ATTACH 4

Trinity River Restoration Program – The Big Questions

Introduction

Collaborative, large-scale, and long-term natural resource projects face many challenges to implementation. Technical complexities, budget and logistical constraints, and competing objectives all make it difficult to effectively implement adaptive environmental assessment and management (AEAM). It is easy to become caught up in the technical details of smaller, more tangible tasks whereas it is difficult to make decisions in relation to broader scale tasks that may involve interaction across a variety of components and have larger implications on the program as a whole. A guidance strategy that has been found useful by a variety of programs is the creation of a short list of key questions or decisions (e.g., EPA Data Quality Objectives approach (US EPA, 2000), Skaha Lake re-introduction 'Big Questions' (Alexander and Pickard, 2009), and the 'Platte River Implementation Program 'Big Questions' (Smith et al. 2011)) which help to focus the direction of the program.

A short list of Big Questions for the Trinity River Restoration Program (referred to hereafter as the Program) should improve focus and guide all aspects of the overall AEAM Program including: design, implementation, monitoring, synthesis, data management, and communication. The questions are a reminder of the big picture, (i.e., what is the point of the Program) which can often be forgotten when dealing with technical details. If used to guide all technical working groups, these questions provide a common focus that will facilitate integration among teams. This approach forces managers to think about how data will be used before they are collected, rather than asking what questions can be answered after collection. They provide a useful framework for Program reports thereby improving the ability to communicate complex scientific hypotheses, analyses, and results across technical teams and to the Trinity Management Council (TMC), Trinity Adaptive Management Working Group (TAMWG), decision-makers and public. The Big Questions do not replace any of the existing work done by the Program. Rather, they provide an overall umbrella under which all aspects of the Program operate and report.

This report describes the approach used to generate Big Questions for the Program, proposes a short list of Big Questions, and suggests how the these questions can be used to provide a comprehensive, yet easily understood overview of the Program.

Approach

The questions should relate directly back to management decisions so as to catalyze adaptive management information feedback loops. They should be seen as an integrated set of questions and not taken independently. They should be flexible enough to allow for the evolution of greater specificity of objectives. They should be broad enough to characterize and unify all aspects of the Program. They should not simply be a bottom up aggregation of the Integrated Assessment Plan (IAP, 2009) assessments. The questions should be straightforward, using plain language to communicate the central questions of the Program.

Stepping back and reflecting on the primary goals and uncertainties of the Program led us to propose two categories of Big Questions. First, a short set of questions derived directly from the Record of Decision (2000) as well as the more recent Master Final Environmental Impact Report (FEIR) (North Coast Regional Water Quality Control Board and U.S. Bureau of Reclamation 2009). These long term questions are focused on the scale of the 'Program as a whole'. Questions at this scale are essentially 'permanent' (within the world of the Program) as they will remain consistently relevant over time. While still incorporated into the AEAM framework, these questions may require evaluation over long time scales (e.g. 20 to 30 years).

The second category of questions, are evaluated on a shorter time-scale. These are focused on high priority current uncertainties, and should have an associated management action. These short term questions are meant to motivate a frequent evaluation of critical management uncertainties, leading to an adjustment of future actions. This should involve a comparison of observed outcomes from current management actions, to predict responses and develop specific objectives for future actions. Such questions are considered 'temporary' (within the world of the Program) as they are expected to be asked and answered within defined, relatively short time frames (annual to 5 years).

BIG QUESTIONS

The "Big Questions" (Table 1) identify critical uncertainties that are at the heart of the Program's need for AEAM implementation and should form the basis for testing of Program management strategies. Program actions should be directed toward answering these "Big Questions". The Big Questions were not organized by priority, but by temporal sequence and/or discipline. For example, fish habitat is mentioned before fish production because it is hypothesized that fish habitat must be restored before the fisheries objectives can be met.

TABLE 1. THE PROGRAM'S "BIG QUESTIONS"

Long term questions (Spatial Scale: upper 40 miles[1]; Temporal Scale: 20 to 30 years)
1. Are Program actions rehabilitating the river itself, restoring the attributes that produce a healthy alluvial river system?
2. Are Program actions on track to produce a sufficient area of suitable salmonid rearing, spawning, and adult holding habitat to meet Program objectives?
3. Are Program actions increasing natural production of healthy juvenile salmon and steelhead, and on track to meet Program objectives for natural smolt outmigrants, escapement, and harvest?
4. Are Program actions sustaining or enhancing the riparian community structure including: vegetation, fish, and wildlife?
5. To what extent do in-basin and out-of basin factors beyond Program control (e.g., extreme climatic events, hatchery practices, lower Klamath conditions, marine survival) influence the system's response to Program actions?
Short term questions (Spatial Scale: variable; Temporal Scale: annual to 5 years)
6. Which channel rehabilitation actions are most effective at creating and maintaining fish habitat?
7. Are flow and sediment actions meeting annual objectives for each water year? a. Are flows and volume of coarse sediment augmentation sufficient to create and maintain fish habitat? b. Are flows creating conditions necessary for fish survival across all life

[1] With the exception of Big Question 5, where the spatial scale encompasses the entire life-history.

stages (e.g. temp, velocity, depth)? c. Is fine and coarse sediment effectively routed through the system?
8. Are watershed restoration actions and sediment pond management effectively reducing fine sediment introduction to the Trinity River?
9. 9. How are Program actions impacting wildlife populations within the Program area?
10. Is the Program effectively implementing results driven adaptive management to fulfill the Adaptive Environmental Assessment and Management (AEAM) vision of the TRRP?

