FUNGUS GNATS AND MARCH FLIES

GENERAL INFORMATION

Fungus gnats and March flies occasionally cause considerable concern when they are found in or about the house, patio, or lawn in large numbers. The fungus gnats may resemble small mosquitoes but neither they nor March flies can "bite." Their status as a pest here is mainly only as a nuisance.

The larvae of the various species are mostly whitish, slender maggots with dark heads. Development from the egg stage to the adult gnat usually takes two to four weeks. The adults are often attracted to lights at night.

FUNGUS GNATS (Mycetophilidae & Sciaridae):

These small (1/8"-3/8") dark flies are found here throughout the year where they inhabit damp, decaying organic matter such as leaf mold, manure, and organic fertilizers and mulches where the larvae feed, especially on fungus growth. Occasionally they may be found breeding within planter boxes for house plants where the moisture favors them. Only in commercial mushroom beds are they usually a potential economic pest.

MARCH FLIES (Bibionidae):

These dark-colored flies (1/4") are usually most common in the spring and early summer. They, like fungus gnats, are primarily scavenger feeders as maggots or larvae in the soil or turf with moist, decaying organic matter from which adults are lazy fliers, often staying close to the ground. They may feed on the nectar of flowers.

CONTROL

Control is not usually warranted. Keeping doors closed and windows tightly screened will help. The flies may enter homes where lights attract them. Where killing thegnats or flies is desired inside buildings, the usual fly space sprays may be used.

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This information is provided to help homeowners with their pest problems. Insecticides may be purchased at nurseries, hardware, farm supply, and pet stores. If additional help is needed, contact with a licensed pest control operator is suggested. No endorsement of trade names or products is intended, nor is criticism implied of similar products not mentioned.

PRECAUTIONS

1. Handle insecticides with care and follow instructions on the label.

2. Do not use around open flame or exposed foods, and always clean food preparation areas after the use of pesticides.

3. Store out of reach of children and pets, preferably in locked cabinets.

4. Never keep pesticides in anything other than the original container.

5. Never reuse the pesticide container to store any other materials.

6. Dispose of all empty containers by placing them in the trash can for removal to the local disposal area.

ORANGE COUNTY MOSQUITO AND VECTOR CONTROL DISTRICT
13001 Garden Grove Boulevard, Garden Grove, CA 92843
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Fungus Gnats

UC IPM, Revised 8/13

(Shutterstock)

Fungus gnats are small flies that infest soil, potting mix, other container media, and other sources of organic decomposition. Their larvae primarily feed on fungi and organic matter in soil, but also chew roots and can be a problem in greenhouses, nurseries, potted plants and interior plantscapes. Adult fungus gnats may emerge from houseplants indoors and become a nuisance.

IDENTIFICATION

Fungus gnats (*Orfelia* and *Bradysia* species), also called darkwinged fungus gnats (Sciaridae), are dark, delicate-looking flies similar in appearance to mosquitoes. Adult fungus gnats have slender legs with segmented antennae that are longer than their head. Their long antennae distinguish them from the more robust shore flies, which are also found in greenhouses, associated with algae and decomposing organic matter, but have short bristle-like antennae. Although a few species are up to 1⁄2 inch long, fungus gnat adults commonly are about 1⁄16 to 1⁄8 inch long. Wings are light gray to clear, and the common *Bradysia* species have a Y-shaped wing vein.

Because adult fungus gnats are attracted to light, you first might notice these pests flying near windows indoors. However, in comparison with more active species such as the common housefly (*Musca domestica*), fungus gnats are relatively weak fliers and usually don't move around much indoors. Fungus gnats often remain near potted plants and run across (or rest on) growing media, foliage, compost, and wet mulch piles.

Females lay tiny eggs in moist organic debris or potting soil. Larvae have a shiny black head and an elongated, whitish-to-clear, legless body. They eat organic mulch, leaf mold, grass clippings, compost, root hairs, and fungi. If conditions are especially moist and fungus gnats are abundant, larvae can leave slime trails on the surface of media that look like trails from small snails or slugs.

DAMAGE

Adult fungus gnats don't damage plants or bite people; their presence is primarily considered a nuisance. Larvae, however, when present in large numbers, can damage roots and stunt plant growth, particularly in seedlings and young plants. Significant root damage and even plant death have been observed in interior plantscapes and in houseplants when high populations were associated with moist, organically-rich soil. Thus, a houseplant that is wilting may not indicate a lack of water, but rather root damage by fungus gnat larvae or (more commonly) other causes of unhealthy roots. However, too much or too little water, root decay fungi, and improper soil conditions (e.g., poor drainage, or waterlogging) are much more common causes of wilted plants.

Serious fungus gnat damage is more common in greenhouses, nurseries, and sod farms. Although larvae also feed on plant roots outdoors, they don't usually cause serious damage.

LIFE CYCLE

Fungus gnats develop through four stages—egg, larva (with four larval stages or instars), pupa, and adult. The tiny eggs and oblong pupae occur in damp organic media where females lay eggs and larvae feed. At 75ºF, eggs hatch in about 3 days, the larvae take approximately 10 days to develop into pupae, and about 4 days later the adults emerge. A generation of fungus gnats (from female to female) can be produced in about 17 days depending upon temperature. The warmer it is, the faster they will develop and the more generations will be produced in a year.

Fungus gnats have many overlapping generations each year. Outdoors, they are most common during winter and spring in interior areas of California, when water is more available and cooler temperatures prevail. They can occur during any time of the year in moist coastal regions and indoors.

MANAGEMENT

Most of the fungus gnat's life is spent as a larva and pupa in organic matter or soil, so the most effective control methods target these immature stages rather than attempting to directly control the mobile, short-lived adults. Physical and cultural management tactics—primarily the reductions of excess moisture and organic debris—are key to reducing fungus gnat problems. Commercially-available and naturally-occurring biological control agents can also control this pest. Insecticides are considered an important control option in some commercial plant production but generally aren't recommended for fungus gnat management in and around the home.

Monitoring

Visual inspection for adults usually is adequate for determining whether a problem exists. You will see adults resting on plants, soil, windows, or walls, or you might see them in flight. Besides looking for adults, check plant pots for excessively moist conditions and organic debris where larvae feed. Yellow sticky traps can be used to trap adults. Chunks of raw potato placed in pots with the cut sides down (not the peels) are sometimes used to monitor for larvae.

Water and Soil Management

Because fungus gnats thrive in moist conditions, especially where there is an abundance of decaying vegetation and fungi, avoid overwatering and provide good drainage. Allow the surface of container soil to dry between waterings. Clean up standing water, and eliminate any plumbing or irrigation system leaks. Moist and decomposing grass clippings, compost, organic fertilizers, and mulches are also favorite breeding spots. Avoid using incompletely-composted organic matter in potting media unless it is pasteurized first, because it will often be infested with fungus gnats. Improve the drainage of the potting mix (e.g., increase the proportion of perlite or sand in the mix). Minimize organic debris around buildings and crops. Avoid fertilizing with excessive amounts of manure, blood meal, or similar organic materials. Screen and caulk leaky windows and doors to help prevent pests from coming indoors.

If you have infested plants, don't move them to new areas where flies can emerge to infest other pots. In some cases you may wish to toss out severely infested plants.

Purchase and use only pasteurized container mix or potting mix. Commercial growers often treat potting soil with heat or steam before using it; this will kill flies and the algae and microorganisms they feed on. Home gardeners can solarize soil:

- Moisten it.
- Place it in a bag of transparent plastic or black plastic.
- Make the pile no deeper than about 8 inches.
- Place the bagged soil on a slightly elevated surface, such as a pallet in a sunny location, for about 4 to 6 weeks.

See the *Pest Note: Soil Solarization* for details. Store pasteurized potting soil off the ground and in closed containers to prevent it from becoming infested before use.

Trapping

In home situations where fungus gnat adults are a nuisance, it may be possible to reduce the problem by using sticky traps available at retail nursery and garden centers. Yellow sticky traps can be cut into smaller squares, attached to wooden skewers or sticks and placed in pots to trap adults. Also, raw potato chunks placed in the soil are very attractive to fungus gnat larvae. These may be used not only to check pots for larvae but also to trap them away from plant roots. After a few days in a pot, remove infested chunks, dispose of them, and replace with fresh ones.

Biological Control

Three commercially available biological control agents can be purchased to control fungus gnats in pots or container media (Table 1). These include *Steinernema* nematodes, *Hypoaspis* predatory mites, and the biological insecticide *Bacillus thuringiensis* subspecies *israelensis* (Bti). Several Bti products (Mosquito Bits, Gnatrol) are readily available in retail nurseries and garden centers, so these products may be the most convenient for home gardeners to use. Bti does not reproduce or persist indoors, so infestations in potting media might require repeated applications at about five-day intervals to provide control. Nematodes and *Hypoaspis* mites must be mail-ordered and are live and perishable products, requiring immediate application. Nematodes can provide relatively long-term control of fungus gnat larvae, and they can be self-reproducing after several inoculative applications to establish their populations. *Steinernema feltiae* is more effective against fungus gnats than other commercially available nematode species. Mix Bti or nematodes with water, and apply as a soil drench, or spray onto media using a hand-pump spray bottle or other spray equipment, following label directions.

