

TWG  
11-1-98

## Effects Matrix Process and Assumptions

In the November Technical Work Group Meeting (November 4-5 1997) a portion of the meeting was devoted to discussion about potential high inflows to Lake Powell and subsequent releases from Glen Canyon Dam higher than 25,000 cfs. Included in this discussion was the possibility of implementing short duration, experimental high flows (Beach Habitat Building Flows: BHBF) as a resource management strategy. The course of the discussion led to the recognition that the TWG needed to develop a process to evaluate the resources and a rating to establish the effects between January to June 1998 of a 45,000 cfs release, to assist in the decision-making process concerning which month to run a BHBF.

The recommended process involved compiling the expert opinions and research citations supporting that opinion of scientists experienced with the Colorado River ecosystem, and providing a matrix that used a 7-point rating scale (positive, negative, no effect). In addition, resource impacts should be considered relative to the hydrologic trigger before and after the BHBF, because most spills and BHBF will occur during high flow years. Comments were made by some TWG members that the matrix needed to be more comprehensive, however, the degree to which the matrix should be further developed was not defined by TWG members. The TWG recommended that GCMRC use this process to develop a Resource Effects Matrix for the months of January to June.

### Assumptions

Based on the above criteria, the assumptions for a resource effects matrix are as follows:

- A short duration (2-4 days) high flow of 45,000 cfs could take place in months January - June 1998.
- BHBF occur in high flow years, so expect flows prior to and after a BHBF event to be high (20-25 cfs, at least).
- Hydrologic conditions meeting the triggering criteria indicate that there is a high probability of a dam safety related spill. The decision for or against a BHBF does not significantly change the risk of an emergency release later in the season. By implementing a BHBF, the beneficial effects of a spill (e.g., sand storage) can be maximized and the deleterious effects (e.g., biological disturbance) can be mitigated through advanced planning.

### Directions to Developers of Resource Matrix

- Utilize a 7-point scale that varies from +3 to -3 with 0 representing no effect, +3 being strongly positive and -3 being strongly negative.
- The matrix was only for consideration for the year 1998 and it was not intended that a BHBF would be conducted every year.

An event such as this is unlikely because the hydrologic trigger would not be met every year. The intent and structure of the matrix only allows for a high flow scenario to be evaluated, as was the recommendation of the TWG to GCMRC (see November minutes). The effects of a steady flow (20k cfs. for example) was not evaluated beyond the patterns associated with the current operations since February 1997.

The process associated with the matrix and accompanying supporting citations involved contacting researchers that had been directly involved with the 1996 BHBF (attachment a) as well as researchers recommended by program managers. Because funds limited the ability to bring researchers together for a workshop and the time of year also limited people's ability to participate, we decided to compile researcher opinions via fax and mail. A mailing was sent out in November 13, 1997 and researchers were asked to reply by December 3, 1997.

Comments from scientists were received and scores for the matrix were averaged and provided to the TWG in their December 1997 meeting with a review provided by Barry Gold. The scientists rated effects to resources in a range from -3 (negative) to +3 (positive). The TWG recommended that that matrix be sent out again to the researchers for review and evaluation with a revised matrix available by January 15, 1998 to TWG and AMWG. It was discussed that a meeting of the scientists providing information might be required to fully describe potential effects on resources.

The matrix was sent out again prior to winter holidays with a request that evaluations be returned by January 9, 1998. Revised scores and comments were incorporated into the matrix and accompanying text. Included in the text were concerns voiced by researchers that pertain to resources such as sediment, the aquatic food base, Kanab ambersnail, and vegetation. The revised matrix, comments, notes and a summary of details were provided to the TWG in the January meeting by Barbara Ralston. Barbara explained how the values for the resources were obtained--via average scores and provided comments to the TWG member from the researchers regarding specific resources. Among the comments by the researchers was vagueness of the scale associated with the matrix and a desire by the researchers to have an idea of what the anticipated flow volumes following a high flow event might be. The TWG and GCMRC agreed that researchers should be gathered to discuss the scale and to further develop the assumptions associated with the matrix.

Researchers in areas that had negative impacts (-1 or greater) associated with the resource were requested to come to GCMRC to discuss the rating scale and to clarify the assumptions. Prior to the meeting, the researchers were provided the previous matrices and text as well as a copy of the hydrologic trigger document, "BHBF Triggering Criteria" developed by the TWG Spike Flow Subgroup. Three groups of researchers were convened: sediment, aquatic biology, and terrestrial biology. In these discussions, the following assumptions were developed for the resources.

Assumptions


- A high flow would occur in the event that hydrologic triggering criteria were met.
- A high flow would likely only be triggered in high water years so that flows preceding and flows following a BHBF would be high (e.g., 20-25,000 cfs).