Long Term Questions

1. **Are Program actions rehabilitating the river itself, restoring the attributes that produce a healthy alluvial river system?**

   Program management actions (i.e., flows, sediment management, watershed restoration, and mechanical actions) are intended to increase fluvial geomorphic processes to prevent detrimental riparian encroachment and increase the topographic and structural complexity of the river channel through time (e.g., IAP Objectives 1 and 5). Together, these management action outcomes are expected to increase and maintain high quality fish and wildlife habitat. This question is focused on alluvial processes while Questions 2-4 are outcome focused.

2. **Are Program actions on track to produce a sufficient area of suitable salmonid rearing, spawning, and adult holding habitat to meet Program objectives?**

   The current quantity and quality of available habitat within the upper 40 miles is thought to limit natural production. Program actions are intended to restore the aquatic habitat conditions necessary to meet natural production objectives for salmonids (e.g., IAP Objective 2). Rearing habitat was identified as the critical bottleneck at the time of the Trinity River Flow Evaluation Study (TRFES, 1999) and therefore is the priority focus for rehabilitation. However, as the river restoration progresses other habitat needs could potentially become limiting.

3. **Are Program actions increasing natural production of healthy juvenile salmon and steelhead, and on track to meet Program objectives for natural smolt outmigrants, escapement, and harvest?**

   The cumulative effects of Program actions are intended to result in improved spawning, incubation and emergence success, as well as increased growth rates, size at age and juvenile production of salmonid populations (e.g. IAP Objective 3). Increased natural production will be necessary to achieve both Program adult escapement targets and the desired restoration of harvest opportunities to affected tribal and non-tribal fisheries (e.g., IAP Objective 4).

4. **Are Program actions sustaining or enhancing the riparian community structure including: vegetation, fish, and wildlife?**

   Combined Program actions are intended to promote patchy, diverse, heterogeneous riparian vegetation throughout the river corridor on constructed and naturally created floodplains while reducing detrimental riparian encroachment. This should provide useable habitat for riparian and aquatic birds, and other wildlife species (e.g., IAP Objective 5). Enhanced aquatic and riparian habitat complexity is expected to benefit wildlife species, maintaining (or even increasing) population abundances and (for riparian and aquatic birds) species diversity (e.g. IAP Objective 6). Additionally, healthy floodplain forests are part of the restoration strategy that will influence channel morphology, provide nutrients to the river, cover for fish, cool air and water temperatures, providing desirable water temperature variability (off-channel habitats, alcoves, etc.) and ultimately benefit all riverine and riparian dependent organisms.

5. **To what extent do in-basin and out-of basin factors beyond Program control (e.g., extreme climatic events, hatchery operations, lower Klamath conditions, marine survival) influence the system's response to Program actions?**

   There are many in-basin and out-of-basin factors that are outside the direct control of the Program that could affect habitat responses or negatively influence the productivity of Trinity River native fish or

wildlife populations. While the Program may not be able to manipulate these factors, they must be considered during analysis and interpretation of results to ensure that effects resulting from Program actions are not obscured by other limiting factors.

Short Term Questions

6. **Which channel rehabilitation actions are most effective at creating and maintaining fish habitat?**

   Channel rehabilitation projects should be regularly assessed to evaluate the relative success and combined effects of the different design elements (e.g., alcoves, berm notches, side channels, high flow scour channels, flattened tailings, terraces etc.) and the overall rehabilitation site design in creating and maintaining fish habitat. Such evaluations are critical for informing design decisions around yet to be constructed rehabilitation sites, or for reconsidering existing design features of rehabilitation projects that have already been implemented.

7. **Are flow and sediment actions meeting annual objectives for each water year?**
   a. **Are flows and volume of coarse sediment augmentation sufficient to create and maintain fish habitat?**
   b. **Are flows creating conditions necessary for fish survival across all life stages (e.g. temp, velocity, depth)?**
   c. **Is fine and coarse sediment effectively routed through the system?**

   Regular evaluation of scheduled flows and coarse sediment augmentation is required to assess whether the combination of recommended flows and sediment augmentation is achieving its full range of intended functions (e.g., in high flow water years scour and mobilize the channel bed, transport coarse and fine sediment through the mainstem, maintain/expand created habitat at channel rehabilitation sites, initiate bank erosion in other areas of the river, etc.; in all water years provide seasonal flows and habitat that can sustain all life stages of fish and wildlife populations).

