Approved

San Juan River Basin Recovery Implementation Program
Hydrology Committee Meeting
April 17, 2007

Member/Alternates Present	Representing
Pat Page, Chairman	U.S. Bureau of Reclamation
Ray Alvarado	Colorado Water Conservation Board
Ron Bliesner	Keller-Bliesner Engineering (BIA)
Steve Cullinan	U.S. Fish and Wildlife Service, Region 2
Rick Cox	Water Development
Aaron Chavez for Randy Kirkpatrick	Water Development
Bill Miller	Southern Ute Indian Tribe
John Simons	U.S. Bureau of Reclamation
Dan Meyer	Jicarilla Apache Nation
Steve Harris	Water Development
John Whipple	State of New Mexico
Earle Dixon for John Leeper	Navajo Nation
Chuck Lawler	Southern Ute Indian Tribe

Program Management

Other Interested Parties	
Dave King	U.S. Bureau of Reclamation
Timothy Jones	Public Service Company of New Mexico
Steve Lynch	U.S. Bureau of Indian Affairs
Michael Howe	U.S. Bureau of Indian Affairs-NIIP
Brent Uilenberg	U.S. Bureau of Reclamation
Brad Dodd	U.S. Bureau of Reclamation
Catherine Condon	Southern Ute Indian Tribe
Tami Sheldon	Southern Ute Indian Tribe
Erin Wilson	State of Colorado
John Kay	City of Albuquerque

1. Introductions and review and approval of agenda items

2. Comments/Concerns Regarding Proposed Revisions to Operations Decision Tree – Reclamation

Brad Dodd, Chief of the Facility Maintenance Group in Reclamation's Durango Office explained the inspection standards/schedules for both the main and the auxiliary outlet works at Navajo Dam. The 5,000 cfs release is comprised of 3,400 cfs from the main outlet and 1,600 cfs from

the auxiliary outlet (1,200 cfs of which goes through the City of Farmington power plant). The main outlet must be inspected after 30 continuous days at more than 3,200 cfs. This would result in an approximate 3-day shut down (from 5,000 cfs to 1,600 cfs) while the inspection is being performed. The auxiliary outlet needs to be inspected after 14 days at its maximum flow (1,600 cfs). This would result in an approximate 2-day shutdown (from 5,000 cfs to 3,400 cfs) while the inspection is being performed. Brad wanted to make sure the SJRIP knew about these restrictions because the proposed revisions to the decision tree call for release durations that would often trigger the need for the inspections during the spring peak release.

3. StateMod presentation - Ray Alvarado

Ray Alvarado gave an overview of StateMod. Power point presentation is available on the BoR website www.uc.usbr.gov.

4. Presentation on StateMod/Gen3 Model Analysis - John Simons and Dave King

Dave and John gave a presentation on the status of the Gen3 model and how StateMod is incorporated. The presentation included a list of both near- and long-term recommendations.

The outline of the presentation is attached.

5. Strategy to Complete Gen3 (review and recommendations attached)

The HC engaged in a discussion regarding the outstanding issues that must be resolved in order to recommend to the CC that Gen3 be accepted as the new model and how the model should be used by the Service/Program.

Steve Harris – concerned that model is being used as a regulatory threshold rather than a planning tool. Would like to see model run for "blocks" of depletions rather than for individual projects.

Ron Bliesner – Indicated that the real issue is the Flow Recommendations not just the model. Stated that we need to make sure the tool (i.e., Gen3) is ready for the revised Flow Recommendations.

John Whipple – Stated 5 issues with the model that he feels need to be addressed:

1) San Juan – Chama discrepancies must be resolved
2) Consistency with Hydrologic Determination depletion schedule must be obtained
3) Baseline issues on Indian Settlement Rights
4) Issues regarding baseline irrigation depletions in Colorado exceeding historic depletions due to different methodology
5) How the tool is used (i.e., comparative analysis or regulatory tool)
6) SJ Chama baseline depletion data will be requested from Eric Wilson in Colorado.

Rick Cox – would like to see StateMod segregated from Riverware to simplify model

A request was made of Colorado to provide detailed monthly historic and baseline depletion data modeled for the drainages above the San Juan-Chama Project points of diversion.

