Application for Federal Assistance SF-424							
* 1. Type of Submissi	ion: ected Application	* 2. Type of	i Application: * [ nuation * ion [	<sup>°</sup> If R	Revision, select appropriate letter(s):		
* 3. Date Received: 06/25/2015	5	4. Applicant	t Identifier:				
5a. Federal Entity Ide	entifier:			5	5b. Federal Award Identifier:		
State Use Only:				<u> </u>			
6. Date Received by	State:	7.	State Application I	den	entifier:		
8. APPLICANT INFO	ORMATION:						
* a. Legal Name: Me	erced Irrigati	on Distri	lct				
* b. Employer/Taxpay	yer Identification Nun	nber (EIN/TI	N):	*	* c. Organizational DUNS:		
d. Address:							
* Street1: Street2: * City: County/Parish:	744 W. 20th Streeet Merced						
* State: Province: * Country:					CA: California		
* Zip / Postal Code:	95340-3601						
e. Organizational U	Init:						
Department Name:				D M	Division Name: Water Supply/Rights		
f. Name and contac	ct information of pe	erson to be	contacted on ma	itter	ers involving this application:		
Prefix:     Mr.       Middle Name:	1	]	* First Name	:	Marco		
Title: Senior Wat	er Resources E	Ingineer		_			
Organizational Affiliat	tion:						
* Telephone Number: (209) 354-2857 Fax Number: (209) 726-4176							
* Email: mbell@me	ercedid.org			_			

Application for Federal Assistance SF-424
* 9. Type of Applicant 1: Select Applicant Type:
D: Special District Government
Type of Applicant 2: Select Applicant Type:
X: Other (specify)
Type of Applicant 3: Select Applicant Type:
* Other (specify):
Irrigation District
* 10. Name of Federal Agency:
U.S. Department of the Interior, Bureau or Reclamation
11. Catalog of Federal Domestic Assistance Number:
15.514
CFDA Title:
* 12. Funding Opportunity Number:
R15AS00046
* Title:
WaterSMART: Drought Resiliency Project Grants Grants for Fiscal Year 2015
13. Competition Identification Number:
Title:
14. Areas Affected by Project (Cities, Counties, States, etc.):
Add Attachment         Delete Attachment         View Attachment
* 15. Deceriptive Title of Applicant's Project:
Merced Irrigation District
DROUGHT PROTECTION WATER MANAGEMENT MODEL
Attach supporting documents as specified in agency instructions.
Add Attachments         Delete Attachments         View Attachments

Application	Application for Federal Assistance SF-424								
16. Congressi	onal Districts Of:								
* a. Applicant	CA-016			* b. Program/Projec	t CA-016				
Attach an additi	onal list of Program/Project C	ongressional Distric	ts if needed.						
			Add Attachment	Delete Attachment	t View Attachment				
17. Proposed	17. Proposed Project:								
* a. Start Date:	02/01/2015			* b. End Date	e: 07/31/2016				
18. Estimated	Funding (\$):								
* a. Federal		0.00							
* b. Applicant		486,082.32							
* c. State		0.00							
* d. Local		0.00							
* e. Other		0.00							
* f. Program Inc	come	297,977.00							
* g. TOTAL		784,059.32							
* 19. Is Applica	ation Subject to Review By	/ State Under Exe	cutive Order 12372	Process?					
🗌 a. This app	olication was made availab	le to the State und	er the Executive Or	der 12372 Process for re	view on				
b. Program	n is subject to E.O. 12372 b	out has not been s	elected by the State	e for review.					
🔀 c. Program	n is not covered by E.O. 12	372.							
* 20. Is the Ap	plicant Delinquent On Any	Federal Debt? (If	"Yes," provide ex	planation in attachment.)	)				
Yes	🔀 No								
If "Yes", provid	le explanation and attach								
			Add Attachment	Delete Attachment	View Attachment				
<ul> <li>21. *By signing this application, I certify (1) to the statements contained in the list of certifications** and (2) that the statements herein are true, complete and accurate to the best of my knowledge. I also provide the required assurances** and agree to comply with any resulting terms if I accept an award. I am aware that any false, fictitious, or fraudulent statements or claims may subject me to criminal, civil, or administrative penalties. (U.S. Code, Title 218, Section 1001)</li> <li> <sup>**</sup> I AGREE     <sup>**</sup> The list of certifications and assurances, or an internet site where you may obtain this list, is contained in the announcement or agency specific instructions.   </li> </ul>									
Authorized Re	presentative:								
Prefix:	Mr.	* Fin	st Name: Hicham						
Middle Name:									
* Last Name:	ElTal								
Suffix:	PE								
* Title: Deputy General Manager, Water Supply/Rights									
* Telephone Nu	mber: (209) 354-2854			Fax Number: (209) 72	26-4176				
* Email: heltal@mercedid.org									
* Signature of A	uthorized Representative:	Hickan S	oll		* Date Signed: 06/19/2015				

#### **BUDGET INFORMATION - Non-Construction Programs**

**Grant Program** Catalog of Federal **Estimated Unobligated Funds** New or Revised Budget Function or Domestic Assistance Activity Number Federal Non-Federal Federal Non-Federal Total (b) (a) (c) (d) (e) (f) (g) 1. WaterSMART 15.514 \$ 486,082.32 \$ \$ 297,977.00 \$ 784,059.32 \$ 2. 3. 4. 5. \$ \$ \$ 486,082.32 \$ Totals 297,977.00 \$ 784,059.32

#### **SECTION A - BUDGET SUMMARY**

Standard Form 424A (Rev. 7- 97) Prescribed by OMB (Circular A -102) Page 1

OMB Number: 4040-0006 Expiration Date: 06/30/2014

#### SECTION B - BUDGET CATEGORIES

6. Object Class Categories		GRANT PROGRAM, FUNCTION OR ACTIVITY					Total	
	(1)		(2)	)	(3)		(4)	(5)
		WaterSMART						
a. Personnel	\$	126,266.00	\$		\$		\$	\$ 126,266.00
b. Fringe Benefits		51,769.06						51,769.06
c. Travel								
d. Equipment		129,746.14						129,746.14
e. Supplies								
f. Contractual		405,000.00						405,000.00
g. Construction								
h. Other								
i. Total Direct Charges (sum of 6a-6h)		712,781.20						\$ 712,781.20
j. Indirect Charges		71,278.12						\$ 71,278.12
k. TOTALS (sum of 6i and 6j)	\$	784,059.32	\$		\$		\$	\$ 784,059.329
7. Program Income	\$		\$		\$		\$	\$

Authorized for Local Reproduction

Standard Form 424A (Rev. 7- 97)

Prescribed by OMB (Circular A -102) Page 1A

	SECTION C - NON-FEDERAL RESOURCES									
	(a) Grant Program			(b) Applicant		(c) State	(	d) Other Sources		(e)TOTALS
8.	WaterSMART		\$	486,082.32	\$		\$		\$	486,082.32
9.										
10.										
11.										
12.	ΓΟΤΑL (sum of lines 8-11)		\$	486,082.32	\$		\$		\$	486,082.32
		SECTION	D -	FORECASTED CASH	NE	EDS				
		Total for 1st Year		1st Quarter		2nd Quarter		3rd Quarter		4th Quarter
13.	Federal	<b>\$</b> 297,977.00	\$	100,000.00	\$	100,000.00	\$	<del>97,977</del> .00	\$	
14.	Non-Federal	\$ 486,082.32		186,082.32		150,000.00		150,000.00	]	
15.	FOTAL (sum of lines 13 and 14)	\$ 784,059.32	\$	286,082.32	\$	250,000.00	\$	247,977.00	\$	
	SECTION E - BUD	GET ESTIMATES OF FE	DE	RAL FUNDS NEEDED	FOF	R BALANCE OF THE	PR	OJECT		
	(a) Grant Program					FUTURE FUNDING	PE	RIODS (YEARS)		
				(b)First		(c) Second		(d) Third		(e) Fourth
16.	WaterSMART		\$		\$		\$		]\$	
17.									]	
18.							[		]	
19.							[		]	
20. TOTAL (sum of lines 16 - 19)			\$		\$		\$		\$	
		SECTION F	- 0	THER BUDGET INFOR	MA				1	
21.	1. Direct Charges: 22. Indirect Charges: provisional									
23.	23. Remarks:									

#### **ASSURANCES - NON-CONSTRUCTION PROGRAMS**

Public reporting burden for this collection of information is estimated to average 15 minutes per response, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to the Office of Management and Budget, Paperwork Reduction Project (0348-0040), Washington, DC 20503.

# PLEASE DO NOT RETURN YOUR COMPLETED FORM TO THE OFFICE OF MANAGEMENT AND BUDGET. SEND IT TO THE ADDRESS PROVIDED BY THE SPONSORING AGENCY.

**NOTE:** Certain of these assurances may not be applicable to your project or program. If you have questions, please contact the awarding agency. Further, certain Federal awarding agencies may require applicants to certify to additional assurances. If such is the case, you will be notified.

As the duly authorized representative of the applicant, I certify that the applicant:

- 1. Has the legal authority to apply for Federal assistance and the institutional, managerial and financial capability (including funds sufficient to pay the non-Federal share of project cost) to ensure proper planning, management and completion of the project described in this application.
- 2. Will give the awarding agency, the Comptroller General of the United States and, if appropriate, the State, through any authorized representative, access to and the right to examine all records, books, papers, or documents related to the award; and will establish a proper accounting system in accordance with generally accepted accounting standards or agency directives.
- Will establish safeguards to prohibit employees from using their positions for a purpose that constitutes or presents the appearance of personal or organizational conflict of interest, or personal gain.
- 4. Will initiate and complete the work within the applicable time frame after receipt of approval of the awarding agency.
- Will comply with the Intergovernmental Personnel Act of 1970 (42 U.S.C. §§4728-4763) relating to prescribed standards for merit systems for programs funded under one of the 19 statutes or regulations specified in Appendix A of OPM's Standards for a Merit System of Personnel Administration (5 C.F.R. 900, Subpart F).
- Will comply with all Federal statutes relating to nondiscrimination. These include but are not limited to:

   (a) Title VI of the Civil Rights Act of 1964 (P.L. 88-352) which prohibits discrimination on the basis of race, color or national origin; (b) Title IX of the Education Amendments of 1972, as amended (20 U.S.C.§§1681-1683, and 1685-1686), which prohibits discrimination on the basis of sex; (c) Section 504 of the Rehabilitation

Act of 1973, as amended (29 U.S.C. §794), which prohibits discrimination on the basis of handicaps; (d) the Age Discrimination Act of 1975, as amended (42 U. S.C. §§6101-6107), which prohibits discrimination on the basis of age: (e) the Drug Abuse Office and Treatment Act of 1972 (P.L. 92-255), as amended, relating to nondiscrimination on the basis of drug abuse; (f) the Comprehensive Alcohol Abuse and Alcoholism Prevention, Treatment and Rehabilitation Act of 1970 (P.L. 91-616), as amended, relating to nondiscrimination on the basis of alcohol abuse or alcoholism; (g) §§523 and 527 of the Public Health Service Act of 1912 (42 U.S.C. §§290 dd-3 and 290 ee- 3), as amended, relating to confidentiality of alcohol and drug abuse patient records; (h) Title VIII of the Civil Rights Act of 1968 (42 U.S.C. §§3601 et seq.), as amended, relating to nondiscrimination in the sale, rental or financing of housing; (i) any other nondiscrimination provisions in the specific statute(s) under which application for Federal assistance is being made; and, (j) the requirements of any other nondiscrimination statute(s) which may apply to the application.

- 7. Will comply, or has already complied, with the requirements of Titles II and III of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (P.L. 91-646) which provide for fair and equitable treatment of persons displaced or whose property is acquired as a result of Federal or federally-assisted programs. These requirements apply to all interests in real property acquired for project purposes regardless of Federal participation in purchases.
- Will comply, as applicable, with provisions of the Hatch Act (5 U.S.C. §§1501-1508 and 7324-7328) which limit the political activities of employees whose principal employment activities are funded in whole or in part with Federal funds.

- Will comply, as applicable, with the provisions of the Davis-Bacon Act (40 U.S.C. §§276a to 276a-7), the Copeland Act (40 U.S.C. §276c and 18 U.S.C. §874), and the Contract Work Hours and Safety Standards Act (40 U.S.C. §§327-333), regarding labor standards for federally-assisted construction subagreements.
- 10. Will comply, if applicable, with flood insurance purchase requirements of Section 102(a) of the Flood Disaster Protection Act of 1973 (P.L. 93-234) which requires recipients in a special flood hazard area to participate in the program and to purchase flood insurance if the total cost of insurable construction and acquisition is \$10,000 or more.
- 11. Will comply with environmental standards which may be prescribed pursuant to the following: (a) institution of environmental guality control measures under the National Environmental Policy Act of 1969 (P.L. 91-190) and Executive Order (EO) 11514; (b) notification of violating facilities pursuant to EO 11738; (c) protection of wetlands pursuant to EO 11990; (d) evaluation of flood hazards in floodplains in accordance with EO 11988; (e) assurance of project consistency with the approved State management program developed under the Coastal Zone Management Act of 1972 (16 U.S.C. §§1451 et seq.); (f) conformity of Federal actions to State (Clean Air) Implementation Plans under Section 176(c) of the Clean Air Act of 1955, as amended (42 U.S.C. §§7401 et seq.); (g) protection of underground sources of drinking water under the Safe Drinking Water Act of 1974, as amended (P.L. 93-523); and, (h) protection of endangered species under the Endangered Species Act of 1973, as amended (P.L. 93-205).
- 12. Will comply with the Wild and Scenic Rivers Act of 1968 (16 U.S.C. §§1271 et seq.) related to protecting components or potential components of the national wild and scenic rivers system.

- Will assist the awarding agency in assuring compliance with Section 106 of the National Historic Preservation Act of 1966, as amended (16 U.S.C. §470), EO 11593 (identification and protection of historic properties), and the Archaeological and Historic Preservation Act of 1974 (16 U.S.C. §§469a-1 et seq.).
- 14. Will comply with P.L. 93-348 regarding the protection of human subjects involved in research, development, and related activities supported by this award of assistance.
- 15. Will comply with the Laboratory Animal Welfare Act of 1966 (P.L. 89-544, as amended, 7 U.S.C. §§2131 et seq.) pertaining to the care, handling, and treatment of warm blooded animals held for research, teaching, or other activities supported by this award of assistance.
- 16. Will comply with the Lead-Based Paint Poisoning Prevention Act (42 U.S.C. §§4801 et seq.) which prohibits the use of lead-based paint in construction or rehabilitation of residence structures.
- Will cause to be performed the required financial and compliance audits in accordance with the Single Audit Act Amendments of 1996 and OMB Circular No. A-133, "Audits of States, Local Governments, and Non-Profit Organizations."
- Will comply with all applicable requirements of all other Federal laws, executive orders, regulations, and policies governing this program.
- 19. Will comply with the requirements of Section 106(g) of the Trafficking Victims Protection Act (TVPA) of 2000, as amended (22 U.S.C. 7104) which prohibits grant award recipients or a sub-recipient from (1) Engaging in severe forms of trafficking in persons during the period of time that the award is in effect (2) Procuring a commercial sex act during the period of time that the award is in effect or (3) Using forced labor in the performance of the award or subawards under the award.

SIGNATURE OF AUTHORIZED CERTIFYING OFFICIAL	TITLE
1/2/2 Contr	Deputy General Manager
Ruhan JM	
APPLICANT ORGANIZATION	DATE SUBMITTED
Merced Irrigation District	06/19/2015

Standard Form 424B (Rev. 7-97) Back

# **Merced Irrigation District**

# **DROUGHT PROTECTION WATER MANAGEMENT MODEL**

## Funding Opportunity Announcement No. R15AS00046

## WaterSMART: Drought Resiliency Project Grant for Fiscal Year 2015

The Drought Protection Water Management Model is a WaterSMART Drought Resiliency grant project submitted by the Merced Irrigation District (MID). The proposed project is to develop a new real time simulation (RTS) water management based on the U.S. Army Corps of Engineers' Hydrologic Engineering Center computer software. The model will have the capability to analyze and predict drought conditions. Also included in this submittal are on-ground weather stations, stage gages, and groundwater level monitors that will supply real time field data. The model will enhanced MID's efficiency in managing a drought response including the protection of endangered fish species, ecosystem habitats, and water supply. The RTS model will also help address climate-related impacts, enhance drought resiliency and provide drought protection.



APPLICANT Merced Irrigation District 744 W. 20<sup>th</sup> Street Merced, CA 95340-3601 Project Manager Marco A. Bell, MBA, M.Sc., P.E. Senior Water Resources Engineer Phone (209) 354-2857 Fax (209) 726-4176 <u>mbell@mercedid.org</u> 744 W. 20<sup>th</sup> Street, Merced, CA 95340-3601

# **Table of Contents**

1.	Exec	utive Summary1
2.	Back	ground Data2
3.	Tech	nical Project Description9
4.	Evalı	ation Criteria12
	<b>4.</b> A.	Evaluation Criterion A – Project Benefits
	<b>4.B</b> .	<b>Evaluation Criterion B – Drought Planning and Preparedness14</b>
	<b>4.C.</b>	Evaluation Criterion C – Severity of Actual or Potential Drought Impacts
	<b>4.D</b> .	Evaluation Criterion D – Nexus to Reclamation
	<b>4.E.</b>	Evaluation Criterion E – Project Implementation
5.	Perfo	ormance Measures20
6.	Envii	ronmental and cultural resources compliance21
7.	Requ	ired permits or approvals25
8.	Lette	ers of project support
9.	Offic	ial resolution27
10.	Proje	ect budget29
APF	PENDI	X 1 – Excerpts of Applicable Drought Plans Page 1 of 63
	1.	Sacramento and San Joaquin Basins Climate Impact Assessment, RECLAMATION
	2.	California Drought Contingency Plan12
	3.	Central Valley Project and State Water Project Drought Operations Plan
	4.	Merced Integrated Regional Water Management – Drought Impacts & Water Conservation Measures

## **FIGURES**

Figure 1. – Project Watershed Map (Merced and Mariposa County, California)	2
Figure 2. – New Exchequer Inflow Exceedance Probabilty Chart	7
Figure 3. – New Exchequer Storage	8
Figure 4. – Example of Variable Rain Flood Curve with Forecast-Based Operations	10
Figure 5. – Annual Wasted Flow Losses	12
Figure 6. – Forecast Informed Operations for Ecosystem and Water Supply – Lake McCLure Carryover Storage	14
Figure 7. – Potential Temperature Management Benefits for Chinnok Salmon	14
Figure 8. – California Drought Monitor = D4 Exceptional Drought	16
Figure 9. – Project Ghant Chart	18

## **TABLES**

Table 1 Water Conveyance and Delivery System	5
Table 2. – Flow Path values in TAF for 2000 through 2008	5
Table 3. – Past Water Transfers with a Reclamation Relationship	6
Table 4. – Historical Drought Conditions Allocations	6
Table 5. – Model Components	11
Table 6. – Summary of non-Federal and Federal Funding	29
Table 7. – Funding Sources	29
Table 8. – Budget Proposal	30
Table 9. – MID Equipment	32

# **Merced Irrigation District**

# **DROUGHT PROTECTION WATER MANAGEMENT MODEL**

# **Technical Proposal and Evaluation Criteria**



Empty Lake McClure Exposing the Old Exchequer Dam

## 1. Executive Summary

June 25, 2015

#### APPLICANT

Merced Irrigation District 744 W. 20<sup>th</sup> Street Merced, Merced County, CA 95340-3601

#### WORK PROPOSED

Project Manager Marco A. Bell, MBA, M.Sc., P.E. Senior Water Resources Engineer Phone (209) 354-2857 Fax (209) 726-4176 <u>mbell@mercedid.org</u>

The Drought Protection Water Management Model is a WaterSMART Drought Resiliency grant project submitted by the Merced Irrigation District (MID). The proposed project is to develop a new real time simulation (RTS) water management based on the U.S. Army Corps of Engineers' Hydrologic Engineering Center computer software. The model will have the capability to analyze and predict drought conditions. Also included in this submittal are on-ground weather stations, stage gages, and groundwater level monitors that will supply real time field data. The model will enhanced MID's efficiency in managing a drought response including the protection of ecosystem habitats, and water supply. The RTS model will also help address climate-related impacts, enhance drought resiliency and provide drought protection.

#### USE OF FUNDS - PROJECT COST \$784,059 - GRANT REQUEST \$297,977 (39%)

The use of the requested grant funds will be to contract the development of RTS drought water management model, to install two weather stations, and install two river stage gages stations.

#### **PROJECT CONTRIBUTION**

The Drought Protection Water Management Model contributes to accomplishing the goals of this FOA because it meets the requirements of Task B – Projects to Improve Water Management through Measurement, Modeling, and Tools. With the model and on-ground equipment, MID will increase the reliability of water supply and sustainability, improve water management and increase operational flexibility, provide benefits for fish and wildlife and the environment, and mitigate poor water quality caused by droughts all in real time.

#### **PROJECT SCHEDULE**

The project schedule is 1.5 year which began in February 2015 and will end July 2016.

#### NOT LOCATED ON A FEDERAL FACILITY

The project is not located on a Federal facility but portions of the MID service area is within the USBR Central Valley Project (CVP) service area and portions of the snow covered watershed areas lie within Yosemite National Park and the Sierra National Forest. New Exchequer Dam is subject to the provisions of Section 7 of the Flood Control Act of 1944 (33 U.S.C. 709).

## 2. Background Data

The Merced Irrigation District (MID or District) lies on the eastern side of the San Joaquin Valley in eastern Merced County, California, approximately 120 miles south of Sacramento and 275 miles north of Los Angeles and can be seen below in Figure 1.



Figure 1. - Project Watershed Map (Merced and Mariposa County, California)

MID owns and operates New Exchequer Dam on the Merced River for multiple purposes including flood control, water supply, environmental compliance, hydropower production, and recreation. The New Exchequer watershed is about 1,276 square miles with the upper watersheds located in the Central Sierra Mountains and includes the Yosemite National Park, Mariposa County and portions of Madera County. The watershed basin receives both rain and snowmelt inflows. The average annual runoff of the Merced River at New Exchequer Dam is approximately 974 TAF with a median of 878 TAF. The storage capacity is 1.02 million acrefeet. Flows from New Exchequer discharge into McSwain Dam, a regulating reservoir with a storage capacity of 9,730 acrefeet. Water released from McSwain Dam flows directly into Merced Falls reservoir that is owned and operated by Pacific Gas & Electric (PG&E).

Releases from Merced Falls Dam flow to an impoundment behind Crocker-Huffman Diversion Dam where the Main Canal diverts water. Downstream of Crocker-Huffman Diversion Dam numerous riparian water users divert water from and return water to the Merced River to the confluence with the San Joaquin River. New Exchequer Dam flood control operations are subject to the provisions of Section 7 of the Flood Control Act of 1944 (33 U.S.C. 709) according to the U.S. Army Corps of Engineers Water Control Manual, Appendix VII to the Master Water Control Manual, San Joaquin River Basin, California, October 1981. The Water Control Manual includes requirements for a maximum of 350 TAF of rain flood space and recommendations for conditional or snowmelt space based on the forecasted spring runoff. Other reservoirs include Castle, Bear, Burns, Owens and Mariposa which are part of the Merced Stream Group.

