STATE OF CALIFORNIA - THE NATURAL RESOURCES AGENCY EDMUND G. BROWN, JR., Governor

COLORADO RIVER BOARD OF CALIFORNIA
770 FAIRMONT AVENUE, SUITE 100
GLENDALE, CA 91203-1068
(818) 500-1625
(818) 543-4685 FAX

May 31, 2013

NOTICE OF REGULAR MEETING OF THE COLORADO RIVER BOARD

NOTICE IS HEREBY GIVEN pursuant to the call of the Chairperson, Dana B. Fisher, Jr., by the undersigned, the Executive Director of the Colorado River Board of California, that a regular meeting of the Board Members is to be held as follows:

Date:	June 12, 2013, Wednesday
Time:	10:00 a.m.
Place:	Vineyard Room Holiday Inn Ontario Airport 2155 East Convention Center Way Ontario, CA 91764-4452 TEL: (909) 212-8000, FAX: (909) 418-6703

The Colorado River Board of California welcomes any comments from members of the public pertaining to items included on this agenda and related topics. Oral comments can be provided at the beginning of each Board meeting; while written comments may be sent to Mr. Dana B. Fisher, Jr., Chairperson, Colorado River Board of California, 770 Fairmont Avenue, Suite 100, Glendale, California, 91203-1068.

An Executive Session may be held in accordance with provisions of Article 9 (commencing with Section 11120) of Chapter 1 of Part 1 of Division 3 of Title 2 of the Government Code and in accordance with Sections 12516 and 12519 of the Water Code to discuss matters concerning interstate claims to the use of Colorado River System waters in judicial proceedings, administrative proceedings, and/or negotiations with representatives from other states or the federal government.

Requests for additional information may be directed to: Ms. Tanya M. Trujillo, Executive Director, Colorado River Board of California, 770 Fairmont Avenue, Suite 100, Glendale, CA 91203-1068, or 818-500-1625. A copy of this Notice and Agenda may be found on the Colorado River Board's web page at www.crb.ca.gov.

A copy of the meeting agenda, showing the matters to be considered and transacted, is attached.

Tanya M. Trujillo
Executive Director

attachment: Agenda

Regular Meeting
COLORADO RIVER BOARD OF CALIFORNIA
June 12, 2013, Wednesday
10:00 a.m.

Vineyard Room
Holiday Inn Ontario Airport
2155 East Convention Center Way
Ontario, CA 91764-4452

AGENDA

At the discretion of the Board, all items appearing on this agenda, whether or not expressly listed for action, may be deliberated upon and may be subject to action by the Board. Items may not necessarily be taken up in the order shown.

1. Call to Order

2. Opportunity for the Public to Address the Board (Limited to 5 minutes)
   As required by Government Code, Section 54954.3(a)

3. Administration
   a. Minutes of the Meeting held April 10, 2013, Consideration and Approval **(Action)** ..... TAB 1
   b. Election of Board Vice-Chair **(Action)**
   c. Approval of Fiscal Year 2013-2014 Colorado River Board Budget **(Action)** ..... TAB 2

4. Protection of Existing Rights
   a. Colorado River Water Report(s) ..... TAB 3
      Report on current reservoir storage, reservoir releases, projected water use, forecasted river flows, scheduled deliveries to Mexico, and salinity
   b. State and Local Water Reports ..... TAB 4
      - Reports on current water supply and use conditions
   c. Colorado River Operations ..... TAB 5
      - Development of the 2014 Annual Operating Plan
      - Status of the Glen Canyon Dam Long-Term Experimental and Management Plan (LTEMP) EIS Process
      - Report regarding Lower Colorado River Multi-Species Conservation Program
   d. Basin States Discussions ..... TAB 6
      - Minute 319 Update
      - Status of the Colorado River Basin Water Supply and Demand Study
      - Review of Basin States Technical Committee Meeting, April 17, 2013, Las Vegas, Nevada
      - Presentation by Central Arizona Project regarding the Proposed Drain Water Interceptor Project

Agenda (continued)

e. Colorado River Water Quality
   - Colorado River Basin Salinity Control Forum and Advisory Council Meetings, Grand Junction, Colorado, May 14-17, 2013

5. Executive Session
   An Executive Session will be held by the Board pursuant to provisions of Article 9 (commencing with Section 11120) of Chapter 1 of Part 1 of Division 3 of Title 2 of the Government Code and Sections 12516 and 12519 of the Water Code to discuss matters concerning interstate claims to the use of Colorado River system waters in judicial proceedings, administrative proceedings, and/or negotiations with representatives from other states or the federal government.

6. Other Business
   a. Next Board Meeting: Regular Meeting
      July 10, 2013, Wednesday, starting 10:00 a.m.
      Holiday Inn Ontario Airport
      2155 East Convention Center Way
      Ontario, CA 91764-4452
      TEL: (909) 212-8000, FAX: (909) 418-6703

3.a. - Approval April 10, 2013, Board Meeting Minutes

Minutes of Regular Meeting
COLORADO RIVER BOARD OF CALIFORNIA
Wednesday, April 10, 2013

A Regular Meeting of the Colorado River Board of California (Board) was held in the Vineyard Room, of the Holiday Inn Ontario Airport, 2155 East Convention Center Way, Ontario, California, Wednesday, April 10, 2013.

Board Members and Alternates Present

Dana Bart Fisher, Jr., Chairman
Franz W. De Klotz
James Cleo Hanks
Michael T. Hogan
Henry Merle Kuiper
Glen D. Peterson
David R. Pettijohn

Jeanine Jones, Designee
Department of Water Resources

Board Members Absent

John V. Foley
Terese Maria Ghio
James B. McDaniel

Christopher G. Hayes, Designee
Department of Fish and Wildlife

Others Present

Steven B. Abbott
Autumn Ashurst
James M. Barrett
Brenda Burman
John Penn Carter
J.C. Jay Chen
Dan Denham
Leslie Gallagher
Christopher S. Harris
William J. Hasencamp
Michael W. Hughes
Lisa Johansen
Lori A. Jones
Thomas E. Levy
Lindia Y. Liu
Jan P. Matusak
Doug McPherson
W.D. Bud Pocklington
Halla Razak
Jack Seiler
Tina L. A. Shields
Ed W. Smith
Gary E. Tavetian
Tanya M. Trujillo
Mark Van Vlack
Michael Yu
Gerald R. Zimmerman

CALL TO ORDER

Chairman Fisher announced the presence of a quorum and called the meeting to order at 10:14 a.m.

OPPORTUNITY FOR THE PUBLIC TO ADDRESS THE BOARD

Chairman Fisher asked if there was anyone in the audience who wished to address the Board on items on the agenda or matters related to the Board. Hearing none, Chairman Fisher moved to the next agenda item.

ADMINISTRATION

Approval of Minutes

Chairman Fisher asked if there was a motion to approve the March 13th minutes. Mr. Kuiper moved the minutes be approved. Seconded by Mr. Pettijohn and unanimously carried, the March 13th meeting minutes were approved.

New Board Member Materials

Ms. Trujillo reported that Board staff had prepared orientation materials for new Board members. Ms. Trujillo also introduced Ms. Lori Jones and Ms. Lisa Johansen from the Board's office to be available to answer questions regarding administrative issues.

Ms. Trujillo reported that in addition to the administrative information contained in the orientation binders, there was also an overview and information associated with many of the Board's ongoing programs. Ms. Trujillo also reported that she received suggestions from Board members that detailed presentations on these programs would be appreciated. Ms. Trujillo reported that periodic presentations would be included in the agendas for future meetings.

Ms. Trujillo also reported that included in the binders were the last few River Reports by the Water Education Foundation that highlight activities along the Colorado River. The River Reports include reports on the U.S. and Mexico negotiations, the Glen Canyon Dam Adaptive Management Program, the Lower Colorado River Multi-Species Conservation Program, and many others. Ms. Trujillo also reported that included in the binders was the current budget. Finally, there were some discussions regarding the filing of Form 700 and the ethics training.

PROTECTION OF EXISTING RIGHTS

Colorado River Water Report

Mr. Harris reported that precipitation from October 1st to April 1st was 74 percent of average, and the snowpack was about 73 percent of average as of April 1st. The forecasted April through July 2013 unregulated flow into Lake Powell is 3.3 million acre-feet (maf) or 46 percent of average. The forecasted 2013 water year unregulated flow

into Lake Powell is 5.2 maf, or 48 percent of average.

Mr. Harris reported that, as of April 1st, the storage in Lake Powell was 11.65 maf, or 48 percent of capacity. The water surface elevation was 3,599 feet. The storage in Lake Mead was 13.47 maf, or 52 percent of capacity, and water surface elevation was 1,118.6 feet. Total System storage was about 31.87 maf, or 53 percent of capacity. Last year's total System storage was 37.56 maf, or 63 percent of capacity.

Mr. Harris reported that Reclamation has projected consumptive use (CU) for the State of Nevada to be under its basic entitlement of 300,000 acre-feet (i.e., 262,000 af), Arizona's CU of Colorado River water to be slightly under its 2.8 maf apportionment (i.e., 2.758 maf), and California's CU is projected to be slightly under its 4.4 apportionment (i.e., 4.218 maf). The CU in the Lower Basin is expected to be about 7.238 maf.

State and Local Water Reports

Ms. Jeanine Jones of the Department of Water Resources (DWR) reported that the precipitation conditions in the State were below normal. This is going to be a dry year and last year was also dry. She explained the State had good storage, which has mitigated the effects of the low precipitation and low storage in Water Year 2011. Even though this year is hydrologically a dry year, reservoir storage is pretty much either at, or just slightly above, average. The Eight Station Precipitation Index for the Sacramento River system and the Five Station Index for the San Joaquin system set a record low for this year over the January, February, and March period going back to the 1920's. The snowpack in the Sierra system actually peaked rather early in March. The forecasted runoff throughout the Sierra Nevada is likely to be low with low snowpack. The runoff actually ranges from a high of 74 percent on the Feather River down to 24 percent on the Tule River in the south end of San Joaquin Valley.

Ms. Jones described the Drought Prediction Workshop that DWR and Western States Water Council will hold from April 29th through May 1st in San Diego, California. The purpose of the workshop is to work with the federal agencies to encourage them to put more resources and effort into developing more effective methods for predicting drought and its severity. She encouraged staff to attend.

Board Member Mr. Peterson reported that reservoir storage for the Metropolitan Water District of Sothern California (MWD) is at 82 percent. MWD's diversion of Colorado River water is estimated to be about 848,000 acre-feet for calendar year 2013. MWD's use of Colorado River water is currently below average, but water use is likely to increase because of the dry conditions. The February delivery was 195,000 acre-feet, which was 83 percent of the 248,000 acre-feet historically delivered.

Board Member Mr. Pettijohn of Los Angeles Department of Water and Power (LADWP) reported that deliveries of water from the Los Angeles Aqueduct may be the lowest in the history of the system due to the dry winter conditions. Additionally, there is

water going out onto Owens Lake bed and other environmental mitigation projects in the Owens Valley. It is anticipated that less than 100,000 acre-feet of water will be coming from the aqueduct this year. The City of Los Angeles will be buying more water from MWD than in a normal year. LADWP anticipates buying an additional 100,000 acre-feet from MWD this coming year.

Colorado River Operations

Coachella Valley Water District Names Mr. James Barrett as General Manager-Chief Engineer

The Board acknowledged the selection of Mr. James Barrett as the new General Manager and Chief Engineer of the Coachella Valley Water District.

Status of the Development of the Glen Canyon Dam Long-Term Experimental and Management Plan and the Glen Canyon Dam Adaptive Technical Work Group Meeting on April 3, 2013

Ms. Trujillo reported that the National Park Service and Reclamation have released a draft of the Alternative Analysis Performance Criteria for Glen Canyon Dam Long-Term Experimental and Management Plan (LTEMP) EIS. As has been reported previously, the Basin States have submitted a proposed alternative for the future operation of Glen Canyon Dam. It provides an adaptive management approach to dam operations, evaluation of impacts of water releases on species and sediment conservation downstream of the dam. The states have assembled a technical committee that works closely with a science team and the Department of the Interior (DOI). This summer, Reclamation and the National Park Service, who are the co-leads for the EIS, will hold a workshop to provide more input regarding the development of the alternatives.

On April 3, 2013, the Glen Canyon Dam Technical Work Group held a webinar meeting. Several routine technical matters were discussed, including budget proposals and updates from the science panels. The next Adaptive Management Work Group (AMWG) meeting was scheduled for May 8th by webinar.

In response to a question from Chairman Fisher, Ms. Trujillo explained that there is an intensely technical dialogue going on regarding the LTEMP EIS. The states are concerned about DOI's proposal to utilize a process called structured decision-making to analyze potential outcomes of various scenarios. It is not clear exactly how that is going to work because the issues involved are complex. For example, there may be competition between maintaining a world class trout fishery and ensuring the long-term survival of the endangered humpback chub. The comments that the states are assembling are in an effort to improve the overall process in developing a feasible LTEMP alternative.

Basin States Discussions

Colorado River Basin Water Supply and Demand Study Report Next Steps

The Basin States continue to work with Reclamation and additional stakeholders on the development of a plan for moving forward with the next steps associated with the Colorado River Basin Water Supply and Demand Study. Workshops were held in Salt Lake City, Utah, on March 25th and in Phoenix, Arizona, on March 26th. A three-hour webinar was conducted on April 3rd by Reclamation staff who gave a more in-depth presentation of the existing elements in the Basin Study. Over 200 people signed on to the webinar. It will be transcribed and posted on their website. There will be work groups associated with municipal and agricultural conservation to document the existing work that has occurred to date and to review additional opportunities for water conservation and savings. The states want to continue to focus on potential augmentation projects. California requested a more in-depth overview of the existing assumptions in the Basin Study relating to agricultural conservation, and Reclamation scheduled a telephone conference/webinar for April 19, 2013.

Minute 319 Updates and Next Steps

Ms. Trujillo commented that a series of work groups have been set up. She attended a work group meeting on April 9th in Yuma, Arizona, relating to environmental projects and the pilot program that is contemplated pursuant to Minute 319. One of the main focuses from the U.S. perspective will be to make sure that the delivery plan for the pulse flows and base flows for environmental purposes makes sense to water managers in the U.S. In addition, a focus will be on monitoring the parameters of what was agreed to in Minute 319. There have also been work group meetings related to topics such as the proposed All-American Canal turn-out that Imperial Irrigation District (IID) has been working on together with Mexico. Mexico is interested in the opportunity to take water from the All-American Canal at a turn-out location close to IID's property.

DWR Board Member Designee, Ms. Jeanine Jones, commented that DWR has been approached by both the Reclamation and the National Oceanic and Atmospheric Administration (NOAA) about expanding the use of California Irrigation Management Information System (CIMIS) program, which is a system that provides climate prediction and evapotranspiration (ET) data that can be used by the agricultural community in California. The expansion of CIMIS throughout the west, including the other Basin States and/or in Mexico, is under discussion.

In response to a question, Ms. Trujillo explained that the Minute 319 releases for the pulse flows and base flows will be Mexican water acquired and designated for these purposes. There will be a need to establish agreed-upon side-boards for the deliveries. Reclamation's Yuma Area Office is involved and they are monitoring the issues to make sure there will be no adverse impacts to users on the U.S. side. The goal is to try to have environmental benefits for the Mexican delta area from the pulse flows and the base flows, but not at the expense of adverse impacts to the U.S. users.

Basin States Technical Committee Meeting, April 17, Las Vegas, Nevada

A Basin States Technical Committee meeting will be held on April 17, 2013. Updates will be received from Reclamation associated with current and projected hydrologic conditions in the Colorado River Basin. There will be some state-specific reports, including a California report on the status of the Quantification Settlement Agreement (QSA).

OTHER BUSINESS

Next Board Meeting

Chairman Fisher announced that the next meeting of the Colorado River Board will be held on Wednesday, May 15, 2013, at 10:00 a.m. at the Holiday Inn, Ontario Airport, 2155 East Convention Center Way, Ontario, California.

There being no further items to be brought before the Board, Chairman Fisher asked for a motion to adjourn the meeting. Upon the motion of Mr. Pettijohn, seconded by Mr. Kuiper, and unanimously carried, the meeting was adjourned 11:00 a.m. on April 10, 2013.

Tanya M. Trujillo
Executive Director

3.c. - Approval of Fiscal Year 2013-2014 Colorado River Board Budget

COLORADO RIVER BOARD OF CALIFORNIA
FY 2013-14 BUDGET
(Budget Approved June 12, 2013; Assessments Approved June 12, 2013)

	Current Year Authorized FY 2012-13	Current Year Funded FY 2012-13	Anticipated Expenditures FY 2012-13	Budget FY 2013-14
1. Colorado River Board Direct Support	$ 1,545,800	$ 1,545,800	$ 1,513,800	$ 1,618,000
Six Agency Share	$ 1,545,800	$ 1,545,800	$ 1,513,800	$ 1,618,000
2. Colorado River Basin Salinity Control Forum Support	$ 40,200	$ 40,200	$ 40,200	
Six Agency Share	$ 40,200	$ 40,200	$ 40,200	
3. Total Budget Estimate Colorado River Board	$ 1,586,000	$ 1,586,000	$ 1,554,000	$ 1,618,000
Six Agency Share	$ 1,586,000	$ 1,586,000	$ 1,554,000	$ 1,618,000

STATE OF CALIFORNIA
STANDARD AGREEMENT
STD 213 (Rev 06/03)

AGREEMENT NUMBER
46
REGISTRATION NUMBER

1. This Agreement is entered into between the State Agency and the Contractor named below:

STATE AGENCY'S NAME
Colorado River Board of California

CONTRACTOR'S NAME
Six Agency Committee

2. The term of this Agreement is: July 1, 2013 through June 30, 2014

3. The maximum amount of this Agreement is: $ 1,618,000.00

4. The parties agree to comply with the terms and conditions of the following exhibits which are by this reference made a part of the Agreement.

Exhibit A – Scope of Work	1 page(s)
Exhibit B – Budget Detail and Payment Provisions	1 page(s)
Exhibit C* – General Terms and Conditions	
Check mark one item below as Exhibit D:	
☐ Exhibit - D Special Terms and Conditions (Attached hereto as part of this agreement)	NA page(s)
☐ Exhibit - D* Special Terms and Conditions	
Exhibit E – Additional Provisions	NA page(s)
NA	

Items shown with an Asterisk (*), are hereby incorporated by reference and made part of this agreement as if attached hereto. These documents can be viewed at www.ols.dgs.ca.gov/Standard+Language

IN WITNESS WHEREOF, this Agreement has been executed by the parties hereto.

CONTRACTOR		California Department of General Services Use Only
CONTRACTOR'S NAME *(if other than an individual, state whether a corporation, partnership, etc.)* Six Agency Committee		
BY *(Authorized Signature)*	DATE SIGNED *(Do not type)*	
PRINTED NAME AND TITLE OF PERSON SIGNING Dana B. Fisher, Jr., Chairman		
ADDRESS c/o 770 Fairmont Ave., Suite 100, Glendale, CA 91203-1068		
STATE OF CALIFORNIA		
AGENCY NAME Colorado River Board of California		
BY *(Authorized Signature)*	DATE SIGNED *(Do not type)*	
PRINTED NAME AND TITLE OF PERSON SIGNING Tanya M. Trujillo, Executive Director		☐ Exempt per:
ADDRESS 770 Fairmont Ave., Suite 100, Glendale, CA 91203-1068		

EXHIBIT A

WHEREAS, pursuant to Part 5 of Division 6 of the California Water Code, the Colorado River Board of California has the duty and responsibility to protect the rights and interests of the State of California, its agencies and citizens in the water and power resources of the Colorado River System; and

WHEREAS, the 2013-14 State Budget sets forth an expenditure program for the Colorado River Board of California in the amount of $1,618,000.00; and

WHEREAS, the 2013-14 State Budget provides for neither General Fund nor California Environmental License Plate Fund support to the Board; and

WHEREAS, the State Agency and Contractor consider that it is in the best interest of the people of the State of California to maintain the program set forth in the 2013-14 State Budget, and to carry out this objective, State Agency and Contractor agree that the Contractor shall fund and the State Agency shall accept the cost of said budget in the amount of $1,618,000.00, as modified by subsequent adjustments pursuant to the Budget Act of 2013 and Executive Orders of the Governor and in accordance with Exhibit B;

NOW, THEREFORE, State Agency and Contractor hereby agree to the terms and conditions set forth in Exhibit B.

EXHIBIT B

The State Agency shall provide the program set forth in the 2013-14 State Budget within the total expenditure of $1,618,000.00 as modified by subsequent adjustments pursuant to the Budget Act of 2013 and Executive Orders of the Governor;

The Contractor shall pay the sum of $1,618,000.00 toward said 2013-14 State Budget, such payment to be made no later than August 30, 2013. Said funds will be used to pay California's share of the funding of the seven-state Colorado River Basin Salinity Control Forum, and related activities, the Lower Colorado River Multi-Species Conservation Program and salaries, benefits and operating expenses to support activities of the Colorado River Board.

