

SAN DIEGO COUNTY WATER AUTHORITY EMERGENCY STORAGE PROJECT

Summary

The introduction to the San Diego County Water Authority 2005 Annual Report (http://www.sdcwa.org/about/annual_2005.pdf) states,

For more than 60 years, the San Diego County Water Authority has moved forward with diligence and purpose to carry out its mission of providing a safe and reliable water supply to the San Diego region. The county has seen a dramatic change during that time, from what was considered a Navy town surrounded by rural areas to one of the most thriving counties in the country. As the San Diego region continues to grow and the economy continues to change, the Water Authority has used its expertise and forward momentum to adjust and plan for change. To sustain the quality of life for San Diego County residents, the Water Authority constantly envisions what lies ahead in the region's water future. Through the strategic planning of our member agencies, board of directors, and staff, fiscal year 2005 demonstrated the Water Authority's continued commitment to provide a safe and reliable water supply to the region.

The Water Authority mapped out its strategic plan for meeting water needs over the next 25 years with its Regional Water Facilities Master Plan. The master plan, approved by the board of directors, recommended additional facilities, improvements to existing facilities, and supplies needed cost effectively to meet the Water Authority's mission through 2030. At the end of fiscal 2004, the projects from the master plan were added to the Water Authority's Capital Improvement Program (CIP).

The CIP budget identifies capital needs over a 25-year period. It is updated on a biennial basis, reducing the chance of investment in infrastructure before it becomes necessary. This process separates "Needs" from "Wants" and focuses expenditures at times when funds are available. The board-approved CIP totals approximately \$3.4 billion (2006 estimate).

Major elements of the CIP:

- Pipeline Projects
- System-wide Improvements
- Emergency Storage Projects
- Water Supply Projects

- Flow Control and Pumping Facilities

The 2006-2007 San Diego County Grand Jury elected to study the Emergency Storage Project (ESP) element of the CIP program. The study consisted of review of the San Diego County Water Authority 2005 Annual Report, The Regional Water Facilities Master Plan and related documents, briefing by the Water Authority staff, visits to the Olivenhain reservoir, Lake Hodges reservoir, San Vicente reservoir, San Vicente Pipeline sites, and interviews of key personnel. The findings and recommendations of this report reflect the opinion of this Grand Jury that the San Diego County Water Authority is doing a commendable service for our community by working to provide for emergency water in the event of the interruption of imported water deliveries. This can be considered as an affordable insurance policy for citizens and the multi-billion dollar economy of San Diego County.

PURPOSE

To verify that the Emergency Storage Project work identified in the Regional Water Facilities Master Plan is in fact being carried out by the San Diego County Water Authority in a timely and efficient manner.

PROCEDURE

Visits:

- Visited project work sites including Lake Hodges, Olivenhain Reservoir and San Vicente Reservoir.

Reviews:

- Reviewed the San Diego County Water Authority 2005 Annual Report.
http://www.sdcwa.org/about/annual_2005.pdf
- Reviewed the Regional Water Facilities Master Plan.
<http://www.sdcwa.org/infra/masterplan.phtml>
- Reviewed the San Diego County Water Authority 2005 Urban Water Management Plan.
<http://www.sdcwa.org/manage/pdf/2005UWMP/Final2005UWMP.pdf>
- Reviewed the San Diego County Water Authority Business Plan 2011 (A Rolling 5 Year Plan) Released January 2006.
<http://www.sdcwa.org/news/pdf/BizPlanFINAL.pdf>

Interviews:

- Interviewed Key Members of the County Water Authority Staff.

DISCUSSION

History

San Diego received the water it needed to grow as a result of the work of engineers and politicians plus the pressures of WWII. A brief history can be found in Appendix A.

The San Diego County Water Authority was created by the California Legislature in 1944 to administer the region's Colorado River water rights, import water, and take over the operation of the aqueduct from the Navy. The first imported water arrived in the county in November 1947.

The San Diego Aqueduct was designed as a gravity conduit, tapping the Colorado River Aqueduct of the Metropolitan Water District (MWD) at the westerly portal of the San Jacinto tunnel, and extending in a southerly direction to discharge into San Vicente reservoir. The total length is 71.1 miles, of which 30.4 miles are in Riverside County and 40.7 miles are in San Diego County. The aqueduct from the regulating reservoirs near the San Jacinto tunnel to the San Vicente reservoir consists of pipelines and tunnels which are of sufficient size to carry the full capacity of 185 cubic feet per second. The San Diego Aqueduct was completed and placed in operation in December 1947, providing for about one half of the ultimate capacity needed. Construction of a second pipeline was completed by the County Water Authority in 1954.

The California Aqueduct became the second major aqueduct system to bring water to Southern California. It was completed in 1958. It captures water from the Feather River, funnels it south through the Sacramento River/San Joaquin Bay- Delta, feeds it into the California Aqueduct, pumps it over the Tehachapi Mountains, and delivers it to reservoirs near the Antelope Valley north of Los Angeles.