MID uses the New Exchequer water for irrigation through diversions on the Merced River. The normal operating objective is to maximize surface water use to preserve groundwater for use in drought years when surface supplies are limited. Irrigation water is allocated to lands within MID's boundaries, including lands annexed from the former El Nido Irrigation District. The total area served by the MID is 164,000 acres of which 138,000 acres are irrigable. MID can also provide water to other irrigator's within the District's sphere of influence (SOI), but outside of the District's boundaries. SOI water is provided only when available and offsets groundwater pumping in these areas. Primary crops are almonds, sweet potatoes, alfalfa, corn, tomatoes and cotton. Livestock water is also used. We serve over 2,200 growers.

MID provides water to meet environmental instream flow requirements contained in the District's current FERC license and in a Davis-Grunsky Act contract with the State of California. Pulse flows totaling 12.5 TAF are provided annually for fall fish releases as a condition of the District's water right licenses. Water is also released to meet water rights settlement agreements with riparian water users along the Merced River downstream of Crocker-Huffman Diversion Dam. Other agreements required delivery to Stevinson Water District and other users. Additionally, pulse flows 12.5 TAF each year are provided for fall fish release as a condition of the District's water right licenses.

MID enjoys pre-1914 water rights on the Merced River, local reservoirs (e.g. Lake Yosemite which was completed in 1888) and creeks (e.g. Bear Creek) that are intertwined with its distribution system. In addition, MID holds six appropriative water right licenses on the Merced River issued by the State Water Resources Control Board, Division of Water Rights for the direct diversion and storage of Merced River water. Licenses 2685, 6047 and 11395 are for consumptive use purposes while Licenses 990, 2684 and 11396 are for power production. Power production is an ancillary benefit of flood control and water supply operations.

The MID distribution system includes portions of natural streams (or drains) that convey irrigation water during the irrigation season and flood flows during the off season. These reaches collect and enable reuse of canal operational discharges and return flows during the irrigation season. Recent emphasis has been placed on improving the distribution system to better integrate reuse into operations, leading to reduced flow-through requirements. MID also owns 235 groundwater wells of which 198 wells are currently operational. Table 1 provides information on District wells and conveyance facilities.

MID maintains recreational facilities as requirements of its existing FERC license, as well as a public resource on select locations unrelated to the Merced River Hydroelectric Project (the Project). Project recreation facilities are located on the main stem of the Merced River at two Project reservoirs – Lake McClure and McSwain Reservoir. The Project consists of five developed recreation areas. Four of the recreation areas are located at Lake McClure, including McClure Point Recreation Area (RA), Barrett Cove RA, Horseshoe Bend RA, and Bagby RA. McSwain RA is the only recreation area located at McSwain Reservoir.

Annual Merced River Diversions, the main source of MID's surface water supplies, should be higher in wet years compared to dry years. In fact, wet year Merced River Diversions have averaged 50,000 AF more in wet years, 479,000 compared to 429,000 AF. MID pumps groundwater to the Distribution System and directly to irrigated lands. During an average wet year, 92 percent of the District's water supply comes from surface water sources compared to 85 percent from surface water in an average dry year. The remainder of the supply comes from groundwater. Groundwater levels continue to degrade in the Merced Basin. The State of CA legislature passed AB 3030 that identified groundwater as a valuable resource that should be managed to ensure its safe production and its quality. Groundwater regulation is only expected to become more extensive in the near future requiring MID to develop and establish sound groundwater management practices. Drought conditions have impacted groundwater levels.

The Drought Protection Water Management Model will integrate hydrologic and hydraulic components in a real time model and serve as a drought management decision support tool that will increase efficiency in managing and operating the water supply and save 25 to 65 TAF of water. We have named this modeling tool MIDH2O, an acronym for Merced Irrigation District Hydrologic and Hydraulic Optimization model. The Drought Protection Water Management Model will result in increased water supply reliability, enhance power market generation and reduce risk from potential floods and extended droughts. MIDH2O will enhance our ability to maintain compliance and plan for the irrigation season. An added benefit is that this real time model will bring the water resources analytical tools up to state of the art engineering with current hydrologic and hydraulic principles and analytical tools.

# Table 1. - Water ConveyanceTable 2. - Flow Path values in TAF for 2000 to 2008and Delivery System

Table 3.2 Water Conveyance and Delivery System					
System Used	Number of Miles				
Unlined canal	422				
Natural Channels (creeks and sloughs)	121				
Lined canal	97				
Pipelines	177				
Drains	45				
Total Mileage of System	862				
Wells	235				
Delivery Gates	1,968				

	Expected F Between Wet- Year	Actual Averages in Thousands of AF			
Flow Path	Wet	Dry	Wet	Dry	
Merced River Diversions	+	-	479	437	
MID Pumping to Distribution System	-	+	5	29	
Deliveries to MID - Irrigated Lands	=	=	254	275	
MID Pumping to Irrigated Lands	-	+	9	7	
Private Pumping	-	+	23	35	
Total Applied Water	=	=	286	317	
Seepage (Canal System)	=	4	104	96	
Deep Percolation	+		57	61	

""+" denotes a higher expected value for the flow path in the indicated year type relative to the other year type; "-" denotes a lower expected value relative to the other year type.

We have a working relationship with Reclamation. Reclamation has been a willing buyer of our water and MID a willing seller. Under the San Joaquin River Agreement, since 2000, MID and others provide water to help support meeting a pulse flow of up to 110,000 acre-feet of supplemental water for a 31-day period in the San Joaquin River at Vernalis, California, during April and May for ecological resources as prescribed in the Vernalis Adaptive Management Plan (VAMP). The agreement also included a fall flow of 12,500 acre-feet from MID, with the flow schedule developed in consultation with the Reclamation, the US Fish & Wildlife Service and CA Fish and Game. The fall flow has since been incorporated into Merced ID's water rights as previously described and the requirement will continue after the San Joaquin River Agreement expired. The agreement, as amended, expired on December 31, 2011.

This year as a result of consecutive critical dry years, the MID Board of Directors did not allocate surface water to farmers. The reservoir reached its lower level ever, a record setting storage of 63,489 acre-feet on 2/3/2015. MID is only delivering less than 60,000 acre feet of groundwater as minimal supplemental irrigation water made available by the District through conjunctive groundwater pumping in feasible areas. Throughout its history, MID has operated as a conjunctive-use district, replenishing groundwater upward of 100,000 acre feet each year with water from Lake McClure. In dry years, MID pumps a portion of that water back out for its growers' use. The conjunctive use water supply is only a fraction of the surface water that would typically be provided to MID's 2,200 growers from Lake McClure.

The Merced Irrigation District Agricultural Water Management Plan link is:

http://www.mercedid.com/index.cfm/water/ag-water-management-plan/

				VOLUME	
YEAR	YEAR TYPE	TIME PERIOD	<b>Transfer Dates</b>	(Acre-Feet)	PURCHASER
1999	Above	Fall	Oct 1 - Oct 31	11,998	SJRA
1999	Above	Spring	Apr 17 - May 17	82,200	VAMP
2000	Above	Fall	Oct 15 - Dec 31	12,500	SJRA
2000	Above	Fall	Oct 21 - Nov 30	24,748	USBR
2000	Above	Spring	Apr 15- May 15	46,750	VAMP
2001	Dry	Fall	Nov 12 - Dec 31	12,496	SJRA
2001	Dry	Spring	Apr 20 - May 20	42,120	VAMP
2002	Dry	Fall	Oct 15 - Oct 31	12,470	SJRA
2002	Dry	Spring	Apr 15 - May 15	25,840	VAMP
2003	Below	Fall	Oct 1- Oct 31	12,500	SJRA
2003	Below	Spring	Apr 15 - May 15	38,257	VAMP
2004	Dry	Fall	Oct 1 - Oct 31	12,500	SJRA
2004	Dry	Spring	Apr 15 - May 15	42,680	VAMP
2005	Wet	Fall	Oct 1 - Oct 26	12,500	SJRA
2006	Wet	Fall	Oct 8 - Oct 28	12,500	SJRA
2007	Critical	Fall	Nov 6 - Dec 31	12,500	SJRA
2007	Critical	Summer	Jun 10 - Jun 18	15,000	USBR
2007	Critical	Fall	Oct 24-Nov 8	25,000	USBR
2007	Critical	Spring	Apr 22 - May 22	28,960	VAMP
2008	Critical	Fall	Oct 1 - Oct 24	12,500	SJRA
2008	Critical	Spring	Apr 22 - May 22	47,300	VAMP
2009	Below	Fall	Oct 8-Oct 28	12,500	SJRA
2010	Above	Fall	Oct 15- Nov 8	12,500	SJRA
2010	Above	Spring	Apr 25 - May 25	21,800	VAMP
2011	Wet	Fall	Oct 1- Oct 31	12,500	SJRA
2012	Critical	Spring	Apr 29 - May 11	25,000	USBR
2012	Critical	Spring	May 11 - May 12	714	USBR
2013	Critical	Spring	Apr 15-Apr 25	4,800	USBR
2012	Critical	Winter	Jan 3-Jan 31	734	USBR
2012	Critical	Fall	Nov 1-Dec 31	2,793	USBR
2013	Critical	Summer	Sep 14- Sep 30	1,645	USBR

## Table 3. - Past Water Transfers with a Reclamation Relationship

## Table 4. -Historical Drought Conditions Allocations

Water Year	Year	AF-Sold	Irrigated Acres	AF/Acre
DRY	2001	327,944	97,716	3.4
DRY	2002	326,405	94,737	3.4
DRY	2004	328,863	104,805	3.1
CRITICAL	2007	293,095	97 <i>,</i> 878	3.0
CRITICAL	2008	211,492	90,082	2.3
DRY	2012	315,295	104,480	3.0
CRITICAL	2013	265,613	101,802	2.6
CRITICAL	2014	137,910	87,989	1.6
CRITICAL	2015	0	0	0.0

#### Figure 2. - New Exchequer Inflow Exceedance Probabilty Chart







The Merced Irrigation District is requesting grant support for this Drought Protection Water Management Model to:

- Develop a new real time water resources model for the Merced Irrigation District to analyze and predict drought conditions. The model will track water supply conditions and demands with a detailed hydrologic simulation system of the watershed above Lake McClure, which is MID's primary storage reservoir. The model would be based on the U.S. Army Corps of Engineers' Hydrologic Engineering Center RTS computer software. The data would be coordinated with the California Department of Water Resources, the California Nevada River Forecast Center and be published on a real time basis in CDEC, the California Data Exchange Center to serve to as an online decision support tool.
- 2. Install two weather stations and two river stage stations to accurately track water conditions. This will improve measurement accuracy, monitor river water temperature for fisheries benefits, and help track riparian water use, and buffer flow reductions.
- Collect LiDAR to define a GIS based DEM topography and an accurate capacity curve. The capacity curves are used to manage water supply at New Exchequer Reservoir and the Merced River topography will be used to manage the routing in the Merced River.
- 4. Obtain permitting for the on-ground components of the grant.

The Model leads directly to increased efficiency and water supply savings. MID will be able to modify operations based on the model results. The District has performed analyses that indicate:

- Surplus flows due to river releases above the flow requirements could be reduced by over 25,000 Acre-Feet per year.
- Re-operation can result in more water storage prior to the irrigation season, about 40,000 Acre-Feet on average annually;
- Re-operation can also increase the average annual surface water deliveries by 2,000 Acre-Feet;
- Re-operation can enhance average annual generation by 2 GWhrs and optimized generation could potentially generate an additional annual 3 GWhrs.

The above statistics are primarily based on a study performed by MBK Engineers for the Merced Irrigation District: System Reoperation Program: Merced River Analysis dated July 2013. However, to modify daily operations and capture these benefits will require a real time water management tool that will increase efficiency in managing and operating water supply including inflows, outflows, irrigation deliveries, and Merced River releases for the benefit of fishery on the river. If awarded, MID will conserve and use water more efficiently, improve energy efficiency, and help address climate-related impacts with water savings that will enhance drought resiliency. Improvements in forecasting technology, data communications, and hydrologic modeling in recent decades have allowed for reservoir inflow forecasts to become more accurate and reliably available than when existing flood rules were developed. As such, it is now possible to make informed decisions based on these forecasts themselves, in addition to measured inflow.





For this Project, MID will create a Real Time Simulation (RTS) system of the Merced River watershed. The RTS ties the Hydrologic Modeling System (HMS), Reservoir Simulation (ResSIM) and the River Analysis Systems models together. These were developed by the Hydrologic Engineering Center (HEC) and are publicly available. These models are extremely flexible and literally dozens of possible analysis options are available. MIDH2O will expand on the work currently being developed for the San Joaquin River by the U.S. Army Corps of Engineers.

#### **Table 5. - Model Components**

HMS	Hydrologic Modeling System
ResSim	<b>Reservoir System Simulation</b>
RAS	River Analysis System

With the model, MID has the potential to provide a source of additional water supply to meet other objectives such as farming needs, recharge, water transfers, and environmental enhancement in the San Joaquin River system. The Merced River is a tributary of the San Joaquin River. The Merced River Watershed is within the Bay-Delta solution area, and any improvements to the water supply and storage on the Merced River has a collective benefit to the Bay Delta, mainly during droughts.

Specific tasks under this proposed Drought Protection Water Management Model are:

- > Develop a DEM that includes new Lake McClure and Merced River LiDAR;
- Code custom scripts to manage time series data in WISKI and DSS for our functional needs and interacting with the HEC based software;
- Develop portions of a spatial database for our geographic data, static data, and topography in GIS based Arc-Hydro compatible formats;
- Developing an RTS model to handle weather and local inflow forecasts including snowmelt runoff, to simulate reservoir operations, and to manage river flows;
- Simulation of drought water management scenarios to increase efficiency and to reduce operating costs and buffer losses;
- > Develop strategies for irrigation season deliveries; and

The Model would also provide the following additional benefits:

- > Enrichment of the linkage between computer models for operations and for planning;
- Provide a common decision support system for dialogues between hydroelectric operators, regulators, environmentalists, and economists;
- Emphasis of consistency in operations and integration of resources;
- Provide real time forecasts that utilizes state of the art hydrologic models to analyze the water supply and reduce losses in the river system; and
- > Provide a platform for potential environmental ecosystem functions modeling.

The above benefits are primarily operating benefits and do not include the additional macroeconomic benefits gained by the local agricultural industry due to enhanced water supply.

## 4. Evaluation Criteria

The Drought Protection Water Management Model provides benefits in all of the evaluation criterions with an average annual water supply savings of 25 Acre-Feet from buffer flows. When re-operation is implemented an additional 40 Acre-Feet of benefits will be obtained.

## 4.A. Evaluation Criterion A – Project Benefits

Wasted flows is a term MID uses to describe the additional water released to ensure regulatory compliance at downstream points. These wasted flows occur when MID is compelled to release flows above and beyond the required to minimum regulatory flows to compensate for uncontrolled changes in river diversions in the 32 miles stretch between the point of release at New Exchequer Dam and the compliance point at Shaffer Bridge. Without these surplus flows, compliance cannot be assured as a result of unknowns, mainly uncoordinated river diversions by riparian users, who are obligated to coordinate with the District. With the real time Drought Protection Water Management Model, these uncertainties can be more efficiently managed. The District estimates that based on historical wasted flows, it could reduce these flows on average by approximately 25,000 Acre-Feet per year. This benefit will last as long as there are riparian users and regulatory flows, essentially for the entire project life.



#### **Figure 5. – Annual Wasted Flow Losses**

The buffer flows are computed by analyzing the flows at CDEC station "MERCED RIVER AT CRESSY (CRS)". The observed flows are compared to the flow requirements on a daily basis. The buffer is the difference between observed and required flows. The drought management RTS model will help keep buffer flows at a minimum and enhanced the available water supply. The 25,000 Acre-feet of savings was based on analyzing previous operations and considering how much water could be saved if we could predict water demands better in both quantity and timing. We ran some operational experiments under static conditions and we were able to manage the flows with a stage buffer of equal to or less than 0.02 feet (daily avg). If this could be done in real time, the savings would be 25,000 Acre-Feet or 5% of the average annual irrigation water supply. This is very significant in drought years, since the water has been valued at about \$1,000 per acre-foot during drought conditions. The flows would be monitored at Cressey station to evaluate performance. The additional water supply can be used during drought conditions for meeting water supply demands including irrigation allocations, fish pulses, or maintain water quality in the river such as river temperature for fish survival.

The project weather stations and gage stations will make new information available that will help analyze water demands, buffer flows, and water supply forecasts for both, real time operations and for water management planning. The information includes precipitation, stage, flow, temperature, wind and relative humidity. This information will help fine tune the model and increase system efficiency to minimize system losses, reduce buffer flows, and take into account local conditions that may impact current operations. For example, local inflows are currently not properly accounted for and result in increased buffer flows. The model would consider local inflows directly and account for it in the water operations.

The San Joaquin River Agreement (SJRA) involved most of the irrigation districts in the San Joaquin Valley, the U.S. Bureau of Reclamation, U.S. Fish and Wildlife Service, California Department of Water Resources, California Department of Fish and Game and various municipal water agencies and environmental interests.

The Drought Protection Water Management can help with the management and routing of flows to benefit Merced River fisheries and habitat. The MBK results presented in Figure 12 illustrate how carryover storage in Lake McClure is higher, relative to existing operations, as a result of Forecast Improved Operations. The higher carryover storage will provide higher protection against prolonged droughts and make water availability more reliable for various benefits including the environmental. MID provides water flows to protect Chinook salmon in the Merced River and the Merced Fish Hatchery. MID also delivers water to refuge areas within Merced County. Furthermore, with enhanced water supply during drought conditions, reservoir levels are expected to be higher affording lower water temperature for fisheries.



Figure 6. - Forecast Informed Operations for Ecosystem and Water Supply - Lake McCLure Carryover Storage

## 4.B. Evaluation Criterion B – Drought Planning and Preparedness

**Appendix 1** - **Excerpts of Applicable Drought Plans** is comprised of three drought plans and the entire plan can be found in the links provided below.

- 1. Sacramento and San Joaquin Basins Climate Impact Assessment, Reclamations http://www.usbr.gov/WaterSMART/wcra/docs/ssjbia/ssjbia.pdf
- 2. California Drought Contingency Plan <u>http://www.water.ca.gov/waterconditions/docs/Final\_CA\_Drought\_Contingency\_Plan-</u> <u>11-18-2010a.pdf</u>
- 3. Central Valley Project and State Water Project Drought Operations Plan http://www.water.ca.gov/waterconditions/docs/2014-Operations-Plan.pdf
- 4. Merced Integrated Regional Water Management Drought Impacts & Water Conservation Measures <u>http://www.mercedirwmp.org/files/Att2\_DG\_Impact\_1of1.pdf</u>

Highlighted portions in the excerpts represent specific sections that are applicable to this grant proposal. Of special interest in Appendix 1 is page 46 of 63 where the **Bureau of Reclamation** 

states that they are interested in greater real time operational decision making. Approving this grant proposal will help develop a modeling tool that meets this need. MID is a participant in forecast information coordination with the NOAA, USBR and the CA Dept. of Water Resources.

All of the drought plans and documents where developed and approved through a collaborative stakeholder process as documented in the plans themselves. The Merced Integrated Regional Water Management (Merced IRWM) program is a collaborative effort to identify water management issues, needs, objectives, actions, and priorities to meet the long-term water needs of the Merced Region east of the San Joaquin River. The plan has been adopted by the City of Atwater. City of Livingston, City of Merced, East Merced Resource Conservation District, Merced County, Merced Irrigation District, and Planada Community Services District.

The California Drought Contingency Plan does include climate change impacts and analysis see page 18 of 63 in Appendix 1. The proposed model will be a real time physical based numerical model that is design to simulate climate change impacts without being skewed by historical hydrological statistics. It will have the capability to handle hydrologic behavior due to warmer temperatures, changes in precipitation and runoff patterns including the increase in frequency and intensity of drought condition in the Merced Basin. The projects were listed and not prioritized. However, the plans recognize that data monitoring is of primary interest.

## 4.C. Evaluation Criterion C – Severity of Actual or Potential Drought Impacts

The Central Valley of California, including the Merced River Basin is experiencing the worst drought in history. Figures 2 and 3 on pages 8 and 9 show that we have hit records in terms of storage and inflows. The Drought Monitor (Figure 8) shows we are still in a D4 Exceptional Drought. The Central Valley has been in an Extreme Drought or worst since November of 2013. This is our third critical drought year. Freshwater inflows from mountain-fed rivers could see significantly less water due to climate change, according to a new climate model recently released by University of California. Professors Roger Bales from the University of California, Merced, and Michael L. Goulden from the University of California, Irvine, have been looking into how climate change affects certain plant functions in upper elevations of the Sierra Nevada. The results of their work, "Mountain Runoff Vulnerability to Increased Evapotranspiration with Vegetation Expansion Opens a New Window.," were published recently in the Proceedings of the National Academy of Sciences of the United States of America. The link to the publication is at:

http://www.pnas.org/content/111/39/14071.full.pdf



#### Figure 8. - California Drought Monitor = D4 Exceptional Drought

The State of California has documented the climate change assessment and may be found at:

### http://climatechange.ca.gov/climate action team/reports/climate assessments.html

One of the links there is the SCENARIOS OF CLIMATE CHANGE IN CALIFORNIA: AN OVERVIEW. Page 14 of the overview states that although most climate model simulations project relatively moderate changes in precipitation over this century, rising temperatures are expected to lead to diminishing snow accumulation in mountainous watersheds, including the Sierra Nevada. Warmer conditions during the last few decades across the western United States have already produced a shift toward more precipitation falling as rain instead of snow (Knowles et al. 2005), and snowpacks over the region have been melting earlier in the spring (Mote et al. 2005; Stewart et al. 2005). Delays in snow accumulation and earlier snowmelt will have cascading effects on water supplies, natural ecosystems, and winter recreation. Management of these impacts will require the real time model proposed. Also documented are impacts to agriculture, changes in wildfires, ecosystem productivity, forest resources, water, health, hydropower, electric demand, sell level, and many other assessments. The extended exceptional drought condition caused surface water allocations to be zero, as shown in Table 4, page 6. The Merced Integrated Regional Plan, Appendix E also discusses climate change and potential impacts on the water supply and may be found at:

http://mercedirwmp.org/files/Appendix%20E%20Climate%20Change%20Study.pdf

## 4.D. Evaluation Criterion D – Nexus to Reclamation

We have a past working relationship with Reclamation. Reclamation has been a willing buyer of our water and MID a willing seller. Under the San Joaquin River Agreement, between 1999 and 2012, MID and others provided water to help support meeting a pulse flow of up to 110,000 acre-feet of supplemental water for a 31-day period in the San Joaquin River at Vernalis, California, during April and May for ecological resources as prescribed in the Vernalis Adaptive Management Plan (VAMP). MID also provides a fall flow of 12,500 acre-feet, with the flow schedule developed in consultation with the Reclamation, the US Fish & Wildlife Service and CA Fish and Game. Please see Table 3 on page 6.

