Sustainable Rivers Program

Event Coordination and Initial Results
2010 Experimental Release
Alamo Dam, Bill Williams River, Arizona

May 2010

Compiled by Andrew Hautzinger, U.S. Fish and Wildlife Service

500 Gold Ave SW Room 4002, Albuquerque, NM 87102

Prepared for U.S. Army Corps of Engineers

and other cooperating organizations

COMPILATION OF INFORMATION ASSOCIATED WITH MEASUREMENTS MADE MARCH-APRIL, 2010 (as provided by involved scientists and others to A. Hautzinger for the Bill Williams River Corridor Steering Committee's April 20, 2010 Quarterly Meeting (BLM-AZ Sate Office, Phoenix AZ)
Re: BWR HIGH FLOW RELEASES:

- 3,000 cfs Pulse Event (MARCH 7-9, 2010);
- 2,000 cfs Release (MARCH 15-22, 2010);
- Riparian Release Drawdown (MARCH 23-April 15, 2010) .

SUMMARY TABLE of PRIMARY DATA COLLECTION EFFORTS: (running from late January – through mid-April, 2010)

#	ENTITY	DATA TYPE	DATA PURPOSE(s)	COMMENTS
1)	USGS-WRD (Yuma & Tempe Field Offices)	Discharge & Sediment	Flow Dynamics, Model Calibration	3-sites: 1) blw. Alamo (Q); 2) Mineral Wash; 3)BW Mouth
2)	USGS-WRD (Flagstaff Science Center & Tucson)	Turbidity (Lake Havasu)	Sediment Dynamics / Q Impact to LCR	5-sites: BW Mouth-to-CAP Inlet (max NTU
3)	USBR-LC (Santee, Pernick & Murphy)	Helicopter Imagery (video & stills)	Qualitative Record (e.g., beaver)	Pre-flight 1/26/10; Post-flight 3/19/10 (builds on several year of same type of flights)
4)	Tetra Tech, Inc. (under contract to USFWS/Corps) (field support provided by BLM, BOR & BWRNWR)	Water Surface Elev. Observations	Model Calibration	36 WSEL obs. for 3k cfs event; 38 WSEL obs. for 2k cfs event.
5)		Cross-Section Surveys	Model Calibration, Sediment Dynamics	Pre- & post-13 cross-sections (3k event) using BWRCSC sweet Perm. Hydro X-sect's;
6)		Aerial Photography	Model Calibration; General	Flown 18MAR10; (during 2k Q; 3k flight scuttled)
7)	Univ. of Montana's Dept. of Geosciences (Wilcox & Johnsen)	Geomorphology (stage, suspended, sediment, GPS topo.)	Sediment Dynamics, Model Development/Calibration	Detailed GPS grid surveyed pre- & post @ Rankin and Mineral Wash, river stage observed, suspended sediment .
8)	UofA's Dept. of Hydrology & Water Resources (Simpson & Meixner)	Water Quality, Stage	Tie flow events to changes in water-sources	Suite of chemical and physical data collected throughout corridor w/ some data at Alamo & upper tributaries (10 min. stage record!)
9)	USGS-BRD (Shafroth, Andersen)	Beaver Dam Surveys, Detailed Topography	Q Impact to Beavers & Ecosystem; Tracking riparian response.	Pre-surveys: late Jan.; Post-3k Q (Rankin & Mineral), leveraged data collection to support other studies.
10)	OSU's Lytle Lab (Lytle, McMullen & Bogan)	Aquatic Invertebrate Surveys	Q Impact to Aquatic Insects & Ecosystem	Pre- & Post Surveys (3k event, Rankin & Mineral + Santa Maria pre) adding to extensive dataset from previous pulses.
11)	U. of Wash's Aquatic/Fish Sciences (Olden, Pool)	Fish Surveys	Q Impact to (blw. dam) Fisheries	Limited data collected (turbid flows, <3 cm visibility), data collected @ Upper Planet (7 sites now studied)
12)	Other			Numerous other general information sources exist...

USGS-WRD: Summary of turbidity measurements made in Lake Havasu, March 8 through Mid-April, 2010 (extracted from nightly email updates provided by USGS during flow events): ALL VALUES IN Nephelometric Turbidity Units (**NTU's**)

Turbidity Measurements: Lake Havasu, Colo. R. (USGS-WRD-Flagstaff)	**3,000 cfs PULSE EVENT**				**2,000 cfs Release and Riparian Drawdown**					
	8-Mar	9-Mar	10-Mar	11-Mar	17-Mar	18-Mar	24-Mar	25-Mar	7-Apri	8-Apr
1) At mouth of Bill Williams	Pre-arrival	835 am 610 pm	73 am 129 pm	13 am	220	132	42	44	18.9	17.3
2) Downstream from mouth		32-135	20-90	10-25	2-10	50-100	20-35	10-40	~4-9	~3-9
3) Buoy by CAP inflow channel		4-26	20-7	~5	4	62	17	16	~5	~3
4) Directly in front of CAP		<4 all day	~20	~8	4	48	21	16	~5	~5
5) Near Parker Dam		<1	~1	<1	<1	<1	<1	2	<1	<1

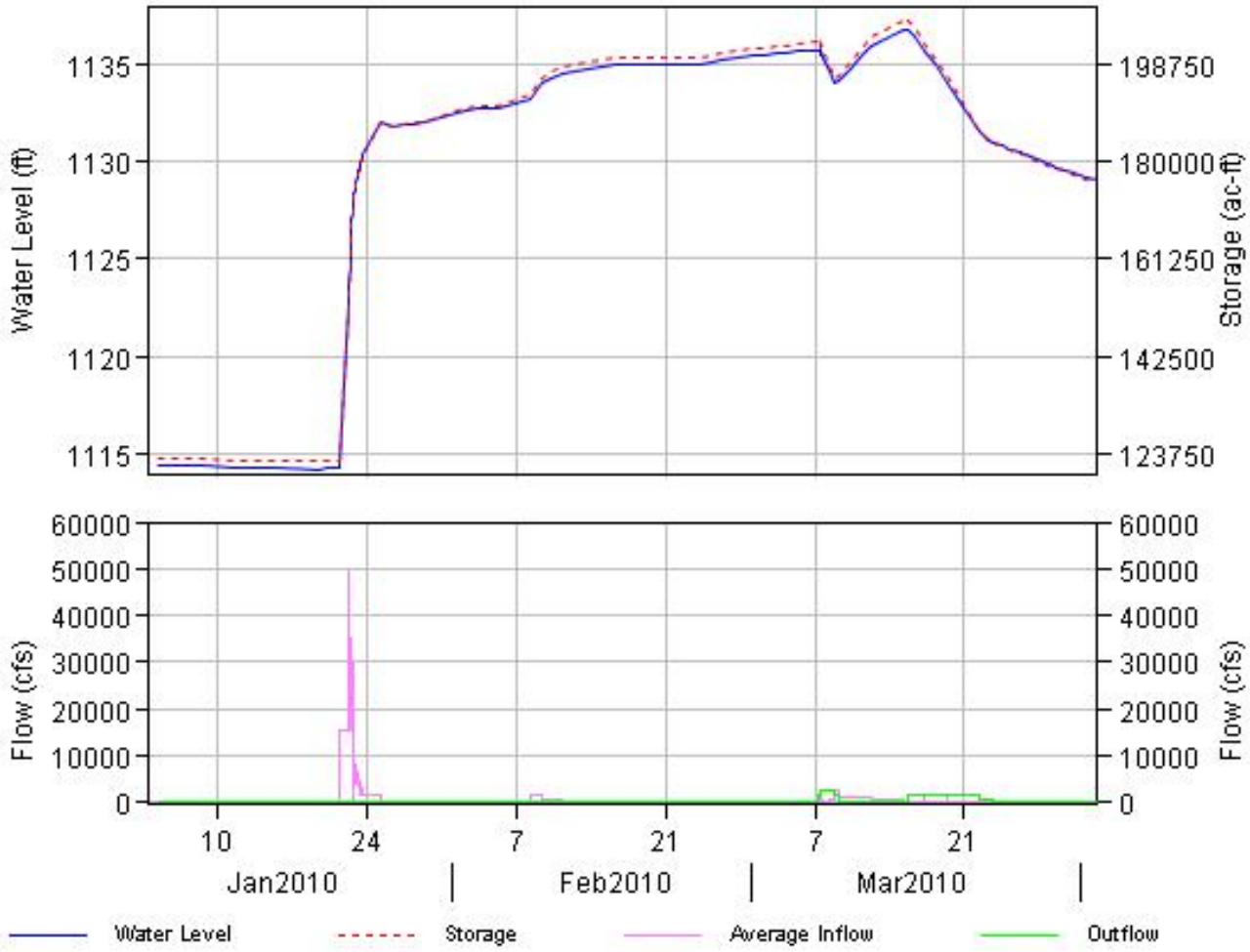
	BW Mouth		**CAP Inlet***	
	NTU_{max}	(date)	**NTU_{max}**	(date)
3,000 cfs event (Mar.7-9)	835	(3/9/10)	20	(3/10/10)
2,000 cfs release (Mar.15-22)	220	(3/9/10)	48	(3/18/10)
RPRN Drawdown (Mar. 23-Apr.15)	44	(3/9/10)	17	(3/24/10)