The quality of water from the Colorado River depreciates each year with regard to total dissolved solids, affecting water hardness, and is approaching unacceptable limits. Therefore, additional river water from the California Aqueduct is needed to improve quality. Other sources of drinking water such as seawater distillation and wastewater reclamation are constantly being evaluated. However, these supplies are either too expensive or not acceptable as potable water.

The subject of this report, the Emergency Water Storage Project (ESP), is a system of reservoirs, pipelines and other facilities to increase emergency storage and pumping capabilities that are critical to the reliability of the water supply. This action will ensure

that the region has enough water and the flexibility to deliver the water during potential disruptions due to drought, earthquakes or other disasters.

The Regional Water Facilities Master Plan identified in the summary had its beginnings much earlier as the result of continuous upgrade of plans and studies.

The following is quoted from the San Diego County Water Authority Website for ESP information.

http://sdcwa.org/infra/esp_faq2.pdf

In 1989, the San Diego County Water Authority embarked on a Capital Improvement Program. The CIP was initiated to make improvements to the Water Authority's pipeline delivery system and to increase its operational flexibility in supplying water throughout the county. Included in the \$3.4 billion CIP is the \$970 million Emergency Storage Project, a system of reservoirs, pipelines, and other facilities that work together to store and move water around the county in the event of an interruption in imported water deliveries. Since the Water Authority imports up to 90 percent of the region's water supply from the Metropolitan Water District of Southern California, an earthquake, drought, or other disaster could interrupt San Diego County's imported water supply for up to six months. Some communities would be without water within three to four days.

The Emergency Storage Project connects existing sources of water in San Diego County, enabling water to flow throughout the system even in the event a disaster disrupts the region's imported water supply. The project provides an additional 90,100 acre-feet of water storage capacity. The Emergency Storage Project is projected to meet the county's emergency needs through 2030.

“Emergency Storage Project Components

- The 318-foot-high Olivenhain Dam and 24,000-acre-foot reservoir (*completed in 2003*)
- A pipeline connecting the new Olivenhain Reservoir to the Water Authority's second aqueduct (*completed in 2002*)
- A pipeline connecting the new Olivenhain Reservoir with Lake Hodges (*in progress*)
- A pipeline connecting San Vicente Reservoir to the Water Authority's second aqueduct (*under construction*)
- Raising San Vicente Dam by at least 54 feet to provide additional water storage
- Five new pump stations
- Related facilities

The ESP Schedule

“Phase One (1998 - 2003)

- Olivenhain Dam
- Olivenhain Pipelines and Power line
- Olivenhain Pump Station, Surge Control Pipe

“Phase Two (2002 - 2009)

- San Vicente Pipeline
- San Vicente/Moreno-Lakeside Interconnect Pipeline
- San Vicente Pump Station
- San Vicente Surge Control Facility

“Phase Three (2004 - 2008)

- Lake Hodges Pipeline
- Lake Hodges Pump Station
- Pipeline 3 Pump Station and Interconnection
- Pipeline 4 Pump Station

“Phase Four (2008 - 2012)

- San Vicente Dam Raise
- San Vicente Recreational Facilities
- Operations Center Upgrade”

Improving Water Reliability

The following is quoted form the San Diego County Water Authority Website for Lake Hodges information.

http://sdcwa.org/infra/pdf/LakeHodges_FactSheet.pdf

The Lake Hodges projects are an important part of the Emergency Storage Project and will increase the amount of water available within the county for use during emergencies. There are three components to the projects – an underground pipeline, a pump station with an inlet-outlet structure, and a power line and substation. Construction began in 2005 and will be completed in 2008. Nestled in a coastal canyon south of Escondido, Lake Hodges is used for a variety of recreational activities as well as providing drinking water to nearby communities.

Lake Hodges is owned and operated by the city of San Diego. The 130-foot-high Lake Hodges Dam was built in 1917 and holds up to 30,250 acre-feet of water. When full, the lake has a surface area of 1,234 acres. Fed solely by local rainwater, Lake Hodges cannot maintain a consistent water level and is subject to both flooding and drought, depending on weather conditions.

The San Diego County Water Authority identified Lake Hodges as a component of its region wide Emergency Storage Project in a 1996 environmental study. The Lake Hodges pipeline will connect the new Olivenhain Reservoir with Lake Hodges, thereby linking it with the Water Authority's imported water delivery system and allowing water to move between the two reservoirs. The pipeline provides various benefits, including the ability to store 20,000 acre-feet of water at Lake Hodges for use during an emergency, keep the reservoir at a more consistent level, and capture water before it periodically spills over Lake Hodges Dam and into the ocean during rainy seasons.