8. **Are watershed restoration actions and sediment pond management effectively reducing fine sediment introduction to the Trinity River?**

   Reducing fine sediment in the Trinity River is expected to improve the survival and development of salmonid eggs. Sediment ponds are used to trap fine sediment from tributaries preventing it from entering the Trinity River. Upslope watershed restoration projects (e.g., road decommissioning) throughout the basin are expected to reduce the source of fine sediment.

9. **How are Program actions impacting wildlife populations within the Program area?**

   Program actions (i.e., flow, sediment management, rehabilitation site construction, or watershed management) are expected to have long-term beneficial impacts on wildlife populations, however there may be short-term detrimental impacts which need to be mitigated to ensure the benefits are realized.

10. **Is the Program effectively implementing results driven adaptive management to fulfill the Adaptive Environmental Assessment and Management (AEAM) vision of the TRRP?**

    AEAM is a core component of the Program strategy. Adaptive Management principles should be incorporated into all facets of the Program at all scales (e.g., setting targets, evaluating management actions, and the Program as a whole). Is the Program implementing each of the components of an AEAM Program adequately?

    The components of an AEAM Program:

    - Define measureable goals and objectives;
    - Document/evaluate baseline conditions with respect to goals and objectives;
    - Develop testable hypotheses of how to achieve goals and objectives through management actions;
    - Predict river response to management actions before implementing management actions;
    - Implement, monitor, and evaluate management actions;

- Re-evaluate objectives, refine hypotheses, improve models, and improve management;
- Continually self-examine AEAM science and management via external peer review.

Recommended Next steps

While the Big Questions are intended to provide overall focus for management actions, they are insufficient on their own to inform decisions about the allocation of Program resources for monitoring. Several important steps should be incorporated into future planning and investigation plans.

1. **Identify which Big Question is being addressed and how the activity will contribute to a better understanding of how river function has improved.**

2. **Identify specific uncertainties within the Big Question and describe how reducing these will help to answer the Big Question**

3. **Identify and describe the data needs to address this uncertainty**

4. **Define quantitative targets for the question**
   Targets are a necessary part of an AEAM framework. Without clear targets, it is impossible to determine the monitoring effort required to evaluate each of the Big Questions. Targets imply the spatial and temporal scale at which monitoring needs to occur and the level of effort or precision required. The targets themselves may require periodic testing and re-evaluation.

5. **Quantitatively describe the spatial / temporal bounds of the problem including the expected response time**
   This information is critical to informing the spatial and temporal scale of the monitoring design which has significant implications for the allocation of effort. How frequently should monitoring occur? At what scale should data be collected (e.g., rehabilitation sites or system-wide)?

6. **Document and quantify the precision necessary to adequately answer the question or uncertainty**
   How well do you need to answer the question? This depends on the target or scale of the effect you would like to be able to detect. Generally speaking it takes less effort to be able to identify a big change. However, for some of the shorter term questions that attempt to address uncertainties in the management actions, it may be important to be able to detect smaller changes to ensure the Program is tracking in the right direction.

7. **Integration of assessments**
   Identify important linkages among assessments and be aware that in some cases an 'orphaned' assessment may provide little or no value as a stand-alone evaluation, although when paired with several others it is very useful. Funding decisions should acknowledge these relationships.

8. **Describe the expected outputs and corresponding analyses**
   What would you do with the data if you had it? This is a useful exercise to ensure that all the necessary data are collected to complete the analyses and that none of the data are unnecessary. This is also useful to ensure that the outputs resulting from the monitoring will actually help to answer the Big Question. Because a particular dataset has always been collected is not a sufficient justification for it to continue to be collected.

9. **What are the implications of different outcomes?**
   What would you do differently if you reduced this uncertainty? Would you adjust a management action (e.g., flow, sediment, or rehabilitation site construction)? Would you revise your sampling design (e.g., spatial scale, frequency, or intensity)? Would you revise your targets? Would you revise your performance measures or analytical approaches?

10. **Synthesis report**

It is recommended that the Program's annual report include: 1) a summary of what was done in the current year; 2) a summary of

performance measures (current year and historical); and 3) a synthesis section which describes how the results of all of the individual activities and assessments come together to tell a story about the Big Questions.

The recommended next steps are derived both from experiences in the Trinity River Restoration Program and with many other large complex monitoring projects. The process of addressing these steps will provide sufficient detail to decide on the appropriate allocation of resources. In other words, how much effort will it take to answer the question, at the right spatial and temporal scale, with sufficient precision? While all of these steps are important, in many cases they won't all be able to be addressed immediately. When a step can't be addressed immediately (e.g., due to a lack of quantitative targets), it then becomes the focus of the current investigation plan. For many assessments the IAP already addresses steps 3, 5, & 7 however in most cases steps 4, 6, & 8-10 have not yet been formally incorporated.

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