Several natural enemies help to manage fungus gnat populations in outdoor systems, such as landscapes and gardens, and indoors in greenhouses and conservatories, including the predatory hunter flies, *Coenosia* spp. These flies catch and consume adult fungus gnats in mid-air, and prey on fungus gnat larvae in soil while developing as larvae themselves. Conserve these and other natural enemies by avoiding broad-spectrum insecticide applications.

Table 1. Commercially Available Biological Pesticides and Natural Enemies for Controlling Fungus Gnat Larvae.

Biological	Comments
Bacillus thuringiensis subspecies *israelensis* (Bti) (Gnatrol)	A naturally occurring, spore-forming bacterium produced commercially by fermentation. Bti applied at labeled rates provides temporary control and is toxic only to fly larvae, such as mosquitoes, black flies, and fungus gnats. Repeat applications commonly are needed for long-term control. This Bt is a different subspecies from that applied to foliage to control caterpillars. Bt labeled for caterpillars is not effective against fly larvae.
Hypoaspis (=*Geolaelaps* or *Stratiolaelaps*) *miles*	A light-brownish predaceous mite adapted to feeding in the upper layers of moist soil. Preys on fungus gnat larvae and pupae, thrips pupae, springtails, and other tiny invertebrates. Commercial mites commonly are shipped in a shaker-type container used to apply them.

	Recommended rates in commercial nurseries are about 1/2 to several dozen mites per container or square foot of media. Make applications before pests become abundant. *Hypoaspis* probably won't perform very well in individual houseplants and probably isn't a good choice for use in homes.
Steinernema feltiae	This nematode is effective when temperatures are between 60° to 90°F and conditions are moist. You can apply it as a soil drench and to media using conventional spray equipment. Nematodes reproduce and actively search for hosts, so under moist conditions they can provide season-long control after several initial applications to establish populations.
These materials are essentially nontoxic to people and are compatible for application in combination. Bt is available from many well-stocked nurseries and garden supply stores. Predaceous mites, Bti, and nematodes, are commercially available through mail order from special suppliers.	

Chemical Control

Insecticides are rarely warranted to control these flies in and around homes. However, if you do apply an insecticide for fungus gnats, consider using Bti or *Steinernema feltiae* nematodes to control the larvae; see the section Biological Control for more information.

If Bti or nematodes aren't available and high populations are intolerable, pyrethrins or a pyrethroid insecticide may provide temporary, fast-acting control. Spray the surface of potting soil and plant parts where adults typically rest. Do not aerially fog indoors or attempt to spray adult gnats in flight. Be sure the product is labeled for your particular use (e.g., for "house plants") and read and follow the product's directions.

Pyrethrins have low toxicity to people and pets and are the active ingredients in the botanical pyrethrum, which is derived from flowers of certain chrysanthemums. Many products include a petroleum-derived synergist (piperonyl butoxide, or PBO) to increase pyrethrum effectiveness. Pyrethroids (e.g., bifenthrin, permethrin) are synthesized from petroleum to be chemically similar to pyrethrins; they often are more effective and persistent but are more toxic to beneficial insects. When using these products on houseplants or interiorscape containers, if possible move plants outdoors for treatment as a precaution, and wait about a day after applying the chemical before bringing them back inside.

For information on managing fungus gnats in commercial flower, nursery or greenhouse operations, see the *UC IPM Pest Management Guidelines: Floriculture and Ornamental Nurseries* and the book *Integrated Pest Management for Floriculture and Nurseries*.

Memorandum

DATE: February 15, 2022

TO: Member Agencies – MWDOC Division One

FROM: Al Nederhood, Director – Division 1

SUBJECT: Monthly Water Usage Data, Tier 2 Projection & Water Supply Information

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The attached figures show the recent trend of water consumption in Orange County (OC), an estimate of Imported Water Sales for MWDOC, and selected water supply information.

- OC Water Usage, Monthly by Supply ***OCWD Groundwater was the main supply in December.***
- Estimated OC Water Usage, Monthly, Comparison to Previous Years Water usage in December ***2021 was below average compared to the last 5 years***. We are projecting a decrease in overall water usage compared to FY 2020-21. On July 8th 2021, state officials have ask California residents to voluntary reduce their water usage by 15% compared to 2020 levels.
- Historical OC Water Consumption Orange County M & I water consumption is ***projected*** to be ***529,000 AF in FY 2021-22*** *(this includes ~11 TAF of agricultural usage and non-retail water agency usage).* This is about ***30,000 AF less than FY 2020-21*** and is about ***4,000 AF less than FY 2019-20***. Water usage per person is projected to be slightly lower in ***FY 2021-22 for Orange County at 150 gallons per day*** (This includes recycled water usage). Although OC population has increased 20% over the past two decades, water usage has not increased, on average. A long-term decrease in per-capita water usage is attributed mostly to Water Use Efficiency (water conservation) efforts. ***O.C. Water Usage for the period of Fiscal Years FY 2015-16 to FY 2019-20 was the lowest since the 1982-83 Fiscal Year*** (FY 1982-83 was the third wettest year on record). ***O.C. Water Usage in FY 2020-21 was the highest since FY 2010-11.***

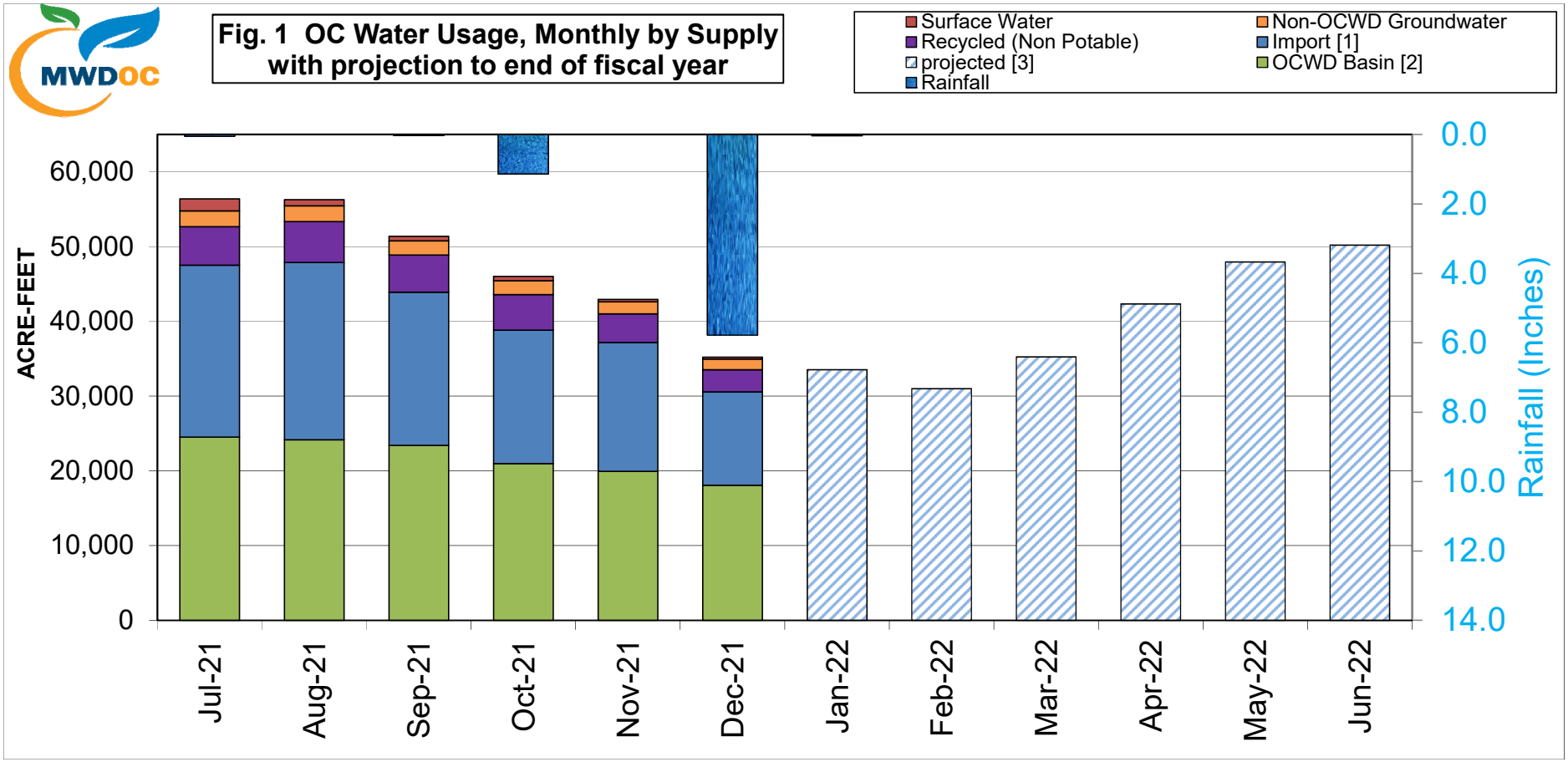
Water Supply Information Includes data on Rainfall in OC; the OCWD Basin overdraft; Northern California and Colorado River Basin hydrologic data; the State Water Project (SWP) Allocation, and regional storage volumes. The data have implications for the magnitude of supplies from the three watersheds that are the principal sources of water for OC. Note that a hydrologic year is Oct. 1st through Sept. 30th.