Construction Components

The Lake Hodges Pipeline tunnel will be 5,800 feet long with a diameter of up to 12 ½ feet. The pipe inside the tunnel will measure 10 feet in diameter. The first 500 feet of the tunnel, which starts from the Olivenhain Reservoir in Escondido, was tunneled in advance of the rest of the pipeline and before the reservoir was filled. This eliminated the need to lower the reservoir water level later. The Lake Hodges pump station will be built to help move water to and from Lake Hodges. The pump station will be mostly below ground with an aboveground structure measuring 30 feet wide, 50 feet long and 18 feet high. The inlet outlet structure and pipe will be 15 feet in diameter and will connect the pump station and Lake Hodges. The pump station will generate electricity (40-megawatt capacity) by use of pump turbines, capturing energy created when the water runs downhill by gravity from the Olivenhain Reservoir to Lake Hodges. The electricity generated will be transmitted to an outdoor switchyard located adjacent to the pump station, then to a new 1/4-mile-long power line that will connect to the existing local transmission system. The captured energy will provide revenue to defray the cost of operating the facilities at Lake Hodges and other Water Authority programs that ensure a reliable water supply for the county. The Water Authority provides information to update nearby communities about the Lake Hodges Projects and welcomes all comments and questions about the projects.

The Carryover Storage Project

A project associated with the ESP is the Carryover Storage Project (CSP). The CSP has an effect on the San Vicente Dam raise construction. The Water Authority's Regional Water Facilities Management Plan (RWFMP) identifies the need for additional water storage capacity to improve water supply reliability for the region. The Water Authority is currently conducting environmental reviews of project alternatives, including a possible expansion of the San Vicente Reservoir. Combining the two requirements and making the San Vicente Dam raise a single construction project makes good sense, both technically and financially. The CSP would add 100,000 acre-feet (af) to the 52,000 af already scheduled as the San Vicente portion of the ESP.

The Water Authority has identified three main reasons for carryover storage:

Enhanced water supply reliability - Carryover storage provides a reliable and readily available source of water during periods of potential shortage, such as dry years.

Increase system efficiency - Carryover storage provides operational flexibility to serve above normal demands, such as those occurring in dry years, from storage rather than by the over-sizing of the Water Authority's imported water transmission facilities.

Better management of water supplies - Carryover storage allows the Water Authority to accept additional imported deliveries during periods of availability, such as during wet years, to ensure water availability during dry years.

The Water Authority receives delivery of State Water Project (SWP) supplies from the Metropolitan Water District (MWD), which can be significantly influenced by the need to protect environmental resources in the Sacramento River/San Joaquin Bay-Delta region. This protection requires that the State Water Project reduce deliveries in dry years, but similarly allows for increased deliveries during wet years. Efficient management of this system therefore requires carryover storage to absorb the annual fluctuations in supply.

In July, 1998 an article in the *U.S. Water News Online* provided a simple functional description of what has become the Emergency Storage Project. The following is quoted from *U.S. Water News Online* archives.

<http://www.uswaternews.com/archives/arcsupply/8autdir7.html>

SAN DIEGO --The San Diego County Water Authority board of directors today approved construction of a system of reservoirs, pipelines, and other facilities that will help meet the region's emergency water needs well into the 21st century.

The Emergency Water Storage Project will add 90,100 acre-feet in additional storage capacity within the county -- the largest such increase since San Vicente Reservoir was completed in 1944. (One acre foot is about 326,000 gallons -- enough water to meet the average household needs of two families for one year.)

Combined with storage space already dedicated to emergency use, the additional capacity will meet the county's emergency needs through at least 2030, according to Authority projections. The project also will result in new pipelines and pump stations to deliver the water during emergencies throughout the Authority's 909,000-acre service area.

The project will cost \$554.2 million in today's dollars. The action by Authority directors increased the Authority's capital budget by \$730 million, a figure that takes into account anticipated inflation over the project's life.

Adoption of the project and other Authority programs will increase the average household water bill in San Diego County by about \$2.30 per month by 2003 and by about \$5 per month by 2010, according to Authority projections.

The project calls for the authority to construct a new reservoir in the Olivenhain area and connect it with nearby Lake Hodges. In addition, the Authority will expand San Vicente Reservoir. All three facilities will be connected with the authority's second aqueduct, which extends north from the Riverside County line to Lower Otay Reservoir in the South County.

The water will be reserved for use when any of the Authority's five pipelines are out of service or lack of supply forces the agency to reduce normal deliveries to any part of its service area by at least 25 percent. The Authority serves 97 percent of San Diego County's residents.

The Authority imports water from the Colorado River and Northern California waterways in aqueducts that cross three earthquake faults and the flood-prone San Luis Rey River before reaching San Diego County. A major earthquake or flood will cut the region off from imported water deliveries for between two and six months.

“A catastrophe of this magnitude would leave San Diego totally dependent on water stored south of the earthquake breaks until repairs are made, but the county's local supplies would not be adequate in such a case, says Authority General Manager Maureen A. Stapleton.

"An emergency that cuts off our imported water supply will affect everyone who lives here and damage our \$87 billion regional economy," Stapleton said. "Our Emergency Water Storage Project will ensure that the San Diego region has enough water to withstand a prolonged disruption of normal water deliveries without suffering sustained economic and environmental damage."...