#### Directions to Developers of the Resource Matrix

- The primary intent of the BHBF is sediment conservation with no harm to other resources. In effect, if sediment criteria are not met, then it is unlikely that a BHBF would proceed.
- Sediment effects should include the variable high sediment storage in the channel vs. low sediment storage in the channel.
- Sediment storage should be divided into the sections of major sediment input (i.e., the Paria River to the LCR and LCR and below). This division covers the marble canyon reach which is considered a sediment starved or reduced sediment input reach compared to reaches below the LCR.
- Biological resources should be evaluated on the biology/life history of an organism without Endangered Species considerations over-riding scale factors.
- The scale for the biological resources were defined in terms of recovery, because a flood is a disturbance and the effect of the disturbance is evaluated in the response/recovery and long-term benefits to a resource in some cases in addition to the immediate impact to the resource. The scale for biological resources were 0 - no effect, -1 the resource would be affected but recover within the a year at the most; -2 the resource might be affected and recovery would take longer than a year; -3 the resource would be affected and recovery would be unlikely.

#### Additions to the Resource Matrix

The biological researchers felt that the matrix was too general to explain the values assigned to particular resources and suggested that a narrative be developed to accompany the matrix for the biological resources. The intent of the narrative was to describe life history patterns associated with identified resources and to point out months that coincide with developmental stages or potentially critical times associated with an organism's reproductive effort. A narrative was written based on material generated from GCES phase I and II and was distributed to the researchers for comments, corrections and additions. The researchers were also asked to re-evaluate their previous values. The narrative and matrix were sent out February 20, 1997 and responses were requested by March 12, 1998.



A presentation of this last iteration was made on March 18, 1997 by Barbara Ralston at the TWG meeting. During this presentation, questions concerning the process used to develop the matrix were brought up, who was contacted and how the values for the numbers that were associated with the matrix were derived. A lack of time provided to the TWG members to review the document was noted. The TWG members were given a week to review the document and submit comments concerning either the matrix or the narrative for incorporation into the document. Comments from Debra Bills and Norm Henderson has since been received and will be incorporated into the comments portion of the document. Accompanying their comments will be some explanation of why some of their concerns might not be able to be addressed via the matrix.

## **Resource Criteria and Resource Effects Matrix Interactions**

The hydrologic triggering criteria developed by the TWG Spike Flow Subgroup in January 1998 called for the development of comparable criteria for resources below Glen Canyon Dam. In contrast to the triggering criteria that utilized inflows into Lake Powell and monthly releases greater than 1.5MAF, criteria for resources are multivariate and effects of BHBF vary across resources with respect to magnitude and time of year. The decision process and resource criteria evaluation for a BHBF is dependent upon the state of resources, the management objectives for the resources and the effect of timing of the BHBF on resources.

The decision tree that accompanies this document represents an overview of the processes, information needs and decisions that need to be made before a BHBF can go forward. This diagram and description describes the pathway by which decisions can be made. The intent is to provide an initial framework by which criteria for each resource can be developed and decisions proceed. The criteria on which decisions would be based are not developed in this description. The specific criteria require development of values of acceptable loss or gain of resources associated with a BHBF, in accordance with management objectives. For example: currently no numeric values are assigned to low vs. high channel storage of sediment that occurs on the effects matrix. The idea of low vs high channel storage is related to when the last BHBF occurred and how much input from tributaries the mainstem has received, however there is no value attributed to these categories. The following then, is a description of how the process might proceed and what information is still needed in order to develop resource criteria for BHBF triggering.

### **Decision-making Process**

1. The first step required to begin considering resources is to determine if the hydrologic triggering criteria are met. If these are NOT met, then a BHBF would not take place. In the event that the triggering criteria are met, then the next decision to make is to determine the hydrograph for the flow (i.e., magnitude and duration) and the purpose of the flow.
2. Currently, the GCD-EIS calls for BHBFs with the intent to manage beaches, sediment, some native fish habitat and vegetation and not to impact other resources such as cultural properties, endangered species, economic/recreation aspects. This is one purpose of high flow and the magnitude of this type of flow was presented as 45,000 cfs for a week in the EIS, and possibly occurring in late March. As knowledge regarding the affects of short duration high flows increases, flows of different duration and magnitude may be proposed with the intent of those flows to be different from that described in the EIS. The critical decision in this step is to determine the timing (January - July), magnitude (32,000 - 45,000 cfs or greater), duration and hypothesized results of a flow above power plant capacity.
3. When a decision is made regarding the timing, magnitude, duration and hypothesized results of the high flow, then the decision process begins to run in parallel. In one direction, compliance issues associated with Cultural Properties and Endangered Species need to be addressed and satisfied. In the other direction, specific resources

need to be assessed and the impacts of a anticipated flows considered. The assessment of a resource requires examining the "effect matrix" to determine if time of year may be an issue and to determine if specific life-stage aspects associated with a resource (e.g., larval vs adult stages in fish) need to be considered. The matrix is limited in the information it can give concerning a resource.<sup>1</sup> It only points to a resource or component of a resource that might be affected by a high flow for a given time of year. It does not describe the specific magnitude of impact beyond a scale of recovery time for biological resources or immediate impact to resources such as fishing, or power revenues. In effect, the matrix would be consulted to determine resources that need further consideration.

