# SUSTAINABLE AND RELIABLE ORANGE COUNTY WATER SUPPLY:

# ANOTHER ENDANGERED SPECIES?

**GRAND JURY 2013-2014**

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## SUMMARY

Wholesale water districts, Orange County Water District (OCWD), Metropolitan Water District of Southern California (MET), Municipal Water District of Orange County (MWDOC), and Orange County (OC) retailers (cities and districts) comprise the water supply chain. They collectively estimate future demand and develop projects to improve water quality, source and system reliability. Imported water from the State Water Project (SWP) is now safer and less, but still vulnerable to earthquakes and long term drought due to a number of recent projects undertaken by the wholesalers. Projects include significant increases in State water storage, upgrading water treatment, improving time to detect and repair damaged infrastructure, upgrading infrastructure seismic design, and negotiating water transfer agreements with other wholesale agencies.

The local OC supply is also less vulnerable to major drought and earthquake events because of a number of innovative retailer and wholesaler water suppliers' policies and infrastructure projects. Policies have primarily focused on conservation and tiered water rates. Infrastructure projects have been directed at treating waste water for use in large scale landscape irrigation and ground water replenishment.

City Public Works and Water Districts are to be commended for their diligence and foresight in pursuing these source and system reliability projects. Similar projects are either being studied or developed, but will have a marginal impact on the water supply; *the low hanging fruit has already been picked.*

However, loss of State Water Project (SWP) due to a 6.7 magnitude or greater earthquake and diminished Colorado River (COR) flows due to drought coupled with future climate effects could severely impact OC imported water deliveries for multiple years. New local sources of water and/or significant curtailments will be required to mitigate these events.

Water source reliability and sustainability issues have been widely reported and discussed in the media with a specific focus on depleted reservoir storage (currently at about 50% of normal) and interrupted water supplies from the SWP to protect salmon runs and smelt populations. One proposed solution is the recently released Bay Delta Conservation Plan (BDCP). This plan requires $25 billion dollars of Federal, State and local water district funding over a 15 year construction project life. The objective is to restore the Sacramento River delta ecology and improve the reliability of exported water deliveries. Under several drought scenarios little or no water is available for export to the SWP. News articles have also discussed various planned and executed projects to improve or develop more locally sourced water supplies, specifically, increased storage, seawater desalination and water transfer agreements. These approaches have their supporters and detractors, and have varying effects on the environment and local water supply reliability.

Locally sourced desalinated seawater, a nearly infinite supply, has significant merit and should be a primary candidate to ensure water supplies against climate change, drought or a catastrophic event. Four Southern California seawater desalination projects are currently in various stages of development:

1. 50 Mgd (million gallons per day) Huntington Beach plant which is in the final stages of permitting and financing.
2. 15 Mgd Doheny Beach plant (South Coastal Ocean Desalination Project) which has completed a small scale pilot plant to evaluate a novel, low environmental impact seawater intake system.
3. 50 to 150 Mgd Camp Pendleton plant located in Northern San Diego County which has completed feasibility and conceptual design studies.
4. 50 Mgd plant located in Northern San Diego County which is currently under construction.

These desalination projects have sufficient total capacity to replace about 20% of OC's current water demand, or about 40 % of imported water purchases. This supply would substantially mitigate the loss of either the COR aqueduct or SWP water. Unfortunately, new, large infrastructure projects have significant implementation costs, difficult permitting issues, and are usually contentious and highly politicized.

OC water suppliers need the public's active involvement in supporting sustainable solutions to ensure a reasonable quality of life and to support economic growth. The public should also understand that to ensure future water supplies additional investments will need to be made to acquire new water sources and improve existing system reliability and performance. These projects will inevitably increase urban water rates, result in allocation issues among the stakeholders, and will have some small impact on the local ecology. *OC water suppliers with significant public support should immediately select, expedite and execute seawater desalination projects with sufficient total capacity to replace up to 40% of OC's imported water.*

## REASON FOR THE STUDY

There is another "inconvenient truth." We live in a semi-arid ecosystem where water supplies are frequently unpredictable and sometimes, scarce. With the exception of a few native sources of water such as the Santa Ana River (SAR) water shed and associated aquifer, about 50% of the Orange County (OC) potable water is developed from out-of-County sources. Both native ground water and external sources (primarily from the State Water Project and the Colorado River aqueduct) are vulnerable to a number of events beyond the local water wholesalers' control. Extended drought, interruptions (earthquakes and flooding) of supply due to infrastructure failures, and the potential longer range effects of climate change (ground water contamination due to sea level rise and lower snowpack) can probably be managed over short periods. However, the combined effects of sustained drought and catastrophic events can

substantially impact OC water supplies. Agencies in the water supply chain are continually studying and developing tactical and strategic plans for managing these crises under various hypothetical event scenarios. The question is whether these plans are sufficient to ensure a reasonable quality of OC life after an extended drought and significant event.

The primary objective of this report is to evaluate proposed game changing, cost-effective and reliable infrastructure projects and to shine a light on their efficacy. The 2012-2013 Orange County Grand Jury investigated and developed a status report[1] on OC water sustainability and is an excellent source of historical and contemporary information. However, the report's recommendations were more generalized and did not convey a great sense of urgency. The Grand Jury conducted this investigation to assess the effectiveness of current planning in addressing the future reliability and sustainability of the OC water supply. It is this Grand Jury's intent to develop findings and recommendations which will further create a public awareness, interest and involvement by shining a light on the highly complex legal, permitting, policy, and financing issues confronting water suppliers.

## BACKGROUND AND FACTS

This section describes the chain of supply and baselines, the ability of the existing local retailers, County and State infrastructure, and policies to respond to various catastrophic events. The major wholesale supplier for imported water is the MET which distributes water from two sources, the COR Aqueduct and the SWP, Figure 1. The major wholesaler of locally sourced ground water is the OCWD. MWDOC and OCWD are the major wholesale agencies distributing water to the local retail water districts and cities.

### State of the County Infrastructure and Supply

North Orange County (NOC) districts are blessed with a large Santa Ana basin aquifer managed by the Orange County Water District (OCWD). The aquifer supplies 65 to 80% of NOC's total water use. South Orange County (SOC) districts, on average, import about 80% and NOC only imports about 20 % of their water. This imported water is primarily supplied through the wholesalers, Metropolitan Water District of Southern California (MET) and the Municipal Water District of Orange County (MWDOC). With fifty percent of the OC water supply being imported there is legitimate concern for supply chain infrastructure damage due to catastrophes such as earthquakes or flooding and for sustained droughts which drain storage reservoirs. The wholesale water suppliers have undertaken a number of large projects at considerable cost over the last 10 years to develop local water sources, increase storage, improve water use efficiency,

[1] 2012/2013 Orange County Grand Jury Report, "Orange County Water Sustainability: Who Cares?" pg 269-303: http://www.ocgrandjury.org/pdfs/2012_2013_reports/OCGJOC-Water061913.pdf

and discourage waste; Table 1. The Diamond Valley Project located in Riverside County cost over two billion dollars and required four years to construct.