- Orange County's accumulated precipitation through ***early February was below average*** for this period. Water year to date rainfall in Orange County is ***6.32 inches***, which is ***93% of normal***.

- Northern California accumulated precipitation through ***early February was 114% of normal for this period***. Water Year 2021 was 48% of normal while water year 2020 was 63% of normal. The ***Northern California snowpack was 88% as February 3rd, 2021. As of late January, 99.3%*** of California is experiencing ***moderate to exceptional drought conditions*** while 100.00% of the state is experiencing abnormally dry conditions. The State Water Project Contractors Table A Allocation was increased in January to 15% for WY 2022.

- Colorado River Basin accumulated precipitation through ***late January was 112% of normal*** for this period. The ***Upper Colorado Basin snowpack was 99% of normal*** as of February 2nd 2021***. Lake Mead and Lake Powell*** combined have about ***45.0% of their average storage volume*** for this time of year and are at ***30.4% of their total capacity***. For the first time on the Colorado River, Lake Mead's ***levels have fallen below the "trigger" limit of 1,075 ft. at the end of a calendar year***. The US Bureau of Reclamation (USBR) has declared a shortage at Lake Mead, impacting Colorado River water deliveries to the Lower Basin states. Lake Mead as of early February, were ***7.96' BELOW the "trigger" limit***. The USBR has declared a ***shortage on the Colorado River staring January 1st 2022***. ***There is and a 97% chance of shortage continuing in 2023.***

Fig. 1 OC Water Usage, Monthly by Supply with projection to end of fiscal year

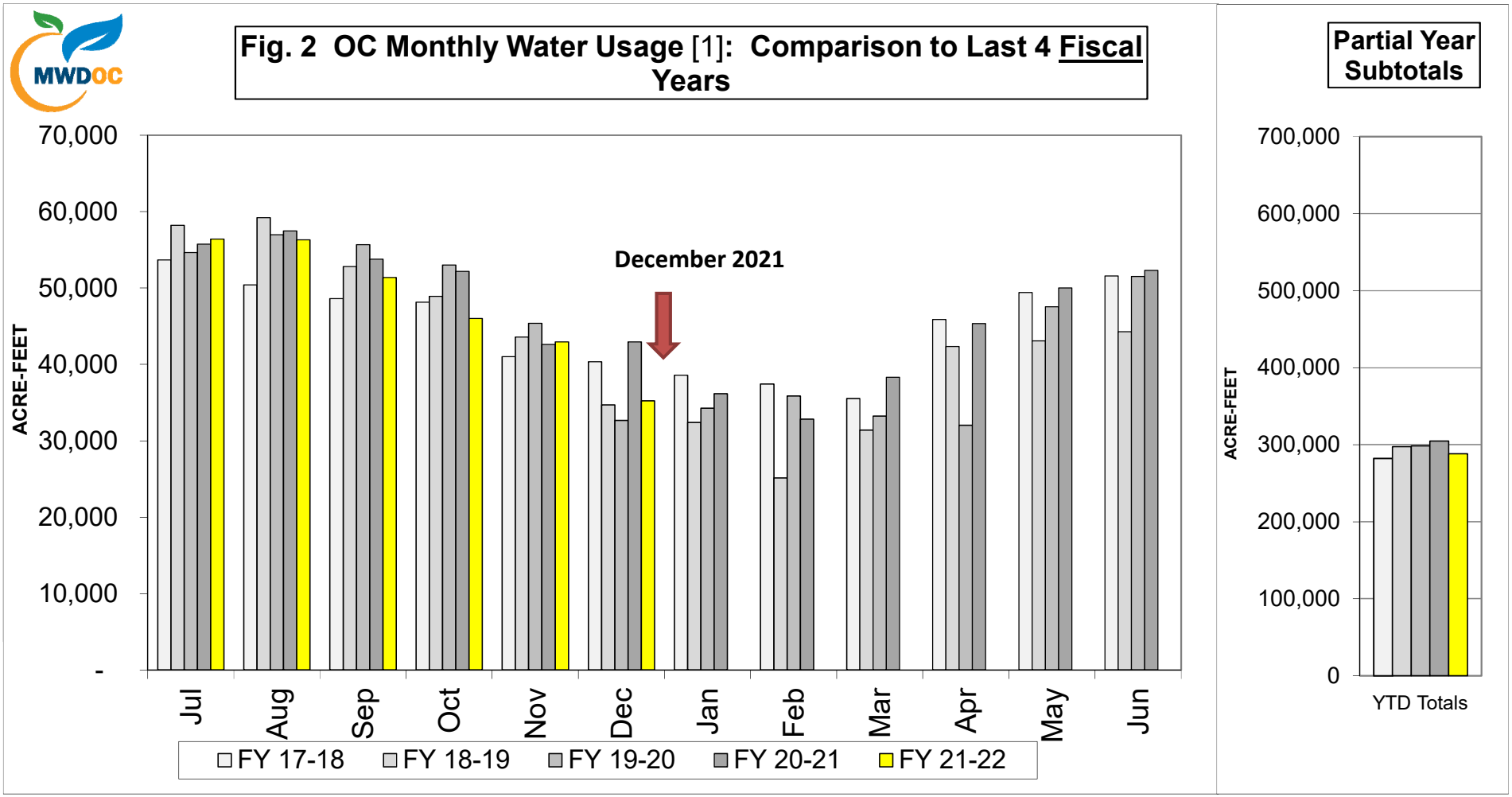


[1] Imported water for consumptive use. Includes "In-Lieu" deliveries and CUP water extraction. Excludes "Direct Replenishment" deliveries of spreading water and deliveries into Irvine Lake.

[2] GW for consumptive use only. Excludes In-Lieu water deliveries and CUP water extraction that are counted with Import. BPP in FY '21-22 is 77%.

[3] MWDOC's estimate of monthly demand is based on the projected 5 Year historical retail water demand and historical monthly demand patterns.

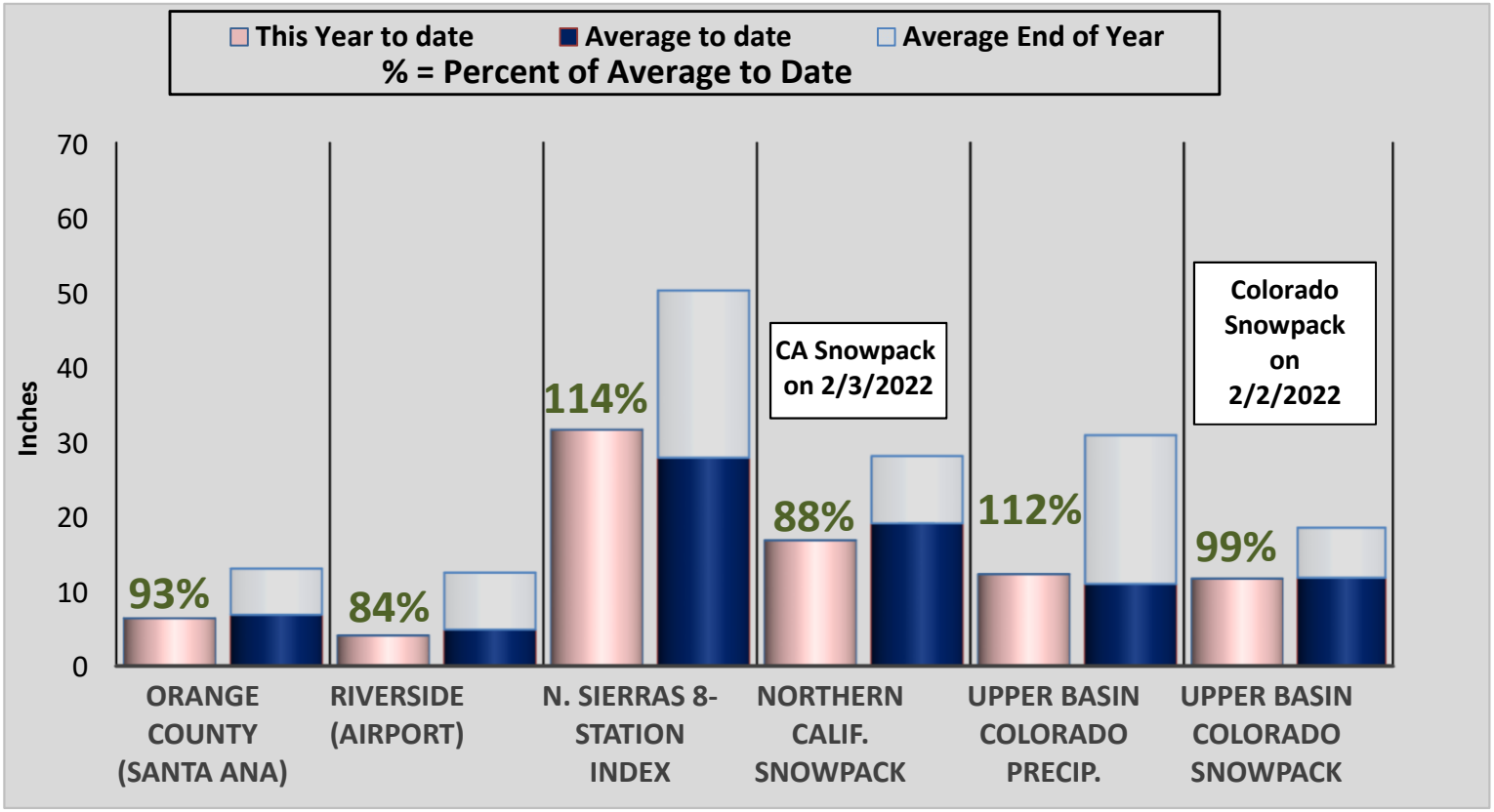
[4] Total water usage includes IRWD groundwater agricultural use and usage by non-retail water agencies.



