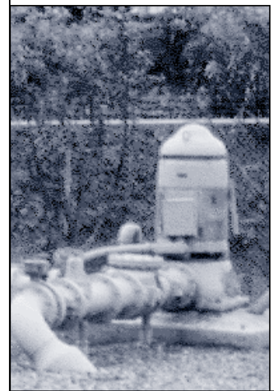
SECTION 4 – LOCAL WATER SUPPLIES



Although imported water meets the majority of the region's needs, local resources are also an important component of the water resources mix. Local resources provide the Authority and its member agencies with highly reliable water, under local control, with more price certainty than is provided by Metropolitan, the Authority's main supplier of imported water. Additionally, capital investments in local supplies, in the long-term, will result in lower cost sources once associated debt service is retired.

Local resources include surface and groundwater supplies, recycled water, demand management (water conservation) measures, and in the future, desalinated seawater. This section describes the existing and future local supplies for the San Diego region. The estimates for future local supplies included in this section could be even greater depending upon a variety of factors such as, increased funding opportunities, technology advances and cost-effectiveness of local projects.

Before 1947, the San Diego region relied upon local surface water runoff in normal and wet weather years, and upon groundwater pumped from local aquifers during dry years, when stream flows were reduced. As the economy and population grew, local resources were not sufficient to meet the region's water supply needs. From the 1950's onward, the region became increasingly reliant on imported water supplies. Since 1980, a range of 5 to 30 percent of the water used within the Authority's service area has come from local sources, primarily from surface water reservoirs that have yields varying directly with annual rainfall. A small but growing share of local supply comes from recycled water and groundwater recovery projects. In 1998-99, total local water sources provided 25 percent of the water used in the Authority's service area. Water conservation and demand management measures represent another type of local resource. By making more efficient use of existing water supplies, area residents and industries can reduce the need for imported water supplies.

4.1 DEMAND MANAGEMENT

4.1.1 Description

Demand management, or water conservation, is frequently the lowest-cost resource available to the Authority and its member agencies. Water conservation is a critical part of the Authority's 2000 Plan and long-term strategy for meeting the water supply needs of the San Diego region. The goals of the Authority's water conservation program are to: reduce demand for more expensive, imported water; demonstrate continued commitment to the Best Management Practices (BMPs) and Agricultural Efficient Water Management Practices (EWMPs); and to ensure a reliable future water supply.

Best Management Practices

The California Urban Water Conservation Council (CUWCC) was formed in 1991 through a Memorandum of Understanding Regarding Urban Water Conservation in California (MOU). The urban water conservation practices, or BMPs, included in this MOU are intended to reduce California's long-term urban water demands. **Table 4-1** provides an overview of the Authority and its member agencies' progress in the implementation of the recently updated BMPs as outlined by the CUWCC. The Authority's FY1999 and FY2000 BMP Report is included in **Appendix D**. Major Authority activities include: active participation in the development and implementation of statewide BMPs; participation with member agencies, Metropolitan and American Water Works Association Research Foundation in research and development activities; and implementation of public information and education programs.

Implementation of BMPs

Since program inception, the Authority and its member agencies have provided incentives for the installation of 383,948 ultra-low-flow toilets (ULFTs). Financial incentives have also been provided for installation of 4,479 residential high-efficiency clothes washers (HEWs) and 1,707 coin-operated HEWs. The Authority, member agencies and San Diego Gas and Electric (SDG&E) have also distributed over half a million showerheads to customers. Since 1990, the Authority has spent close to $9 million on implementation of these and other conservation programs.

The Authority's FY200 budget includes $1.2 million for conservation programs that are anticipated to save 38,000 AF/YR over the useful life of the measures. This funding is augmented by Authority member agencies, the USBR, SDG&E, and Metropolitan. In FY2000 this additional funding totaled $5.1 million. Therefore, the total amount expected to be spent during FY2000 for all conservation programs is $6.3 million. The Authority provides approximately 19 percent of all conservation funding. The Authority and its member agencies also administer both the Agriculture Audit Program and California Irrigation Management Information Systems (CIMIS) for agricultural use. Additional information on implementation of the BMPs by the Authority is available in **Appendix D**, CUWCC BMP Report.

TABLE 4-1
BEST MANAGEMENT PRACTICES FOR URBAN WATER CONSERVATION IN CALIFORNIA

BMP #	DESCRIPTION	CONSERVATION PROGRAMS	COMPLIANCE
1	Residential Surveys	• Residential Survey Program	Yes
2	Residential Plumbing Retrofit	• Showerhead distribution	Yes
3	Distribution System Water Audits		Yes
4	Metering with Commodity Rates		Yes
5	Large Landscape Programs and Incentives	• Professional Assistance for Landscape Management (PALM) Program • Protector Del Agua	Yes
6	High-Efficiency Clothes Washer Rebates	• Residential High-Efficiency Clothes Washer (HEW) Program	Yes
7	Public Information Programs	• Media Coverage • Xeriscape Awards • WebSite • Water Conservation Literature	Yes
8	School Education Programs	• Classroom Presentations • Splash Science Mobile Lab • Youth Merit Badge Program • Magic Show • Teaching Garden • Mini-grants of up to $250	Yes
9	Commercial, Industrial & Institutional (CII) Water Conservation	• CII Voucher Program	Yes
10	Wholesale Agency Assistance Programs	Ongoing	Yes
11	Conservation Pricing	Ongoing	Yes
12	Water Conservation Coordinator	Water Resources staff	Yes
13	Water Waste Prohibition		Yes
14	Residential ULFT Replacement Programs	• Residential ULFT Voucher and Rebate Programs • Community Based ULFT Distribution Program	Yes

4.1.2 Issues

Revenue Impacts

Water conservation is a well established component in ensuring that there will be a reliable water supply in the future for the increasing population and commerce of our local region. However, conservation occasionally suffers from the perception that it reduces commodity-based rate revenues. Over the long-term, conservation measures actually serve to defer or limit rate increases by reducing the region's need for other, more expensive supplies and increased infrastructure. The Authority's FY2001 budget included $1.6 million for conservation programs, which represents an average cost of $3.00/AF of projected water sales during FY2000.

