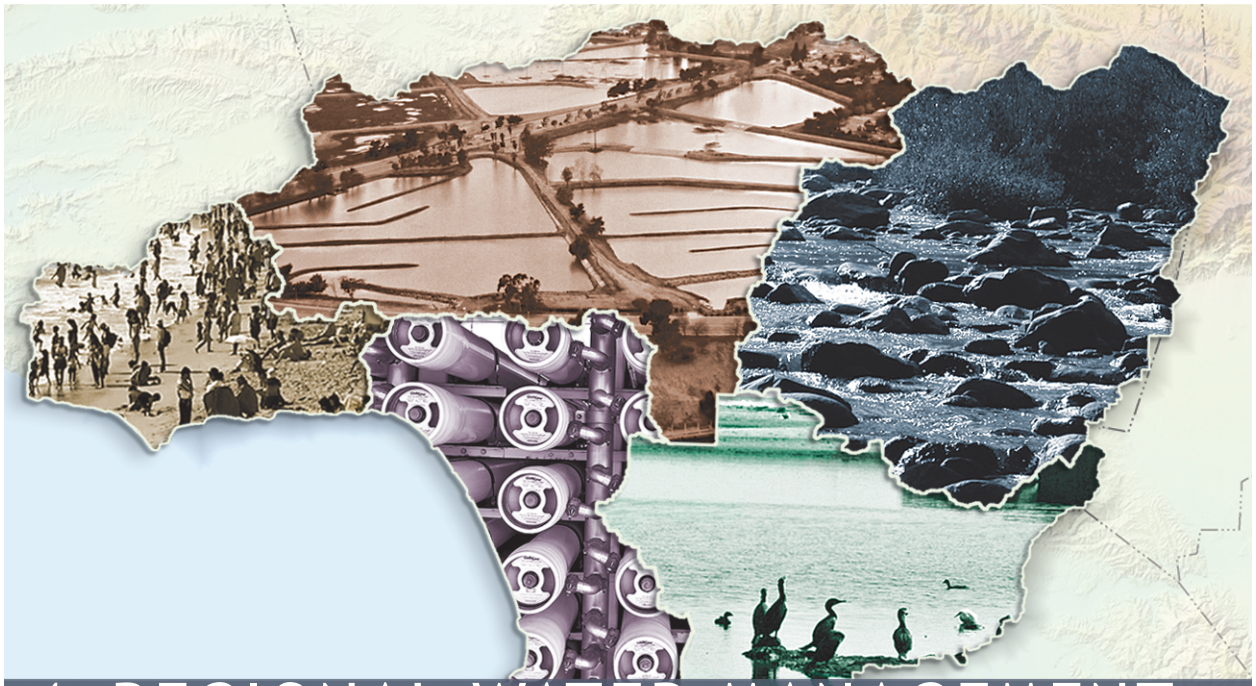


4. REGIONAL WATER MANAGEMENT

The Region integrates a diverse mix of water management strategies

The public receives the benefit of more efficient use of limited fiscal resources through the coordination of water management strategies.

4.1 Introduction

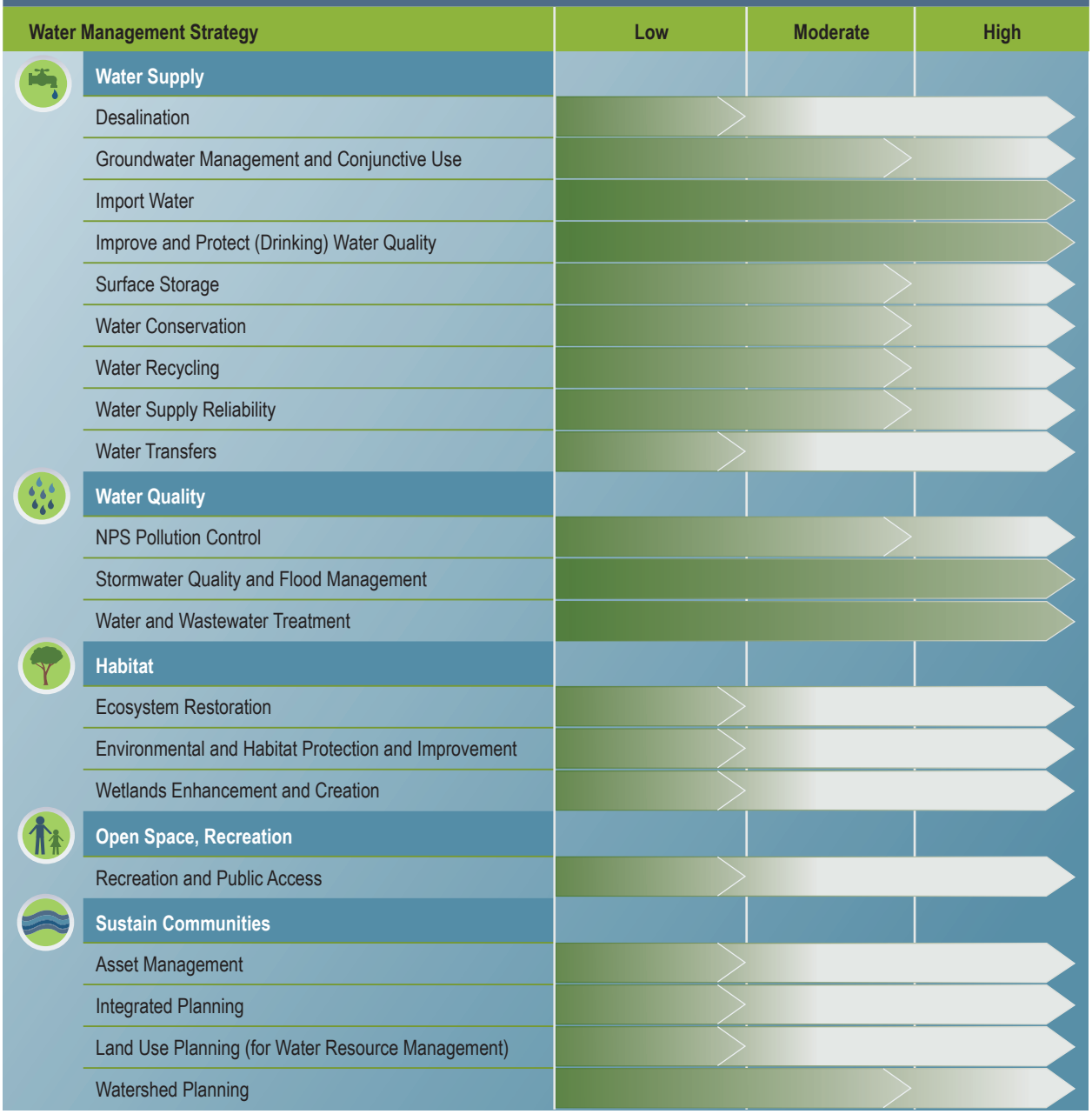
The purpose of this section is to describe the various water resource management strategies that are applicable in the Region and describe opportunities for integration of those strategies.

4.2 Water Management Strategies

The Integrated Regional Water Management Grant Program Guidelines (DWR, 2004) identify 20 water management strategies that may be utilized to enhance water supplies and improve water supply reliability, and specifies that eleven of those strategies must be discussed in an IRWMP. The following section describes the current and potential future applicability of the strategies identified in the guidelines, and two additional strategies (asset management and integrated planning) which the Leadership Committee determined were relevant to the Region. The identification of which water management strategies are included in this Plan is based on review of strategies, actions, and opportunities identified in the Metropolitan Water District's IRP, the UWMPs of Regional water wholesale districts, Common Ground, from the Mountains to the Sea (the watershed and open space plan for the Los Angeles and San Gabriel Rivers), and recent watershed plans on major creeks and tributaries.