The Merced Basin is part of the San Joaquin River Basin addressed in Reclamation's Sacramento and San Joaquin Basins Climate Impact Assessment dated September 2004. As report stated that the models simulated hydrology and water management within specific sub-basins only with limited detail. This proposal helps meet the need for detail modeling in the Merced Basin.

### 4.E. Evaluation Criterion E – Project Implementation

_	1	10.00	les et a		1202
5	Task Name	Start	Finish	2015 Jan FehMar Anr May	2015 y lun, lui, Aug Sen, Oct Nov Dec, lan Feh Mar Ang May luw, lui, Aug
1	PHASE 1 - LIDAR COLLECTION AND DEM DEVELOPMENT				an an anglep occupy occupier to the approved and and and
2	Data Flight, Processing	2/2/15	3/2/15	/2 3/2	
3	QA/QC and EDM Development	3/2/15	5/1/15	3/2 5/	/1
4	PHASE 2 - DATA COLLECTION AND AUTOMATION				
5	START IF GRANT AWARDED	7/31/15	7/31/15		• 7/31
6	Hydrologic Data Collection	7/31/15	9/1/15		7/31 9/1
7	Flow Data Collection	7/31/15	9/1/15		7/31 9/1
8	Weather Stations, Precipitation, Temperature, Building WX	7/31/15	9/1/15		7/31 9/1
)	Flow Gages	9/1/15	10/1/15		9/1 10/1
0	Reservoir Data, Gates & Spillways	9/1/15	10/1/15		9/1 10/1
1	River Cross-sections	10/1/15	11/30/15		10/1 11/30
2	DATA COLLECTION EFFORT COMPLETED	12/1/15	12/1/15		• 12/1
3	Operational Rules, Water Control, and Regulatory Requirements	10/1/15	12/31/15		10/1 12/31
4	WISKI-DSS-GIS-CDEC Data Integration	10/1/15	12/31/15		10/1 12/31
5	DATA AUTOMATION COMPLETED	1/1/16	1/1/16		• 1/1
6	PHASE 3 – MIDH20 RTS				
7	Hydrologic Analysis	1/1/16	2/1/16		1/1 2/1
8	HMS	1/1/16	3/1/16		1/1 3/1
9	INFLOWS INTO EXCHEQUER COMPLETED	3/1/16	3/1/16		• 3/1
0	ResSIM	3/1/16	5/1/16		3/1 5/1
1	RAS	4/1/16	5/1/16		4/1 5/1
2	Real Time Synchronization, Reporting and Automation	5/1/16	6/1/16		5/1 6/1
3	Calibration, PEST and Sensitivity	5/1/16	6/1/16		5/1 6/1
4	BASE RTS MODEL COMPLETED	6/1/16	6/1/16		• 6/1
5	PHASE 4 - TESTING				
6	Runoff Computations and Optimization Adjustments	4/1/16	6/1/16		4/1 6/1
7	Security Systems & Backup Analysis	5/1/16	6/1/16		5/1 6/1
8	PHASE 5 - IMPLEMENTATION				
9	GO LIVE	6/1/16	6/1/16		• 6/1
0	Training	6/1/16	7/1/16		6/1 7/1
1	Planning Model	6/1/16	7/1/16		6/1 7/1
32	END OF PROJECT	7/31/16	7/31/16		- 7/

## Figure 9. - Project Ghant Chart

Our project is capable of proceeding upon entering into a financial assistance agreement with Reclamation. The above MS Project Ghant Chart shows our estimated schedule with Phases, major tasks, milestones and dates. The project start date is upon execution of the financial assistance agreement and the project end date is July 2016. Phase 1, LiDAR collection has been completed and we are in the process of developing the DEM. Following the development of the DEM, we plan on collecting all the available hydrologic and hydraulic data relevant to the model. Installation of the gage stations and weather stations are schedule early in the process to help with the calibration of the equipment and to incorporate as inputs to the RTS model.

MID has contracted the permitting services and are currently under negotiation and processing. We expect to have the regulatory permit requirements completed in time for construction. Permitting may have an impact on our scheduling if we run into an unexpected snag; however the model can insert new input sources any time in the process even after development. The project schedule is quite flexible since the components are not generally interdependent. The two gage stations are planned to be installed on existing bridge piers, therefore no disturbing activities are expected due to installation. The two gage stations are of standard design and they have been coordinated with the CA Department of Water Resources. The two weather stations will be installed in MID property adjacent to two ground water monitoring wells. All required permitting will be completed prior to any installation of any equipment.

The only administrative action required to implement the project is approval of a resolution by the Board and authorization of in-kind contributions and funding.

## 5. **Performance Measures**

The exceptional drought has seriously impacted MID. The drought has significantly reduced our revenues, irrigation allocations, and the available water for environmental protection. Droughts also adversely impact recreation, fish, water temperature, water quality, and the general agriculture based economy of the region. To help document the success of the model and MID's ability to predict and manage drought conditions, the performance measures are:

- 1. **Annual Buffer Flow Volume Reduction**. The flow requirements are measured at the Shaffer Bridge gage. We know the required flows which are computed as a combination of FERC flows, Davis Grunsky Agreement, and diversions from local riparian users. That number is compared to actual measured flows and the difference is the buffer flows. The performance will be how much we can reduce the buffer flows on annual basis.
- 2. **Dry Year Environmental Water Allocations**. Since the objective is to increase drought resiliency, we can measure the environmental water allocations. The measurement is done at Crocker Huffman Dam diversion minus the losses and riparian diversions.
- 3. **Dry Year Agricultural Water Allocations.** This is a value assigned by the MID Board. The allocations for dry years can be compared to pre-model implementation.
- 4. **Model Output Reliability.** The model results will be automated and communicated via email. The reliability can be measured in the percent of successful events that the output produced properly computed results and sent via email to users. The project engineer can monitor this performance measure.
- 5. **Exchequer Inflow April-July Volume Performance.** An important component of water supply is the April to July inflow into Exchequer. The April 1<sup>st</sup> forecast volume can be compared to observed inflows. The percent difference would be the performance measure.

In addition, the project schedule has specific benchmarks that set performance goals for the project team. At the end of the day, the primary performance measure will be the endorsement of the stakeholders and users that the model results have been beneficial in providing drought resiliency and helping meet the water supply needs.

**Merced Irrigation District** 

# **DROUGHT PROTECTION WATER MANAGEMENT MODEL**

Environmental and cultural resources compliance

**Required permits or approvals** 

Letter of project support

**Official resolution** 

**Project budget** 



**Boat Ramp with No Water** 

## 6. Environmental and cultural resources compliance

The development of a drought management model used as a decision support tool does not require any environmental and cultural resources compliance. There will be no construction activities with this project other than the installation of two weather stations and two gaging stations. MID will comply with all environmental regulations as required. Below are answers to the environmental and cultural resources questions.

1. The project consists primarily of development of a computer model which will not involve any earth-disturbing work that would affect the air, water, or animal habitat. Therefore, project area is not an applicable term for this project. However, the project does include the installation of two river gage stations and two weather stations. The two river gages will measure water flow in the Merced River and will be installed on existing bridge piers where the river passes a private bridge known as the Gallo Bridge and the Highway 59 Bridge. The two weather stations are, for all intents and purposes, simple rain gages that will be installed on MID property adjacent to existing groundwater monitoring wells. No ground disturbing activities are planned, and existing roadways will be used for ingress/egress during installation. There will be temporary, minor impacts to the surrounding environment during installation of the two gage stations and the two weather stations. Neither the installation nor the operation of the river gages, nor the development of the computer model itself, will affect or impact the air, water or animal habitat.

The project consists of development of a computer model, which will be located in the District's main office. The model will use existing forms of information together with information gathered from 2 new river gages and 2 new weather stations in order to look at and make predictions about hydraulic runoff from a watershed into the Merced River. The watershed (approximately 2,300 square miles) may have federally listed threatened or endangered species or designated critical habitat within it, such as habitat designated as critical for the Central Valley Steelhead in the lower Merced River below Crocker Huffman Diversion Dam, but if so, neither the species nor its habitat will be affected by this project. The project does include the installation of two river gages and two weather stations. The two river gages will be installed on existing bridge piers and the two weather stations will be installed on MID property adjacent to existing groundwater monitoring wells. Existing roadways will be used for ingress/egress during installation. There are no known federally listed threatened or endangered species at

any of the four sites. Merced ID's 2012 Final License Application submitted to the Federal Energy Regulatory Commission (FERC) may be found at:

http://www.eurekasw.com/MID/Relicensing%20Documents/Forms/AllItems.aspx?Root Folder=%2fMID%2fRelicensing%20Documents%2f2014-0423%20-%20Amended%20Application%2fVol%20II%20-%20E&View=%7b46031050-6787-4F03-8737-3C21A1D9C7FF%7d

Volume II, Exhibit E, Section 3.3.05 of the Application, describes the potential for federally listed threatened or endangered species to occur within the Merced River Hydroelectric Project area and is at:

http://www.eurekasw.com/MID/Relicensing%20Documents/2014-0423%20-%20Amended%20Application/Vol%20II%20-%20E/3.3.05 T%20and%20E%20Species.pdf

Note that when this section refers to the Project, it is referring to the Merced River Hydroelectric Project, not the proposed project herein.

- 2. As mentioned above, the project area is not an applicable term for this project, as the project consists of development of a hydrologic computer model for the Merced River watershed, including the installation of two river gage stations and two weather stations. The watershed (2,300 square miles) may have wetlands or other surface waters that potentially fall under CWA jurisdiction, but if so, they will not be affected by this project. The project does include the installation of two river gage stations and two weather stations. The two gages will be installed on existing bridge piers and the two rain gages will be installed on MID property adjacent to existing groundwater monitoring wells. Existing roadways will be used for ingress/egress during installation.
- 3. There are no known wetlands at any of the four sites, although the Merced River may be considered "Waters of the United States." No impacts are estimated to these waters as installation of the two gage stations will be installed on existing bridge piers and will be used simply to measure flows of water in the river.

Volume II, Exhibit E, Section 3.3.04 of the Merced ID's 2012 Final License Application submitted to the Federal Energy Regulatory Commission (FERC) describes the potential for wetlands in the project area is found at:

http://www.eurekasw.com/MID/Relicensing%20Documents/2014-0423%20-%20Amended%20Application/Vol%20II%20-%20E/3.3.03 Aquatic%20Resources.pdf

Note that when this section refers to the Project, it is referring to the Merced River Hydroelectric Project, not the proposed project herein.

- 4. Portions of the delivery system were initially constructed Pre-194. New Exchequer Reservoir was completed in 1966.
- 5. The project will not result in any modification of effects of the current infrastructure. The project will help on the efficient management and operations of the water supply.
- 6. There are no buildings or structures in the irrigation district listed or determined eligible for listing on the National Register of Historic Places (NRHP). The project consists of development of a hydrologic computer model for the Merced River watershed, including the installation of two river gage stations and two weather stations. The river gages will be installed on existing bridge piers, while the two weather stations will be installed on existing MID monitoring well sites. Neither the two bridges nor the monitoring well installations are listed or have been determined eligible for listing on the National Register of Historic Places. Please refer to:

Flint, Sandra S., Matthew Behrend, Nicole Ramirez, Monica Mackey, and Richard Norwood. 2013. *Cultural Resources Inventory for the Merced Irrigation District's Merced River Hydroelectric Project Relicensing (FERC Project No. 2179), Mariposa County, California*. Prepared by HDR Engineering, Inc., Sacramento, California. Submitted to Merced Irrigation District, Merced, California.

Volume II, Exhibit E, Section 3.3.08 of the Merced ID's 2012 Final License Application submitted to the Federal Energy Regulatory Commission (FERC) describes the cultural resources in the project area is found at:

http://www.eurekasw.com/MID/Relicensing%20Documents/2014-0423%20-%20Amended%20Application/Vol%20II%20-%20E/3.3.08 Cultural%20Resources.pdf
Note that when this section refers to the Project, it is referring to the Merced River Hydroelectric Project, not the proposed project herein.

- 7. The project area is not an applicable term for this project, as the project consists of development of a hydrologic computer model for the Merced River watershed. The watershed (2,300 square miles) may have known archeological sites, but if so, they will not be affected by this project. There is one archaeological site in the District that is eligible for listing on the NRHP. The project does include the installation of two gage stations and two weather stations. There are no known archeological sites at any of the four sites.
- 8. No. In fact, the project will benefit low income populations. Merced ID serves the eastern half of Merced County. This area is considered a disadvantaged community as the term is defined by California law and the California Department of Water Resources. Improved water management tools will benefit the region and those that live and work here.
- 9. No. The project consists of development of a hydrologic computer model for the Merced River watershed, including the installation of two river gage stations and two weather stations. The two gages will be installed on existing bridge piers and the two rain gages will be installed on MID property adjacent to existing groundwater monitoring wells. The project will not limit access to and ceremonial use of Indian sacred sites or result in other impacts on tribal lands.
- 10. No. The project consists of development of a hydrologic computer model for the Merced River watershed, including the installation of two river gage stations and two weather stations. The two gages will be installed on existing bridge piers and the two rain gages will be installed on MID property adjacent to existing groundwater monitoring wells. Existing roadways will be used for ingress/egress during installation. The project will not contribute to the introduction, continued existence, or spread of noxious weeds or non-native invasive species known to occur in the area.

MID has contracted with a private firm to assist in the securing of the permitting and regulatory requirements of this project.

### 7. Required permits or approvals

No permits or regulatory approvals are needed to development the model or installation of the weather stations – as the stations will be wholly on MID rights of way. Although the District does not believe it is necessary, MID will verify whether the California Department of Fish and Wildlife requires a Section 1600, Streambed Alteration Permit, for installation of the river gages. No other permits or approvals are anticipated.



Merced ID's 2012 Final License Application submitted to the Federal Energy Regulatory Commission (FERC) may be found at:

http://www.eurekasw.com/MID/Relicensing%20Documents/Forms/AllItems.aspx?Root Folder=%2fMID%2fRelicensing%20Documents%2f2014-0423%20-%20Amended%20Application%2fVol%20II%20-%20E&View=%7b46031050-6787-4F03-8737-3C21A1D9C7FF%7d

### 8. Letters of project support

STATE OF CALIFORNIA -- CALIFORNIA NATURAL RESOURCES AGENCY

EDMUND G. BROWN JR., Governor

### DEPARTMENT OF WATER RESOURCES

DIVISION OF FLOOD MANAGEMENT P.O. BOX 219000 SACRAMENTO, CA. 95821-9000



January 21, 2015

Bureau of Reclamation Acquisition Operations Branch Attention: Mr. Shaun Wilken Mail Code: 84-27852 P.O. Box 25007 Denver, Colorado 80225

Dear Mr. Wilken,

The California Department of Water Resources (DWR) supports the award of a WaterSMART grant to Merced Irrigation District (MID) for the implementation of its Water Supply Savings Project. The project will conserve and use water more efficiently, improve energy efficiency, protect endangered and threatened species, and help address climate-related impacts on water. The primary purpose of the project is to prepare a real-time water supply model that will increase efficiency in managing and operating the water supply including inflows, outflows, irrigation deliveries, and environmental water for protected fish species and fish habitats. The implementation of the project will result in water savings that enhance the resiliency to combat extended drought periods and help reduce the risk to fish and wildlife during prolonged droughts.

Please feel free to contact me at Boone.Lek@water.ca.gov or 916-574-2633 for further assistance in DWR's support to MID's grant application.

Sincerely,

Boone Lek, Chief Reservoir Coordinated Operations Section Hydrology Branch DWR Division of Flood Management

cc: Art Hinojosa Sudhakar Talanki Dear Bureau of Reclamation:

The California-Nevada River Forecast Center supports the award of a WaterSMART Drought Resiliency grant to Merced Irrigation District (MID). The District is proposing the development of a Drought Protection Water Management Model. The project assist the District with conservation and use water efficiency, help protect endangered and threatened species, and help address climate-related impacts on water management through measurement, modeling and tools.

The focus of the project is to prepare a real time water management model and to install two gaging stations to monitor flows in the Merced River. The implementation of the project may result in water savings that enhance the resiliency to combat extended drought periods and potentially help reduce the risk to fish and wildlife during prolonged droughts.

MID has been a long-time partner of the National Weather Service and the California-Nevada River Forecast Center. I fully expect that MID to develop its modeling capability in an open and collaborative fashion and to share results and insights gained. Consistent with past performance, I also expect that any new gaging station data will be shared with the full water management community through the California Data Exchange Centers and that MID would reliably maintain those gages in good working condition.

If you have questions or need additional information, please feel free to contact me at 916-979-3056 or <u>Robert.Hartman@noaa.gov</u>.

Sincerely,

Robert K. Hartman

Robert K. Hartman Hydrologist in Charge California-Nevada River Forecast Center



### 9. Official resolution

An official resolution has been prepared and will be submitted to our Board for Approval on July 7, 2015. The MID Board of Directors is scheduled to meet on that day where they will consider a resolution authorizing the commitment of the district to the financial and legal obligations associated with receipt of the WaterSMART Drought Resiliency Project Grant financial assistance. A copy of the resolution meeting the requirements set forth by the WaterSMART Grant requirements will be provided within 30 days.

### MERCED IRRIGATION DISTRICT

### **RESOLUTION NO. 2015-XX**

### <u>Resolution Authorizing Application for WaterSMART Grant through the United States Bureau of</u> <u>Reclamation for Development of a Drought Protection Water Management Model</u>

**WHEREAS,** the reliability of water supply is essential to all water users within the Merced Irrigation District (the District); and

**WHEREAS,** the District is the only public agency in eastern Merced County that relies on the Merced River to meet its customers demand; and

**WHEREAS**, the District has a progressive history in conserving water, increasing system efficiency, and optimizing its conjunctive use practices; and

**WHEREAS**, the District efforts not only include calculated reduction in groundwater pumping, but also reducing water quality concerns as well as upgrading, automating and controlling surface water on a real-time basis with the goal of improving the sustainability of the Districts water resources; and

**WHEREAS**, the Board of Directors for the District (the Board) supports such projects for its local and statewide benefit; and

WHEREAS, the United States Bureau of Reclamation (USBR) has made available funds through its WaterSMART grant program for the purpose of supporting projects that seek to conserve and use water more efficiently, increase the use of renewable energy, protect endangered species or facilitate water markets; and

**WHEREAS**, the District is interested in analyzing and developing a project that includes the development of a water supply decision support tool that will increase efficiency in managing and operating the Districts water supply resources in real-time; and

**WHEREAS**, the Board desires and hereby determines it to be in the best interests of the District to authorize application for the WaterSMART grant funding described herein and further desire to authorize and approve execution and delivery of such documents as may be necessary or desirable in connection with the execution and delivery of such documents.

**WHEREAS**, the Board behooves the USBR to support this effort for its overall perpetual benefit to water and the economy in Merced County at large, which is mainly dependent on water supply.

**THEREFORE, BE IT RESOLVED** by the Board of Directors of the Merced Irrigation District that pursuant and subject to all of the terms and provisions of the United States Bureau of Reclamation WaterSMART Grant Program, application by the Merced Irrigation District be made to the United States Bureau of Reclamation to obtain a grant to fund a water conservation project consistent with the recitals set forth hereinabove and with the intent of the grant program.

**BE IT FURTHER RESOLVED THAT**, if the Districts grant application is approved, the Merced Irrigation District will contribute an estimated cost share of \$500,000, which will be contributed in addition to a \$300,000 maximum grant funding from the USBR to complete the project, thereby bringing the Merced Irrigation District to 62% of the total project cost.

**BE IT FURTHER RESOLVED THAT**, the General Manager or his designee is instructed to work with the USBR to meet established deadlines for entering into a cooperative agreement and further, the Board authorizes the General Manager and such employees or consultants as the General Manager may designate, to execute such other documents, and to take such additional actions as may be necessary or convenient to carry out and implement the intent of this Resolution.

### **10. Project budget**

MID is requesting \$297,977 and is providing \$486,082 of cost share contributions. Total project cost is \$784,059. MID in-kind contributions of goods and services is 62% of the total.

### 4.A. Funding Plan and Letters of Commitment

The District's share of project cost will be obtained through Board Approval and the source will be through Board approved budgets. There are no third party funding sources.

There are no incurred costs before the project start date of February 1, 2015.

\* In-kind Contributions including labor.

Table 6 Summary of non-Federal and Federal Funding Sources			
Funding sources		<b>Funding Amount</b>	
Non-Federal Entities			
Merced Irrigation District*	\$	486,082.32	
Non-Federal subtotal:	\$	486,082.32	
Other Federal Entities			
Other Federal subtotal:	\$	-	
Requested Reclamation funding:		297,977.00	
Total Project funding:	\$	784,059.32	

### 4.B. Budget Proposal

Table 7 Funding Sources					
Percent of Total Total cost by					
<b>Funding sources</b>	Study Cost		source		
Recipient funding	62.0%	\$	486,082.32		
Reclamation funding	38.0%	\$	297,977.00		
Other Federal funding	0.0%	\$	-		
Totals	100%	\$	784,059.32		

Table 8 Budget Proposal					
Budget Item	Unit Cost	Quatity	Quantity Type	٦	otal cost
MID Salary and wages					
Salary and wages subtotal:				\$	126,266.00
MID Fringe benefits	41%	1	Lump Sum	\$	51,769.06
MID Travel	\$-	0	Lump Sum		0
MID Equipment					
Two Merced River Gage Stations	\$57,323.07	2	each	\$	114,646.14
Two Weather Stations	\$15,100.00	1	Lump Sum	\$	15,100.00
Subtotal MID Equipment:				\$	129,746.14
MID Supplies/materials	\$-	0	Lump Sum		0
Consultant LiDAR data collection	\$42,600.00	1	Lump Sum	\$	42,600.00
Consultant billing rates					
Consultant billing rates subtotal:				\$	325,400.00
Consultant travel					
Consultant travel subtotal:				\$	13,500.00
Consultant Supplies/materials	\$-	0	Lump Sum		0
Consultant Measurement Equipment	\$ 6,000.00	1	Lump Sum	\$	6,000.00
Consultant Permitting Costs	\$12,500.00	1	Lump Sum	\$	12,500.00
USBR Environmental and Regulatory Costs	\$ 5,000.00	1	Lump Sum	\$	5,000.00
Total Direct costs				\$	712,781.20
Indirect Costs - de minimis 10%				\$	71,278.12
Total projec	t costs			\$78	84,059.32

### 4.C. Budget Narrative

MID is requesting \$297,977 and is providing \$486,082 of cost share contributions. Total project cost is \$784,059. MID in-kind contributions of goods and services is 62% of the total.

### 4.D. Salaries and Wages

Program Manager MID is Marco A. Bell, MBA, M.Sc., P.E., senior water resources engineer.

MID daily salaries are as follows:

Consultant daily billing rates:

### 4.E. Fringe Benefits

Fringe benefits were computed at . The benefits were analyzed by MID's budget office and are based on standard accounting practices. Our budget is audited annually and certified by an independent accounting firm.