The project has been authorized on both the federal and state levels. Authority directors in 1996 certified the project's environmental impact report, which is required by California law. Last year, the U.S. Army Corps of Engineers issued a permit for the project under Section 404 of the federal Clean Water Act.

The Corps' record of decision, which was based on information compiled in the Authority's environmental impact statement, found the Authority's project to be technically feasible, economically justified, environmentally acceptable, and in the public interest.”

The Authority has adopted agreements with the city of San Diego regarding joint use of San Vicente and Lake Hodges and with the Olivenhain district concerning joint use of the Olivenhain reservoir.”

The Capital Improvement Program (CIP) schedule and budget have changed slightly since the above article was written. in July 1998. The project was divided into four phases and work started in 1998.

Phase I - Olivenhain Dam and Reservoir. Those tasks have been completed on time and within budget in August, 2003.

Phase II - San Vicente Pipeline. Construction is in process. Completion is scheduled for 2008.

Phase III - Lake Hodges. Tasks are in construction or final design. Completion is scheduled for 2008.

Phase IV - San Vicente Dam Raise. Tasks are in early design. A change in scope to include the Carryover Storage Project is underway. Completion is now targeted for 2012.

Costs have grown on Phase II, III, & IV as a result of increased worldwide demand for high quality steel; an increased demand in San Diego County for concrete and an increased demand for skilled labor to keep up with local building activity and changes in scope (e.g. addition of the Carryover Storage Project) of the CIP.

The estimates and inflation factors used by the Water Authority to establish a cost basis in 1998 have proven to be wrong for a variety of reasons. However, the estimating methods and cost-escalation forecasting have been improved and now appear to be tracking “real world” pricing. Rate payers throughout the County will still be paying for all of the work being done. The cost of the water delivered to each of the water companies in the service area contains a charge for all of the projects in work. For 2007 this charge is about 5% of the commodity portion of the average household monthly billing. The water costs from Metropolitan Water District (MWD) will likely increase by about 5.3% per year over the next 12 years if nothing changes. The Water Authority is trying to cut back on MWD supplies by bringing water online from the Coachella Canal and the All-American Canal Lining projects and Imperial Irrigation District (IID) transfer supplies. In the meantime the Water Authority continues to work with MWD to keep rate increases at a justifiable minimum.

In addition to developing better “should cost” estimates, the Water Authority has developed a strategy in conjunction with other agencies to coordinate when they actually bid projects. A spokesman stated that the Water Authority has joined with the San Diego Association of Governments (SANDAG), the California Department of Transportation (CALTRANS), the San Diego County Regional Airport Authority, the County of San

Diego, the Port Authority and other agencies that build large projects to coordinate their job schedule and contracting announcements. By releasing the requests for bids in this way, the competing construction companies will have fewer large jobs to bid on at the same time. This should allow each company to do a better job of estimating and submitting a workable bid.

The Water Authority has also developed a Contractor Outreach Program that seeks to boost competition and lower bid costs by promoting San Diego as a region of choice for business opportunity; making future projects visible through open house events; and soliciting contractor input to improve the bidding and contracting process.

FACTS/FINDINGS

Fact: The Capacity of the ESP is established as approximately 92,000 acre-feet of water stored as follows:

San Vicente: 52,000 + acre-feet

Hodges: 20,000 acre-feet

Olivenhain: 20,680 acre- feet

Finding: The capacity was established as a best estimate of the water required to provide usable service to the County for up to 6 months. Two months is thought to be adequate for emergency repair of earthquake damaged supply lines.

Fact: The San Vicente pipeline connection between Aqueduct One (the eastern 71.1 mile branch) and Aqueduct Two (the western branch), plus the associated pumps and controls, will allow water to be transferred throughout the region instead of by gravity flow from the north to the south.

Finding: The current aqueduct system is gravity-fed and can only deliver water from high elevations in the north to lower elevations in the south. The San Vicente pipeline and associated pumps and controls should allow water to be transferred throughout the system. This pipeline and pump system also makes it possible to use the San Vicente Reservoir for additional storage. (Carryover Storage Project)

Fact: The Olivenhain Dam is the first Roller Compacted Concrete (RCC) dam in California. At a height of 318 feet, it is taller than any other RCC in the United States. The Olivenhain Dam is also the first new dam in California in 50 years.

Finding: The thorough testing and analysis program that preceded the construction of the Olivenhain Dam cleared the RCC method for use in this large structure. Not only did the test confirm the usability of the granite quarried on site, it also reduced the

requirement to interrupt work to allow for concrete bonding. The RCC process saved both time and money and is expected to be used for the San Vicente Dam raise.

Fact: The pipeline that connects Lake Hodges with the Olivenhain Reservoir allows local supplies of water collected in the lake, in addition to the 20,000 acre-feet stored in the lake to be used to meet emergency demands.