**Fig. 1.** Chain of Water Supply, Source to Retail Agencies

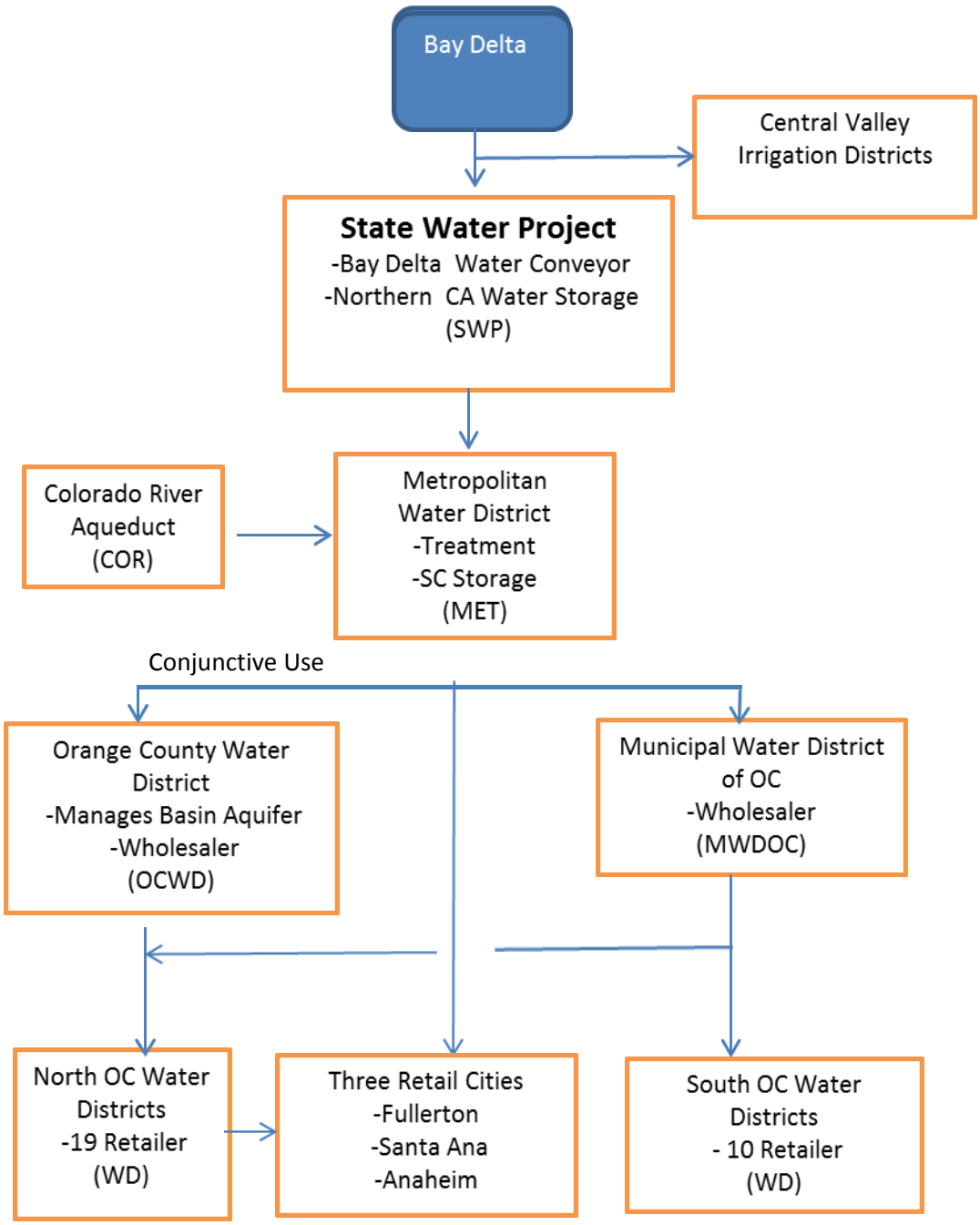


**Table 1, Operational Large OC Water Projects**

| Item | District or Developer | Project Description | | | |
|---|---|---|---|---|---|
| | | Project/Technology | Location | Capacity | Cost $ M[1] |
| Storage Projects, AF[4] | | | | | |
| 1 | OCWD | Prado Dam SAR Storm Run-off Capture | Riverside | 50,000 | |
| 2 | Irvine Ranch Water | Strand Water Storage, Transfer, and Banking | Kern | 50,000 | |
| 3 | Irvine Ranch Water | Recycled Treated Winter Water Storage | OC | 4,500 | |
| 4 | MET | Diamond Valley Lake, Emergency Imported Water | Riverside | 810,000 | 2,100 |
| 5 | OCWD | Green Acres Recyle Storage | OC | 7,500 | |
| 6 | Santa Margarita WD | Upper Chiquita Emergency Storage Reservoir[3] | OC | 750 | 50 |
| Source Projects, Mgd[5] | | | | | |
| 1 | OCW | Ground Water Replinishment System[2] | OC | 70 | 500 |
| 2 | Irvine Ranch Water | Michelson Recycled Irrigataion Water-purple pipe | OC | 33.5 | 44 |
| 3 | Mesa/Irvine Ranch | Deep Aquifer Pumping and Treatment Systems | OC | 14 | |
| 4 | Santa Margarita WD | Upper Chiquita Water Reclamation Plant | OC | 5 | |
| 5 | Irvine Ranch Water | Irvine Desalter Treated Contaminated Ground Water | OC | 7 | |
| 6 | La Habra | La Bonita Park Pump and Blend Water Facility | OC | | |
| Reliability Projects, Mgd | | | | | |
| 1 | MET | Aggressive Infrastructure Inspection/ Maintenance | LA/OC | | |
| 2 | MET | Diemer Water Treatment Plant Quake Hardening | OC | | 130 |
| 3 | Irvine Ranch Water | South County Emergency Intertie[3] | OC | 19 | |
| 4 | Mesa Water District | Monitor, Inspect, Repair or Replace Project | OC | | |

Notes: 1, M=million

2, Waste Water Reclaimation, Purification and Aquifer Storage

3, multiagency allocation

4, AF=acre-ft, an acre under one foot of water

5, Mgd=millions of gallons/day

Large infrastructure projects have been undertaken by the OCWD; a few are listed below.

1. Ground Water Replenishment System (GWRS) recycles waste water to potable quality and injects and stores it in the OC aquifer.
2. Prado Dam project captures urban and Santa Ana River (SAR) water run-off and employs biological ponds to remove nitrates.
3. SAR recharge facility uses inflatable dams to divert storm water run-off to percolation ponds for ground water replenishment.

A 30 million gallon per day (Mgd) expansion of the Orange County Water District's (OCWD) GWRS is currently in progress which will increase its production to about 100 Mgd, about 6% of OC's annual water demand. There are contingency plans for an additional 30 Mgd by connecting to the Huntington Beach waste water treatment plant.

Local water districts have undertaken similar projects on a smaller scale. Reclaimed and treated waste water in central and SOC is more typically used for landscape irrigation and distributed through a non-potable, separate "purple pipe" system. Some additional, smaller scale waste water recycling is still feasible, but there are challenges. Matching production to seasonal needs (higher irrigation demand in summer months) requires winter storage. This is more difficult in SOC since reservoir storage needs to be developed which adds additional costs. Therefore, small scale recycle and urban run-off capture projects tend to be less cost effective.

**Drivers Affecting Future Supplies**

Population growth, drought and climate change will negatively affect the water demand and supply balance, which collectively could have a significant negative effect on the OC economy and resident quality of life. Recorded history and archeology suggest that many ancient civilizations (Mesopotamian, Assyrian, and Mayan to name a few) have risen and fallen on the issue of water availability and sustainability driven by climate change.[2] Historically, significant climate change[3] and sea level changes of over 6 ft. (2m) have been documented within a short span of several hundred years. The major demographic and environmental drivers affecting future OC supplies are:

a) climate change resulting in higher sea levels with salt water infiltration into coastal aquifers and the Bay Delta and less mountain winter snow storage,
b) population growth in both North (infill), and South OC (new development),
c) water conservation, sometimes referred to as water use efficiency, and
d) the need to protect ecosystems and endangered species.

Detrimental climate effects are already being felt in California as evidenced by the abnormally low level and higher water temperatures of the State lakes and reservoirs, and shrinking (30 to 70%) Sierra Glaciers. There has also been a higher acreage of forest fire burns over the last 20 years and several inches of local sea level rise. Except for one exceptionally wet (20 inches) 2011 season, a six-year drought over the last seven years has significantly depleted most State and local storage levels. The Colorado River (COR) water shed has experienced a 10 year drought, 90% of the time the river has run dry by the time it has reached Baja California. More recently, MET imported water supplied from the Bay Delta has been significantly curtailed to protect Delta smelt and salmon runs.

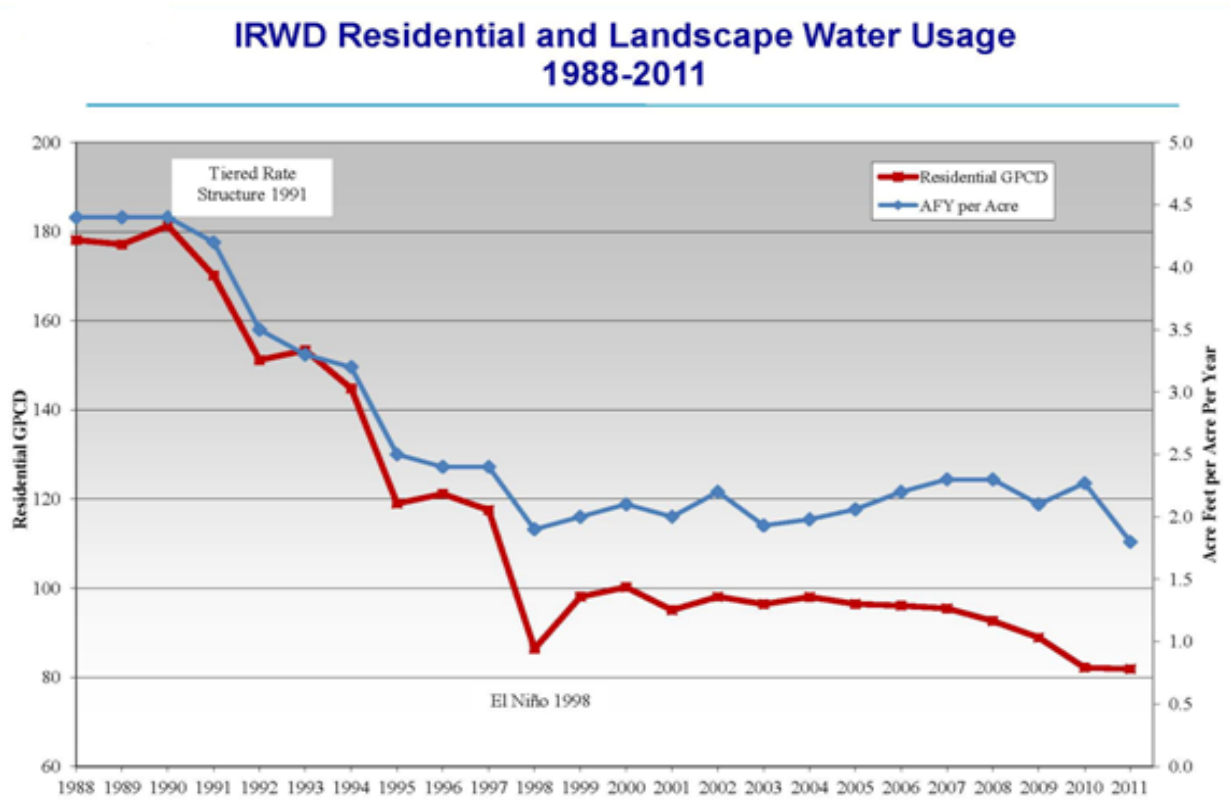
The OC population continues to grow, albeit at a slower rate. Although this should place additional pressure on the water supply, water use efficiency measures driven by the 20/20 State Mandate[4] (20% per capita urban water reduction by 2020) have reduced per-capita demand. In the early years conservation was focused on in-door use (efficient toilets, washers and shower

[2] Isabel King," Drought Cited In Downfall of Ancient Lands", Orange County Register
[3] Ken Caldera, "The Great Climate Experiment, Scientific American", v 307, #3, September 2013
[4] California Department of Water Resources, "20x2020 Water Conservation Plan", February 2010: http://www.swrcb.ca.gov/water_issues/hot_topics/20x2020/docs/20x2020plan.pdf

heads). A revised plan has been developed[5] which focuses on out-side uses. Smart irrigation water flow controllers, drought resistant plants, and artificial turf replacement are being promoted. Rebates for their installation cost are available.

Tiered escalating rate pricing has also been adopted by a number of agencies to discourage high residential consumption. These rates seem to work best for intermediate tiers more typically applied to middle income users; wealthy users are negligibly impacted and low income families typically use less water. The Irvine Ranch Water District, Figure 2, has reduced per capita use by about 50% over 10 years, although the recent recession has contributed in some small part to this reduction.