### 4.F. Travel

For simplification, federal per diem rates for Merced, CA were used. It is assumed 3 team members of the consultant team will make three trips: project discovery, midterm update, and final results.

likelihood, the Program Manger and both Senior Water Resources Engineers will be doing the traveling. Travel by MID staff will not be charged to this project.

**Project budget** 

In all

### 4.G. Equipment

### **Table 9. – MID Equipment**

MID Equipment				
Two Merced River Gage Stations	\$57,323.07	2	each	\$ 114,646.14
Two Weather Stations	\$15,100.00	1	Lump Sum	\$ 15,100.00
Subtotal MID Equipment:				\$ 129,746.14

The equipment was priced based on recent prices of similar equipment. None of the equipment is rented.

### 4.H. Materials and Supplies

Ten temporary stream gages will be located throughout the watershed for use in calibrating the model. Each gage is \$600 and the cost is based on past engineering experience.

### 4.I. Contractual

The contractual costs are to complete the development of the RTS model and to assist with permit compliance. The budgeted costs for consultants were determined to be fair and reasonable by comparing the consultant costs with other existing consulting services contracts.

### 4.J. Environmental and Regulatory Compliance Costs

Environmental and Regulatory Compliance are \$12,500. USBR Environmental and Regulatory Costs budgeted costs are \$5,000 in case any unforeseen issue arises during more formal activities.

### 4.K. Other Expenses

There are no other expenses.

### 4.L. Indirect Costs

The indirect costs used was a de minimis 10% rate

### 4.M. Total Costs

MID is requesting \$297,977 and is providing \$486,082 of cost share contributions. Total project cost is \$784,059. MID in-kind contributions of goods and services is 62% of the total.

### 4.N. Budget Form

SF 424A is included and completed.

### 4.0. Funding Restrictions

Expenses will be incurred beginning on February 1, 2015.

# **Merced Irrigation District**

# **DROUGHT PROTECTION WATER MANAGEMENT MODEL**

# **APPENDIX 1 – Excerpts of Applicable Drought Plans**

1.	Sacramento and San Joaquin Basins Climate Impact Assessment,
	RECLAMATION
2.	California Drought Contingency Plan12
3.	Central Valley Project and State Water Project Drought Operations Plan
4.	Merced Integrated Regional Water Management – Drought Impacts & Water
	Conservation Measures



This is Bagby Bridge over Lake McClure. The photo on the left is from 2011. The photo on the right was taken in fall of 2014



# West-Wide Climate Risk Assessment

# Sacramento and San Joaquin Basins Climate Impact Assessment





U.S. Department of the Interior Bureau of Reclamation

September 2014

# **Mission Statements**

The mission of the Department of the Interior is to protect and provide access to our Nation's natural and cultural heritage and honor our trust responsibilities to Indian Tribes and our commitments to island communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

# **RECLANATION** Managing Water in the West

# West-Wide Climate Risk Assessment

# Sacramento and San Joaquin Basins Climate Impact Assessment

Prepared for Reclamation by CH2M HILL under Contract No. R12PD80946

### U.S. Department of the Interior Bureau of Reclamation

Michael K. Tansey, PhD, Mid-Pacific Region Climate Change Coordinator Arlan Nickel, Mid-Pacific Region Basin Studies Coordinator

By

### **CH2M HILL**

Brian Van Lienden, PE, Water Resources Engineer Armin Munévar, PE, Water Resources Engineer Tapash Das, PhD, Water Resources Engineer

# **Chapter 1 – Executive Summary**

### Introduction

Section 9503 of the SECURE Water Act, Subtitle F of Title IX of P.L. 111-11 (2009) (SWA), authorizes the Bureau of Reclamation (Reclamation) to evaluate the risks and impacts of climate change in each of the eight major Reclamation river basins identified in the Act, and to work with stakeholders to identify climate adaptation strategies. Reclamation implements Section 9503 of the SWA through the Basin Study Program, part of the Department of Interior's WaterSMART Program, which is working to achieve a sustainable water strategy to meet the Nation's water needs now and for the future. Through West-Wide Climate Risk Assessments (WWCRAs) conducted under that program, Reclamation is conducting reconnaissance-level assessments of risks to water supplies and related resources in eight major Reclamation river basins in the Western United States.

This report presents the results of the Sacramento and San Joaquin Climate Impact Assessment (SSJIA), which addresses impacts in two of these major basins in California. The SSJIA also includes the Tulare Lake Basin in the southern part of the Central Valley of California; part of the Trinity River watershed from which some water is diverted into the Central Valley; and a portion of California's central coast region where Central Valley Project (CVP) and State Water Project (SWP) water supplies are delivered. The water supplies and demands analyzed in the SSJIA include CVP water users, SWP water users, and the other non-project water users in the study area.

Included in the report is an overview of the current climate and hydrology of California's Central Valley (Sacramento, San Joaquin and Tulare Lake Basins), an analysis of observed trends in temperature and precipitation over historical record, and a comparison of these trends to future water operation projections not considering climate change. The report then presents hydrologic projections developed from global climate models to evaluate the ways that projected climatic and hydrologic changes could impact water availability and management and water demands within the Sacramento, San Joaquin and Tulare Lake basins. The SSJIA analyzes potential impacts of climate change under a current trends projection of future urban growth considering the conversion of agricultural to urban land use and assuming the continuation of current crop types in the Central Valley. Finally, the SSJIA assesses risks to the eight major resource categories identified in the SWA by looking at a range of climate futures and attempting to book-end future uncertainties.

The SSJIA complements and builds on several previous climate change impact studies performed by Reclamation. In 2011, Reclamation completed its first climate change and impact assessment report under the SWA (Reclamation 2011). The 2011 SWA report was based on 112 climate change projections developed for the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment report (IPCC 2007) as part of the World Climate Research Program's Coupled Model Intercomparison Project phase 3 (CMIP3). The primary focus of the 2011 SWA report was on 21<sup>st</sup> century changes in temperature, precipitation and their impact on "unimpaired" flows in the eight major Reclamation river basins, including the

### Chapter 1 – Executive Summary

Sacramento and San Joaquin rivers. These flows were simulated to represent what would occur without current infrastructure, reservoir and project operations and regulatory requirements. The report also contained qualitative estimates of impacts on other SWA resource categories.

The Central Valley Project Integrated Resource Plan (CVP IRP), completed by Reclamation in 2013, employed the same climate change projections as the 2011 SWA report, with the addition of sea level rise, and expanded the study area to include the entire CVP Service Area. The CVP IRP also used different methods and models to characterize future climate and socioeconomic uncertainties and their impact on water supply, demand, and some related resources. Most significant was the inclusion of current reservoir and conveyance infrastructure, CVP/SWP operational criteria, and regulatory requirements. The SSJIA leverages the methodologies and tools developed for the CVP IRP – expanding the analysis to include all water users in the Sacramento, San Joaquin, and Tulare Lake basins, and completing a more comprehensive assessment of impacts in all the resource categories identified by the SWA.

Reclamation is also currently working with five non-federal cost-share partners on a Sacramento and San Joaquin Basins Study (SSJBS), a collaborative evaluation of potential climate impacts and formulation of adaptation strategies. The SSJBS, conducted under Reclamation's Basin Study Program as a complement to the SSJIA, is scheduled to be completed in 2015 and is not included in this report. Currently, the SSJBS study partners are updating the climate impact assessments using the new IPCC CMIP phase 5 climate projections and the latest California Water Plan Update 2013 socioeconomic projections.

## **Study Approach**

Reclamation employed a scenario based approach in the SSJIA to evaluate the impacts of potential climate change to water and related resources in the 21<sup>st</sup> century. The two major uncertainties affecting future impacts included climate and socioeconomic conditions. Future socioeconomic assumptions used in the SSJIA were based on population projections to 2050 as developed by the State of California's Department of Finance (DOF) and assumptions about the effects of urban growth on agricultural lands. The DOF projections were extended from 2050 to 2100 using projections developed by the Public Policy Institute of California. Climate uncertainties were addressed by including multiple 21<sup>st</sup> century projections using Global Climate Model (GCM) simulations to represent a wide range of potential future climate conditions.

A total of 18 socioeconomic-climate scenarios were developed for the SSJIA. A single socioeconomic projection representing a continuation of "Current Trends" in population and land use changes was employed. In this projection, California's Central Valley population was assumed to increase from the 2005 base levels by 8 million in 2050 and 19 million in 2100. The Current Trends scenario also assumed that as population increased in California's Central Valley, the expansion of urban regions would encroach into surrounding agricultural areas and would result in a projected loss of 500,000 irrigated acres by 2050 and 1.7 million acres by 2100.

The Current Trends socioeconomic projection of water demands was combined with 18 projections of potential future climate (temperature, precipitation and carbon dioxide) changes. These transient projections included one which assumed no climate change and 17 GCM-based projections. Of these projections, five future climates were developed using ensembles of multiple climate projections to characterize the central tendency and four bounding potential climates relative to the central tendency. In addition, six GCMs considered to be especially relevant to California hydrology were included and climate projections were developed based on both high and low greenhouse gas (GHG) emissions scenarios to represent a wide range of potential future climate conditions.

The SSJIA also included one projection of sea level rise. This transient projection was the mean estimate developed by the National Research Council (NRC 2012). This sea level rise projection was simulated to estimate the salinity changes of the Sacramento-San Joaquin Delta (Delta). These simulations assumed that Delta levees would remain intact despite rising sea levels in the 21<sup>st</sup> century.

The modeling of the impacts of potential climate changes on water and the related resources was accomplished by using the suite of decision support tools developed for the CVP IRP study. These models use the 18 socioeconomic-climate projections as inputs to quantify water supplies and demands. Current reservoir and conveyance infrastructure, CVP/SWP operations and regulatory requirements are assumed to remain in place throughout the 21<sup>st</sup> century. In addition to climate impacts to water supplies and demands, the modeling tools estimate impacts to river and Delta flows, reservoir storage, CVP/SWP exports, groundwater pumping, water quality (river water temperatures and Delta salinity), CVP/SWP hydropower generation and associated GHG emissions. The relative effects of socioeconomic-climate changes on SWA resource categories can also be observed by comparing the model results with various performance metrics which are presented in greater detail in the body of the SSJIA.

### Summary of Results

### **Climate Changes**

The central tendency projected changes in annual average temperature in the Central Valley basins relative to the 1970 – 2000 historical period range from approximately 1 °C in the early  $21^{st}$  century to slightly less than 2 °C by mid-century. In the late  $21^{st}$  century, annual average temperatures are projected to increase in excess of 3 °C. A significant west to east geographic trend exists with greater change in temperatures projected in the interior Central Valley and Sierra regions as the distance from the cooling effect of Pacific Ocean increases.

The projected changes in annual average precipitation in the Central Valley basins show a clear north to south trend of decreasing precipitation, similar to historical conditions. This trend is projected to occur throughout the 21<sup>st</sup> century. In the northern part of the Sacramento Valley, projections indicate a slight increase of a few percent in precipitation around the mid-century period. A slight decrease in precipitation was projected to occur in both the San Joaquin and Tulare Lake basins. In these basins, the reductions tend to increase throughout the 21<sup>st</sup> century from a few percent to nearly 10 percent in the southern parts of the Central Valley.

Sea level, relative to levels in 2000 at the Golden Gate Bridge in San Francisco, could rise by 92 centimeters by the end of the century with a potential range from 42 to 166 centimeters.

### Water Supplies and Demands

The potential climate change impacts on water supply and demand were assessed for each major hydrologic region in the study area. In each region, the climate scenarios exhibit a shift to more runoff in the winter and less in the spring months. This projected shift occurs because higher temperatures during winter cause more precipitation to occur as rainfall, which increases runoff and reduces snowpack. The projected annual runoff into major Central Valley reservoirs is similar to the historical period with a north to south geographical trend toward slightly reduced runoff reflecting a similar trend in precipitation.

Under current reservoir operational criteria, the seasonal shift in runoff has a negative impact on the ability to store water for later use. With earlier runoff and more precipitation occurring as rainfall, reservoirs may fill earlier and excess runoff may have to be released downstream to ensure adequate capacity for flood control purposes.

Water demands were impacted by both changes in climate and socioeconomics. The projected increases in population resulted in a steady increase in urban water use during the 21<sup>st</sup> century. Agricultural demands were also impacted by the assumed decrease in irrigated acreage and the changing climate. Unlike urban demands, agricultural demands have considerable inter-annual variability. In low precipitation years, demand is higher while in high precipitation years, agricultural water demands decrease. During the 21<sup>st</sup> century, the average annual agricultural demands are projected to decrease because of reduced irrigated acreage and to a lesser extent the effects of increasing carbon dioxide on decreasing water use by some crops despite increased temperatures in the latter half of the 21<sup>st</sup> century.

### System Risk and Reliability

The SWA mandates the analysis of impacts that changes in water supply may have on eight specific resource categories. The summary presented in Table 1 provides a generalized assessment of the SWA Resource category impacts. The overall 21<sup>st</sup> century projected impacts are evaluated by changes in performance metrics with contributing factors described. The evaluation is based on current CVP/SWP operations, infrastructure and regulatory requirements without the implementation of adaptation strategies.

It is important to recognize that there are limitations to the interpretation of the impacts presented in Table 1. First, the resource impacts represent overall 21<sup>st</sup> century average conditions. However, there exists considerable variability during this period. Second, other limitations exist because of uncertainties in the socioeconomic-climate scenarios, the use of performance-based change metrics, and in the models employed for the impact evaluations. The column titled "Overall 21st Century Projects Impacts" shows an average of the central tendency range of impacts and is a representation of one of several possibilities examined. Please see Chapter 8 of this report for a more in-depth discussion of the projected impacts for each resource category.

SWA Resource Category	Change Metrics	Overall 21 <sup>st</sup> Century Projected Impacts	Contributing Factors
Water Deliveries	Unmet Demands, End of September Storage, CVP/SWP Delta Exports	Unmet demands - Projected to increase by 3% End of September Storage – Projected to decrease by 2% CVP/SWP Delta Exports – Projected to decrease by 3%	Projected earlier seasonal runoff would cause reservoirs to fill earlier, leading to the release of excess runoff and limiting overall storage capability and reducing water supply; Sea level rise and associated increased salinity would result in more water needed for Delta outflow standards with less water available to deliver to water contractors
Water Quality	Delta Salinity and End of May storage	Delta Salinity – Projected to increase by 33% End of May Storage – Projected to decrease by 2%	Projected sea level rise would contribute to increased salinity in the Delta; climate warming and reduced reservoir storage would contribute to increased river water temperatures
Fish and Wildlife Habitats	Pelagic Species Habitats, Food Web Productivity	Pelagic Species Habitats – Projected to decrease by 12% Food Web Productivity – Projected to decrease by 8%	Increasing Delta salinity would contribute to declining pelagic habitat quality; reduced Delta flows in summer would contribute to declining food web productivity
ESA Species	Adult Salmonid Migration, Cold Water Pool	Adult Salmonid Migration – Projected to decrease by 1% Cold Water Pool – Projected to decrease by 4%	Projected reduced Delta flows in summer would contribute to declining salmonid migration; reduced reservoir storage would contribute to reduced cold water pool
Flow Dependent Ecological Resiliency	Floodplain Processes	Projected to decrease by 1%	Projected reduced reservoir storage and reduced spring runoff due to decreasing snowpack would contribute reduced river flows
Hydropower	Net Power Generation	CVP Net Generation - Projected to decrease by 2% SWP Net Generation – Projected to increase by 8%	Projected decreased in CVP reservoir storage would contribute to less power generation; projected decreased SWP water supply would result in reduced power use for pumping and conveyance
Recreation	Reservoir Surface Area	Projected to decrease by 17%	Projected lower reservoir levels would impact the surface area available for recreation
Flood Control	Reservoir Storage below Flood Control Pool	Projected to increase by 7%	Projected increases in early season runoff would contribute to releases earlier in the flood control period providing more flood storage.

### Table 1. Summary of Projected Impacts by SWA Resource Category



Figure 5. Projected Annual Average Temperature Changes (°C) in the early, mid, and late 21<sup>st</sup> century

As can be observed on the figure, there is a significant west to east trend with more warming in the interior regions as the distance from the cooling effect of Pacific Ocean increases. In the study area, warming increases from about 1 °C in the early  $21^{st}$  century to slightly less than 2 °C at mid-century and exceeds 3 °C in the eastern most regions by late in the  $21^{st}$  century.

Figure 6 shows the central tendency (Q5) projected changes in annual average precipitation expressed as a percentage relative to the average 1970 – 2000 historical period during the early (2025), middle (2055), and late (2084) 21<sup>st</sup> century for the Central Valley and surrounding areas.



Figure 6. Projected Annual Average Precipitation Changes (percent) in the early, mid and late 21<sup>st</sup> century

# Chapter 9. Study Limitations and Next Steps

The SSJIA provides valuable new information for long-range planning purposes as well as the SSJBS which is developing more detailed and updated assessments of the impacts of future climatic change in the Sacramento River, San Joaquin River, and Tulare Lake hydrologic basins. However, there are limitations that should be acknowledged when evaluating the results of these analyses:

- The SSJIA is a reconnaissance-level analysis that simulates the most important components of the CVP/SWP water management system by using simplified representations of the CVP, SWP, and local project operations within the Central Valley of California. Additionally, although the scope of the analysis included all supplies and demands within the Central Valley of California, the effects of climate change were not analyzed for smaller-scale local regions such as the CVP, SWP or non-project service areas. The SSJBS will address the areas served by the SWP and CVP water users as part of the analysis.
- The analyses used WEAP-CV and CalLite models developed for the CVP IRP. These models have simplified representations of much of the complexity of the CVP and SWP water management systems in comparison to more complex models such as CALSIM II. These models capture the most prominent aspects of the Central Valley of California hydrology and system operations, but simulated hydrology and water management within specific sub-basins has limited detail. Therefore, the models did not simulate some aspects of SWP/CVP operations, such as Cross Valley Canal deliveries or CVPIA (b)(2) operations.
- The CT socioeconomic scenario combined with the 18 CMIP 3 hydroclimate projections may not represent a sufficient range of uncertainty for development of adaptation strategies. The SSJBS, due to be completed in early 2015, will provide a more comprehensive analysis that includes other means of characterizing future uncertainties including paleoclimate data, more refined and updated socioeconomic information, and multiple sequences of climate variability. Additionally, this SSJIA analysis used CMIP3 climate data because CMIP5 data sets were not available at the time the analysis was performed. The SSJBS will incorporate the newer CMIP5 climate data sets.
- Although the analytical approach utilized in the SSJIA addresses a broad range of performance metrics related to the Central Valley water management system, it does not address some aspects of California water management that could be considered important metrics for assessment of impacts. In particular, additional analysis methods could be included to consider more detailed aspects of ecological resources, flood control, and recreation. Despite these limitations, the SSJIA provides a solid foundation for improved understanding of the greater range of impacts of future climate change on the Central Valley water management system. The limitations identified here provide a basis for additional improvements in the analytical approach, which will be pursued as part of the SSJBS and other future long-term Reclamation planning activities.

# **California Drought Contingency Plan**

State of California | Natural Resources Agency | California Department of Water Resources

DEPARTMENT OF WATER RESOURCES 1416 NINTH STREET, P.O. BOX 942836 SACRAMENTO, CA 94236-0001 (916) 653-5791



NOV 17 2010

To: California Water Plan Steering Committee and Interested Stakeholders

The California Drought Contingency Plan (DCP) represents the first State drought plan and was developed following the Governor's executive orders and drought proclamations in 2008 and 2009. It is a planning and implementation document which may be used to assist agencies in preparing for, responding to, and recovering from drought. The goals of the DCP are to minimize drought impacts through improved agency coordination, enhanced procedures for monitoring drought conditions and early warning capability, improved assessment drought impacts, and more effective response to drought emergencies.

The DCP has been prepared in conjunction with the California Water Plan (CWP) and will be updated every five years. As part of the development of this first plan, a number of important ideas were raised about how to further improve drought response and coordination with local agencies. The planning process for CWP Update 2013 will include the development and discussion of these important ideas.

As part of ongoing drought planning, DWR will continue to implement programs such as Integrated Regional Water Management, Water Use Efficiency and education and outreach as part of statewide drought preparedness. These programs in association with actions to address California's comprehensive water issues will ensure that the State's water needs can be met now and into the future.

Sincerely,

mayala-

Mark W. Cowin Director

### EXECUTIVE SUMMARY

California's water resources have been stressed by periodic drought cycles and unprecedented restrictions in water diversions from the Sacramento-San Joaquin Delta in recent years. Climate change is expected to increase extreme weather. It is not known if the current drought will abate soon or if it will persist for many years. However, it is certain that this is not the last drought that California will face.

In response to the recent drought, Governor Arnold Schwarzenegger issued Drought Proclamations and Executive Orders in 2008 and 2009 directing State agencies to take immediate actions to manage the crisis. The Department of Water Resources (DWR) was required to provide a report on the state's drought conditions and water availability. DWR subsequently committed to developing a Drought Contingency Plan (DCP) to address the possibility of continuing dry conditions in 2010 and beyond. This DCP contains strategies and actions State agencies may take to prepare for, respond to, and recover from droughts. Some components of this plan may be applied to water shortage events that occur in the absence of a drought.

The purpose of the DCP is to minimize drought impacts by improving agency coordination; enhancing monitoring and early warning capabilities; water shortage impact assessments; and preparedness, response, and recovery programs. The plan identifies an integrated, regional approach to addressing drought, drought action levels, and appropriate agency responses as drought conditions change.

An effective DCP will need transparent coordination and clearly defined roles and responsibilities of federal, State, and local agencies, and the timely dissemination of information to decision-makers. A drought communication and coordination structure is provided as Figure 1 and represents a general framework for agency planning and coordination. An Interagency Drought Task Force (Task Force) will be convened to provide coordination among agencies.

The Task Force will be chaired by the DWR Drought Coordinator with assistance from the California Emergency Management Agency (Cal EMA) Drought Coordinator. The roles of DWR and Cal EMA are defined and key duties of the Drought Coordinators are listed in Section V. DWR will coordinate overall drought activities while Cal EMA will focus on emergency response and recovery efforts. Drought coordination will occur through the DWR Regional Offices and Cal EMA Regions, and emergency response will be implemented in accordance with the Standardized Emergency Management System. State agencies participating in the Task Force is expected to function within existing agency authorities, responsibilities, and funding.

The Task Force provides policy direction to the Drought Monitoring Committee and the Impact Assessment Work Groups. The Committee and Work Groups provide situation reports and impact assessment reports to the Task Force, respectively. The Task Force ensures accurate and timely distribution of water supply data and drought forecasts to water managers and the public. Committee members consist of representatives from agencies responsible for monitoring weather and water supply data. Work Group members include representatives who assess drought impacts on the various regions and sectors. The situation and assessment reports will be distributed to appropriate agencies and will be posted on the DWR Drought website (<u>www.water.ca.gov/drought</u>).

The potential roles and responsibilities of agencies and organizations which may be involved in drought management are defined in Attachment 1. By properly defining agency roles, drought response can be more effective and successful. Action tables are included in Tables 1 through 3 of the Attachment section and list activities agencies may take before, during, and after a drought with respect to planning and coordination, monitoring, local assistance, and conservation.