Finding: The Lake Hodges Dam, originally completed in 1918, captures the drainage area of 303 square miles. The water collected in heavy rain years has exceeded the capacity and escaped over the spillway. The interconnecting pipeline should allow any captured water to be transferred to the Olivenhain Reservoir and then to the aqueduct system rather than being lost over the spillway. The condition of the water currently in Lake Hodges is of concern to the residents of the Olivenhain water district. Some treatment or filtering process will probably be necessary before actual water transfer can proceed.

Fact: The pipeline and pump/generator system being installed between Lake Hodges and the Olivenhain Reservoir allows Lake Hodges to store 20,000 acre-feet of water that can be transferred to Olivenhain Reservoir for distribution throughout the aqueduct system.

Finding: In addition to stabilizing the level of Lake Hodges the pump system can move water to the Olivenhain Reservoir during low electrical power usage at night and generate electricity when the water is returned to Lake Hodges. Thus, the pump system acts as both a base load for the power grid and a 40 megawatt peaking plant. The revenue from hydroelectric power generated will help to cover the cost of installation as well as maintenance of the system.

Fact: The San Vicente Dam raise will use the same RCC technique applied in the construction the Olivenhain Dam. The current plan is aimed at accommodating the volume increase required for both the ESP and the CSP for a total of 152,000 acre-feet, an increase of 100,000 acre-feet.

Finding: In October 2006 the Water Authority and the U.S. Army Corps of Engineers as co-leads began the process of preparing the environmental impact report and the environmental impact statement (EIR/EIS) for the carryover storage project at San Vicente. The proposed action would raise the San Vicente Dam 63 feet higher than the approved emergency storage project dam raise. The construction, if approved, would raise the dam 117 feet as a single project. The work is schedule to begin in 2009 and completed in 2012.

Fact: The construction of the 11 mile long San Vicente pipeline tunnel is underway. The large-diameter pipeline connects the San Vicente Reservoir in Lakeside to the Water Authority's second aqueduct west of Interstate 15. The construction is scheduled to be completed in early 2009.

Finding: The pipeline is being built in a tunnel, using state of the art tunneling machines, at a depth ranging from 50 to 600 feet underground. The tunnel will not pass directly under any homes. Tunneling, rather than cut-and-cover trenching, enables the Water Authority to build the pipeline with fewer impacts to land surfaces and the surrounding communities.

RECOMMENDATIONS

The 2006-2007 San Diego County Grand Jury recommends that the San Diego County Water Authority:

07-23: Continue to refine the cost estimating process on all of the ongoing and future projects to provide reasonable “should cost” figures for purposes of finance planning and bid review.

COMMENDATIONS

The San Diego County Water Authority is a public agency serving the region as a wholesale supplier of water. The Water Authority works through its 24 member agencies. The cooperative effort of many dedicated people was required to bring the Emergency Storage Project into being and to its current state of completion. The ESP is a work in progress and represents an insurance policy that safe, reliable water will be available to support the region’s economy, the job base, and the quality of life for the more than three million residents, even if the primary water supply lines are temporarily disrupted. The members of the Board of Directors and staff involved with this project deserve a vote of thanks for following through on addressing a decades old concern.

REQUIREMENTS AND INSTRUCTIONS

The California Penal Code §933(c) 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 §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 therefor.
- (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 therefor.
- (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 authority. The response of the elected agency or department head shall address all 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 the Penal Code §933.05 are required from the:

<u>Responding Agency</u>	<u>Recommendations</u>	<u>Date</u>
San Diego County Water Authority	07-23	08/13/07

Web Sources

¹http://www.sdcwa.org/about/annual_2005.pdf

²<http://www.sandiegohistory.org/journal/2002-1/sholders.htm>

³http://www.sdcwa.org/infra/esp_faq2.pdf

⁴http://sdcwa.org/infra/pdf/LakeHodges_FactSheet.pdf

⁵<http://www.uswaternews.com/archives/arcsupply/8autdir7.html>

⁶www.sdcwa.org/infra/masterplan.phtml

⁷<http://www.sdcwa.org/manage/pdf/2005UWMP/Final2005UWMP.pdf>

⁸<http://www.sdcwa.org/news/pdf/BizPlanFINAL.pdf>

APPENDIX A

The following history was written by one of our Grand Jury members for The Winter 2002 issue of the *Journal of San Diego History*, Volume 48, Number 1 Titled Water Supply Development in San Diego and a Review of Related Outstanding Projects by Mike Sholders². The article is reprinted here with the permission of the *Journal of San Diego History*. The brief history describes how San Diego County ended up with enough usable water to support its current population.

People create cities near water to maximize opportunities for commerce, recreation, and most importantly to ensure drinking water for the population. In San Diego County, natural streams and lakes are very small, compared to other large cities, and most are in the coastal range many miles from the metropolitan area.

San Diego is classified as a semiarid section of the United States and has so little annual rainfall that the agricultural area is continuously dependant upon irrigation. The average annual rainfall on the County's coastal plain over the last 150 years is about 10 inches. Mountain streams provide only a limited and extremely variable water supply. Many reservoirs have been constructed to store water for use in dry years and to provide regulation of water flow. Only a few watersheds have reliable groundwater, and their wells provide only a small percentage of the water needed for the County's large agricultural producers.