* 5 NTU Threshold of Concern for Central Arizona Project

US Army Corps of Engineers
Los Angeles District
Reservoir Regulation Section

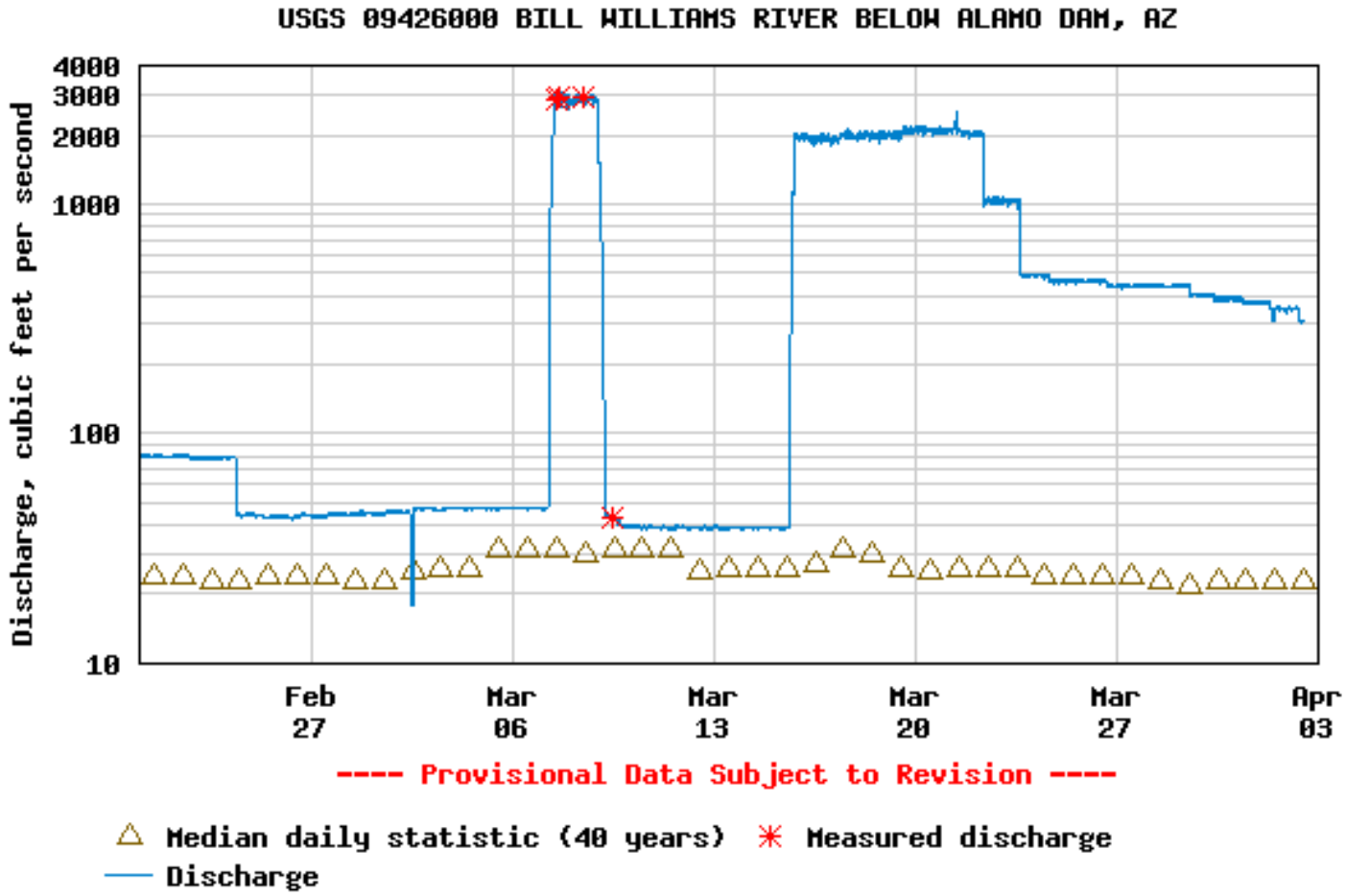
Warning: This automatically generated product has not been screened for errors.

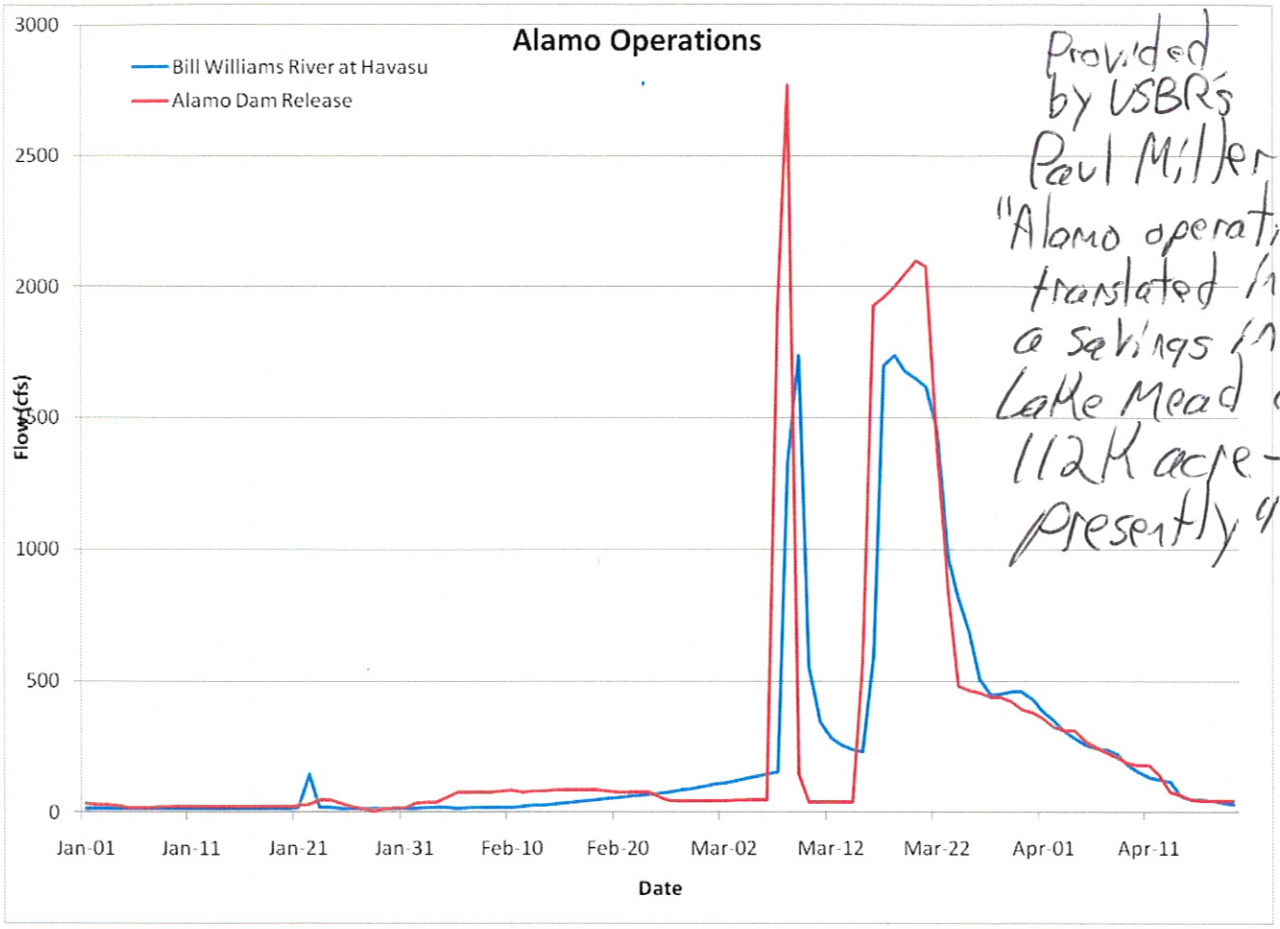
Alamo ResCal Data for Previous 90 Day(s) as of Fri Apr 02, 2010 @ 12:40