Tables 1 through 3 also suggest lead and supporting agencies to carry out the potential actions, and note related documents or references. Table 2 includes five levels of drought response, with each level signifying worsening drought conditions. For example, Level 1 represents an Abnormally Dry period (Raising Awareness of Drought), Level 3 a Severe Drought (Mandatory conservation in some communities and emergency actions), and Level 5 an Exceptional Drought (Water supplies cut off and maximum response). A Governor's emergency drought proclamation may be initiated at a Level 3 response. Drought indicators generally based on hydrologic parameters are recommended, but are not quantified to provide flexibility in drought response. Drought response actions may be unique to a particular region and not necessarily uniform statewide. Actual response may be based on evaluation of situation and/or assessment reports and observation of field impacts.

Implementation of activities or programs in Tables 1 through 3 is intended to minimize drought impacts and enhance recovery. Actions may be added or modified to these tables based on field experience and input from stakeholders. Flexibility and adaptability must be incorporated into these actions because of changing conditions and circumstances, and the inherent uncertainty in the nature of drought.

The DCP is intended to become part of the California Water Plan Update process which occurs every five years. This may require that the plan be periodically updated to best serve the needs of California. As the plan gets refined, it will include updated information, technology, and strategies.

Implementation of strategies contained in this DCP supports the comprehensive approach needed to provide clean, reliable, and sustainable water supplies to people, farms, and business in California. California's water problems do not end when the drought ends. Immediate action is needed on a comprehensive solution that includes aggressive conservation, new groundwater and surface water storage facilities, conveyance facilities and environmental restoration. California's future economic growth, quality of life and prosperity depend on it.

### I. INTRODUCTION

The 2008 and 2009 Drought Proclamations and Executive Orders directed the Department of Water Resources (DWR) and other State agencies to take specific actions to respond to droughts. The February 2009 emergency proclamation required the preparation of a March 2009 status report to the Governor's office, which updated the state's drought conditions and water availability and identified activities DWR would initiate or support to help meet our most essential water needs in 2009 and plan for the possibility of a dry 2010.

The list of drought activities in the March 2009 status report included the preparation of a Drought Contingency Plan (DCP) to address the possibility of continued dry conditions through 2010 and beyond. The DCP was developed in consultation with the California Water Plan (CWP) Steering Committee (representing 21 State government agencies with jurisdictions over different aspects of water resources) and receiving input from its Advisory Committee.

The purpose of the DCP is to minimize drought impacts by improving agency coordination; enhancing monitoring and early warning capabilities; water shortage impact assessments; and preparedness, response, and recovery programs. The DCP includes a coordinated State government strategy to prepare for, respond to, and recover from droughts and water shortages, and identifies an integrated regional approach to assessing droughts, drought action levels, and appropriate agency responses as drought severity changes. This plan may be reviewed and updated with each CWP Update or as necessary to provide current information, technology, and strategies.

To accomplish the above purpose, the Drought Contingency Plan:

- 1. Recommends a general framework for agency planning and coordination to facilitate drought response and management.
- Identifies activities and strategies that may be implemented to minimize drought impacts on vulnerable regions and sectors. These activities include actions that may be implemented before, during, and after a drought with respect to planning and coordination, monitoring, local assistance, and conservation programs.
- 3. Identifies the State, federal, tribal, and local agencies that have the lead or supporting roles in managing the drought response activities.
- 4. Promotes effective use of public, private, and tribal resources to manage response and mitigation efforts.

**Definition:** Drought mitigation is actions or programs agencies may implement to minimize drought impacts and enhance recovery.

Although the current drought will eventually end, the restrictions on pumping from the Sacramento-San Joaquin Delta will continue to impact California's water supply. California may continue to experience significant negative economic impacts, requiring emergency responses due to widespread and deep water shortages, even in a year of

average or above-average precipitation and snowpack. Some components of the DCP (such as the communication and coordination structure in Figure 1) could also be applied to water shortage events which may occur in the absence of a drought.

An effective drought response requires clear communication among State, federal, local, and tribal agencies and stakeholders and the timely dissemination of information to the public. An emergency drought response will be implemented in accordance with the Standardized Emergency Management System (SEMS) mandated for multi-agency and multi-jurisdictional responses to emergencies in California. DWR will chair the Interagency Drought Task Force (Task Force) and serve as the primary coordinator of the State's drought effort. The California Emergency Management Agency (Cal EMA) will support DWR in this function, focusing on emergency response and recovery. The Task Force will coordinate with federal, local, and tribal agencies and other stakeholders on drought management and response efforts. A general communication and coordination structure (Figure 1) is proposed for agency planning and drought response. The structure, or components of it, may be used at any phase of drought management.

Being proactive to drought management requires continuous monitoring of factors indicating the onset and severity of drought, as well as impacts to stakeholders. The DWR Drought (www.water.ca.gov/drought) and California Data Exchange Center (www.cdec.water.ca.gov) websites contain comprehensive water supply data such as precipitation, snowpack, and reservoir conditions. Drought and water shortage data will be used to assess drought and impacts, and help develop appropriate drought responses. The DWR Drought website also provides information on available emergency, technical and financial assistance programs; tips on water conservation; guidance on water transfers; and links to other State, federal, and local agency websites.

Defining when a drought occurs is commonly a function of dry conditions' impacts on water users and their responses, which may vary depending on the severity of the drought. A drought does not have a clearly defined beginning and end and it does not impact all water users equally. As a result of the variability and severity of droughts, the varying impacts experienced by different regions and sectors, and the unpredictability in the duration of droughts, this DCP must be flexible to adjust to local circumstances. Examples of State agency response actions for each drought stage are provided in Tables 1 through 3 of the Attachment; however, actual field conditions may dictate greater or lesser response actions based on evaluation of drought severity and impacts. Conditions must be evaluated as they occur and appropriate responses selected to address those specific conditions. The specific actions may need to be adapted, as conditions warrant, to the unique circumstances that may occur.

### **II. UNDERSTANDING DROUGHT AND WATER SHORTAGE**

The onset of drought is a gradual phenomenon, whereas water shortage may be sudden, as would occur if an earthquake causes massive and cascading Delta levee failures, resulting in a shutdown of the Delta's export water pumps. Most natural disasters, such as floods or forest fires, occur relatively rapidly and afford little time for preparation for disaster response. With the exception of impacts to dryland farming and grazing, drought impacts may occur slowly over seasonal periods, and the effects may linger for years after the end of the event.

In California, drought is commonly associated with impacts and below normal precipitation. Drought impacts increase with the length of a drought, as water supplies in reservoirs are depleted and groundwater levels decline due to increased pumping. The extent of drought impacts is dependent on many factors including climate, water use patterns, available water supplies and geography.

More discussion related to understanding drought and drought response in California can be found in the article "Droughts Concepts and Impacts in California" (See Attachment 3). This article also describes drought impacts on different sectors in greater detail, including predicted outcomes from climate change.

### III. HISTORICAL DROUGHT AND CLIMATE CHANGE

Droughts exceeding three years in California's measured hydrologic record have been relatively rare in Northern California, which is where the majority source of the State's water supply originates. Historical multi-year droughts include: 1912-13, 1918-20, 1923-24, 1929-34, 1947-50, 1959-61, 1976-77, 1987-92, and most recently the current drought which began in 2007. The 1929-34 Drought established the criteria commonly used in designing storage capacity and yield of large Northern California reservoirs.

In addition to historical measured data, scientists are now reconstructing historical weather conditions through analysis of tree rings (dendrochronology). Information on the thickness of annual growth rings can be used to infer historical weather and streamflow conditions. Some of the longest and best reconstructions have been developed for the Colorado River spanning more than 1,000 years. These reconstructions clearly show extended drought periods that are far more severe than anything experienced in the historical record. The recent drought and new information about drought patterns in the past 1,000 years have raised awareness of the need to address the possibility of long-term, sustained drought.

Warming temperatures due to global climate change, combined with changes in precipitation and runoff patterns, are projected to increase the frequency and intensity of droughts in California. Regions that rely heavily upon surface water (rivers, streams, and lakes) could be particularly affected as runoff becomes more variable, and more demand is placed on groundwater. Climate change and a projected increase in California's population will also affect water demand. Warmer temperatures will likely increase evapotranspiration rates and extend growing seasons, thereby increasing the amount of water that is needed for the irrigation of many crops, urban landscaping and environmental water needs.

### IV. CALIFORNIA EMERGENCY SERVICES ACT AND GOVERNOR'S EMERGENCY PROCLAMATION

The California Emergency Services Act, Government Code Sections 8550 et seq, establishes how conditions of emergency are declared and describes the authorities of public agencies to prepare for and respond to emergencies. Pursuant to this Act, an emergency may be proclaimed by the Governor or by a city or county.

The governing body of a city or county proclaims a local emergency when the conditions of disaster or extreme peril exist. The proclamation enables the city or county to use emergency funds, resources, and powers, and to promulgate emergency orders and regulations. A local proclamation is a prerequisite to requesting a gubernatorial proclamation of emergency. The Secretary of Cal EMA may issue a letter of concurrence to a city or county declaration of local emergency. Cal EMA concurrence makes financial assistance available for repair or restoration of damaged public property pursuant to the California Disaster Assistance Act.

The Governor assesses the emergency situation and may proclaim a state of emergency when local resources are insufficient to control the disaster or emergency, typically in response to a local emergency proclamation. The Governor's proclamation activates the State Emergency Plan and invokes the California Disaster and Civil Defense Master Mutual Aid Agreement facilitating the provision of mutual aid from other cities and counties and state ageny assistance, permits suspension of state statutes or regulations, allows for state reimbursement of city and county response costs associated with the emergency, and allows property tax relief for damaged private property.

### V. COMMUNICATION AND COORDINATION STRUCTURE FOR DROUGHT RESPONSE OR DROUGHT MANAGEMENT

Drought management is a responsibility shared by many agencies and organizations at the federal, State, Region, and local levels. This DCP outlines the roles and responsibilities of agencies and organizations that may be involved in drought management (See Attachment 1).

State agencies will be more effective in managing and responding to drought if there is an established structure for communication and coordination. SEMS is the established structure for emergency management, preparedness, response, recovery and mitigation, communication and coordination. A drought emergency would follow the same SEMS structure as used for all other statewide emergencies and disasters. Figure 1 depicts a general structure that can be used for emergency drought response. Some components of this structure, such as the Drought Monitoring Committee and/or Impact Assessment Work Groups, may be used at any phase (Before, During, or After a drought) of drought management.

# Standardized Emergency Management System (SEMS) Organizational Chart - Drought



### FIGURE 1: General Drought Communication and Coordination Structure

In addition, DWR's Public Affairs Office is expanding its comprehensive drought communication strategy to provide better access to water supply and drought information to a variety of audiences. The drought website, drought list serve, eNews and focused outreach to water policy managers, legislators and the media are all tools that can be used to meet drought communication needs.

Implementation of SEMS on emergency drought response and the general tasks of individuals, agencies, and working groups are described below.

### Standardized Emergency Management System (SEMS)

As stated in Reference 5, SEMS is the cornerstone of California's emergency response system and the fundamental structure for the response phase of emergency management. SEMS is required by the California Emergency Services Act for managing multi-agency and multi-jurisdictional responses to emergencies in California. The

Action	Agencies with expertise or	Related Documents or
Provide public general information on drought as it relates to wildfire issues	Cal Fire (L), USFS, USBLM	Kelerences
Provide ranchers and farmers with	CDEA (I.) LICCE LISDA Tribal	
workshops on coping with drought	Representatives	
Provide public with information on	CDEG (L) USEWS USES	
wildlife issues – especially how to deal	CDOF	
with increased interactions.		
Conduct drought preparedness regional workshops for the purpose of : Developing proper indicators for each region Assess potential needs for regional assistance Determine relative risk of regions Capturing Drought component of Urban Water Management Plans	DWR (L), Cal EMA, CDFA, CDPH , Tribal Representatives	Multi Hazards Mitigation Plan, State of CA Emergency Plan, CWP- DCP
Provide public with information on	CDSP (L), DBW, DWR, ACOE,	CWP DCP
impacts to recreation. Inform public of ways to enjoy recreation with less impact to drought stressed environment.	USFS, CSLC, CDPR	
Prepare and update informational brochure on drought for general public.	DWR (L), Cal EMA, IRWM	DWR "Save Our Water" campaign
Determine precise needs of water providers for information on drought; what types of information are most relevant. This will vary by region and system. Set up system of indicators with triggers to inform decision makers and public on status and severity of	DWR (L), IRWMs, CDFA, Water Contractors and Purveyors	CWP-DCP, DWR Programmatic EIR/EIS for Water Transfers office.
Develop coordination and	DW/P (I) LISBP ACOE CDEG	
communication protocol between federal, State and Local, (County, etc) and Tribal entities.	USFWS, CDFA, IRWMs, Tribal Representatives	
Clarify emergency response procedures with State Agencies	Cal EMA (L), DWR, IRWMs	Multi Hazards Mitigation Plan, State of CA Emergency Plan, CWP- DCP
Prepare a handbook or checklist on procedures to expedite needed permits for response to drought.	DWR (L), SWRCB, CDFG, USFWS, USBR, ACOE, DPH	Multi Hazards Mitigation Plan, State of CA Emergency Plan, CWP- DCP
Arrange for funding to support drought relief, groundwater projects, desalination, conservation, recycling and other water management projects to assist regions in dealing with drought.	DWR (L), CDPH	CWP-DCP

Action	Agencies with expertise or authority (Lead-L)	Related Documents or References
Facilitate watershed and local planning		
for drought		
Develop risk-based vulnerability assessment for each basin /watershed.	DWR (L), IRWMs, CDFG, CDFA, USBR, USGS, NOAA, SWRCB, DPH	CWP-DCP
Prepare a "Map of Drought Vulnerability" showing areas where drought is more likely to upset water supplies.	DWR (L), IRWMs, CDFG, CDFA, USBR, USGS, NOAA,SWRCB, DPH	Multi Hazards Mitigation Plan, State of CA Emergency Plan, CWP- DCP
Develop a water budget for each watershed/basin – integrating inflows and outflows to meet all needs including quantification of carrying capacity.	DWR (L), IRWMs, CDFG, CDFA, USBR, USGS, NOAA, SWRCB	CWP-DCP
Investigate opportunities for regional drought planning through IRWM to facilitate drought response and assist IRWM planning efforts in developing regional responses to drought.	DWR (L), SWRCB, USBR, IRWMs	CWP-DCP
Explore Coordinated Management of Wildlife and Livestock.	CDFA (L), CDFG, DWR, USFS, BLM, USDA	
Direct state resource managers to develop drought plans for State Lands and State Parks	Natural Resources Agency (NRA), DWR, CDSP, CSLC	
Develop program for temporary transfers of water for instream flows to protect native fish and sports fisheries	DWR (L), SWRCB, USBR, ACOE, CDFG, USFWS, (Potential Partnerships with Cal WARN, CUEA, and/or CRWA)	DWR Water Transfers Office Documents and Programmatic EIR/EIS
Initiate partnerships with local water users and regulatory agencies to develop emergency alternative water supplies to habitat for critical species. Look to Urban Water Management Plans for existing information.	DWR (L), SWRCB, USBR, ACOE, CDFG, USFWS	DWR Water Transfers Office Documents and Programmatic EIR/EIS
Evaluate improvements to the institutional mechanism for temporary and voluntary drought related water transfers.	DWR (L), SWRCB, USBR, ACOE, CDFG, USFWS	DWR Water Transfers Office Documents and Programmatic EIR/EIS
Provide plan template and guidance to assist water providers in the development of drought plans and initiate a reporting and review program.	DWR (L), Cal EMA, CDPH, IRWMs	
Provide incentives and funding for comprehensive leak detection efforts.	DWR (L), CDPH	
Local Assistance		
Develop relative risk of regions to drought and the best indicators of droughts and water shortages.	DWR (L), IRWMs, USBR, NOAA, CDFA, CDFG, CDF, USFS, BLM	
Conduct regional workshops on the best metrics for monitoring droughts.	DWR (L), IRWMs, USBR, NOAA, CDFA, CDFG, CDF,	CWP-DCP

Action	Agency(ies) with expertise or authority (Lead-L)	Related Documents or References			
Level 1 - Abnormally Dry (Raising Awareness of Drought)					
<b>Drought Indicator</b> – The State's precipitation, snowpack, or runoff is lower than normal, or reservoir levels are below average. Conservation measures should be increased voluntarily, to help manage the state's current water supply					
Communication/Coordination and Planning					
Activate Drought Operations Center at DWR for central point of contact and information	DWR (L), Cal EMA(S), Appropriate Agencies	CWP-DCP			
Convene Drought Monitoring Committee and Impact Assessment Work Groups (situation and assessment reports)	DWR (L), Appropriate Agencies	CWP-DCP			
Designate agency spokesperson(s) to interact with the public and media	DWR(L), Appropriate Agencies	CWP-DCP			
Issue a Drought Advisory and press release	DWR(L), Appropriate Agencies	CWP-DCP			
Direct State agencies to conserve water at state facilities	DWR(L), Appropriate agencies	CWP-DCP			
Expedite drought-related permit applications	DWR(L) Appropriate agencies	CWP-DCP			
Communicate conditions, reinforce general conservation tips. Hold drought preparedness workshops.	DWR (L), Cal EMA, CDPH	20x2020, CWP			
Coordinate with Federal, State, Local (County) and Tribal entities	DWR (L), Appropriate Agencies	CWP-DCP			
Accelerate work with local governments and water providers on public awareness and outreach.	DWR (L), Appropriate Agencies	CWP-DCP			
Review State laws to reduce impediments to providing water supplies to communities in emergency need – modify as necessary. (short- term)	CDPH (L), DWR	CWP-DCP			
Monitoring					
Collect regional impact data and information	DWR (L), Appropriate Agencies	CWP-DCP			
Publish community and State facility water use information through website, media and other public outreach.	DWR (L), Appropriate Agencies	CWP-DCP			

## Table 2 – Potential Actions by Agencies in Responding to a Drought

### Table 3 – Potential Actions by Agencies in Recovery from a Drought

**Drought Indicators** – Current Water Conditions throughout the State are at normal levels. No drastic water conservation measures are necessary, although water conservation should always be practiced. The state's reservoirs are full or nearly full and runoff across the state is at normal levels

Action	Agency(ies) with	Related
	expertise or authority	Documents or
	(Lead - L)	References
Communication/Coordination and		
Planning		
Identify and communicate when drought	DWR (L)	
restrictions set by the State should ease or cease.		
Monitoring:		
Ongoing monitoring of recovery (reservoir	DWR (L)	
replenishment and longer term climate data)		
Assure replenishment of reservoirs and		
groundwater resources.		
Monitoring of groundwater levels including municipal wells.	CDPH (L), Local agencies	
Monitoring salt-water intrusion in coastal aquifers	DWR (L), Local agencies	
which may have been accelerated due to drought		
to assure intrusion is halted or reversed.		
Facilitation of watershed and local		
planning for drought:		
Manage pasture, rangelands and forest recovery	CDFA (L), State Lands, CAL- FIRE	
Local Assistance		
Reduction-of-herd recovery assistance for dairy	CDFA (L)	
and cattle operations.		
Return emergency water supply augmentation	DWR (L), Appropriate other	
measures to stockpile. Perform maintenance	Agencies	
necessary for proper storage of equipment such		
as desalination units.		
Drovide technical engisteries to districts requesting		
Provide technical assistance to distincts requesting	DVVR (L)	
standard water rates		
Pasture rehabilitation - State provides assistance		
in form of :		
Loans and Grants		
Technical Assistance		
Actions to diminish first flush concerns (For	SWRCB (L), RWQCB	
example: sediment transport off of denuded lands		
due to drought and/or wildfire)		
Provide deferred maintenance assistance for	DWR (L), CDFA	
pumps, farming equipment and other water		
related infrastructure.		
Conservation:		
Maintain drought conservation measures	DWR (L)	

### ATTACHMENT 5 - 2008 Executive Order and Emergency Drought Proclamation

Office of the Governor of the State of California

Page 1 of 3



#### EXECUTIVE ORDER S-06-08

#### 06/04/2008

WHE RE AS Statewide rainfall has been below normal in 2007 and 2008, with many Southern California communities receiving only 20 percent of normal rainfall in 2007, and Northem California this year experiencing the driest spring on record with most communities receiving less than 20 percent of normal rainfall from March through May: and

WHE RE AS California is experiencing critically dry water conditions in the Sacramento and San Joaquin River basins and the statewide runoff forecast for 2008 is estimated to be 41 percent below average; and

WHE RE AS water storage in many of the state's major reservoirs is far below normal including Lake Oroville, which supplies the State Water Project, at 50 percent of capacity, Lake Shasta at 61 percent of capacity and Folsom Lake at 63 percent of capacity; and

WHE REAS the Colorado River Basin has just experienced a record eight-year drought resulting in current reservoir storage throughout the river system reduced to just over 50 percent of total storage capacity, and

WHEREAS climate change will increasingly impact California's hydrology and is expected to reduce snowpack, alter the timing of runoff and increase the intensity and frequency of droughts in the western United States; and

WHE RE AS diversions from the Sacramento-San Joaquin River Delta for the State Water Project (SWP) and federal Central Valley Project (CVP) are being greatly restricted due to various factors including federal court actions to protect fish species, resulting in estimated SWP deliveries of only 35 percent, and CVP deliveries of only 40 percent, of local agencies' requested amounts for 2008; and

WHE RE AS dry conditions have created a situation of extreme fire danger in California, and these conditions resulted in devastating fires last year, resulting in proclamations of emergency for the counties of El Dorado, Los Angeles, Orange, Ventura, Santa Barbara, Riverside, San Bernardino, Santa Clara, Santa Cruz and San Diego, with wildfires there causing millions of dollars in damages; and

WHE RE AS on May 9, 2008, I signed an Executive Order directing various agencies and departments within my administration to respond to these dry conditions and prepare for another potentially severe wildfire season; and

WHE RE AS the current drought conditions are harming urban and rural economies, and the state's overall economic prosperity; and

WHE RE AS some communities are restricting new development and mandating water conservation and rationing, and some farmers have idled permanent crops and are not planting seasonal crops this year, because of unreliable or uncertain water supplies; and

WHERE AS recent supply reductions have jeopardized agricultural production in the San Joaquin Valley; an

WHE RE AS it is not possible to predict the duration of present drought conditions; and

WHE RE AS while communities throughout the state have worked to significantly improve their drought preparedness, the readiness to cope with current and future drought conditions varies widely; and

WHE RE AS immediate water conservation measures are needed this year to address current conditions and prepare for a dry 2009; and

http://gov.ca.gov/index.php?/print-version/executive-order/9797/

6/16/2010
WHEREAS the State of California is committed to enhancing drought response and drought preparedness and to protecting the state's economy and its environment

NOW, THEREFORE, I, ARNOLD SCHWARZENEGGER, Governor of the State of California, do hereby proclaim a condition of statewide drought, and in accordance with the authority vested in me by the Constitution and statutes of the State of California, do hereby issue the following orders to become effective immediately

IT IS HEREBY ORDERED that the Department of Water Resources (DWR) shall take immediate action to address the serious drought conditions and water delivery limitations that currently exist in California, and that are anticipated in the future, by taking the following actions:

- Expedite existing grant programs for local water districts and agencies for new or ongoing water conservation and water use reduction programs and projects that are capable of timely implementation to ease drought conditions in 2008 or 2009.
- Facilitate water transfers in 2008 to timely respond to potential emergency water shortages and water quality degradation, and prepare to operate a dry year water purchasing program in 2009.
- In cooperation with local water agencies and other water-related organizations, conduct an aggressive water conservation and outreach campaign.
- Immediately convene the Climate Variability Advisory Committee to prioritize and expedite drought-related elimate research that will assist in responding to current drought conditions and help prepare for a potentially dry 2009.
- Provide technical assistance for drought response to local water agencies and districts for improving landscape and agricultural irrigation efficiencies, leak detection and other measures as appropriate.
- Review the water shortage contingency elements of Urban Water Management Plans and work cooperatively with water suppliers to implement improvements.
- Coordinate and implement State Water Project operations and water exchanges to alleviate critical impacts to San Joaquin Valley agriculture.
- Implement additional actions to facilitate drought response, preparedness and promote water conservation in 2008 and 2009, and which will contribute to achieving long term reductions in water use.