4.1.3 Future Water Conservation Savings

Projected water savings and effectiveness provided in the 2000 Plan are based on industry standard methodologies for calculating savings, as defined by CUWCC. The Authority assists the CUWCC in conducting pilot programs and analyzing ways to increase the accuracy of savings calculation methodologies. It is projected that the implementation of existing and proposed urban BMPs would produce water savings of approximately 93,000 AF/YR by the year 2020 within the Authority's service area. (**Table 4-2**)

TABLE 4-2
POTENTIAL WATER CONSERVATION SAVINGS THROUGH 2020 WITHIN AUTHORITY SERVICE AREA

BEST MANAGEMENT PRACTICES	2005 AF	2010 AF	2015 AF	2020 AF
EXISTING BMPs				
Residential Surveys	1,100	1,100	1,100	1,100
Plumbing Retrofits	8,100	8,100	8,100	8,100
New Residential Construction	6,800	10,900	14,100	17,300
Main Line Leak Detection	13,230	18,320	18,360	19,310
Large Landscape Audits	1,400	1,600	1,900	2,200
Commercial, Industrial & Institutional	1,100	1,100	1,100	1,100
Residential Landscape	900	900	900	900
ULFT Incentives	20,800	28,280	31,240	31,240
Clothes Washer Incentives	1,000	3,000	4,000	5,000
Subtotal	54,430	73,300	80,800	86,250
PROPOSED BMPs				
Appliance Efficient Standards	200	560	2,060	6,400
Car Wash Retrofits	250	500	500	500
Greywater 200	30	40	40	50
Subtotal	470	1,100	2,600	6,950
TOTAL	54,900	74,400	83,400	93,200

This conservation target is appropriate for the current staffing and funding levels set by the Authority's Board of Directors. Additionally, this target coincides with the availability of anticipated member agency, Authority and/or Metropolitan funds. The estimates presented in **Table 4-2** are based on savings projections from implementation of various conservation measures. Updated SANDAG demographic information is also used to determine savings through BMP implementation. This data is incorporated into the Authority's revised demand forecast as discussed in **Section 2.4**.

Some of the BMPs that are not quantified in **Table 4-2** such as public information and school education do not directly result in water savings. These BMPs instead result in a decision by a water user to take an action that will result in savings. For example, a water user may learn about the availability of showerheads through a public information program, but water will not be saved until the user installs a water saving showerhead, available through the plumbing retrofit program. To avoid double counting, the projected savings from the showerhead is reflected only in the plumbing retrofits BMP.

The Authority is a leader of innovative programs in water conservation. Efforts have been so successful, however, that many of the conservation programs which were implemented in the early 1990's are maturing. There are additional measures that could be taken to achieve further water savings. Commercial, Industrial, and Institutional (CII), residential, and landscape are areas where such measures have not been implemented to their fullest potential.

Landscape

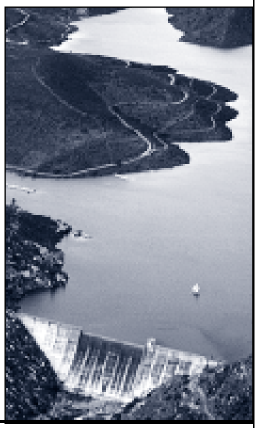
Additional landscape water savings can potentially be achieved through both incentives and mandated regulations/rates. Future potential incentives include: vouchers for purchase of improved efficiency irrigation devices; additional conservation literature; expanded water user efficient irrigation training programs; more landscape audits and increased support for member agency landscape design demonstration gardens. More aggressive enforcement of the landscape design standards included in State Assembly Bill 325 regulations could be pursued. Additionally, the Authority's member agencies could be encouraged to consider retail rate structures and water budgets that incorporate pricing signals designed to sway residential customers to make decisions that lead to increased landscape water use efficiency. Finally, water budgets and pricing signals could be encouraged for CII customers as well.

Commercial, Industrial, & Institutional

There is a potential to achieve additional savings from CII water users. Participation in the existing CII Voucher Program could potentially be increased with an enhanced marketing effort. Additionally, maximum per device voucher incentives could be increased when cost effective. The CII Voucher Program could also be expanded to include additional devices, like water efficient commercial dishwashers and multi-load HEWs. Finally, opportunities may exist to enhance participation in the Commercial HEW Program through very targeted marketing.

Residential

Installation of hot water on demand systems in new homes could be investigated. Additionally, incentives for undersink hot water demand systems for existing homes could be explored. The Residential HEW Program could be expanded, and if



appropriate, the per machine voucher amount could be increased. While the Residential ULFT Program has reached a significant portion of the homes in the Authority's service area, untapped markets may exist. An effort to identify those markets and overcome any obstacles to participation could be undertaken.

Finally, the Authority and its member agencies will continue to cooperate with the CUWCC and Metropolitan to identify future opportunities for water conservation savings.

4.2 SURFACE WATER

4.2.1 Description

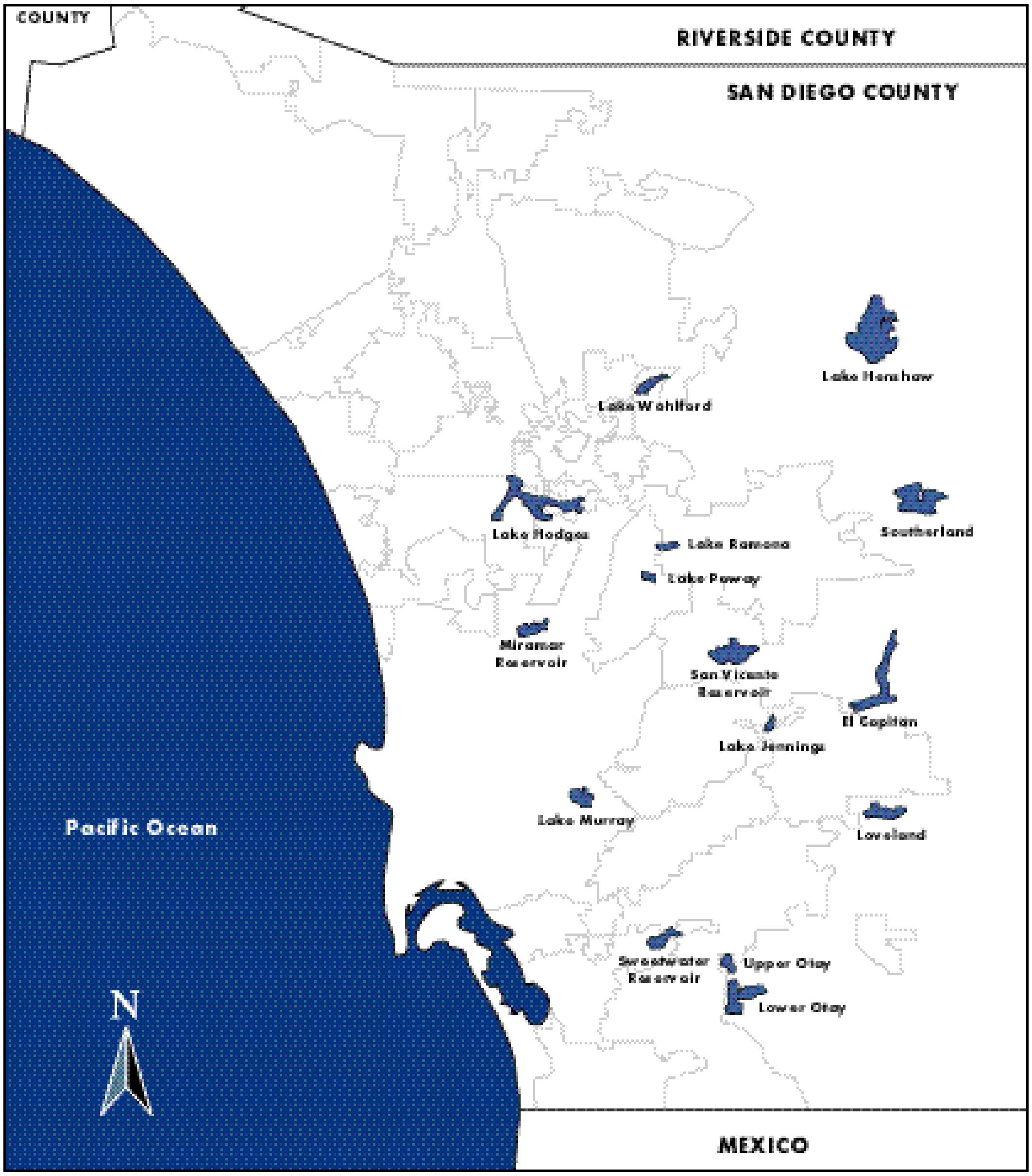
Seven major stream systems originate in the mountains of San Diego County and drain into the Pacific Ocean. Runoff within these watersheds has largely been developed over the last century. Twenty-four surface reservoirs are located within the Authority's service area, with a combined capacity of approximately 571,000 AF. **Table 4-3** lists the largest reservoirs in the county, which have a combined storage capacity of approximately 556,000 AF. The Sutherland Reservoir, which was completed in 1953, was the last major reservoir completed in the Authority's service area (**Section 1.4.1** describes work proceeding on construction of a new reservoir as part of ESP). **Figure 4-1** shows the location of several local reservoirs.

