow or land use cause channel instability problems?</td>
<td>Geomorphic, Sediment transport</td>
<td>Hydrologic and hydraulic—environmental flows, foundation elevations</td>
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<td>Why does this area have channel instability problems and what are the impacts?</td>
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<td>Are there areas where channel instability is causing problems for people or habitat?</td>
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<td>15 Remove non-native/invasive species and/or reduce their habitat suitability</td>
<td>How will future water management or land use changes affect non-native or invasive species?</td>
<td>Biological inventory; vegetation mapping; various rapid assessment methods; stream function assessment (e.g., FACstream), PHABSIM or 2D modeling using species-specific Habitat Suitability Indices (HSI).</td>
<td>Species inventory, distribution, relative abundance; habitat suitability &amp; use; relative effectiveness of control or eradication methods; ancillary effects on non-target species (e.g., natives)</td>
</tr>
<tr>
<td>16 Address specific water quality challenges (e.g., metals, c. coli, temperature, etc)</td>
<td>Will known future changes in flow or land use cause water quality to degrade?</td>
<td>WQ sampling &amp; analysis program (e.g., field testing of water temperature and/or laboratory analysis for other pollutants; Macroinvertebrate surveys); Review of existing data</td>
<td>Water quality— Existing conditions (short-term) or Long-term trends</td>
</tr>
<tr>
<td>17 Protect habitat for listed and/or potentially threatened or endangered species</td>
<td>How will future water management or land use changes affect known habitat for T&amp;E species?</td>
<td>See Ecology above depending on if habitat or flow focused</td>
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<td>18 Identify target ecosystem flows in anticipation of future reduced flows (climate change, new projects, population growth, etc)</td>
<td>What should target flows be given proposed/ anticipated changes in water management or climate?</td>
<td>Scenario development process; environmental/ecological flow needs, etc</td>
<td></td>
</tr>
<tr>
<td>19 Explore Wild &amp; Scenic Rivers designation or a community-driven alternative</td>
<td>Are there segments that could be found eligible for WSR designation?</td>
<td>Existing document review; Stakeholder inventory and survey</td>
<td>Existing situation, draft suitability</td>
</tr>
<tr>
<td>20 Identify methods to more regularly meet junior consumptive or in-stream flow water right volumes</td>
<td>Will future changes in water management exacerbate known shortages?</td>
<td>Water Rights Assessment (e.g., State DSS Hydrobase tools and StateMod)</td>
<td>Social/legal—Owners represent potential project partners</td>
</tr>
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<td>21 Build/modify infrastructure to operate efficiently and minimize waste at a range of flows</td>
<td>Will changes in water management divert existing infrastructure’s ability to divert?</td>
<td>Diversion infrastructure assessments and interviews with water users</td>
<td>Potential water conservation/repair opportunities</td>
</tr>
<tr>
<td>22 Identify in-river infrastructure that could be improved/modified to enhance ecosystem function or create safe/better recreational experiences</td>
<td>How can we address known problems with specific structures?</td>
<td>Diversion infrastructure assessments and interviews with water commissioners</td>
<td></td>
</tr>
<tr>
<td>23 Address head-cutting and/or bank erosion causing headgate operational issues</td>
<td>Are there areas where infrastructure is causing channel stability problems for people or habitat?</td>
<td>Diversion infrastructure assessments and interviews with recreational users</td>
<td>Potential restoration/retrofit opportunities</td>
</tr>
<tr>
<td>24 Reduce risk of flood damage to priority areas</td>
<td>What is the risk to important human or natural areas from flooding?</td>
<td>FEMA flood hazard mapping and Colorado hazard mapping</td>
<td>Foundation extent at different flows/return intervals Maps of structural features that limit floodplain connection</td>
</tr>
</tbody>
</table>

*Note: The table above is a sample and may not represent the full range of questions and approaches included in the document.*