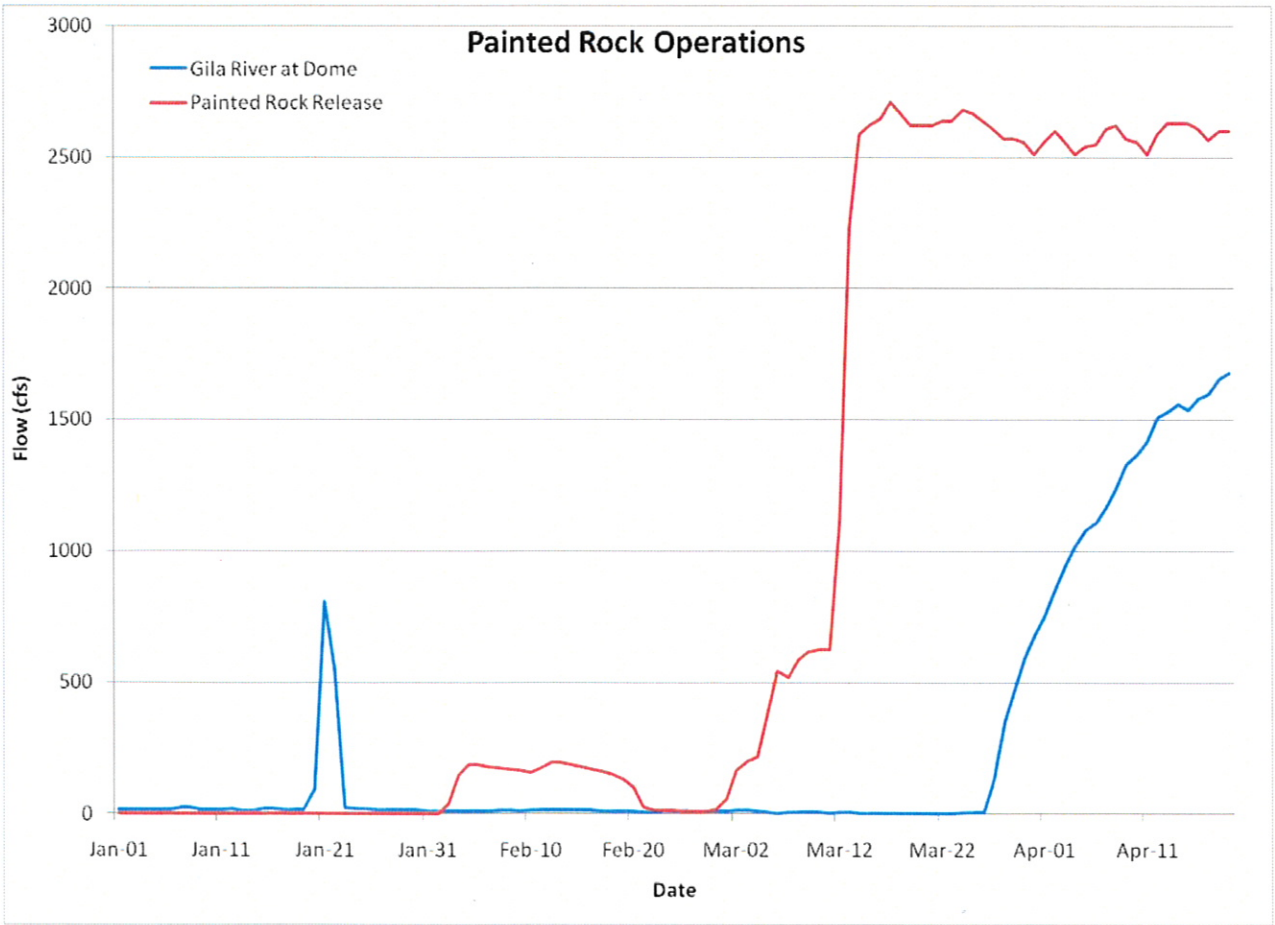
Discharge, cubic feet per second

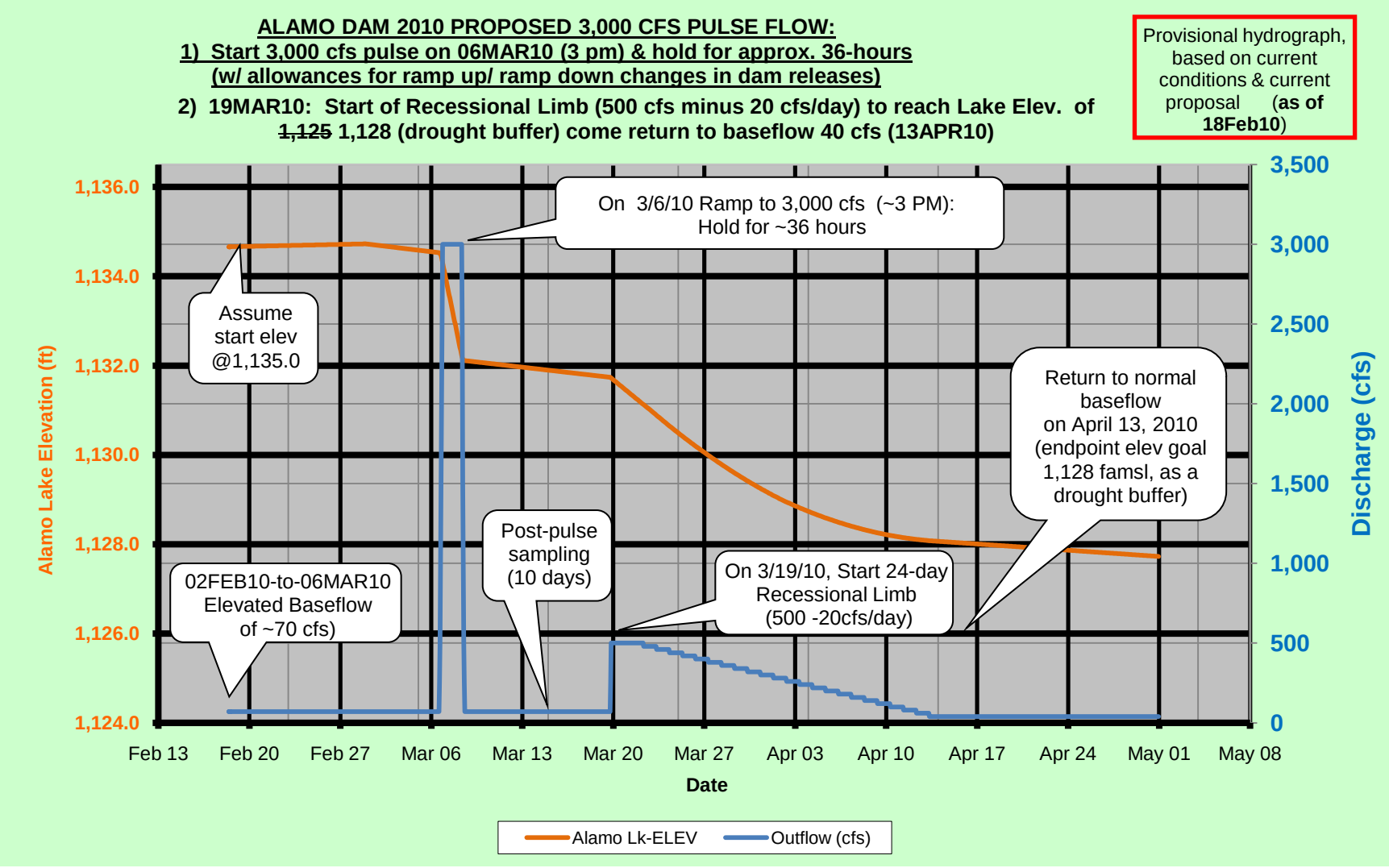
Most recent instantaneous value: 310 04-02-2010 11:30 MST



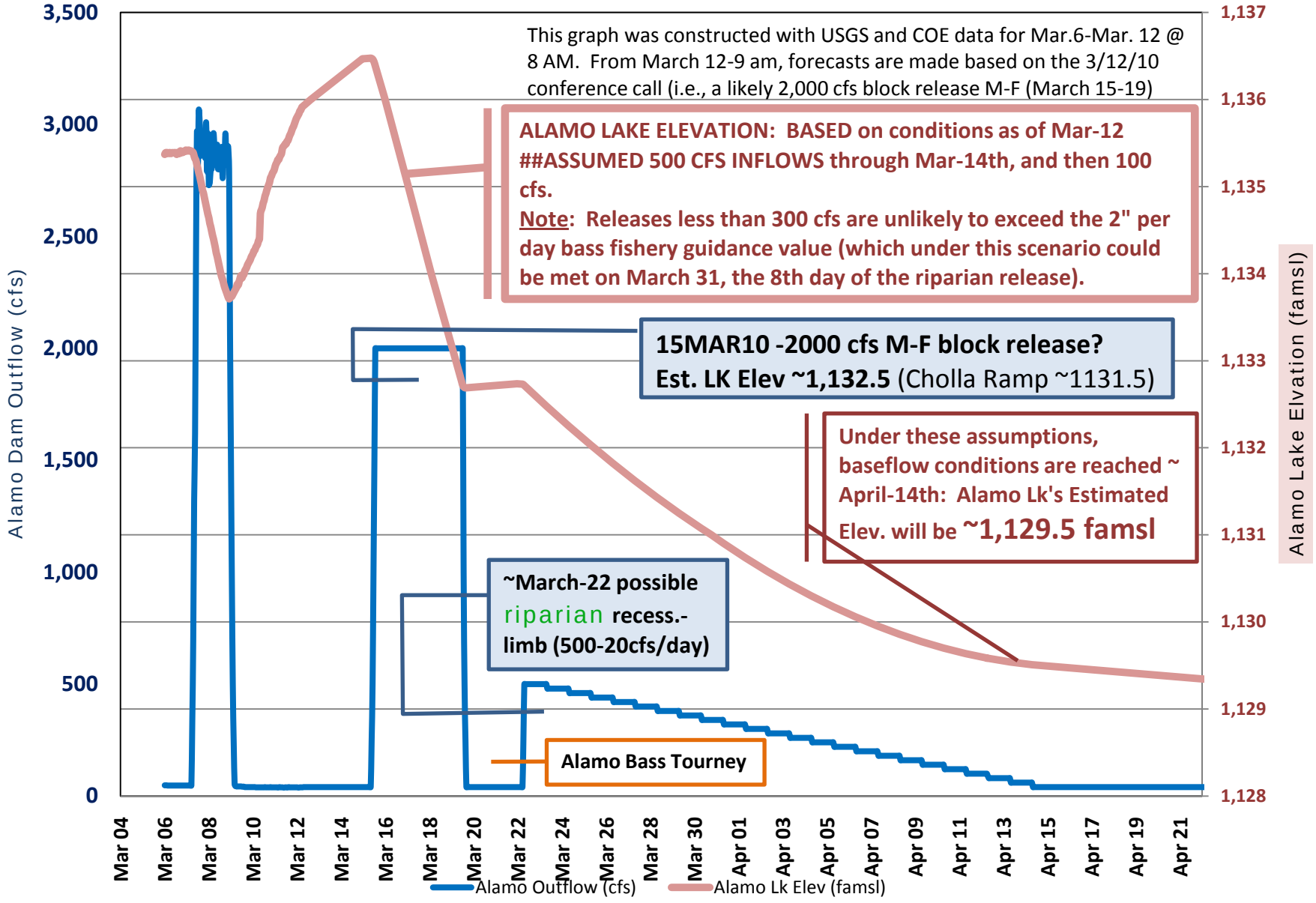


Provided by USBR's Paul Miller "Alamo operations translated into a savings in Lake Mead of 112K acre-feet, presently"