**Fig. 2.** Irvine Ranch Water District (IRWD) Per Capita Reduction in Water Use Due to Water Conservation and Tiered Rates




This rate is adjusted up or down based on current weather station measurements and, longer term, for drought conditions. Of the six retail suppliers interviewed, four used tiered rates and thought them to be effective in reducing consumption. Two agencies (located in NOC) thought tiered rates treated users unfairly and did not use them.

[5] MWDOC Water Use Efficiency Master Plan Report-2013 draft final

## Future Water Demand

Estimates of Orange County future water demand are built from the bottom up with input from the retail agencies. Estimates are made based on the current per capita water use, estimated increases in population, and the estimated impact of additional conservation policies. NOC agencies typically estimate a nearly flat demand; their residential land is essentially built out and conservation will continue to reduce per-capita consumption. SOC agencies typically estimate modest demand increases due to on-going residential development.

OC water is provided by three wholesale agencies (supply chain flow chart on page 6):

1. Municipal Water District of Orange County (MWDOC) supplies 28 retail districts and cities.
2. Metropolitan Water District of Southern California (MET) supplies imported water to one wholesaler (MWDOC) and three retail cities.
3. Orange County Water District (OCWD) supplies 19 NOC retailers from the managed Santa Ana aquifer.

The MET/MWDOC typically supplies about 42% (five year average) of the OC demand or about 240,000 acre feet per year (AFY) which is estimated to increase 3 to 6 % per year over the next 20 years.[6] The OCWD typically supplies about 320,000 AFY, 65% to 70 % from ground water depending on Basin Production Percentage (BPP) allocations. The total OC demand is estimated to grow to about 700,000 AFY (about 15%) by 2035.

## Catastrophic Events and Their Effects

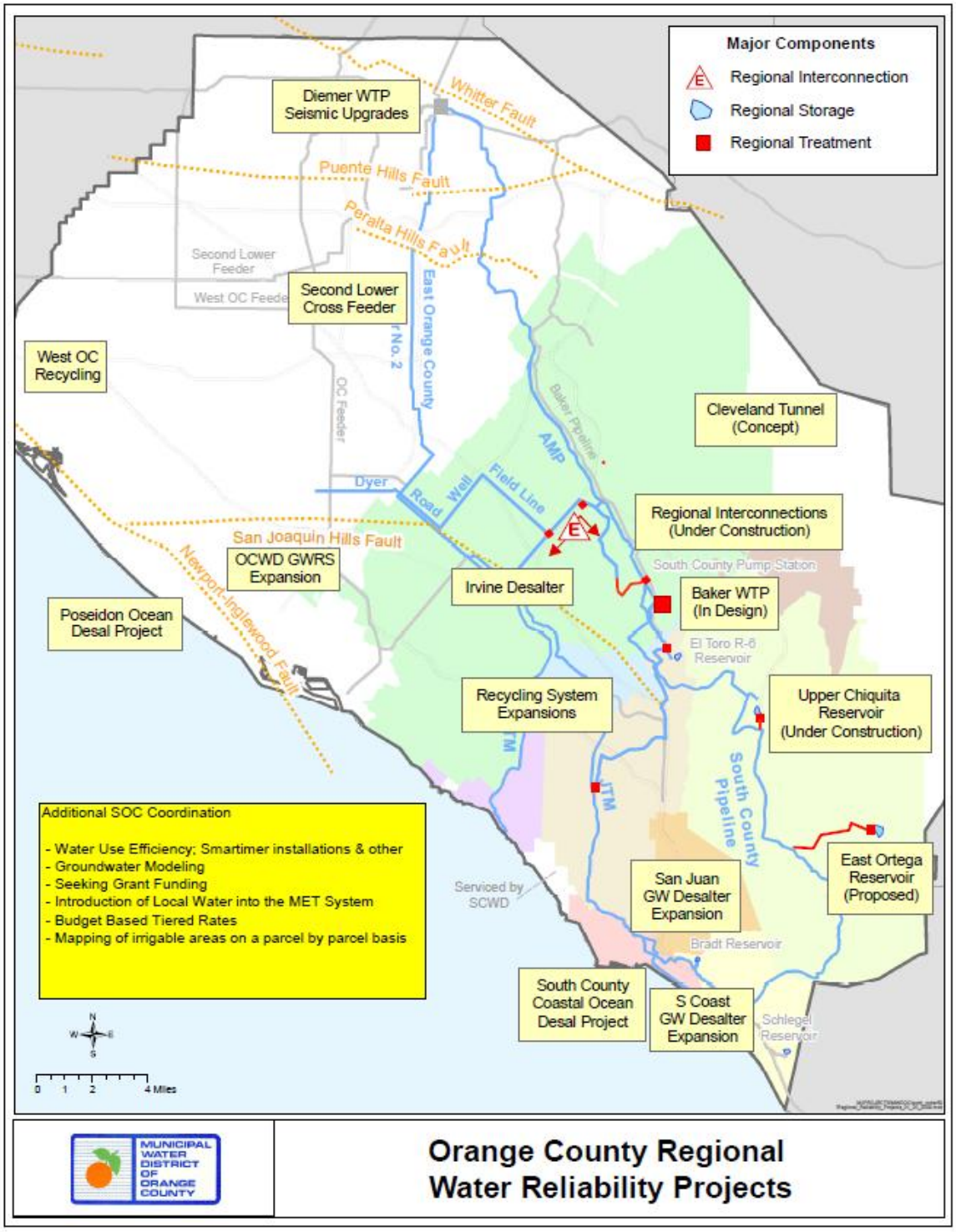
Emergency event coordination is performed by the Water Emergency Response Organization of Orange County (WEROC) from its Fountain Valley headquarters. In the event of a major emergency, inter-agency needs and resources are identified and allocated through mutual aid agreements. WEROC also coordinates agency activities with other first responders like the Orange County Fire Authority (OCFA) and the County Health Care Agency.

Both the MET and OCWD supplies are vulnerable to interruption due to earthquake caused infrastructure damage and extended drought. The MET system has vulnerable infrastructure sites which, if significantly damaged, could result in lengthy imported water supply interruptions of up to three years. The most vulnerable infrastructures are:

1. The Sacramento Bay Delta water intakes-a magnitude 6.7 quake could result in levee failures and an in-rush of seawater resulting in contaminated water at the Banks Aqueduct Pump Station located in the Delta.
2. Four Hundred miles of SWP conveyance and pump stations.
3. The Oroville dam which has the second largest reservoir capacity in the SWP system.

[6] Water Supply Report, Water Advisory committee of Orange County, December 13, 2013

**Fig. 3.** Location of Major Existing and Proposed Infrastructure Relative to Earthquake Faults




4. The Diemer Water Treatment Facility and its MET feeders located in Yorba Linda, the primary facility for treating OC imported water from both the Colorado River (COR)

Aqueduct and State Water Project (Bay Delta Water). Damage to the COR aqueduct could interfere with water transfer and conveyance to the Diemer treatment plant from the Imperial Valley agricultural water districts via transfers with SDCWA or from MET's Diamond Valley Reservoir.

Diamond Valley Lake is the largest emergency source of stored surface water (0.81 MAF) in Southern California and the closest to OC. The transport pipeline does not cross the San Andreas Fault; pipeline damage is not expected to be severe and outages should be relatively short. However, a concurrent extended drought on the COR watershed could reduce California's urban allocation under the multi-state, multi-district Quantification Settlement Agreement. Under this agreement California irrigation districts have a higher priority than urban Southern California to Colorado River (COR) water.

Locally, three significant fault lines traverse the main MET Diemer feeders (Figure 3 preceding page). Two faults straddle the Diemer plant. A severe earthquake along one of these faults would have a significant impact on SOC supply and also result in a more rapid depletion of the NOC groundwater.

OC water districts and cities may experience difficulties in executing water transfers between themselves due to local earthquake infrastructure damage. Distribution piping within a district service area may also be affected. Except for OCWD's Ground Water Replenishment Facility, most of the OC infrastructure (wells, pumping stations and distribution piping) is geographically distributed and backed up with redundant equipment and emergency power. Wide-spread curtailments would not be expected.

**Mitigation Measures**

Measures are underway to further mitigate the effects of drought and earthquakes, although some issues remain unresolved and are discussed later in this report. Projects include new storage and source development and improvements in system reliability (Table 2). These projects are in various stages of evaluation or implementation and have varying impacts and capital costs. The two largest projects and potential game changers are the Huntington Beach Seawater Desalination Plant (50 Mgd, in the final phase of permitting) and the Bay Delta Conservation Plan (4,200 Mgd exported to California urban users) which has been submitted for public comment. OC has typically received about 130 Mgd of State Water Project (SWP) imported water.