6. Discussion of Long-term Model O&M – Reclamation

Pat Page and Brent Uilenberg indicated that Reclamation's position on long-term O&M of the model is that once the Gen3 model has been completed, Reclamation would hand the model over to either the Service or the Program for them to use.

Most every HC member reacted negatively to this announcement.

7. Hydrologic Conditions Discussion –Navajo Reservoir water supply is sufficient to provide a full supply to project users and therefore no water supply shortages are predicted for this year

8. Navajo Reservoir Operations

Current Navajo Reservoir conditions for April 16, 2007 are:
WS = 6079.55 ft, content = 1,618,000 af (129% for this date in history), inflow = 1358 cfs, releases = 715.5 cfs and NIIP div = 67 cfs.

Forecast: The April mid month modified unregulated forecast of Apr-Jul inflow increased from 475,000 af that was predicted in the April 1st forecast to 480,000 af. This is 62% of the 30-year Mod Unreg inflow.

Spring Release: Under current reservoir content and this forecast, The Decision Tree calls for the 1st hydrograph, 7 days at 5,000 cfs. But because the reservoir has carried over the large October 2006 thunderstorm runoff, Reclamation will release an additional 36,000 af by releasing the 2nd hydrograph, a 23 day event with 14 days at 5,000 cfs. **Also, in anticipation of a potential early spring runoff, the peak release will occur earlier than in previous years.** Ramp up will begin on Monday, April 30th, reach 5,000 cfs on Thursday, May 3rd. Ramp down will begin on Thursday, May 17th, hold at 2,400 cfs for the weekend, then on Monday May 21 continue decreasing and reaching 500 cfs on Wednesday, May 23rd.

For the Maximum Probable inflow, the maximum hydrograph would be released beginning on the April 27th and ramping up at the rate of 1,000 cfs a week. Staying at 5,000 cfs for 21 days and then ramping down to 500 cfs over 14 days.

Under the Minimum Probable inflow, the minimum hydro graph would be released: 7 days ramping up to 5000 cfs, 7 days at 5000 cfs and 7 days ramping down to 500 cfs.

Base minimum release will be 500 cfs this year.

9. New Projects – Update from HC Members on any new projects on the horizon
Nothing reported

10. Adjourn

Next Meeting
June 12, 2007 – Changed to a conference call – 9:00 am to noon

HYDROLOGY COMMITTEE ACTION ITEM LOG
(Updated June 28, 2007)

	Action Item	*Meeting/ Origination Date*	*Responsible Party*	*Due Date*	*Revised Date*	*Date Completed*
4	Add model runs and other information to the permanent hydrology website: http://uc.usbr.gov	7/25/01	Erik Knight	Ongoing		
5	Model modification briefings.	7/25/01	Reclamation and Keller-Bliesner	Ongoing		
12	Any new data or methods incorporated into RiverWare or State Mod will be shared with the Hydrology Committee.	7/25/01	Keller-Bliesner and Reclamation	Ongoing		
34	Gage error analysis discussion: the Hydrology Committee still needs to determine whether big losses are due to daily deagregation. The Committee has the option to re-evaluate losses once the 3rd Generation model is complete. HC decided to live with gage error.	11/27/01	Pat Page need to have a discussion with USGS	Ongoing	Postponed until StateMod analysis is completed	
105	USGS agreed to give a presentation annually to the Hydrology Committee regarding the effectiveness of the gage readings.	8/5/03	USGS	Annually		
136	Coordinate documentation for depletion differences for Gen 2 & Gen 3	5-18-04	Ron Bliesner & Dave King	Ongoing		
139	Committee will report any new projects which will be coming up.	5-18-04	Hydrology Committee	Ongoing		

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(Updated June 28, 2007)

	Action Item	*Meeting/ Origination Date*	*Responsible Party*	*Due Date*	*Revised Date*	*Date Completed*
140	Follow-up on (USGS) gage at Archuleta right-of-way	5-18-04	Pat Page	Pending		
141	Budget Report to include foot notes with explanation of expenditures.	11-9-05	Pat Page, Dave King and (HC comments)	Ongoing		
142	Letter from State of NM requesting funds from program to support USGS to be forwarded to Biology Committee	09-12-06	Pat Page	Complete		
143	Ron will send Firm Yield Study 1989 Addendum and the model comparison results table to NM and CO on concerns with Gen3 .	09-12-06	Ron Bliesner	12-05-06		
144	BoR will work with NM and CO on their concerns with G3.	09-12-06	Pat Page/John Whipple & Ray Alvarado	12-05-06		
145	CO to provide John Whipple with the statistical relations for regressions to get the natural flows for the period outside of records for diversion points in Gen3	09-12-06	Ray Alvarado	12-05-06		
146	Provide John Whipple with the differences between historic and baseline depletions	09-12-06	BoR	12-05-06		