TABLE 4-3
MAJOR SAN DIEGO COUNTY RESERVOIRS

MEMBER AGENCY	RESERVOIR	CAPACITY (AF)
City of Escondido	Wohlford	6,506
*City of Poway Lake	Lake Poway	3,200
City of San Diego	Barret	37,947
*†City of San Diego	El Capitan	112,807
‡City of San Diego	Hodges	33,550
*City of San Diego	Miramar	7,185
City of San Diego	Morena	50,207
*City of San Diego	Lower Otay	49,510
*City of San Diego	San Vicente	90,230
City of San Diego	Sutherland	29,685
Helix W D	Cuyamaca	8,195
*Helix WD	Jennings	9,790
*Ramona MWD	Ramona	12,000
Sweetwater Authority	Loveland	25,400
*Sweetwater Authority	Sweetwater	28,079
Vista ID	Henshaw	51,774
Total Storage- 16 Major Reservoirs		556,065

* Connected to Authority aqueduct system
† Imported water can be delivered via San Vicente
‡ System connection is proposed as part of the Emergency Storage Project

FIGURE 4-1
MAJOR SAN DIEGO COUNTY RESERVOIRS



4.2.2 Issues

Optimization of Reservoir Operations

The management of the region's extensive reservoir system to achieve the optimal use of local and imported water is an important element of resources planning. Local surface water supplies can be used to offset dry-year shortfalls in imported water. However, water use records indicate that local reservoirs are generally operated to maximize the use of local supplies in wet and normal years to reduce the need for imported water purchases. While this mode of reservoir operation reduces losses due to evaporation and spills, it also results in increased demands for imported water during dry years, when imported water is more likely to be in short supply. Many local reservoirs could be operated to maintain carry-over storage, but this would tend to decrease their average annual yield.

4.2.3 Future Surface Water Supplies

Surface water supplies represent the largest single local resource in the Authority's service area. However, annual surface water yields can vary substantially due to fluctuating hydrologic cycles. Since 1980, annual surface water yields have ranged from a low of 33,000 AF to a high of 174,000 AF. For planning purposes, local surface water supplies are assumed to have a dependable yield of 25,000 AF and a normal yield of 85,600 AF (based on a historic 24-year average). Table 4-4 shows the projected average surface water supply within the Authority's service area.

TABLE 4-4
PROJECTED SURFACE WATER SUPPLIES
NORMAL YIELD (AF/YR)

2005	2010	2015	2020
85,600	85,600	85,600	85,600

4.3 WATER RECYCLING

4.3.1 Description – Water Recycling

Water recycling is defined as the treatment and disinfection of municipal wastewater to provide a water supply suitable for non-potable reuse. Non-potable reuse is the term applied to recycled water used for non-drinking water purposes. Examples range from landscape irrigation to recreational impoundments. Agencies in San Diego County use recycled water to fill lakes, ponds, and ornamental fountains; to irrigate parks, campgrounds, golf courses, freeway medians, community greenbelts, school athletic fields, food crops, and nursery stock; to control dust at construction sites; and to recharge groundwater basins. Recycled water can also be used in certain industrial processes and for flushing toilets and urinals in non-residential buildings. As an example, the newly constructed detention facility in the Otay Mesa area of San Diego County was dual-plumbed to allow use of recycled water for toilet and urinal flushing. However, current regulations allow only new buildings to be dual-plumbed for this specific use. Additional uses for recycled water are being identified and approved as local agencies and regulators become comfortable with its use.

Water recycling is an important component of the area's local water resources. A number of agencies in the San Diego region continue to implement and expand their water recycling projects. Currently, about 13,700 AF of recycled water is beneficially reused within the Authority's service area annually. Approximately 94 percent of the water is used for agriculture, landscape irrigation, and other M&I uses; the remaining 6 percent is recharged into groundwater basins.

4.3.2 Issues

There are a number of issues that local agencies have to consider when developing recycled water projects. These include economic and financial considerations, water quality, regulatory, institutional, and public acceptance. These issues, if left unresolved, can limit the amount of wastewater that can be recycled in San Diego County. Recycled water development issues are discussed in greater detail below.

Economic and Financial Considerations

The capital intensive cost of constructing recycled water projects has traditionally been a barrier to project implementation. The up-front capital cost for construction of treatment facilities and recycled water distribution systems can be expensive, while full market implementation is usually phased in over a number of years, thus effecting the cash flow in the early project years. This situation is compounded by the seasonal nature of recycled water demands. Recycled water demands tend to peak during the hot summer months and drop off during the winter months when landscape irrigation demands are low. Projects that serve a large portion of irrigation demands, like the majority of the projects in the Authority's service area, often utilize only half of their annual production capacity due to these seasonal demand patterns. The costs of these projects tend to be higher than those of projects that serve year-round demands, since the project facilities must be sized to accommodate seasonal peaking. Projects that serve mostly irrigation demands also tend to have less stable revenue bases, since irrigation demands are heavily influenced by hydrologic conditions.

There are significant benefits to implementing a water recycling project and as uncertainty over purchasing imported supplies from Metropolitan increases in the future, recycling projects become more economically viable.