Probably the worst case scenarios involve earthquake damage to the MET operated COR aqueduct and the SWP imported water infrastructure. MET is prepared to address COR aqueduct failures. MET has expanded their facilities to manufacture and repair large diameter piping. Piping is manufactured in spool sections with dimensions which allow for over-the-road transport. MET does not anticipate that damaged pipe outages will last more than several months. Locally, the worst potential earthquake impact would be the loss of the Diemer Water

**Table 2, Status of Large, New OC Water Sustainability Projects**

| Item | District or Developer | Project Description | | | | |
|---|---|---|---|---|---|---|
| | | Project/Technology | Location | Capacity | Cost $ M[1] | Status |
| New Storage Projects, AF[4] | | | | | | |
| 1 | Santa Margarita Water | Cadiz Valley Project, Imported Desert Aqifier | SBC | | | Negotiation |
| 2 | Santa Margarita Water | Coto de Caza, Urban Run-off Basin Reclamation | OC | 200-850 | 20.9 | Construction |
| 3 | Irvine Ranch Water | Stockdale Ranch Banking, Water Exchange | Kern | 25,000 | | Development |
| 4 | Santa Margarita Water | Ortega Reservoir Recycled or Potable Water | OC | | | Study |
| 5 | Irvine Ranch Water | Expanded Syphon Recycled Water Reservoir | OC | 4,500 | 72 | Study? |
| New Source Projects, Mgd[5] | | | | | | |
| 1 | OCWD | Water Replenishment Expansion, 25% Capacity | OC | 25 | | Construction |
| 2 | MWDOC | Doheny Desalination Plant | OC | 15 | 153 | Pilot Plant |
| 3 | Poseidon Resources | Huntington Beach Desalination Plant | OC | 50 | 1,000 | Permitting |
| 4 | El Toro Water | Recycle water system expansion | OC | | | Planning |
| 5 | Santa Margarita Water | Upper Chiquita Reclaim | OC | 4.7 | | Proposed |
| 6 | Irvine Ranch Water | Phase 2, Michelson Waste Water Collection | OC | 14.9 | | Development |
| Reliability Projects, Mgd | | | | | | |
| 1 | MET/MWDOC | Second Lower Feeder Interconnection[2] | LA/OC | 30 | 51 | Terminated |
| 2 | OCWD | North/South County Interconnection | OC | | | Study |
| 3 | Fullerton | 100 Miles of Water Main Replacement | OC | | 263 | Authorized |
| 4 | Joint District | Baker Treatment Plant, CO river to potable | OC | 28 | 90 | Construction |
| 5 | Santa Ana | 200 Miles or Distribution Pipe Replacement | OC | | 263 | Construction |
| 6 | MET/MWDOC | Bay Delta Conservation Plan[3,6] | SacC | 4,200 | 25,000 | Planning |

Notes:
1, M=million
2, Emergency supply, 4' diameter pipeline, 100 cfs, actual amount depends on availability,
3, Dual tunnel, 33' diameter pipeline in Bay Delta, actual flow depends on allocation during drought
4, AF=acre-ft, an acre under one foot of water, sufficient for 2.5 households
5, Mgd=millions of gallons/day
6, Maximum SWP allocation to OC is about 180 Mgd ( 4%)

Treatment Plant located in Yorba Linda, which would substantially reduce imported water flows from all sources. MET is stabilizing sloping landfills and reinforcing structures around the Diemer water treatment plant to achieve a higher seismic standard. This $120 million earthquake hardening project is currently about 50% completed. When completed, earthquake caused outages are not expected to exceed several months. The currently under construction Baker Water Treatment Plant, located adjacent to the Allen McColloch Pipeline, will provide a by-pass around the Diemer Treatment Plant. When operational, it will provide a significant alternative SOC's potable water supply (about 25% of average demand). The proposed MET owned second lower tier feeder intertie to the East OC feeder has been under study (now deemed infeasible) and would have replaced an additional 25% of Diemer sourced water to SOC.

The major concern is loss of Bay Delta SWP water which is typically about 60% of the imported water supply. The fragility of the Bay Delta has been recognized for over 70 years. Protecting this ecosystem and fairly distributing water to users has been contentious for years. This has resulted in a tug of war between Northern, Central Valley and Southern California over water allocations. The Sacramento river water shed is sourced from Sierra Nevada mountain range winter run-off and summer snow pack melt, most of which flows through the delta. This water shed is mostly owned by Federal and State agencies and, in theory, the water should be fairly allocated between the urban population, agriculture and the fish. The currently promoted

concept, the "Bay Delta Conservation Plan" (BDCP) is intended to achieve the following objectives.

1. Restore part of the Delta ecosystem and protect endangered species and salmon runs.
2. Improve the reliability of the State Water Project.

The major features of the plan are:

1. Relocate the Delta water intakes (3 new ones dispersed along the river) to a higher than sea level elevation near the junction of the Sacramento and San Joaquin rivers.
2. Connect the new intakes to the existing Banks Aqueduct Pumping Station with 30 miles of dual, underground tunnels with a maximum capacity of 9,000 cfs (5,800 Mgd).
3. Selectively remove levees to flood several delta islands currently below sea level.
4. Restore 145,000 acres of delta wetlands to its native condition.

The BDCP is costly (both construction and operating); the water infrastructure portion is currently estimated at about $25 billion, and will require a significant time, about 15 years, to complete. Bay Delta water exported to the SWP is targeted at about 4.7 million acre feet/year (MAFY), about 250 Mgd of which would be allocated to OC assuming there is adequate river flow for endangered species protection. It is alleged that the State Water Project supply reliability is enhanced since intake water quality will not be affected by levee failures or sea level rise. Further, the project probably has higher value to Northern California and the San Joaquin Valley and Delta farmers than to Southern California urban users. Northern California is at the start of the pipeline and Southern California is at the terminal end. Both Northern and Southern California obtain 30 % of their water from the Bay Delta SWP. The tail-end of the aqueduct could very well run dry. *Under extreme drought conditions all of the water is allocated to the fish.* A second, perhaps more economically viable option to the BDCP is the peripheral canal concept.[7] This project does not rely on a risky and expensive, dual, underground pipeline. A California bond issue was introduced in 1982 to implement this project, but was defeated due to significant opposition from Northern California voters.

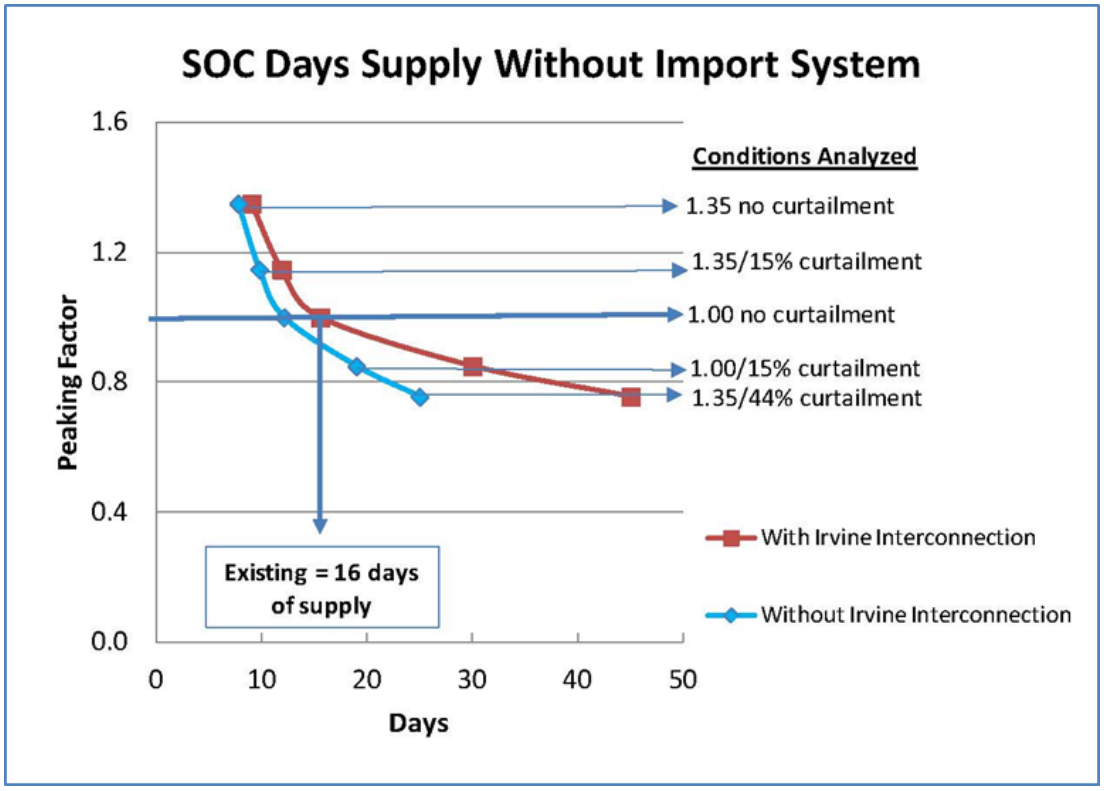
In general, distribution systems within the County are less vulnerable to earthquakes and unscheduled outages due to the execution of a number of reliability projects, (see Table 1, page 7). Reliability projects have been undertaken collectively or individually by OC districts, agencies and cities, and include:

a. cross ties between district distribution systems which will allow interagency water exchanges for short outages, some agencies have cross ties with all of their neighboring agencies,
b. ground water well redundancy, if production at several wells is lost there are sufficient operating wells to provide adequate service,

[7] Ellen Hanak, et al, Navigating the Delta: Comparing Futures, Choosing Options, Public Policy Institute of California, Research Brief, July 2008

c. back-up command and control system emergency electrical power supplies,
d. back-ups to pumping stations, either emergency power generators to run the pumps and/or spare pumps,
e. emergency reservoir and tank storage sufficient to accommodate 12 to 31 days, (Figure 4), of average annual demand with various levels of curtailment, the MWDOC goal for SOC is 30 to 60 days of local storage with curtailed demand and is a work in progress,[8]
f. tanker trucks to shuttle potable water to an agency with substantial interruptions of their water supply,
g. "Condition based maintenance" using software programs that predict safe maintenance intervals, allowing inspection and replacement before equipment failure,
h. monitoring and where required, the repair or replacement of aged conveyance and distribution piping,
i. waste water recycling for ground water replenishment and irrigation, and
j. infrastructure reliability projects and replacement of antiquated pipelines.

**Fig. 4.** South Orange County Supply with No Imported Water for Various Curtailment Scenarios




Curtailments apply only to SOC's annual average water demand (1.00). A higher, 35% seasonal increase (1.35) in demand or a lower curtailment decreases the days service can be met.

[8] Municipal Water District of Orange County," South Orange County Water Reliability Study," 2013 update

The Grand Jury was pleasantly surprised at the diligence with which our local agencies and cities are pursuing reliability and sustainability projects within their jurisdictions and with each other. Most have active projects in various stages of planning and/or execution, although they may be constrained by environmental activism, funding, regulatory issues, local geology and demographics. Some of the larger projects addressing additional emergency storage, new local sources and reliability are highlighted in Table 2, page 13. Smaller surface water capture and reuse projects are being pursued and, where cost effective, can be used for local irrigation and aquifer recharging. However, these are not game changers as the captured flows are relatively small and highly dependent on winter run-off.