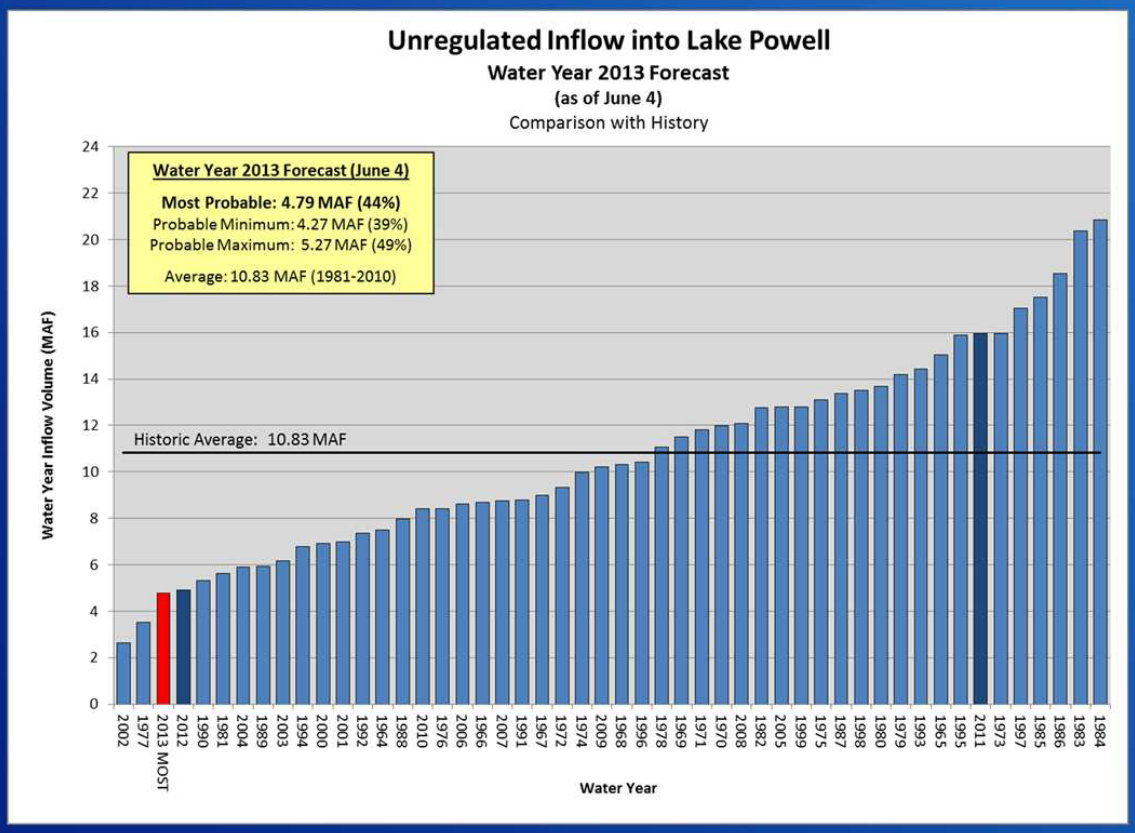
In the event at the end of the 2013-14 FY there remains an unexpended balance of the sum set forth in the 2013-14 State Budget for the Colorado River Board plus any additional funds advanced to the State Agency, State Agency shall reimburse to Contractor a sum equal to the said balance.

4.a. - Colorado River Water Report

SUMMARY WATER REPORT
COLORADO RIVER BASIN
June 1, 2013

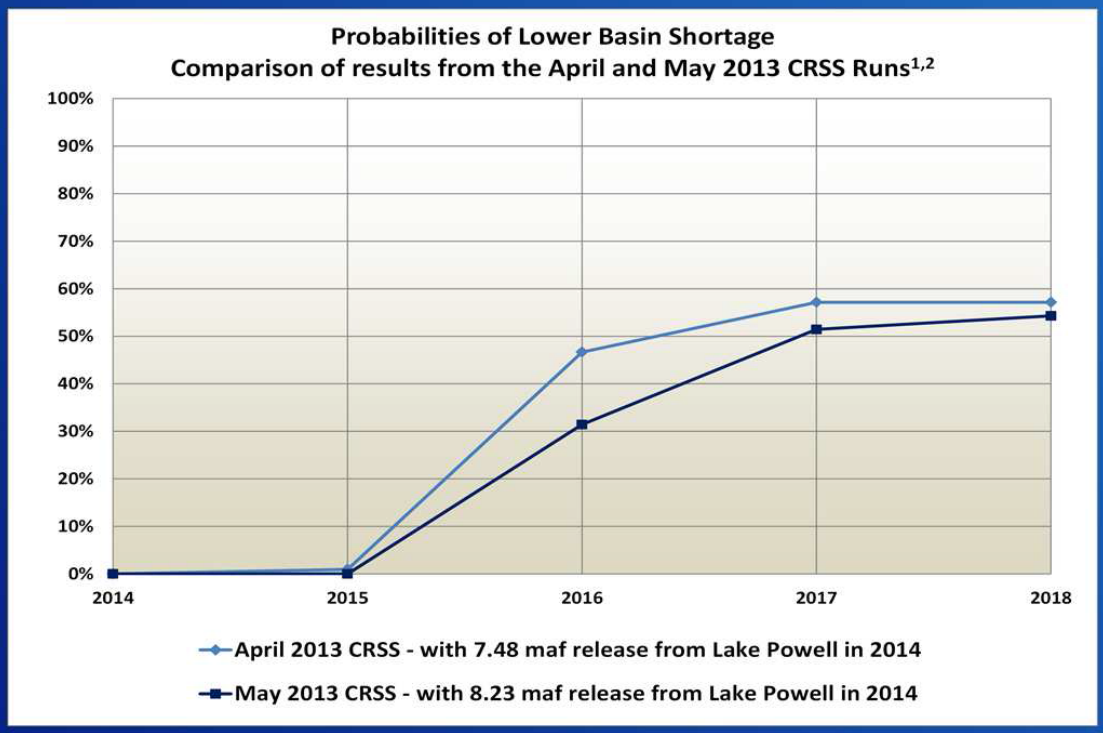
RESERVOIR STORAGE (as of May 31)	June 1, 2013 MAF	June 1, 2013 ELEV. IN FEET	June 1, 2013 % of Capacity	May 1, 2013 MAF	May 1, 2013 ELEV. IN FEET	May 1, 2013 % of Capacity
Lake Powell	11.697	3,599.4	**48**	11.422	3,596.5	**47**
Flaming Gorge	3.003	6,020.5	**80**	3.000	6,020.6	**80**
Navajo	0.990	6,028.2	**58**	0.928	6,021.8	**55**
Lake Mead	12.495	1,108.4	**48**	12.921	1,112.9	**50**
Lake Mohave	1.733	644.2	**96**	1.723	643.9	**95**
Lake Havasu	0.595	448.8	**96**	0.587	448.4	**95**
Total System Storage	31.220		**52**	31.166		**52**
System Storage Last Year	36.761		**62**	37.179		**62**

			May 6, 2013	
WY 2013 Precipitation (Basin Weighted Avg) 10/01/12 through 6/03/13	**80 percent (18.7")**		**80 percent (17.2")**	
WY 2013 Current Basin Snowpack (Basin Weighted Avg) on day of 6/03/13 (Above two values based on average of data from 116 sites.)	**64 percent (1.4")**		**77 percent (8.7")**	
			May 2, 2013	
May 16, 2013 Forecast of Unregulated Lake Powell Inflow	MAF	% of Normal	MAF	% of Avg.
2013 April through July unregulated inflow	3.000	**42 %**	3.000	**42%**
2013 Water Year	4.835	**45 %**	4.833	**45%**



RECLAMATION

Lower Basin Shortage through 2018



[1] April CRSS run: Reservoir initial conditions based on projected levels on Dec. 31, 2013, from the April 2013 24-Month Study (7.48 maf from Powell in 2014)

[2] May CRSS run: Reservoir initial conditions based on projected levels on Dec. 31, 2013, from the May 2013 24-Month Study (8.23 maf from Powell in 2014)

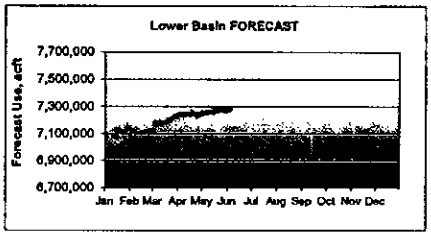
RECLAMATION

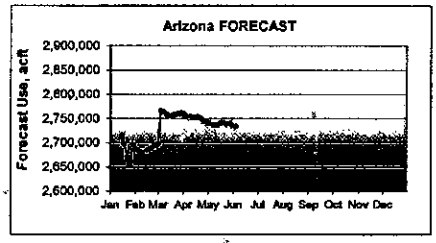
06/04/13 8:54 AM U.S. BUREAU OF RECLAMATION
LOWER COLORADO REGION
PROVISIONAL CY2013

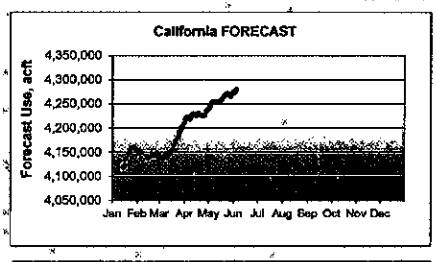
ARIZONA, CALIFORNIA, NEVADA, MEXICO
FORECAST OF END OF YEAR CONSUMPTIVE USE
FORECAST BASED ON USE TO DATE AND APPROVED ANNUAL WATER ORDERS /1
(ACRE-FEET)

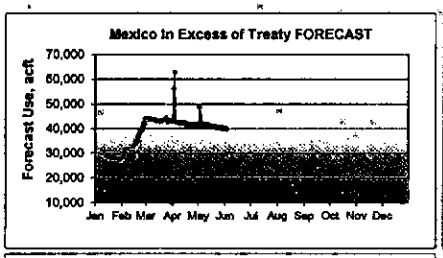
WATER USE SUMMARY	Use To Date CY2013	Forecast Use CY2013	Approved Use /2 CY2013	Excess to Approval CY2013
ARIZONA	1,246,016	2,733,206	2,799,391	-66,185
CALIFORNIA	1,856,445	4,279,282	4,112,917	166,365
NEVADA	81,033	266,349	300,000	-33,651
STATES TOTAL /3	3,183,494	7,278,837	7,212,308	66,529
MEXICO IN SATISFACTION OF TREATY (including downward d	784,339	1,539,772	1,500,000	39,772
TO MEXICO AS SCHEDULED	761,817	1,500,000		
MEXICO IN EXCESS OF TREATY	22,522	39,772		
BYPASS PURSUANT TO MINUTE 242	48,754	125,086		
TOTAL LOWER BASIN & MEXICO	4,016,587	8,943,695		

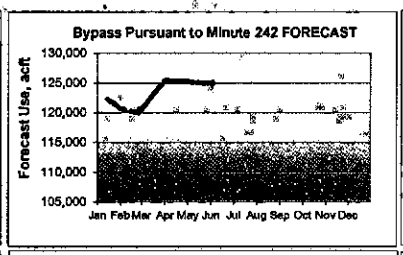
1/ Incorporates Jan-Apr USGS monthly data and 77 daily reporting stations which may be revised after provisional data reports are distributed by the USGS. Use to date estimated for users reporting monthly and annually.
2/ These values reflect adjusted apportionments. See Adjusted Apportionment calculation on each state page.
3/ Includes unmeasured returns based on estimated consumptive use/diversion ratios by user from studies provided by Arizona Dept. of Water Resources, Colorado River Board of California, and Reclamation.

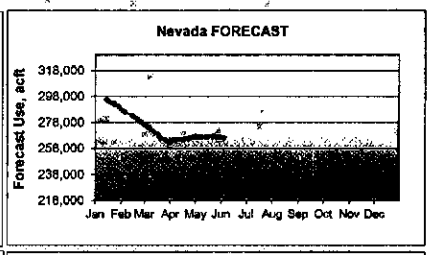


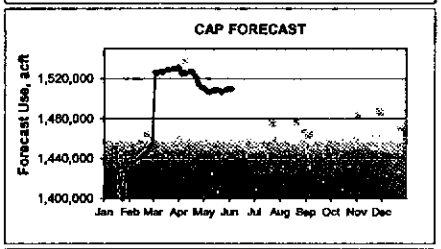


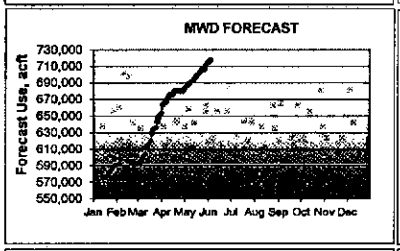


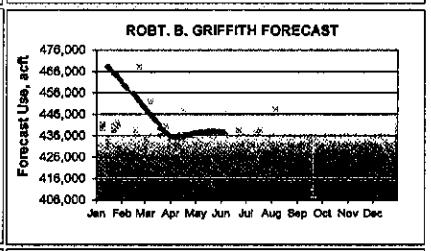


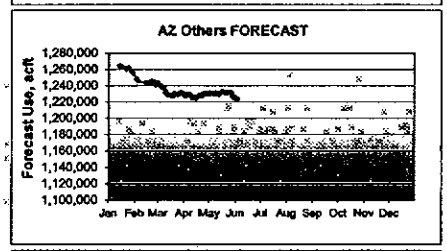


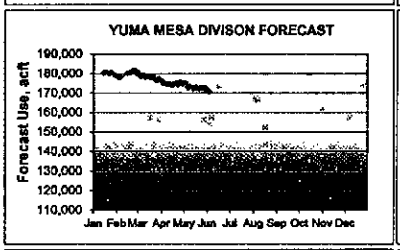


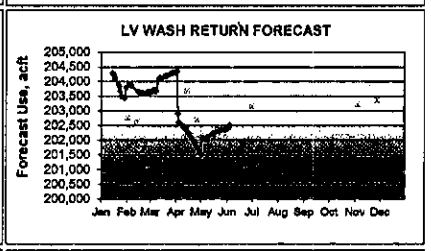


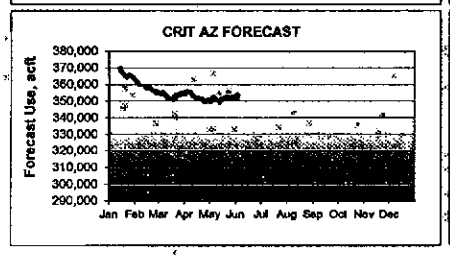


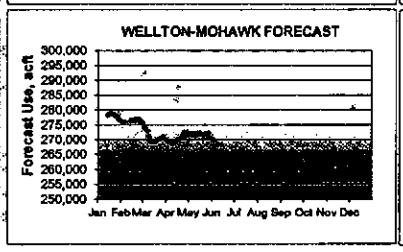


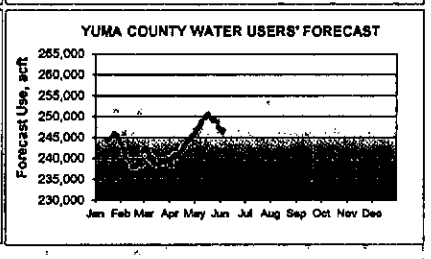












Graph notes: Jan 1 forecast use is scheduled use in accordance with the Annual Operating Plan's state entitlements, available unused entitlements, and over-run paybacks. A downward sloping line indicates use at a lower rate than scheduled, upward sloping is above schedule, and a flat line indicates a use rate equal to schedule. Lower priority users such as CAP, MWD, and Robt.B.Griffith may adjust use rates to meet state entitlements as higher priority use deviates from schedule. Abrupt changes in the forecast use line may be due to a diversion schedule change or monthly updating of provisional realtime diversions.

06/04/13

U.S. BUREAU OF RECLAMATION
LOWER COLORADO REGION
PROVISIONAL CY2013

NOTE:
- Diversions and uses that are pending approval are noted in *red italics*.
- Water users with a consumptive use entitlement - **Excess to Estimated Use** column indicates overrun/underrun of entitlement. Dash in this column indicates water user has a diversion entitlement.
- Water user with a diversion entitlement - **Excess to Approved Diversion** column indicates overrun/underrun of entitlement. Dash in this column indicates water user has a consumptive use entitlement.

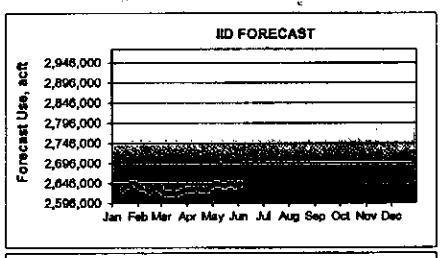
CALIFORNIA WATER USERS
FORECAST OF END OF YEAR CONSUMPTIVE USE
FORECAST BASED ON USE TO DATE AND APPROVED ANNUAL WATER ORDERS
California Schedules and Approvals
Historic Use Records (Water Accounting Reports)

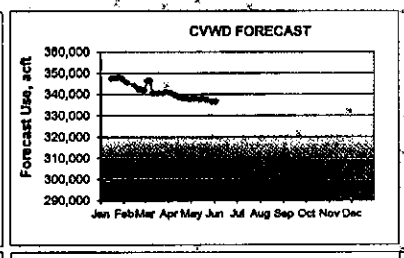
WATER USER	Use To Date CY2013	Forecast Use CY2013	Estimated Use CY2013	Excess to Estimated Use CY2013	Diversion To Date CY2013	Forecast Diversion CY2013	Approved Diversion CY2013	Excess To Approved Diversion CY2013
CALIFORNIA PUMPERS	780	1,725	1,725	—	1,411	3,119	3,119	0
FORT MOJAVE INDIAN RESERVATION, CA	3,725	8,440	8,910	—	6,925	15,691	16,565	-874
CITY OF NEEDLES (includes LCWSP use)	873	1,931	1,931	0	1,230	2,720	2,720	0
METROPOLITAN WATER DISTRICT	350,966	717,689	563,511	—	352,248	721,760	*566,615*	—
COLORADO RIVER INDIAN RESERVATION, CA	1,676	3,705	3,705	—	4,227	9,345	9,345	0
PALO VERDE IRRIGATION DISTRICT	176,386	443,551	437,084	—	387,660	965,190	947,155	**18,035**
YUMA PROJECT RESERVATION DIVISION	24,260	44,447	47,023	—	42,953	92,715	99,900	-7,185
YUMA PROJECT RESERVATION DIVISION - INDIAN UNIT	—	—	—	—	20,357	44,566	48,600	-4,034
YUMA PROJECT RESERVATION DIVISION - BARD UNIT	—	—	—	—	22,596	48,148	51,300	-3,152
YUMA ISLAND PUMPERS	1,739	3,845	3,845	—	3,143	6,950	6,950	0
FORT YUMA INDIAN RESERVATION - RANCH 5	0	604	1,046	—	0	1,092	1,891	-799
IMPERIAL IRRIGATION DISTRICT	1,153,079	2,645,615	2,626,340	**19,275**	1,145,732	2,706,874	*2,731,917*	—
SALTON SEA SALINITY MANAGEMENT	12,156	70,000	70,000	0	12,615	72,303	72,270	—
COACHELLA VALLEY WATER DISTRICT	130,534	336,934	347,000	-10,066	134,635	347,611	-361,165	—
OTHER LCWSP CONTRACTORS	271	599	599	—	437	967	967	0
CITY OF WINTERHAVEN	0	69	69	—	0	104	104	0
CHEMEHUEVI INDIAN RESERVATION	0	128	6,101	—	5,129	11,340	11,340	0
TOTAL CALIFORNIA	1,856,445	4,279,282			2,141,298	4,957,781	4,832,023	
FORT YUMA INDIAN RESERVATION /1	—	—	—	—	21,752	48,777	53,610	-4,833

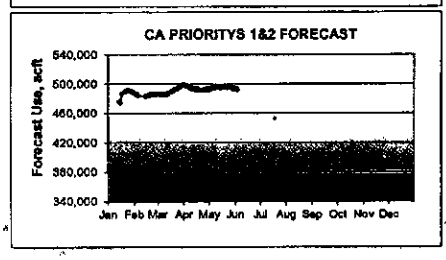
CALIFORNIA ADJUSTED APPORTIONMENT CALCULATION	
California Basic Apportionment	4,400,000
Payback of IOPP Overrun (IID, Ft Mojave)	*-62,083*
Intentionally Created Surplus Water (IID)	*-25,000*
Creation of Extraordinary Conservation ICS (MWD)	*-200,000*
Total State Adjusted Apportionment	4,112,917
Excess to Total State Adjusted Apportionment	166,365

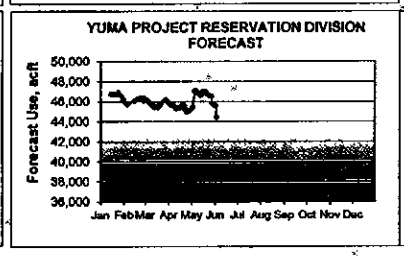
ISG ANNUAL TARGET COMPARISON CALCULATION	
Priorities 1, 2, 3b Use (PVID+YPRD+Island+PVID Mesa)	491,843
MWD Adjustment	-71,843
Total California Agricultural Use (PVID+YPRD+Island+IID+CVWD)	3,474,392
California Agricultural Paybacks	-52,000
Misc. PPRs Covered by IID and CVWD	14,500
California ICS Creation (IID ICS)	25,000
Total Use for Target Comparison[2]	3,380,049
ISG Annual Target (Exhibit B)	3,462,000
Amount over/(under) ISG Annual Target	(81,951)

NOTES:
Ranch 5
Yuma Island assumed to be included in Priority 2.
Click on California Schedules and Approvals above for incoming diversion schedules and approvals.
1/ Fort Yuma Indian Reservation includes Yuma Project Reservation Division Indian Unit, Ranch 5, an estimate of domestic use and pumpers.
2/ Includes MWD Adjustment, California Agricultural Use and Paybacks, IID-CVWD covered PPRs, and taking out the MWD-CVWD Exchange