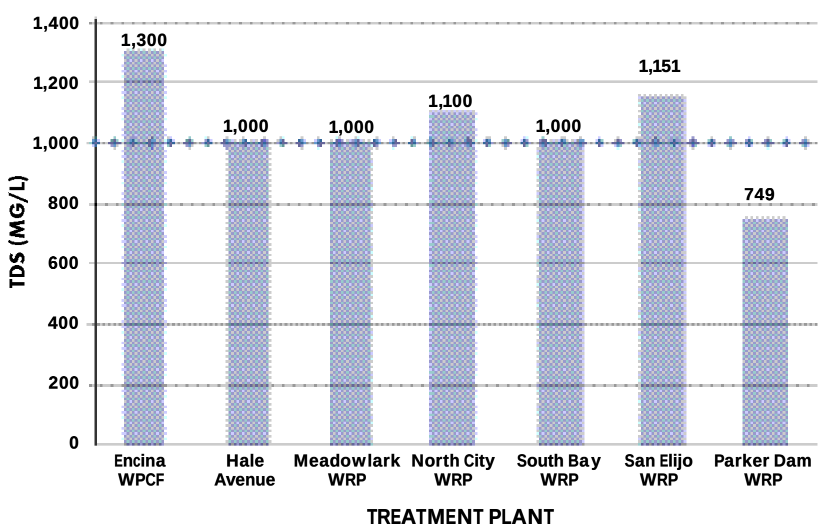
To be financially feasible, a project's benefits must offset or exceed its associated costs. Project benefits can take the form of: (1) revenues from the sale of recycled water; (2) increased supply reliability; (3) increased control over the cost of future water supplies; (4) avoided water and wastewater treatment, storage, and conveyance costs; and (5) financial incentives from the Authority, Metropolitan, and federal and state agencies. Agencies developing recycled water projects must be able to quantify these benefits in order to determine the financial feasibility of a project. Many of the economic issues can be offset in the long term through investment in a supply that when debt service is retired only operating costs remain, thus making it a low-cost supply. When the long-term economics are considered along with the increased reliability, water recycling is a viable option.

Water Quality

Water quality, as it pertains to high salinity supplies, is another significant issue. As described in the **Section 3.1.3**, Metropolitan's historic deliveries to the Authority have consisted primarily of Colorado River water, which has a high salinity content, expressed in terms of TDS. High TDS source water poses a special problem for water recycling facilities because conventional treatment processes are designed to remove suspended, but not dissolved, particles. TDS removal, or demineralization, requires an advanced treatment process, which can significantly increase project costs.

Residential use of water typically adds 200 to 300 mg/l of TDS to the wastewater stream. Self-regenerating water softeners can add another 60 to 100 mg/l. Infiltration of brackish groundwater into sewer lines can also cause an increase in TDS. If an area receives a water supply that has a TDS of more than 700 mg/l, and residents add 300 mg/l or more through normal use, the recycling facility will produce recycled water with a TDS concentration of 1,000 mg/l or higher. **Figure 4-2** shows the average TDS at several of the existing and projected water recycling treatment plants. In general, TDS over 1,000 mg/l becomes problematic for irrigation and industrial reuse customers. This greatly limits the potential uses and marketability of recycled water, particularly for agricultural purposes, because certain crops and nursery stock cannot be irrigated with high-TDS water.

FIGURE 4-2
TREATMENT PLANT AVERAGE EFFLUENT TDS (MG/L)



One of the actions included in Metropolitan's 1999 Salinity Management Study, to reduce the salinity impact on water recycling development, is establishment of a TDS concentration objective of 500 mg/l in Metropolitan's distribution system. Metropolitan has been able to maintain the 500 mg/l objective since initiation of the objective in April 1999. Although Metropolitan has adopted the 500mg/l TDS objective, there is no guarantee, due to natural events and other factors, that Metropolitan will be able to continuously meet the objective, thus putting this sizeable investment in recycling projects at risk.

Regulatory

There are two state agencies primarily responsible for regulating the application and use of recycled water; the State Department of Health Services (DHS) and the California Regional Water Quality Control Board (Regional Board). Planning and implementation of water recycling projects could entail numerous interactions with these regulatory agencies prior to project approval.

The DHS establishes the statewide effluent bacteriological and treatment reliability standards for recycled water uses in Title 22 of the California Administrative Code. Under Title 22, the standards are established for each general type of use based on the potential for human contact with recycled water. The highest degree of standards is established for recycled water used for unrestricted body contact.

The Regional Board is charged with establishing and enforcing requirements for the application and use of recycled water within the state. Permits are required from the Regional Board for each water recycling operation. As part of the permit application process, applicants are required to demonstrate that the proposed recycled water operation will not exceed the ground and surface water quality objectives in the Basin Plan and is in compliance with Title 22 requirements.

A regulatory issue that will hinder development of projects is the DHS groundwater recharge rule that requires treatment prior to injection of recycled water in order to reduce the total organic carbon (TOC) concentration to less than 2.0 mg/l. This would increase the cost and thereby limit development of groundwater recharge.

Institutional

One of the primary institutional issues, related to the development of water recycling in San Diego County, is interagency coordination. The most common example is where the wastewater agency that produces the recycled water is not the water purveyor within the reuse area. Effective communication and cooperation between both agencies regarding distribution of recycled water and providing service to the water customer is vital and should begin early in the planning process.

These institutional arrangements require the establishment of contracts and/or agreements between the parties and/or agencies involved. The terms of these agreements are established on a case-by-case basis. The agreements usually define reporting and compliance responsibilities, the amount of water deliveries, water pricing, and financing plan that identifies which agency will be receiving financial incentives.

Public Acceptance

Without public acceptance it would be difficult for any agency to site, finance, construct, and operate a water recycling project. It has been found that the most successful means to obtain public acceptance is through education and involvement. Agencies in the San Diego region have formed citizen advisory groups and held public workshops in order to get the public more involved in development of their projects.

4.3.3 Encouraging Recycled Water Development

The Act requires agencies to describe in their plan the actions, including financial incentives, which may be taken to encourage the use of recycled water. **Table 4-5** summarizes a list of the programs used by the Authority's member agencies to assist and encourage development of recycled water. A description of the major programs is also included. Some of these programs are developed by the water recycling agencies while others, such as the funding programs, are primarily provided by the Authority, Metropolitan, and state and federal agencies.

TABLE 4-5
PROGRAMS TO ENCOURAGE RECYCLED WATER USE

Incentive Programs • Reclaimed Water Development Fund (Authority) • Local Resources Program (Metropolitan)
Grants • Title XVI Funding Program (Bureau) • Proposition 13 Grant (State of California)
Low Interest Loans • Financial Assistance Program (Authority) • State Revolving Fund (State of California) • Water Reclamation Loan Program (State of California) • Proposition 13 Loan (State of California)
Long-Term Contracts (Price/Reliability)
Rate Discounts
Public Education/Information
Regional Planning
Model Water Reclamation Ordinance • Dual Plumbing Standards • Prohibits Specific Potable Water Uses
Guidance Documents • Model Rules and Regulations for Recycled Water Service • Construction Specifications for Recycled Water Systems • Recycled Water Retrofit Guidelines • Recycled Water User's Manual

Funding Programs

One of the most significant pieces in creating a successful recycling project is diversified funding and funding partnerships. The Authority has focused on providing and facilitating the acquisition of outside funding for water recycling projects as a very high priority. The several programs detailed in this section are critical success factors in the implementation of water recycling in San Diego County.

There are a number of financial assistance programs available to San Diego County agencies that include: the Authority's Financial Assistance Program (FAP) and Reclaimed Water Development Fund (RWDF); Metropolitan's Local Resources Program (LRP); the USBR Title XVI Grant Program; and the SWRCB low-interest loan programs. Together, these programs offer funding assistance for all project phases, from initial planning and design to construction and operation. Financial assistance programs administered by the Authority, Metropolitan, and the USBR provided $12 million to San Diego County agencies during the fiscal year ending June 30, 1999.