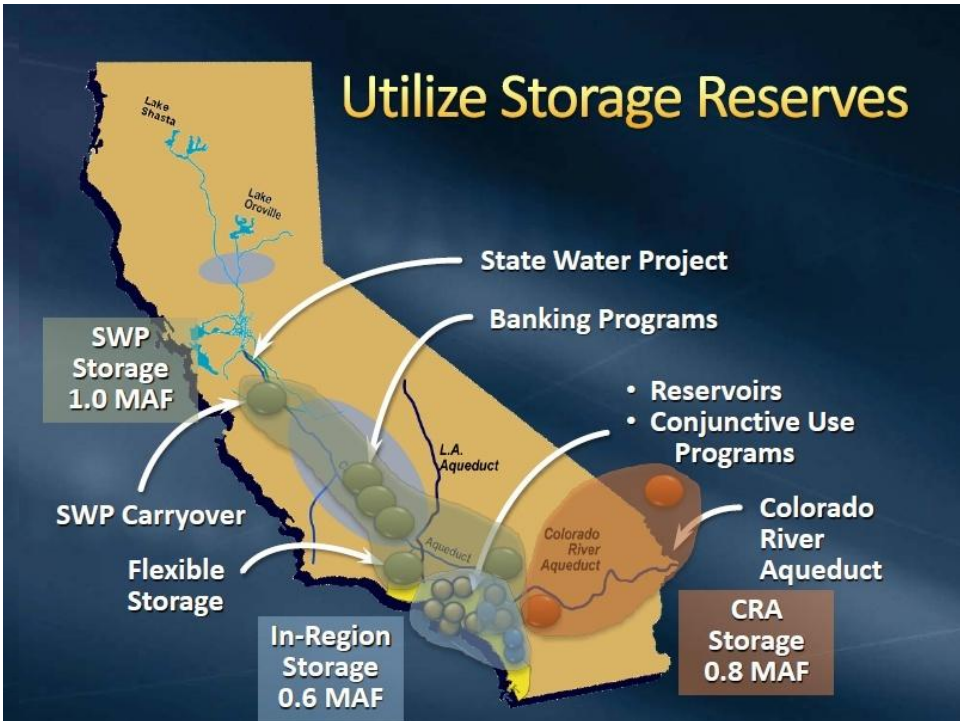
**Climate Change Events**

Climate change can significantly impact future MET and local water sources due to:

a) reduced imports of COR water and even less during the high demand summer months,
b) more rapidly depleted local and State ground and reservoir water storage to compensate for reductions in imported water,
c) the possible contamination of the Bay Delta pump intake-water due to sea level rise if the BDCP or peripheral canal equivalent has not been implemented, and
d) significantly lower winter Sierra and Rocky Mountain snow packs with less summer run-off.

Under the "Quantification Settlement Agreement" California irrigation agencies have higher priorities to COR water, but can transfer limited quantities to urban districts. In the past, irrigation water district surplus water allocations were used to replenish MET owned water storage systems. MET has increased its storage capacity, mostly in reservoirs, from approximately 3 to 5.5 MAF (almost doubled) over the last 10 years, Figure 5. The latest project, Diamond Valley, has a storage capacity of 0.81 MAF and is currently at 75% of its capacity. Climate change could have a significant impact on the MET's ability to maintain adequate reserves. Rising sea levels could increase water salinity near the Bay Delta intakes. Intake water could become brackish resulting in non-potable water which would require additional expensive treatment such as reverse osmosis (RO) either before transport or at the receiving treatment plant.

**Fig. 5** Metropolitan Water District and State Water Project Reservoir Storage




**Water Quality and Safety**

Water quality is assured through an extensive monitoring system operated by the wholesalers (MET and OCWD) and retail districts. The MET performs more than 320,000 analytical tests per year using Environmental Protection Agency (EPA) and State certified methods. Monitoring of regulated contaminates is performed at transfer points and water treatment plants (both entering and treated discharge). Tests are also performed to validate the efficacy of the disinfection treatment, typically with ozone (preferred) and chloramines. In combination, these disinfectants will produce significantly less by-products and odors. MET and water district annual water quality reports are available on their web sites. Contaminate tests typically include the following:

a) microbial such as bacteria and viruses,
b) naturally occurring radioactive material,
c) inorganic compounds which pose operating issues such as mineral deposits or which are toxic, and
d) toxic or carcinogenic organic compounds.

The OCWD monitors more than 700 wells using 1,400 sampling points. The OCWD conducts more than 18,000 analyses for 330 contaminates including unregulated water quality parameters. Analyses are performed in a State-of-the-art, EPA certified laboratory.

Ground water is monitored at least once a year for non-treated wells and more frequently for those processing brackish or colored water to potable standards. Pipe line valves are located throughout the potable water distribution network to isolate areas suspected of contamination. Retail district wells are typically disinfected with ozone or chloramines.

**Financing and Permitting Large Scale Infrastructure Projects**

Increasing OC water supplies will require new, large infrastructure projects with associated large capital financing and long project timelines. Large water projects are costly, typically $100 million to $2 billion, Table 1, page 7. California projects from planning to operation such as seawater desalination plants have taken 10 to 15 years to implement.

There are four methods of financing projects:

a. Pay-as-you-go using (a) capital reserves and/or (b) consumer rate increases,
b. Local agency general obligation or revenue bonds,
c. Private/public financing, the latter through investor LLC's or IPO offerings, and
d. Grants from local, State and Federal agencies.

A number of water districts maintain large capital reserves (50 to 180% of their annual operating budget) which can be used to finance multi-million dollar projects or as collateral to negotiate favorable bond rates. City public works projects more typically rely on general obligation bonds paid through property taxes or pay- as-you-go rate increases.

A significant impediment to developing large infrastructure projects is the number of local, State, and Federal agencies having sometimes conflicting jurisdictions over the permitting process. For example, a few of the up to 23 permits/approvals are required to construct seawater desalination plants. Representative samples are listed below:

1. California Coastal Commission
2. California Environmental Quality Act (CEQA)
3. Local Land Use Permits (EIR Certification, City Conditional Use and Coastal Development Permits)
4. Department of Public Health Services Permit
5. State Lands Commission Permit

Other government agencies have successfully addressed shortening the permitting procedure. The Federal Nuclear Regulatory Commission's (NRC) stream-lined procedure for power plants is a one-stop construction and operating permit process which takes about five years.[9] A similar approach could substantially reduce the extremely lengthy 10 to 15 years needed to execute large water infrastructure projects.

[9]Nuclear Regulatory Commission, Fact Sheet on Nuclear Power Plant Licensing Process, September 22, 2009

**System Reliability Improvements**

System reliability is a measure of how well the water treatment and distribution infrastructure functions under normal and stressed conditions, and how fast it can recover from normal outages and catastrophic events.

OC water reliability has been significantly improved with redundant systems, back-up power, good maintenance diagnostics, inventoried materials and equipment for planned and emergency repair outages, mutual aid agreements, and interties of retailer and wholesaler distributions systems. Incremental system improvements will yield diminishing returns.

**Improving Source Reliability**

Future local sources of water supply are more valuable than imported sources. The latter are vulnerable to pipeline, aqueduct, and pumping station outages due to routine maintenance and repair or substantial infrastructure damage. Longer term depletion of locally and regionally stored water due to climate change is also a major concern. The primary source of local water well into the future will be the NOC aquifer. The means of replenishing this aquifer after large draw-downs is a top priority in OCWD's water management planning.

OC has access to coastal seawater which could be desalinated. Except for the Great Lakes there are no other large sources of water that are relatively immune to climate change. The desalination technology of choice is reverse osmosis (RO) which is capable of directly producing potable water. The RO process requires the following equipment and infrastructure:

a. seawater intake infrastructure extending up to 6,000 ft. from the shore line; currently proposed and under-construction projects alternatively use an existing coastal electrical power plant cooling water discharge pipeline for the RO plant feed and brine discharge,
b. filtering and chemical conditioning equipment to adjust feed water acidity, remove sediment, and resist fouling of the RO membranes,
c. High pressure pumping station to raise pressures to about 950 pounds per square inch (psi), the energy intensive step,
d. a large array of RO canisters arranged in parallel flow to remove the salts and chemicals by filtering the seawater through plastic polymer membranes,
e. chemical conditioning unit to disinfect the now potable water for distribution,
f. concentrated brine which is twice the salinity of the intake seawater is discharged to the sea through multiple distribution ports, and
g. additional large diameter piping to interconnect the plant's produced, treated water to the users' distribution system.

The most significant negative impact is the cost of the desalinated water, currently estimated at between $1,700 to 1,900/AF. This is about a 45 % increase over current imported water cost of about $1,000/AF which it would replace. It should be noted that MET is currently providing a

$250/AF incentive (subsidy) to develop local water supplies which would partially off-set the higher cost of desalinated seawater.

Large desalination plant systems (buildings and equipment) are relatively straight forward to design, construct and estimate price. However, the cost of the ancillary infrastructure such as seawater intakes, brine discharge out-takes and a connection to the local user's distribution piping is highly variable, depending on geology, demographics, method of financing, and environmental issues. For example, spreads in total capital cost for a nominal 50 Mgd plant are typically between $800 to $1,200 million.[10] A 50 Mgd plant would require about 35 MW's of power, which is about 25% of the total operating costs. To put it in perspective, this power consumption is similar to that of a large university campus or a regional hospital.

Supporters make the following case for desalination:

1. The source of water is local and nearly infinite; with sea level rise there will only be more of it.
2. Once permitted, the projects can be constructed much faster, with less risk than the BDCP; the Huntington Beach, 50 Mgd plant is almost shovel ready waiting for final permitting and financing and could be in production in about 4 years.
3. RO is a mature technology which is widely used in Australia, the Middle East, and elsewhere in the United States.
4. Contrary to its detractors, a desalination plant has little impact on the CA coastal marine ecology, CA has 1,000 miles of coast, a properly designed plant intake and outflow might negligibly affect marine life; however, beyond a 200 to 1,000 ft. radius of the discharge, the effects are well within regulated values[11].
5. New low pressure RO membranes and more energy efficient designs are in development which will substantially reduce power consumption, one of the largest operating costs.