ALAMO DAM 2010 PROPOSED 3,000 CFS PULSE FLOW:
1) Start 3,000 cfs pulse on 06MAR10 (3 pm) & hold for approx. 36-hours
(w/ allowances for ramp up/ ramp down changes in dam releases)
2) 19MAR10: Start of Recessional Limb (500 cfs minus 20 cfs/day) to reach Lake Elev. of
~~1,125~~ 1,128 (drought buffer) come return to baseflow 40 cfs (13APR10)
Provisional hydrograph, based on current conditions & current proposal (as of 18Feb10)
On 3/6/10 Ramp to 3,000 cfs (~3 PM): Hold for ~36 hours
Assume start elev @1,135.0
Return to normal baseflow on April 13, 2010 (endpoint elev goal 1,128 famsl, as a drought buffer)
Post-pulse sampling (10 days)
On 3/19/10, Start 24-day Recessional Limb (500 -20cfs/day)
02FEB10-to-06MAR10 Elevated Baseflow of ~70 cfs)
Alamo Lake Elevation (ft)
1,136.0
1,134.0
1,132.0
1,130.0
1,128.0
1,126.0
1,124.0
Discharge (cfs)
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Feb 13
Feb 20
Feb 27
Mar 06
Mar 13
Mar 20
Mar 27
Apr 03
Apr 10
Apr 17
Apr 24
May 01
May 08
Date
Alamo Lk-ELEV
Outflow (cfs)

Mock Hydrograph for 3/15/10 Alamo Dam Discussions



BWR 2010 Pulse--Schedule (for planning purposes) AS OF SATURDAY MARCH 6th

Calendar: March 4-thru-~Mid April, 2010

Mar.20-21: Major Bass Tourny (Alamo)

Starting March 4, 2010 (note: USGS-BRD collected pre-pulse data Feb. 5-12 & BOR Heli flew on 1/26/10)

IDENTIFY WHERE HELP IS NEEDED

Corps ROC: 213 452-3623 (emer)

Hautzinger: 505 362-2821 (cell)

riparian recessional limnb: details

	3/4	3/5	3/6	3/7	3/8	3/9	3/10	3/11	3/12	3/13	3/14	3/15	3/16	3/17	3/18	3/19	3/20	3/21	3/22	3/23
						RAMP DOWN														
Days with BASEFLOWs (40 cfs)	40	40	40	-------	-------		40	40	40	40	40	40	40	40	MIX	40	40			
Days with PEAKFLOWs (2,000-3,000cfs)	-------	-------	-------	3k	3k	MIX	-------	-------	-------	-------	-------	-------	-------	-------	<2k? <2k?	-------	-------			
Days with Riparian Flows (500 cfs-20/day)	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------		RPR	RPR
	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue

	Physcial Science Activities		(red font=HELP NEEDED)	(red fill=HELPER ASSIGNED)	3/4	3/5	3/6	3/7	3/8	3/9	3/10	3/11	3/12	3/13	3/14	3/15	3/16	3/17	3/18	3/19	3/20	3/21	3/22	3/23
	GROUP	NAMES	ACTIVITY / PURPOSE	COMMENTS																				
1	USGS-WRD	Hugh Darling	Peak flows, suspnd sediment	WRD Crew 1/2 (BW nr Mineral Wash)	Hugh's cell: 928			PK	PK	PK									?	?				
	POC: Steve	Hoffman, Hart, etc.	Peak flows, suspnd sediment	WRD Crew 2/2 (BW Mouth)	580-5596			PK	PK	PK									?	?				
	Wiele	Arthur Rees	blw. Alamo Q meas's	Arthur is blw. Alamo gager (Tempe)				PK	?	?	WRD will make occassional post pulse measurements (turbidity in Lk. Havas													
2	Tetra Tech	Erich Schwaller	Pre-pulse x-sect surveys	+10 cross-sections PARTY of 2-3	TT	TT	TT	Erich cell:505 977 2625																
	POC: Walt Kuhn	Robin Cunningham	PARTY of 2-3		TT	TT	TT	Robin cell: 805 704 1048																
	(cell: 505 453-	TT Main 505 881-3188	Peak WSELS (Tetra Tech)	peak water-surface elev obs				TT	TT	TT														
	3342)	PEAK HELPERS: Mar. 8th & 9th: 2 crews of 2 (Ashlee 8th-9th, Stan 8th, Paul 9th)						TT	TT	TT														
	USBR	Ashlee Rudolph (BR) (w/ 4x4 rig): Mar. 8-9		Meet @ Parker Best W., 6AM (8th-9th)					AR	AR														
	NWR	Stan Culling (NWR) (w/ 4x4 rig): Mar. 8		Meet @ Parker Best W., 6AM (8th)					Stan															
	BLM	Paul Fuselier (BLM) (w/ 4x4 rig): Mar. 9		Meet @ Parker Best W., 6AM (9th)						Paul	(Paul's cell: 928 846-9580)													
	AERIAL FLIGHT FLYOVER 3/9/10 (noon?) during PEAK (to calibrate HEC-RAS model)(w/ WSEL's)							FLIGHT																
		Erich & Robin	Post-pulse x-sect surveys	+10 cross-sections PARTY of 2-3								POST		??										
3	U.NV-Reno	POC: Kyle House	Peak Obs.	Geomorph. Observations in the El-Paso X-ing reach				PK	PK	PK	?													
			Pipeline Geomoorph Obs.																					
4	Univ. Montana	AW w/ James Johnsen	Pre-,Peak & Post sampling	detailed pre-/post-pulse topo. Measurements in Rankin and Mineral Wash reaches (w/ PK sed. meas.)	PRE	PRE	PRE	PRE	PK	PK	?	James		Audrey & Amanda: Work with James (UM) and Pat (USGS										
	POC: Andrew	1of2 BLM Intern, Mar. 9-11 (Amanda Deeds)							---	BLM1of2				1) Be prepared to camp 9th-11th (dinner provided)										
	Wilcox	2of2 BLM Intern, Mar. 9-11 (Audrey Cheaton)								BLM2of2				2) Meet Pat & Cindy @ BWRNWR HQ 3 PM, 3/9/10 (NWR ri										
5	U.of Arizona	Scott Simpson	Pre-pulse surveys	pre & Post- WQ Sampling																				
	POC: Tom	Others?	Peak sediment meas.	SAMPLING HELP NEEDED from OTHER CREWS																				
	Meixner																							
6	USBR-Heli	Mark Santee	Pre-pulse Heli-IMAGERY collected 1/26/2010 (2 passes, full coord.)		Pre- flight done 1/26/2010																			
	POC: Terry	Andy Pernick	Lake Havasu TURBIDTY Heli-IMAGERY (early peak, and then over next 2(?) weeks)		Mark cell: 702 293-8391							OCCASSIONAL POST-Pulse BOR-Heli Lake Havasu Flyovers....TBD												
	Murphy	Others?			Andy cell: 702 286-0636																			
7	CAP	Brian Henning	TURBIDTY @ CAP Pump Station (peak and days afterwards)		Henning: 623-869-2567																			
	Biological Science Activities																							
8	USGS-BRD	Doug Andersen	Pre-pulse Beaver Dam surveys	Robust pre- & post-pulse surveys (dam geometry, pond size/depth, etc.)	PRE	PRE	PRE																	
	POC: Pat	Pat Shafroth	Post-pulse Beaver Dam surveys		PRE	PRE	PRE	---	---	---			STAN											
	Shafroth (cell:	(Lindsey, Cindy)	Longer term Rip.veg. response		PRE	PRE	PRE				----------BRD POST----------													
	970 420-0109)	HELP: Nicki & Stan for pre-pulse days, BLM Interns post-pulse (Audrey and Amanda) w/ UM									2 HELPERs NEEDED w/ RIG (see UM abv)								NWR Rig to be picked up 3/9/10					
9	OSU	Michael Bogan	Pre-pulse aquatic bug surveys	Forth datapoint (adding to 2005-2006 measurements of lentic/lotic community responses)	PRE	PRE	?																	
	POC: Dave Lytle	(Mike's cell: 831 601-9231	Post-pulse aquatic bug surveys					---	---	---		POST		?		(OSU might do another post trip in April?								

USGS-WRD: Summary of turbidity measurements made in Lake Havasu, March 8 through Mid-April, 2010 (extracted from nightly email updates provided by USGS during flow events): ALL VALUES IN Nephelometric Turbidity Units (**NTU's**)

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3) Buoy by CAP inflow channel		4-26	20-7	~5
4) Directly in front of CAP		<4 all day	~20	~8
5) Near Parker Dam		<1	~1	<1

Turbidity Measurements: Lake Havasu, Colo. R. (USGS-WRD-Flagstaff)	**2,000 cfs Release and Riparian Drawdown**					
	17-Mar	18-Mar	24-Mar	25-Mar	7-Apri	8-Apr
1) At mouth of Bill Williams	220	132	42	44	18.9	17.3
2) Downstream from mouth	2-10	50-100	20-35	10-40	~4-9	~3-9
3) Buoy by CAP inflow channel	4	62	17	16	~5	~3
4) Directly in front of CAP	4	48	21	16	~5	~5
5) Near Parker Dam	<1	<1	<1	2	<1	<1

Andrew and others,

We continued turbidity measurements on the Lake this morning and the following data are for <u>March 11, 2010</u>. Overall the sediment plume stayed closer to the Bill Williams inlet and migrated along the northeast side of the Wildlife Refuge. We also saw some turbid water near Parker Dam.