<u>Financial Assistance Program</u> As an impetus to begin local projects, the Authority offers the FAP to encourage, through the provision of matching funds, facility planning, feasibility investigations, preliminary engineering studies, environmental impact reports, and research projects related to water recycling and groundwater development. Since its inception in June 1988, the FAP has provided local agencies more than $1.8 million for water recycling studies and nearly $797,000 for groundwater development studies. Agencies receiving FAP funds are required to reimburse the Authority when implementation of the project results in funding from other sources, such as the LRP or RWDF, or within five years of certification of the project environmental report, whichever occurs first.

<u>Reclaimed Water Development Fund</u> In response to significant up-front costs of many water recycling projects, the RWDF, adopted by the Authority's Board of Directors in April 1991, contributes up to $100/AF of beneficial reuse for recycling projects that demonstrate a financial need. This contribution is to offset costs, especially in the early years of project start-up. In order to qualify, project expenses must exceed project revenues. To date, the Authority has entered into RWDF agreements for ten projects with a combined ultimate yield of 32,000 AF/YR. In FY2000, the Authority provided local agencies $704,810 in RWDF incentives. These funds are received after projects are operating.

<u>Local Resources Program</u> Metropolitan also has a program that currently underwrites local projects during the initial years of operation. Metropolitan's local resources program provides subsidies of up to $250/AF for recycled water and groundwater development projects. Historically, while San Diego area agencies received funding from these programs, it was far less than San Diego area ratepayers paid to Metropolitan on account of Metropolitan subsidy programs. Metropolitan

is developing a new rate structure and the availability of the LRP for new projects is uncertain; the Authority will consider whether it would be better served to expand existing programs for local area agency funding on its own account.

The Reclamation Wastewater and Groundwater Study and Facilities Act – Title XVI
The Title XVI Grant Program is a significant source of funding for San Diego area recycling projects. Title XVI of Public Law 102-575, the Reclamation Wastewater and Groundwater Study and Facilities Act, authorizes the federal government to fund up to 25 percent of the capital cost of authorized recycling projects, including the San Diego Area Water Reclamation Program, an inter-connected system of recycling projects serving the Metropolitan Sewage System service area. PL104-266, the Reclamation Recycling and Water Conservation Act of 1996, authorized two additional projects in northern San Diego County: the North San Diego County Area Water Recycling Project and the Mission Basin Brackish Groundwater Desalting Demonstration Project. To date, the USBR has obligated more than $38 million in Title XVI funds for San Diego projects, including more than $10.1 million obligated during Federal Fiscal Year (FFY) 1999. The FFY2000 Budget includes an additional $12.1 million for San Diego area projects.

State Revolving Fund / Water Reclamation Loan Program The State Revolving Fund (SRF) and the Water Reclamation Loan Program (WRLP) provide agencies with low-interest construction loans for water recycling and groundwater projects. The SRF and WRLP loans carry an interest rate equal to 50 percent of the state's general obligation bond interest rate. This below-market interest rate can result in substantial savings on debt service. In November 1996, Proposition 204 was approved by the voters and provided $80 million for the SRF and $60 million for WRLP. Proposition 13, approved by the voters in March 2000, provides an additional $40 million for low-interest loans and grants for design and construction of water recycling projects to the existing water recycling funding program. Combining this with loan repayments from prior loans and funds remaining from Proposition 204, over $100 million is available.

Policies, Ordinances, and Guidance Documents

The Authority has adopted a number of policies, guidance documents, and a model ordinance to assist local agencies with water recycling project implementation. Many local agencies have adopted the Authority-sponsored ordinance. The ordinance includes provisions that typically require new development projects to install recycled water systems. The ordinance also states that where allowed by law and available in sufficient quantities, at a reasonable cost and quality, recycled water shall be the sole water supply delivered for non-potable uses.

Water recycling guidance documents available from the Authority include, Model Rules and Regulations for Recycled Water Service, Construction Specifications for Recycled Water Systems, Retrofit Guidelines, and a recycled water user's manual.

Training

The Authority, in partnership with other water agencies, offers a one-day certified course designed to provide irrigation supervisors with a basic understanding of recycled water. Completion of the Recycled Water Site Supervisor Training fulfills the training requirement as mandated by regulatory authorities. The class provides information to supervisors on the water recycling process, recycled water quality and safety issues, the duties and responsibilities of the supervisor, landscape irrigation fundamentals, maintenance and management, and cross connection control shut-down tests and inspections. Understanding similarities and differences between recycled and potable water is important to the successful operation of a recycled water system.

The first class started in 1993 with 14 participants. At this time over 500 participants have been certified. Instructors include a state registered environmental health specialist and environmental assessor, water quality chemist/reclamation specialist and landscape specialists.

Optimizing the Use of Recycled Water – Regional Perspective

While local agencies typically expand and develop their respective recycled water projects independently based on local interests, the Authority is conducting a study that will identify opportunities to expand the region's recycled water projects and develop a regional system or systems that could maximize reuse on a regional scale. This study, named the "Regional Recycled Water System Alternatives Analysis (Regional Recycling Study)" is scheduled for completion in early 2001. The Regional Recycling Study will identify opportunities to develop a regional recycled water system(s) that would potentially utilize Authority and local agency facilities. The USBR is conducting a similar study, on a much larger study area, called the "Southern California Comprehensive Water Reclamation and Reuse Study (SCCWRRS)." The SCCWRRS was started about five years ago and is in its final phase. It is due for completion by the end of year 2000. The Authority's Regional Recycling Study will build on work from SCCWRRS and has a more focused and detailed objective than SCCWRRS. The two studies will be closely coordinated and the Authority's Regional Recycling Study will utilize the data previously collected for the SCCWRRS.

4.3.4 Future Recycled Water Use

As noted previously, San Diego agencies currently beneficially reuse about 13,700 AF/YR of recycled water, primarily for groundwater recharge, landscape irrigation and other industrial, and commercial uses. The region's demand for recycled water is projected to increase to about 45,100 AF/YR in 2010 and about 53,400 AF/YR in 2020. **Figure 4-3** shows the location of the recycled water treatment plants. **Table 4-6** displays the total projected recycled water use anticipated through the year 2020 within the Authority's service area. These projections were provided by the local agencies implementing the projects. **Table E-1** in **Appendix E** includes detailed information on the recycling projects, including the sponsoring agency, location, projected supply, and type of reuse.