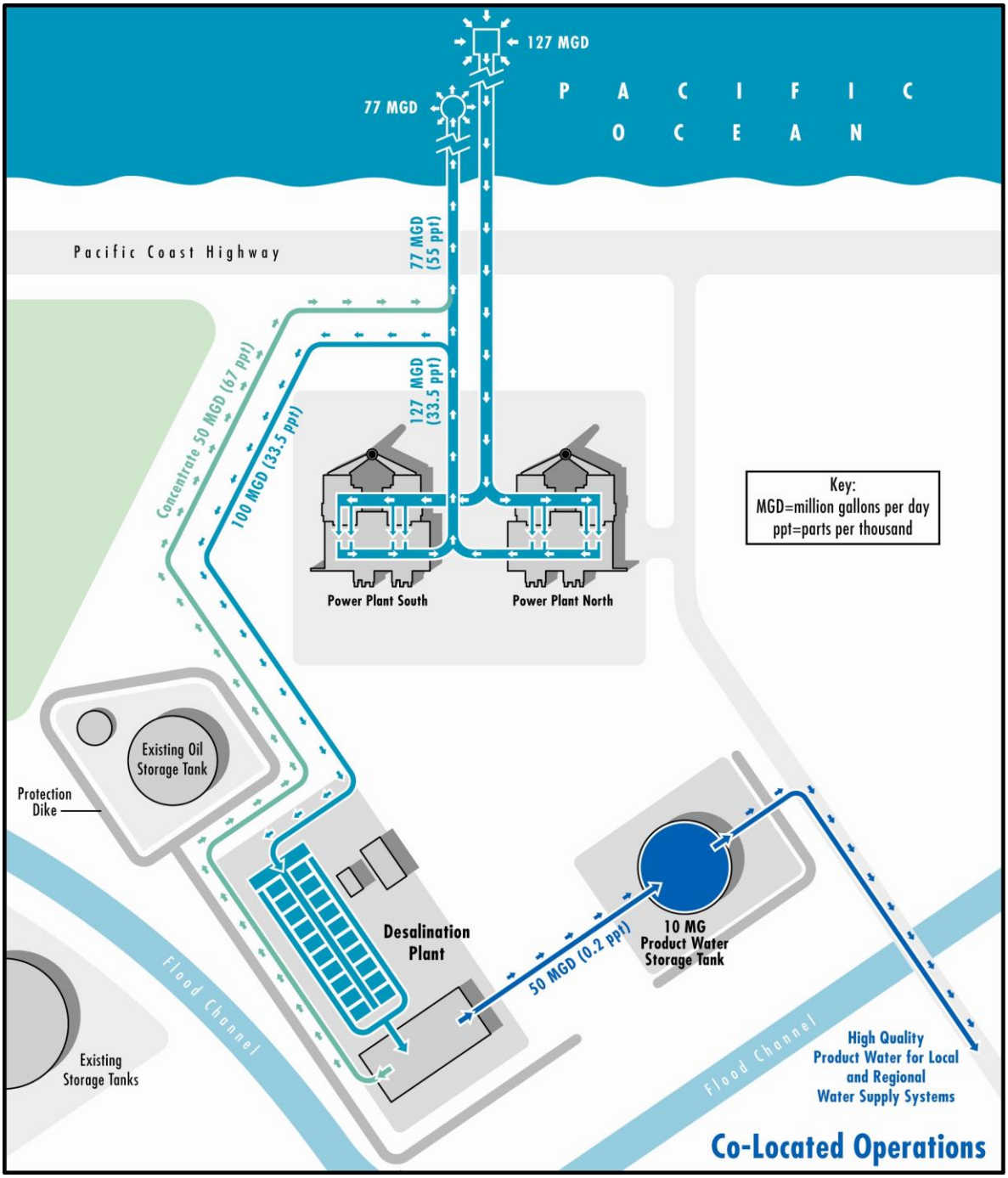
The desalination detractors argue that:

1. It is expensive water and that there are less costly source options– however, if the imported water supply is significantly reduced or lost this a moot point.
2. It damages the marine ecology--this is a very local effect and can be substantially mitigated with good design practice and without resorting to expensive, multiple, subsurface slant drilled intakes.
3. There are more cost effective options such as additional waste water recycling--see discussion below.
4. A base loaded, constant flow, RO supply is mismatched to fluctuations in water demand --see discussion below.

[10] Water Reuse Association White Paper, Seawater Desalination Costs, January 2012
[11] Steve Christie and Veronique Bonnelye, Perth, Australia: Two-year Feed Back on Operation and Environmental Impact, presented at IDA World congress, November 7-12, 2009

The San Diego County Water Authority[12] (SDCWA) estimates that its currently under construction Carlsbad 50 Mgd desalination plant will increase average residential water bills by about $5 to 7/mo. The proposed Huntington Beach plant[13] is similarly configured, Figure 6, with a less complicated user interconnection and should have a similar cost impact on rates.

**Fig. 6.** Proposed Huntington Beach Desalination Plant Co-located with the AES Power Plant




[12] San Diego County Water Authority, Seawater Desalination-the Carlsbad Desalination Project, March 2013
[13] Poseidon Resources Proposed Water Reliability Agreement, Jan 2013

This monthly rate increase is about the same as the cost of a Starbucks Venti, a small price to pay for a more secure water source. Desalinated water may compare more favorably in future years with imported costs since the latter is estimated to escalate at a faster rate. The time to achieve a break even cost has been estimated at between 20 to 30 years assuming a 50 year project life. Increasing water costs and environmental issues will be a reality no matter what new supply options are selected.

The San Diego County Water Authority in consultation with the Camp Pendleton Marine Corp has completed a conceptual engineering study to evaluate the feasibility of constructing a second world class desalination plant. Two coastal sites suitable for up to a 150 Mgd plant have been investigated, both located along highway I-5 on the southern end of the base near the Santa Margarita River Estuary. Capital costs are estimated at slightly under $2 billion and water deliveries could be initiated during 2018. Twenty three permits were identified and included Federal, State, County, and local city regulatory agencies. It is conceivable that this facility could also be connected to a SOC feeder, providing an additional source of supply and further insulating OC from loss or curtailment of imported water.

## METHOD OF STUDY

The Grand Jury gathered information for this report from interviews, site tours, agency meetings and research (articles, reports). Specifically the following water supply chain interviews were undertaken.

1. Metropolitan Water District of Southern California (MET); imported wholesaler.
2. Municipal Water District of Orange County (MWDOC); wholesale distributor.
3. San Diego County Water Authority; a wholesaler similar to MWDOC.
4. Four retail Orange County Water Districts with different approaches to infrastructure reliability and financing.
5. One privately held water district.
6. Three Cities with different approaches to self-sufficiency, water sourcing, infrastructure. reliability and financing.

Interviewed water agencies were a representative cross section of the OC supply chain and reflect the following diversity in demographics and practices.

1. North versus South County sources of water supply (reliance on imported water).
2. Policies with respect to financial reserves.
3. Policies and resources dedicated to infrastructure maintenance and reliability improvements.
4. Diversity of projects to provide water supplies in emergencies or during planned outages.
5. Policies, plans and resources dedicated to developing locally controlled sources of supply.

Meetings, with wholesale and retail water districts and cities within the water supply chain, explored the following questions.

1. What drivers have been considered in the Reliability and Sustainability Planning function?
2. How effective are the ongoing water rate restructuring and conservation programs in reducing water demand?
3. What is the future water demand (potable and landscape irrigation), how is it estimated and with what accuracy?
4. What are the plans for ameliorating significant interruptions (earthquakes, global warming, terrorist attack, loss of power) of the water supplies during short and long term outages?
5. What capital intensive, long development time infrastructure will be required for implementing /ameliorating of Items 3 and 4?
6. Are there adequate financial reserves to maintain the existing and planned infrastructure?
7. How is reliability addressed in the design and implementation of current and future projects?
8. What alternate sources of water supply (Cadiz aquifer, desalinization) can be developed, with what technology and in what time frame and at what cost?
9. How do politics affect OC water policy and planning, and how are they addressed with regard to competing stakeholders (recreational and ecological, flood control, other water agencies)?
10. What is the current storage status of local reservoirs and ground water reserves (number of days of supply for normal and emergency use)?
11. Can capture rates and storage capacity of surface run-off be improved during the wet season?

In addition, interviews were conducted with academic consultants specializing in water infrastructure engineering and financing and with a company which develops and constructs large water infrastructure projects. Members of the Grand Jury also attended two presentations on the BDCP jointly sponsored by MWDOC and WACO.

The following field trips were undertaken to validate the extent to which the issues raised in the above questions have been addressed.

1. Bay Delta and Oroville Dam Tour, source of MET's imported State Water Project water.
2. Parker Dam and the Colorado Aqueduct, source of imported MET Colorado River water.
3. OCWD's Prado Dam Wetlands Project, the capture of Santa Ana river run-off and its nitrate removal with biological treatment.
4. Orange County Water District (OCWD) Ground Water Replenishment Project which treats and recycles waste water, currently producing about 70 Mgd of treated water.

5. Mesa Water District's Water Reliability Facility which extracts colored water from a deep aquifer and treats it to potable standards at the well head.
6. MWDOC's Doheny Ocean Desalination Project, a pilot plant which is evaluating the feasibility of subsurface seawater extraction to minimize marine impacts.

During the Grand Jury's trip on November 2013, to the Bay Delta SWP, Lake Oroville, the second largest reservoir in the SWP system was visited. At that time this reservoir was at about 50% of its average seasonal capacity because of the extended drought, Figure 7. The light colored "bath-tub" ring is the level reduction below its annual average level.

**Fig. 7.** The Effect of Drought on Water Level at Lake Oroville

## ANALYSIS

Both source and system reliability must be addressed to ensure a sustainable OC water supply now and in the future. Source reliability relates to the current and future probability that water will be available. System reliability relates to the ability to convey, treat, and distribute water under normal and catastrophic events. Superimposed on both of these reliability requirements is the potential impact of the wild card, *climate change*, on planning for sustainability.