Fortunately, the early pioneers and community leaders planned for and constructed water supply facilities that were necessary to sustain the County's population. They also had the vision to recognize the need for imported water from the Colorado River and other sources. The planning and construction of water supply facilities for sufficient imported water has been a serious issue that still remains today.

This article addresses the history of the planning and construction of the major water supply facilities that make San Diego one of the finest and most desirable cities in the world. Also, it will emphasize the role and importance of civil engineering to the water supply development in San Diego County.

The history of water utilization in San Diego County may be broken down into four periods: the Mission Period (1769-1834), the Early California Period (1835-1885), the Boom Period (1886-1895), and the Present Day Period or Planned Development (1869 to the present).

The Mission Period, from 1769 to 1834, was characterized by the efforts of the Franciscan missionaries to obtain water for the Mission San Diego de Alcala and for the Presidio. There were many attempts to obtain a good source of water supply. The first was water from the dug wells in the gravels of the San Diego River. Later efforts to obtain a good supply included ditches with sand and brush diversion dams and storage of

water in small reservoirs and cisterns. These efforts culminated in the construction of the Padre Dam (Old Mission Dam) in 1816, a brick and mortar storage and diversion dam near the head of Mission Gorge and an aqueduct to carry the waters to the Mission and the Mission lands. The Padre Dam itself is still in existence. However, since its completion, some portions of the dam have been destroyed by floods.

The Early California Period, from 1835 to 1885, is best characterized by the lack of any coordinated or planned development of a water supply. From 1834 to 1872, almost all water was obtained from dug and drilled wells, both in the San Diego River and the New Town (downtown San Diego) area. In 1873, the first planned development of water was started, with the incorporation of the San Diego Water Company. During the early years of the company, water was still pumped from wells and distributed to consumers in both San Diego and Old Towns.

The Boom Period of 1886-88 saw San Diego's population grow at tremendous rate, and the entire population seemed to think that San Diego and the County area were going to continue growing rapidly. Developers, investors, and speculators planned immense water conservation projects and, within a period of fourteen years, formed many water-related companies. These ventures included: the San Diego Land and Town Company in 1881, the Otay Water Company in 1886, Linda Vista Irrigation District also probably in 1886, the San Diego Flume Company in 1886, the Mount Tecarte Land and Water Company in 1897, the Pamo Water Company in 1888, and the Southern California Mountain Water Company in 1895.

There were numerous other plans that never had a name or reached the incorporation stage. Engineering achievements during this period include the building of the Sweetwater Dam and distribution system and the Cuyamaca Dam and flume. After the completion of Cuyamaca Dam and flume, water was purchased from the San Diego Flume Company and distributed to the populace.

A more planned period of development began after the boom was over. Only three of the companies listed above survived the drought of 1895-1904; the Otay Company, the Flume Company, and the Mountain Water Company. However, the plans of those that failed pointed the way to later developments. In fact, all the major reservoirs that are being considered for development at the present time, or that have been built, were a part of the plan of at least one of those original companies.

At the turn of the last century, the City of San Diego began purchasing some of the properties of the existing water companies to ensure a reliable water supply for its population. In 1901, the City purchased the facilities of the San Diego Water Company that lay within the City limits for \$600,000. In February, 1913, it purchased the Barrett-Otay System from the Southern California Mountain Water Company for \$2,500,000. In 1920, the City began purchasing water from the San Dieguito Mutual Water Company.

Five years later, it purchased the San Dieguito system from the San Diego County Water Company for \$3,750,000.

The City of San Diego also began building water projects itself. In 1913, the City built the Mission Valley pumping station. The following year the Bonita pipeline, eight miles of 28-inch riveted steel pipe, was installed. During the 1916 flood, the Otay reservoir dam, built of rock fill with a steel plate core, was overtopped and destroyed. In 1917 and 1918, the Otay reservoir dam was replaced with a gravity section concrete arch dam 145 feet high. Then, over the period of 1921 to 1923, Barrett Dam, a gravity section concrete arch dam 171 feet high, was constructed. The Lakeside-University Heights pipe line, 17 miles of 36-inch lock joint riveted steel pipe, was installed in 1927. In that same year, the Lakeside and Riverview pumping plants were installed. Work was undertaken in 1927 through 1931 to improve the spillway at Hodges Dam. In 1928, a water filtering plant was built in University Heights, with sixteen gravity filter units. The lower Otay-San Diego second main pipeline was installed in 1929, with 8.1 miles of 40-inch electric welded steel pipe, another 8.1 miles of 36-inch pipe. The El Capitan Dam, a fill-rock embankment, 217 ft. high, was completed in 1935 at a cost of \$3,000,000. These are just a few of the projects that provided a reliable water supply to San Diego County.