TABLE 4-6
PROJECTED RECYCLED WATER USE (AF/YR)

2005	2010	2015	2020
33,400	45,100	51,800	53,400

4.3.5 Wastewater Generation, Collection, Treatment and Disposal

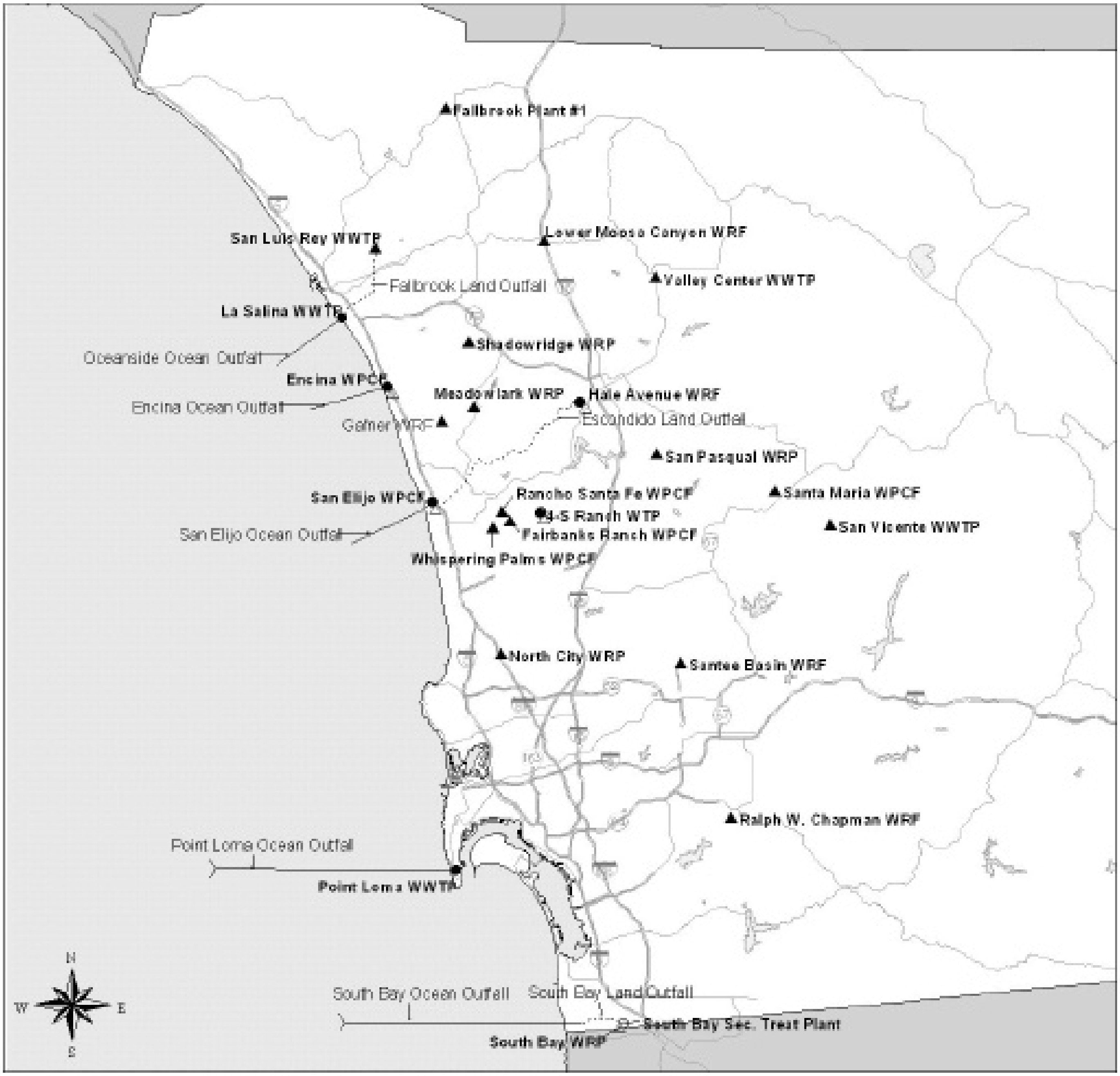
As required by the Act, the following is a review of the collection, treatment, and disposal of wastewater within the Authority's service area. Approximately 300 million-gallons-per-day (mgd) of wastewater is currently being generated, collected, and treated. Most of the large wastewater treatment plants are located along the coast for easy and convenient access to an ocean outfall. These plants serve most of the San Diego region's highly urbanized areas. Figure 4-3 identifies the location of the wastewater treatment plants and the associated outfall systems. The coastal location of the plants is not always conducive to development of recycled water. Most of the market for recycled water is located at higher elevations making it costly to construct distribution systems to serve the customers. A detailed list of the wastewater treatment plants within the county, showing their capacities at various levels of treatment, average effluent TDS, and type of disposal is included in **Table E-2**, **Appendix E**. In addition approximately 10 to15 mgd of wastewater within the Authority's service area generated and disposed of through private systems such as septic tanks.

4.4 GROUNDWATER

4.4.1 Description

Agencies within the Authority's service area currently use about 24,000 AF of groundwater annually. In addition, private well owners also draw on local basins for their water supplies, which offset imported water demands. The amount of groundwater pumped by private wells is suspected to be significant, but has not to date been accurately quantified for the region.

FIGURE 4-3



Existing
- ● Wastewater Treatment Plant
- ▲ Water Recycling Plant

Proposed
- ○ Wastewater Treatment Plant
- △ Water Recycling Plant

Outfalls
- Land Outfall
- Ocean Outfall

Source: SDCWA, SANDAG, CH2MHill

5 0 5 10 15 Miles

San Diego County Wastewater Treatment and Water Recycling Facilities

San Diego County Water Authority WATER RESOURCES GIS

Groundwater supplies in the Authority's service area are limited by both the geology and the semi-arid hydrologic conditions of the region. Narrow river valleys with shallow alluvial deposits are characteristic of many of the more productive groundwater basins. Additionally, irrigation with saline imported water and over pumping has led to excessive salinity in many of the most promising basins. Outside of these alluvial basins, much of the geology consists of fractured crystalline bedrock and fine-grained sedimentary deposits that are generally capable of yielding only small amounts of groundwater to domestic wells. One notable exception is the San Diego Formation, located in the southwestern portion of the county. This large and complex aquifer shows promise for groundwater recharge and recovery. However, additional hydrogeologic investigations must be completed before the aquifer's groundwater development potential can be fully determined. **Figure 4-4** shows the location of the principal alluvial groundwater basins located within the Authority's service area.

Although groundwater supplies are less plentiful in the San Diego region than in some other areas of Southern California, such as the Los Angeles Basin, sufficient undeveloped supplies exist to help meet a portion of the region's future water needs. Several agencies within the Authority's service area have identified potential projects that could provide an additional 35,000 AF/YR of groundwater production in the coming years, although the total development potential may be several times greater. The potential projects can be grouped into three categories:

<u>Groundwater Extraction and Disinfection Projects</u> These projects are generally located in basins with higher water quality levels, where extracted groundwater requires minimal treatment for use as a potable water supply. Examples of this type of groundwater project includes projects currently operated by USMC Camp Pendleton, Yuima MWD, and the Sweetwater Authority (National City Well Field). The unit cost of water produced from simple groundwater extraction and disinfection projects is generally well below the cost of imported water. Because most of the higher quality groundwater within the Authority's service area is already being fully utilized, a relatively small amount of this "least cost" groundwater is available for the development of new supplies.