## Local Water Source Reliability

Local sources of water have been aggressively pursued by OC water wholesalers and retailers, mostly focused on ground water recharging with recycled water or surface run-off water, and brackish or contaminated water reclamation. OC wholesale and retail agencies have focused on storage within the County to provide some level of drought protection and for emergencies. NOC has a large capacity aquifer for potable water storage, but little capacity or compatible infrastructure for storing reclaimed water for irrigation. SOC has limited geology for ground water storage, but some opportunity for expanding or developing canyon reservoirs.

Most cost effective projects involving large waste water sources and their means of storage have been completed. Agencies are primarily concentrating on capturing urban and storm run-off, a more marginal and costly effort. These projects usually produce less than 4 Mgd and are typically highly seasonal and sensitive to climate change. The recycled and reclaimed water projects tend to be more expensive, but produce higher flow capacities. Seasonal storage will be required for large projects which will substantially increase operating and infrastructure costs.

It would seem prudent that Orange County accelerate a path toward more self-sufficiency with the objective of replacing the potential loss of 40% of its imported water within 3 to 10 years. This replacement would provide OC with sufficient capacity to meet potable water demand upon loss of all imported water. Some seasonal curtailment of outside use might be required.

Mitigating the loss of SOC imported water after a catastrophic event could be accomplished by some combination of:

a) more waste water treatment and recycling, although issues of infrastructure, demographics, economics and regulatory compliance may limit the size and number of viable new project,
b) construction of several world class seawater desalination plants, about 50 Mgd each, but possibly down-scaled if it makes permitting easier,
c) additional out of County aquifer replenishment, storage, and transfer agreements, for example, the Cadiz (now Fanner) Valley Project located in Riverside County, and
d) development of a County water distribution system model in order to evaluate the adequacy and strategies for water deliveries to retailers under various outage scenarios.

Climate effects will require additional infrastructure projects similar to those proposed for earthquake mitigation, but their implementation might be deferred pending validation of adverse climate affects. An additional 50 Mgd seawater desalination plant and more severe water use restrictions may be necessary at some future date.

## Local System Reliability

Distribution system interties between agencies and cities, existing and planned, should facilitate conveying NOC ground water and desalinated seawater south. The County could limp along

with a user curtailed water supply for an indeterminate time. There are a number of inter-agency mutual aid agreements, although it is not clear how well they will function in a highly stressed, catastrophic event. The Grand Jury did not find a detailed County wide master plan on how to identify and inter-connect city, district and MET systems when large interruptive events occur. If not available, there needs to be an evaluation of the total OC water distribution system and its inter-connections to confirm that adequate flows between North and South County retailers and their wholesale suppliers can be managed under different infrastructure damage scenarios and/or with proposed new or modified infrastructure. *It is the Grand Jury's opinion that the merger of OCWD and MWDOC wholesale districts could significantly facilitate the implementation of all of the above recommendations.*

**Imported Water System Reliability**

The availability of imported water from the State Water Project could be severely impacted by a failure of the Bay Delta levees after a magnitude 6.7 earthquake on the Hayward fault. Unfortunately, there is no durable, short-term fix for this issue and OC future sustainability could be greatly compromised. The l5-year fix is the completion of the Bay Delta Conservation Plan (BDCP) proposed conveyance system for exporting water to the SWP. Although this project is important to the State Water Project and fisheries, its primary benefit to OC would be as a future, sustainable water source of unknown improved reliability and availability (climate change and ecological needs could severely limit flows to Southern California). The Grand Jury has the following additional concerns relative to this project as it is currently configured:[14]

a) the survivability of the dual tunnel system after a major quake, and the time to repair underground/underwater large diameter piping,
b) the vulnerability to outages and quake damage of the Banks Aqueduct Pumping Station which supplies Delta water to the SWP Aqueduct, and
c) the actual water allocations to stakeholder under severe shortages.

Thirty miles of tunnel under squishy delta soil subject to liquefaction is a risk the Grand Jury hopes will be adequately vetted for quake survival.

*It is critical that a sustainable, properly and cost effectively executed BDPC be implemented and supported by MET and MWDOC, but OC should not rely solely on this option!*

**Imported Water Source Reliability**

The MET cannot control the climate and drought. Therefore, it has aggressively pursued conservation and water storage as the primary means of managing long term water supplies. The MET and MWDOC have also been strong champions of the BDCP which improves the reliability of SWP deliveries. However, MET reservoirs and lakes are remote (except for

[14] DHCCP-Program, Support Document for BDCP EIR/S Administrative Draft, Conceptual Engineering Report-Isolated Conveyance Facility, All Tunnel Option, January 2013

Diamond Valley reservoir) from OC and the transport infrastructure to Southern California is vulnerable to quake damage. In the long term, the ability to replenish storage will be subject to the effects of drought and climate change, even with a more reliable Bay Delta water source.

**The Case for Seawater Desalination**

Even though a supportive argument can be made for constructing a world class OC seawater desalination plant, its permitting has been stymied by environmental activists. However, an argument can also be made for adverse environmental impacts caused by the construction of any large scale infrastructure project. It's doubtful that the Colorado River Aqueduct or State Water Projects could be built with today's environmental constraints and permitting issues. Clearly, environmental concerns should be addressed to the extent they can be cost-effectively accommodated. However, OC residents should be granted a reasonable quality of life under adverse water supply conditions. Yes, we could probably survive with half the water we currently use if we want to live without green spaces. No, we can't afford to wait for a long, drawn out BDCP process to achieve a compromised imported water solution.

Any new source or Delta fix will increase user water rates. However, this should be thought of as the equivalent of home fire insurance. We pay for it annually, but do not expect to use it. In the case of a desalination plant, OC receives an annuity, a potable water supply to use or bank. Surplus desalination water produced during low demand at night can be banked as necessary using the large SA aquifer or local retailer reservoirs.

Environmental activists assert a high mortality rate in the millions/day for marine life like fish eggs and larvae which are sucked into the seawater intake. Whether these numbers are founded on good science and applicable to a specific site and technology is moot. It is hard to believe that all of the marine life in the Pacific has migrated to a single intake location. A well-documented, multi-year evaluation of the impact of the Perth, Australia desalination plant (of similar size to those proposed along the SC coast) found no significant marine impacts 200 feet from the intake and discharge locations[15]. Also, plants that use existing power plant discharges as proposed at Huntington Beach and Carlsbad have a small impact on local salinity due to the dilution factor of the higher power plant cooling water flows. When the power plant is not operating the intake flows are substantially reduced resulting in less marine life ingestion. *The environmentalists have had their say and have been reasonably accommodated.*

*The wholesale agencies should form and significantly fund a working group with the San Diego County Water Authority to explore in greater depth the possibility of developing the proposed 50 to 150 Mgd Camp Pendleton seawater desalination project.*

[15] www.waterboards.ca.gov/water_issues/programs/ocean/desalination

At the very least, this group should develop a preliminary design for the project and perform sufficient CEQA investigations to identify and initiate critical path permitting activities. If the current extended drought continues or when significant climate changes start to impact source reliability coastal Southern California will be in a better position to expedite the permitting and construction of another large seawater desalination plant. This venue has minimal coastal impacts and the least impact on public access.

Huntington Beach is one of several Southern California venues where a world class desalination plant can be built.

*It's time to complete the permitting and contract negotiations, and start construction of the Huntington Beach desalination plant!*

## FINDINGS

In accordance with California Penal Code Sections 933 and 933.05, the 2013-2014 Grand Jury requires responses from the Board of Directors of the Orange County Water District and the Municipal Water District of Orange County affected by the findings presented in this section. The responses are to be submitted to the Presiding Judge of the Superior Court.

Based on its investigation of water reliability and sustainability in Orange County, the 2013-2014 Orange County Grand Jury has arrived at ten principal findings, as follows:

**F.1.** MWDOC's SOC water reliability study objective of a 30 to 60 day emergency supply from local storage will fall short, requiring between 33 and 48 Mgd of additional capacity. Mitigation of this short fall may require the development of a new water source.

**F.2.** The BDCP is an expensive, long-term, ($25 billion in capital and operations over 50 years) plan yet to be approved or funded project to restore the Bay Delta and improve exported water source reliability. The future effects of climate change on water allocations and the vulnerability of the dual, under delta tunnels have not been well defined and should be developed further before MWDOC allocates significant resources to its implementation.

**F.3.** Most of the local and County water sources have been developed and optimized. Some additional capture of ground water and recycling of municipal waste water is in various stages of planning and execution, but these options are progressively more expensive to execute and, by themselves, are not game changers.

**F.4.** OC water quality is widely and frequently monitored by both wholesalers and retailers and, in general, is well within the State standards. Some wells have been contaminated with seawater or industrial chemicals and are either capped or the water is treated on site. All wells and transfer interfaces are frequently monitored for water quality.

**F.5.** The largest, yet to be developed source of local water is the Pacific ocean. Two OC desalination projects are being evaluated by regulatory agencies and OC water districts, Poseidon's 50 Mgd Huntington Beach project and the MWDOC's Doheny Coastal Ocean Desalination Project rated at 15 Mgd potable/15 Mgd barrier injection at Doheny Beach.

**F.6.** The MWDOC imported water supply source and transport infrastructure has been greatly improved, but it is vulnerable to several major events outside of their control. These include flooding or a large earthquake in the Bay Delta which could collapse levees. Quakes could also damage critical infrastructure such as conveyance piping, water treatment plants and pump stations. Contamination of Bay Delta intakes due to the seawater infiltration is a possibility; some say it's likely. Long periods of drought could also result in the depletion of major State reservoir storage which are currently at 50% or less of annual average capacity.

**F.7.** The local OC water supply is less vulnerable to major events because of a number of innovative retail water supplier and OCWD efforts. The primary focus has been on large waste or surface run-off water reclamation, increased winter and emergency storage, conservation and rate pricing strategies, preventative maintenance, back-up and redundant equipment, and a large number of interconnections between district distribution pipelines.