San Juan Recovery Implementation Program (SJRIP)
San Juan Basin Hydrology Model (SJBHM)
Review and Recommendations
4/17/2007

A. Background
- 1. General background
  - a. The third generation SJBHM (Gen3 Model) consists of a StateMod model and several RiverWare models
  - b. StateMod is used to compute natural flows and most of the inflows to the daily decision model
  - c. A number of issues and differences between StateMod and RiverWare were identified and documented in Chapter 8 of the draft Gen 3 Model Hydrology Manual
  - d. None of these issues were deemed to affect the overall results
  - e. Recommendations were made to improve StateMod to RiverWare data flow and to consolidate methods, a few of which have been implemented
- 2. Review background
  - a. Before implementation of the Gen 3 Model, the Biology Committee requested that Reclamation and Keller-Bliesner Engineering use the Gen3 model to do some special runs. The work included development of new Navajo Reservoir operating rules to analyze the feasibility of revising the flow recommendations and the testing and debugging of the model
  - b. During this phase of work, issues arose regarding the data used in the model and the results of the model when compared to previous versions of the SJBHM as well as other independent operating models and hydrological analyses. The following issues were identified:
    - 1. Data and methods used in StateMod to determine depletions and natural flows
    - 2. Discrepancies in depletions and diversions between Gen2 and Gen3
    - 3. Discrepancies related to the modeled diversions and operation of the San Juan Chama (SJC) Project
  - c. The Hydrology Committee requested that Reclamation review StateMod, Colorado data, and the StateMod San Juan model, and their use in the SJBHM. This document reports the findings of the review

B. What Was Done To Expand Understanding of StateMod
- 1. Review of StateMod Depletions
  - a. Historic by Month by Diversion Structure
  - b. Baseline by Month by Diversion Structure
  - c. Irrigation efficiencies and variable efficiency method
  - d. Consistency between Historic and Baseline
- 2. Review of Missing Data Filling Methods
  - a. Average Wet and Dry months to for historic diversions
  - b. Extension of Natural Flows by Mixed Station Model
- 3. Review of Natural Flow Computation
  - a. Three Step Process
  - b. Distinction between natural flows and baseflows
- 4. Review of Operations
  - a. Operation primarily driven by water rights
  - b. Supplemental supplies from reservoirs and other diversions use built-in StateMod operations selected by user
  - c. EOM Targets influence reservoir operations
  - d. Special Operations such as La Plata Compact
- 5. Review of Validation and Calibration Methods

a. Regressions of H1 (validation) and H2 (calibration) to historic flows
b. Accumulated differences of H1 and H2 to historic flows

6. Review of Data Management Procedures and Version Control
   a. StateMod data management
   b. Data exchanges between Reclamation and CDSS.
7. Review of Documentation
   a. StateMod software documentation
   b. Data Management Interface (DMI) documentation
   c. San Juan StateMod model documentation

C. Findings of StateMod Review
1. No systematic problem with methods or approach exists.
2. General approach to computation of natural flows in StateMod using nodal computations in lieu of black box computations is generally preferable. However:
   a. Requires more data
   b. Does not provide a means of reporting actual natural flow depletions.
3. Identified some case specific errors which are being addressed. These are:
   a. Navajo natural flow error due to spatial disaggregation set up
   b. Baseline setup for projects that changed at some point in time
4. Natural flow filling by Mixed Stations Model (soon to be done by TSTool) is limited to log log regressions
5. The automation of a number of procedures improves productivity but makes it problematic to track derivation of a specific number in some cases
6. Inclusion of Indian Water Rights Settlement depletions is inconsistent with second generation SJBHM
7. Consistency between StateMod historic and baseline depletions
   a. Non inclusion of stock water depletions in both historic and baseline. Livestock water is included in historic diversions but livestock depletions are not, except for six percent of return flow.
   b. Baseline setup uses maximum of historic headgate demand and IWR divided by efficiency. This incorporates livestock diversions into baseline.
8. Inconsistency between StateMod depletions and other depletions
   a. Use of Original Blaney-Criddle for elevations above 6500 feet
   a. StateMod to CU&L and Hydrologic Determination
   b. StateMod to second generation SJBHM and SJRIP reporting
9. Although data management procedures have improved significantly during SJBHM development, areas for improvement exist
10. Version control of SJBHM version of San Juan StateMod model is problematic
11. San Juan StateMod documentation and DMI documentation are adequate. However, StateMod software documentation is insufficient and non-user friendly