1) At the mouth of Bills Williams River, the turbidity values in the morning were about 13 NTUs.
2) Downstream from the mouth (about a 1/4 - 1/2 mile) into the refuge area of the lake, values were ranging from about 10 NTUs to 25 NTUs.
3) At our site at the CAP inflow channel (at the refuge buoy), values were about 5 NTUs.
4) At our site directly in front of the inlet to the CAP intake (near the pumping station buoy line), values were about 8 NTUs.
5) Near Parker Dam values were up to about 3 NTUs, but further upstream near the aquaduct intake, the values were less than 1 NTU.

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Andrew and others,

As a follow-up to Bob Hart's email, here are the data for March 10th, 2010. These data are surface measurements and we have not yet processed the data at depth.

1) At the mouth of Bills Williams River, the turbidity values in the morning were about 73 NTUs, slightly increasing in the afternoon to 129 NTUs.
2) Downstream from the mouth (about a 1/4 - 1/2 mile) into the refuge area of the lake, values were ranging from about 20 NTUs to 90 NTUs.
3) At our site at the CAP inflow channel (at the refuge buoy), values were about 20 NTUs in the morning and decreased to about 7 NTUs in the afternoon.
4) At our site directly in front of the inlet to the CAP intake (near the pumping station buoy line), values were about 20 NTUs all day.
5) From Parker Dam to upstream of the aqueduct intake, values were about 1 NTU all day.

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Subject: Summary of turbidity measurements for today, March 9, 2010

Andrew and others - Sorry this is a bit late this evening but I can blame it on internet problems! Anyway, we measured turbidity (plus several other water quality parameters) at over 20 sites this morning and again this afternoon. We use a depth-profile instrument , so we have a very robust data set. To summarize for you what we observed today, here is what we found:

1. At the mouth of Bills Williams River, the turbidity values in the morning were about 835 NTUs, decreasing in the afternoon to 601.These were the highest values measured.
2. As we continued to measure downstream from the mouth (about a 1/4 - 1/2 mile) into the refuge area of the lake, values were significantly lower compared to at the mouth. Values however slightly increased during the day ranging from about 32 NTUs to 135.
3. At our site at the CAP inflow channel (at the refuge buoy), values increased during the day from about 4 to 26 NTUs.
4. At our site directly in front of the inlet to the CAP intake (near the pumping station buoy line), values were constant during the day at about 3.5. No change from morning to afternoon.
5. From Parker Dam to upstream of the aqueduct intake, values were less than 1 NTU.

We will measure again tomorrow and Thursday, in the morning and afternoon. We will return to measure the week of the 15th.

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Robert (Bob) J. Hart
Scientist in Charge, Flagstaff Science Campus
Chief, Flagstaff Programs Office
USGS Arizona Water Science Center
2255 N. Gemini Dr.
Flagstaff, AZ 86001
Email bhart@usgs.gov
voice (928) 556-7137
Cell (928) 853-0680

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SUMMARY OF BILL WILLIAMS RIVER BELOW ALAMO DAM discharge measurements:
(as provided by Arthur Rees, USGS-WRD Tempe)

Location: BWR blw. Alamo Dam, AZ
Date: 3/7/2010
Time: 1121
Staff: Arthur Rees
Gage height: 16.65
Discharge: 2,850 cfs

Location: BWR blw. Alamo Dam, AZ
Date: 3/7/2010
Time: 1400
Staff: Arthur Rees
Gage height: 16.63
Discharge: 2,950 cfs

Location: BWR blw. Alamo Dam, AZ
Date: 3/8/2010
Time: 0959
Staff: Arthur Rees
Gage height: 16.58
Discharge: 2,900 cfs

Location: BWR blw. Alamo Dam, AZ
Date: 3/9/2010
Time: 1012
Staff: Arthur Rees
Gage height: 12.48
Discharge: 42.8 cfs

SUMMARY OF LOWER BILL WILLIAMS RIVER **discharge and sediment** measurements made during the 3,000 cfs Pulse Evennt: (no measurements made during the 2k cfs flows)
LOCATIONS: 1) upstream of Mineral Wash; 2) Mouth (write up via pers. comm. with Hugh Darling, USGS-WRD Office Chief, Yuma Area Office):

MINERAL WASH BOAT MEASUREMENTS (sediment and discharge):

- 1,800 cfs peak flow measured some 200 yards upstream from BWR junction with Mineral Wash (fallen trees in previous meas. location necessitated new site).
- Over twenty successful passes made with ADCP; “strong data set”

MOUTH OF BILL WILLIAMS RIVER BOAT MEASUREMENTS (sediment and discharge):

- 2,100 cfs peak flow measured (which Hugh thinks is more reliable; some local rains likely contributed to difference as well)
- Over twenty successful passes made with ADCP; “Great data—much better than previous pulses”

Sediment samples being analyzed in USGS lab in WA.

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TETRA TECH, INC.

MEMORANDUM

TO: Andrew Hautzinger

FROM: Walt Kuhn

SUBJECT: **Bill Williams Data Collection Summary for March 2010**

Cc:

DATE: April 15, 2010

During March, 2010 there were two flood releases from Alamo Dam, 3000 cfs from 3/7 to 3/9 and 2000 cfs from 3/17 to 3/18. The following is a list of data collected:

3000 CFS Release

- 13 cross section surveys pre and post flood event. (3) Lincoln Ranch, (2) Pipeline Reach, (8) Planet Ranch
- 36 high flow water surface elevations from Lincoln Ranch to Lake Havasu
- Aerial Photography was NOT collected due to weather

2000 CFS Release

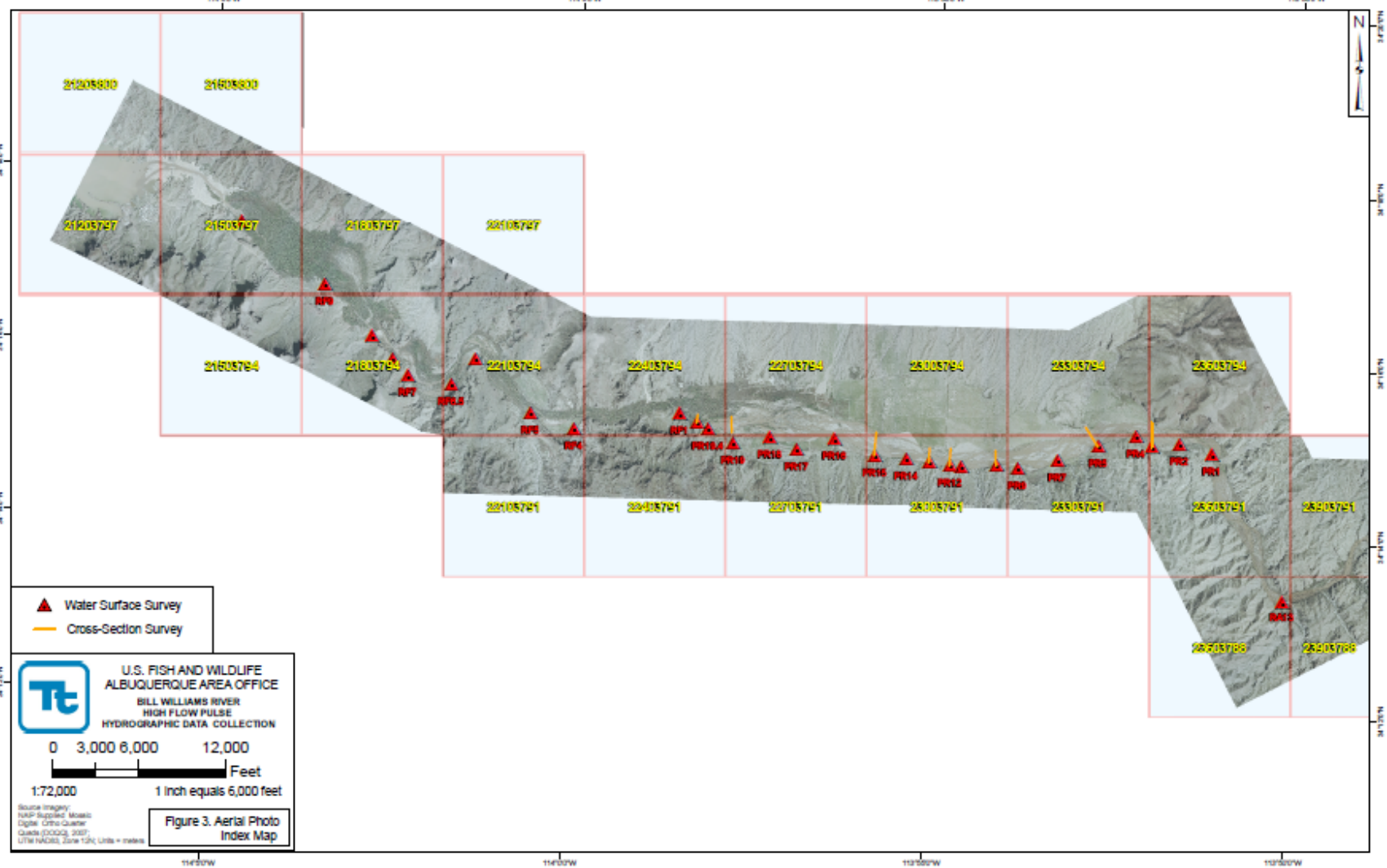
- 38 high flow water surface elevations from Lincoln Ranch to Lake Havasu
- Aerial Photography was collected (March 18, 2010)(subsequent orthorectification went well)

Data collection went smoothly. Some observations:

- Vegetation seemed similar to 2006 with the exception of Lincoln Ranch and the downstream end of Planet Ranch where it was significantly denser.
- There was limited change in the vegetation pre and post the 3000 cfs flood event

Delivery of Information

- Data Collection Report – week of 4/12
- Aerial Photography - week of 4/12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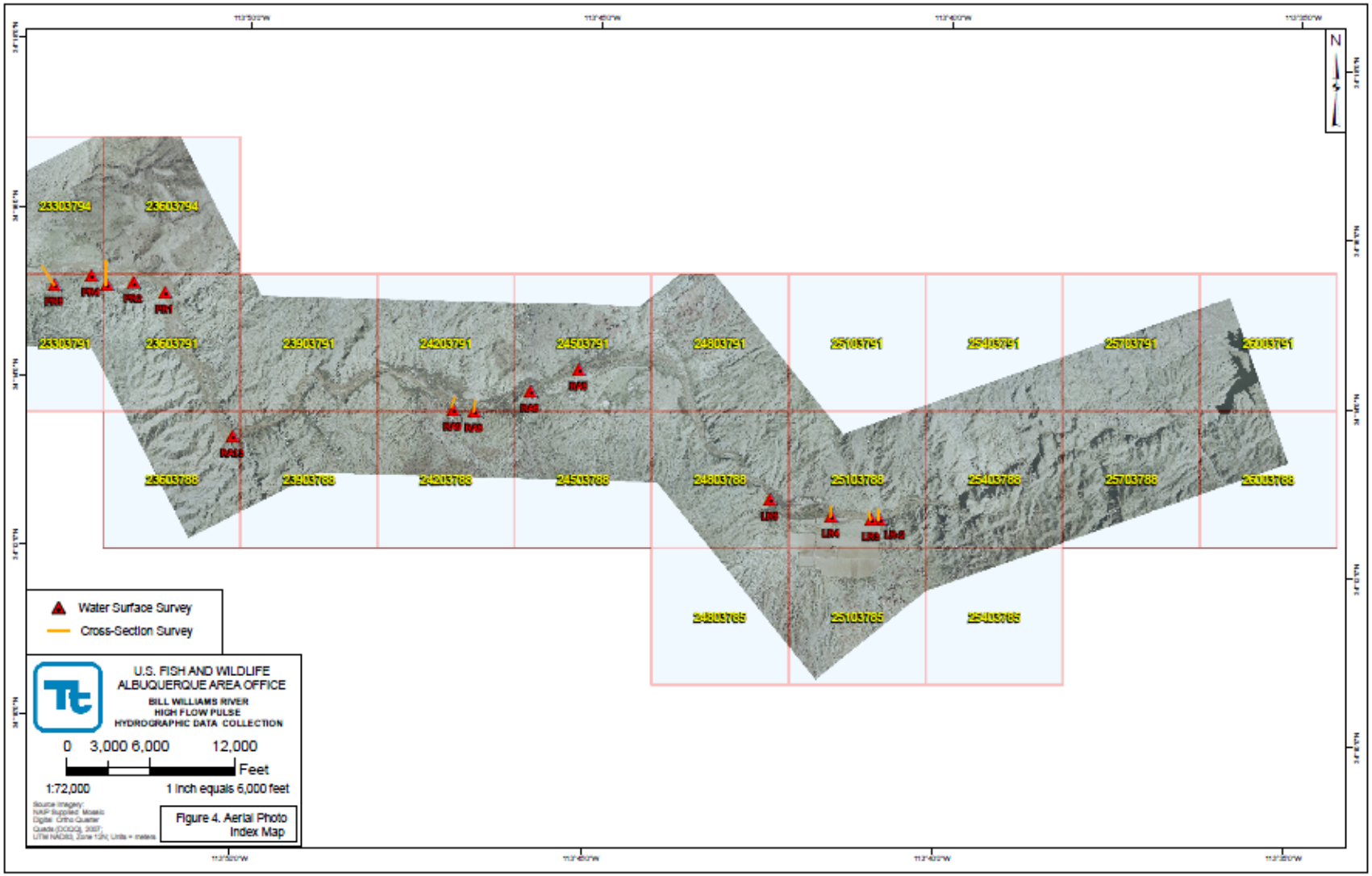
Water Surface Survey
Cross-Section Survey
U.S. FISH AND WILDLIFE
ALBUQUERQUE AREA OFFICE
BILL WILLIAMS RIVER
HIGH FLOW PULSE
HYDROGRAPHIC DATA COLLECTION
0 3,000 6,000 12,000
Feet
1:72,000
1 inch equals 6,000 feet
Source Imagery:
NAIP Supplied Mosaic
Digital Ortho Quarter
Quads (DOQQ), 2007;
UTM NAD83, Zone 12N; Units = meters
Figure 3. Aerial Photo
Index Map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Water Surface Survey
Cross-Section Survey
U.S. FISH AND WILDLIFE
ALBUQUERQUE AREA OFFICE
BILL WILLIAMS RIVER
HIGH FLOW PULSE
HYDROGRAPHIC DATA COLLECTION
0 3,000 6,000 12,000
Feet
1:72,000
1 inch equals 6,000 feet
Source Imagery:
NAIP Supplied Mosaic
Digital Ortho Quarter
Quads (DOQQ), 2007
UTM NAD83, Zone 12N; Units = meters
Figure 4. Aerial Photo
Index Map

Here is a brief summary of what the University of Montana researchers found during March 2010 data collection. Note that our data collection was confined to the 3000 cfs release; no data were collected during the follow-up 2000 cfs event. All data presented here are preliminary and subject to continued additional review. Our data collection was concentrated in a reach near Rankin Ranch (~18 km downstream of the dam), at the nearby illegal road crossing (~19 km downstream of the dam), and at Mineral Wash (~48 km downstream of the dam; topography only). Data collection consisted of stage recordings (with Hobo water level loggers), suspended sediment measurements (with a DH-74 sampler), and pre- and post-pulse topography surveys (with RTK-GPS).

Stage recordings (Figure 1) indicate that, the leading edge of the rising limb arrived at our Rankin reach about 9.5 hours after the upramp appeared at the Alamo gauging station (5:30 am at gauge; 2:50 pm at Rankin). The lag between peaks was slightly less. Lag time to the illegal road crossing was 0.5 hours longer.

Suspended sediment measurements (Table 1) were completed at the illegal road crossing on the Sunday 3/7 (evening) and Monday 3/8 (afternoon). A measurement at close to the peak flow on 3/7 indicated a TSS concentration of 5600 mg/L. Measurements on 3/8, at essentially the same discharge as the 3/7 measurement, were an order of magnitude lower and decreased steadily over a 4-hour period. These results are suggest that fine sediments that had been transported and deposited at lower flows were flushed out fairly quickly during the early part of the pulse release. No measurements were completed the night of 3/7 for safety reasons, and the field crew was performing a water surface elevation profile in the Rankin reach the morning of 3/8.

In terms of topographic surveys, we have not processed our data yet, but qualitative observations indicate that geomorphic changes at both Rankin and Mineral were limited and that many cattail and woody seedlings survived the event. Please contact Andrew Wilcox (andrew.wilcox@umontana.edu) if you have questions.

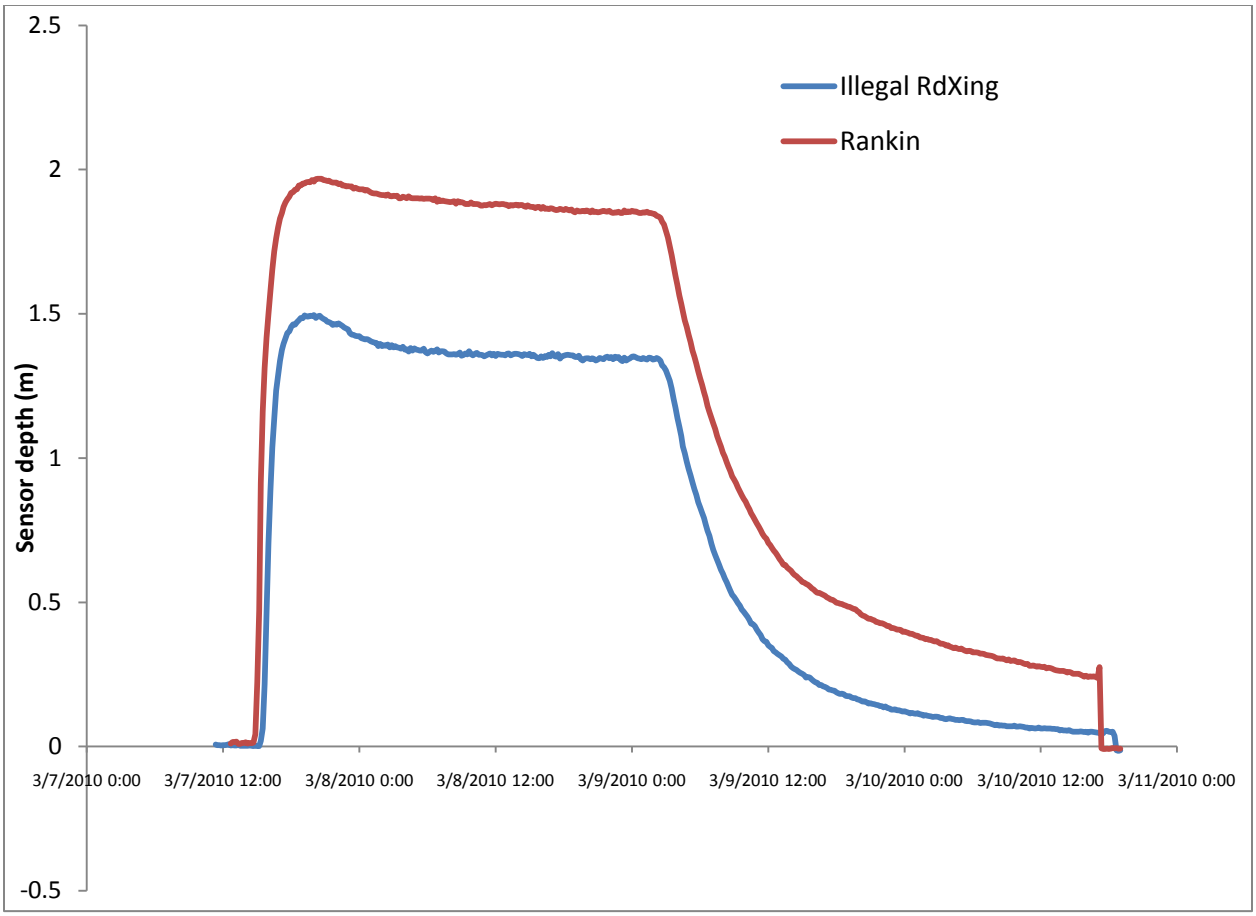

Figure 1. Pressure transducer data recorded with Onset Hobos at Illegal Road Crossing and Rankin Ranch reaches during March 2010 3000 cfs pulse.