[1] Sum of Imported water for consumptive use (includes "In-Lieu" deliveries; excludes "Direct Replenishment "and "Barrier Replenishment") and Local water for consumptive use (includes recycled and non-potable water and excludes GWRS production) Recent months numbers include some estimation.

Accumulated Precipitation

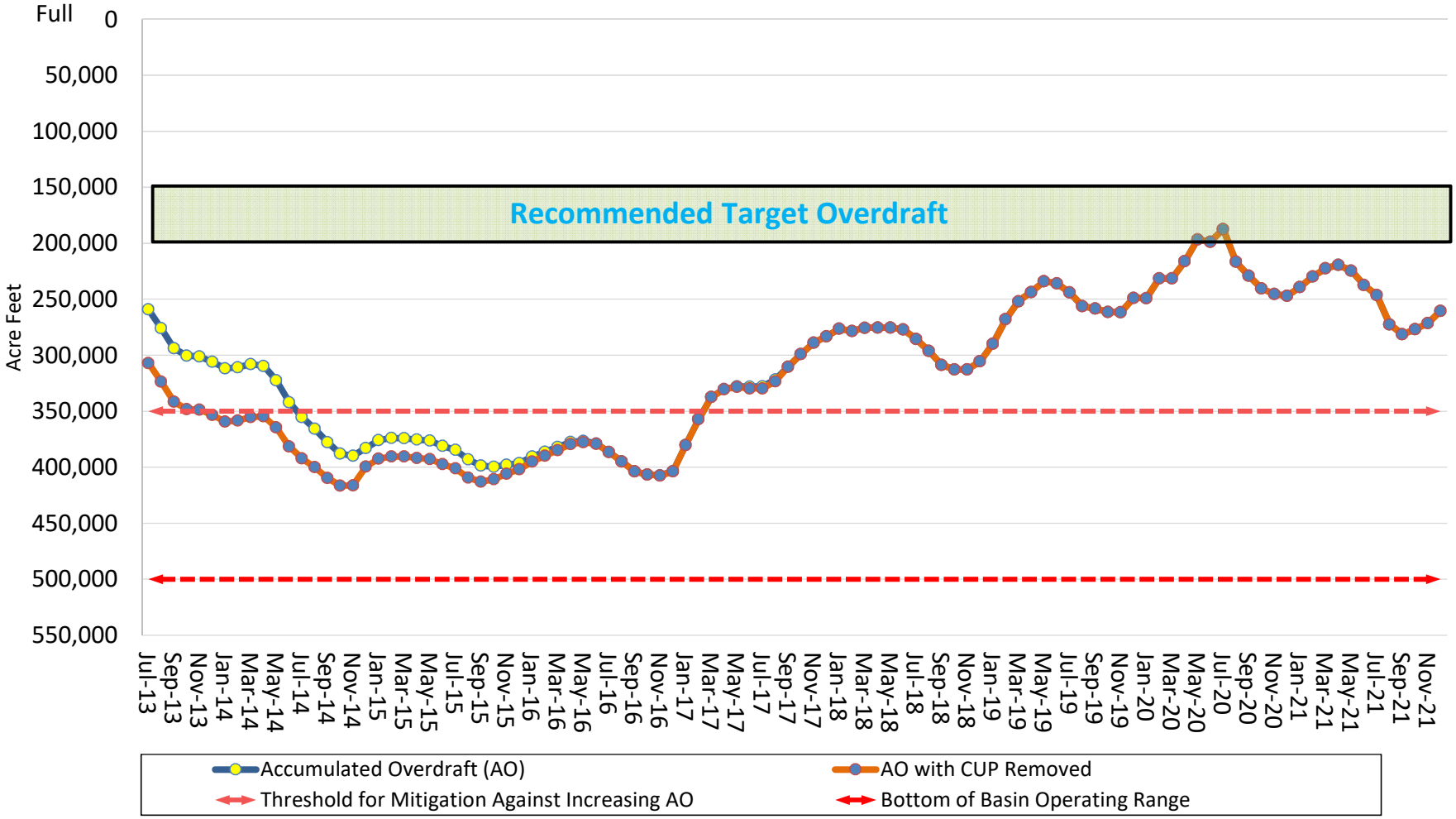
for the *Oct.-Sep.* water year, early February 2022



MWDOC

* The date of maximum snowpack accumulation (April 1st in Northern Calif. , April 15th in the Upper Colorado Basin) is used for year to year comparison.