D. Additional Review and Findings
1. San Juan Chama Project Review
   a. Consulted with SJC Project operators
   b. Review of DPR and Firm Yield Studies
   c. Review of second and third generation data and operations
2. San Juan Chama Project Findings
   a. Identified some incorrect diversion data in early years of project
   b. SJC Project operators use bypasses consistent with Regional Director memorandum dated 1/7/1977
   c. URGWOM and SJBHM bypasses use 4 cfs instead of 27 cfs for September Little Oso bypass
   d. Second generation model has Navajo River incorrectly configured
   e. Configuration error did not affect second generation results
   f. Second generation model operated SJC incorrectly

g. Second generation baseline depletions above SJC diversions are less than historic

h. Operators use Azotea Tunnel diversions in lieu of individual diversions

i. Heron evaporation rates in SJBHM incorrectly use Navajo rates

3. Third generation RiverWare models and Reclamation data

a. Efficiencies provided by Reclamation used by StateMod H1 and H2 scenarios were incorrect.

b. Colorado incidental losses have to be computed by rule in RiverWare models.

c. Data storage, management and analysis involves too many spreadsheets

d. Multiple RiverWare models increases data management and probability of mistakes.

4. RiverWare capabilities have improved dramatically, including the ability to process water rights efficiently. In addition, an actual random number generation function is available

5. Although the StateMod RiverWare system for the third generation SJBHM is overly complicated and some methods vary between the systems, use of StateMod to provide data for the RiverWare models is acceptable and should not affect the intended use of the SJBHM. Specifically, the formulation of revised flow recommendations, the evaluation of alternative operating scenarios for Navajo Reservoir, and for basin consultations is not adversely affected by StateMod. Whether StateMod or RiverWare is used to generate input to the daily decision model is a moot point.

E. Near Term Recommendations

1. Specify SJRIP version of San Juan StateMod model. Suggested specification should include:

a. No Soil Moisture

b. Animas La Plata Project turned off

c. RIP operations turned off

d. SJC Project turned off

2. Implement improved version control of SJRIP version of San Juan StateMod model and data exchanges.

3. Better coordination of configuration and data management changes

4. Review all data exchanges systematically including input data, calibration, and operations.

5. Incorporate RiverWare random number generation function into forecast error computations.

6. Develop evaporation rates that are specific to Heron Reservoir.

7. Incorporate Azotea Tunnel data into SJC Project historic data that is used to compute natural flows.

8. Obtain direction from Hydrology Committee regarding depletions difference between second and third generation models.

9. StateMod should be modified so that realized depletions associated with natural flow computations are available

10. Implement correct Little Oso September bypass flow.

F. Long Term Recommendations

1. Move as much non-Colorado data storage as possible to Hydrologic Database (HDB)

2. Add ability for TSTool to communicate with HDB

3. Implement ability to compute return flow based incidental losses as an engineering method in RiverWare

4. Incorporate ability to use straight regressions into StateMod natural flow extensions

5. Add ability to incorporate soil moisture in RiverWare

6. Convert RiverWare migration model to a daily timestep as an incremental step toward creation of an operations model and using RiverWare to generate all input to daily decision model

G. Remaining Issues and Concerns

1. NMISC concerns regarding SJC Project need to be provided to Hydrology Committee for review and consideration

2. Disposition of revised flow recommendations and adjustments to Navajo operations

I. Plan and Schedule

a. Complete extension of data and models through 2005 (June 2007)

b. Obtain direction from Hydrology Committee and Biology Committee regarding completion of SJBHM and implementation of revised flow recommendations (April 2007)

c. Consider recommendations of NMISC regarding disposition of SJC Project data and operations (June 2007)

d. Complete third generation model development (September 2007)