As described below, all of the water management strategies identified in the Proposition 50 guidelines are currently being utilized in the management of water resources in the Region, although the relative utilization of these strategies varies. The relative application of each of these strategies on a Regional basis is summarized in Table 4-1, although there is substantial Subregional variation. In the Lower San Gabriel

Table 4-1. Current Application of Water Management Strategies in IRWMP Region



and Los Angeles River Watersheds, the strategies that are currently most prevalent are: Import Water, Improve and Protect Water Quality, Flood Management, and Water and Wastewater Treatment. In the North Santa Monica Bay Watersheds, the strategies that are currently most prevalent are: Ecosystem Restoration & Environmental and Habitat Protection & Improvement, NPS Pollution Control, Recreation & Public Access, Stormwater Quality Management, Water Conservation, Water Recycling, Watershed Planning. In the South Bay Watersheds, the strategies that are currently most prevalent are: Desalination, Water Conservation, Water Recycling, Water Supply Reliability, and Wetlands Enhancement and Creation. In the Upper Los Angeles River Watershed, the strategies that are currently most prevalent are: Import Water, Stormwater Management, Water and Wastewater Treatment, Water Recycling, and Watershed

Planning. In the Upper San Gabriel River and Rio Hondo Watersheds, the strategies that are currently most prevalent are: Groundwater Management/ Conjunctive Use and Water Conservation.

Based on the current application of the water management strategies in the Region, the following strategies are currently being implemented on a widespread basis: Flood Management, Import Water, Water and Wastewater Treatment, and Protect and Improve (Drinking) Water Quality. These strategies will continue to be implemented in the Region, although substantial expansion of the utilization of these strategies is not anticipated.

The following water management strategies are being implemented in the Region, but their application may not be widespread, and substantive opportunities exist for expanded integration of these strategies: Groundwater Management/ Conjunctive Use; Nonpoint Source (NPS) Pollution Control; Surface Storage; Water Conservation; Water Recycling; Watershed Planning; and Water Supply Reliability. However, opportunities for expansion of Surface Storage are limited.

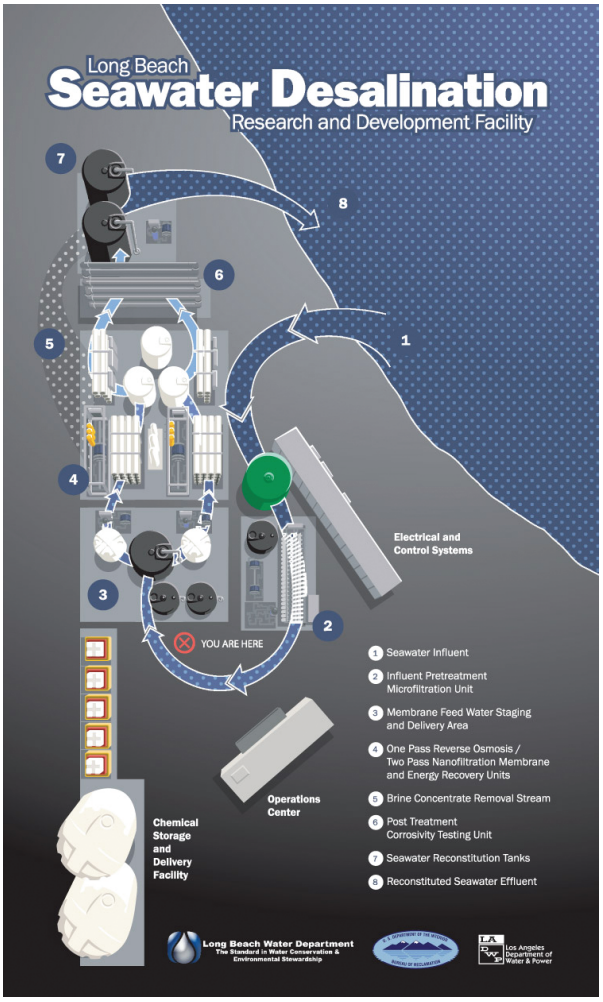
The following water management strategies are currently being implemented in the Region, but their application is relatively limited: Asset Management, Desalination; Ecosystem Restoration; Environmental & Habitat Protection & Improvement; Land Use Planning; Recreation and Public Access; Stormwater Quality Management; Water Transfers; and Wetlands Enhancement and Creation. Expanded utilization of these strategies could be implemented to enhance water supplies and improve water supply reliability.

For the purposes of this Plan, all 20 of the water management strategies identified in the Grant Program Guidelines are discussed in this Plan, although groundwater management and conjunctive use are combined as a single strategy below, some titles have been modified (e.g., "import water" instead of "imported water"), and two additional strategies are included (asset management and integrated planning).

Water Supply

Desalination

Brackish groundwater desalination (i.e., the removal of salts by forcing water through porous membranes) has been in practice in the Region for many years, in part due to financial incentives provided by the Metropolitan Water District. The Water Replenishment District of Southern California and the West Basin MWD operate brackish water desalters that produce significant water supplies from local groundwater sources.



The City of Long Beach Water Department has constructed the largest prototype seawater desalination research and development facility of its kind in the United States (300,000 gallon-per-day). Desalination will become a relevant water management asset as the costs of imported water increase and the impacts of desalination decrease with advances in technology.

Reverse Osmosis Membranes at West Basin Municipal Water District, Brewer Desalination Facility. Desalination of local brackish groundwater helps reduce the Region's dependence on imported water.

Until recently, seawater desalination has not been an economic alternative to conventional sources of water supply. As improvements in high-pressure reverse osmosis membrane technology have lowered operating pressure, the cost of producing drinking water from seawater has become more attractive. Considering the vast supply of seawater available to coastal Regions and the demand for "new" water, ocean desalination would appear a promising addition to the Region's water supply. Several water providers are currently examining the feasibility of desalinating seawater through pilot and demonstration scale projects.

In order to diversify the Regional water resource mix further, the Metropolitan Water District has developed a program to provide $250 per acre-feet for water produced from desalination and thereby defray the production cost, which is particularly sensitive to the cost of electrical power. Ongoing research to improve membrane efficiency may lower power costs and therefore the total cost of ocean desalination.

Challenges to the expanded use of desalination in the Region include the following: disposal of saline discharge water (or brine) which from inland locations; typically requires a pipeline and ocean outfall; environmental concerns about entrapment and entrainment of fish, fish larvae, and plankton by seawater intake structures; sensitivity of desalination facilities to the cost of electrical power, as much of the Region's power is currently generated by natural gas, which is subject to market-driven variations; and a need for new infrastructure to deliver water from ocean desalination facilities to more inland locations.

Figure 4-1. Local water suppliers operate brackish water desalters that produce significant water supplies from groundwater sources.

Opportunities for expanded use of desalination in the Region include expanded desalination of brackish groundwater and new ocean desalination facilities. New ocean desalination facilities include the 1,000 acre-feet/year dual pass nanofiltration plant at Haynes Generating Station, a joint effort by the City of Long Beach and the LADWP; LADWPs proposal for a 25,000 acre-feet/year reverse osmosis seawater desalination facility at the City's Scattergood Power Plant in El Segundo; and West Basin MWD's planned 20,000 acre-feet/year reverse osmosis seawater desalination plant at an adjacent El Segundo Power Plant (currently in pilot-scale testing).

Groundwater Management and Conjunctive Use

Groundwater represents a significant portion of local supplies in the Region, although the extent of impervious surfaces resulting from urban and suburban development has greatly curtailed natural recharge. In some basins expanded pumping has caused significant declines in groundwater levels, seawater intrusion, other water quality concerns, and limited the ability of producers to continue pumping from the basin without drilling deeper wells. As conditions deteriorated, and producers were not willing to settle on a compromise to reduce production and protect the groundwater basin, one of the appropriators in the basin would file a lawsuit against the other appropriators to adjudicate the groundwater basin and seek title to a portion of the water rights in the basin. Through engineering investigations, a safe yield is typically

established by a court and rights to the safe yield are allocated to the parties in the lawsuit. Given long-standing groundwater demand, very few basins remain unadjudicated in the Region.