Accumulated Overdraft of the OCWD Groundwater Basin as of December 2021

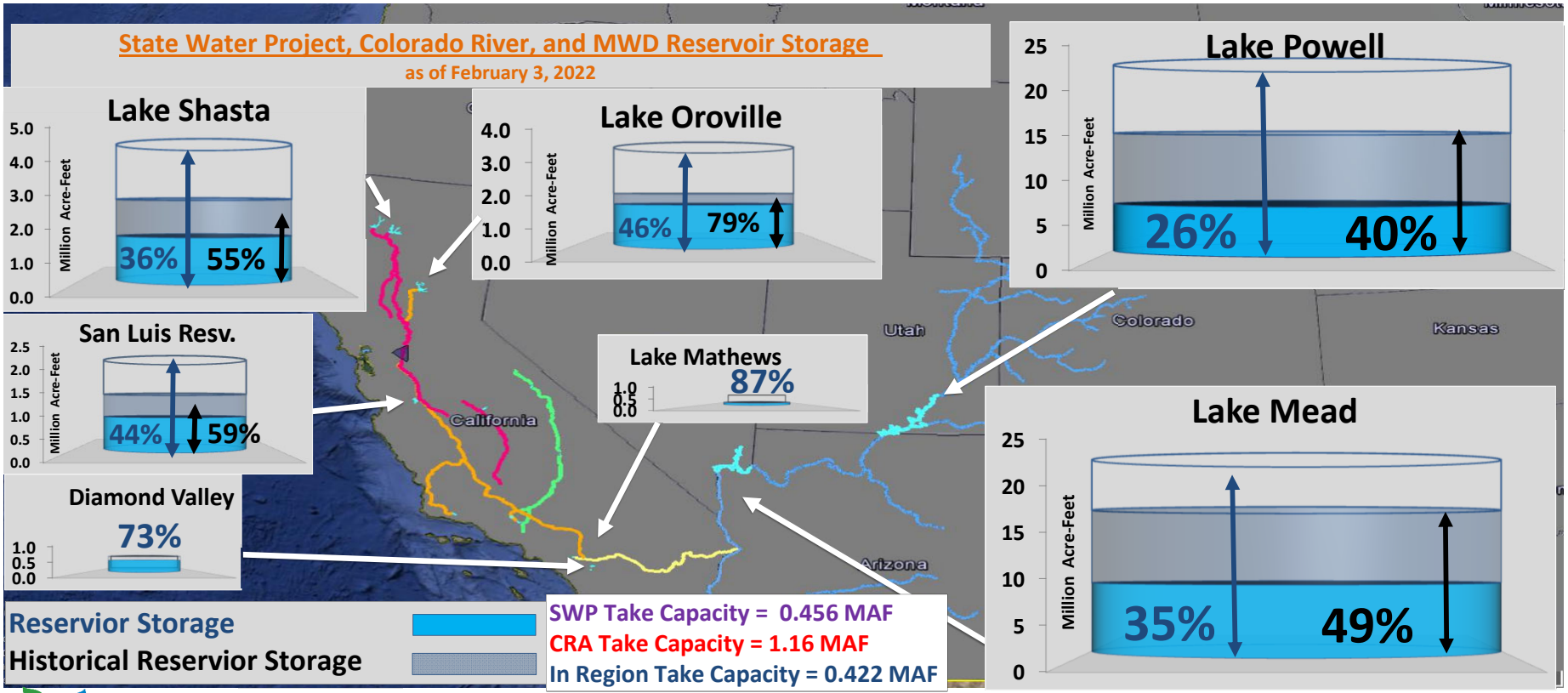


	Jul-20	Aug-20	Sep-20	Oct-20	Nov-20	Dec-20	Jan-21	Feb-21	Mar-21	Apr-21	May-21	Jun-21
AO (AF)	187,392	216,548	229,124	240,414	245,441	246,998	239,329	229,738	222,470	219,388	224,458	237,335
AO w/CUP removed (AF)	187,392	216,548	229,124	240,414	245,441	246,998	239,329	229,738	222,470	219,388	224,458	237,335
	Jul-21	Aug-21	Sep-21	Oct-21	Nov-21	Dec-21	Jan-22	Feb-22	Mar-22	Apr-22	May-22	Jun-22
AO (AF)	246,350	272,443	281,354	276,909	271,455	260,387						
AO w/CUP removed (AF)	246,350	272,442	281,354	276,909	271,455	260,387						

**** Source ~ OCWD Monthly Board of Directors Packet, Water Resources Summary***

MWDOC

Source of data = OCWD monthly Water Resources Report in Board meeting packet

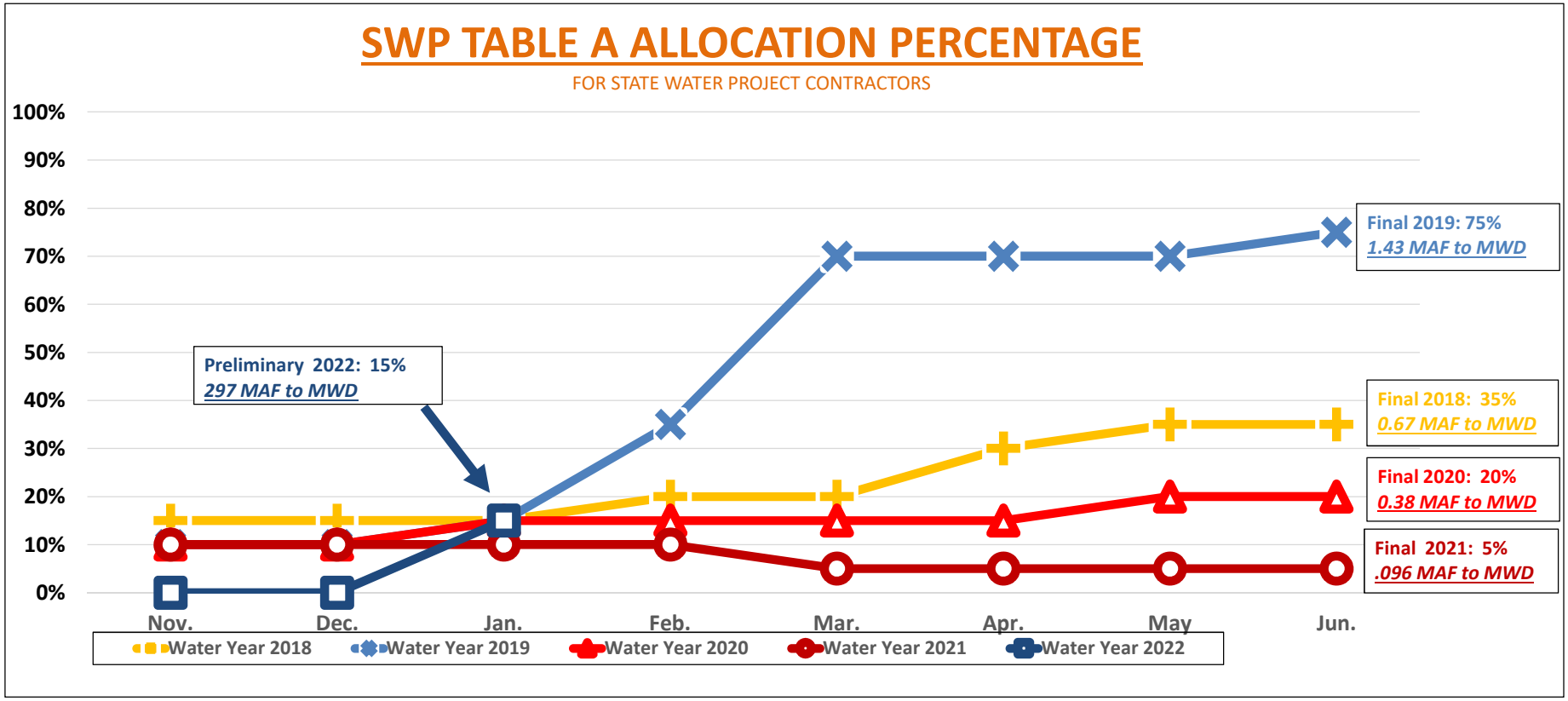


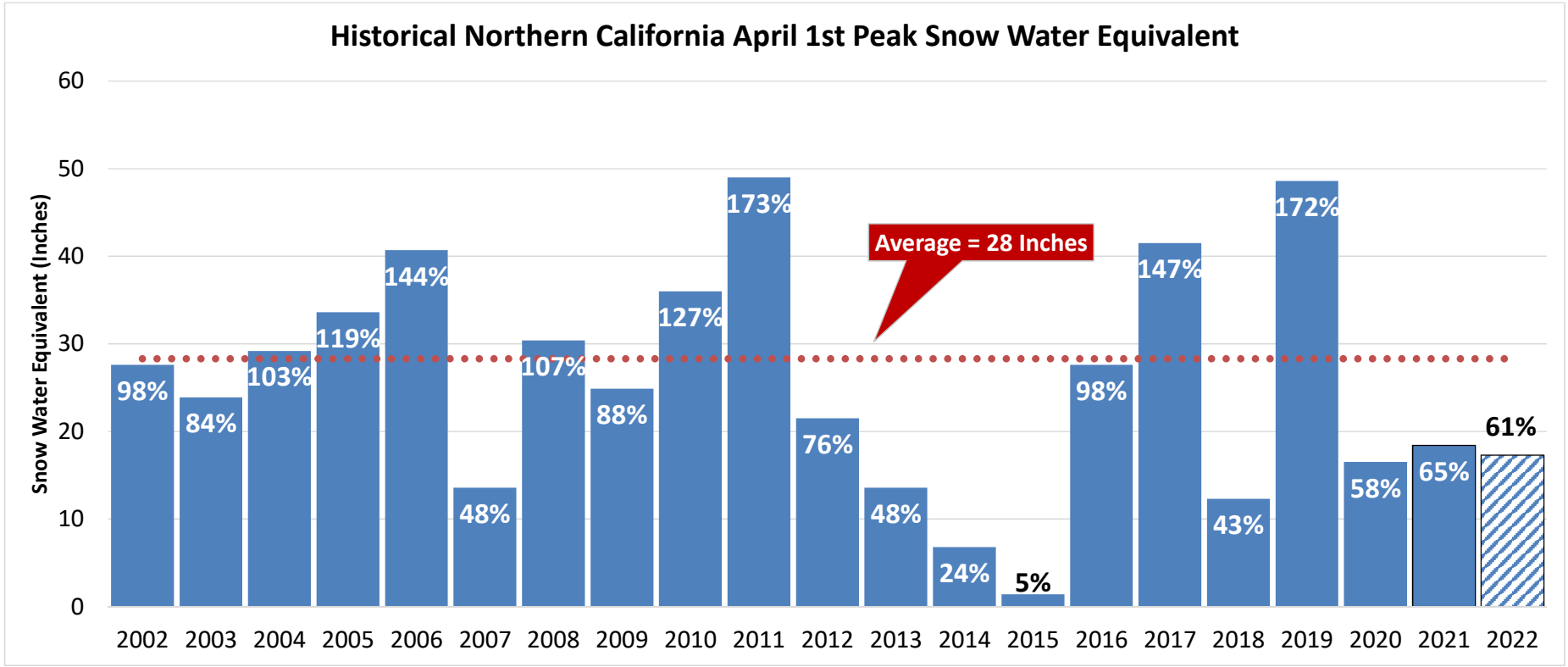
MWDOC

prepared by the Municipal Water District of Orange County
*Number are Subuject to Change