Early in the last century, planners began looking for sources of water beyond the local watersheds. Civil Engineers began working on the development of the Colorado River as early as 1902, when Congress enacted the Reclamation Act. A special appropriation was awarded to the Bureau of Reclamation in 1914, for intensive studies of the river basin. Civil Engineers in the U.S. Geological Service provided the basic data needed from stream gauging stations that were used to predict the amount of water available for conservation and development purposes. These studies were completed and a report compiled by the Bureau of Reclamation Project Engineer, John T. Whistler, in March, 1919.

More funds were made available for further studies in May, 1920 and the Chief Engineer for the Bureau of Reclamation, Frank E. Weymouth, directed further investigations. This resulted in a famous report known as the Fall-Davis Report that was submitted to the Senate in 1922. This report recommended the construction of the All- American Canal to serve Imperial Valley and the construction of Boulder Dam, later known as the Hoover Dam. This report was the substance of the Swing-Johnson bill authored by Senator Hiram E. Johnson and Congressman Phil Swing of California. Weymouth prepared a report in February, 1924 that fixed the site of the Boulder Dam at Black Canyon. This report caught the attention of Engineers and political leaders in southern California and resulted in the formation of the Metropolitan Water District in 1928. Mr. Weymouth became the first Chief Engineer and General Manager of the Metropolitan Water District.

The Colorado River Compact was developed in 1922 by another engineer, Herbert Hoover, who was then the Secretary of Commerce. This Compact apportioned the use of the Colorado River water between its upper and lower basins, with the point of division at

Lees Ferry. The upper basin states are Wyoming, Colorado, Utah and New Mexico. The lower basin states are Nevada, Arizona and California. The apportionment to each of the states was to be 7,500,000 Acre Feet per year for beneficial consumption, with a further grant to the lower basin states to increase their use by 1,000,000 acre feet per year. Arizona refused to ratify the Compact, so it applied just to the other six states. A provision in the final version limited the use of California to 4,400,000 acre feet per year, plus not more than one half of the surplus water not apportioned. The six states ratified the Compact by 1929, and the Boulder Dam Project was adopted by Congress, with the provision that applied, at the time, only to the six states. Herbert Hoover, now president, issued the final proclamation on Mar 6, 1929. Arizona finally ratified the Compact in February, 1944.

The San Diego City Council first discussed the necessity for drawing water from the Colorado River on July 25, 1921. Dr Elwood Mead, the Director of the Bureau of Reclamation was very supportive of the idea and defined the many benefits that the City could derive by filing for a permit to obtain Colorado River water. On May 18, 1923, the Boulder Dam Association supported this concept. This group consisted of many influential citizens in southern California, and John L. Bacon, Mayor of San Diego was its first president. Following a systematic and effective campaign of public education, the demand for action was culminated on April 18, 1926, when Bacon signed an application to the State Division of Water Resources for the right to deliver 112,000 acre feet per year from the Colorado River. This application was later broadened to include the County of San Diego.

Two contracts assured the benefits of the Hoover Dam and Lake Mead to the City and County of San Diego. The first, the result of much effort by San Diego's Civil Engineer H.H. Savage, was executed on February 15, 1933 and provided 250,000 acre feet of capacity in Lake Mead and for the delivery of 112,000 acre feet per year to San Diego at a point in the river immediately above Imperial Dam. The second achievement by Mr. Savage, in co-operation with Congressman Phil D. Swing, dated October 2, 1934, provided for the construction of a diversion dam, main canal and appurtenant structure for the all American Canal to satisfy the 153 cubic feet per second (cfs) allotment of lake-river water for San Diego.

Construction of an aqueduct to bring Colorado River water to the Los Angeles area began as soon as work on Boulder Dam was under way. As financed and constructed by the Metropolitan Water District of Southern California, the Colorado River Aqueduct is designed, with some ultimate enlargement, to deliver 1500 cfs to the District's present fourteen constituent areas and to other areas that may become annexed to the District. The Aqueduct was completed and placed under operation in 1941, at a cost of \$190,000,000.

However, this did not get the water to San Diego. World War II caused a great increase in water consumption in San Diego, and it became imperative to bring in Colorado River

water as soon as possible. The Bureau of Reclamation completed studies in 1943, comparing the costs of two possible connections for linking with the Los Angeles area aqueduct. An office was opened in Escondido and field surveys were completed.