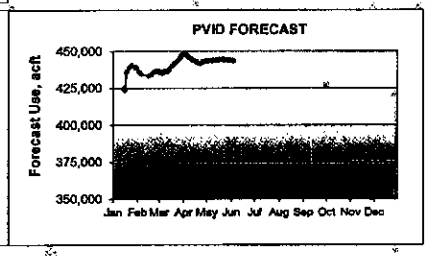


Figure 1. SNOTEL Water-Year-To-Date (WYTD) SWE for the CO headwaters basin

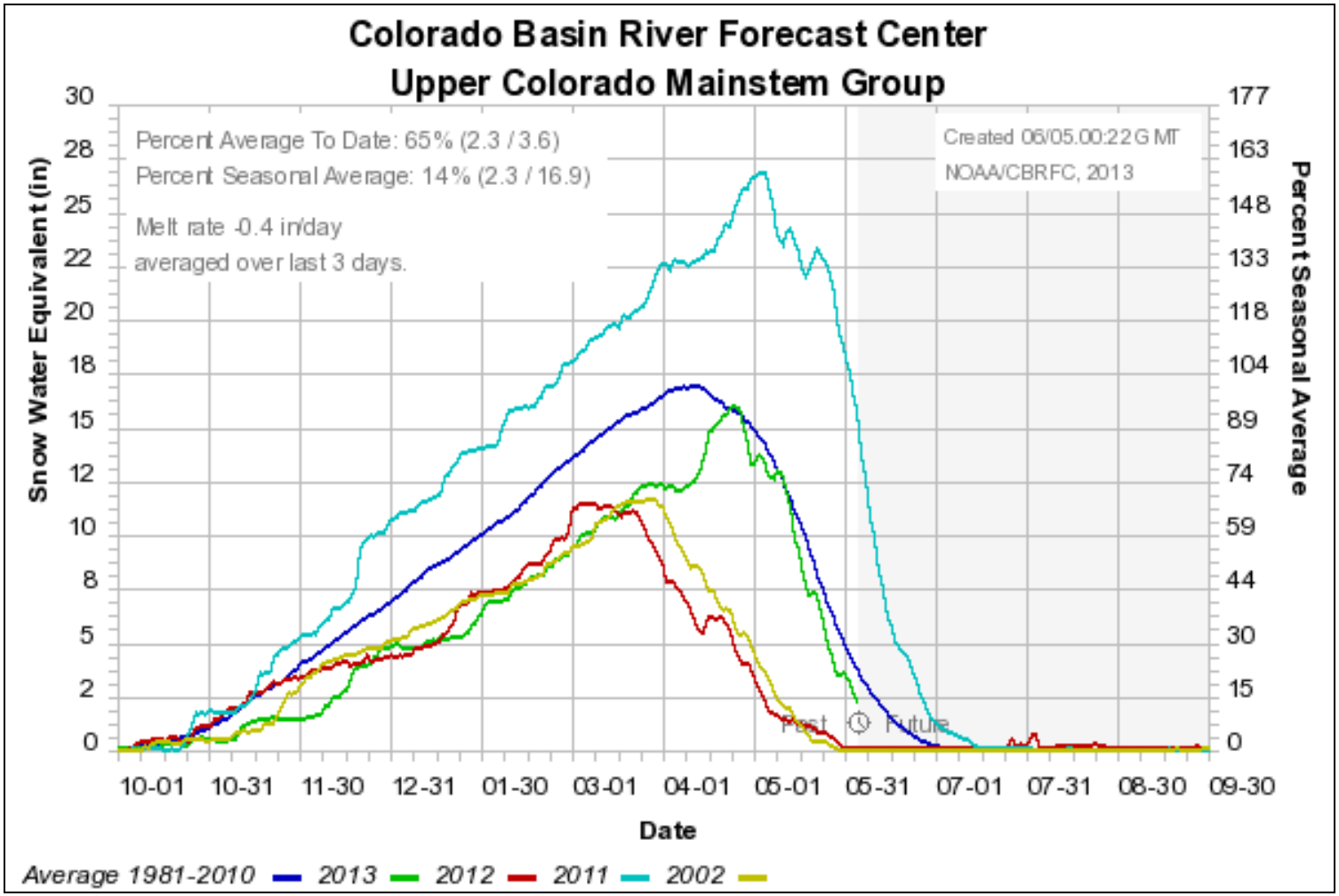
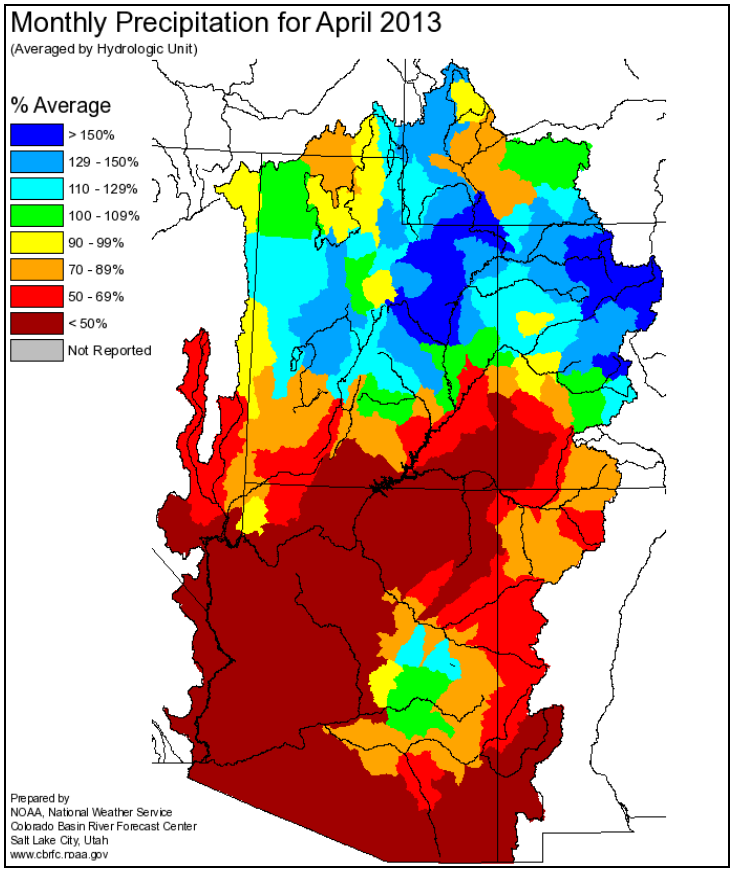


Figure 2. NOAA National Weather Service Monthly Precipitation Maps for April and May 2013



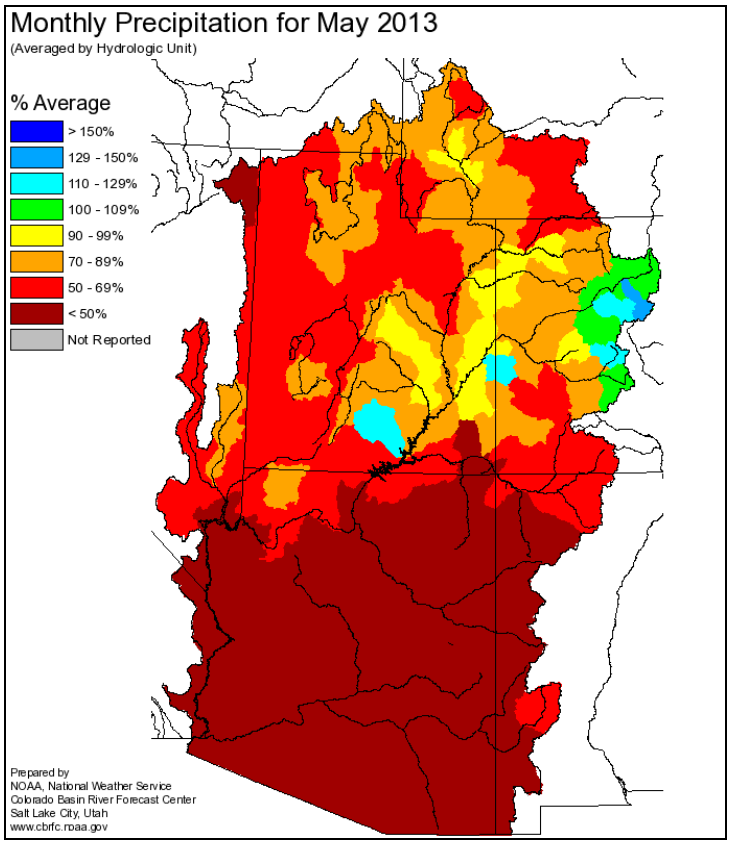
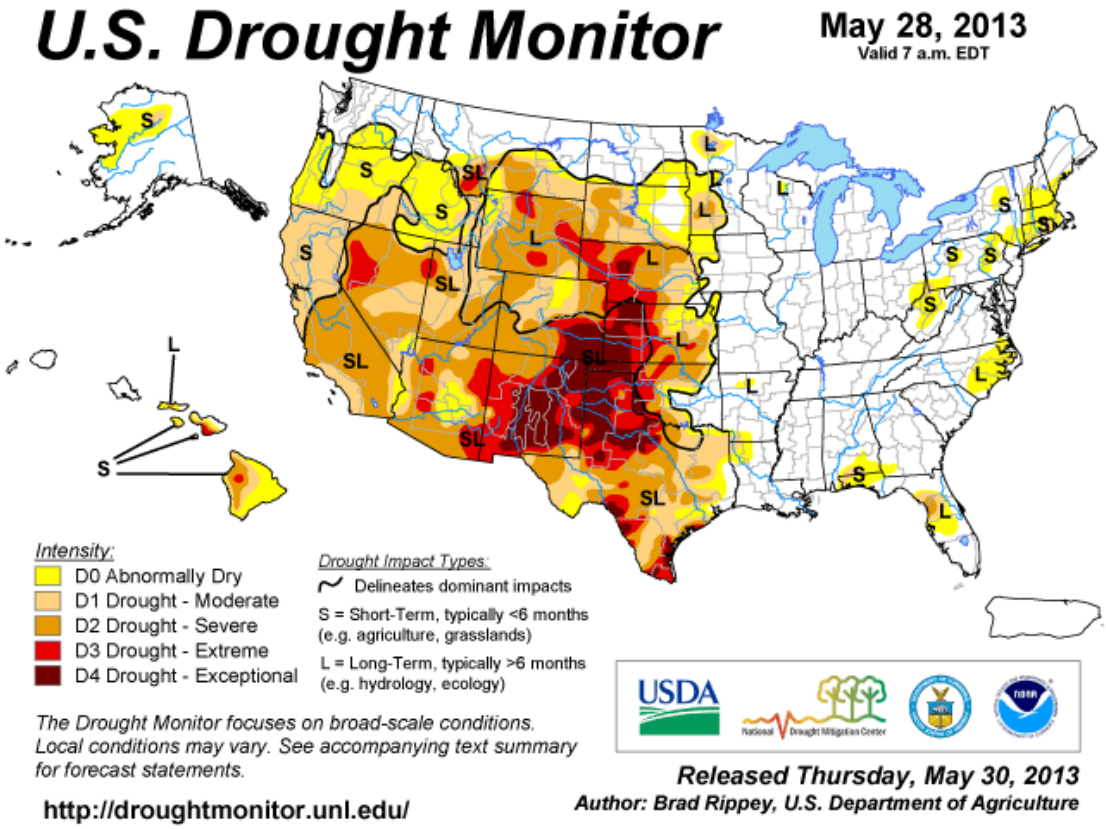
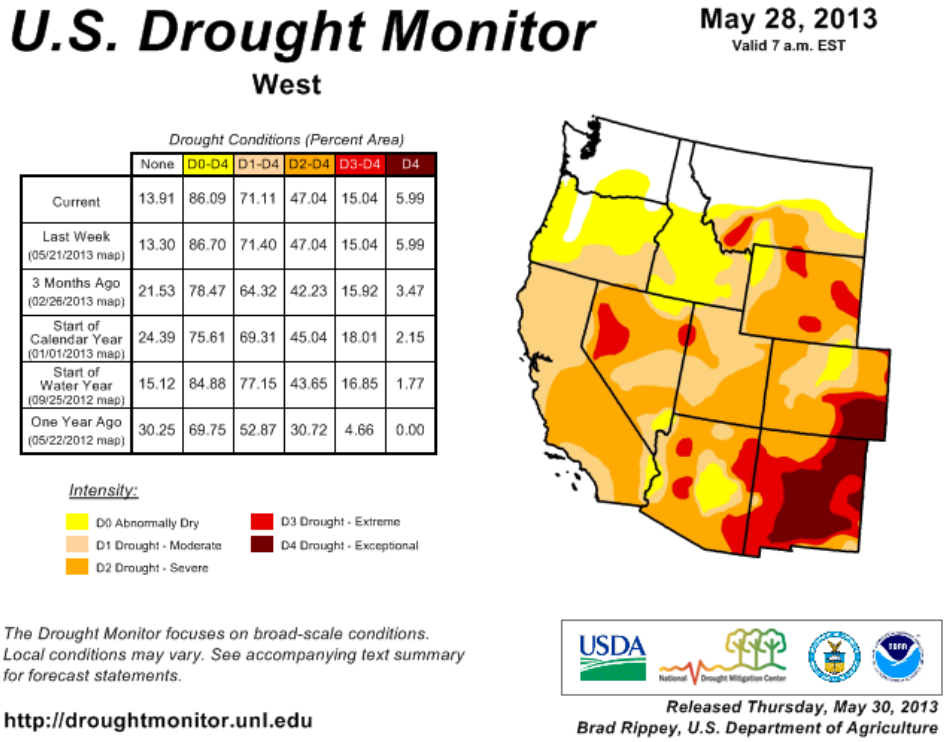


Figure 3. USDA United States Drought Monitor Map



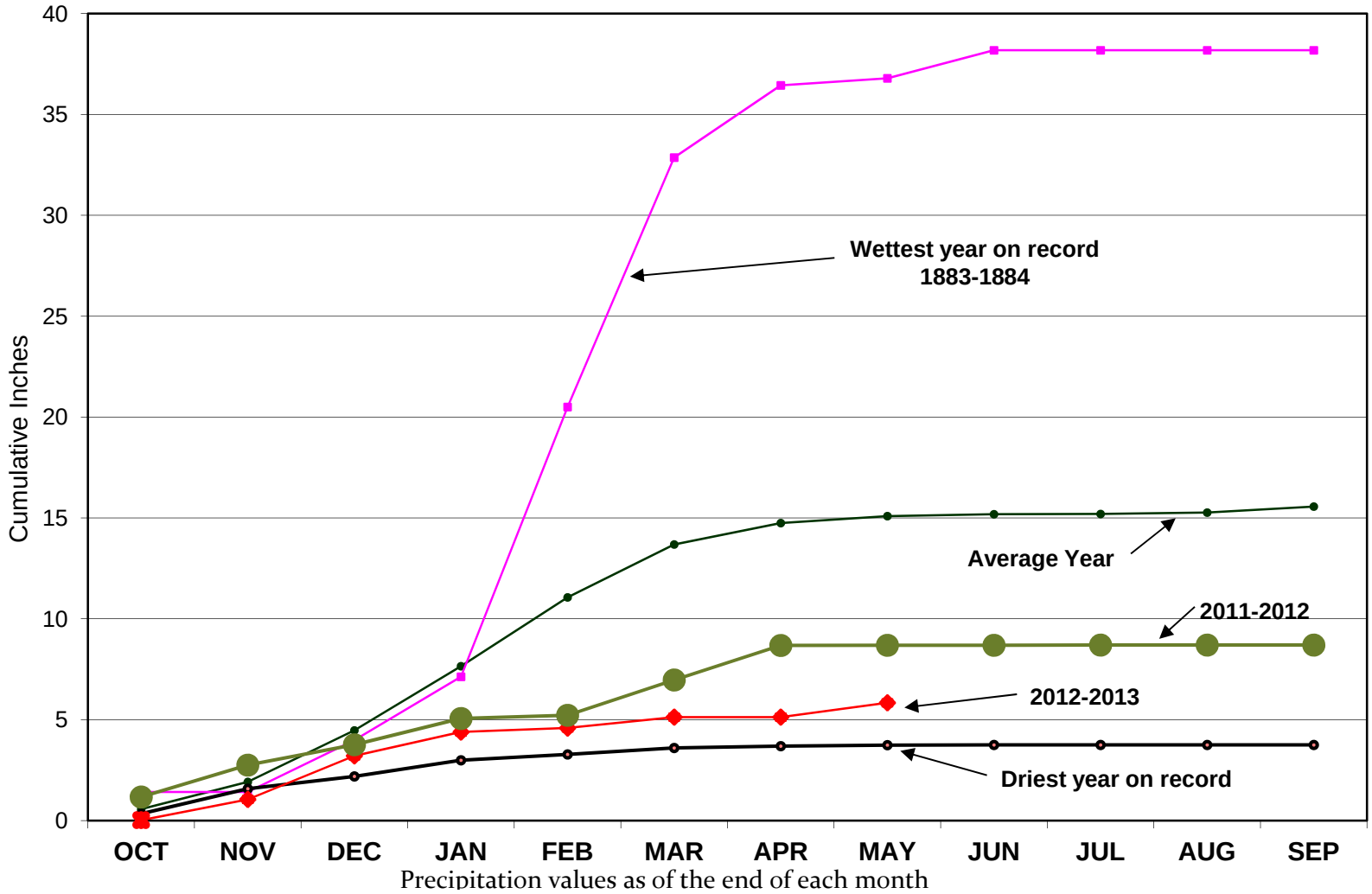


Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	13.91	86.09	71.11	47.04	15.04	5.99
Last Week (05/21/2013 map)	13.30	86.70	71.40	47.04	15.04	5.99
3 Months Ago (02/26/2013 map)	21.53	78.47	64.32	42.23	15.92	3.47
Start of Calendar Year (01/01/2013 map)	24.39	75.61	69.31	45.04	18.01	2.15
Start of Water Year (09/25/2012 map)	15.12	84.88	77.15	43.65	16.85	1.77
One Year Ago (05/22/2012 map)	30.25	69.75	52.87	30.72	4.66	0.00

4.b. - State and Local Water Reports

Los Angeles Civic Center Precipitation

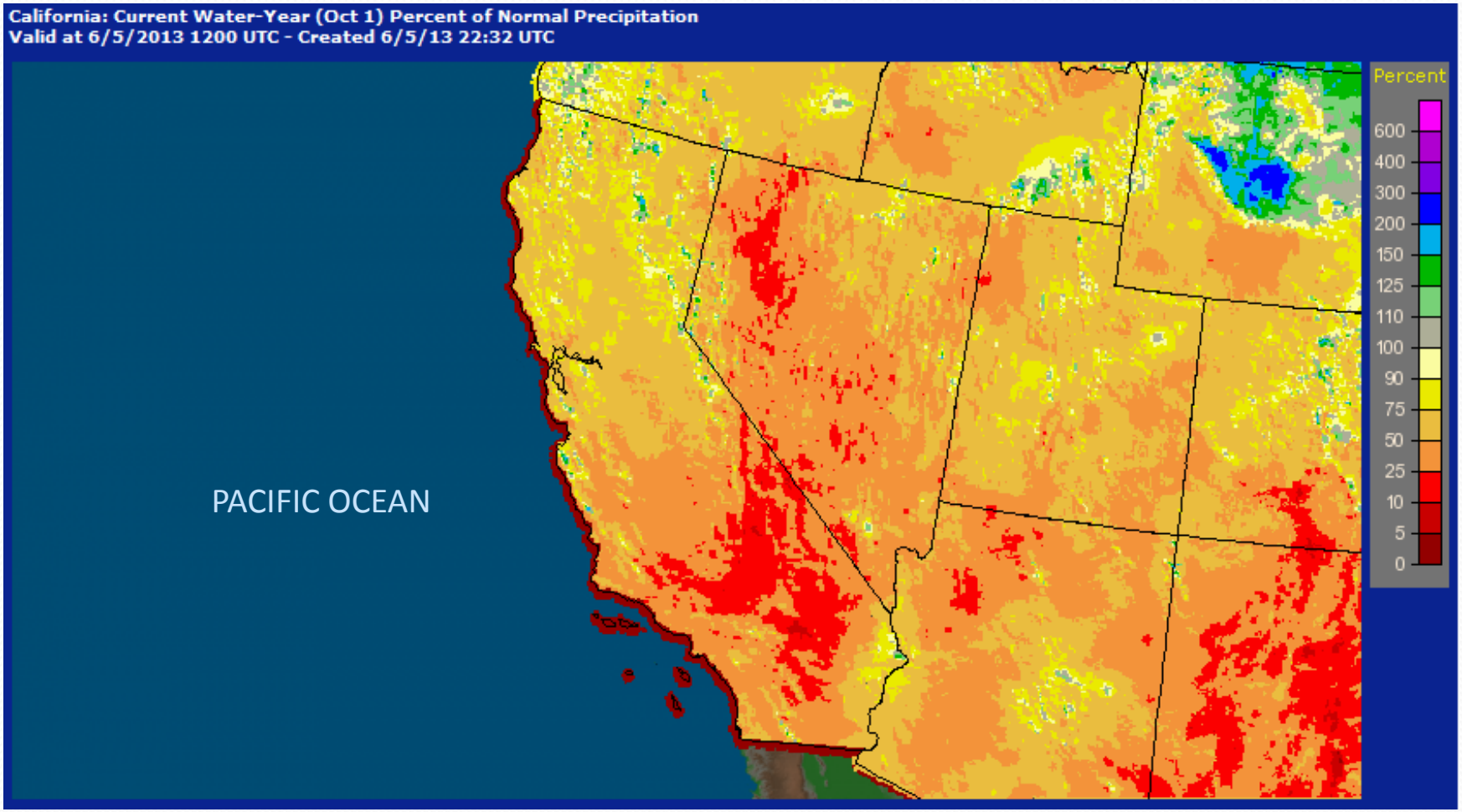


Precipitation at Six Major Stations in Southern California

From October 1, 2012 to June 1, 2013

Station	Precipitation in inches May	Precipitation in inches Oct 1 to June 1	Average to Date	Percent of Average
San Luis Obispo	0.11	7.91	22.00	36%
Santa Barbara	0.01	8.15	17.44	47%
Los Angeles	0.71	5.84	15.09	39%
San Diego	0.21	4.23	9.85	43%
Blythe	0.00	1.82	2.57	71%
Imperial	0.00	0.80	2.18	37%