SWP TABLE A ALLOCATION PERCENTAGE

FOR STATE WATER PROJECT CONTRACTORS




Historical Northern California April 1st Peak Snow Water Equivalent
Snow Water Equivalent (Inches)
60
50
40
30
20
10
0
Average = 28 Inches
98%
84%
103%
119%
144%
48%
107%
88%
127%
173%
76%
48%
24%
5%
98%
147%
43%
172%
58%
65%
61%
2002
2003
2004
2005
2006
2007
2008
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2011
2012
2013
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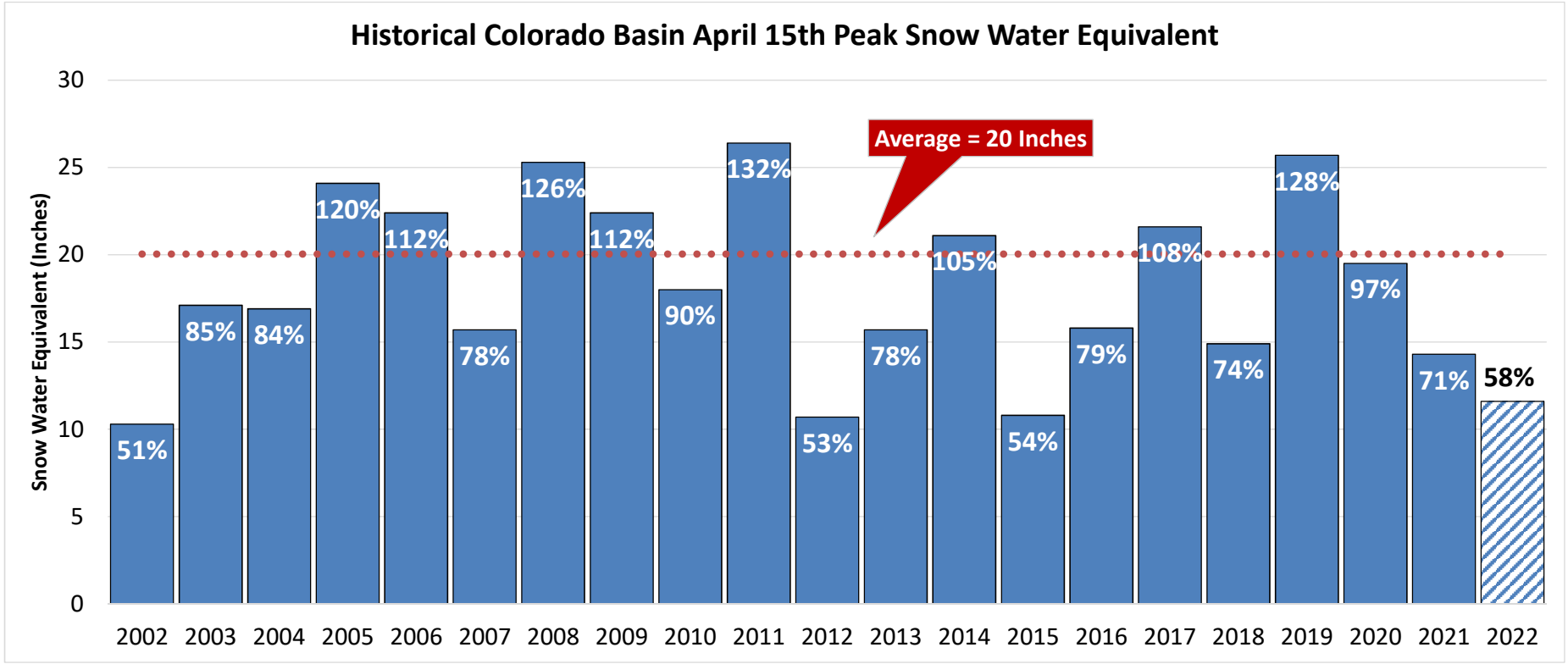
2016
2017
2018
2019
2020
2021
2022


Historical Colorado Basin April 15th Peak Snow Water Equivalent
Snow Water Equivalent (Inches)
30
25
20
15
10
5
0
Average = 20 Inches
51%
85%
84%
120%
112%
78%
126%
112%
90%
132%
53%
78%
105%
54%
79%
108%
74%
128%
97%
71%
58%
2002
2003
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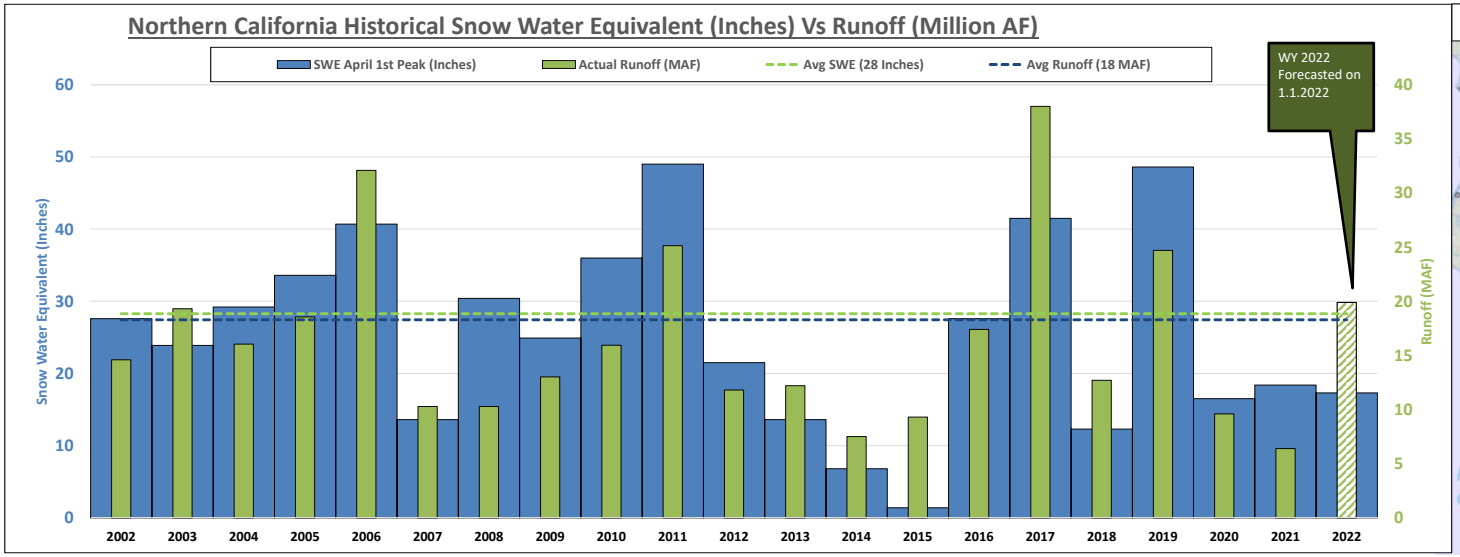
2020
2021
2022


Northern California Historical Snow Water Equivalent (Inches) Vs Runoff (Million AF)
SWE April 1st Peak (Inches)
Actual Runoff (MAF)
Avg SWE (28 Inches)
Avg Runoff (18 MAF)
WY 2022 Forecasted on 1.1.2022
Snow Water Equivalent (Inches)
Runoff (MAF)
0
10
20
30
40
50
60
0
5
10
15
20
25
30
35
40
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022