Many overlying groundwater users in the Region use artificial recharge as a means of maintaining groundwater levels and production volumes. Artificial recharge can occur with either local water (e.g., surface runoff or storm events) or imported water. Spreading grounds are typically used to recharge local water whereas imported water recharge can occur through direct means using spreading grounds or injection wells or in-lieu means. In some instances, spreading is limited because of the capacity limitations of the spreading facilities rather than water supply. Recharge by in-lieu means does not require facilities. It simply requires that an agency suspend production from its wells and meet retail demand needs through deliveries of other supplies into its distribution system. Groundwater levels recover due to the reduction in pumping.

Groundwater basin water quality is a significant issue in the Region. Many factors have contributed to the deterioration of water quality in portions of certain groundwater basins including historic overdrafting resulting in seawater intrusion, industrial discharges, farming and agricultural chemical

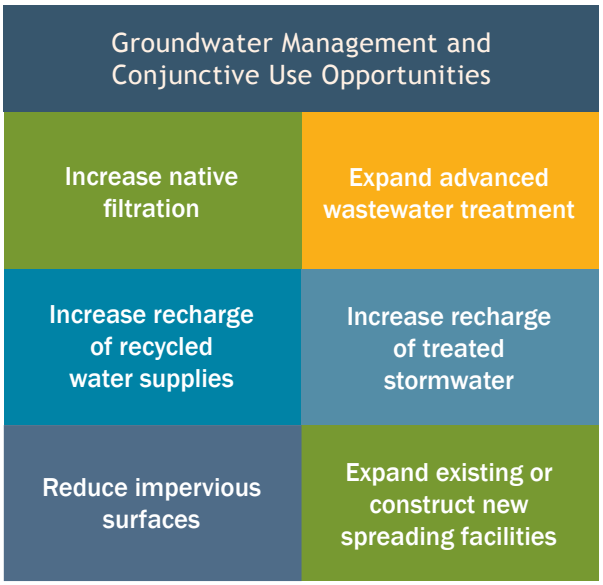


Figure 4-2. Groundwater basin water quality is a significant issue in the Region as many factors that have contributed to the deterioration of water quality in the groundwater basins.

GROUNDWATER MANAGEMENT

San Gabriel Valley Water Company's Plant B6 in Baldwin Park

Figure 4-3. Groundwater Projects. The San Gabriel Basin Water Quality Authority has helped fund a complex network of groundwater remediation projects. Over one million residents rely primarily on these resources for potable supply.

San Gabriel Valley Water Company's Plant No. 8 treatment facility in South El Monte.

Spreading basins in the Arroyo Seco are used to percolate rain water into underlying aquifers.

usage, and naturally occurring constituents. The cost of treating these contaminants is significant. Additionally, effective treatment has not yet been identified for some chemicals and various agencies are currently testing different treatment technologies to identify the preferred treatment alternative.

Opportunities for the optimized use of groundwater basins in the Region include: a reduction in impervious surfaces to increase native infiltration; expansion of existing, or construction of new, conjunctive use facilities to spread or inject both local and imported water when available; expansion of existing, or development of new, projects to replenish local groundwater aquifers using recycled water; enhancement of seawater intrusion barrier facilities to increase their effectiveness; implementation of projects to recharge treated stormwater; and inter-basin transfers of recycled water. All of these opportunities for optimized use of groundwater basins should be used to maximize storage potential identified in Table 4-2; to the extent that institutional challenges can be overcome and cost-effectiveness can be demonstrated.

Import Water

The Region is heavily dependent on imported surface water for drinking water supply. The primary sources of imported water supplies are the SWP, the Colorado River, and the Mono Basin and Owens Valley. Although these sources have been instrumental in the growth of much of the Region, each of these sources faces various challenges and issues, including concerns about the higher salt content of some sources.

Table 4-2. Groundwater Management and Conjunctive Use

Basin	Additional Storage Potential (Acre-Feet)
Los Angeles Coastal Plain Basins	1,089,000
Raymond Basin	144,000
Six Basins	30,000
San Fernando Basins	150,000
San Gabriel Basin	400,000
Total	**1,813,000**

The Association of Groundwater Agencies has estimated that the groundwater basins underlying the Los Angeles IRWMP planning area have long-term storage potential of an additional 1,813,000 acre-feet. Water supply agencies are continually evaluating projects to make use of this efficient and reliable storage.

The California SWP is a system of reservoirs, pumps and aqueducts that carries water from north of the Sacramento area to areas north, west and south of the Sacramento-San Joaquin Delta. Although originally designed to deliver slightly more than 4 million acre-feet/year, as the system was never fully completed, it typically delivers less than designed. The decline of key fish populations in the Bay-Delta system (e.g., the Delta smelt) has limited the volume of water that can be pumped to the SWP. The potential impact of further declines in ecological indicators in the Bay-Delta system on SWP water deliveries is unclear. Additionally, uncertainty about the long-term stability of the levee system surrounding the Delta system raises concerns about the ability to transfer water via the Bay-Delta to the SWP.

The Colorado River Aqueduct delivers water from the Colorado River to Southern California. Metropolitan has traditionally received in excess of its entitlement when excess water is available. Future water allotments to California supplies from the Colorado River may be reduced as other states increase their diversions in accord with their authorized allotments. California's Colorado River Water Use Plan and the Quantification Settlement Agreement identify measures to increase the beneficial uses of the water and offset potential reductions in future deliveries to California.

The Los Angeles Aqueduct delivers high-quality water from the Mono Basin and Owens Valley to the City of Los Angeles. Approximately 480,000 acre-feet/year of water can be delivered to the City of Los Angeles, however the amount the aqueduct delivers varies from year to year due to fluctuating precipitation in the Sierra Nevada and mandatory in-stream flow requirements. In addition, the diversion of water from Mono Lake has been reduced by a decision of the SWRCB and export of water from the Owens Valley is limited by the Inyo-Los Angeles Long Term Water Agreement (and related MOU) and an additional MOU between the Great Basin Air Pollution Control District and the City

Figure 4-4. The Region is continually improving its ability to reduce its dependence on imported surface water for drinking water supply.

of Los Angeles (to reduce particulate matter air pollution from the Owens Lake bed). As a result of these restrictions, future deliveries are expected to be reduced to an average of 321,000 acre-feet/year over the next 20 years.

Thus, although imported water will continue to be an important component of the Region's water supply, as the major sources are fully allocated or have constraints on deliveries, it is unlikely that substantial new sources of imported water will be available to meet the Region's future needs.

Improve and Protect Water Quality

For the purposes of this Plan, the strategy to improve and protect water quality includes the quality of potable water, the quality of groundwater, and the quality of stormwater and urban runoff.

The USEPA requires all states to establish and implement a Source Water Assessment Program (SWAP) for all public water systems, as promulgated in the 1996 Amendments to the federal Safe Drinking Water Act. In California, the federal SWAP requirement is administered by the DHS (Health and Safety Code Chapter 4, Section 116270). DHS developed the Drinking Water Source Assessment and Protection (DWSAP) Program, to evaluate the vulnerability of water sources to contamination and prioritize activities for protective measures. Surface water used for local water supplies may be susceptible to potential contamination from a variety of land use practices, such as agricultural and urban runoff, recreational activities, residential and industrial development and wildland fires. The California DHS requires that water suppliers complete a Watershed Sanitary Survey every five years, to examine possible sources of drinking water contamination and recommend how to protect water quality at the source.

Protection of groundwater quality has historically been a local concern, most notably reflected by seawater intrusion along the coast. Los Angeles County operates and maintains three seawater intrusion barrier systems along the coast that rely upon recycled water and imported water to reduce the intrusion of saline water in underground aquifers. In recent decades, there has been a growing recognition that historical and current agricultural and industrial activities have the potential to adversely affect groundwater quality, which is reflected in expanded enforcement of other regulatory programs to implement clean-up of contaminants. Public water supply wells are also subject to the Wellhead Protection Program, which requires the identification of potential water quality threats (in close proximity to the wellhead) and measures to address the identified threats.