IT IS FURTHER ORDERED that DWR and the Department of Public Health (DPH) prioritize processing of loan and grant contracts for water suppliers and public water systems demonstrating drought-related hardships.

IT IS FURTHER ORDERED that DWR and DPH coordinate with the State Office of Emergency Services and local offices of emergency services to identify public water systems at risk of experiencing health and safety impacts due to drought conditions and water delivery limitations, and to mitigate such impacts.

IT IS FURTHER ORDERED that DWR and DPH work with local water districts to evaluate system interconnections among the state's large water purveyors, review the status or availability of mutual aid agreements among those large water purveyors, and work with the parties to those mutual aid agreements to correct any deficiencies that restrict the movement of water in an emergency situation

IT IS FURTHER ORDERED that DWR coordinate with the California Public Utilities Commission to identify investor-owned water utility systems at risk of experiencing health and safety impacts due to drought conditions and water delivery limitations, and to mitigate such impacts.

IT IS FURTHER ORDERED that DWR work with the Department of Food and Agriculture (CDFA), the United States Department of Agriculture and the United States Bureau of Reclamation to identify potential federal funding for local water agencies and farmers to facilitate the rapid installation of best available irrigation management and conservation systems.

IT IS FURTHER ORDERED that the CDFA work with county Agricultural Commissioners and others as necessary to identify and gather data on crop losses and other adverse economic impacts caused by the drought and, when necessary, transmit that information to the appropriate federal and state agencies.

IT IS FURTHER STRONGLY ENCOURAGED that local water agencies and districts work cooperatively on the regional and state level to take aggressive, immediate action to reduce water consumption locally and regionally for the remainder of 2008 and prepare for potential worsening water conditions in 2009.

This Order is not intended to, and does not, create any rights or benefits, substantive or procedural, enforceable at

http://gov.ca.gov/index.php?/print-version/executive-order/9797/

Page 3 of 3

law or in equity, against the State of California, its agencies, departments, entities, officers, employees, or any other person.

I FURTHER DIRECT that as soon as hereafter possible, this Executive Order be filed in the Office of the Secretary of State and that widespread publicity and notice be given to this Executive Order.



IN WITNESS WHEREOF I have hereunto set my hand and caused the Great Seal of the State of California to be affixed this 4<sup>th</sup> day of June 2008.

ARNOLD SCHWARZENEGGER Governor of California

ATTEST

DEBRA BOWEN Secretary of State

http://gov.ca.gov/index.php?/print-version/executive-order/9797/

Page 1 of 4



#### PROCLAMATION

06/12/2008

#### State of Emergency - Central Valley Region

PROCLAMATION by the Governor of the State of California

WHEREAS on June 4, 2008, I issued an Executive Order proclaiming a statewide drought; and

WHEREAS in my June 4 Executive Order, I called on all Californians to conserve water, and I directed state agencies and departments to take immediate action to address the serious drought conditions and water delivery reductions that exist in California; and

WHEREAS in issuing my June 4 Executive Order, I said that I would proclaim a state of emergency in any county where emergency conditions exist due to the drought, in an effort to protect the people and property of California, including the businesses, workers and communities that depend on water deliveries for their livelihood and survival; and

WHEREAS since issuing my June 4 Executive Order, I have determined that emergency conditions exist in Central Valley counties caused by the continuing drought conditions in California and the reductions in water deliveries; and

WHEREAS statewide rainfall has been below normal in 2007 and 2008, with many Southern California communities receiving only 20 percent of normal rainfall in 2007, and Northern California this year experiencing the driest spring on record with most communities receiving less than 20 percent of normal rainfall from March through May; and

WHEREAS California is experiencing critically dry water conditions in the Sacramento and San Joaquin River basins and the statewide runoff forecast for 2008 is estimated to be 41 percent below average; and

WHEREAS water storage in many of the reservoirs serving the Central Valley are far below normal including San Luis reservoir which is at 53 percent of capacity, Lake Shasta at 61 percent of capacity and Lake Oroville at just 50 percent of capacity; and

WHEREAS diversions from the Sacramento-San Joaquin River Delta for the State Water Project (SWP) and federal Central Valley Project (CVP) are being greatly restricted due to various factors including federal court actions to protect fish species, resulting in estimated SWP deliveries of only 35 percent, and CVP deliveries of only 40 percent, of local agencies' requested amounts for 2008; and

WHEREAS the United States Bureau of Reclamation (USBR) recently announced an unexpected reduction in its water supply allocations to Central Valley Project (CVP) contractors within the San Luis Delta Mendota Water Agency Service Area from 45 percent to 40 percent; and

WHEREAS this unanticipated reduction will result in crop loss, increased unemployment and other direct and indirect economic impacts to Central Valley counties; and

WHEREAS water rationing has been ordered by the City of Long Beach, the City of Roseville, and the East

http://gov.ca.gov/index.php?/print-version/proclamation/9898/

Bay Municipal Utility District, which serves 1.3 million people in Alameda and Contra Costa counties; and

WHEREAS on June 10, 2008, the Metropolitan Water District of Southern California, which supplies water for 26 cities and water agencies serving 18 million people in six southern California counties, declared a water supply alert in an effort to sustain their water reserves; and

WHEREAS some communities are also restricting new residential and commercial development because of unreliable or uncertain water supplies, and this is causing harm to the economy; and

WHEREAS dry conditions have created a situation of extreme fire danger in California, and these conditions resulted in devastating fires last year, with wildfires causing millions of dollars in damages; and

WHEREAS San Joaquin Valley agriculture constitutes a \$20 billion industry, and serves as an essential part of California's economy, and

WHEREAS the lack of water will cause devastating harm to the communities that rely on this important industry, as growers lack sufficient water to finish the growing season, are forced to abandon planted crops, and are forced to dismiss workers, and

WHEREAS the lack of water is causing agricultural workers in the Central Valley to lose their jobs, resulting in a loss of livelihood, an inability to provide for their families, and increased negative social and economic impacts on the communities that depend on them, and

WHEREAS San Joaquin Valley agricultural production and processing industries account for almost 40 percent of regional employment, and every dollar produced on the farm generates more than three dollars in the local and regional economies, and the loss of these dollars is devastating communities; and

WHEREAS almost 20 percent of San Joaquin Valley residents already live in poverty, and it consistently ranks as the top region in the nation in foreclosures; and

WHEREAS as workers lose their jobs because of the lack of water, they often move their families away from the communities, resulting in further harm to local economies, lower enrollments in local schools and reduced funding for schools; and

WHEREAS the city of Fresno received only 54 percent of normal rainfall in 2007 and 76 percent of normal in 2008, and had its fourth driest spring on record, and

WHEREAS on June 11, 2008, the Fresno County Board of Supervisors passed a resolution declaring a local state of emergency due to the severe drought conditions, stating among other things that the lack of water has resulted in water rationing by Fresno County water districts; that these reductions are causing abandonment of current planted seasonal crops and permanent crops; that the cumulative crop reductions will result in job losses in Fresno County government tax revenue; and that there will be a substantial negative economic impact to the community; and

WHEREAS the Fresno County Board of Supervisors also requested that I declare a state of emergency due to the drought conditions; and

WHEREAS the Central Valley cities of Bakersfield, Modesto, Stockton, and Sacramento experienced their driest spring on record in 2008, and additional Central Valley counties are experiencing similar emergency conditions caused by drought and lack of water deliveries; and

WHEREAS to date, almost \$65 million in losses have been reported by 19 counties due to reduced rangeland grasses that are used to graze livestock, and those reductions have been caused by drought, and

WHEREAS statewide and local conditions collectively have led to the rationing of water by affected water districts to their member farmers and these further reductions are resulting in abandonment of current planted seasonal crops and permanent crops; and

WHEREAS the crop losses will cause increased food prices, which will negatively impact families and economies throughout California and beyond our borders; and

http://gov.ca.gov/index.php?/print-version/proclamation/9898/

WHEREAS the lack of water deliveries has forced local communities to draw water from their emergency water reserves, putting communities at risk of further catastrophe if emergency reserves are depleted or cut off, and

WHEREAS the circumstances of the severe drought conditions, by reason of their magnitude, are beyond the control of the services, personnel, equipment and facilities of any single county, city and county, or city and require the combined forces of a mutual aid region or regions to combat; and

WHEREAS under the provisions of section 8558(b) of the California Government Code, I find that conditions of extreme peril to the safety of persons and property exist within the counties of Sacramento, San Joaquin, Stanislaus, Merced, Madera, Fresno, Kings, Tulare and Kern, caused by the current and continuing severe drought conditions.

NOW, THEREFORE, I, ARNOLD SCHWARZENEGGER, Governor of the State of California, in accordance with the authority vested in me by the California Constitution and the California Emergency Services Act, and in particular, section 8625 of the California Government Code, HEREBY PROCLAIM A STATE OF EMERGENCY to exist within the counties of Sacramento, San Joaquin, Stanislaus, Merced, Madera, Fresno, Kings, Tulare and Kern.

IT IS HEREBY ORDERED that all agencies of the state government utilize and employ state personnel, equipment and facilities for the performance of any and all activities consistent with the direction of my Office of Emergency Services (OES) and the State Emergency Plan, and that OES provide local government assistance under the authority of the California Disaster Assistance Act, and that the emergency exemptions in sections 21080(b)(3) and 21172 of the Public Resources Code shall apply to all activities and projects ordered and directed under this proclamation, to the fullest extent allowed by law.

#### **I FURTHER DIRECT THAT:**

- OES shall provide assistance under the authority of the California Disaster Assistance Act, by assisting public water agencies with drilling of groundwater wells or the improvement of existing wells and water delivery systems for human consumption, sanitation, and emergency protective measures, such as fire fighting.
- The Department of Water Resources (DWR) shall transfer groundwater of appropriate quality through the use of the California Aqueduct to benefit farmers in the San Joaquin Valley
- DWR and the State Water Resources Control Board (SWRCB) shall expedite the processing of water transfer requests.
- 4. DWR, in cooperation with USBR, shall make operational changes to State Water Project facilities, including the San Luis Reservoir and Southern California reservoirs, that will permit additional water deliveries to the San Joaquin Valley.
- DWR shall prepare and file necessary water right urgency change petitions to facilitate surface water transfers and the use of joint point of diversion by the SWP and Central Valley Project.
  - SWRCB shall expedite the processing and consideration of water rights urgency change petitions filed by DWR and other water agencies to facilitate water transfers to the San Joaquin Valley.

I FURTHER DIRECT that as soon as hereafter possible, this proclamation be filed in the Office of the Secretary of State and that widespread publicity and notice be given of this proclamation.

IN WITNESS WHEREOF I have hereunto set my hand and caused the Great Seal of the State of California to be affixed this 12th day of June, 2008.

ARNOLD SCHWARZENEGGER Governor of California

http://gov.ca.gov/index.php?/print-version/proclamation/9898/

Page 4 of 4

ATTEST:

DEBRA BOWEN Secretary of State

http://gov.ca.gov/index.php?/print-version/proclamation/9898/

# CALIFORNIA DEPARTMENT OF WATER RESOURCES 1416 Ninth Street, Sacramento, CA 95814

http://www.water.ca.gov/drought/

# Central Valley Project and State Water Project Drought Operations Plan and Operational Forecast April 1, 2014 through November 15, 2014

Balancing Multiple Needs in a Third Dry Year

April 8, 2014

# Central Valley Project and State Water Project Drought Operations Plan and Operational Forecast April 1, 2014 through November 15, 2014

#### Balancing Multiple Needs in a Third Dry Year

This Drought Operations Plan and Operational Forecast (the Plan) is based on collaborative discussions between the U.S. Bureau of Reclamation (Reclamation), California Department of Water Resources (DWR), U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), California Department of Fish and Wildlife (CDFW), and the State Water Resources Control Board (State Water Board). The Plan will be modified based on evolving information which could include additional conditions in State Water Board regulatory approvals as well as federal Endangered Species Act (FESA) and California Endangered Species Act (CESA) requirements. Most importantly, the Plan, as described below, is based upon hydrologic conditions as of early March including recent storms. Reclamation and DWR intend to continue to refine the Plan in collaboration with other agencies as ongoing weather changes current conditions and forecasts for the Sierra snowpack, reservoir storage, and river flow.

## I. Introduction and Purposes of the Plan

As California approaches the summer of a third consecutive dry year, economic and environmental challenges for our State are mounting. Limited water supplies create a crisis that will require extraordinary management measures on the part of water project operators, water quality and environmental regulators, the hundreds of local water agencies that supply most Californians with water, and State residents themselves. The latest National Weather Service data continue to show nearly the entire State in severe drought and over two-thirds in extreme drought. According to this same data, more of the State is in exceptional or extreme drought than when the Governor issued his drought proclamation on January 17, 2014. In this extraordinarily dry year, all water users, including agricultural, municipal, and fish and wildlife uses will suffer hardship.

Since December of 2013, State and Federal agencies that supply water, protect fish and wildlife, and regulate water quality have worked together daily to cope with drought. Together, these agencies have maximized regulatory flexibility to adjust quickly to changes in the weather and environment and bolster water supplies when possible while minimizing impacts to fish and wildlife.

These agencies also are currently charting a collaborative course for the coming summer and fall of 2014. This Plan and Operational Forecast was developed in coordination with Reclamation and DWR, USFWS, NMFS, CDFW, and the State Water Board. The Plan outlines proposed actions and a likely range of coordinated operations of the Central Valley Project (CVP) and State Water Project

(SWP) from April 1 through November 15, 2014, and is based on the conservative but prudent assumption that conditions will remain dry, and that drought may persist into 2015.

The following are the purposes of the Plan:

- 1. During this extreme drought year, operate the CVP and SWP to provide for, at a minimum, essential human health and safety needs throughout the CVP and SWP service areas from April 1 through November 15, 2014, and retain the capability to provide for such minimum needs in water year 2015 if the drought continues. For clarity, Reclamation and DWR's consideration of these essential human health and safety needs includes adequate water supplies for drinking water, sanitation, and fire suppression, but does not extend to other urban water demands such as outdoor landscape irrigation. While most Californian communities have adequate reserve supplies, some will require continued delivery of limited amounts of water through the CVP and SWP systems to meet these basic needs.
- 2. Another primary purpose is control of saltwater intrusion in the Sacramento-San Joaquin Delta. The Delta drains roughly 40 percent of California. Enough fresh water must flow into the Delta throughout dry months to repel saltwater that pushes inland on ocean-driven tides from San Francisco Bay. If there is not enough water in upstream reservoirs to release to rivers to repel the saltwater, it can contaminate the channels from which water supplies are drawn, not just for the SWP and CVP, but also for Delta farmers and water districts in nearby Contra Costa, Alameda, and San Joaquin counties. Maintaining enough reservoir storage to control Delta salinity this spring through the fall is critical. Therefore, this Plan balances the need to protect upstream storage, the need to maintain minimal exports from the Delta in the spring and summer, and the need to maintain salinity control in the Delta for future deliveries later in the year and into 2015.
- 3. A third major purpose in crafting a plan for water project operations this spring through the fall involves the need to preserve enough cold water deep in Shasta Lake and other reservoirs to maintain cool water temperatures in the Sacramento River for different runs of Chinook salmon. These same water supplies may be needed to provide for critical needs in 2015, if conditions remain dry.
- 4. A fourth major purpose is the continued need to maintain minimum protections for endangered species and other fish and wildlife resources that are suffering from unavoidable impacts due to a drought of this magnitude and necessary drought-related actions. Most elements of the controlling regulations that provide protection will be fully implemented this year. This Plan calls out those elements that have been or could be modified in order to balance all needs, while providing minimum protections required by law. As such, Reclamation and DWR propose this Plan to ensure compliance with applicable laws and requirements of the regulatory agencies for operations through November 15, 2014. The Plan will be submitted by Reclamation and DWR for concurrent review under applicable laws, including the Federal ESA, CESA, and the California Water Code.

2

## IV. Overview of 2014 Operations and Forecasts

### A. <u>Overview</u>

Reclamation and DWR's proposed Drought Operations Plan for 2014 incorporates the following components, to be implemented as needed based on hydrology, to support the combined drought operations of the CVP and SWP for the remainder of Water Year 2014:

- Operational forecasts based on the March 1 90 percent (with and without barriers) and 50
  percent exceedance runoff forecasts and assumptions outlined in the Plan (see CVP and
  SWP Operational Forecasts below);
- Upstream flow and temperature management actions for Feather River, Sacramento River, Trinity River, Clear Creek, American River, and Stanislaus River. This includes Sacramento River Temperature Analysis of potential cold-water management objectives as described in NMFS RPA Action 1.2.3.C;
- A suite of proposed modifications to Delta criteria for April and May, including modified DCC gate operations to protect water quality, an export regime designed to take advantage of natural or abandoned flow in those months, and some actions to offset adverse effects to out-migrating San Joaquin River steelhead and salmon;
- A contingency for placement of emergency drought barriers in the Delta and corresponding modification to Delta water quality objectives; and,
- A suite of proposed modifications to Delta criteria for June through November 15, including modifications to some State Water Board D-1641 requirements.

Overall, this Plan addresses both proposed operations in April and May of 2014, as well as monthly objectives through November 15, 2014. The general CVP and SWP operational objectives for both periods are to improve cold water pool storage in upstream reservoirs through May, continue some water deliveries, operation of the Delta pumping facilities while taking advantage of opportunities to export natural or abandoned flow while maintaining Delta water quality and minimizing adverse effects to listed fish, and to manage reservoir releases in June through September to concurrently benefit in-stream temperature objectives and to meet Sacramento Valley in-basin needs and preserve carryover storage. April and May operations include temporary modifications to the San Joaquin River inflow to export ratio objective (NMFS RPA IV.2.1), San Joaquin River flow objectives (D-1641), the Delta export to inflow (E/I) ratio objective (D-1641), and the X2 Delta Outflow objectives (D-1641).

Delta inflow conditions can change very quickly and are difficult to accurately forecast beyond five to ten days – sometimes less. The water project operations will depend on quickly adapting to observed hydrologic and biological conditions within the operating parameters described below. To facilitate this goal, and the goals outlined in this Plan, Reclamation and DWR will continue to

11

coordinate operations through the typical agency processes and protocols including the existing Water Operations Management Team (WOMT) and RTDOMT processes.

The Plan will continue to be refined as April forecasts are finalized and future weather conditions continue to change the Sierra snowpack, reservoir storage, and river flows. Changing precipitation could also lead to a reassessment of water supply availability and/or the need for extraordinary measures, including temporary rock barriers (Emergency Drought Barriers) on three channels in the Sacramento-San Joaquin Delta. While many of the planning assumptions used are conservative based on hydrologic conditions remaining dry, the approach outlined also allows for adapting decisions to changing hydrology and water availability. The Plan is based on current (March 2014) operations forecasts. If the operations change in such a way that is not considered in this Plan, Reclamation and DWR will alert the regulatory agencies and reinitiate Section 7 consultation, as necessary.

### B. <u>CVP and SWP Operational Forecasts</u>

The combined operational forecasts for CVP and SWP operations through November 2014 are summarized in Attachment B. These forecasts take into account observed March reservoir inflows and the projected runoff estimates developed by DWR. The operational outlooks for the 90 percent exceedance (both with and without the proposed emergency drought barriers) and 50 percent exceedance forecasts provide a range of anticipated monthly averaged flow rates and estimated end-of-month reservoir storage levels These operational forecasts are based on the following:

- Hydrology is based on the March 1, 2014, DWR runoff forecasts at the 90 percent exceedance and 50 percent exceedance levels. These runoff forecasts, to be updated monthly through June, include reservoir inflows as well as estimates of accretions and depletions in the Sacramento River Basin;
- Installation, operation, and removal of emergency drought barriers in one of the 90 percent exceedance forecast;
- Operating to a Sacramento River flow at Wilkins Slough target of 4,000 cfs;
- Stanislaus River operations coordinated through the Stanislaus Operations Group (SOG). River releases of Table 2E flows (NMFS BiOp) will be closely coordinated to also achieve benefits as a pulse flow on the San Joaquin River. The action will be coordinated with modified D1641 San Joaquin River flow requirements.

The coordination of Jones Pumping Plant and Banks Pumping Plant operations in April and May to offset effects to San Joaquin River steelhead (see Section VIII, the majority of exports will be exported through the CVP's Jones Pumping Plant to the extent possible, as fish loss is lower at the CVP facility) are not reflected in the monthly operations summary tables. This coordination will be done on a real time basis to best respond to observed hydrological and operational conditions.

## ATTACHMENT D

## WINTER-RUN CONTINGENCY PLAN

#### Winter-run Drought Contingency Plan for 2014

#### Background

The March forecast indicated that Shasta End-of-September storage would still be too low (662thousand-acre-feet in the 90% forecast) to maintain winter-run egg incubation and fry production through August and September in the Sacramento River. Recent rains have increased Shasta Reservoir storage to 1.7 million-acre-feet, however, temperature modeling showed greater than 50% of the eggs may be lost due to high temperatures in the 90% forecast (driest). However, temperature modeling using the 50% forecast (wet, or average condition) showed that a temperature of 56-Fahrenheit as required by NOAA's National Marine Fisheries Service (NMFS) to support successful egg and fry incubation could be maintained all summer until mid-October down to South Bonneyview Road Bridge/Clear Creek gauge (ten miles below Keswick Dam).

The Livingston Stone National Fish Hatchery (LSNFH) winter–run production would also be subject to these projected high temperatures since it relies on its water supply through Shasta Dam. The LSNFH will also likely lose their water intake located on the powerhouse penstock if the forecast shows that the reservoir elevation will drop below the powerhouse intake on Shasta Dam.