Sacramento River Basin
OREGON
CALIFORNIA
SISKIYOU
MODOC
SHASTA
LASSEN
TRINITY
TEHAMA
PLUMAS
MENDOCINO
SIERRA
NEVADA
SONOMA
YOLO
SOLANO
Sacramento
Santa Rosa
Fort Bragg
Redding
Chico
Oroville
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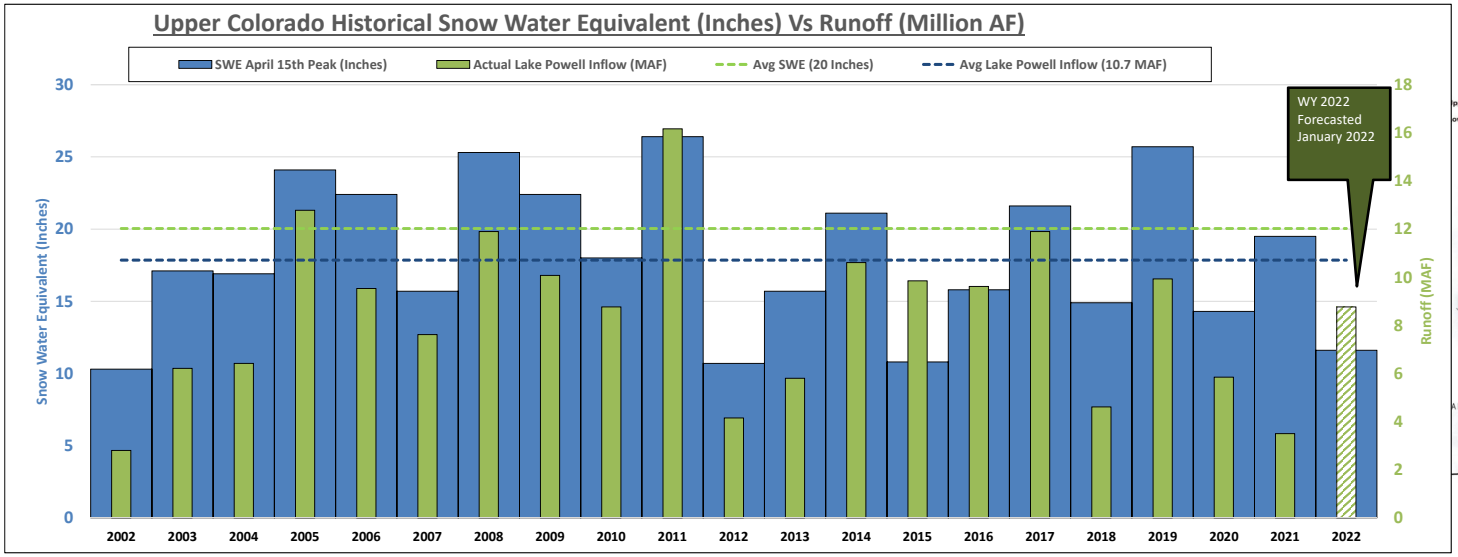
Eureka
Crescent City
Mount Shasta
Red Bluff
Oakland
San Francisco
Stockton
Pacific Ocean


Upper Colorado Historical Snow Water Equivalent (Inches) Vs Runoff (Million AF)
SWE April 15th Peak (Inches)
Actual Lake Powell Inflow (MAF)
Avg SWE (20 Inches)
Avg Lake Powell Inflow (10.7 MAF)
WY 2022 Forecasted January 2022
Snow Water Equivalent (Inches)
Runoff (MAF)
0
5
10
15
20
25
30
0
2
4
6
8
10
12
14
16
18
2002
2003
2004
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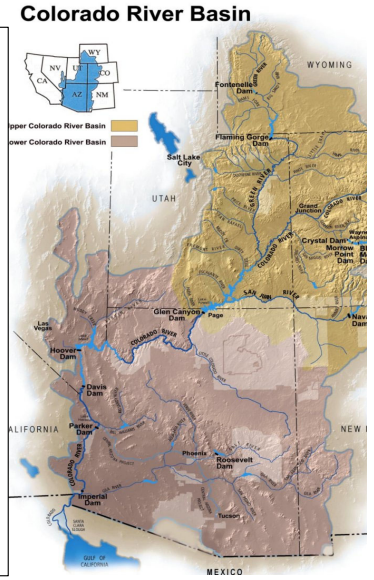
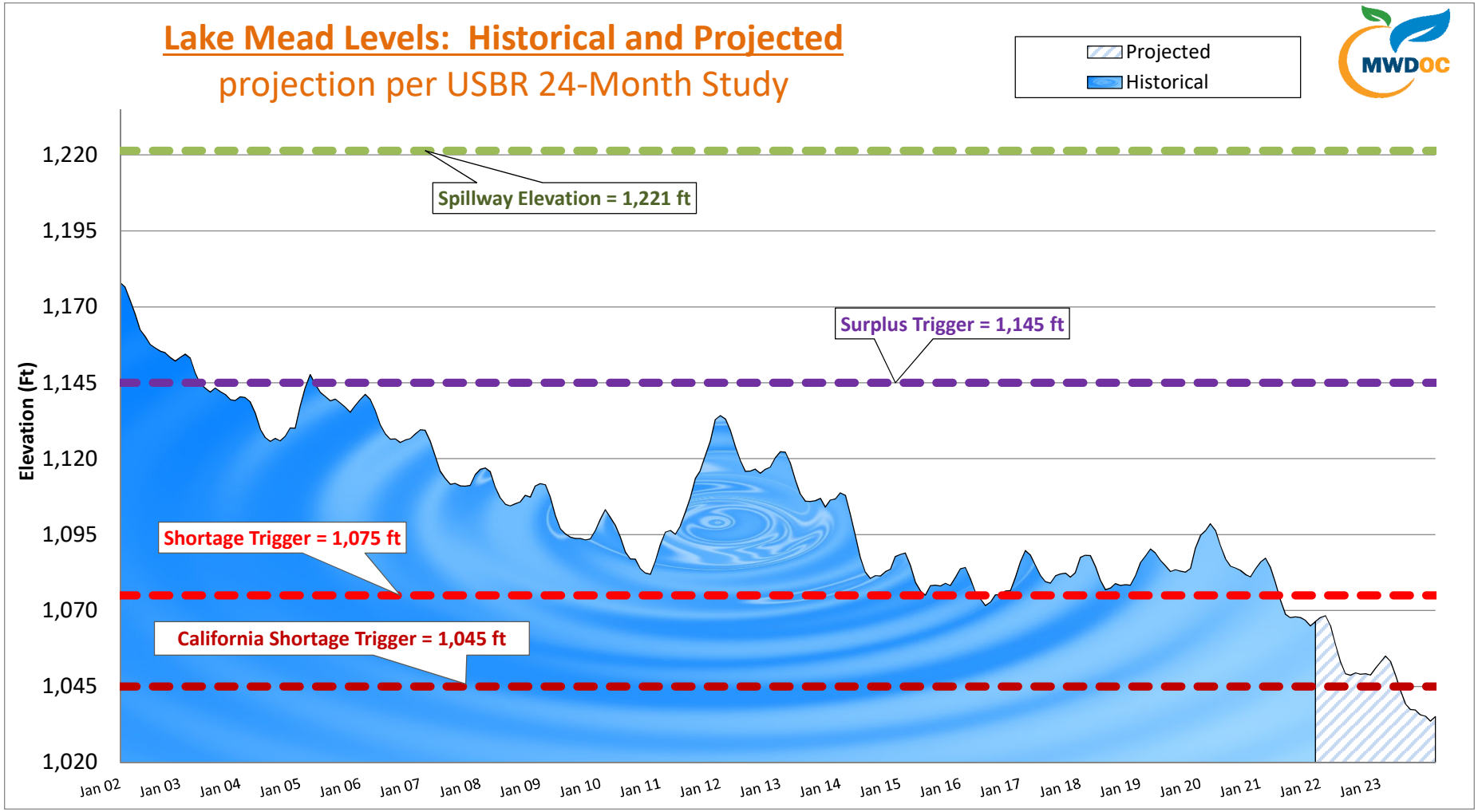
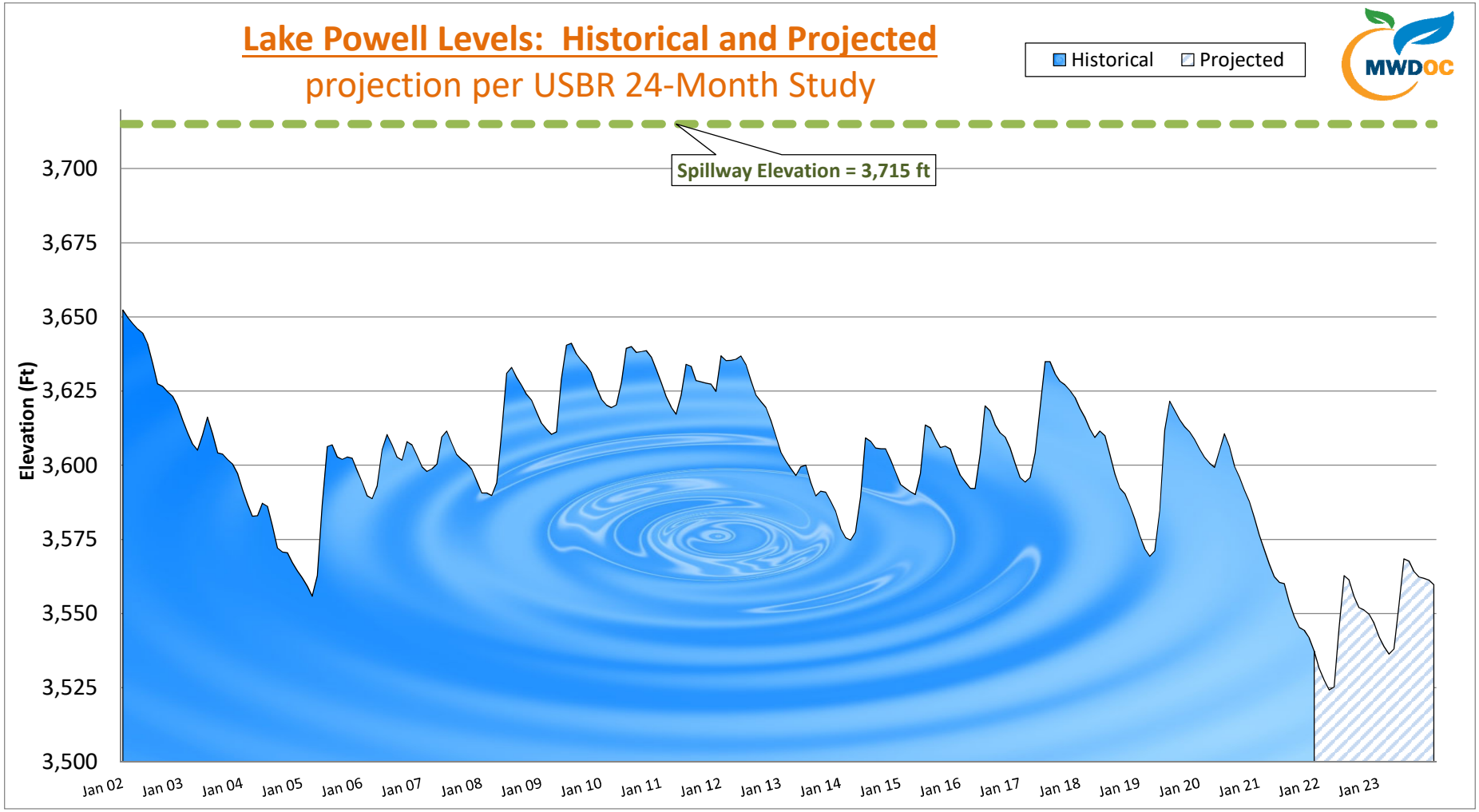