The protection of surface water quality (e.g., in the rivers, creeks, and storm drains) is regulated by the SWRCB and its RWQCBs, via the applicable Basin Plan, which identifies surface and groundwater bodies, designates applicable beneficial use classifications to each water body, establishes general and water body-specific water quality objectives; and suggests an implementation plan for main-

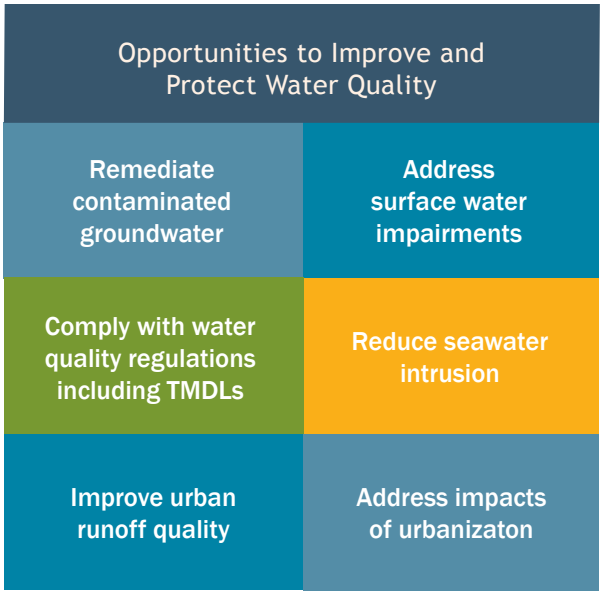


Figure 4-5. For the purpose of this Plan, the strategy to improve and protect water quality includes the quality of potable water, groundwater, and stormwater/urban runoff.

taining or restoring the water quality objectives. The RWQCBs utilize NPDES permits and Waste Discharge Requirements to limit the discharge of contaminants and protect surface water quality.

Constraints to the implementation of water quality protection and improvement programs and projects include the extent of urbanization, pressure for development within the foothills and adjacent mountains, contamination of soils from previous land uses, and importation of water, which contributes to salt management issues.

Opportunities for the expansion of water quality protection and improvement programs and projects include: SDWA projects; and programs to remediate groundwater contamination; and address surface water impairments through the establishment and implementation of TMDLs and public education to reduce point and non-point source pollutants.

Surface Storage

As the water supply in the Region is heavily dependent on imported surface water, various surface reservoirs (managed by Metropolitan Water District and the SWP) located outside the Region are used to facilitate water delivery to various local water agencies. Several smaller reservoirs have been developed within the Region to assist in the management of local water supplies. However, most of these reservoirs are limited in their ability to capture local runoff. Most of the remaining dams in the Region have been developed for flood management purposes and are not used for long term surface storage.

Surface Storage Opportunities	
Increase water storage capability	Improve management of water flows
Increase operational flexibility of local reservoirs, canals and dams	Surface impoundments for recycled water and treated stormwater runoff

Figure 4-6. LACFCD oversees several surface water storage facilities, which were created to improve flood protection and store runoff for subsequent release and diversion to groundwater spreading grounds for recharge.

Los Angeles County Flood Control District operates inflatable dams on the San Gabriel River to promote short-term in stream recharge.

LACFCD oversees several surface water storage facilities, which were created to improve flood protection and store runoff for subsequent release and diversion to groundwater spreading grounds for recharge. These include dams for short-term storage, and in-stream rubber dams to promote short-term instream recharge. Las Virgenes MWD purchases pretreated water from Metropolitan and stores it in the Las Virgenes Reservoir in the City of Westlake Village. The reservoir also provides seasonal water storage allowing Las Virgenes MWD to purchase supplies off-season and deliver at times of peak demand to meet high summer irrigation needs. The in-city water distribution systems of the City of Los Angeles once included 15 open distribution reservoirs. Due to concerns from DHS about open water storage, nine reservoirs have been bypassed, replaced, or covered.

Constraints on the development of additional surface storage in the Region include: the lack of suitable sites for surface impoundments, since most of the mountainous areas are protected open space; constraints on open reservoirs to reduce potential contaminants; and the cost of developing new reservoirs.

Opportunities to enhance surface storage include: modification of local reservoirs, canals, and dams to increase storage capability and operational flex-

ibility; installation of additional in-channel rubber dams to improve management of flows; creation of new surface impoundments for recycled water and/or treated stormwater runoff; and the development of unused resource extraction sites (e.g., gravel pits) as surface impoundments. It should be noted that gravel pits are privately-owned industrial sites and any use other than the owner's intended use would be subject to approval by the owner.

Water Conservation

Water conservation is a critical water resource management strategy for the Region. The strong reliance on imported water and the inherent variability in both imported and local supplies has spurred efforts throughout the Region to minimize the use of water where possible through water efficiency measures. Conservation is an element in drought planning as well as an ongoing strategy to ensure long term availability of local supplies in the face of additional demand generated by population growth.

Given the substantial progress already made by local agencies, further expansion of water conservation will need to incorporate economic incentives and new technology and in some instances, change public perceptions (e.g., about the desirability of sub-tropical landscaping in a semi-arid climate). Conservation techniques must offer the consumer opportunities to save money as well as save water. In some cases—such as subsidies to change out older, water-using appliances such as washing machines and toilets—the subsidizing agency can reduce demand as an alternative to building infrastructure. The expanded utilization of California friendly landscaping may also benefit from economic incentives such as rebates or land use ordinances established by the cities or counties. Newer technologies, such as irrigation controllers that use current weather information to modify irrigation patterns, have worked well in commercial applications, but have proven to be expensive for homeowners without the use of rebates. As this technology evolves, it is anticipated that such controllers will become more widespread, facilitated by agency programs for free or reduced cost distribution of the units. Care must be taken in projecting potential conservation savings to account for hospitals, restaurants and other applications where specific, high-water use protocols have been established to protect the public's health.

The Madrona Marsh Nature Center's Nature Plan garden in the city of Torrance. Garden showcases native and drought tolerant plants that can provide attractive alternatives to traditional Southern California landscaping.

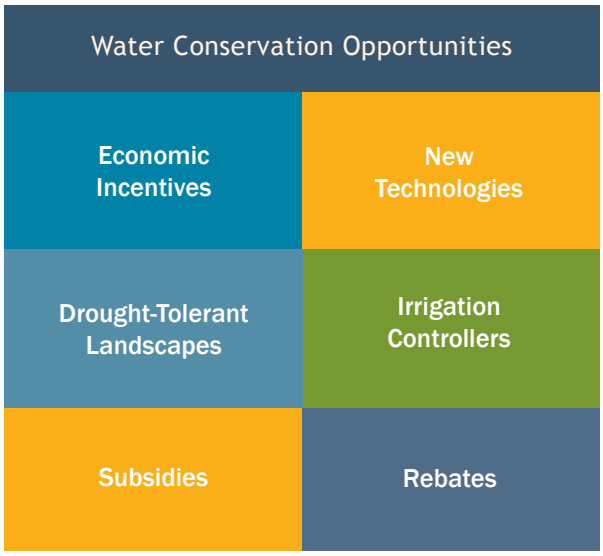


Figure 4-7. Strong reliance on imported water and the inherent variability in both imported and local supplies has spurred efforts throughout the Region to minimize the use of water where possible through water efficiency measures.

Since the drought of 1987-1992, conservation efforts have stepped up significantly within the Region. Most local agencies have adopted specific goals for water conservation which suggests that additional conservation is still feasible. The

California Urban Water Conservation Council has established a set of 14 BMPs for water conservation, although not all agencies in the Region are signatories to a MOU to implement these BMPs. Water conservation also has the potential to produce corollary benefits, as reduced water consumption in homes and business reduce the volume of wastewater discharge that must be treated, and improved irrigation techniques can reduce irrigation runoff and thereby improve surface water quality.

Opportunities to expand water conservation generally fall into two categories – active and code-based. Active conservation comes from programs offering things such as rebates, device installation, and plumbing retrofit. Although many agencies have ongoing programs, expanding active conservation can be directly influenced by water agencies. Expansion of code-based conservation can occur either through local ordinances or new State laws that require either certain water conservation actions or penalize the theft or waste of water. In addition, local water agencies could develop water conservation master plans (such as those recently completed by the Central and West Basin MWDs), to coordinate and prioritize conservation efforts and identify enforcement protocols.