CA Current Water Year - Percent of Normal Precipitation



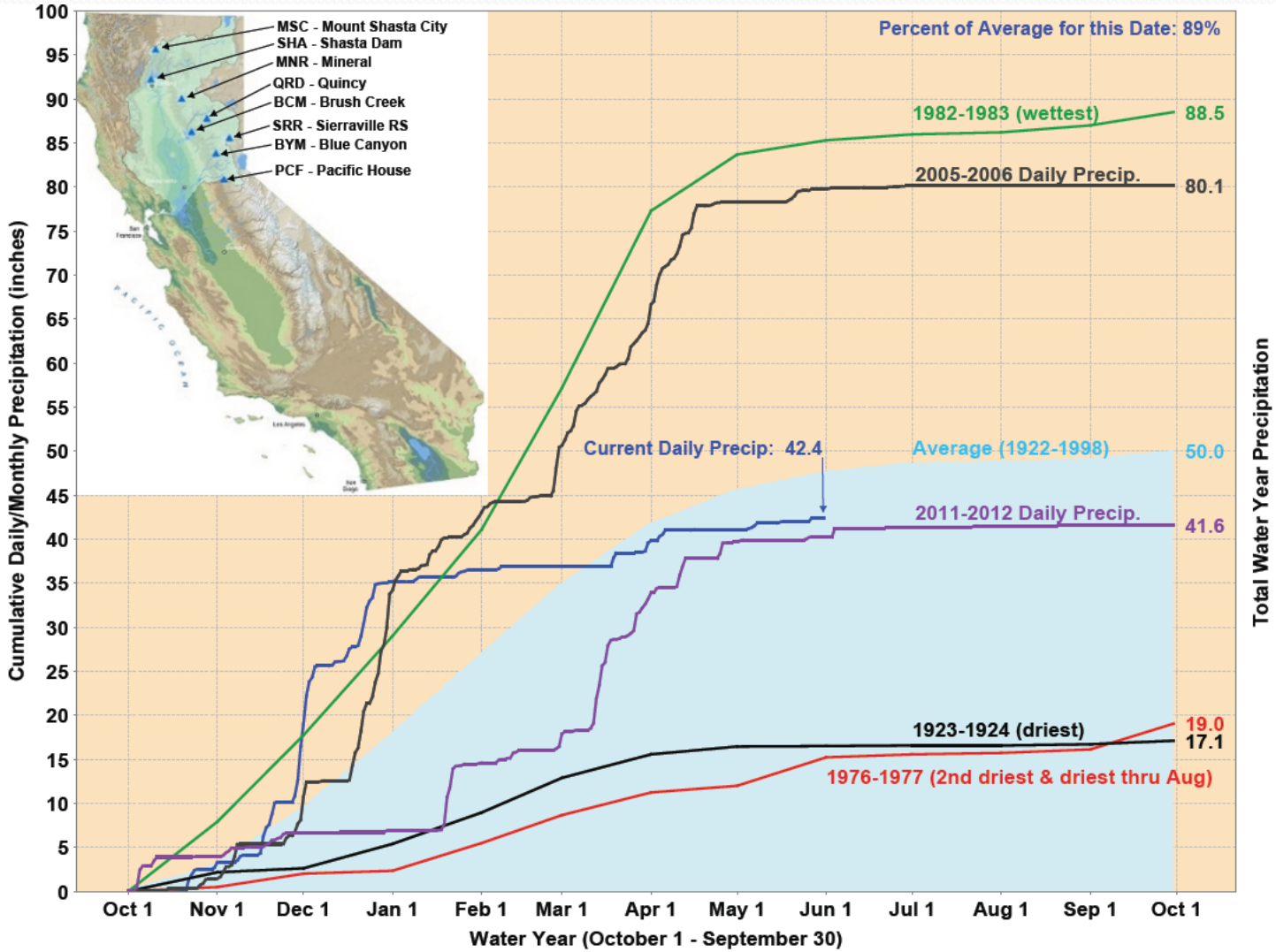
National Weather Service –Advance Hydrologic Prediction Center
http://water.weather.gov/precip/

Statewide Summary of Water-Year Data as of June 1, 2013

Water Year	Precipitation (233 Stations) % of avg.	Runoff (31 Rivers) % of avg.	Res. Storage (155 Reservoirs) % of avg.	Sacto. Riv. Run-off * (MAF)
2008-09	80	65	80	12.9
2009-10	110	90	105	15.9
2010-11	135	145	130	15.1
2011-12	75	60	95	11.8
Comparison of Water Year Data as of June 1				
2011-12	75	65	105	10.1
2012-13	75	70	85	10.3

* The Sacramento River Run-off is the sum of the unimpaired water year flow from the Sacramento River above Bend Bridge near Red Bluff, Feather River inflow to Oroville, Yuba River at Smartville, and American River inflow to Folsom. The average annual run-off is 18.4 MAF.

Northern Sierra Precipitation-8 Station Index - May 31, 2013



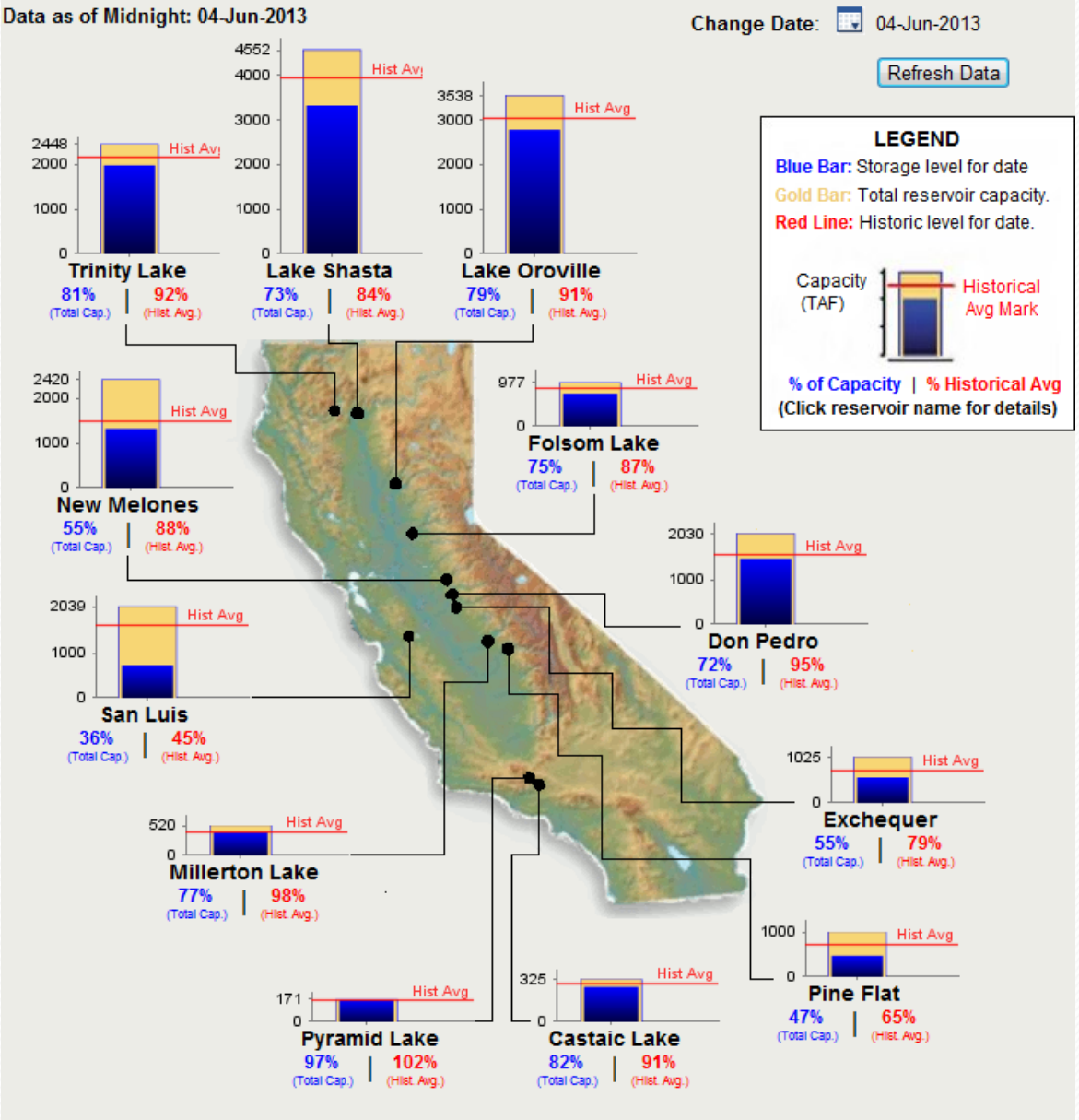
California Data Exchange Center
http://cdec.water.ca.gov/cgi-progs/products/PLOT_ESI.pdf

Comparison of SWP Water Storage: June '12 vs June '13

		2012 Storage (acre-feet)		2013 Storage (acre-feet)	
Reservoir	**Capacity**	**As of 6/1/2012**	**% of Cap.**	**As of 6/1/2013**	**% of Cap.**
Frenchman	55,475	43,646	79%	36,382	66%
Lake Davis	84,371	68,152	81%	67,329	80%
Antelope	22,564	22,788	101%	22,676	100%
Oroville	3,553,405	3,498,693	98%	2,803,656	79%
TOTAL North	3,715,815	3,633,279	98%	2,930,043	79%
Del Valle	39,914	35,459	89%	40,241	101%
San Luis (DWR)	1,062,180	762,788	72%	314,208	30%
Pyramid	169,901	165,599	97%	165,485	97%
Castaic	319,247	308,818	97%	272,362	85%
Silverwood	74,970	73,195	98%	71,397	95%
Perris	126,841	73,840	58%	72,663	57%
TOTAL South	1,793,053	1,419,699	79%	936,356	52%
TOTAL SWP	5,508,868	5,052,978	92%	3,866,399	70%

State Water Project Projected Deliveries:
On March 22, 2013, Table-A allocations <u>decreased from 40% to 35%</u>

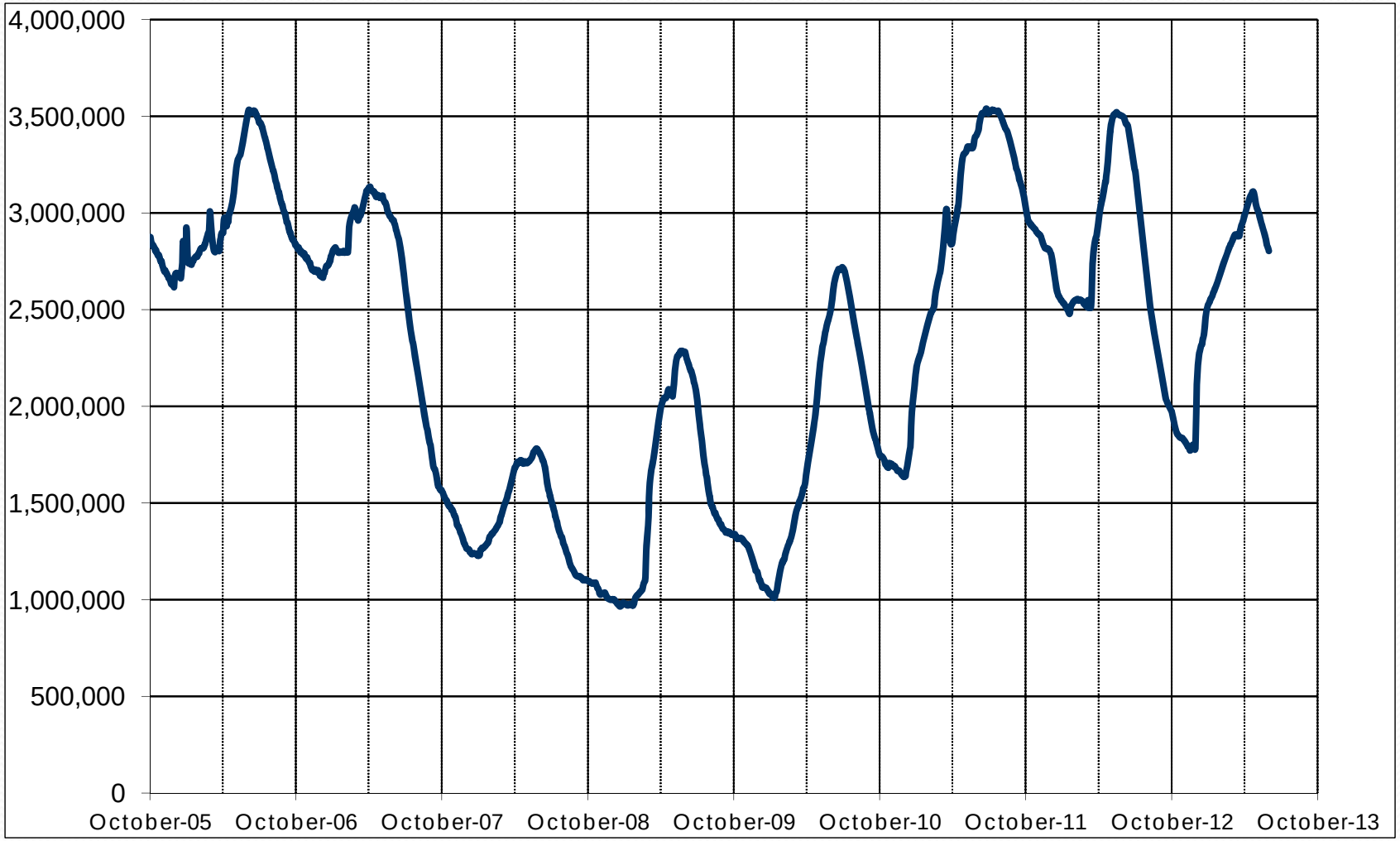
Current Reservoir Conditions



http://cdec.water.ca.gov/cdecapp/resapp/getResGraphsMain.action

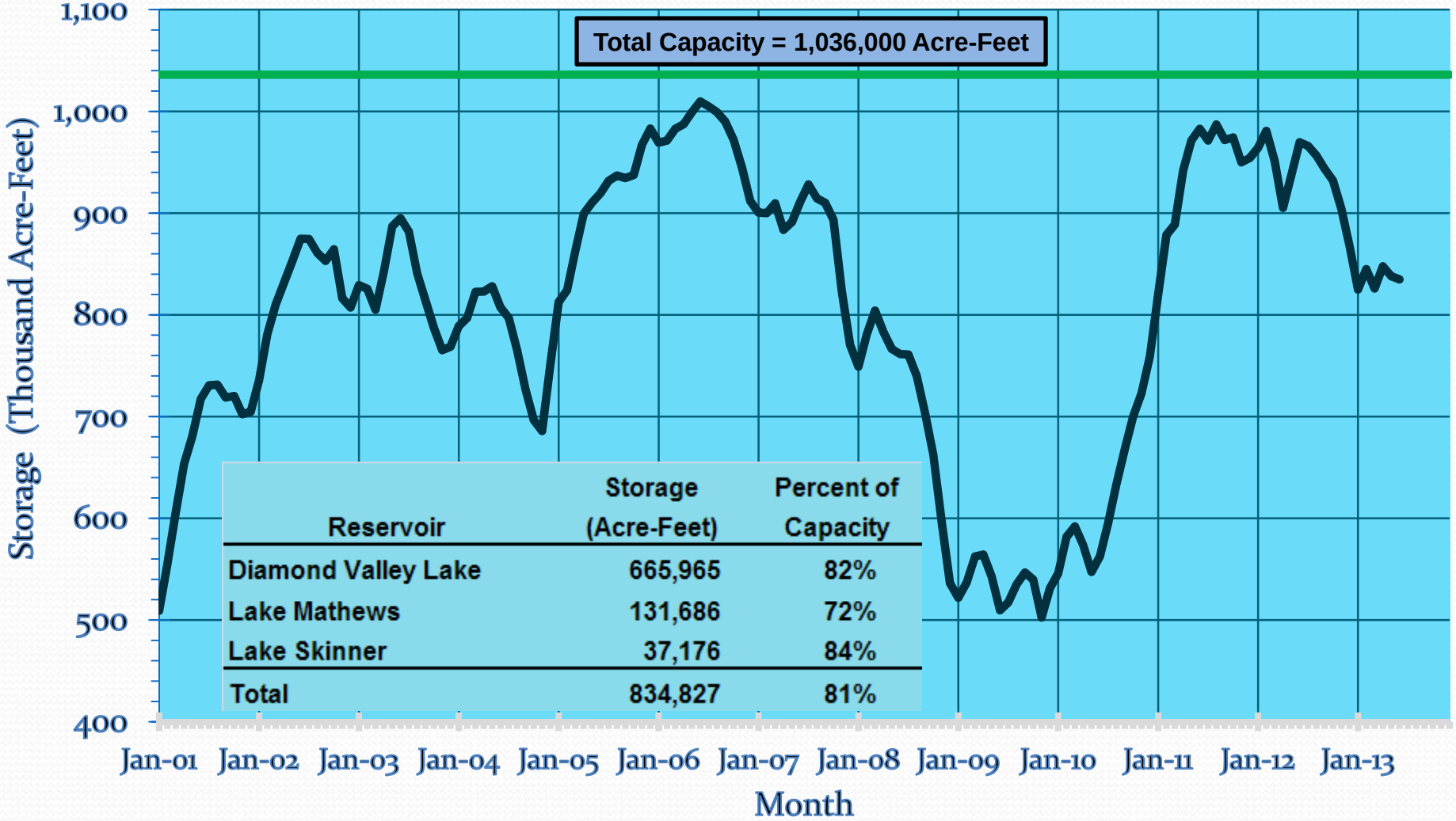
Oroville Storage (acre-feet)

October 1, 2005 – June 1, 2013



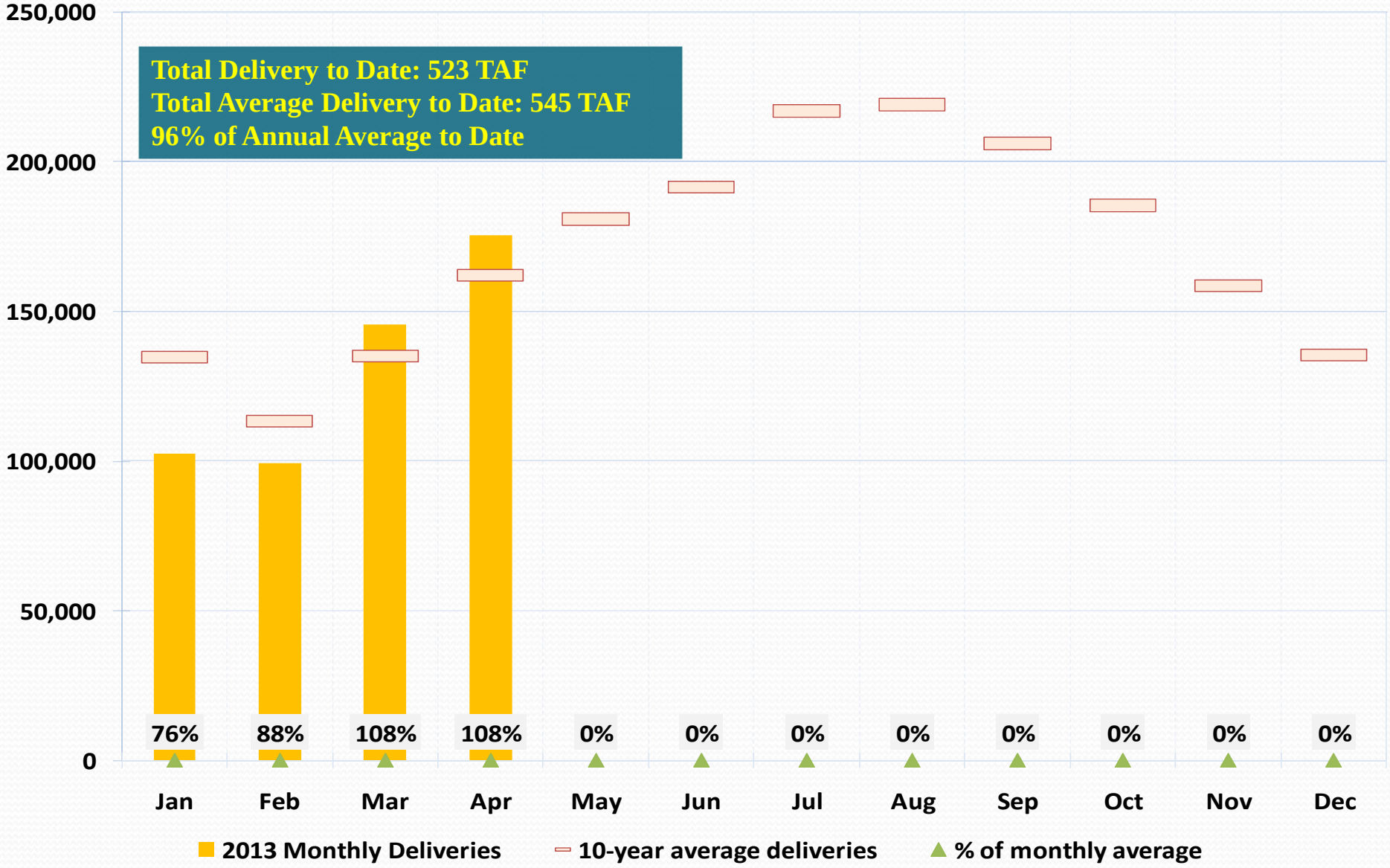
MWD's Combined Reservoir Storage as of June 1, 2013

Lake Skinner, Lake Mathews, and Diamond Valley Lake



Reservoir	Storage (Acre-Feet)	Percent of Capacity
Diamond Valley Lake	665,965	82%
Lake Mathews	131,686	72%
Lake Skinner	37,176	84%
Total	834,827	81%

2013 Water Deliveries to Member Agencies (AF)



4.c. - Colorado River Operations

RECLAMATION

Managing Water in the West

2014 Colorado River Annual Operating Plan

Colorado River Management Work Group
First Consultation
May 30, 2013

U.S. Department of the Interior
Bureau of Reclamation

RECLAMATION

Managing Water in the West

DRAFT Annual Operating Plan for Colorado River Reservoirs 2014

This draft document of the 2014 AOP is based upon the published 2013 AOP. Edits, in red, indicate changes from the 2013 AOP.

*Hydrologic projections in this draft document of the 2014 AOP are based on the **April 2013 24-Month Study**. Subsequent drafts will be updated with contemporary projections of hydrology.*

Text and values highlighted in blue are provisional and subject to change.