Colorado River Basin
WYOMING
UTAH
Fontenelle Dam
Flaming Gorge Dam
Salt Lake City
Green River
Crystal Dam
Morrow Point Dam
Glen Canyon Dam
Page
Las Vegas
Hoover Dam
Davis Dam
Parker Dam
Phoenix
Roosevelt Dam
Imperial Dam
Tucson
MEXICO

Lake Mead Levels: Historical and Projected

projection per USBR 24-Month Study




Lake Powell Levels: Historical and Projected
projection per USBR 24-Month Study
Historical
Projected
MWDOC
Spillway Elevation = 3,715 ft
Elevation (Ft)
3,700
3,675
3,650
3,625
3,600
3,575
3,550
3,525
3,500
Jan 02
Jan 03
Jan 04
Jan 05
Jan 06
Jan 07
Jan 08
Jan 09
Jan 10
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Jan 12
Jan 13
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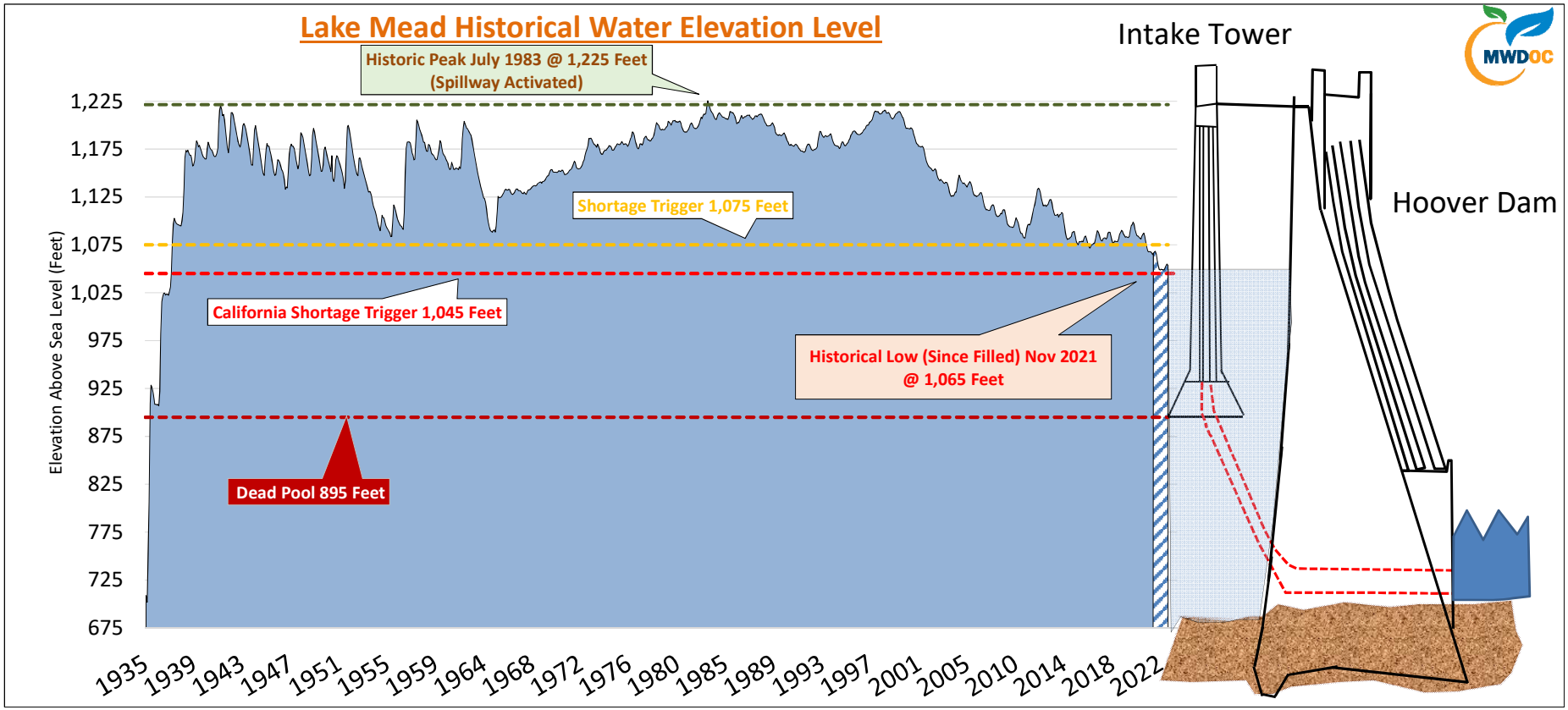
Jan 16
Jan 17
Jan 18
Jan 19
Jan 20
Jan 21
Jan 22
Jan 23


Lake Mead Historical Water Elevation Level
Historic Peak July 1983 @ 1,225 Feet
(Spillway Activated)
Shortage Trigger 1,075 Feet
California Shortage Trigger 1,045 Feet
Historical Low (Since Filled) Nov 2021
@ 1,065 Feet
Dead Pool 895 Feet
Elevation Above Sea Level (Feet)
1,225
1,175
1,125
1,075
1,025
975
925
875
825
775
725
675
1935
1939
1943
1947
1951
1955
1959
1964
1968
1972
1976
1980
1985
1989
1993
1997
2001
2005
2010
2014
2018
2022
Intake Tower
Hoover Dam
MWDOC

MONTHLY REPORT: Yorba Linda

January

	Monthly	Year to Date (YTD)	County Monthly	County YTD
OPERATIONS				
Service Requests Completed:	4	4	156	156
Mosquitoes:	2	2	103	103
Rats:	0	0	33	33
Rifa:	2	2	18	18
Number of Swimming Pools Treated/Inspected:	34	34	1,359	1,359
Hours Spent Treating/Inspecting Gutters	0	0	0	0.0
Undergrounds Treated:	0	0	0	0
Acres of Flood Channels Treated:	0	0	0.534	0.534
Acres of RIFA Treated/Inspected:	113	113	2,946	2,946
Number of Inspection Treatments:	67	67	1,338	1,338
LABORATORY				
Adult Mosquitoes Collected:	0	0	0	0
Collected From Trustee Home:	0	0	0	0
Invasive Aedes	0	0	0	0
Mosquito Pools (Samples) Tested:	0	0	0	0
WNV Positive Samples:	0	0	0	0
WNV Positive Birds:	0	0	0	0
Number of Human Infections/Deaths:	0	0	0	0
Fleas, Ticks, and Others Tested:	-	-	-	166
COMMUNICATIONS				
Outreach Events Attended:	0	0	0	0
General Presentations:	0	0	0	0
Educational Program Presentations:	0	0	13	13
Calls Received	-	-	136	136

PROJECTS IN COLLABORATION WITH OCMVCD

None at this time

COUNTY RESPONSE LEVEL / AVERAGE RATING:

Normal Season (1.0 to 2.5)
Elevated Risk (2.6 to 4.0)
High Risk (4.1 to 5.0)

TOTAL	5
AVERAGE	1.25