Water Recycling

Recycled (or reclaimed) water will become an ever more important source of water in the Region primarily for non-direct potable uses, but also for displacing the need for "new" potable water. Several agencies currently produce more recycled water than is currently being reused within their systems; other agencies are leveraging the economic and environmental benefits of this water source. The cost of developing needed infrastructure (storage facilities, pump stations, and distribution lines) to distribute recycled water has limited the use of recycled water in some areas. Some agencies, including the Metropolitan Water District and the U.S. Bureau of Reclamation, provide grant funding for such facilities. As the cost of "new" water increases due to market forces, recycled water will become increasingly economically and environmentally desirable.

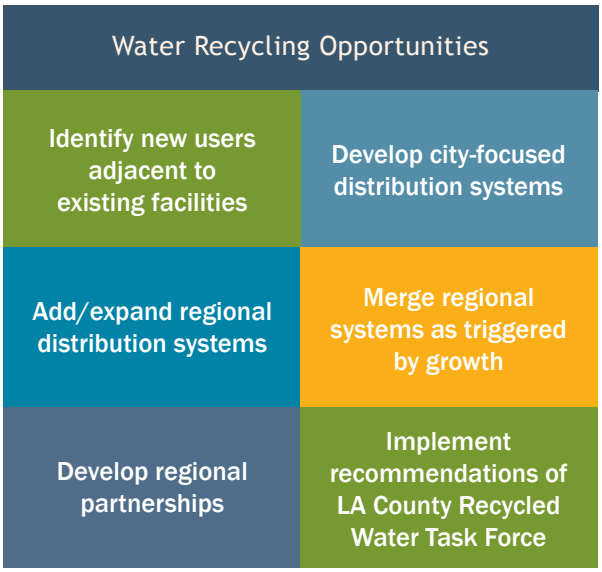


Figure 4-8 As the cost of "new" water increases because of market forces, reclaimed water will become an increasingly economic and environmental choice.

Current recycled water annual average flows (including both tertiary and advanced treated water) total approximately 225 mgd, which represents approximately 25 percent of the current secondary treated effluent annual average flows. Of these 225 mgd, approximately 105 mgd are currently reused for municipal and industrial applications, environmental uses, groundwater replenishment, or seawater barrier. The reused flows represent approximately 45 percent of the available recycled water flows. The rest of the recycled water flows are currently discharged to local streams and rivers, which may dilute the concentration of some pollutants.

Key challenges for the use of recycled water in the Region include: identification of new projects for large recycled water users in the close vicinity of wastewater treatment plants that expand demand for recycled water; disposal of advanced treatment waste products (e.g., brine); seasonal variations in recycled water demand for irrigation; cost-effectiveness of building additional infrastructure (storage facilities due to seasonal variations in demand, pump stations, distribution lines, and purple pipe); water quality treatment requirements; regulatory trends (which suggest increasingly stringent wastewater discharge standards); requirements to maintain minimum in-stream flows; proximity of reclaimed water production to area of demand; and

Figure 4-9. Water Recycling. Recycled/reclaimed water currently provides 120,000 acre-feet/year to the Region. Recycled water will become an increasingly important water source for the Region.

political/public support. In addition, one constraint on LACSDs recycling program is their inability to serve the recycled water due to restrictions imposed by the Service Duplication Act. The State's Recycled Water Task Force suggested various regulatory changes, research needs, and increased funding to overcome many of these obstacles.

Opportunities to expand recycled water use could be based on incremental approach to recycled water distribution networks, which could include: encourage large recycled water users in the close vicinity of wastewater treatment plants to develop projects that use recycled water; development of City-focused distribution systems; add and/or expand Regional distribution systems; merge Regional systems as triggered by growth; and develop groundwater recharge and seawater intrusion projects (although these could implemented at any time during the life of a recycled water program).

Additionally, development of Regional partnerships and projects could be pursued, such as those as identified in the Southern California Comprehensive Water Reclamation and Reuse Study (which identified proposals for several Regional projects within the Calleguas/Las Virgenes, East San Gabriel, West Basin, and Central Basin areas).

The newly created Los Angeles County Recycled Water Task Force will look at the issues of recycled water and report back to the Board of Supervisors with policy recommendations on how the County can advance the use of recycled water for non potable purposes.

Water Supply Reliability

The availability of imported water in southern California, beginning with the LADWPs system from the Owens Valley and later continuing with Metropolitan's Colorado River Aqueduct and partnership in the California SWP allowed many agencies throughout the Region to shift their reliance to imported water and away from local supplies. Increasing costs for imported water, concerns about the health of the Bay-Delta ecosystem, enlightened environmental attitudes in areas where imported water originates, and increasing competition for potable water resources, has resulted in a rekindling of interest in local resources. In some cases, new reservoir storage, expansion of groundwater recharge basins, or the implementation of conjunctive groundwater projects, have

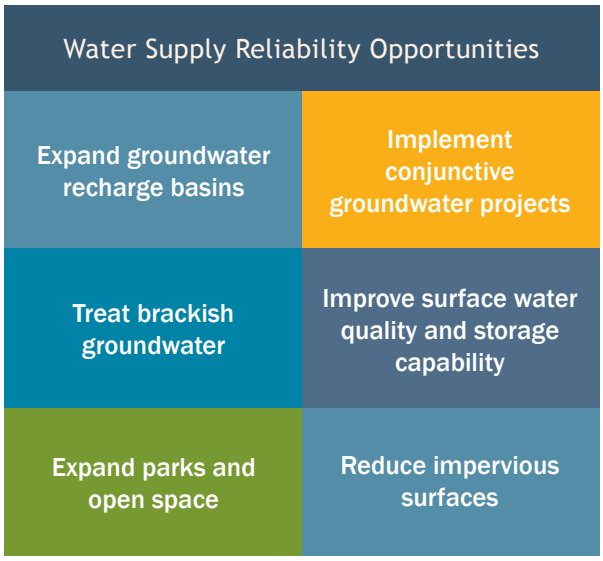


Figure 4-10. Increasing competition for potable water resources, has resulted in a rekindling of interest in local resources.

all been developed to take advantage of surplus imported water (water not required to satisfy immediate consumptive demand). These measures can decrease reliance on imported water and improve local water supply reliability during periods of drought.

Pumping and treating brackish groundwater can expand local supplies and create opportunities to enhance water supply reliability by removing and replacing the brackish water with higher quality water. This could be accomplished through well injection operations (to replace the removed brackish water with fresh or treated water) or expanded groundwater spreading operations to recharge surplus runoff or imported water. Such operations must be carefully designed, to avoid adversely affecting the quality of the injected or recharged water.

Urban growth displaces open space and increases impervious surfaces, thereby reducing natural recharge of precipitation. The channelization of streams, particularly when the channel bottom becomes impervious, reduces natural percolation of streamflow into underlying soils. Thus, the preservation of open space, particularly in those areas that directly recharge aquifers used for water supply, and the preservation of natural stream channels, preserves groundwater recharge in many areas, and thus contributes to the long-term reliability of existing groundwater supplies. The creation of new parkland, which may reduce impervious surfaces (e.g., via removal of existing development) may also reduce runoff and enhance groundwater recharge. The creation of new habitat, such as wetlands, can improve groundwater recharge by increasing retention of runoff.

Constraints to the improvement of water supply reliability include the limited availability of undeveloped land for the expansion of recharge facilities or creation of constructed wetlands and the limited ability to recharge groundwater across large portions of the coastal plain due limited permeability in soils with high clay content.

Opportunities to improve water supply reliability include: the expansion of groundwater recharge basins; the implementation of conjunctive groundwater projects; and the development of natural treatment systems, such as constructed wetlands, to improve both surface water quality and storage capability.