DRAFT

U.S. Department of the Interior
Bureau of Reclamation

4.d. - Basin States Discussions

Colorado River Basin State Representatives of Arizona, California, Colorado, Nevada, New Mexico, Utah, Wyoming, and the Upper Colorado River Commission

April 15, 2013

Via E-Mail
Anne_Castle@ios.doi.gov

The Honorable Anne J. Castle
Assistant Secretary for Water and Science
U.S. Department of the Interior
Office of the Secretary
1849 C. Street, NW, MS-6640
Washington, D.C. 20240

Re: Comments on Resource Goals, Performance Criteria, and Structured Decision Making Process for the Long-Term Experimental and Management Plan for the Operation of Glen Canyon Dam

Dear Assistant Secretary Castle:

Enclosed please find technical comments submitted by the seven Colorado River Basin States and the Upper Colorado River Commission regarding the Draft Performance Criteria dated February 21, 2013, for the Glen Canyon Dam Long-Term Experimental and Management Plan (LTEMP) Environmental Impact Statement (EIS) and the structured decision making process proposed to be used in connection with that EIS. As you know, we have representation in the Glen Canyon Dam Adaptive Management Work Group, and in some cases, Cooperating Agency status in the LTEMP EIS process. On January 31, 2012, we submitted scoping comments relating to the LTEMP and the enclosed comments are a continuation of that ongoing EIS process.

We appreciate the opportunity to comment on the structured decision making process and the Draft Performance Criteria. We have a particular interest in ensuring the success of the LTEMP while avoiding potential negative impacts. We would like the LTEMP EIS process to include our input and recommendations, especially those relating to the Law of the River, and we ask that the Department of Interior consider and incorporate the enclosed comments. We believe these issues are very important and would like to schedule a time to discuss these comments with you at your earliest convenience.

Sincerely,

Sandra A. Fabritz-Whitney
Director
Arizona Department of Water Resources

Dana B. Fisher, Jr.
Chairman
Colorado River Board of California

Jennifer Gimbel
Director
Colorado Water Conservation Board

Patricia Mulroy
General Manager
Southern Nevada Water Authority

Jayne Harkins
Executive Director
Colorado River Commission of Nevada

Estevan R. López
Director
New Mexico Interstate Stream Commission

Dennis J. Strong
Director
Utah Division of Water Resources
Utah Interstate Stream Commissioner

Patrick T. Tyrrell
State Engineer
State of Wyoming

Don A. Ostler
Executive Director and Secretary
Upper Colorado River Commission

Enclosures

cc: Mr. Glen W. Knowles, Chief, Adaptive Management Group, Bureau of Reclamation, Upper Colorado Region
Mr. Rob Billerbeck, Colorado River Coordinator, National Park Service
Dr. Kirk E. LaGory, Senior Program Manager, Argonne National Laboratory

Memorandum

April 15, 2013

To: Principals of the Seven Colorado River Basin States and the Upper Colorado River Commission

Re: Comments on Resource Goals, Performance Criteria, and Structured Decision Making Process for the Long-Term Experimental and Management Plan for the Operation of Glen Canyon Dam.

The Department of the Interior ("Department") invited the seven Colorado River Basin States and the Upper Colorado River Commission to comment on the Draft Performance Criteria for the Glen Canyon Dam Long-Term Experimental and Management Plan Environmental Impact Statement, dated February 21, 2013, ("Performance Criteria") and the structured decision making process ("SDM") to be used in connection with the Environmental Impact Statement ("EIS") for the Long-Term Experimental and Management Plan for Operation of Glen Canyon Dam ("LTEMP").

Science Panel Comments

We requested a panel of preeminent scientists with expertise in relevant Grand Canyon resources to examine the SDM process and Performance Criteria. We support their specific comments and incorporate them herein by this reference. The comments are provided as Attachment A to this memorandum for your consideration.

Additional Comments

Our independent comments concerning the SDM process and Performance Criteria are set forth below.

A. Reliance on the SDM Process – During the February Glen Canyon Dam Adaptive Management Work Group ("AMWG") meeting, the Department introduced the concept of potentially using a "structured-decision analysis" process in connection with the LTEMP EIS. Based on discussions during that meeting, we understand and confirm that the SDM process is not intended to be a "decision-making" process, and that the Department will not rely on it as the sole mechanism for screening and evaluating alternatives for the LTEMP EIS. There is still significant uncertainty regarding how the SDM process will be applied to the LTEMP EIS, and whether it will be a useful tool for comparing various scenarios. Given this uncertainty, we would appreciate additional dialogue with the Department regarding the SDM process after the Department has had a chance to review our comments.

Based on the complexities described below and in the science panel's comments attached hereto, we are concerned with broad application of this new process in the LTEMP EIS. At this time, very little of the cause-and-effect relationships of resources in the Colorado River ecosystem are understood and the complexity of the resources, issues, and science surrounding the operation of Glen Canyon Dam are not easily summarized into specific components and hypotheses.

Without knowing more details, we are wary that the SDM process may be used to set forth unknown assumptions or oversimplify resource analyses to justify whatever ultimate decision is made. The SDM process should be structured to objectively evaluate alternatives, be transparent, and provide full disclosure of how assumptions, rankings, models, and metrics are developed and decided upon.

B. Performance Criteria – The Performance Criteria are specific quantitative metrics intended to evaluate various alternatives moving forward. Although we recognize the utility of using performance criteria in general, we have a number of concerns with the proposed criteria for the LTEMP EIS.

First and foremost, we are concerned that requirements set forth in federal law, such as water deliveries and endangered species protections, are reduced to individual performance criteria to be given numerical values and weighed against other criteria. Pursuant to the Grand Canyon Protection Act, under which the LTEMP EIS is being performed, actions taken to protect, mitigate and/or improve the resources at Grand Canyon National Park and Glen Canyon National Recreation Area must be "fully consistent with and subject to the Colorado River Compact, the Upper Colorado River Basin Compact, the Water Treaty of 1944 with Mexico, the decree of the Supreme Court in *Arizona v. California*, and the provisions of the Colorado River Storage Project Act of 1956 and the Colorado River Basin Project Act of 1968 that govern allocation, appropriation, development and exportation of waters of the Colorado River basin" (the "Law of the River"). Within this context, the Department has confirmed on a number of occasions, beginning with the scoping process, that the Law of the River is a non-negotiable sideboard throughout the development of the LTEMP EIS. Therefore, components of the Performance Criteria that do not comply with the requirements set forth in the Law of the River (e.g., meeting water delivery requirements under the Colorado River Compact or the 2007 Interim Guidelines) should not be used to evaluate alternatives for the LTEMP EIS. Likewise, the requirements of the ESA should also be considered imperative.

In addition, we support the recommendations included in the attached Science Panel evaluation and as follows. First, each resource goal being considered for the Performance Criteria should track with the language and definitions of the Adaptive Management Program's Desired Future Conditions ("DFCs"), as approved by the Secretary of the Interior. The DFCs are the result of extensive

stakeholder consultation and reflect both the ideas and wording to balance the conflicting interests represented by the AMWG. It is our belief that while similar, the DFCs and resource goals as currently written have significant meaningful differences.

Second, the resource goals and objectives for the Performance Criteria need to be prioritized and baselines established against which impacts can be measured. Without such information, certain goals and objectives would be mutually exclusive and comparison of alternatives could not be achieved in an equitable manner.

Third, the resource goals and objectives should distinguish between what is possible solely through dam operations and what requires additional or different action. We understand the scope of the LTEMP EIS is intended to focus on dam operations, leaving structural options, if appropriate, for a different EIS process.

Fourth, we have a concern about how some of the proposed resource goals and criteria will be modeled and applied in this LTEMP process. Specific examples of these concerns are set forth below:

a. Archaeological and Cultural Resources performance criteria (pg. 1, lines 19-34) are founded on the principle that conserving sediment is the best method to protect these resources. From the AMWG meetings, it is clear that this may not be the case for all Tribes and all cultural sites. This criteria appears to be too broad and inadequate to address all Tribal and cultural concerns.

b. Natural Processes performance criteria (pg. 2, lines 41-50) establish an inappropriate evaluation process and fail to acknowledge the changed paradigm that has occurred in Glen and Grand Canyons since the building of Glen Canyon Dam. First, since the LTEMP EIS is focusing on a plan for operating the dam, as indicated by the EIS purpose and need statement, and confirmed within the scoping process, it is inappropriate to consider returning the ecosystem to a pre-dam condition. Second, the proposed performance criteria (pg. 2, lines 42-50) combine a mix of resources when the individual resources are already being considered. Third, these criteria overlook the need to prioritize the individual resources and the conditions of those resources. Fourth, evaluation of alternatives based on their deviation from such pre-dam conditions (which cannot be described in a manner to which everyone agrees) provides little value in this process. Finally, there is little evidence that attempting to restore such conditions would benefit key resources such as humpback chub.

c. The resource goals related to recreational experience and sediment both (pgs. 3-4, lines 101-145) appear to focus exclusively on sediment, raising the possibility that sediment will be given double weighting among the various resource goals. This is particularly troubling because it is unclear how any of the resource goals will be weighted or prioritized.

   Additionally, recreational experiences for the users of the Colorado River ecosystem include flatwater and whitewater boating, river corridor camping, and angling. Although the identified criteria are reasonable to an extent, we disagree that sand delivered by HFEs, erosion rates, and erosion risk factors are the *only* factors that measure recreational experience in the Colorado River ecosystem. Previous AMWG discussions, which have identified additional factors that could be used to evaluate recreational experience as a resource goal, should also be considered.

d. We do not believe there should be a separate water delivery resource goal and performance criteria (pgs. 5-6, lines 182-196) because water delivery is mandatory, not discretionary. In addition, the draft performance criteria do not accurately capture how water delivery is to be accomplished pursuant to the Law of the River.

   As discussed above, water delivery pursuant to the Law of the River is a requirement, and a proposed alternative that does not comply with those laws is inappropriate for evaluation in the LTEMP EIS. As such, water delivery in conformance with the Law of the River should be held paramount to other criteria, and proposed alternatives that violate the Law of the River should be eliminated from further analysis.

   Two performance criteria are proposed for evaluating water deliveries. The first criterion (pg. 6, lines 191-193) evaluates the "[f]requency of deviation from the No Action Alternative to Lake Powell Annual Operating Tier as specified by the 2007 Interim Guidelines." However, because no exceptions to meeting the requirements of the 2007 Interim Guidelines are acceptable, the frequency and volume of any exceptions are irrelevant. Compliance with the Law of the River, including the 2007 Interim Guidelines, is a mandatory sideboard for all alternatives.

   The second draft performance criterion (pg. 6, lines 194-196), which evaluates the "[f]requency and volume of exceptions to meeting the annual release target volumes specified by the 2007 Interim Guidelines," is similarly flawed. In addition, the prediction of target and actual annual release volumes using the CRSS RiverWare ("CRSS") model not only incorrectly suggests that it is acceptable to violate the Law of the River, but also misunderstands the capabilities of the CRSS model. CRSS

models the system under ideal conditions and does not accurately assess the real-time nature of evolving forecasts or operational capacity of Glen Canyon Dam. As the snow-pack season evolves and more snow is accumulated, adjustments are made to increase the volume released from Lake Powell. The interannual evolution of a real snow pack season is not accurately captured in the CRSS model; therefore, it schedules water out earlier in the year than would actually occur. Furthermore, the CRSS model does not account for maintenance activities at the dam and always assumes full generation capacity, which would minimize the appearance of deviation from the 2007 Interim Guidelines. The model is not designed to assess the occurrence of these sorts of interannual scale problems; it is designed to provide long-term probabilities and trends. The use of the CRSS model for this criterion would be inappropriate.

C. Water Quality – We agree that water quality does not rise to the level of a separate resource for which resource goals, objectives or overall performance criteria are necessary for the LTEMP EIS. To be complete and comprehensive, however, we collectively recognize and agree the LTEMP EIS should include a water quality impacts analysis as a result of the various alternative operations, and that such analysis should specifically assess impacts to water quality at Lake Mead.

Sincerely,

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Executive Director and Secretary
Upper Colorado River Commission

Attachment

Attachment A: Science Panel Evaluation

April 12, 2013

To: Colorado River Basin States and the Upper Colorado River Commission

From: Basin States' Science Panel:
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Josh Korman, Ph.D. (Ecometrics; Vancouver, BC)
Bill Pine, Ph.D., assisted by Colton Finch, M.S. (Univ. of Florida; Gainesville)
Robert A. Mussetter, Ph.D., PE (Tetra Tech; Ft. Collins, CO)
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Re: Evaluation of the Structured Decision-Making Process and Performance Criteria; Glen Canyon Dam Long-Term Experimental and Management Plan (LTEMP) Environmental Impact Statement

The seven Colorado River Basin States and the Upper Colorado River Commission representatives (collectively referred to as the Basin States) submitted the alternative, entitled "A Resource Targeted Condition-Dependent Strategy" (RTCD; July 2, 2012), as part of the Department of the Interior's preparation of a Long-Term Experimental and Management Plan Environmental Impact Statement (LTEMP EIS). A Science Panel assisted the Basin States in the development of the RTCD. The DOI has accepted the RTCD as one of eight alternatives for evaluation as part of the NEPA process.

As part of the DOI's evaluation of alternatives, the LTEMP EIS Team provided draft Resource Goals and Performance Criteria (LTEMP Team 2013) to cooperating agencies and AMWG stakeholder groups for review and comment by April 15, 2013. The Basin States requested an evaluation by the Science Panel of these goals and criteria, and the Structured Decision-Making (SDM) process being used by DOI for evaluation of the EIS alternatives. The following is the Science Panel's evaluation of these topics.

Structured Decision-Making (SDM)

The LTEMP Team currently intends to use a SDM framework for providing an initial ordering of the alternatives and for advising the Secretary of Interior on a preferred alternative. This process is being used to initially screen the alternatives and not as part of the NEPA impact analysis. The SDM framework has been used as an approach for identifying and evaluating alternatives (e.g., Runge et al. 2011a, 2011b).

The general manner in which SDM will be used to evaluate alternatives of the LTEMP has been presented to stakeholders (Runge, M. Power Point Presentation to AMWG, February 20, 2013), but specific descriptions of how—and to what extent—the SDM will be used, have not been provided as a formal or written document. It is understood that SDM will not be the only tool used, and that as SDM is used, it will be done in a

transparent and well documented manner. We recognize that SDM has been used and proven helpful in a number of situations requiring problem solving. However, it is not a universal or typical approach used in NEPA analyses and we have the following concerns about SDM as it may be applied to evaluation of alternatives for the LTEMP EIS:

- **SDM Process Tends Toward Flow-Driven Approach and not an EMP.—**The intent of the LTEMP EIS is to develop an Experimental and Management Plan (EMP). The SDM process tends toward selection of a flow-driven alternative that would be responsive to conditions, with no clear understanding of causation. This process will tend to drive selection of alternatives toward flow treatment options with no clear delineation of management policy (based on prior understanding) and scientific experimentation (to resolve uncertainty), whereas it is precisely the interaction between these two which lies at the heart of adaptive management (Walters 1986). The Notice of Intent for the LTEMP EIS clearly identifies the need for an EMP: "The purpose of the proposed action is to fully evaluate dam operations and identify management actions and experimental options that will provide a framework for adaptively managing Glen Canyon Dam over the next 15 to 20 years consistent with the GCPA and other provisions of applicable Federal law. The need for the proposed action stems from the need to utilize scientific information developed over the past 15 years to better inform Departmental decisions on dam operations and other management and experimental actions…" (Federal Register Notice of Intent, July 6, 2011).
- **Appropriateness of SDM Process.—**It is not clear if SDM is the most appropriate or effective process for evaluating alternatives for the LTEMP EIS, given the wide array of resource issues and the complexity of the Colorado River Ecosystem. The SDM has not been used in an EIS process with this much scientific uncertainty and complexity. The SDM should be continually evaluated for how well it can fulfill the Purpose and Need of the EIS. In the early stages of applying the SDM, it appears that the process does not address uncertainty with experimentation, but rather incorporates uncertainty after management actions are developed. This is the key objection to the SDM process as currently being implemented. In situations where uncertainty is high and the value of information is also high, one must be cautious in employing this approach. It is not clear at this point how the SDM process will help identify and balance management actions and experimental options and evaluate these different approaches in an apples-to-apples comparison of alternatives.
- **SDM Process Assumes Scientific Certainty.—**The SDM process, as it is being applied to the LTEMP EIS, is to produce management actions that are conditioned on the state of certain resources—and it presumes that scientific knowledge is in place to implement these specific management actions. As we note elsewhere in this evaluation, important questions regarding key resources still have to be tested to find the answers that will allow for management actions to be put into place. Further, the SDM process is not structured to advance an alternative that explores an experimental approach. The decision structure should incorporate a paradigm of experimentation. As we have highlighted, it is

premature to have a decision structure based on the paradigm that enough scientific certainty exists to produce management actions that respond to key resource conditions. Specified management actions and experiments should be set up in such a way that scientific knowledge is gained regardless of the direction of resource response and every effort possible will be made to reduce confounding from other factors—which is symptomatic of some recent Glen Canyon Dam experiments.

- **Process may not be Compatible with Adaptive Management.—**LTEMP discussions have focused on development of state-dependent decision rules. Control theorists refer to such rules as "feedback policies" and recognize that such rules are not adaptive policies and in fact can result in actively anti-adaptive system behavior. For example, a decision rule that always keeps rainbow trout abundance low at the Little Colorado River would actively prevent us from learning about whether warm temperatures alone are sufficient to insure successful humpback chub recruitment in the Colorado River mainstem, independent of trout abundance. To resolve the sufficiency issue in relation to temperature, scientists will need the opportunity to observe humpback chub recruitment under the warm water-high trout abundance condition.
- **Experimentation Should be a Key Consideration of Alternatives.—** Experimentation is a major component of the LTEMP EIS, and as such, alternatives that incorporate experimentation should rank well in an evaluation process. The SDM process, as described, defers experimentation until the likely outcomes of actions are determined. This seems a reversal of the process that is central to adaptive management, whereby, uncertainty is identified through knowledge assessment, and informed through experimentation. At the least, the SDM should evaluate the effectiveness of experimentation in each alternative, including the proper and appropriate application of robust experimental design.
- **Lack of Proper Experimentation and Monitoring Could Lead to Bad Outcomes.—**Failure to have an improved understanding of causation could lead to a series of mitigation measures that do not effectively address the cause(s). This can potentially create more problems and lead to a failure to improve resource conditions despite adjustments in practices. A large aquatic system like the Colorado River Ecosystem is like an extremely complex piece of machinery where trial-and-error tinkering, undertaken only when problems are blatantly apparent, is unlikely to lead to ideal outcomes. Additionally, this segment of the Colorado River is not a homogenous river system, but rather a transition of three or four ecologically distinct reaches from up to downstream; each with its own unique temperature, water quality, and geomorphic framework influenced by local geology and sediment mass balances and affected by the larger and lesser tributaries that supply both fine and coarse-grained sediment. Emphasis on integrated assessment of both abiotic and biotic responses to experimental managed flows is a critical need for any long-term EMP; this integration begins with sound planning and development of a long-term monitoring plan that feeds information directly into ongoing adaptive decision-making (see Melis et al. 2012).

- **Utilize Previous Knowledge Assessments.—**Previous knowledge assessments, such as the one conducted in 2005 (e.g., Melis et al. 2005, 2005; GCMRC 2006, 2008), have derived directional relationships for resources in the Grand Canyon between 2000 and 2006, as well as more recently in the form of expert responses to uncertainties relating to aquatic resources below Glen Canyon Dam (Kennedy 2013). The current process of resource goals, performance criteria, and SDM does not seem to have used much of the information developed and synthesized by several of these prior workshops of scientists—despite the fact that this was the primary motivation for these synthesis efforts. Instead, the desire to quantify likely outcomes using models developed just for the SDM evaluation process may over-reach the current state of the science. Walters et al. (2000) resolved to develop the first uncertainty matrix for resources below Glen Canyon Dam on the basis of their ability to resolve resource-response predictions at that time. Considerable progress has been made in understanding relationships of key resources, but despite advances in modeling and monitoring over the last 15 years, meaningful quantitative predictions for several key resources in responses to flow and non-flow experimental treatments now proposed are still not possible. Consequently, the most scientifically defensible approach to adaptive management in the Grand Canyon is not to link management to predictive models which are assumed to represent accurate abstractions of the ecosystem, but to link management to well-reasoned experiments and appropriate monitoring from which learning can be derived and courses for adaptation charted.
- **Need Objective Evaluation of Alternatives.—**This process of evaluating alternatives is fundamentally a screening process that could prejudice the NEPA impact analysis. The goals and criteria used in this first phase need not look like the resource goals necessary to be evaluated in the effects analysis, and thus, may bias alternative selection. This process also risks selection of a given alternative based on uncertainty built on uncertainty. We propose that the desire for quantitative results for the performance criteria should be reconsidered in many cases for this extremely complex ecosystem and the suite of management actions possible.
- **SDM Risks Linear Evaluation.—**Parsing of alternative elements minimizes evaluation of complex interactions and risks selection of a particular alternative based of the perceived benefit to a single resource, while missing consequences and collateral effects on other resources. For example, sediment is an important canyon resource that drives many ecological processes, including the food resources (e.g., algae, aquatic invertebrates) and web of feeding relationships important to fishes (commonly referred to as “food base”). Food base is likely a driver for a lot of potential impacts to biological resources (e.g., Cross et al. 2011, 2013); but our limited understanding of food base dynamics and relationship to flow, temperature, sediment, etc. should not preclude adequate and appropriate consideration of this resource in the SDM process.
- **Lack of Non-Flow Actions and Experiments.—**The lack of integration of “non-flow” actions and experiments into the evaluation process ignores an important aspect of any alternative. Examples of these actions include: trout removal in

Bright Angel Creek, humpback chub translocations, and nonnative fish removal approved in 2012 under the recent EA. If the net outcome of the LTEMP EIS is a truly an integrated EMP, then non-flow actions and experiments should be fully integrated into the various alternatives with more emphasis on how each will need to be monitored and evaluated.

- **Role of Triggers.**—Many aspects of the alternatives are not fully considered in the SDM process. For example, decision-making triggers will need to be an important consideration in the adaptive management of this EIS. As a type of pre-negotiated commitment, triggers specify what actions will be taken if monitoring information shows an important or critical condition. Triggers must be clearly defined and agreed upon by stakeholders as pre-defined commitments that bridge scientific inquiry with management.

Performance Criteria

Evaluation of Draft Criteria

The LTEMP Team has drafted performance criteria intended to be objective metrics for the performance of alternatives relative to goals for each resource (Draft LTEMP Performance Criteria, February 21, 2013). These draft performance criteria are to be used as a comparative tool to evaluate alternatives against one another.