**F.8.** The imported water supply is less vulnerable to earthquakes and long term drought because of a number of recently completed projects such as:

1. Increasing southern California reservoir storage about doubled over the last 10 years and is currently at about 5.5 MAF (million acre-feet, an acre under one foot of water).
2. Upgrading the Diemer imported water treatment plant seismic design.
3. Developing the Diamond Valley reservoir and connecting pipeline to store Colorado River (COR) and State water for emergency use-note that transport piping does not cross the San Andreas Fault and should be less vulnerable to quake caused catastrophic failures.
4. Adding ozone treatment at three water treatment plants for disinfecting potable water.
5. Implementing an extensive conditioned maintenance program for mechanical and electrical equipment including the ability to fabricate, transport and install large diameter pipe spool pieces to repair damaged sections of piping.
6. Negotiating transfer agreements with Imperial and Central Valley agricultural districts for water exchanges and transfers during surplus wet years.

**F.9.** Permitting large water infrastructure construction projects consumes many years, and cuts across many agencies and jurisdictions. Permitting issues are frequently used by stakeholder special interests to manipulate outcomes that are not always consistent with the public's greater good.

**F.10.** The San Diego County Water Authority (SDCWA) has geological, demographic and water import issues which are similar to SOC. They are pursuing similar conservation and storage

projects, but have also committed to water purchases from a large, 50 Mgd desalination plant located in Carlsbad to achieve a more diverse, local water portfolio. Their interest in seawater desalination has primarily been driven by an imported water curtailment of 50% in 1991. It has taken over 10 years and significant public involvement to obtain regulatory approvals. SDCWA has also completed a conceptual engineering study of the feasibility of locating a second large desalination plant at the Camp Pendleton Marine Base.

The Grand Jury recognizes that it lacks jurisdiction over the San Diego Water County Water Authority, but makes the finding merely to demonstrate the complexity of desalination projects and length of time needed for regulatory approval is similar to Orange County. The Grand Jury believes that coordination and advocacy between water districts would be beneficial.

## RECOMMENDATIONS

"In accordance with California Penal Code Sections 933 and 933.05, the 2013-2014 Grand Jury requires (or, as noted, requests) responses from the Board of Directors of the Orange County Water District and the Municipal Water District of Orange County which are affected by the recommendations presented in this section. The responses are to be submitted to the Presiding Judge of the Superior Court."

Based on its investigation of water reliability and sustainability in Orange County, the 2013-2014 Orange County Grand Jury makes the following five recommendations:

**R.1.** MWDOC and OCWD should assemble and finance a strong inter-agency (OCWD, MWDOC, and select retailers) advocacy group to drive the final permitting and construction of several large scale seawater desalination plants with the objective of significantly accelerating the process and shortening project schedules. (**F.1.** through **F.6.),** (**F.10.)**

**R.2.** MWDOC and OCWD should work with legislators, contractors, other stakeholders, and the regulatory agencies to streamline and accelerate the large infrastructure permitting process. The goal should be the development of a one-stop agency capable of representing and adjudicating conflicting or overlapping agency permit requirements. (**F.9.),** (**F.10.)**

**R.3.** MWDOC and OCWD should develop an interconnection process flow network diagram connecting all relevant OC agencies (City, County, and MET) and use it to investigate the impact of "what if" scenarios (various emergency outages due to failed wells and pumping stations, damaged piping, etc.) which could impact local district water supplies. Close coordination of resources and plans is necessary to integrate the local OC water infrastructure. (**F.7.)**

**R.4.** MWDOC should continue to monitor and support the BDCP, but a favorable resolution of water supply allocations and tunnel vulnerability issues is required before significant resources should be expended. (**F.2.**), (**F.8.)**

**R.5.** MWDOC and OCWD should consider merging into a single wholesale agency to better evaluate, coordinate, and integrate more complex strategies involving the allocation and distribution of ground and imported water under emergency and climate change impacts. This merger would facilitate the implementation of Recommendations 1-4. (**F.1.**), (**F.4.**), (**F.6.)**

## REQUIRED RESPONSES

The California Penal Code §933 requires any public agency which the Grand Jury has reviewed, and about which it has issued a final report, to comment to the Presiding Judge of the Superior Court on the findings and recommendations pertaining to matters under the control of the agency. Such comment shall be made no later than 90 days after the Grand Jury publishes its report (filed with the Clerk of the Court); except that in the case of a report containing findings and recommendations pertaining to a department or agency headed by an elected County official (e.g. District Attorney, Sheriff, etc.), such comment shall be made within 60 days to the Presiding Judge with an information copy sent to the Board of Supervisors.

Furthermore, California Penal Code Section §933.05 (a), (b), (c), details, as follows, the manner in which such comment(s) are to be made:

(a) As to each Grand Jury finding, the responding person or entity shall indicate one of the following:

(1) The respondent agrees with the finding

(2) The respondent disagrees wholly or partially with the finding, in which case the response shall specify the portion of the finding that is disputed and shall include an explanation of the reasons therefore.

(b) As to each Grand Jury recommendation, the responding person or entity shall report one of the following actions:

(1) The recommendation has been implemented, with a summary regarding the implemented action.

(2) The recommendation has not yet been implemented, but will be implemented in the future, with a time frame for implementation.

(3) The recommendation requires further analysis, with an explanation and the scope and parameters of an analysis or study, and a time frame for the matter to be prepared for discussion by the officer or head of the agency or department being investigated or reviewed, including the governing body of the public agency when applicable. This time frame shall not exceed six months from the date of publication of the Grand Jury report.

(4) The recommendation will not be implemented because it is not warranted or is not reasonable, with an explanation therefore.

(c) If a finding or recommendation of the Grand Jury addresses budgetary or personnel matters of a County agency or department headed by an elected officer, both the agency or department head and the Board of Supervisors shall respond if requested by the Grand Jury, but the response of the Board of Supervisors shall address only those budgetary /or personnel matters over which it has some decision making aspects of the findings or recommendations affecting his or her agency or department.

Comments to the Presiding Judge of the Superior Court in compliance with Penal Code section §933.05 are required.

Responses to Findings **F.1.**, **F.2.**, **F.4.**, **F.5.**, **F.6.**, **F.8.**, and **F.9.** are required from the Board of Directors of the Metropolitan Water District of Orange County.

Responses to Findings **F.2.**, **F.3.**, **F.5.**, **F.7.**, and **F.9.** are required from the Board of Directors of Orange County Water District.

Responses to Recommendations **R.1.** through **R.5.** are required from the Board of Directors of the Metropolitan Water District of Orange County.

Responses to Recommendations **R.1.** through **R.5.** are required from the Board of Directors of the Orange County Water District.

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## Appendix B – Acronyms

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|---|---|
| AF | Acre-feet, one acre (football field equivalent) under one foot of water |
| AFY | Acre-feet/year, measure of large scale conveyance flows, sufficient for 2.5 households/year |
| BDCP | 2013 Bay Delta Conservation Plan, a water source reliability and restoration plan |
| BPP | Basin production percent, amount of OCWD ground water allocated to purchasers |
| CEQA | California Environmental Quality Act |
| cfs | cubic feet/second, measure of flow in pipe or conveyance systems |
| COR | Colorado River, source for SC district and County aqueduct water |
| EPA | Environmental Protection Agency |
| GWRS | Ground Water Replenishment System, OCWD's 70 Mgpd waste water reclamation Plant |
| MAF | Millions of acre feet, typically refers to storage capacity |
| MET | Metropolitan Water District of Southern California, Wholesale distributor for SWP |
| Mgd | Millions of gallons/day |
| MW | Megawatts of electrical power generation or consumption |
| MWDOC | Municipal Water District of Orange County, imported MET water wholesaler to districts and cities |
| NOC | North Orange County |
| OC | Orange County |
| OCFA | Orange County Fire Authority |
| OCWD | Orange County Water District, owner/operator of the GWRS and SA aquifer |
| Psig | Water Pressure, lbs/square inch |
| RO | Reverse Osmosis, a technology for removing chemicals and salts from water |
| SAR | Santa Ana River |

| | |
|---|---|
| SC | Southern California |
| SDCWA | San Diego County Water Authority, similar function as MWDOC |
| SOC | Southern Orange County |
| SWP | State Water Project, imported Bay Delta water supplier to MET |
| WACO | Water Advisory Committee of Orange |
| WEROC | Water Emergency Response Organization of Orange County |

## Appendix C – Glossary

Aquifer — underground reservoir of stored water in a natural geologic feature comprised of stratified alluvial sand and gravel.

Brackish water — non-potable water with a high mineral and salt content.

Breakeven point — the time at which the estimated annualized cost (operating and amortized capital) of a project equals the cost of an alternative project.

Chloramines — a strong oxidizing compound incorporating chlorine for disinfecting water.

Conditioned maintenance program — a computer program that monitors a large data base of critical equipment and estimates inspection/repair intervals.

Conjunctive Use Agreement — a purchase agreement between wholesale and/or retail agencies for water transfers during surpluses which are used for recharging aquifers and reservoirs, sometimes with the transferee's right to a percent of the transferred water when needed.

Intertie — the connection of two separate water distribution systems to improve reliability.

Mean time to repair — the time required after the detection of an equipment malfunction to obtain parts and materials, and perform corrective maintenance or replacement.

Potable water — water suitable for human consumption and meeting local, State, and federal safety standards.

Purple pipe system — waste water treated to comply with State Standards for Irrigation and distributed through a separate pipeline, primarily used in SOC for large scale irrigation.

Santa Ana river basin or OC aquifer — a large, deep, natural underground water storage area composed of old Santa Ana river alluvial sand and gravel which underlies NOC.

Quantification Agreement — an entitlement agreement between Colorado River water users (Western States and irrigation districts) which prioritizes allocations based on availability and need.

Ozone — a strong oxygen based agent used to disinfect water.

Watershed — an extensive area of land where surface water drains to a common location, a major river, lake, or reservoir.

Well head — the discharge piping located at the top of the well.