Water Transfers

Prior to 1991, water transfers within the Region had mostly been limited to transfers of annual groundwater basin rights (which continue to occur, although conditions imposed by groundwater basin adjudication sometimes restrict export of groundwater outside the basin's boundaries), and transfers water to enhance operational flexibility. Additionally, the Metropolitan Water District's

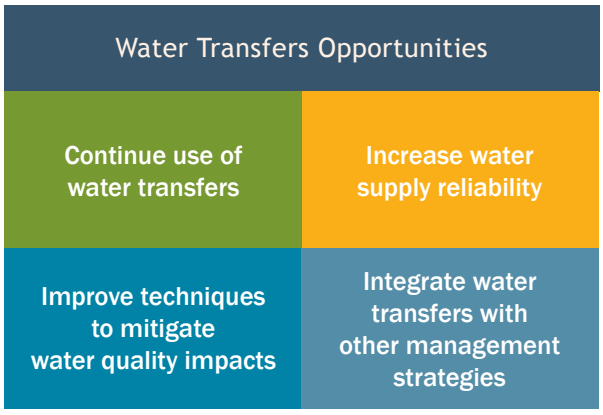


Figure 4-11. Historically, water transfers were arrangements between two parties; one with surplus water supply, and one in need of additional water.

transmission facilities have not been used to transfer local water from one agency to another mainly because of water quality issues and potential downstream impacts. Lastly, regulations limit mixing of different source waters in transmission lines used for potable water, which sometimes imposes restrictions on the movement of water.

With the 1991 drought, the Governor's Water Bank was developed. Metropolitan Water District and other SWP contractor's took advantage of that resource to augment supplies and lessen the severity of the impacts of the drought. Since that time, Metropolitan has participated in water transfers as a water management strategy to augment supplies. The City of Los Angeles plans to develop water transfers as part of its supply strategy rather than purchasing water from Metropolitan during dry years. Should the costs of purchasing and wheeling transfer water from outside the Region be lower than purchasing Metropolitan water, other agencies would likely be interested in such a supply strategy.

Constraints to the use of water transfers within the Region include institutional constraints related to the wheeling (or transfer) of water, which may affect various transmission elements, and the limitation on using Metropolitan facilities because of potential water quality impacts to downstream users.

The Santa Monica Urban Runoff Recycling Facility collects, treats, and reuses approximately 500,000 gallons per day of urban runoff.

Water Quality

Nonpoint Source Pollution Control

To conform to the requirements of the federal Clean Water Act and the federal Coastal Zone Act Reauthorization Amendments of 1990, the State of California has developed the NPS Program Strategy and Implementation Plan (1998–2013) which identified actions to reduce nonpoint pollution, and a companion volume, the California Management Measures for Polluted Runoff Review Document, identifies a range of management measures for agriculture, forestry, urban areas, marinas and recreational boating, hydro-modification (including modification of stream channels, water impoundments, and stream bank erosion), and wetlands, riparian areas and vegetated treatment systems. Additional information on sources of nonpoint pollution and measures to reduce and/or treat polluted runoff is provided in the California NPS Encyclopedia, developed by the SWRCB.

To reduce stormwater pollution the RWQCBs have issued stormwater and urban runoff NPDES permits which regulate the discharge of runoff from municipal storm sewer systems (MS4s), otherwise known as storm drains. These permits

Caltrans has a succesful program to reduce pollutants from freeway stormwater runoff. Their research is ongoing in the Los Angeles Basin.

prohibit non-stormwater discharges into the storm drain system, limit discharges to receiving waters that would cause or contribute to a violation of water quality standards, and require implementation of a Stormwater Quality Management Program (SQMP) that includes the use of BMPs to reduce the discharge of pollutants identified. Within most of Los Angeles County, the SQMP has seven programs, including:

- The Industrial/Commercial Facilities Control Program, covers industrial and commercial facilities, including restaurants, automobile service facilities, retail gasoline outlets, automobile dealerships and other federally-mandated facilities;
- The Development Planning Program, requires implementation of post-construction BMPs and site-specific mitigation measures for commercial developments on sites one acre or greater in impervious area, automotive repair shops, retail gasoline outlets, restaurants, residential development with ten or more dwelling units, parking lots with 25 or more spaces (or are greater than 5,000 square feet in area), single-family hillside residences, and locations within, or directly adjacent, or discharging to, environmentally sensitive areas;
- The Development Construction Program, requires control of erosion and the prevention of runoff from construction sites, the containment of construction materials, equipment fuel, maintenance and washing fluids through a combination of BMPs, inspections, and for projects over one acre in area, preparation of a Stormwater Pollution Prevention Program, per the Construction Activities Stormwater General Permit (Order No. 99-08-DWQ);
- The Illicit Connections and Illicit Discharges Elimination Program, which requires the County and the cities to identify and investigate illicit discharges, resolve undocumented connections to the storm drain system, and take enforcement action;
- The Public Agency Activities Program, consists of maintenance, inspection, and response to minimize stormwater impacts from public agency activities;
- The Public Information and Participation Program, requires measures to increase awareness, change behavior, and involve the public in mitigating the impacts of stormwater pollution; and
- The Countywide Monitoring Program, requires measures to assess receiving water impacts, identification of sources of pollution, evaluation of BMPs, and measure of long-term trends in mass emissions.

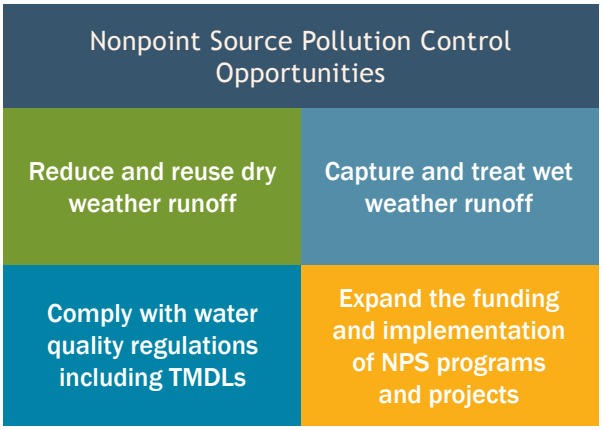


Figure 4-12. Improvement of stormwater runoff quality will lead to an increase in the availability of local non-potable water supplies.

In response to the identification of water quality impairments (via the 303(d) list), the RWQCBs have begun to establish TMDLs for contaminants including trash, metals, organic compounds, nutrients, and bacteria. Given the pervasive nature of some contaminants, development of implementation plans for some TMDLs may need to include measures to address NPS pollutants. In addition, the discharge of dry-weather runoff is prohibited in a portion of the North Santa Monica Bay as an ASBS (described in Section 2, Regional Description), which may require specific measures to address NPS pollutants in upland areas draining to the ASBS.

Constraints to the implementation of NPS pollution control programs and projects include: the substantial portion of the Region that has been subject to urban and suburban development; the pervasive nature of surface water contaminants; and the need for widespread individual action for some aspects of NPS pollution control.

Opportunities include the continued implementation of existing programs in accordance with

NPDES permits and establishment and implementation of TMDLs, which may expand funding and implementation of NPS programs and projects.

Stormwater Quality and Flood Management

Historically, the management of stormwater has been viewed either as an element of flood management, or as a means to augment water supply, via the managed transfer of runoff from river or stream channels into groundwater recharge basins (discussed above in groundwater management). However, that component of stormwater that is not already used for groundwater recharge (and is therefore discharged via the flood control network to the ocean), is a potential candidate for capture and treatment, to improve surface water quality in the rivers and other bodies of water, and to further augment local water supplies.

Given the extent of urbanization in the Region (with approximately 54 percent developed), runoff quality has been notably degraded in most of the rivers and tributaries. The capture (and subsequent treatment) of stormwater, as a structural solution to surface water quality impairments, could be implemented as one element of a comprehensive surface water quality improvement program.

In some locations, historical concerns about the quality of stormwater runoff have limited the willingness of water supply agencies to consider recharge of stormwater from urbanized areas. To address these concerns, the Los Angeles and San Gabriel Rivers Watershed Council is conducting the Water Augmentation Study, a long-term research project to explore the potential for increasing local water supplies and reducing urban runoff pollution by increasing the infiltration of stormwater runoff. The project began in January 2000 to assess the viability of adding these stormwater resources to local water supplies, in terms of groundwater quality and quantity. The Phase II Final Report (LASGRWC, 2005) provides encouraging results which suggest that migration of pollutants is not occurring at the six sites being monitored. The City of Los Angeles' IRP for the Wastewater Program has identified the potential to direct dry-weather flows to wastewater treatment plants for treatment, and subsequent reuse as recycled water.