The Resource Goals and Draft Performance Criteria are provided in Table A-1 at the end of this document. For each goal and criterion, we provide comments and recommendations to improve and clarify these goals and criteria for a more effective and meaningful evaluation of the alternatives.

We summarize our evaluation of the resource goals and performance criteria as follows:

- **Resource Goals Should More Directly Relate to Desired Future Conditions (DFCs).—**The DFCs – as official DOI policy – established the environmental goals for the Colorado River Ecosystem in accord with the need identified by the National Research Council (1999); page 56; “Before the Adaptive Management Program can measure its success, it must first develop a clear statement of what it is trying to accomplish.” We recommend that the performance goals and criteria more directly follow the DFCs. Without such goals, it is difficult to link management policy adopted and endorsed by the AMWG with necessary experimentation for a more information strategy for operating Glen Canyon Dam.
- **Some Resource Goals are too General.—**Some resource goals are rather general and broadly stated, making it difficult to understand the desired result or achievement as measured or indicated by the performance criteria. For example, the resource goal for “Natural Processes” appears to use an arbitrary standard of “natural (unregulated) pattern” as a base against which to gauge alternative performance. Many aspects of the Colorado River Ecosystem comprise natural

processes, but trying to parse important structure and function is meaningless in a complex and dynamic setting such as the Grand Canyon.

- **Performance Criteria Apply Across Resource Goals.—**Some performance criteria, such as aspects of sediment conservation, apply to more than one goal. For example, flow and non-flow actions designed to create nearshore habitats, such as backwaters, also rebuild and maintain camping beaches and affect riparian vegetation and archaeological sites. Care should be taken in developing these performance criteria to avoid developing criteria that unfairly weight one resource (e.g., sediment), or possibly contradict other criteria and detrimentally affect resources.
- **Important Performance Criteria may be Left Out.—**While we suggest a substantial reduction in the number of resource goals, with a concentration on the key resources, important criteria pertaining to these goals are left out. In the interest of trying to hone in on the most important apparent performance criteria, other equally or more important criteria may be left out of the process. For example, the sediment performance criteria do not include mention of sand grain size of sandbars, yet over a decade of sediment research has identified sand grain size as being as or even more important to suspended-sand transport and beach formation as discharge from the dam. Perhaps the grain size parameter can be identified as a performance measure tied to how well various dam operating alternatives achieve retention and conservation of new tributary sand inputs. Another example of our concern has to do with the performance criteria for humpback chub, other native fish, trout fishery, and warmwater nonnative fish focus on one or few demographic attributes, such as abundance or growth, when in fact, there are more vital and reliable performance criteria that are part of a larger suites of measures.
- **Performance Criteria are Based on Unknown or Highly Uncertain Relationships.—**Performance criteria such as measures of sandbar volume above the high-water line and erosion rates of banks are labor-intensive and difficult to measure; and, when measured, show an unclear relationship to flow. We suggest NOT using unknown or highly uncertain relationships to gauge the performance of an alternative. It is perilous at best and at worst misleads the reader and decision-makers with regard to what is known and unknown. Performance criteria should be developed that recognize experimentation and contribute to a better understanding of uncertainty. Predicting future sandbar area and volume may be impractical or impossible until researchers are able to resolve an eddy/sandbar evolution model that can, for example, at least replicate the sandbar dynamics measured by researchers during the March 2008 HFE. As mentioned above, similar uncertainties exist regarding the ability to predict food web and fish population dynamics in response management treatments.
- **Performance Criteria Should be Reasonable and Realistic.—**Some performance criteria are presently difficult to measure (e.g., sandbar volume, bank erosion). There should be recognition that while some criteria are preferred, they may not be realistic and reasonably measured at the same frequency that

experimental management flow treatments are implemented; potentially annual HFEs being a case in point. Criteria that are uncertain are likely to provide meaningless or wrong information that will skew the decision-maker to take an action that may have little scientific support. For example, sandbar volume above the water line cannot be reasonably measured at a scale sufficient to link with flow volume and in-channel sediment transport. Instead of establishing sandbar volume as a metric at this time, we think it is prudent to first develop quantitative linkages that would reduce the uncertainty of that metric.

- **Relationships of Performance Criteria to Flow are Incorrectly Stated.—**The performance criteria should be expressed in the proper and accurate context with respect to the capability of existing and peer-reviewed quantitative models. For example, the sediment-transport model (Wright et al. 2010) estimates the mass of suspended sand transported by water in the river channel, and it can be used to determine reach-scale sand mass-balance (Wright et al. 2005; Wright and Grams 2010). Some of the draft criteria suggest that this model can somehow help to determine changes in sandbar and beach volumes above the high-water line, as well as bank erosion rates. This understanding is erroneous and should be reconciled in finalization of the performance criteria. Previously developed 2- and 3-dimensional eddy/ sandbar models have so far failed to simulate field measurements of sandbar evolution within two eddies during the March 2008 HFE (Sloff et al. 2010, 2012). It follows that the simpler 1-dimensional suspended-sand routing model of Wright et al. (2010) cannot be used to approximate such complex flow-induced sand storage changes within hundreds of eddies throughout the river channel. Again, this is just one example—there are similar cases relating to other resources.
- **Warmwater Nonnative Fish.—**There is no test to describe the resource goal for warmwater nonnative fish (Goal 12), and the following text is recommended: "Manage nonnative fish populations consistent with recreational sportfishing and conservation of native and endangered fish populations." The threat of additional warmwater nonnative fish becoming established in Grand Canyon is real given the presence of a diverse assemblage of warmwater nonnative species in both Lakes Powell and Mead. The risk to humpback chub and other native fishes viability is high if a highly predaceous or competitive species were to suddenly expand in abundance and range in the Colorado River through Grand Canyon. We urge the LTEMP Team to give strong consideration to minimizing the possibility for such an event.
- **Sandbar Area and Volume.—**Reference is made in several performance criteria to the sandbars above 25,000 cfs elevation. A great deal of work is needed to more precisely monitor sandbar volumes over the same time scales that flow and suspended-sand geomorphic processes are known to occur in sandbar building and erosion. Only about 8% of all sandbars in upper or lower Marble Canyon have been measured annually (Schmidt and Grams 2011). The number of measured sandbars is an even smaller percentage of the total number of sandbars in eastern, central, and western Grand Canyon. Detailed measurements of sandbars and the adjacent channel were made before and after the three HFEs: at

32 sites in 1996, 12 sites in 2004, and 40 sites in 2008. Only 11 of these sites were monitored in Marble Canyon before and after each of the three HFEs, and only 19 were monitored in Grand Canyon before and after the 1996 and 2008 HFEs. Collecting detailed topographic information about a significantly greater number of the sandbars on an annual basis has never been feasible, because such sampling would require a great many resources.

- **Water Delivery is a Legal Issue.**—Compliance with the Law of the River is a legal issue and should not be considered as performance criteria. Alternatives must be in compliance with the Law of the River, and if they are not, they should not be considered viable alternatives.

Recommendations

We see an opportunity to better define resource goals and better reflect DFCs, while also consolidating and unifying performance criteria for more clearly defined metrics. This should help the evaluation of the EIS alternatives and should help to avoid redundancy and possible conflicting consequences on resources. We have taken the 12 Resource Goals provided in the Draft Performance Criteria and consolidated these into 5 Resource Goals (Table 1). Recommended Performance Criteria are provided for each of the Resource Goals in a manner that clarifies the criteria, minimizes redundancy, and avoids confusion and the possibility of conflicts among resources. We followed these principles because we believe that the criteria should show differences among alternatives, especially where there are tradeoffs of effects on resources; e.g., one alternative may be good for sediment and trout, but bad for humpback chub and food base.

Table 1. Recommended Resource Goals and Performance Criteria.

Resource Goal	Performance Criteria
1. Fish and aquatic food base: Maintain viable native fish populations, especially ESA listed species, maintain a quality recreational rainbow trout fishery in Glen Canyon, and maintain the food base that sustains these species, while minimizing or reducing the threat of nonnative warmwater species.	• Maintain a viable, self-sustaining population of humpback chub; criteria should be consistent with species recovery goals and should consider vital rates in long-term trends, such as: (1) adult abundance, (2) juvenile survival, (3) recruitment from juvenile to adult, (4) adult survival, (5) establishment of additional spawning aggregation(s), and (6) minimization of threats, such as nonnative fish predation and hazardous materials spills at the Cameron Bridge. • Maintain a quality, healthy rainbow trout population in Glen Canyon based on vital rates such as: (1) angler catch rate >0.5 fish/hr, (2) range of adult abundance, (3) juvenile survival, (4) recruitment from juvenile to adult, (5) adult survival, (6) reduced emigration of trout from Lees Ferry, and (7) monitoring and minimization of threats; including whirling disease, trout nematodes, and introduction of detrimental nonnative invasive species. Minimal short-term disruption to Lees Ferry angling (3 days to a week). • Minimize or remove threat of warmwater nonnative species to the conservation of native and ESA listed fish populations. • No long-term detrimental effects to the food base, including

Resource Goal	Performance Criteria
	invertebrate productivity and diversity, and other organic matter resources (e.g., algae and detritus) important to fishes, especially to native fish populations downstream of Lees Ferry, but that also serve as prey resources for many terrestrial organisms (e.g., adult aquatic insects and fish are important prey for birds).
2. Sediment-related resources: High elevation open riparian fine-sediment deposits along the Colorado River in sufficient volume, area, and distribution so as to provide habitat to sustain native biota and desired Colorado River Ecosystem processes; e.g., • Nearshore habitats for native fish, • Marsh and riparian habitat for fish (food chain maintenance), • Cultural resource preservation, • Maintenance of camping beaches.	• Use sand and possibly finer sediment inputs to build beach area and volume in critical reaches. • Maintain long-term sand mass balance for the purposes stated (in the performance goal). • Maintain sandbars above the 8,000 cfs elevation (i.e., "the reference stage"); currently not easily or practicably measureable. • Provide greatest probability for an HFE of the largest magnitude and optimal duration. • Protect high elevation sandbars and terraces for riparian vegetation and cultural resources, including vegetation management for beach area.
3. Vegetation, habitat, and special status species: Native riparian systems, in various stages of maturity, are diverse, healthy, productive, self-sustaining, and ecologically appropriate.	• Protects and preserves diversity of native vegetation communities; except old high water zone which cannot be rewatered. • Minimizes dispersal of invasive nonnative plant species, such as from seed dispersal. • Allows for recovery of native vegetation following scouring or burial. • No long-term detrimental effects to riparian and terrestrial wildlife habitat; excluding old high water zone which cannot be rewatered.
4. Cultural resources: Maintain the ability of traditionally associated Indian Tribes to access and use culturally important resources, and maintain and protect culturally important and appropriate resource conditions.	• High terraces protected. • Minimum adverse effect to historic properties. • Minimum adverse effects to cultural resources. • Maintain the integrity of National Register eligible or listed historic properties, where possible, with preservation methods employed on a site specific basis.
5. Hydropower: Maintain and increase Glen Canyon Dam capacity and energy generation, load following capability and ramp rate capability, minimize carbon emissions and costs, and maximize the benefits of hydropower generation to the greatest extent practicable consistent with other resource objectives. Emergency operational flexibility and reliability must also be met.	A single criterion would be developed that incorporates the following six parameters and quantifies the sufficient and efficient production of hydropower in order to provide the revenues to support CRSP facilities and purposes. • Value of energy production by year • Value of capacity as measured by load following by month • CO2, SO2, NOx emissions (tons) resulting from need to purchase alternative sources of power • Flexibility of operations from load following and ramp rate capabilities • Powerplant water consumption • Impacts to the Upper Colorado River Basin Fund and U.S. Treasury

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Table A-1. Science Panel Evaluation of LTEMP Team Resource Goals and Draft Performance Criteria.

LTEMP Team Draft Resource Goals and Performance Criteria	Comments and Suggestions by Science Panel
1. Archaeological and Cultural Resources	
• Resource Goal: Maintain the integrity of potentially affected National Register eligible or listed historic properties in place, where possible, with preservation methods employed on a site specific basis.	• Suggest: "Protect and maintain…" • If the resources are listed in the NRHP or they are eligible for listing in the NRHP they are equally important. The site types, size of the site, number of features or the number of artifacts do not matter. The criteria (A, B, C, D) are not something that can or should be weighted. • The "importance" of the resource should not be a variable measured. • The variable that should be measured is "threat". Then sites can be ranked by eminency of "threat" and treated accordingly.
• Draft Performance Criteria:	• Draft Performance Criteria:
o Net sediment conservation (proportion of sediment conserved in each reach above the 25,000 cfs elevation minus the lateral erosion rate of banks in the reach) in Glen and Grand Canyons as related to the magnitude, duration, and frequency of high-flow events (HFEs) and characteristics of intervening flows (monthly, daily and hourly release patterns) for alternatives. ∑RrNrWr, where Rr=the reach specific net sediment conservation value for reach r (see equation below), Nr=ranking of reach r according to number of sites or site density, Wr=weighting reflecting the value of resources in reach r according to NHPA, tribal, or information potential. Rr=SrDr-Er Hr, where Sr=amount of sediment conserved in reach r, Dr=proportion of sediment conserved about the 25,000 cfs elevation, Er=rate of erosion in reach r, and Hr=frequency of HFEs. Model output from the sand budget model would be used to determine sediment conservation and erosion rates for each alternative.	o This performance criterion requires measurements of sand above the high-water line that are highly variable and not reliably related to flow; and erosion rates of banks, which have been measured for only selected sandbars (Alvarez and Schmeeckle 2012). It is unclear if either of these variables can be reliably linked to HFEs and flow characteristics. o Net sediment (sand) conservation, as defined in the criteria, cannot be determined with present models and monitoring, and the relationship to HFEs and intervening flows is not known. The sediment conserved above the 25,000 cfs elevation is periodically estimated with hypsometric measurements of selected sandbars and beaches, but while this information is important for modeling and making predictions, the measurements collected previously are highly variable and the area of bars and beaches has been shown to not bear a constant and reliable relationship to flow. o "Lateral erosion rate" is not currently measured and cannot be derived from the sediment-transport model (Wright et al. 2008, 2010), which estimates the amount of sand transported by the flow of the Colorado River—and not the movement of sand from the bar into the channel, or vice-versa. The sediment-transport model also does not provide an estimate of sandbar or beach area or volume, and cannot presently be used to estimate erosion rates or as an index of sand bar persistence.
2. Natural Processes	
• Resource Goal: Restore, to the extent practicable, ecological patterns and processes within their range of natural variability, including the natural abundance, diversity, and genetic and ecological integrity of the plant and animal species native to those ecosystems.	• This is a very general and broad goal that does not describe or define "natural variability." • If this Performance Criteria is maintained what is the baseline condition and do the stakeholders as a whole have an opportunity to agree with the baseline? How do you recognize that the existence of the dam as a given if this Performance Criteria is

LTEMP Team Draft Resource Goals and Performance Criteria	Comments and Suggestions by Science Panel
	retained?
• Draft Performance Criteria:	• Draft Performance Criteria:
o Measures of deviation from a natural (i.e., unregulated) pattern for five biophysical parameters (flow, sediment, turbidity, temperature, and nutrients/ aquatic invertebrate communities), combined in a way that reflects the need for all processes to be operating. For each alternative, the difference between predicted and natural values for the five parameters, and their component metrics, would be calculated and summed for the LTEMP period. An index of deviation for each parameter would be calculated (i.e., individual metrics would be combined) and then these five parameter indices combined into a single weighted index that reflects overall deviation from natural patterns.	o This performance criterion proposes to compare present condition with a "…natural (unregulated) pattern…" An unregulated pattern is essentially a "run-of-the-river" operation that for the contemporary condition is absent of historic water temperature patterns, sediment load, and organic load. This pattern is unrealistic hydrologically, given the constraints of dam releases. This criterion presupposes that a 'natural unregulated pattern' is the most suitable condition for natural processes, but this supposition has never been demonstrated in this or any other regulated river. o A "natural pattern" would also have to consider—and presuppose--that many aspects of the Colorado River Ecosystem that are now changed would be sufficiently understood to be used as an index. Understanding the natural pattern contains as much uncertainty as understanding the contemporary ecosystem. o We agree that ecological processes and ecological diversity (Naiman et al 2012) are important resource considerations of this EIS, but we do not support such a broad and general performance criterion. Furthermore, we do not believe that it is reasonable or realistic to compare current condition with some perceived and undefined standard of "natural (i.e., unregulated) pattern" as the gauge for performance of the alternatives.
3. Humpback Chub	
• Resource Goal: Meet humpback chub recovery goals including maintaining a self-sustaining population, spawning habitat and aggregations in its natural range in the Colorado River and its tributaries below the Glen Canyon Dam.	• Recommend: "…maintaining a viable self-sustaining…" • More specific criteria should be available as the U. S. Fish and Wildlife Service revises the Humpback Chub Recovery Plan.
• Draft Performance Criteria:	• Draft Performance Criteria:
o Predicted minimum number of adult chub (i.e., > 200 mm) at the Little Colorado River (LCR) confluence over the LTEMP period. (Note that higher values are considered better, i.e., we want to maximize the minimum value). Predictions would be based on an age-structured model that incorporates LCR and mainstem components of the LCR aggregation using inputs related to water temperature and trout abundance.	o Criteria should be consistent with species recovery goals and should consider vital rates in long-term trends, as well as minimization of threats, such as nonnative fish predation and hazardous materials spills at the Cameron Bridge.
o Probability of self-sustaining spawning aggregations outside of the LCR aggregation with a focus on aggregations at RM30, 88, 108, 119, 125-128, 157, 213. A simple probabilistic model would be developed for each site that considers the magnitude and timing of temperatures relative to spawning and rearing needs for mainstem spawning sites, and rearing needs alone for tributary spawning sites.	o This should be considered one in the suite of criteria described above.
4. Hydropower and Energy	
• Resource Goal: Maintain or increase Glen Canyon Dam electric energy	• May be good to clarify: "…and minimize emissions from purchase of alternative

LTEMP Team Draft Resource Goals and Performance Criteria	Comments and Suggestions by Science Panel
generation, load following capability and ramp rate capability, and minimize emissions, and costs to the greatest extent practicable consistent with improvement and long-term sustainability of downstream resources.	power…"
• Draft Performance Criteria:	• Draft Performance Criteria:
o A single criterion would be developed that incorporates the following five parameters and their component metrics as predicted by the GTMax power systems model from monthly release patterns for the LTEMP period:	o See below
o A single criterion would be developed that the following five parameters and their component metrics as predicted by the GTMax power systems model from monthly release patterns for the LTEMP period:	A single criterion would be developed that incorporates the following six parameters and quantifies the sufficient and efficient production of hydropower in order to provide the revenues to support CRSP facilities and purposes. • Value of energy production by year • Value of capacity as measured by load following by month • CO2, SO2, NOx emissions (tons) resulting from need to purchase alternative sources of power • Flexibility of operations from load following and ramp rate capabilities • Powerplant water consumption o Impacts to the Upper Colorado River Basin Fund and U.S. Treasury
▪ Quantity of hydropower capacity at Glen Canyon Dam (GCD)	▪ See above
▪ Quantity of hydropower generation at GCD	▪ See above
▪ Value of hydroelectric generation at GCD	▪ See above
▪ Flexibility of operations from load following and ramp rate capabilities	▪ See above
▪ Cost to ratepayers	▪ See above
5. Other Native Fish	
• Resource Goal: Maintain self-sustaining native fish species populations and their habitats in their natural ranges on the Colorado River and its tributaries.	• Recommend: "Maintain viable self-sustaining…" • The natural ranges of native fishes in the Colorado River are much larger than the affected area of the LTEMP EIS; i.e., native fish range throughout much of the upper and lower basins. Furthermore, Glen Canyon Dam operations do not affect tributaries and range or habitat of native fish in those tributaries. • This goal is better stated as: "Maintain and protect self-sustaining native fish populations and suitable habitats, as feasible, in the Colorado River through Glen, Marble, and Grand canyons."
• Draft Performance Criteria:	• Draft Performance Criteria:
o Relative effect of alternatives (weighted index) on mainstem flannelmouth suckers at the LCR confluence (RM 61) and near Havasu Creek (RM 157). The relative effect on growth would be predicted from the degree-days above 12C at both sites,	o This performance criterion uses temperature as it affects fish growth and abundance of trout to infer predation on native fish. These criteria are only part of a suite of conditions, including the state of food resources and a complex web of feeding

LTEMP Team Draft Resource Goals and Performance Criteria	Comments and Suggestions by Science Panel
and the degree days above 16C for spawning at Havasu only. In addition to these growth-related effects, the adverse effect of competition and predation from trout at the LCR would be inferred from predicted number of trout under different alternatives. Note that trout effects are not expected at the Havasu Creek location, and spawning is not considered possible at the LCR confluence under any alternative.	relationships, that support viable self-sustaining populations of native fish. The idea that temperature criteria alone could be used to predict effects on these fishes does not match current ecological understanding. o Although measureable growth of most Colorado River native fishes begins at 12C, the amount of growth is usually <5 mm/month or about 2 in/year; this is not a sufficiently fast growth rate to minimize exposure to predation. Growth rates increase substantially at temperatures >14C, which is a more realistic target temperature for growth. o Temperature of the main channel is a function of many variables, including reservoir forebay temperature, air temperature, sun exposure, water volume, and distance from the dam. Expecting a target temperature in a given year by regulating water volume is unreliable, particularly because forebay temperature is highly variable for even a similar range of reservoir elevations, and also varies at least with season, reservoir elevation, and inflow (Vernieu et al. 2005). o Studies of longitudinal warming show that the specific daily to monthly operations have little influence on downstream average monthly temperatures (GCMRC 2006), and more recent studies show that persistent thermal gradients greater than the 0.2 °C accuracy of the instruments were not observed in any of the sampled shoreline environments (Ross and Grams 2013). o Performance criteria for native fish may be similar to criteria for humpback chub. ASMR estimates have been generated for humpback chub, flannelmouth sucker, bluehead sucker (Walters et al. 2012), and could be developed for other native species if consistent tagging programs are followed. The following performance criteria are recommended to protect the species and meet the resource goal: (1) adult abundance, (2) juvenile survival, (3) recruitment from juvenile to adult, (4) adult survival, and (5) minimization of threats, such as nonnative fish predation and hazardous materials spills at the Cameron Bridge.
6. Recreational Experience	
• Resource Goal: Maintain and improve the quality of recreational experiences for the users of the Colorado River ecosystem. Recreation includes, but is not limited to, flatwater and whitewater boating, river corridor camping, and angling in Glen Canyon.	• Suggest: "Maintain and enhance…"
• Draft Performance Criteria:	• Draft Performance Criteria:
o For Grand Canyon National Park (GRCA), a metric that reflects the persistence of camping area (single value, GRCA wide, with lower values preferred). The sand budget model would be used to predict the timing and number of HFEs, the amount of sand delivered by the HFEs, and erosion rates associated with	o It is unclear if the "sand budget model" referenced in this criterion is the "sediment-transport model" as described by (Wright et al. 2008, 2010). To be clear, the "sediment-transport model" measures the amount of sand in the channel below the water line and can be used to estimate the amount of sand transported at various flows. However, this