<u>Brackish Groundwater Recovery Projects</u> Brackish water is typically found in basins which have been impacted by imported water irrigation or by seawater intrusion resulting from the overdraft of coastal basins. Brackish groundwater recovery projects use desalination technologies, such as reverse osmosis (RO), to treat extracted groundwater to potable water standards. The City of Oceanside's 2 mgd Mission Basin desalter is an example of a brackish groundwater recovery project, as well as Sweetwater Authority's existing 4 mgd Richard A. Reynolds Groundwater Demineralization Facility. Unit costs for brackish groundwater recovery projects are considerably higher than those for simple groundwater extraction projects due to the additional treatment requirements, including concentrate disposal needs.

FIGURE 4-4

San Diego County Water Authority WATER RESOURCES GIS

Principal Aquifers in Western San Diego County

Groundwater Recharge and Recovery Projects Recharge projects improve groundwater basin yields by supplementing natural recharge sources with potable or possibly recycled water. Projects proposed in the San Pasqual Basin, the Lower San Dieguito Basin, and the Lower Santa Margarita River are good examples. In addition, the potential for groundwater storage and recovery in the San Diego Formation near the San Diego Bay and the Mission and Bonsall Basins located in the Lower San Luis Rey River Valley are under evaluation (See **Figure 4-4**).

4.4.2 Issues

Economic and Financial Considerations

Because of the saline nature of the groundwater basins in San Diego County, the cost of groundwater development usually includes demineralization, which can be costly to construct and operate. However, because treated groundwater is suitable for all potable uses, groundwater recovery projects face less variation in demand than recycling projects and do not require the construction of separate distribution facilities. In addition, reductions in the cost and operation of low pressure RO membranes have made the demineralization of saline groundwater less expensive and these types of projects are continuing to be more cost-effective and competitive with the development of other supplies. Projects dependent on natural recharge sources, such as surface runoff, can be affected by local hydrologic conditions, which are highly variable and therefore provide less supply reliability than recycled water projects. Therefore, agencies are pursuing development of conjunctive use projects that rely in part on imported or recycled water as a source of recharge to increase reliability. Additionally, project costs could be optimized through the purchase of imported and recycled water during off-peak periods when supplies are more plentiful and prices are lower. After retirement of debt service, these projects may be the lowest cost option available.

Institutional, Legal Issues, Water Quality Issues

Institutional and legal issues can be another obstacle to project development. Because most basins contain multiple water agencies and numerous private wells, water rights are a primary concern. Agencies are often reluctant to implement groundwater development projects unless jurisdictional and water rights issues are resolved beforehand.

Uncertainty over future regulatory requirements for drinking water supplies can pose another barrier to project development. When developing facilities and compliance plans for groundwater recharge projects, agencies must take into account proposed or potential regulatory changes related to water quality issues. Some of the regulations for which changes are expected over the next decade include: (1) state and federal drinking water standards; (2) federal storm water regulations; and (3) DHS groundwater recharge regulations.

Environmental Regulatory Constraints

Regulatory issues related to environmental protection are common to many of the groundwater projects proposed within the Authority's service area. They include potential impacts from groundwater pumping to endangered species or groundwater-dependent vegetation. Such impacts may occur if a project results in seasonal or long-term increases in the depth to groundwater. Although potential environmental impacts can generally be mitigated, mitigation costs can reduce the cost-effectiveness of a project. Concentrate disposal requirements for brackish groundwater recovery projects can also be a constraint for projects sited in inland basins without access to an ocean outfall.

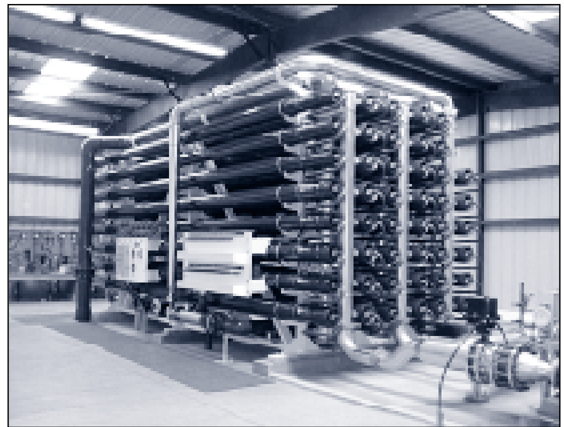
4.4.3 Future Groundwater Supplies

In an effort to inventory existing and proposed groundwater use, the Authority prepared the 1997 Groundwater Report. This report surveyed existing groundwater use, and evaluated planned projects and projects that were currently under study in the Authority's service area at that time. The report estimated a possible annual production (including some recovery of stored imported water) of 92,000 AF. Since then, project planning has continued and project concepts have been revised and/or refined. Current project planning by the Authority's member agencies is reflected in **Table E-3**, **Appendix E**.

The Authority has identified at least eight potential groundwater development projects in its service area. These projects are far enough along in the planning process to support a forecasted potential yield. Estimates of total projected supply from these potential projects along with existing groundwater supplies are shown in **Table 4-7**. These projections were provided by the local agencies proposing to implement the projects. It should be noted that as local agencies continue to evaluate the feasibility of potential groundwater projects, an even greater potential supply could be realized. A detailed list of the projects and projected supplies can be found in **Table E-3**, **Appendix E**. Two of the projects, the City of Oceanside's proposed 6.37 mgd (approximately 4 mgd expansion) demineralization facility and the Sweetwater Authority's proposed 8 mgd demineralization facility (4 mgd expansion), are expansions of existing brackish groundwater recovery projects. The other projects would require the construction of new facilities.

TABLE 4-7
PROJECTED GROUNDWATER SUPPLY
(AF/YR)

2005	2010	2015	2020
31,100	53,500	57,500	59,500



The City of Oceanside anticipates that its 6.37 mgd Mission Basin Desalter expansion will be completed by the end of the year 2002. The project will include the development of the estimated remaining "safe yield" of the basin through expansion of the existing demineralization facility. The Sweetwater Authority's planned Richard A. Reynolds Demineralization Facility 8-mgd expansion is currently in the preliminary design phase. The project will include the completion of additional extraction wells needed to supply brackish groundwater to planned demineralization facility expansion(s). The project is also expected to include an aquifer recharge component.

Current planning efforts indicate that other potential projects in the Authority's service area may also be feasible. A number of groundwater storage and recovery projects are currently being studied by the Authority and its member agencies. These groundwater project concepts will be candidates for possible inclusion in the next plan update. These studies include the San Diego Formation Aquifer Storage and Recovery Project and the Lower San Luis Rey River Valley Groundwater Storage and Recovery Project.

The City of San Diego has indicated to the Authority that they are developing plans to maximize the development of the City of San Diego's rights or interests in several groundwater basins. These plans would utilize basins for groundwater extraction and disinfection, brackish groundwater recovery, and recharge and recovery of imported and recycled water. Other Authority member agencies are also considering additional groundwater projects including the Otay Water District which is currently studying numerous groundwater development options within their service area.

4.5 SEAWATER DESALINATION

Desalinated seawater is used throughout the world as a potable water supply and is sometimes described as the ultimate solution to Southern California's water supply needs. In some areas of the world, such as the Middle East, desalinated seawater represents the primary source of potable water. Until recently, the cost of seawater desalting has limited its large-scale application in the United States. Current projects being developed in Tampa, Florida and the island of Trinidad seem to indicate that the cost of seawater desalting may have decreased to a point where it could be considered a potential resource option for coastal areas such as San Diego County. Therefore, seawater desalination should be considered in the development of any comprehensive water resources management plan for the San Diego region.