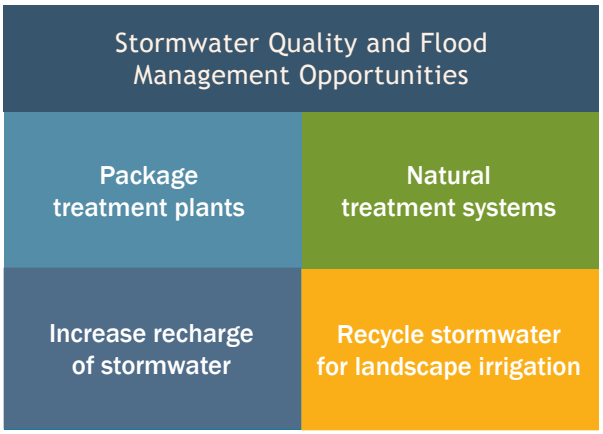


Figure 4-13. Stormwater currently lost to the ocean is a potential candidate for capture treatment, recharge, and reuse.

Challenges to the expansion of stormwater capture and management include: the need to maintain flood protection for any potential modification of storm drain systems that would expand or enhance capture of stormwater in detention basins, cisterns, or recharge basins; concerns about the potential for contaminants in stormwater to migrate to groundwater; limited land availability, which limits options for development of structures to capture and manage stormwater; and short duration/high intensity storm events which make storage difficult.

Opportunities for expansion of stormwater capture and management include development of local and regional facilities to capture and treat urban runoff and stormwater as part of a TMDL compliance strategy. This could include package treatment plants to remove contaminants, filtration systems, or natural treatment systems such as constructed wetlands. Water cleansed by such facilities could either be recharged to groundwater, or stored for delivery to local uses, such as landscape irrigation.

Flood management in the Region is the responsibility of the LACFCD, the Orange County Flood Control District, the Ventura County Flood Control District, the U.S. Army Corps of Engineers, and cities in the Region. The LACFCD was formed in 1915 in response to a devastating flood in 1914, the Orange County Flood Control District was formed in 1927, and the Ventura County Flood Control District was formed in 1944. In 1936, federal legislation gave specific

flood protection duties to the U.S. Army Corps of Engineers.

Flood management measures in the Region began in earnest in the 1920s, but the major elements of the current system were developed beginning in the 1930s. The current flood management system generally consists of concrete river and stream channels designed to expedite flow, dams and reservoirs on the rivers to regulate flow, debris basins on streams to capture sediment washed down from the mountains, and hundreds of miles of channels to direct flow into spreading basins, the rivers, or directly to the ocean. Flood management measures are less developed in those portions of the Region within the Santa Monica and San Gabriel Mountains, where most streams are in their natural state, except for dams on the San Gabriel River, Malibu Creek, and several major tributary streams.

Despite the extensive network of flood management structures and channels, the counties track areas throughout the Region where flooding or drainage problems persist. Information is reported by the cities, through individual complaints, or directly to each county in unincorporated areas. Un-met drainage needs have been identified throughout the Region, but mostly in localized urban areas. If the situation requires a new drainage structure, the cities and the counties, sometimes in conjunction with the U.S. Army Corps of Engineers, will study the best solution. The recently completed Los Angeles County Drainage Area project, which enhanced flood protection on the lower Los Angeles River, is an example.

Constraints to the expansion of flood management programs include: limited funding, the lack of undeveloped land within the urbanized portions of the Region which could be used for flood management improvements, and steep slopes within the local mountains, which combined with the potential for heavy rains, can result in substantial soil erosion or debris flows which may affect the capacity at downstream drainage facilities.

Opportunities to enhance flood management include the Sun Valley Watershed Plan, which addresses an area of chronic flooding with alternative approaches to construction of a flood conveyance channel through the use of gravel pits and underground drains below parkland to infiltrate runoff and thereby enhance groundwater recharge. If successful, the Sun Valley Plan can serve as a model for future localized flood management improvements. Flood attenuation to reduce peak flood flows, via expanded on-site infiltration and increased upstream storage, represents an opportunity to enhance the potential for river channel modifications, such as those proposed in the Los Angeles River Revitalization Master Plan.

Water and Wastewater Treatment

As noted above, the principle sources of water supply in the Region are imported water and groundwater, with recycled and surface water providing small amounts. Thus, the majority of water utilized in the watersheds is potable water which must meet drinking water standards. The federal Safe Drinking Water Act, passed by Congress in 1974, requires the USEPA to develop drinking water standards that must be implemented nationwide. In California, EPA has delegated implementation of drinking water regulations to the state. The California DHS has responsibility to protect the quality of drinking water, in accord with California's Drinking Water Source Assessment and Protection Programs, that were developed in response to the 1995 reauthorization of the Federal Clean Water Act. Drinking water standards for the State of California are specified in the Health and Safety Code (Division 20, Chapter 6.75, Sections 25299.57 to 25299.99.3, and Division 104, Part 12, Sections 116270-117130). Responsibility for

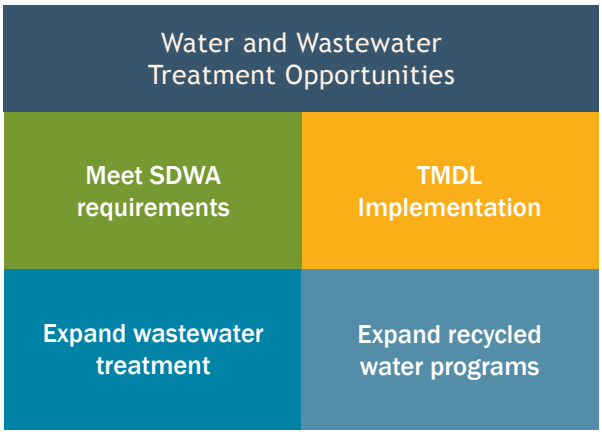


Figure 4-14. The majority of water utilized in the Region's watersheds is potable water which must meet drinking water standards.

treatment of potable water supplies rests with the approximately 120 retail water agencies and districts in the Region. Compliance with SDWA rules may require improvements to potable water supply treatment facilities, reduce disinfection by-products, and reduce inflow of surface runoff to surface impoundments. Considerable uncertainty exists over the timing and extent of possible future requirements related to contaminants which are not currently regulated, such as endocrine-disrupting compounds, pharmaceuticals, and components of common household products, such as shampoo, which have been detected in various source waters.

The treatment of wastewater in the Region is governed by provisions of the federal Clean Water Act, the California Porter-Cologne Water Quality Control Act, the California Toxics Rule, the Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California, the Water Quality Control Plan for the Los Angeles Region (and Santa Ana Region), NDPES discharge permits, and individual Waste Discharge Requirements for wastewater treatment plants established by the RWQCBs. Wastewater treatment services within the Region are currently provided by:

- County Sanitation Districts of Los Angeles County;
- Orange County Sanitation Districts;
- City of Los Angeles Department of Public Works, Bureau of Sanitation;
- The Las Virgenes MWD (under a joint partnership with Triunfo Sanitation District);
- The City of Burbank; and
- The Los Angeles County Department of Public Works.

In addition, various other entities operate small treatment facilities (e.g., less than 0.2 mgd) or onsite package plants.

Constraints to the expansion of water and wastewater treatment programs include: antidegradation issues; land constraints; uncertainty over pending regulatory developments; and the cost of implementation.

Opportunities to expand water treatment include projects designed to meet SDWA requirements, and projects and programs for TMDL implementation. Opportunities to expand wastewater treatment include the Malibu Civic Center Wastewater Reclamation Facility and expansion of recycled water programs.