Table 1. Results of suspended sediment measurements at illegal road crossing. Data are based on depth- and cross-section integrated measurements with a DH-74 sampler at 5 intervals along a cross section. Laboratory analysis was performed at the University of Montana Environmental Biogeochemistry Lab. Note that confidence in the first measurement is low because a small amount of sample spilled during transfer from sampler bottle to temporary storage bottles.

Time at start of sample	TSS (mg/L)
3/7/2010 17:50	9200
3/7/2010 18:06	5600
3/8/2010 12:31	990
3/8/2010 12:37	840
3/8/2010 13:31	810
3/8/2010 13:39	810
3/8/2010 14:35	780
3/8/2010 15:31	730
3/8/2010 16:35	700

Scott Simpson
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Dept. of Hydrology and Water Resources
April 14, 2010

Summary of Data Associated with 3/7/10 BWR Pulse

The nature of chemical and isotopic analysis is such that, given the number of samples I collected during this flood event (*n*=329) and the time required to filter this many turbid samples in the lab, I do not have any water quality results to report yet. We are in the process of analyzing all samples for the seven major dissolved anions (F, Cl, NO_2, Br, NO_3, SO_4, PO_4) and should have all analysis completed by the end of April. I do, however, have some field data to report at this time that may be useful (or at least interesting) to others studying the Bill Williams River.

I installed pressure transducers in the low-flow channel of the river at three locations to record changes in river stage during the pulse: (1) at the western end of Planet Valley (near wells *31ACD2* and *31ACD3*), (2) at Mineral Wash, and (3) in the southernmost channel at the transect of USFWS (?) wells than includes wells *246-249*, which I call the "tamarisk transect." The Planet Valley transducer was lost during the pulse, but the two others were retrieved and their resulting water level data is shown in *Figure 1* [Note: the 'tamarisk transect' transducer was removed five days earlier because it was in a location more susceptible to potential vandalism or theft.] This data was collected every 10 minutes beginning 12+ hours before the pulse arrived at each site.

Each transducer also recorded the temperature and electrical conductivity (EC) of the river. The temperature data is not particularly interesting (at least for our purposes), but the electical conductivity from these locations and our field meter (where I was sampling in western Planet Valley) during the pulse shows some interesting patterns (*Figure 2*). The considerable differences between pre-flood streamflow and pulse water shows great promise for our ability to use dissolved anions (and eventually cations) to determine how streamflow water sources differ before and after this pulse. Whether it's the river depth, temperature or EC data, I would be happy to make any or all of this data available to anyone whose research would benefit from it.

For the sake of being thorough, I'll provide a quick run-down of the samples I was able to collect before, during and after the pulse.

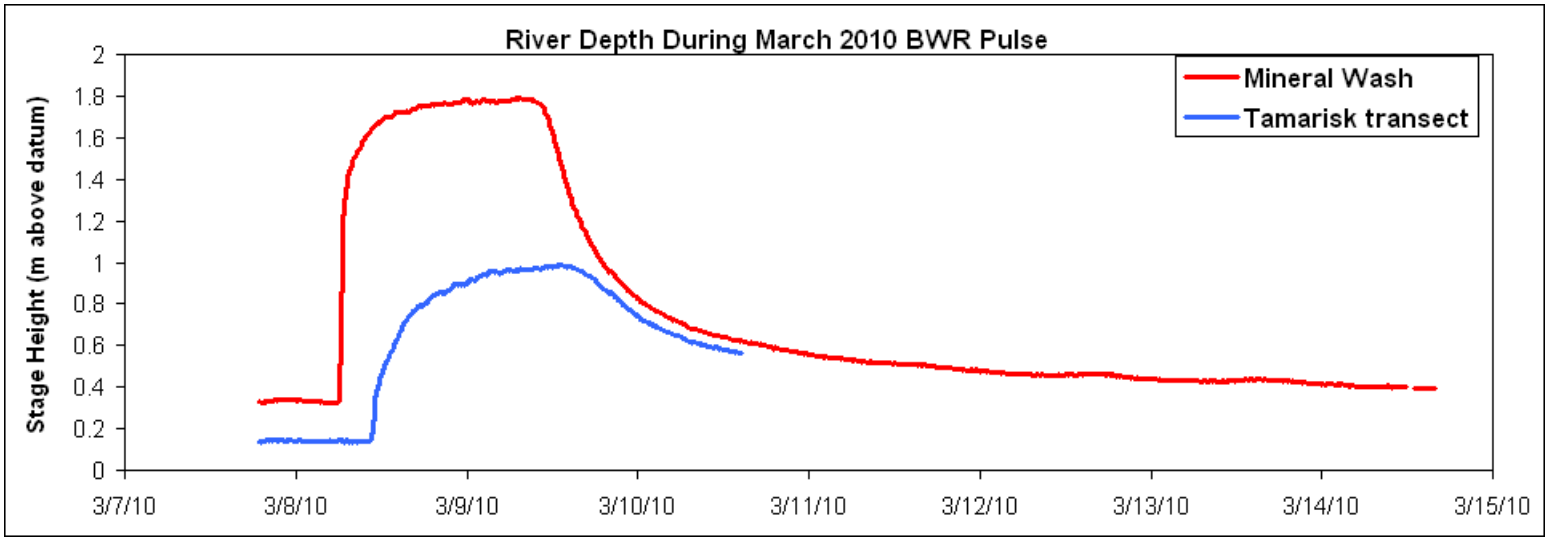

Figure 1 (Above). Bill Williams River stage hydrographs at Mineral Wash and the 'tamarisk transect' of wells.

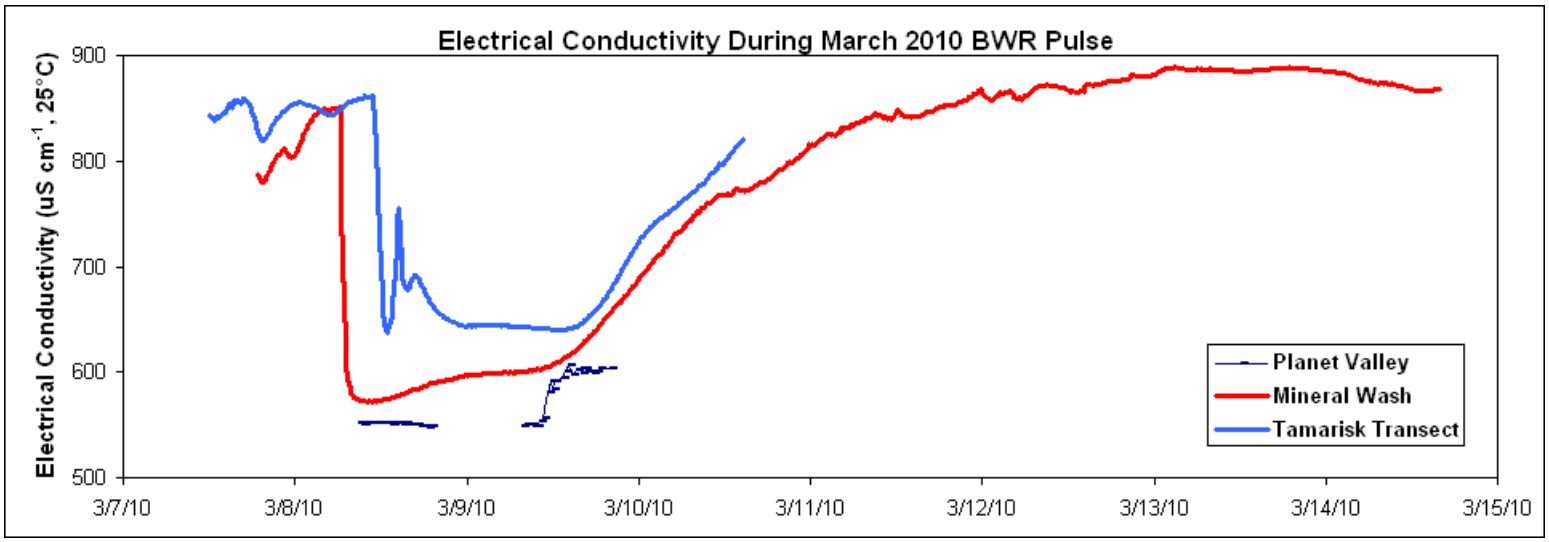

Figure 2 (Above). Bill Williams River electrical conductivity (EC) as a function of time. Differences in EC between baseflow (~850 µS cm^{-1}) and floodwater (550-650 µS cm^{-1}) suggest considerable differences in chemical composition that should be useful in determining the post-flood water quality response of the riparian groundwater system.