LTEMP Team Draft Resource Goals and Performance Criteria	Comments and Suggestions by Science Panel
intervening flows. These predicted values will be used to develop an index of the persistence of sand bars for each alternative.	model does not estimate sandbar or beach area or volume, and cannot be used to estimate erosion rates or as an index of sand bar persistence. There is clearly a need for a better way to measure and monitor sandbars and beaches above the water line. o The sediment-transport model can be used to simulate the sand budget over annual to decadal time scales (Wright et al. 2010; Wright and Grams 2010). The sand budget is defined as the sand inputs to the reach minus the sand export as a function of flow, but does not account for the sand and finer sediment stored in sandbars and beaches. o We also note that Alvarez and Schmeeckle (2012) concluded that "The erosion of intermediate slopes (18° – 22°) is controlled by seepage erosion, whereas the erosion of steep slopes (26°) is governed by mass failures. Erosion rates per diurnal cycle do not depend on ramp rates, but they increase with sandbar steepness. Therefore, steep sandbar faces would rapidly erode by mass failure and seepage erosion to shallower stable slopes in the absence of other erosion processes, regardless of dam discharge ramp rates."
o For Glen Canyon National Recreation Area (GLCA), an Erosion Risk Factor (single value, GLCA wide, with lower values preferred). Based on existing stage-discharge relationships at selected points, the flow levels that would result in high risk of erosion leading to a loss of established campground infrastructure and terrace sediment deposits would be predicted. Modeled daily hydrographs will be used to calculate the frequency of occurrence for critical flows for each alternative.	o As described for the previous criterion, the sand budget model estimates the amount of sand transported by water. It does not estimate—nor can it be used to estimate—erosion. The following performance criteria are suggested: o Maintenance of key sandbars and beaches used for recreation as measured and monitored with a reliable metric. o Control of invasive vegetation to maintain open areas on key sandbars and beaches used for recreation.
7. Sediment	
• Resource Goal: Increase and retain fine sediment volume, area, and distribution in the Glen, Marble and Grand Canyon reaches above the elevation of the average base flow for ecological, cultural, and recreational purposes.	• This resource goal specifically calls for retaining "…fine sediment volume, area, and distribution…" Is this intended to distinguish "fine grain" from "coarse grain" sediment, or is this resource goal intended to encompass all sediment sizes? To be clear, "fine sediment" is delivered into the channel by tributary sediment input, but is quickly transported downstream, leaving a higher concentration of coarse sediment in channel.
• Draft Performance Criteria:	• Draft Performance Criteria:
o Several metrics would be used to reflect sandbar area above 8,000 and 25,000 ft^3/sec in each key reach (RM 0-30, RM 30-61, RM 61-87, and RM 87-277) using existing sediment modeling tools:	o It is unclear what is meant by "existing sediment modeling tools." The sediment-transport model (Wright et al. 2008) estimates the volume of suspended sand transported by water in the river channel. The sediment conserved above the 8,000 and 25,000 cfs elevations is periodically estimated with hypsometric measurements of selected sandbars and beaches, but these estimates are highly variable and show the area of bars and beaches does not bear a constant and reliable relationship to flow.

LTEMP Team Draft Resource Goals and Performance Criteria	Comments and Suggestions by Science Panel
	Thus, we are unaware of any reliable, peer reviewed, predictive models available to do this analysis.
▪ Cumulative sand load for RM 0-61 transported by high flows (flows > 25,000 ft^3/sec) divided by cumulative sand load for entire alternative, measured as a ratio	o This appears to be determinable with the "Screening Tool" developed by Argonne. Care must be taken here to make sure that all aspects of operations in each of the alternatives are considered. For example, how models address downramp rates, time on peak, load-following, and others can substantially affect how sediment transport rates are evaluated under various alternatives. Results may be counterintuitive due to the need to conserve volume daily and thus actual operations may be different than predicted.
▪ Number of events that have peak sediment concentration for RM 0-61 during high flows greater than the average peak concentration among all alternatives	o This criterion is confusing. Does "Number of events" refer to HFEs? If so, it is not the event itself (i.e., HFE) that determines the sand concentration, but the pre-HFE conditions. We would point out that pre-HFE low monthly volumes and suspension of load-following can result in greater sand concentration in the flow of an HFE and may be more effective at bar building. A criterion based on number of events seems to be de-coupled from predictions of resource effects.
▪ One of the following variables that are indicators of mass balance:	o Does this mean that only one of these variables is considered a performance criterion?
– Number of sediment years (begin on July 1) with negative mass balance for RM 0-61	– This criterion is not determinable as a future evaluation of the alternatives because sand mass balance or sand budget is defined as the sand inputs to the reach minus the sand export as a function of flow (Wright et al. 2010). Sand input cannot be predicted, and if it is used in a sand transport model, the timing, location, and volume will affect the manner in which a given alternative performs with respect to mass balance. Also, the implementation of HFEs will have a big impact on the likelihood of having a positive sand mass balance as the HFE, by design, will use the new sand inputs to reach a zero balance by the end of the HFE thereby increasing the risk of having a negative sand balance.
– Number of sediment years (begin on July 1) with large negative (> median annual Paria sand supply) mass balance for RM 0-61	– Same comment as above. This criterion would assume a median sand input annually, then would it include an HFE or would it be based on "normal" operations for each alternative? If intervening flows transport sand, and we know that they do, and HFEs are designed to reach a zero balance during the accounting period, then isn't this a meaningless criteria as all alternatives that include HFEs are more likely to have a negative sand balance over the long term? The only way around this is to balance HFE magnitude and duration with sand inputs to leave behind a portion of those inputs in the channel to offset expected sand transport during intervening flows.
▪ Variance and mean of peak high flow magnitudes at Dam, measured as a flow value	o This criterion is about flow; how does it relate to sediment conservation? This is a redundant criterion to use of the Wright model to predict sediment transport.
▪ Bar half-life for RM 0-61based on erosion rates from empirical information, measured in months	o The term "bar half-life" needs to be defined. If this criterion is intended to help conserve sandbars and beaches above the high-water zone, it should be stated as a measure of

LTEMP Team Draft Resource Goals and Performance Criteria	Comments and Suggestions by Science Panel
	bar volume. However, there is currently no model to predict this volume of sand above the water line; hence this criterion is not useable in the evaluation of alternatives.
o Number of days flow is greater than threshold value (tbd) to threaten terraces in Glen Canyon	o We are uncertain what is meant by flows that "threaten terraces in Glen Canyon." Terraces are generally considered as areas above the range of normal dam operations, and many occur at elevations equivalent to high historic flows (i.e., >100,000 cfs). Is this criterion meant to infer that HFEs of 41,000 cfs somehow "threaten" terraces that are not inundated until flows reach 100,000 cfs?
8. Tribal Perspectives	
• Resource Goal: Maintain the ability of traditionally associated Indian Tribes to access and use culturally important resources, and maintain culturally appropriate resource conditions.	o There appears to be some redundancy between this resource (i.e., "Tribal Perspective") and "Archaeological and Cultural Resources" described in #1 above. This should be combined with #1. o Tribes have typically expressed the need for nature to take its course. This "maintenance" implies manipulation of something to ensure culturally important resources retain their integrity. "Integrity" implies that the resource will retain functionality, regardless of change. The term "condition" is more vague and descriptive, without the dynamics associated with integrity. "condition" should be changed to "integrity."
• Draft Performance Criteria:	• Draft Performance Criteria:
o To be developed in coordination with the tribes	o
9. Trout Fishery	
• Resource Goal: Achieve a healthy high-quality recreational trout fishery in Glen Canyon National Recreation Area and reduce or eliminate downstream trout migration consistent with National Park Service fish management and ESA compliance.	• Suggest: "Achieve and maintain a healthy…"
• Draft Performance Criteria:	• We recommend meaningful fish management objectives based on vital rates such as: (1) angler catch rate, (2) range of adult abundance, (3) juvenile survival, (4) recruitment from juvenile to adult, (5) adult survival, (6) emigration of trout from Lees Ferry, and (7) monitoring and minimization of threats; including whirling disease, trout nematodes, and introduction of detrimental nonnative invasive species.
o Angler catch rate (fish/hr).	o This criterion should be established as part of a suite of management objectives.
o Catch rate of fish that are $\geq$ 14 in. (10-12 fish/day/angler=optimal threshold)	o This is redundant with the prior criterion. It is better to express this criterion as number of fish caught per hour, instead of fish/day/angler; the amount of time spent by anglers fishing in a day varies considerably.
o Emigration of trout from Lees Ferry (average #trout/yr)	o This criterion should be established as part of a suite of management objectives.
A trout production model and linked migration model would be used to predict these three metrics under each alternative.	• We question the efficacy of constructing this model for the purposes described in this SDM process and look forward to seeing the peer review results of the model. We believe that a model could be constructed to explore hypotheses, however a predictive

LTEMP Team Draft Resource Goals and Performance Criteria	Comments and Suggestions by Science Panel
	model would include too many uncertain assumptions to be useful in predicting results.
10. Riparian Vegetation	
• Resource Goal: Maintain native vegetation and wildlife habitat, in various stages of maturity that is diverse, healthy, productive, self-sustaining, and ecologically appropriate.	• It is unclear how this criterion would be effective in describing flow-related action differences among alternatives. Do we truly believe these models are predictive at the scale of differences among the alternatives to show substantial variation? Possible that only non-flow actions would have a substantial impact enough to show variation among alternatives.
• Draft Performance Criteria:	• Draft Performance Criteria:
o Relative change in cover of native vegetation community types on sand bars and channel margins using the total % increase in native states predicted by an existing state and transition model for riparian vegetation communities.	o Is there a "transition model" for riparian vegetation communities? As with many of the other draft performance criteria, this requires some type of mathematical model that somehow relates riparian vegetation to river flow and dam operations. These, like many of the other performance criteria, are uncertainties that continue to be part of research, monitoring, and experimentation in the Grand Canyon and may not be adequately developed to evaluate differences amongst alternatives at this time.
o Relative change in diversity of native vegetation community types on sand bars and channel margins using the Shannon Weiner index for richness/evenness using the results of the state and transition model.	o The Shannon-Wiener index (i.e., Shannon-Weaver index, Shannon entropy) is a quantitative measure that includes the number of different species and the abundance of each. The more unequal the abundances of species, the smaller the corresponding Shannon index. o Given that this index requires estimates of both numbers of species and abundance of each species, it is difficult to understand how these estimates will be derived from a "transition model." If that transition model attempts to relate species and abundance of riparian vegetation to flow, the estimates are likely to be inaccurate, highly variable, and probably unrealistic.
o Relative change in the ratio of native/nonnative dominated vegetation community types on sand bars and channel margins using the ratio of native/nonnative communities predicted by the state and transition model.	o Same comment as above.
o Relative change in the open sand state on sand bars and channel margins using the total % increase in bare sand states predicted by the state and transition model.	o Same comment as above. o It appears that the performance criteria associated with this resource goal rely entirely on flow related metrics. There are also non-flow actions (i.e. vegetation removal) that should also be included as a means of reaching this resource goal. These non-flow actions could better balance riparian vegetation with recreational beaches, such that those actions would provide open campable beach areas while maintaining an esthetic setting around those areas.

LTEMP Team Draft Resource Goals and Performance Criteria	Comments and Suggestions by Science Panel
11. Water Delivery	
• Resource Goal: Ensure that water delivery continues in a manner that is fully consistent with and subject to the Colorado River Compact, the Upper Colorado River Basin Compact, the Water Treaty of 1944 with Mexico, the decree of the Supreme Court in Arizona v. California, and the provisions of the Colorado River Storage Project Act of 1956 and the Colorado River Basin Project Act of 1968 that govern allocation, appropriation, development, and exportation of the waters of the Colorado River Basin.	• It is not appropriate to identify water delivery as an individual criterion, since it is a legal requirement that must be met by all of the alternatives considered.
• Draft Performance Criteria:	• Draft Performance Criteria:
o Frequency of deviation from the No Action Alternative to Lake Powell Annual Operating Tier as specified by the 2007 Interim Guidelines. The Operating Tier is predicted using the CRSS RiverWare model.	o It is not appropriate to identify water delivery as an individual criterion, since it is a legal requirement that must be met by all of the alternatives considered.
o Frequency and volume of exceptions to meeting the annual release target volumes specified by the 2007 Interim Guidelines. The target and actual annual release volumes are predicted using the CRSS RiverWare model.	o It is not appropriate to identify water delivery as an individual criterion, since it is a legal requirement that must be met by all of the alternatives considered.
12. Warmwater Nonnative Fish	
• Draft Performance Criteria:	• We note that there is no "Resource Goal" for warmwater nonnative fish. The following resource goal is recommended: "Manage nonnative fish populations consistent with recreational sportfishing and conservation of native and endangered fish populations."
o Probability of establishment of warmwater nonnative fish and expansion of any nonnative fish that are currently part of the system. Risk of establishment or expansion of potentially invasive species would be predicted using an existing risk assessment model developed for previous temperature control device evaluations. Temperature profiles of different species would be evaluated against predicted temperatures in different reaches of the river under different alternatives to determine risk. Lake Mead levels would be considered as part of this analysis.	This language is too general. We recommend instead the following: o Monitor, regulate, and minimize nonnative fish releases and escapement into the main river, floodplain, and tributaries of the Colorado River in Glen, Marble, and Grand canyons. o Control problematic nonnative fishes as needed. o It is assumed that this resource goal does not include the trout fishery, as described in Resource Goal #9.

Moving Forward on the Colorado River Basin
Please Join Us

Please join Department of the Interior Assistant Secretary for Water and Science Anne Castle and Bureau of Reclamation Commissioner Michael L. Connor along with representatives from the seven Colorado River Basin States, the Ten Tribes Partnership, and conservation organizations in a public event to officially kick off the "Next Steps" in solving the challenges ahead for the Colorado River Basin as described in the Colorado River Basin Water Supply and Demand Study.

When: *May 28, 2013 from 3:00 p.m. to 4:00 p.m. PDT*

Where: *USGS California Water Science Center, 4165 Spruance Road, Suite 200, San Diego, California*

This event is open to the public. Presentations will begin at 3:00 p.m. PDT and will be followed by an open question and answer session.

RECLAMATION
Managing Water in the West

OFFICE OF THE SECRETARY
U.S. Department of the Interior

www.doi.gov

News Release

May 28, 2013
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Interior Leaders Convene Meeting to Discuss *Moving Forward* on Colorado River Basin Water Supply and Demand Challenges

SAN DIEGO - U.S. Department of the Interior Assistant Secretary for Water and Science Anne Castle and Bureau of Reclamation Commissioner Michael L. Connor joined dozens of stakeholders outlining a path of next steps to address projected water supply and demand imbalances in the Colorado River Basin.

In collaboration with representatives from the seven Colorado River Basin states, the Ten Tribes Partnership, and conservation organizations, the *Moving Forward* event highlighted the next steps based on the findings of the Colorado River Basin Water Supply and Demand Study released in December.

"Only by working together can we improve public understanding of the enormous challenges facing the Colorado River Basin and identify the potential solutions that can help reduce future uncertainties and meet those challenges," Assistant Secretary Anne Castle said. "This continuing effort will require innovative thinking, integration of many viewpoints, and a commitment to work in a positive and collaborative spirit."

The *Moving Forward* event at the U.S. Geological Survey's California Water Science Center in San Diego introduced the next steps framework as part of the collaborative process to work on the challenges in the Colorado River Basin.

"We have made substantial progress addressing Colorado River water management over the past several years," Reclamation Commissioner Michael L. Connor said. "From the interim guidelines for shortage and surplus in 2007, the 2012 signing of Minute 319 to the treaty with Mexico and the latest WaterSMART funding announcements supporting new projects and studies, we remain focused on wise use and new technologies to address upcoming gaps in supply and demand."

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Bureau of Reclamation

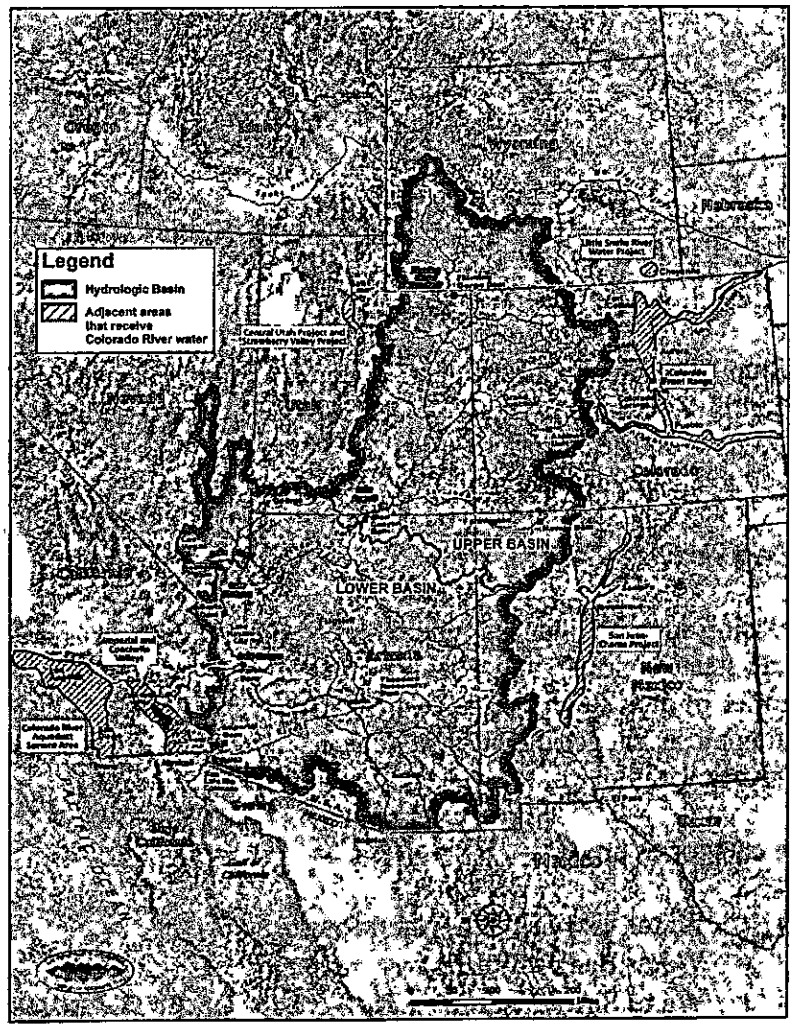
Moving Forward to Address the Challenges Identified in the Colorado River Basin Water Supply and Demand Study

In 2012 the Bureau of Reclamation, in partnership with the seven Colorado River Basin States (Basin States), published the most comprehensive study of future supplies and demands on the Colorado River ever undertaken. The Colorado River Basin Water Supply and Demand Study (Study) confirmed what most experts knew: there are likely to be significant shortfalls between projected water supplies and demands in the Colorado River Basin (Basin) in coming decades.

Those that rely on the Colorado River and its tributaries are committed to approaching these future challenges with the same steadfastness that they have approached and overcome past challenges. Beginning today following the call to action of the Study and as a first step in that commitment, all that rely on the Colorado are taking initial steps — *working together* — to identify positive solutions that can be implemented to meet the challenges ahead.

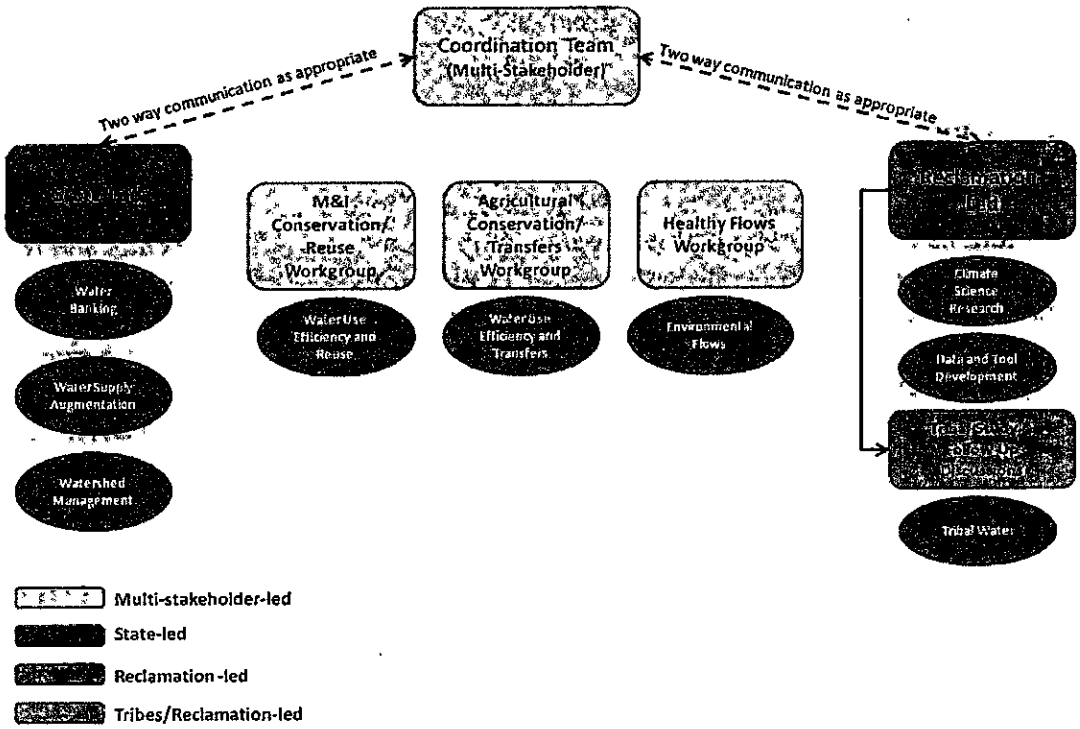
Phase 1: Stakeholder Teams Working Together — Verifying Potential Strategies for Water Conservation, Reuse, Transfers, and Healthy River Flows

Groups representing Federal, State, Tribal, agricultural, municipal, hydropower, environmental, and recreational interests are all engaged in a coordinated way to examine in more detail both the challenges we face together and the potential solutions that will work in the Basin. This effort will require innovative thinking, integration of many viewpoints, and a commitment to work in a positive and collaborative spirit. By working together, we will improve public understanding of the challenges faced in the Basin and identify the potential solutions that can help reduce future uncertainties and meet the significant challenges ahead.