4. Information that would be used to better define BHBF affects associated with a resource would be the narrative for biologic resources that accompanies the matrix, the management objectives associated with the resource, and the annual state of the resource document developed by GCMRC. The information needs and decision-making process would be different for each resource for any month and for any year.
5. After information concerning identified resources is gathered and evaluated, then the process involves making decisions to proceed with a high flow or not. This step involves reviewing values that have been agreed to by the AMWG for resources as acceptable losses or gains. The decision could be grouped into an event having a 1-time effect on the resource, a high flow event causing cumulative effects or a high flow event having an impact on a resource that it exceeds acceptable limits for the resource-- a showstopper.

A suggestion was made that the existing Management Objectives be used as the first tier of Resource Criteria. The GCMRC would compare the Resource Criteria against the probable resource effects identified in the Resource Matrix and Narrative, to determine whether the probable effects of a BHBF would significantly reverse efforts to achieve the respective Management Objectives. Since many of the current Management Objectives lack specificity (i.e., not quantifiable or lack target dates) additional detail will need to be developed.

6. Sensitive and High Value Resources ("showstoppers") were identified by the TWG during their January 20-21, 1998 meeting.

A showstopper could prevent a BHBF unless 1) adequate mitigation measures could be devised or 2) the probability of an emergency release (45,000 cfs or greater) is so high that a BHBF is deemed as the most appropriate protective action. These include Kanab Ambersnail (Biological Opinion), Humpback Chub (no acceptable take), Razorback Sucker (no acceptable take), Southwestern Willow Flycatcher (no acceptable take), Cultural (Programmatic Agreement), Trout (Lees Ferry Recreation - tailwater fishery), Other Native Fish. The cumulative and 1-time effect values would require further deliberation and may or may not result in a high flow event.

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<sup>1</sup> Of critical importance here is the ability to distinguish the immediate disturbance effect a BHBF may have on resources, versus the recovery time for the resources relative to that effect, and the overall importance of the disturbance effect in structuring the ecosystem and related processes.

**Attachment a Researchers receiving matrix and providing comments**

Name	1 <sup>st</sup> mailing (11/13/98)	2 <sup>nd</sup> mailing (12/15/98)	meeting/email
Jan Balsom	yes	no	--
Dean Blinn	yes	yes	yes
Bryan Brown	yes	no	yes
Steve Carothers	no	no	--
Kerry Christensen	yes	no	no
Mike Douglas	no	no	--
David Foster	yes	yes	yes
Owen Gorman	yes	no	no
Dave Harpman	yes	no	--
Bob Hart	yes	no	--
Joe Hazel	yes	yes	yes
Tim Hoffnagle	yes	no	yes
Linda Jalbert	yes	no	--
Matt Kaplinski	yes	yes	yes
Lisa Kearsley	--	--	yes
Michael Kearsley	yes	yes	yes
Dennis Kubly	no	yes	no
Signa Larralde	no	no	--
Bill Leibfried	yes	no	yes
Margaret Matter	no	no	--
Carole McIvor	no	no	--

Ted McKinney	no	no	yes
Vicky Meretsky	yes	yes	--
Wendell Minckley	no	no	--
Tom Moody	no	yes	no
Lars Niemi	yes	no	--
Clayton Palmer	no	no	--
Rod Parnell	no	no	no
Duncan Patten	no	no	--
Bill Persons	no	no	yes
Jim Peterson	--	--	no
Art Phillips	yes	no	no
Andre Potochnik	yes	no	no
Dave Rubin	no	no	--
Jack Schmidt	yes	no	no
Mark Sogge	no	no	--
Jeff Sorenson	no	no	yes
John Spence	yes	yes	no
Larry Stevens	yes	no	yes
Julie Stromberg	no	no	--
Tim Tibbets	--	--	no
David Topping	yes	no	yes
Richard Valdez	no	no	yes
Bill Vernieu	yes	no	--



Dave Wegner	--	--	no
Steve Wiele	yes	no	no
Michael Yeatts	yes	no	--
Ben Zimmerman	yes	no	no
Helen Yard	--	no	no
Michael Yard	--	--	yes

-- indicates that these researcher were not contacted.