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To:

Steve Lloyd UC-215

From: SERENA MANKILLER, GCMRC SECRETARY TO THE CHIEF  
smankiller@flagmail.wr.usgs.gov

Subject: TWG 9/18 Attachment

Comments: Steve - this is all I have in the binder. Maybe Norm can fax you page 1 which is missing. If you get it, I'd appreciate a copy of pg. 1 for our binder too. I don't know what could have happened to pg. 1 (sorry)

If there are any problems with this Fax, please call: 520 556-7094

**From:** Steven Lloyd  
**To:** Serena Mankiller  
**Date:** Wed, May 17, 2000 7:33 AM  
**Subject:** Attachment 3, Sept. 14-15, 1998, TWG Meeting

Serena,

Thank you for the copies of the minutes to the TWG Meetings. They have been very helpful in updating the Web Pages.

As we have been scanning the documents we noticed that attachment 3 is not complete. The copy was one we made at the hotel and the top four lines on each page were cut off. The document is one that you developed in your office. Could you please try to find a better copy and send it to me?

Thanks,

sl

*reference*

A. Henderson TWG  
9-15-98 nHenderson  
attachment 3

that included both types of resources. The cost of the combined GCMRC Lake Powell program was estimate to be \$325,000 in FY-2000 plus the salaries of two GCMRC limnologists.

At the most recent AMWG meeting on July 21-22, 1998, AMWG adopted specific Lake Powell Management Objectives (MO) and Information Needs (IN). AMWG tasked the Technical Work Group (TWG) with reviewing those MOs and INs and categorizing them into those that pertained to Lake Powell and the downstream resources, and those that pertained mostly to Lake Powell itself. AMWG also tasked the TWG with reviewing the FY-2000 and long-term work plans presented by GCMRC. AMWG directed that the AMP would fund those MOs and INs for Lake Powell that were directly related to downstream resources. GCMRC would develop an amended long-term research and monitoring plan and budget to address the downstream component. The MOs and INs related only to Lake Powell (upstream) would still be considered part of the AMP but funding for implementation would come from another source. Specifically, both the Western Area Power Administration and the Colorado River Energy Distributors Association representatives agreed to support CRSP O&M increases within the BOR budget to support Lake Powell studies addressing approved MOs and INs related mostly to Lake Powell resources.

#### CATEGORIZATION OF MANAGEMENT OBJECTIVES AND INFORMATION NEEDS

The TWG developed a comprehensive list of MOs and INs for the AMP that included a specific section for Lake Powell. The AMWG approved this list on July 21, 1998. From this list, two categories of MOs and INs have been developed. (All MOs and INs are written verbatim in order to minimize reader confusion.)

#### Lake Powell Management Objectives and information needs related to downstream resources

Two MOs were adopted by AMWG for Lake Powell. MO 1 relates to resources within Lake Powell that have been shown to directly influence downstream biology and water quality. MO 1 reads as follows:

**Prevent impacts that adversely affect the water quality (physical, chemical, biological) of Lake Powell due to dam operations and ensure that fully informed AMWG decisions are possible both now and in the future.**

MO 1 includes the following Lake Powell INs that directly influence downstream water quality and aquatic ecology:

#### **Physical/Chemical (Limnology)**

**IN 1.1 Determine the effect of current dam operations (under approved operating criteria) on reservoir water quality, including but not limited to the following:**

- a. Determine near-dam hydrogen sulfide levels (and other hazardous chemical constituents) within the hypolimnion occurring under current dam operating under current dam operating criteria.
- b. Determine the dynamics of lake stratification and advective flows and their effects on chemical constituents.

- c. Determine/quantify the dynamics of major cations, anions, and nitrate/phosphate ratios resulting from dam operations
- d. Determine the effects of dam operations (under approved operating criteria) on the physical/chemical dynamics of Lake Powell side channels and embayments.
- e. Quantify/model the heat budget for Lake Powell to determine near-term and long-term (monthly/weekly and annual summaries respectively) effects on a selective withdrawal system.
- f. Determine the effects of current dam operations on reservoir levels of selenium.

**Biological**

**IN 1.1** Determine the impacts of dam operations and resulting water quality on primary and secondary productivity of Lake Powell, including:

- a. algae (phytoplankton)
- c. zooplankton

**Management Objectives and information needs related mostly to upstream resources**

MO 2 relates mostly to Lake Powell aquatic ecosystem with little or no connection to downstream resources. It reads as follows:

**Protect Lake Powell aquatic ecosystem (fishery) from adverse impacts due to dam operations and subsequent effects, including but not limited to: temperature, reservoir surface elevations, elevated selenium levels, advective flow patterns, predator/prey relationships, and fish movements.**

The INs associated with MO 2 that are believed to have relevance mostly to the Lake Powell aquatic ecosystem:

- IN 2.1** Determine the effects of water temperature caused by dam operations.
- IN 2.2** Determine the effects of fluctuations in the reservoir surface elevations caused by dam operations (under approved operating criteria)
- IN 2.3** Determine the effects of elevated selenium levels caused by dam operations (under approved operating criteria)
- IN 2.4** Determine the effects of advective flow patterns on the Lake Powell aquatic ecosystem caused by dam operations (under approved operating criteria)
- IN 2.5** Determine the effects of predator/prey relationships caused by dam operations (under approved operating criteria)
- IN 2.6** Determine the effects of fish movements caused by dam operations

In addition, the following IN associated with MO-1 that relate to mostly to Lake Powell aquatic ecosystem with minimal effect downstream are the following:

### **Biological**

**IN 1.1** Determine the impacts of dam operations and resulting water quality on primary and secondary productivity of Lake Powell, including:

- a. algae (periphyton)
- b. macrophytes
- d. macroinvertebrates

**IN 1.2** Quantify levels of selenium and describe effects of these levels on primary and secondary productivity, fish and waterfowl, and human consumption.

### **RECOMMENDATIONS**

Based on the above discussion and categorization, it is recommended that TWG adopt the following findings and recommendations:

1. All MOs and INs approved by the AMWG for Lake Powell are considered part of the AMP.
2. Those MOs and INs identified above for Lake Powell that relate to downstream resources will be funded through the AMP program (non-reimbursable funds) with oversight by the AMWG, and the research and monitoring conducted by GCMRC.
3. GCMRC will develop a five-year monitoring and research plan and budget to address these MOs and INs (specified in 2 above).
4. FY-2000 budget estimates developed by GCMRC for Lake Powell will be provided to BOR for input into the FY-2000 budget request.
5. Those MOs and INs identified above for Lake Powell that do not relate to downstream resources become the responsibility of the BOR and will be funded through other sources including CRSP O&M power revenues (reimbursable accounts).
6. AMWG/TWG will lend support to a request by WAPA and CREDA to increase regular CRSP O&M funding for BOR to address those needs.
7. BOR will develop a five-year work plan and budget to address the specified information needs and to support the above funding request. It is expected that this plan would be prepared in conjunction with the signatories of the Lake Powell water quality MOU. (The MOU was recently activated when seven members having expertise and interest in Lake Powell water quality and monitoring signed the document).
8. BOR will report to AMP regarding the findings associated with the work plan they develop.