In early 1945, military establishments, war industries, and war housing projects were using over 50 per cent of the water being delivered to consumers from the San Diego water system, and a threatened shortage in the City water supply had become a problem of national importance. An interdepartmental committee was appointed by the President of the United States to study the water supply of the city and to recommend a plan for securing a supplemental supply. The report of the Committee was published as Senate Document No. 249, 78th Congress, 2nd Session. It recommended the immediate construction by the Federal Government of an aqueduct connecting with the Colorado River Aqueduct near San Jacinto, with the War Department, the Navy Department and the Federal Works Agency bearing the cost (estimated at \$17,500,000). The recommended emergency aqueduct was to have a design capacity of 85 cfs. Tunnels and other permanent structures were to be constructed with a design capacity of 165 cfs, provided the bids to be received for such portions of the project indicated an increase of cost no greater than would warrant this action. The report further recommended “that the San Diego County Water Authority or the City of San Diego continue and press negotiations with the Metropolitan Water District of Southern California to the end that an equitable arrangement be worked out, which would make possible permanent service by way of route 1 (the emergency aqueduct connection) in order that the value and permanent utility of the emergency work may be realized, and to protect against the possibility of an interruption in the supplemental water supply on the termination of the war emergency.” The committee’s report and recommendations, dated October 21, 1944, were accepted by the President of the United States. Directives were issued to the departments concerned to proceed with construction. After overcoming some opposition from other Federal Agencies, construction began in the fall of 1945.

The San Diego Aqueduct was designed as a gravity conduit, tapping the Colorado River Aqueduct of the Metropolitan Water District at the westerly portal of San Jacinto tunnel, and extending in a southerly direction to discharge into San Vicente reservoir. The total length is 71.1 miles, of which 30.4 miles are in Riverside County and 40.7 miles are in San Diego County. The aqueduct from the regulating reservoirs near the San Jacinto tunnel to the San Vicente reservoir consists of pipelines and tunnels which are of sufficient size to carry the full capacity of 185 cubic feet per second. The San Diego Aqueduct was completed and placed in operation in December 1947, providing for about one half of the ultimate capacity needed. Construction of a second barrel was completed by the County Water Authority in 1954 and a second aqueduct was completed in 1958.

One unique feature of the San Diego Aqueduct is that the elevation at the Lake Mathews Metropolitan Water District connection is so high that all of the deliveries to the member agencies are by gravity so that pumping is never required. The quality of water from the Colorado River depreciates each year with regard to total dissolved solids, affecting

water hardness, and is approaching unacceptable limits. Therefore, further river water from the California Aqueduct is needed to improve quality. Other sources of water such as seawater distillation and wastewater reclamation are constantly being evaluated. So far, these supplies are either too expensive or not acceptable as potable water.

The San Diego County Water Authority, consisting of five cities, three irrigation districts and one public utility district, was organized June 9, 1944, under an enabling act of the California State Legislature known as the County Water Authority Act. The primary purpose was to import Colorado River water to San Diego County. The Water Authority staff consists of 34 Board Members and a staff of Engineers that occupy a \$16,000,000 facility in San Diego and a smaller field office in Escondido. These engineers and staff are busy planning new projects that will improve the reliability of the system to accommodate the predicted population to the year 2050.

The California Aqueduct became a second major aqueduct system to bring water to Southern California. It captures water from the Feather River, funnels it south through the Sacramento/San Joaquin Bay-Delta, feeds it into the California Aqueduct, pumps it over the Tehachapi Mountains, and delivers it to reservoirs near the Antelope Valley north of Los Angeles. This aqueduct, also called the State Water Project launched a bitter north-south controversy. Northern Californians asked, "Why should the southerners be allowed to steal our water?" Southern Californians countered, "It's not their water; it's California's water and we're all Californians. Eventually, under the leadership of Governor Pat Brown, the State Water Project was built, and it started delivering water to Southern California. With that new resource, both the County Water Authority and the Metropolitan Water District could make good on their commitments to provide water to new areas - for a while. One controversial component of the original plan, a "Peripheral Canal" around the environmentally sensitive Delta, was never built. As a result, the State Water Project has never delivered as much water as originally intended. The effort to find an alternative method to deliver the full contracted amount continues to this day. Concern over environmental and ecological degradation in and around the Delta complicates the problems. During the 1990's, Governor Pete Wilson and President Bill Clinton initiated an unprecedented collaboration of state and federal agencies, as well as urban, agricultural, and environmental groups, to develop a long-term solution that restores the Bay-Delta as both a reliable water supply and a healthy habitat for fish and wildlife. This collaborative body became known as the Cal Fed Bay-Delta Program. San Diego County hopes to benefit from that solution with a more reliable water supply and higher-quality drinking water.

Since the State Water Project supplemented water supplies from the Colorado River, San Diego County now relies on imported water for 75 to 95 percent of its total supply. In 2002, almost three million people living and working in San Diego County depend upon the County Water Authority to make the investments necessary to secure and deliver a reliable water supply. The Authority and its member agencies finance and maintain the water supply and delivery system necessary to support the near 90 billion a year economy

and quality of life enjoyed in San Diego County. Significant milestones in planning for the future include a water conservation and transfer agreement between County Water Authority and the Imperial Irrigation District that will provide up to 200,000 acre feet per year until the year 2073. This agreement represents that largest long-term water transfer in the U.S. history. Also part of future planning is the Emergency Water Storage Project, a system of reservoirs, pipelines and other facilities to increase emergency storage and pumping capabilities critical to the reliability of water supply. This action will ensure the region has enough water and flexibility to deliver the water during potential disruptions due to draught, earthquakes of other disasters.

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