4.5.1 Description

Processes commonly used for large-scale seawater desalination fall into two general categories: (1) thermal processes and (2) membrane processes. Thermal processes use heat to separate salt and other impurities from seawater. Membrane processes, such as RO, use pressure to force seawater through a semi-permeable membrane. The membrane is constructed of materials that will allow water molecules, but not dissolved impurities, to pass through. Thermal facilities currently represent the largest volume of installed seawater desalination capacity. However, these facilities tend to be located in areas of the world where fuel is inexpensive. As membrane technology continues to improve, RO is gaining popularity as a less costly, more energy-efficient desalination technique.

Since 1991, the Authority has closely studied the development of seawater desalination facilities. Early studies evaluated both thermal and membrane processes and concluded that RO would be the most cost-effective desalination technology for this region. Subsequent studies focused on the construction of an RO facility in conjunction with the proposed repowering of the SDG&E South Bay Power Plant. A first year water cost of $1300/AF (1999 dollars) was estimated. Although the project was found to be technically feasible, many of the benefits anticipated from collocating the facility failed to materialize. In 1993, the study concluded that environmental, regulatory, and cost issues combined to make desalinated seawater more expensive than other available water resource options. Since 1993, the Authority has continued to monitor efforts to advance and develop seawater desalination technology into a viable, cost-effective water resource option.

4.5.2 Issues

Economic Considerations

As with other water supply projects, cost remains the primary barrier to project development. However, recent seawater desalination projects in Tampa, and Trinidad, seem to indicate that the cost of seawater desalination, in some site-specific situations, has decreased since the Authority's last seawater desalination study was completed in 1993.

Authority staff has been closely monitoring the progress of the 25 mgd seawater desalination project proposed in Tampa, Florida. The competitive proposal process for the design, construction, and operation of this project gained worldwide attention - with the best and final offer having a first-year water cost (expressed in 1999 dollars) of $560/AF and a 30 year nominal cost of water of $680/AF. The Tampa project includes several factors that contribute to the extraordinarily low water pricing, including:

- Lower feedwater salinity at 26,000 mg/l (average TDS in Tampa Bay) vs. 35,000 mg/l (normal seawater salinity).
- Interruptible power cost at slightly less than $0.04/kilowatt-hour.
- Availability of the power plant's existing cooling water canals for intake and discharge.
- Design modifications to comply with some existing permits.

- Use of large-scale RO trains.
- Economies of scale at the relatively large capacity of 25 mgd.
- Long-term financing over a 30-year contract period.
- Use of tax-exempt private activity bonds.

In Trinidad, a 23-year contract was awarded to build, own, and operate a 28.8 mgd seawater desalination facility for the Water and Sewerage Authority of Trinidad and Tobago. The plant will supply water at a first-year price of $865/AF (1999 dollars).

Although these projects have significantly lower cost then previously identified for San Diego projects, there are concerns relative to their transferability. Both projects possess unique site-specific attributes such as a lower feedwater salinity and extremely competitive power costs that do not provide a comparative cost for a desalination project in San Diego County.

Environmental Constraints

Facility siting constraints can also act as a barrier to project development. Given the environmental sensitivity and land use restrictions associated with most of the San Diego County coastline, it is unlikely that many large-scale desalination facilities could be sited along the coast. Coastal power stations are among the few sites along the coastline where large desalination facilities could likely meet permitting and land use restrictions. Although desalination facilities could be sited farther inland, the expense of pumping seawater and brine concentrate over long distances would add significantly to the cost.

When siting facilities, agencies must also consider the proximity of the site to existing potable water distribution systems. For example, the Authority's distribution system is located several miles from the coast. A large-scale coastal desalination facility would likely require a costly pipeline and pumping system to move product water inland to the Authority's distribution system. Smaller desalination facilities may be able to utilize the local distribution system to serve users along the coast.

Another significant issue affecting the development of seawater desalination facilities is disposal of the brine concentrate produced when fresh water is separated from seawater. For a typical RO seawater desalination facility, the brine concentrate discharge will have a salinity approximately twice that of the source water. Should the concentrate be discharged to the ocean, regulatory agencies are concerned that the high salt concentration could adversely impact the marine environment near the discharge point. Authority studies conducted as part of the South Bay project indicated that the salinity of the concentrate discharge could be reduced by mixing the discharge with another discharge stream, such as treated wastewater or power plant cooling water. In fact, the Tampa project will utilize existing power plant cooling water discharge facilities to dilute concentrate from the desalting plant.

4.5.3 Future Seawater Desalination Supplies

Current projects being developed in Tampa, Florida and Trinidad would seem to indicate that the cost of seawater desalting is at, or very near a point where it should be considered as a viable resource option for San Diego County in the future. Given the current interest in seawater desalination as a resource option and anticipated continued technology improvements, it is reasonable to conclude that at least one seawater desalination facility will be developed in the Authority's service area by 2020.

Given the studies that the Authority has conducted as well as the model that has been established by the upcoming Tampa project, the most likely location for a seawater desalination facility (>20 mgd) along the San Diego County coastline would be at or near an existing coastal power station. The primary reasons for this include:

- The availability of the power plant intake and discharge facilities, particularly so that brine discharge can be mixed with the cooling water discharge to blend down the high salinity of the brine.
- Locating a significant electrical load in close proximity to the power plant, thus minimizing electrical distribution costs.
- The compatible land use offered by a power station site.

Of the two existing power station sites along our coastline (South Bay and Encina), Encina, which is located in the City of Carlsbad, appears to offer the most promise. Encina possesses ocean discharge facilities which should offer an environmentally sensitive, cost-effective means of disposing of the brine from a seawater desalination facility. In addition, the Encina site is located in a part of the Authority's service area where nearby member agencies, at selectively low elevations, would benefit greatly from the development of an additional, drought-resistant local supply. In order to take advantage of economies of scale, it is likely that the minimum anticipated size of a seawater desalination facility developed at Encina would be 25 mgd and potentially on-line by 2020 (See **Table 4-8**).

TABLE 4-8
PROJECTED SEAWATER DESALINATION SUPPLY
(AF/YR)

2005	2010	2015	2020
0	0	0	25,000

4.6 SUMMARY OF LOCAL SUPPLIES

Table 4-9 shows the Authority's projected mix of local water supplies. The estimates for future local supplies included in this section could be even greater depending upon a variety of factors such as, increased funding opportunities, technology advances and cost-effectiveness of local projects. Local water resources are an important component of the Authority's overall mix of resources and is critical to meeting future demands within the San Diego region.

TABLE 4-9
PROJECTED LOCAL WATER SUPPLIES
(AF/YR)

	2005	2010	2015	2020
Surface Water	85,600	85,600	85,600	85,600
Water Recycling	33,400	45,100	51,800	53,400
Groundwater	31,100	53,500	57,500	59,500
Seawater Desalination	0	0	0	25,000
TOTAL LOCAL SUPPLIES	150,100	184,200	194,900	223,500