This document sets out the framework for the first phase of action following publication of the Study and is intended to complement other State and Tribal efforts that will be undertaken in parallel processes.

Phase 1 of this process builds on findings for critical next investigations described in the Study and consists of the formation of three multi-stakeholder workgroups to investigate: 1) Municipal and Industrial (M&I) Conservation and Water Reuse, 2) Agricultural Conservation and Water Transfers, and 3) Healthy Flows to support ecological and recreational resources. Additionally, State or Reclamation-led activities will simultaneously pursue the other next step categories. For example, jointly with the Ten Tribes Partnership, Reclamation is pursuing a study related to tribal water use. This process is described in the following graphic. Categories named in the blue circles correspond with the categories described in the Study where next steps should be taken.



It is anticipated that Phase 1 will be completed within 2013, after which Phase 1 efforts will be reviewed, additional phases will be identified, and the process will be reassessed and modified as needed to facilitate anticipated further phases of work.

Workgroups

Each workgroup consists of members with subject-matter expertise from various entities in an effort to bring important and different perspectives to the workgroup. Workgroup membership includes federal and state agencies, local municipalities, agricultural organizations and irrigation districts, Native American tribes and communities, non-governmental organizations, consultants, and other interested stakeholders. Each workgroup will be led by three co-chairs. A multi-stakeholder team (Coordination Team) will direct and review the efforts of the three workgroups. General descriptions of these groups' major activities within Phase 1 are provided below.

M&I Conservation and Water Reuse Workgroup

M&I conservation and water reuse were common options in the strategies explored in the Study in providing a cost-effective solution for resolving imbalances in the near-term. This workgroup will collect information from municipalities relying on Colorado River water and prepare a report that quantifies each municipality's conservation and reuse savings from the initiation of conservation and reuse programs to date, documents

Proposed Drain Water Interceptor Project

Basin States Technical Meeting
April 17, 2013

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CENTRAL ARIZONA PROJECT
YOUR WATER. YOUR FUTURE.

The Problem

- Drain water from Wellton-Mohawk Irrigation and Drainage District cannot be returned to the Colorado River below Imperial Dam
- Additional 106,000 AF/year must be released from Lake Mead for delivery to Mexico
- 15 feet of Lake Mead elevation lost since 2000
- Increased probability of shortage to Lower Basin
- Increased releases from Lake Powell

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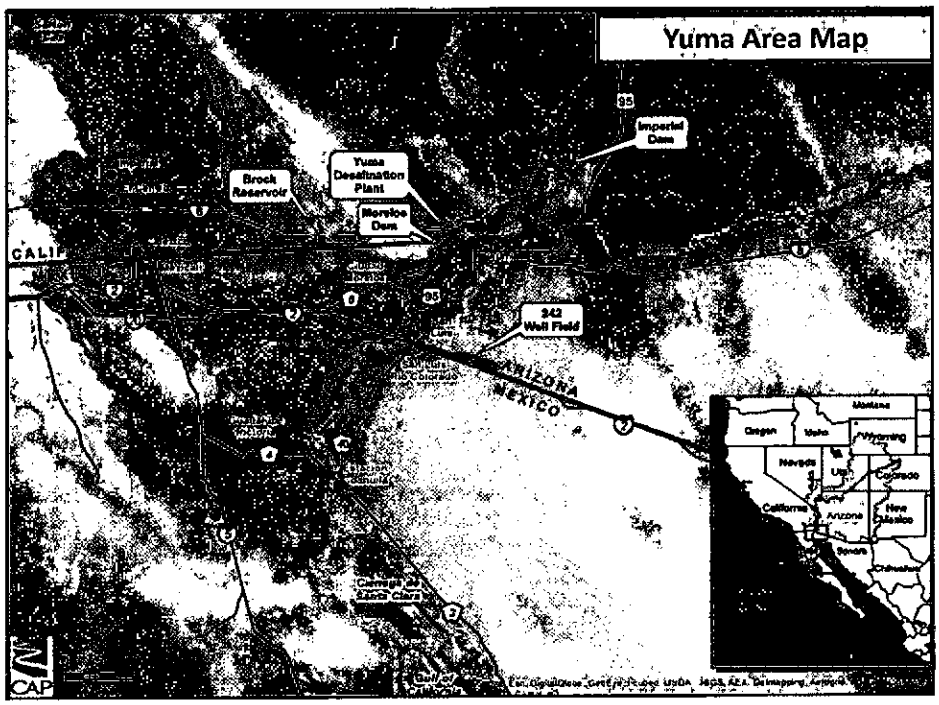
Yuma Area Map
Imperial Dam
Yuma Desalination Plant
Brock Reservoir
Morelos Dam
242 Well Field
ARIZONA
MEXICO
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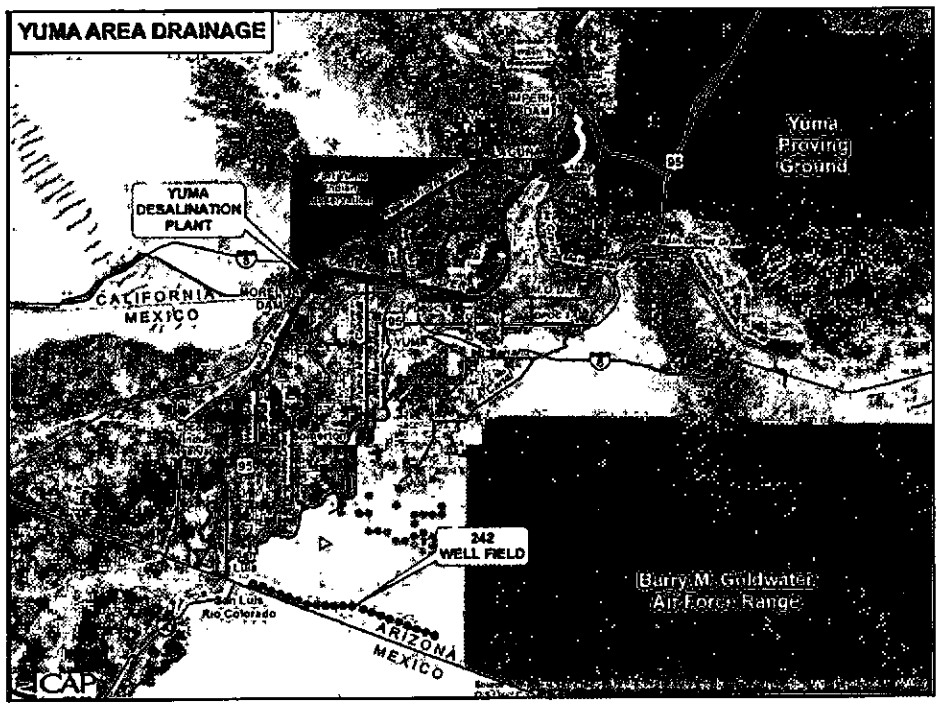
YUMA AREA DRAINAGE
Yuma Proving Ground
YUMA DESALINATION PLANT
CALIFORNIA
MEXICO
242 WELL FIELD
Barry M. Goldwater Air Force Range
San Luis Rio Colorado
ARIZONA
MEXICO
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The Conventional Solution – YDP

- Yuma Desalting Plant intended to be the "permanent and definitive solution"
- YDP cannot be operated without extensive repairs and improvements (est. **$160-450M**)
- YDP would be expensive to operate, even after improvements (**$25-40M/yr**)
- YDP only 75-80% efficient, leaving U.S. with obligation to replace reject stream (≈25 KAF/yr)
  - Additional costs
  - Fallowing?

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Proposed Alternative – DWIP

- Drain Water Interceptor Project would transport MODE water to Colo. River above Imperial Dam
- Conserves 106,000 AF per year in Lake Mead
- Complies with Minute 242
- Estimated capital cost of DWIP is **$100M**
- Estimated annual OM&R for DWIP is **$4M**
- Satisfies all U.S. obligations under Title 1 of Colorado River Salinity Control Act

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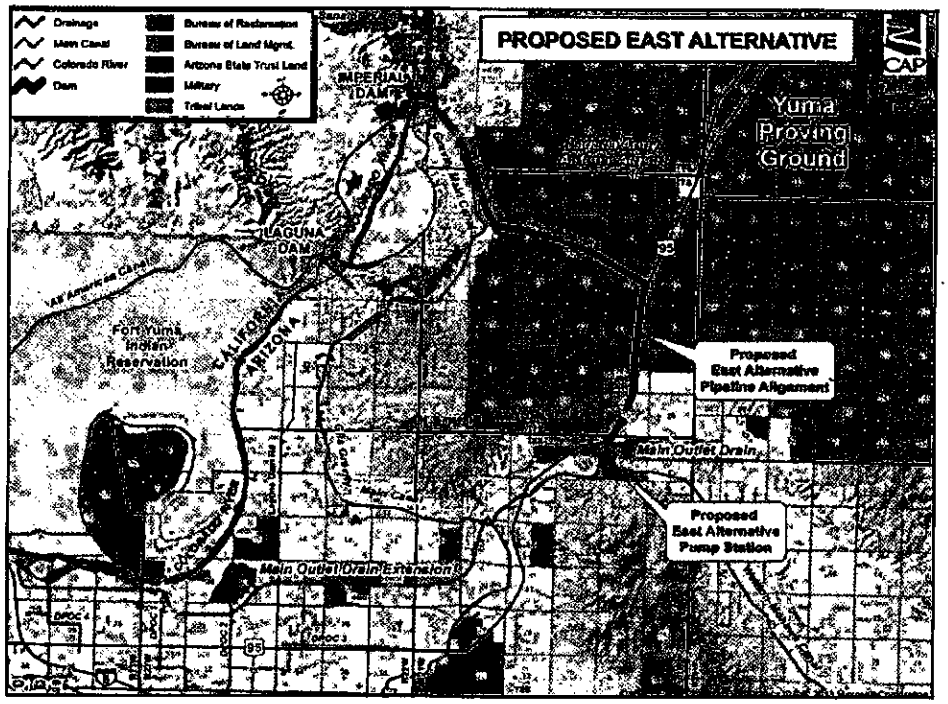
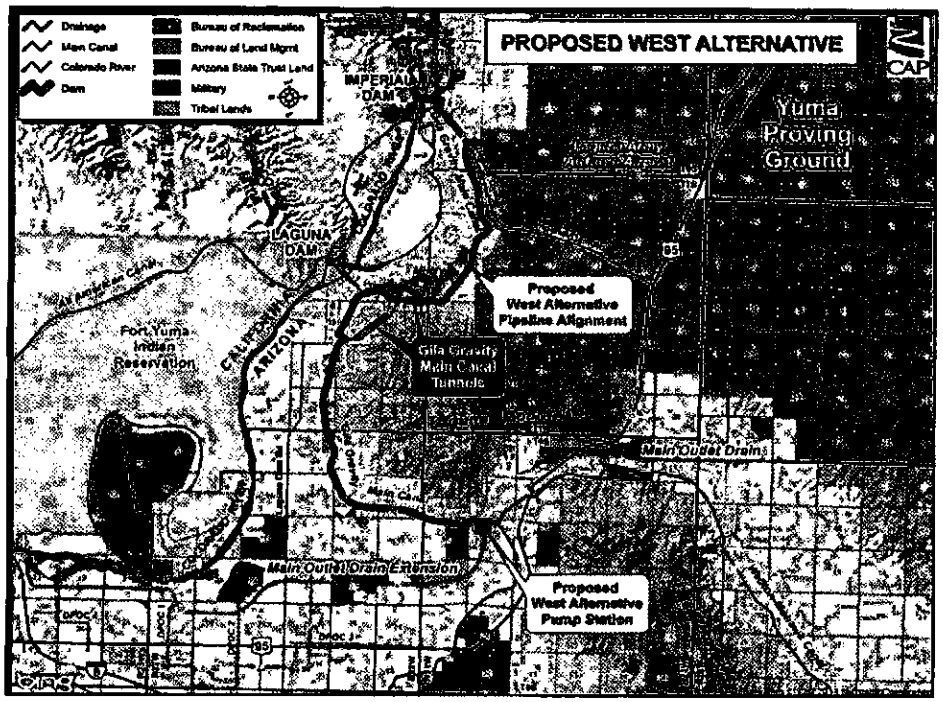

PROPOSED EAST ALTERNATIVE
CAP
Drainage
Main Canal
Colorado River
Dam
Bureau of Reclamation
Bureau of Land Mgmt.
Arizona State Trust Land
Military
Tribal Lands
IMPERIAL DAM
LAGUNA DAM
Yuma Proving Ground
Fort Yuma Indian Reservation
CALIFORNIA
ARIZONA
Proposed East Alternative Pipeline Alignment
Main Outlet Drain
Proposed East Alternative Pump Station
Main Outlet Drain Extension
95


PROPOSED WEST ALTERNATIVE
CAP
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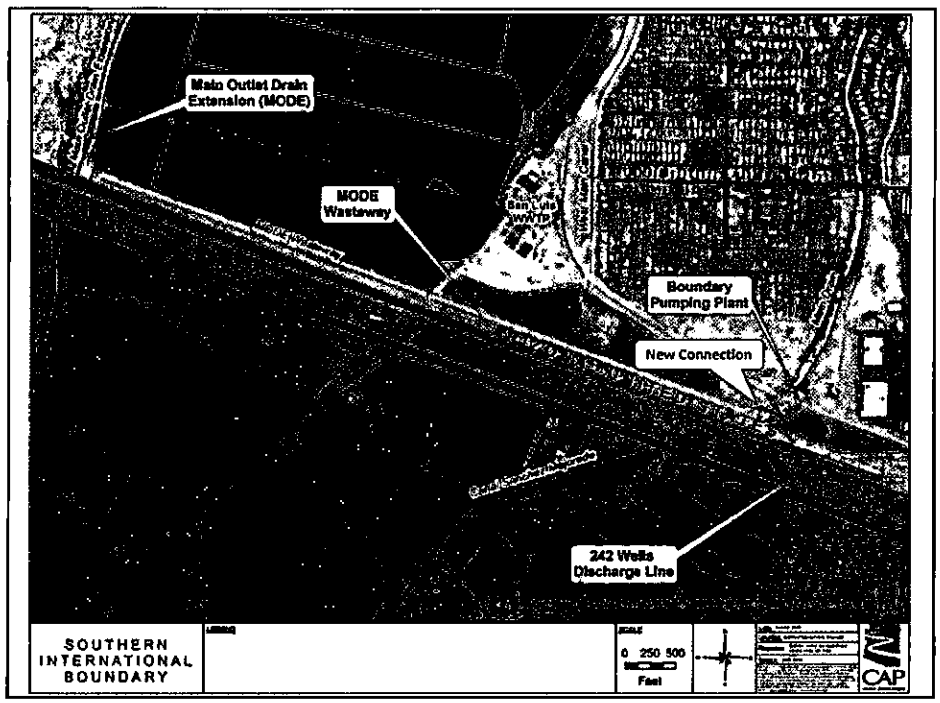
CALIFORNIA
ARIZONA
Proposed West Alternative Pipeline Alignment
Gila Gravity Main Canal Tunnels
Main Outlet Drain
Main Outlet Drain Extension
Proposed West Alternative Pump Station
95

Proposed Cienega Solution

- Both YDP operation and DWIP would reduce volume of water to the Cienega de Santa Clara
- To preserve the environmental values of the Cienega, we propose:
  - U.S. would increase pumping from 242 well field and dedicate 50 KAF/yr of that water to the Cienega
    - Annual cost included in DWIP OM&R estimate
  - 242 water delivered through MODE wasteway
    - Requires only very minor plumbing connection near SIB



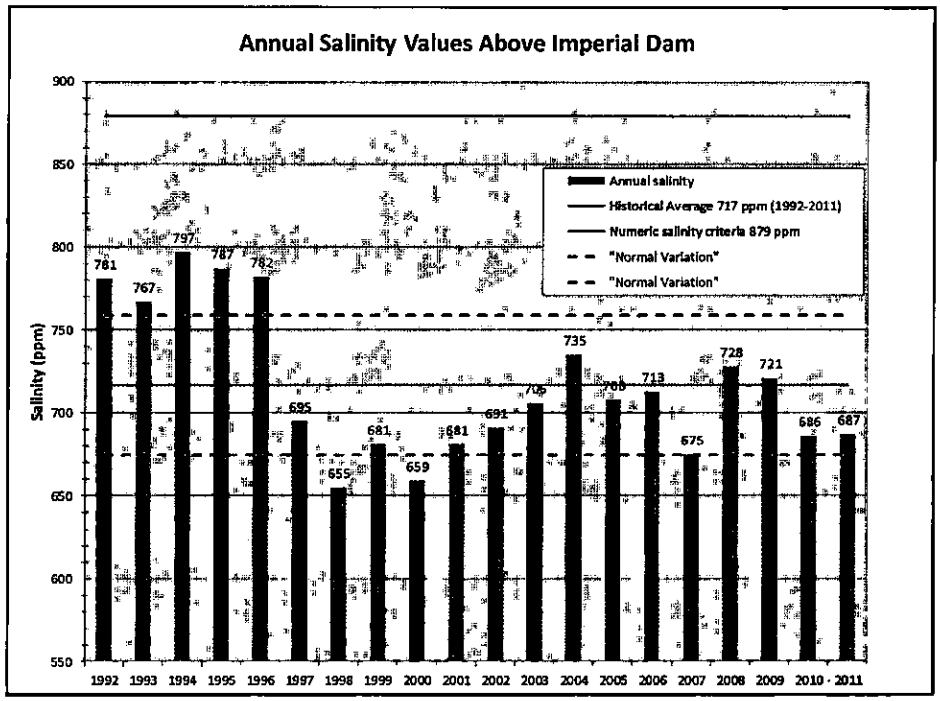
Benefits of Proposal

- Capital cost of DWIP is significantly less than YDP
  - $100M versus $160-$450M
- Annual OM&R for DWIP is far less than YDP
  - $4M* versus $25-$40M
- Eliminates need for U.S. to replace reject stream
- U.S. can satisfy its Title 1 obligations for less than it spends today not operating YDP
- Water dedicated to preserve Cienega

* Includes cost of 242 pumping for Cienega

Salinity at Imperial Dam

- DWIP would increase salinity at Imperial Dam by an estimated 20-30 ppm
- Numerical criteria established by Salinity Control Forum for Imperial is 879 ppm
- Average for 1992-2011 was 717 ppm
- 2011 salinity at Imperial was 687 ppm
- Impact of DWIP is within normal variation



Implementing DWIP

- Brock Reservoir model
  - Non-federal funding partners provide capital for DWIP pipeline and pumping plant
  - Funders receive ICS credits
  - ICS credits are a small fraction of overall system efficiency savings
- U.S. assumes annual OM&R costs for DWIP and 242 pumping
  - Estimated to be less than current Title 1 appropriations

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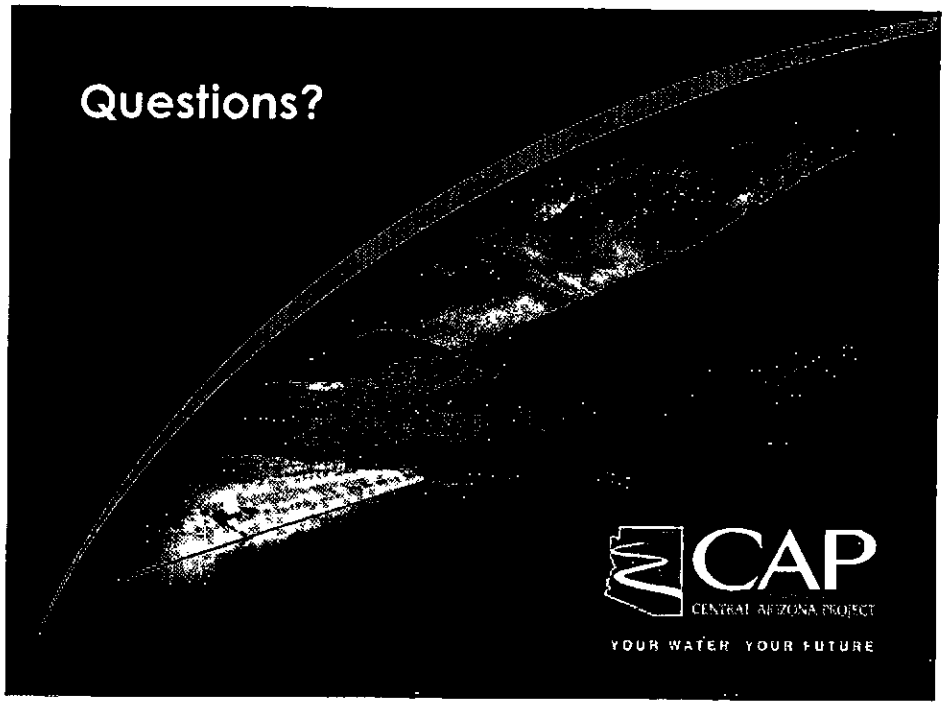
Potential Timeline

2013	Refine concept and perform fatal flaws analyses
2014	Preliminary design, cost refinement, and permitting
2015-17	Construction
2018-20	Begin operation

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