#### Components

- 1) Enhanced Temperature, Flow, and Egg Survival Monitoring Program for assessing naturally spawned winter-run egg survival in the upper Sacramento River.
- 2) Increasing production at LSNFH: Infrastructure needs for normal operations, and additional needs for increasing production.
- 3) Collecting winter-run out of the Sacramento for additional LSNFH broodstock or relocation into Battle Creek (see #5).
- 4) Releasing unfed fry from LSNFH at alternative locations.
- 5) Relocating winter-run to suitable spawning and rearing habitat outside of the Sacramento River.

### **Key Actions**

1) Enhanced Temperature, Flow, and Egg Survival Monitoring [implemented by US Bureau of Reclamation (BOR) and Department of Water Resources].

- a. Implement a permanent temperature monitoring station at Airport Road Bridge.
- b. Place temperature and water level sensors in redds and primary juvenile rearing habitat (in place by May 15).
- c. Monitor temperatures in the secondary channels, within spawning gravel areas, and tributaries (Cow, Cottonwood, and Clear creeks).
- d. Monitor 7-Day Average Daily Maximum.
- e. Incorporate weekly (or daily as needed) winter-run redd dewatering and juvenile stranding real-time monitoring data into water level management and temperature modeling (in

place by May 15). This may be part of the existing California Department of Fish & Wildlife (CDFW) monitoring, and will be reported to NMFS as part of this program.

- i. NMFS will use this data to make operational recommendations to the Sacramento River Temperature Task Group.
  - 1. **TRIGGER**<sup>1</sup> for flow recommendation: Documentation of 5 or more dewatered winter-run redds.
- ii. **TRIGGER** for implementing fish stranding relocation: One observation of an isolated area of stranded juveniles.
- f. Calibrate long-term temperature forecast models to reduce uncertainty.
- g. Evaluate the likelihood of critical depletions through coordination with water contractors more than 30 days in advance of forecasted operations.
- h. Use an existing, more current model than HEC-5Q, such as CE-QUAL-W2, to increase forecast accuracy of long-term temperature forecasts.
- i. Monitor redds at the downstream end of the spawning distribution (near the temperature compliance point) to determine whether healthy fry emerge. Redds located close to the temperature compliance point may be more susceptible to lethal temperatures. This may be incorporated as part of existing CDFW monitoring.
- 2) Increase production at LSNFH: US Fish & Wildlife Service has requested funds from the US Bureau of Reclamation for infrastructure needs for increasing production at LSNFH. Multiagency agreement (winter-run PWT subgroup) to implement this action, and to increase spawned adults from 120 to 400.
  - a. Date broodstock collection completed (June 1)
  - b. Date spawning begins (May 1-15, depending on condition)
  - c. Infrastructure improvements have been addressed (funding pending)
  - d. NMFS Permits and approvals completed
- 3) Collecting winter-run out of the Sacramento for additional LSNFH broodstock or relocation into Battle Creek (see #5). Decision deadline: May 1, 2014.

**TRIGGER**: Close communication with LSNFH, and temperature modeling for the Sacramento River (and #5), will determine the need for this action. Recommended methods:

- a. Rescued winter-run from Colusa Basin Drainage Canal (Section 10(a)(1)(A) Permit 18181). Will be genetically identified as winter-run prior to transporting
- b. Hook and line sampling

Permitting for a. and b. above, could be achieved by modification of existing Section 10(a)(1)(A) Permits (1415 [RBFWO] or 18181 [CDFW])

4) Rearing unfed fry at alternative locations. If LSNFH successfully spawns 400 adults, capacity for rearing fry is only 200 adults, therefore, half of the production (~200,000 to 400,000) will need to be released into Sacramento River as unfed fry, or raised at another facility.

<sup>1</sup> **TRIGGER** is defined as a biological condition that warrants an operational change or action implementation.

**TRIGGER**: Decision will need to be made by June 15 based on how many fish are spawned at LSNFH, this will be a joint decision by the Interagency Winter-run PWT sub Group.

- a. Relocate to Battle Creek to rear (25% survival based on literature)
  - i. Directly into creek as unfed fry
- b. Relocate to alternative hatchery and rear until September-February (e.g., Mt. Shasta Trout Hatchery, or CNFH), (80-90% survival based on LSNFH data)
- 5) Relocating winter-run to suitable spawning and rearing habitat outside of the Sacramento River (Decision deadline: May 1 for adults, June 15 for juveniles).

**TRIGGER**: Only if forecast shows <50% survival or less in the Sacramento River, and temperatures in Battle Creek demonstrate improved survival.

- a. Battle Creek temperatures/egg survival (spawning capacity for 150 adults)
  - i. Monitoring components are to be determined
  - ii. NMFS section 10 Permit has not been modified/completed

### ATTACHMENT E

## BIOLOGICAL REVIEW – SALMONIDS AND STURGEON

Attachment E. Salmonid and Green Sturgeon Biological Review for Endangered Species Act Compliance for WY2014 Drought Operation Plan (4/8/14)



Figure 26. Density plot of velocity (ft/s) observed at DSM2 node 50 (approximately West False River) for three outflow ranges.

# San Joaquin River I:E ratio and San Joaquin River flow downstream of the Head of Old River

Steelhead in the San Joaquin River basin were once abundant and widely distributed, but currently face numerous limiting factors. The NMFS Public Draft Central Valley Recovery Plan identified that 'Very High' stressors for juvenile steelhead outmigration on the San Joaquin River include habitat availability, changes in hydrology, water temperature, reverse flow conditions, contaminants, habitat degradation, and entrainment. It is possible that reduced survival of emigrating smolts may be the greatest management concern to preserving anadromy in *O. mykiss* (Satterthwaite et al. 2010). A conceptual model, developed by the South Delta Salmonid Research Collaborative (Anchor QEA 2016), demonstrates how multiple stressors may affect physical and biological processes in the Delta that influence the steelhead population through multiple mechanisms (i.e. entrainment, predation, survival, Figure 27).

The NMFS Biological Opinion includes two actions that influence CVP/SWP export and flows through the Old and Middle River corridors during April and May, when outmigrating listed juvenile salmonids and green sturgeon are present. Action IV.2.1 identifies maximum levels of export volume as a function of San Joaquin discharge at Vernalis. This action is calendar based and occurs from April 1 to May 31. The action hypothesizes to increase survival of emigrating salmonids by reducing fishes' vulnerability to entrainment into the south Delta and at the CVP/SWP facilities by limiting export to less than 100% of San

#### Attachment E. Salmonid and Green Sturgeon Biological Review for Endangered Species Act Compliance for WY2014 Drought Operation Plan (4/8/14)

Joaquin River inflow, except in critical years. In the proposed drought operation plan for April and May 2014, implementation of this action is projected to be limited to the period of coordinated San Joaquin River pulse flows. Action IV.2.3 limits the extent of reverse negative flows through the South Delta along Old and Middle rivers and adjacent channels. Similar to Action IV.2.1, this action attempts to increase survival of emigrating Sacramento and San Joaquin origin listed salmonids by reducing their vulnerability to entrainment into the south Delta and pumps. The initial OMR limit of -5,000 cfs is calendar-based and runs between January 1 and June 15, but increased entrainment of listed salmon ESUs and steelhead can trigger more positive OMR limits of -3,500cfs or -2,500cfs. Action IV.2.3's implementation will not be modified as part of the proposed drought operation plan, but OMR flow calculations will continue to utilize the Index equation methodology described in the OMR Index Demonstration Project (USBR 2014c, NMFS 2014b).



Figure 27. Conceptual Model for South Delta Salmonid Smolt Survival

The portions of the juvenile Central Valley steelhead, Winter-run and Spring-run Chinook still migrating through the Delta will be affected by more unfavorable hydrodynamic conditions in the South and Central Delta than under unmodified implementation of NMFS RPA IV.2.1.

## ATTACHMENT J

## PRELIMINARY SCIENCE PLAN FOR ANADROMOUS FISH MONITORING AND TECHNOLOGY IMPROVEMENTS

### Preliminary Science Plan for Anadromous Fish Monitoring and Technology Improvements

#### April 7, 2014

As identified in the Bureau of Reclamation (Reclamation) and the California Department of Water Resources' (DWR) Drought Operations Plan for April through October, considerable information and relevant data exists to analyze the potential effects of drought conditions and the actions taken in response to those conditions on threatened and endangered anadromous fishes in the California Central Valley. However, given necessity of rapid management decisions to achieve potential benefits to water storage or the conservation of species, agencies are interested in greater real-time operational decision making, which the current monitoring system does not adequately address. Real-time monitoring requires remote or biologist reported information on a daily (or more frequent basis) to inform the daily decision making desired by agency managers during the drought. To meet these real-time information needs, state and federal agencies are committed to developing, and implementing as appropriate, a multi-objective emergency fisheries monitoring, technology improvement, and science plan to significantly improve the ability to make real-time operational decisions. A second objective of this plan is to undertake monitoring and research to improve understanding of biological effects associated with water operations regardless of hydrologic conditions. Frequently, this information does not require daily reporting, but is needed in a timely fashion to inform the management cycle.

This preliminary plan will be further developed through an interagency team led by NOAA Fisheries and DFW. NOAA Fisheries Central Valley Office and DFW will collaborate with the NOAA South West Fisheries Science Center, and North West Fisheries Science Center, DWR, Reclamation, U.S. Geological Survey, and U.S. Fish and Wildlife Service in developing the plan.

This preliminary plan outlines a number of near-term and long-term actions to address these needs.

### I. Water Year 2014 Actions (near-term):

These actions will be developed by **April 15<sup>th</sup>** and will include:

#### Delta Monitoring:

- 1) Expanded use of field crews through the extended drought season to gather and analyze the pertinent trawl and beach seining data for implementation of the Delta Cross Channel operations criteria proposed in the drought operations plan from April 1-November 15.
- 2) Consider additional monitoring stations (trawl or beach seine) including Georgiana Slough to better quantify the potential risk of entrainment into the Interior Delta.
- 3) Significant new salmonid and sturgeon monitoring as proposed by DWR and related to drought barrier installation and operations (*e.g.* Didson cameras at barrier culverts; additional measures to be determined and pending implementation).
- 4) Expanded use of acoustic arrays already proposed or implemented this season. In response to the potential for modified DCC gate operations, acoustic tag receivers have been placed in the Delta Cross Channel in 2014 to capture passage of acoustically tagged fish released for studies associated with the Georgiana Slough Floating Fish Guidance Structure Project installed in 2014.



# United States Department of the Interior

BUREAU OF RECLAMATION Central Valley Operations Office 3310 El Camino Avenue, Suite 300 Sacramento, California 95821

IN REPLY REFS! TO

CVO-100 ENV-7.00

APR 0 8 2014

Ms. Maria Rea Assistant Regional Administrator California Central Valley Area Office National Marine Fisheries Service 650 Capitol Mall, Suite 5-100 Sacramento, CA 95814

#### Subject: Contingency Plan for Water Year 2014 (WY 2014) Pursuant to Reasonable and Prudent Alternative (RPA) Action 1.2.3.C of the 2009 Coordinated Long-term Operation of the Central Valley Project (CVP) and State Water Project (SWP) Biological Opinion (2009 BiOp)

Dear Ms. Rea:

By letter dated February 28, 2014, the National Marine Fisheries Service (NMFS) concurred that the Bureau of Reclamation's (Reclamation) and the Department of Water Resources' (DWR) Interim Contingency Plan for March 2014, as modified by revised Delta Cross Channel Gate closure criteria, is consistent with RPA Action I.2.3.C, and later concurred with adjustments to the Interim Contingency Plan made on March 14, 2014. Reclamation now requests concurrence from NMFS that the operations described in the attached CVP and SWP Drought Operations Plan and Operational Forecast (Plan) are within the limits of the Incidental Take Statement of the BiOp and serves as the Contingency Plan for the remainder of WY 2014 in accordance with RPA Action 1.2.3.C. Additional, Reclamation requests concurrence that CVP and SWP operations described in the Plan concerning RPA Action IV.2.1 are within the limits of the Incidental Take Statement.

The Plan developed in coordination with DWR, NMFS, the Fish and Wildlife Service, the California Department of Fish and Wildlife, and the State Water Resources Control Board, outlines proposed actions and a likely range of coordinated operation of the CVP and SWP through November 15, 2014. Severe drought conditions continue in California and Reclamation and DWR recognize that it is essential that the CVP and SWP operate to provide for, at a minimum, essential human health and safety needs for the remainder of WY 2014. In addition to health and safety needs the Plan's purposes include controlling of salinity intrusion in the Sacramento-San Joaquin Delta, preserving cold water storage in project reservoirs, and maintaining minimum protections for endangered species and other fish and wildlife resources suffering from the ongoing drought. The Plan will be modified based on evolving information which could include additional conditions in the State Water Resources Control Board regulatory approvals as well as Federal Endangered Species Act and California Endangered Species Act requirements. DWR and Reclamation also intend to continue to refine the Plan as hydrological and biological information become available.

Reclamation and DWR will be submitting a revised Temporary Urgency Change Petition (TUC) to the State Water Resources Control Board to incorporate these drought response actions as needed. Both the revised TUC and the Plan propose to utilize the Real Time Drought Operations Management Team for management of drought operational activities throughout WY 2014.

We appreciate the assistance we have received from NMFS and look forward to your response. Please contact me at 916-979-2199 if you have any questions.

Sincerely,

Rmall Willing-

Ronald Milligan Manager, Operations

Enclosure -1

cc: Mr. Chuck Bonham Director California Department of Fish and Wildlife 1416 Ninth Street Sacramento, CA 95814

> Mr. Mark Cowin Director California Department of Water Resources 1416 Ninth Street Sacramento, CA 95814

> Mr. Dean Messer Chief, Environmental Services California Department of Water Resources P.O. Box 942836 Sacramento, CA 94236-0001

Mr. John Leahigh Operations Control Office California Department of Water Resources 3310 El Camino Avenue, Suite 300 Sacramento, CA 95821 Mr. Ren Lohoefener Regional Director Pacific Southwest Region U.S. Fish and Wildlife Service 2800 Cottage Way Sacramento, CA 95825

Mr. Michael A. Chotkowski Field Supervisor U. S. Fish and Wildlife Service 2800 Cottage Way Sacramento, CA 95825

Mr. David Murillo Regional Director Mid-Pacific Region Bureau of Reclamation 2800 Cottage Way Sacramento, CA 95825 (w/att to each)

# Merced Integrated Regional Water Management Merced Region Drought Grant Proposal

Attachment 2: Drought Impacts



Attachment 2 consists of the following items:

#### ✓ Drought Impacts

Description of the regional water management impacts due to the 2014 Drought and any anticipated or projected impacts if drought or dry year conditions continue into 2014.

#### ✓ Water Conservation Measures

Description of the mandatory or voluntary water conservation measures or restrictions that have been implemented as a result of the 2014 Drought. Description of the planned or anticipated water conservation measures if drought or dry year conditions continue into 2015.

## **Drought Impacts**

The Merced Region encompasses approximately 607,000 acres in the northeast portion of Merced County, largely defined by the 491,000-acre Merced Groundwater Subbasin (Merced Subbasin). Land use patterns in the Merced Subbasin and within the Merced Integrated Regional Water Management (IRWM) Region (region) are dominated by agricultural uses, including animal confinement (dairy and poultry), grazing, forage, row crops, and nut and fruit trees. The region relies heavy on groundwater - it is the primary source of agricultural water supply and the sole source of potable water supply for the Region. The Merced Subbasin is in a state of mild groundwater level decline with a cumulative decrease in storage of approximately 720,000 acre feet (AF) from 1980 to 2007<sup>1</sup>. On average, groundwater levels declined by approximately 10 feet in the MID service area between 2010 and 2013. Groundwater levels in the Le Grand area declined by approximately 50 feet between March and June of 2014 alone.

By the time a drought declaration was proclaimed by Governor Jerry Brown on January 17, 2014, Merced County had already been dealing with drought conditions for two years. For example, between October and December of 2013, inflows to Lake McClure were only 5,563 acre feet (AF). Inflows to Lake McClure during the same time frame in the driest year on record, 1976-1977, were approximately 6.414 AF - 15 percent greater than those observed in 2013 (Eltal 2014)<sup>2</sup>.

The drought has resulted in far-reaching regional water management impacts in 2014; these impacts are expected to be exacerbated if the drought continues into 2015. The primary water management impacts caused by the drought are the reduction in surface water supplies and concomitant reduction in groundwater levels in the Merced subbasin due to the decrease in natural recharge and increase in groundwater extraction. These reductions have created the water management impacts described below. Table 3-1 summarizes existing impacts, as well as impacts expected to occur if the drought continues for an additional year.

Risk of not meeting existing drinking water demands: The current drought has substantially reduced water supply available to meet drinking water demands. As discussed above, groundwater is the sole source of potable supply in the Region. Water suppliers in the region currently extract groundwater to meet demands in the cities of Merced, Livingston, Atwater, and the unincorporated communities of Le Grand, Winton, and Planada, and Franklin-Beachwood. All of these areas are disadvantaged communities (DACs). Voluntary and mandatory conservation measures have already been imposed within these communities. Supply reductions have created challenges for suppliers to comply with the tenets of the Human Right to Water policy, particularly in these communities that do not have alternative drinking water supplies or the resources to purchase additional supply from elsewhere. For example, due to the dire situation in Le Grand, LGCSD had sought assistance from the California Department of Public Health (CDPH).LGCSD secured grant funding through the CDPH Public Water System Drought Emergency Response Program to implement a two-phase emergency drought response program that included interim water hauling to the community, rehabilitation of three of the community's impacted wells (see Appendix 2-1, page 19). LGCSD is already unable to meet existing demands. If the drought were to continue into 2015, water supplies would continue to be insufficient to meet existing demands despite continuing conservation measures.

Risk of not meeting agricultural water demands: Agricultural demand in the region is met by both surface water and groundwater. The current drought has substantially reduced surface water supply available to meet agricultural water demands. For example, MID, whose service area covers 164,000 acres of which 140,000 acres are farmland<sup>3</sup>, was forced to reduce its typical allocation from approximately 3.0 acre feet per acre (AF/AC) to 2.5 acre feet per acre (AF/AC) in 2012, 2.4 AF/AC in 2013 and 1.1 AF/AC in 2014 (see Appendix 2-2) as a result of diminishing supplies and the need to conserve water. The IRWM Region includes a variety of agricultural crops, including pasture, alfalfa, field crops (e.g., corn and soybeans), truck crops (e.g., potatoes and watermelons), tomatoes, tree crops, grains, vineyards, cotton, citrus, olives, and rice. The dominant crop in the region is tree crops (e.g., almonds, apricots, peaches).

<sup>1</sup> AMEC Geomatrix, Inc. 2008. Merced Groundwater Basin Groundwater Management Plan Update. Merced County. July 29. [page 22) <sup>2</sup> Eltal, Hicham. Deputy General Manager. July 3, 2014. Personal Communication.

<sup>3</sup> RMC. 2013. Merced Integrated Regional Water Management Plan. August. [page 2-13]

Impact	Encountered by September 30, 2014?	Encountered by September 30, 2015 if Drought Continues?	Description if Encountered
At risk of not meeting existing drinking water demands	Yes	Yes	DAC communities within the Merced Region including Le Grand do not have sufficient water supplies to meeting existing demands.
At risk of not meeting existing agricultural demands	Yes	Yes	Growers do not have sufficient water to meet demands, resulting in fallowing of land or damage / death of tree crops. This could ultimately lead to a reduction in agricultural crops, particularly tree crops.
At risk of not meeting ecosystem water demands	Yes	Yes	Merced National Wildlife Refuge (NWR) receives water from MID. Reduction in supplies has resulted in MID not meeting its obligation to provide 15,000 AFY to the NWR which has affected habitat and wildlife.
Drinking water maximum contaminant level (MCL) violations	Yes	Yes	High concentrations of various constituents, including TDS, nitrate, and arsenic, are present in groundwater supplies throughout the region. Reduction in groundwater levels has resulted in exceed ances of MCLs in the region.
Groundwater basin overdraft	Yes	Yes	The basin is currently overdrafted. Increased pumping during this drought has further reduced groundwater levels.
Discharge water TMDL violations	N/A	N/A	N/A
Other drought related adverse impacts	Yes – subsidence, economic impacts	Yes – subsidence, economic impacts	Reduction in water supply has led to economic impacts associated with reduced agricultural production, additional costs for rehabilitating inoperable wells caused by decreasing groundwater levels and higher pumping costs.

Table 3-1:	<b>Summary</b>	of Existing	and Ex	pected D	rought Imp	acts

Unlike row crops where the land is tilled at the end of the harvest season annually, perennial crops such as fruit and nut trees cannot be fallowed. Without sufficient water, trees become stressed and could suffer from reduced growth, shoot dieback, reduction in fruit size, reduced tree establishment (for young trees), negative impacts on fruit quality, reduction in fruit bud and nut production (and crops in subsequent years), nutrient deficiencies, increased winter injury, or in the worst case, die. This significant reduction in water allocation to customers has resulted in an inability to meet existing agricultural water demands for crops including orchards and other crops that cannot be fallowed. It is expected if the drought continues through 2015, the allocation to agricultural uses would further decline, thus extending the timeframe for not meeting agricultural water demands and increasing impacts.

Risk of not meeting ecosystem water demands: MID currently provides water during the March to October period to Merced National Wildlife Refuge (NWR) to meet ecosystem water demands. The Merced NWR, located approximately eight miles south of Merced, encompasses approximately 10,258 acres of wetlands, native grasslands, vernal pools, and riparian areas.<sup>4</sup> The NWR is host to the largest wintering populations of lesser Sandhill cranes and Ross' geese along the Pacific Flyway. The Refuge also provides important breeding habitat for other birds. The United States Bureau of Reclamation (USBR or Reclamation) has a contractual obligation under the Central Valley Project Improvement Act (CVPIA)<sup>5</sup>, and in cooperation with the U.S. Fish and Wildlife Service (USFWS) and the

<sup>4</sup> USFWS. No Date. Merced National Wildlife Refuge. Available at:

http://www.fws.gov/refuges/profiles/index.cfm?id=81652 <sup>5</sup> The CVPIA is a multipurpose water legislation which was signed into law on October 30, 1992. It contains 40 separate titles providing for water resource project throughout the West. Title 34, the Central Valley Project

California Department of Fish and Wildlife (CDFW), to provide firm, average annual historical water deliveries (Level 2, or L2) of suitable quality to maintain and improve habitat areas on certain Federal and State wildlife refuges in the Central Valley. In addition to L2 deliveries, an additional increment of water supply is needed for optimal wildlife management (incremental Level 4, or L4). According to USBR's *Report on Refuge Water Supply Investigations* (1989), the L2 water supply need for Merced NWR is 13,500 AFY and the L4 water supply need is 16,000 AFY<sup>6</sup>. MID provides 15,000 AF of water annually to Merced NWR through an existing license with the Federal Energy Regulatory Commission<sup>7</sup>, fulfilling nearly 94 percent of the L4 water supply needs. As a result of dwindling water supplies, MID will shorten the period during which it provides water to Merced NWR by two months in 2014, resulting in a 25 percent reduction in total deliveries to the NWR. If the drought continues through 2015, it is possible that the allocation of water to Merced NWR would be cut even further. MID has also historically made deliveries under various water transfers for environmental purposes, including providing water to the San Luis Wildlife Refuge – East Bear Creek unit<sup>8</sup>. Given declining water levels, MID will not be able to assist USBR in fulfilling its CVPIA obligations to provide water to its refuges to meet ecosystem demands. Reduction in water supplies to the NWR has caused unquantifiable biological resources impacts as well as recreational impacts (e.g., reduction in tourisms associated with birdwatching).