Preflood samples collected (3/5-3/7):

- **Groundwater**: Seven Planet Valley wells located in or adjacent to the river
- **Precipitation**: One precipitation sample collected in Planet Valley while sampling wells
- **River water**: Three principal tributaries to Alamo Lake, BWR at Alamo Dam, BWR at the eastern and western ends of Planet Valley, BWR at Mineral Wash, BWR at 'tamarisk transect'.
- **Shallow substream water** (directly below the river and within 1.5 m of the streambed): 29 in western Planet Valley, 22 at Mineral Wash, 1 at 'tamarisk transect'

Samples collected during pulse (3/7-3/10; ***all are river water***):

- 24 samples from directly below Alamo Dam at 3 hour intervals and spanning the entire event
- 59 samples from the western end of Planet Valley collected at 30 minute intervals during the pulse's daylight hours (all from 3/8-3/9)
- 15 samples from the BWR at Mineral Wash at 2.5 hour intervals and spanning the entire rising limb, peak/plateau and several on the falling limb

Postflood samples (3/10 & 3/14-3/15):

- **River water**: BWR at Alamo Dam, BWR at the western end of Planet Valley, BWR at Mineral Wash, BWR at 'tamarisk transect'
- **Shallow substream water** (directly below the river and within 1.5 m of the streambed): 50 in western Planet Valley, 50 at Mineral Wash and 44 at the 'tamarisk transect'

-----Forwarded by Andrew Hautzinger/RO/R2/FWS/DOI on 05/01/2010 09:47AM -----

To: Andrew Hautzinger/RO/R2/FWS/DOI@FWS
From: Patrick B Shafroth/BRD/USGS/DOI
Date: 04/26/2010 10:49AM
Subject: paragraph

Bill Williams River 2010 Pulse: Summary of field work done by USGS-BRD-FORT (Andersen, Shafroth)

Our work in Spring 2010 continued and expanded our previous work on the effects of pulse flows on beaver dams and associated aquatic habitat. In 2010, we assessed both river-scale and reach scale responses of beaver dams and aquatic habitats to environmental flow releases. We repeated measurements we have taken in association with past flow releases on the Bill Williams River. In addition, we collected some data on riparian and aquatic vegetation associated with our reach-scale study sites. Specifically, at the river-scale, we will use a combination of aerial photography and low-elevation videography to estimate the number and condition of beaver dams before and after the planned March 2010 flow releases. Our primary source of information will be videography, which was flown before and after the 2010 high flow release. These data will be supplemented by field observations of dams in our detailed study reaches (Planet Ranch and Pipeline/Rankin). At the reach scale, we repeated measurements that we made in 2008 of flow velocity, cross-sectional topography, and sediment particle size and organic matter along in two reaches with numerous beaver dams – near the pipeline crossing (32 velocity transects; 17 cross sections) and near Planet Ranch (11 velocity transects; 4 cross-sections). These measurements were made before and after the 2010 high flow release. Sediment samples will be analyzed in the laboratory. New measurements of riparian vegetation in 2010 included line intercept assessment of plant cover along the 21 cross-sections within the Pipeline and Planet study areas, as well as an assessment of the proportion of woody stems that were beaver-cut, uncut, or resprouting along 13 of these cross-sections.

-----Forwarded by Andrew Hautzinger/RO/R2/FWS/DOI on 04/17/2010 08:46PM -----

To: Andrew Hautzinger/RO/R2/FWS/DOI@FWS, Patrick B Shafroth/BRD/USGS/DOI@USGS
From: Douglas C Andersen/BRD/USGS/DOI
Date: 03/16/2010 09:15AM
Subject: Re: Cumulative effects on beaver

Some initial observations and thoughts on effects of the 2010 floods on beaver:

Ground observations at two sites (Pipeline Reach and Planet Reach) indicate the short, 3K pulse removed some dams, but only "skeletonized" others, with some of the latter dams' functionality retained post-flood. Repairs to the latter might be accomplished within weeks or months, if beaver remained present, behaviorally motivated, and flow levels allowed it. Prior to the 3K pulse, all Pipeline dams had already received minor damage from the 80 cfs flows, which likely caused loss of finer dam materials, especially along dam crests.

Adult beaver tracts were observed post-flood throughout both reaches, but actual effects on individual beaver are unknown.

The cumulative duration of the multiple flood pulses in spring 2010 could adversely impact the beaver population's 2010 reproductive output. Based on data collected outside the southwest and reviewed in Baker and Hill (2003), beaver "typically" give birth in spring and produce only 1 litter/year. However, the potential breeding season is long, with parturition reported in "between February and November." The female gives birth in a "nest" in her lodge or bank den, but how flooding of the nest effects maternal behavior is not known. Newborn beaver, although somewhat precocious in being fully furred, are apparently unable to swim until about 4 days of age, and may be unable to stay submerged for a long period (likely required to exit a flooded lodge or den) until several weeks old. Separation from the mother prior to weaning (at 4-6 weeks of age) would also be detrimental, and probably fatal. Thus the probability of a spring flood or floods causing death of young likely increases with the total duration of flood events that raise local stage levels suffiently high to flood dens. A population-level demographic and behavioral study of beaver, involving marking and repeatedly capturing individuals, is necessary to understand and manage these kinds of flood effects on the Bill Williams River beaver population.

Doug

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----- Forwarded by Andrew Hautzinger/RO/R2/FWS/DOI on 04/15/2010 02:46 PM -----

Dave Lytle <lytleda@oregonstate.edu> wrote on 04/04/2010 09:45:54 AM:

> Hi Andrew,
>
> Here's the brief report as I understand it (Mike Bogan did all the
> sampling and he may have more to add):
>
> Prior to the 3000 cfs event, aquatic invertebrates were at the Santa
> Maria River at Palmerita (control site), BWR below Alamo Dam, BWR at
> Rankin Ranch, and BWR at Mineral wash. Standard D-net methods were
> used to ensure results were comparable with samples taken by Laura
> McMullen in 2006, 2007, and 2008 during other flow events. Physical
> habitat measurements were also taken (pH, substrate, dissolved
> oxygen, temperature, conductivity). All sampling was repeated during
> baseflow conditions immediately following the flood.
>
> No specific funding was available for any of the sampling (we
> borrowed from other research funds to pay for travel), and we
> currently have no funds to process the samples which is quite time
> intensive and thus expensive, typically near $10,000 for a single
> round of sampling. Laura McMullen is currently finalizing results
> from previous events (2006-2008) as part of her PhD dissertation, so
> we hope to eventually add the 2010 data to this extensive dataset.
>
> Large amounts of sediment that had been deposited below Alama during
> low flow conditions may present some challenges to data
> interpretation, as this affects invertebrate abundances, and our
> ability to accurately sample invertebrates. This kind of siltation
> also has strong effects on river health by reducing invertebrate
> abundances in flowing riffle habitats. It would be wise to devise
> some protocol for measuring or regulating the amount of fine
> sediments that are transmitted through the dam outflow.
>
> -Dave

> **********
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>

-----Forwarded by Andrew Hautzinger/RO/R2/FWS/DOI on 04/17/2010 08:44PM -----

To: Andrew_Hautzinger@fws.gov,
From: "Julian D. Olden" <olden@u.washington.edu>
Date: 04/04/2010 12:09PM
cc: Dave Lytle <lytleda@oregonstate.edu>, Michael Bogan <boganmi@science.oregonstate.edu>, Laura Elizabeth <mcmullel@science.oregonstate.edu>, Patrick B Shafroth <shafrothp@usgs.gov>, Douglas C Andersen <doug_andersen@usgs.gov>
Subject: Re: Fw: April 20, 2010 BWRCSC Mtg.: Confirmation (10:30 -- 3pm) @ BLM-AZ

Hi Andrew,

Here is the report from the fish crew. We worked on the Bill Will from March 3-5th, with additional plans to sample March 11-20. Our goal was to repeat the pre- and multiple post-event sampling that we conducted in 2008, which focused on Rankin, Pipeline, Seapipe, Swansea and Mohave. Unfortunately, upon arrival we quickly found extremely high turbidity. The result was water column visibility of approx. 2-3 cm. These conditions precluded electrofishing because sampling efficiency depends on the ability to see and capture shocked individuals. Our inability to obtain pre-event data resulted in the cancellation of our post-event sampling.

We did, however, survey the upper end of Planet Ranch (visibility was good). Nothing new - carp, largemouth bass, yellow bullhead, red shiner and Gambusia. With this additional sampling, we now have a really good understanding of the longitudinal distribution of fish assemblages (7 sites total). We plan on writing up the results from the 2008 event and combining this with a analysis of changes in fish communities from historic (pre-1920), 1980, 1994 and 2008 (3 detailed surveys at multiple sites and separated by 14 years exactly).

Future - I hope to conduct research on the Bill Will in future years. Notably, I am interested in adding a dedicated crayfish and amphibian component. I will be starting conversations with Kathleen Blair in terms of her amphibian surveys in the refuge.

Funding - My program has no designated funding for the Bill Williams. I have been tagging this research onto other efforts. I think the time is ripe to develop a proposal to support a more dedicated effort into the future.

FYI - I just returned from 3 days on Mineral Wash (April 1-3). The water is still quite elevated (thanks to Planet) and turbid. Gambusia and red shiner are both present. Also, both Arizona toad and red-spotted toad are actively breeding.

Cheers,
Julian

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