Drinking Water MCL Violations: Water quality in the region varies by location. According to the MIRWMP, groundwater within the Merced Subbasin contains both anthropogenic and naturally occurring constituents. Some of these constituents either currently impact or have the potential to impact groundwater use within the Region in the future. Salinity, nitrate, chloride, iron, manganese, arsenic, hexavalent chromium (Cr6), radionuclides, bacteria, perchlorate, petroleum hydrocarbons, pesticides, trichloroethylene (TCE), and perchloroethylene occur in the shallow and/or deep aquifers. Several municipal water districts have reported wells that have reached or are approaching the maximum contaminant level (MCL) for nitrate, and elevated nitrate concentrations in groundwater are observed in small areas northeast of Merced and southwest of Atwater in areas with high densities of onsite wastewater treatment systems. In portions of the Merced Subbasin, iron and manganese have exceeded secondary MCLs at shallow depths. Localized areas of the region (i.e., northeast of Atwater, near Stevenson, and in the southwest Merced IRWM area) have average arsenic concentrations in the shallow groundwater that exceed the MCL. A small area in the northwest quadrant of the IRWM Region has concentrations of Cr6 that exceed total chromium MCL. Lastly, TCE has been detected at levels exceeding the MCL in two locations of the Merced Subbasin (Castle Airport Aviation and Development Center and the City of Merced's Eastern Industrial Park)<sup>9</sup>. Several areas of the basin do not meet drinking water standards. Overdraft resulting from drought conditions has exacerbated these issues.

Groundwater Basin Overdraft: The current drought has substantially reduced groundwater levels in the Merced Basin. For example, in the community of Le Grand, groundwater levels have shown substantial declines. For example, groundwater elevation at LGCSD's Well 1a (see Figure 3-4 in Attachment 3), which is located in the

Improvement Act, mandates changes in management of the Central Valley Project, particularly for the protection, restoration, and enhancement of fish and wildlife. Provisions of the CVPIA authorized water supplies for those wetland areas covered by the USBR *Report on Refuge Water Supply Investigations – Central Valley Hydrologic Basin, California* (USBR, 1989) and the *San Joaquin Basin Action Plan*, and required the investigation of water and conveyance needs for private wetlands. Specifically, the CVPIA required Reclamation to supply more than 133,000 AF of Level 2 water annually to 19 Central Valley wildlife refuges and wildlife areas and fix plumbing problems that affect water delivers to refuges by 2020.

<sup>6</sup> USBR. 1989. Report on Refuge Water Supply Investigations – Central Valley Hydrologic Basin, California. March. Available at:

https://www.usbr.gov/mp/cvpia/3406d/resc\_docs/Report%20on%20Refuge%20Water%20Supply%20Investigations %20('89%20Report).pdf

<sup>7</sup> Federal Power Commission. Terms and Conditions for Unconstructed Major Project Affecting Lands of the United States. Revised February 1, 1964 (see **Appendix 3-7**)

<sup>8</sup> RMC. 2013. Merced Integrated Regional Water Management Plan. August. [page 2-12]

<sup>9</sup>RMC. 2013. Merced Integrated Regional Water Management Plan. August. (Water quality information is provided on p. 2-43 to 2-46 of the MIRWMP).

southern portion of the service area, dropped by more than 50 feet between March 27 and June 24, 2014 (from 215 feet to 271 feet below ground surface [bgs]).<sup>10</sup> Similar impacts were observed at Well 4, which is located in the northern portion of the service area. This is typical of the groundwater elevation impacts observed throughout the basin, which has historically shown a cumulative decline even prior to this drought. With the reduction in natural and artificial recharge of the basin due to reduced precipitation, combined with the extra stress on the groundwater basin from private groundwater pumpers who must extract additional water to maintain agricultural crops, overdraft conditions have already been exacerbated this year, and will become even more severe in 2015 if the drought continues. Groundwater basin overdraft is the main cause of secondary impacts such as potential water quality violations, loss of existing groundwater wells, and subsidence.

**Regional Subsidence:** Based on recent efforts undertaken by Reclamation as part of the San Joaquin River Restoration Project, subsidence of up to 0.5 foot per year has occurred in the southernmost portion of the Merced Region, with subsidence of more than 0.1 feet per year occurring over most of the Merced Region west of Highway  $99^{11}$ . This subsidence is believed to have occurred as a result of excessive groundwater pumpage<sup>12</sup>. Should the drought continue and groundwater levels continue to drop, it is expected that subsidence will increase.

**Economic Impacts:** As a direct result of declining groundwater levels, existing public and private wells have become inoperable because well heads are now above the groundwater levels. LGCSD had to deepen all three of its municipal wells in 2014 to continue extracting groundwater to meet its urban demands. Deepening wells require additional drilling activities. Within MID, 27 public wells have become inoperable since the start of the 2014 irrigation season in March (see Table 3-5 in Attachment 3 for a figure of the lost wells). MID intends to modify the wells such that it can continue to extract groundwater, albeit at a lower groundwater elevation, by either dropping the bowls (to lower the pumps) or deepening the wells. The cost of modifying wells ranges from \$12,000 to lower a pump to \$80,000 to deepen a well.

As a result of diminishing water supplies to meet agricultural demands, the current drought has caused substantial impacts to agricultural production. Agricultural irrigation represents the largest water demand in Merced County<sup>13</sup>. Due to drought conditions in 2014, MID decreased total water for agricultural irrigation by 63 percent and shortened the irrigation season. MID water prices for the 2014 irrigation season increased by 275 percent (and were originally scheduled to increase by 400 percent)<sup>14</sup>. The estimated cost of additional groundwater pumping is \$98/AF<sup>15</sup>. Thus, farmers in the MID service area can expect to pay roughly an additional \$210 to maintain irrigation similar to previous years. If the drought continues in the 2015 season it is likely that these trends will continue.

With \$940 million dollars in annual revenues, milk is Merced County's largest agricultural product from an economic perspective. Production of cattle and calves accounts for another \$297 million, making livestock management a significant economic driver that directly contributes well over \$1 billion to the regional economy<sup>16</sup>. Only 5 percent of county pastureland receives managed irrigation, meaning that the remaining 95 percent is unproductive in drought years<sup>17</sup>. In 2014, lack of rain has resulted in nearly zero growth of rangeland forage, causing livestock producers and horse owners to purchase hay that would normally not be needed over the fall and

<sup>&</sup>lt;sup>10</sup> LGCSD. 2014. Draw Downs LGCSD for March 20' 2014 to June 24, 2014.

<sup>&</sup>lt;sup>11</sup> RMC. 2013. Merced Integrated Regional Water Management Plan Groundwater Recharge Feasibility Study. August. [p. 30]

<sup>&</sup>lt;sup>12</sup> USGS defines subsidence as the "gradual settling or sudden sinking of the Earth's surface owing to subsurface movement of earth materials." USGS. 2010. Land Subsidence in the United States USGS Fact Sheet-165-00. December. Available at: http://water.usgs.gov/ogw/pubs/fs00165/

<sup>&</sup>lt;sup>13</sup> Nolte Associates, Inc. & Dunn Environmental, Inc. 2009. Merced County General Plan Update Qualitative Comparison of Water Supply and Demands in Merced County Technical Memorandum.

<sup>&</sup>lt;sup>14</sup> Merced Irrigation District. 2014. 2014 Drought and Water Supply Update.

<sup>&</sup>lt;sup>15</sup> Howitt, R., Medellin-Azuara, J., Lund, J., & MacEwan, D. (2014). Preliminary 2014 Drought Economic Impact *Estimates in Central Valley Agriculture*. California Department of Food and Agriculture.<sup>16</sup> Merced County Department of Agriculture. 2013. 2012 Report on Agriculture.

<sup>&</sup>lt;sup>17</sup> Merced County Department of Agriculture. 2013. 2012 Report on Agriculture.

winter period<sup>18</sup>. This has increased industry reliance on forage crops. In the current drought, Central Valley growers are expected to shift water resources from alfalfa to maintain trees and vines<sup>19</sup>, meaning that farmers and ranchers will face a simultaneous decrease in available pasture and local forages and increases in feed prices.

Because milk prices are set nationally, Merced's dairies are sometimes unable to raise prices enough to compensate for increased cost of production. Further, lack of pasture is forcing some ranchers to sell their cattle earlier than normal and at a much lighter weight. The drought is therefore likely to have a significant adverse impact on this sector.

Almonds are a long-term investment for the regional economy. Trees require 10 years of growing and a steady supply of water before they yield enough to pay for themselves. In addition, almond trees must receive 3 to 4 AF/AC every year, or nut production will decrease<sup>20</sup>. Almonds alone use about 10 percent of California's total water supply each year<sup>21</sup>. Once stressed, it takes almond trees a minimum of two years to fully recover (UC Davis, 2014). Further, trees are sensitive to the higher salinity found in deep wells, making it potentially difficult for growers to offset decreases in available surface water $^{22}$ .

California almond growers generally cycle through 30,000 to 40,000 acres of replanted trees each year, which is between 4 and 5 percent of total acreage. Because of severe water shortages this year, estimated removals could increase to 50,000 to 60,000 acres, or 6 to 8 percent<sup>23</sup>. A three percent decrease in total productive almond acreage in the Merced Region translates to a reduction of nearly 3,000 acres or a loss of \$39 million direct and indirect revenues for a single year<sup>24</sup>. If the drought were to continue through 2015 and farmers continued to accelerate the retirement of mature groves at the same rate, that number would likely more than double the adverse effect.

The Merced IRWM region's economy is highly dependent on agriculture. The most lucrative crops within the agriculture sector rely heavily on a consistent water supply. Therefore extended periods of drought have the potential for lasting impacts on the local economy. Initiatives such as groundwater recharge and conservation projects that can reduce pressure on local water supplies will help to stabilize supplies allowing the region to better cope in years of drought and safeguarding important cornerstones of the regional economy.

Other Impacts: As agriculture is the dominant land use in the area, many communities within the IRWM Region are completely reliant on the agricultural economy. A direct result of the drought is the reduction in employment hours on farms, as less work is needed if lands are either fallowed or less production is expected. Reduction in employment hours directly relates to reduced income for families, which affects other aspects of the local economy including the service sector that supports the agricultural community. Within the Le Grand community, the only industry is the Live Oak Farms, a tomato and pepper packing company; it is the second largest consumer of water in Le Grand and employs the majority of Le Grand's residents. Closing of Live Oak Farms due to lack of water would have devastating financial consequences for the community. Public health and safety is also a concern for Le Grand. The public schools, which are the third largest users of water in the community, did not have sufficient pressure to flush toilets in May. The schools are currently not in session, but are expected to be back in session in early August. As only one well is in operation at this time, there is major concern that there would not be sufficient water to meet public health and safety needs. Appendix 2-3 describes issues currently faced by LGCSD.

<sup>24</sup> Norton, M., Castillo, A., Doll, D., & Stoddard, S. 2011. Merced County Agriculture. UC Cooperative Extension.

<sup>&</sup>lt;sup>18</sup> Long, R. F., & Putnam, D. H. 2014. California's Drought is Shaping up to have Large Impacts on Forages. Alfalfa & Forage News. January 21.

<sup>&</sup>lt;sup>19</sup> Long, R. F., & Putnam, D. H. 2014. California's Drought is Shaping up to have Large Impacts on Forages. Alfalfa & Forage News. January 21.

<sup>&</sup>lt;sup>20</sup> Fimrite, P. 2014. California drought: How water crisis is worse for almonds. San Francisco Chronicle. March 24.

<sup>&</sup>lt;sup>21</sup> Holthaus, E. 2014. The Thirsty West: 10 Percent of California's Water Goes to Almond Farming. That's nuts. Slate. May 14.

<sup>&</sup>lt;sup>22</sup>Rodriguez, R. (2014, January 14). San Joaquin Valley farmers take drastic measures to deal with drought. *The Fresno Bee.* <sup>23</sup> Souza, C. 2014.Drought leads to early removal of almonds. *AgAlert*. February 26.

## Water Conservation Measures

As a result of the drought, water supplies in Lake McClure are approaching record lows, and storage continues to decrease despite reduced surface water allocations. In addition, there is a substantial and imminent threat to agriculture within the District and Merced County. In an attempt to mitigate these impacts, the MID Board of Directors adopted Resolution No. 2-14-04 on February 4, 2014, which proclaimed a local emergency caused by California's record setting drought conditions (see **Appendix 2-4**). The drought declaration by MID was followed by drought declarations by other agencies in the Region, including the Merced County Board of Supervisors on February 25, 2014, and the LGCSD Board of Directors on March 6, 2014 (Resolution No. 14-01) (see **Appendix 2-5**).

As part of MID's Resolution 2-14-04, MID specified the following:

- 1. The Board recognizes the hardships that will be experienced, and while programs and efforts have been underway for many years to become more efficient, the Board encourages all of its customers to reclaim, reuse, conserve and use water as efficiently as possible this year;
- 2. While the District's goal is always to minimize water losses, the Board challenges all of its customers and directs all of its staff to take whatever actions are necessary to reduce and eliminate operational spills;
- 3. The Board encourages its customers to reduce their water usage and conserve the limited supplies available, such as by taking any of the following actions:
  - a. Check for system leaks and repair them as soon as possible.
  - b. Install and use accurate water delivery meters.
  - c. Use high efficiency irrigation methods.
- 4. The Board appeals to State, Federal and local agencies as well as water right holders associated with the Merced River to work cooperatively with each other and with the District and its staff to maximize the limited amount of water available for this year's irrigation season.

Voluntary water conservation measures that were originally implemented by MID included increasing water management personnel to monitor the river flows and regulatory requirements to conserve water and to work with growers to increase lead times on ordering water to better manage the MID system.

Historically, MID did not cap the amount of water that growers could purchase. Since the adoption of MID's Resolution 2-14-04, the MID Board of Directors has enacted mandatory conservation (rationing) within the District. MID reduced allocations for its growers set at the beginning of each season from a typical allocation of 3.0 AF/AC to 2.4 AF/AC in 2013 (63 percent reduction) and 1.1 AF/AC in 2014 (73 percent reduction). If the drought were to continue through 2015, MID expects it will set a fixed allocation to its growers at or below 1.1 AF/AC. In addition, MID has conducted a significant public outreach campaign including five town hall meetings and two grower information meetings to discuss water operation rules (e.g., MID's policies on water wheeling and exchanges), the workings of the supplemental water supply program, policies for water theft, new operational procedures that will be implemented during the drought, fees, and water ordering guidelines. The intent of this outreach was to ensure that growers with the same information. MID has also increased patrol of its open canals to minimize water theft, and have instituted monetary penalties for such water thefts.

On March 18, 2014, the MID Board of Directors adopted Resolution 2014-14 to revise Rule 6.6 of MID's Rules and Regulations Governing the Use of District Rules (**Appendix 2-6**). Rule 6.6 addresses the unauthorized use of water, and sets forth that any person who uses MID's water without permission is subject to criminal prosecution and civil liability. The original rule specified that first-time offenders would be required to pay an additional charge, and subsequent offenses would result in forfeiture of the irrigation of water during the remaining season. Resolution 2014-14 revises that rule by setting the charge for the first time offenders as three times the District's in-season

# Merced Integrated Regional Water Management Drought Grant Proposal



# Appendices 2-1 to 2-7

App. #	Document Title
App. 2-1	Funding Agreement Between California Department of Public and Health and Le Grand Community Services District
App. 2-2	MID Water Allocations During Critically Dry Years
App. 2-3	LGCSD Water Issues Memorandum
App. 2-4	MID Resolution No. 2-14-04 (Drought Declaration)
App. 2-5	LGCSD Resolution No. 14-01 (Drought Declaration)
App. 2-6	MID Resolution 2014-14 (Rule 6.6 Revisions)
App. 2-7	LGCSD Ordinance No. 14-02 (Ordinance Amending Title VIII)

# Merced Integrated Regional Water Management Drought Grant Proposal



# Appendix 2-2

# **MID Water Allocations During Critically Dry Years**

#### **Historical MID Water Allocations**

Year	Water Curtailment	AF/AC		
1977	Yes	1.5		
1988	Yes	3		
1989	Yes	2.5		
1990	Yes	2		
1991	Yes	2.5		
1992	Yes	2.5		
1993	No	-		
1994	No	-		
1995	No	-		
1996	No	-		
1997	No	-		
1998	No	-		
1999	No	-		
2000	No	-		
2001	No	-		
2002	No	-		
2003	No	-		
2004	No	-		
2005	No	-		
2006	No	-		
2007	No	-		
2008	yes	2.5		
2009	No	-		
2010	No	-		
2011	No	-		
2012	Yes	2.5		
2013	Yes	2.4		
2014	Yes	1.1		
Average		2.25		
Typical usage	3.0			
% Reduction of water supply				
during critically dry years 75%				

# Merced Integrated Regional Water Management Drought Grant Proposal



Appendix 2-4

MID Resolution No. 2-14-04 (Drought Declaration)

## MERCED IRRIGATION DISTRICT RESOLUTION NO. 2014-04

#### PROCLAMATION OF THE MERCED IRRIGATION DISTRICT OF A LOCAL EMERGENCY CAUSED BY CALIFORNIA'S RECORD SETTING DROUGHT CONDITIONS

WHEREAS, the Merced Irrigation District (the "District") is a conjunctive use district, which relies predominantly on surface water supplies as they are available to supply water to its irrigation customers, drawing from the groundwater aquifer by necessity or in dry years to supplement available surface water supplies;

WHEREAS, thousands of small family farms within eastern Merced County rely on the District to supply them with irrigation water for their farms and businesses, and are likely to suffer extreme hardship due to the lack of available water supplies;

WHEREAS, the state of California is in the 3<sup>rd</sup> year of a drought, this year in particular is projected to be the driest year in recorded history;

WHEREAS, the state's water supplies are at record lows, and in particular the water supplies for the District in Lake McClure are at near record lows, and are projected to reach minimum pool early in the irrigation season even with significantly reduced surface water allocations to its customers;

WHEREAS, these unprecedented conditions pose a substantial and imminent threat to agriculture within the District and in Merced County, which could be especially far reaching on permanent crops and live stock;

WHEREAS, because of the ongoing drought conditions, exacerbated by the record setting dry conditions of this current year, the Governor of California declared a drought state of emergency for California on January 17, 2014 and outlined a series of recommendations and actions that state and local agencies, as well as individual citizens and business can take to lessen the impacts of the drought, and streamline actions or projects that might be implemented to mitigate the drought's effects;

WHEREAS, applicable provisions of law, including but not necessarily limited to Water Code §1058.5, authorize and empower the District to make emergency findings, and pursuant thereto and in response to the drought conditions that exist in this 3<sup>rd</sup> consecutive year of record setting drought, the Board hereby finds it necessary to make an emergency declaration effective immediately in order to, among other things, prevent the waste, unreasonable use, unreasonable method of use, unreasonable method of diversion, of water, and to promote water reclamation, reuse, conservation and efficiency to the greatest extent possible;

**THEREFORE, BE IT RESOLVED THAT** the facts contained in the recitals above are true and correct, and the Board so finds and determines.

#### FURTHER, BE IT RESOLVED THAT:

- The Board recognizes the hardships that will be experienced, and while programs and efforts have been under way for many years to become more efficient, the Board encourages all of its customers to reclaim, reuse, conserve and use water as efficiently as possible this year;
- While the District's goal is always to minimize water losses, the Board challenges all of its customers and directs all of its staff to take whatever actions are necessary to reduce and eliminate operational spills;
- The Board encourages its customers to reduce their water usage and conserve the limited supplies available, such as by taking any of the following actions:
  - a. Check for system leaks and repair them as soon as possible.
  - b. Install and use accurate water delivery meters.
  - c. Use high efficiency irrigation methods.

None

4. The Board appeals to State, Federal and local agencies as well as water right holders associated with the Merced River to work cooperatively with each other and with the District and its staff to maximize the limited amount of water available for this year's irrigation season.

FURTHER, BE IT RESOLVED THAT this emergency declaration shall be deemed to continue to remain in effect until the end of the 2014 irrigation season, unless terminated earlier by further action of this Board.

PASSED AND ADOPTED this 4<sup>th</sup> day of February 2014, by the Board of Directors of the Merced Irrigation District, by the following vote:

Ayes: Noes: Abstain: Absent: Directors: Directors: Directors: Directors: Koehn, Long, Pellissier, Gonzalves, Pimentel None None

Tim Pellissier President Merced Irrigation District

l Ildor

Dave Long Vice President/Secretary Merced Irrigation District
## Merced Integrated Regional Water Management Drought Grant Proposal



## Appendix 2-6

MID Resolution 2014-14 (Rule 6.6 Revisions)

## MERCED IRRIGATION DISTRICT RESOLUTION NO. 2014-14

## RESOLUTION MAKING CHANGES TO MERCED IRRIGATION DISTRICT RULES AND REGULATIONS REGARDING UNAUTHORIZED USE OF WATER

WHEREAS, the Board of Directors for the Merced Irrigation District (the "Board" and "District", respectively) has previously adopted Rules and Regulations Governing the Use of District Water ("Rules");

WHEREAS, Rule 6.6 of the Rules provides that, among other things, the first time use of the District's water without the District's permission shall result in an additional charge, for the water taken, at the rate set by the Board for the unauthorized use of water;

WHEREAS, the Board hereby determines it to be in the best interests of the District to adopt updates to Rule 6.6 in order to provide increased deterrence for such actions;

THEREFORE, BE IT RESOLVED THAT the facts contained in the recitals above are true and correct, and the Board so finds and determines.

FURTHER, BE IT RESOLVED THAT the Board of Directors of the Merced Irrigation District, hereby revises Rule 6.6 and sets the rate for water used without District authorization as follows:

- First Time Unauthorized Use: The additional charge for the water taken will be three times the District's in-season water in effect at the time of the unauthorized use for each acre-foot taken, plus one-thousand dollars (\$1,000.00).
- Subsequent Occurrences of Unauthorized Use: Subsequent taking of water without permission shall result in forfeiture of irrigation water for the remainder of the season. The additional charge for the water taken will be three times the District's in-season water in effect at the time of the unauthorized use for each acre-foot taken, plus one-thousand dollars (\$1,000.00).

FURTHER, BE IT RESOLVED THAT all of the other terms and conditions in its Rules and Rule 6.6 shall remain unchanged and in full force and effect.

PASSED AND ADOPTED this 18<sup>th</sup> day of March 2014, by the Board of Directors of the Merced Irrigation District, by the following vote:

Ayes: Noes: Abstain: Absent: Directors: Gonzalves, Koehn, Long, Pellissier, Pimentel Directors: None Directors: None Directors: None

tin Pellic

Tim Pellissier President Merced Irrigation District

Dave Long Vice President/Secretary Merced Irrigation District