Malibu Lagoon has suffered the negative impacts of human activity. Completely filled in at one point to create ballparks, work has continued since 1983 to restore the natural ecosystem and associated water quality benefits.

Habitat

Ecosystem Restoration

Despite their exceptional importance and value many of the Region's inland, riverine, and coastal ecosystems have suffered from over a hundred years of human impacts—development activities that have destroyed or degraded many ecosystems. Rivers, streams, and wetlands have been diked, ditched, and filled. Dams and flood control channels have been built to contain and direct waterways; fundamentally altering the natural processes that created, preserved, and restored these systems. Much of the historic coastal dunes, woodlands, wetlands, grasslands, scrub communities, and

Rocky tidal pool in Paradise Cove along the Malibu coastline.

estuary ecosystems have succumbed to development or been degraded by declines in water quality and ecosystem functionality.

In recent decades, technologies have emerged to restore function and productivity to degraded or destroyed ecosystems. Scientists, engineers, and community groups have begun working with federal, state, and local governments to restore ecosystem function to the Region's native ecosystems. The fundamental goal of ecosystem restoration is to return the selected ecosystem to a condition that resembles its natural pre-disturbance state as closely as possible. Achievement of this goal entails restoration of the target ecosystem's structure and function both locally and within its broader landscape or watershed context.

Restored ecosystems result in physical, chemical, and biological changes to both the specific system, and the areas that it influences. The benefits of ecosystem restoration are difficult to quantify, but, depending upon the type of ecosystem restored (e.g., aquatic vs. terrestrial), they can include capturing and storing stormwater, groundwater recharge, flood protection, increasing water supply reliability, wildlife habitat creation and enhancement, water quality enhancement, flood control, and recreation. Economic benefits can also be realized through increased property values and the reduced cost of water quality enhancement compared to conventional wastewater and stormwater treatment systems.

To achieve long-term success, ecosystem restoration needs to address the causes and not just the symptoms of ecological disturbance. Sometimes these causes are obvious; sometimes they are subtle and far removed in space and time from the ecological damage, as is the case in many southern California coastal wetlands. Most watersheds that drain into the Region's coastal wetlands were hydrologically modified as a result of urbanization and flood protection measures. Runoff quantities and velocities were increased by the straightened, more efficient drainage systems reduced deposition of sediments on the floodplain and increased the movement of sediments (and pollutants) downstream. These materials entered the coastal wetlands, estuaries and bays, causing water quality problems that fundamentally changed how many of these ecosystems functioned.

These large-scale cause-and-effect relationships pose major constraints to ecosystem restoration such as; the scale of the impact, the cost of both restoration and maintenance, and the magnitude and potentially permanent nature of the environmental changes that resulted in the loss of many ecosystem functions. In addition, although human activities in the watershed have substantially altered many ecological processes, some of these activities provide important public benefits (e.g., flood protection and water supply). Ecosystem restoration therefore must balance the need to provide high quality environments that fulfill the needs of plant and animal communities with preservation of

Ballona wetlands in Marina Del Rey. The Region has lost more than 90 percent of its historic wetlands. The last remaining 600 acres of the Ballona wetlands are in the planning stages of restoration.

the functions provided by human modifications to such ecosystems.

Opportunities for ecosystem restoration in the Region include as examples: the Los Angeles and San Gabriel River Master Plans, the Los Angeles River Revitalization Master Plan; the DeForest-Dominguez Wetlands Restoration Preliminary Plan; the Hazard Park Wetlands Restoration; Devil's Dip Creek Restoration and Daylighting; Topanga Creek Restoration Program; Malibu Creek and Tributary Restoration, Las Flores Creek Restoration; Solstice Creek Restoration, Arroyo Sequit Restoration, Whittier Narrows Nature Center Ecosystem Restoration; Malibu Lagoon Habitat Enhancement Program; Ballona Creek Ecosystem Restoration Project; Hydrodynamic Study for the Restoration of the Tujunga Wash; Taylor Yard Multi-Objective Feasibility Study, the Limekiln Canyon Stream Restoration and Habitat Improvement Project, Puente Chino Hills Wildlife Corridor, and the Los Cerritos Wetlands Restoration.

Environmental and Habitat Protection and Improvement

Risks to the environment and upland and riparian habitat in the Region include urbanization and the loss of green space, invasive species, hydrological alterations, channel hardening, incompatible land uses, habitat fragmentation, and other common problems associated with urbanization and pollution. The results of riparian and aquatic habitat degradation can lead to increased erosion of banks and channels; diminished water quality for wildlife and domestic use; loss of habitat for wildlife; alteration in flood protection; loss of aquatic and terrestrial productivity and health; and loss of recreational, educational, and aesthetic values. For some surface water bodies, water quality impairments include increases of both non-toxic elements such as sediment, nutrients, and water temperature, as well as toxic contaminants such as pesticides, bacteria, and heavy metals. Degraded water quality requires substantial treatment to remove the pollutants that may potentially affect fish and wildlife habitat quality, and limits recreational use of southern California beaches, bays, and lagoons.

In addition, the loss of habitat throughout the coastal watersheds has aggravated water supply and reliability problems since riparian vegetation, wetlands, and surrounding uplands can act to slow and retain stormwater flows and allow the water to recharge groundwater.

The long-term restoration, improvement, and protection of the Region's riparian and aquatic habitat and environment would alleviate or eliminate the water quality, water supply and biological impacts of environmental degradation. Because many of the issues involved in environmental and habitat protection and improvement cut across traditional political and organizational boundaries success will only be accomplished through cooperative planning efforts like the IRWMP that include non-governmental organizations, private landowners, industry, and state and federal government.

The potential for aquatic and riparian restoration is limited by extensive development in the Region, as well as by geologic and topographic constraints. Restoration in such a heavily urbanized Region is hindered because the physical and hydrological landscape has been irreversibly altered in so many locations that it may be impossible to re-establish historic conditions. Hydrologic and land use changes in the watersheds also continue to impact stream corridors and downstream aquatic habitats and many created habitats that were designed

Figure 4-15. Multiple agencies in the Greater Los Angeles Region are collaborating across organizational boundaries to develop long-term solutions to historical environmental degradation.

to mitigate for losses from development seldom perform the same ecological functions as those that were removed.

Opportunities for restoration, improvement, and protection of the Region's riparian and aquatic habitat include the following examples: Las Virgenes Creek Naturalization and Restoration, Restoration of Southern Steelhead Habitat in Solstice Creek, Triunfo Creek Riparian Enhancement, Hahamongna Watershed Park Habitat Restoration and BMP Implementation; the Flint Wash Restoration; the Central Arroyo Park Habitat Restoration and BMP Implementation; the Lower Arroyo Park Habitat Restoration and BMP Implementation; the San Rafael Creek Restoration; Santa Fe Dam Recreation Area and Habitat Enhancements; Rio Hondo Vision Plan (Emerald Necklace Concept); Wilmington Drain Restoration Multiuse Project; Machado Lake Improvements; Stone Canyon Creek Restoration; the Long Beach RiverLink; the Sepulveda Basin Habitat Enhancement; and the Arroyo Seco Watershed Feasibility Study.

Wetlands Enhancement and Creation

The Region has lost more than 90 percent of its historic wetlands. Those remaining are threatened by development, changes in hydrology, invasive species, and poor water quality. The results of degradation of remaining wetlands and the associated environment can lead to increased erosion of banks and channels; diminished water quality for wildlife and domestic use; loss of ecosystem function, loss of habitat for wildlife; alteration in flood protection; loss of aquatic and terrestrial productivity and health; and loss of recreational, educational, and aesthetic values. Water quality impairments include increases of both non-toxic elements such as sediment, nutrients, and water temperature, as well as toxic contaminants such as pesticides, bacteria, and heavy metals. The degraded water quality requires substantial treatment to remove the pollutants which may affect aquatic and terrestrial habitat quality and function, and limits recreational use of beaches, bays, and lagoons. In addition, the loss of wetlands throughout the coastal watersheds has aggravated water supply and reliability problems, since riparian vegetation

Figure 4-16. The long-term restoration, improvement and protection of the Region's wetlands would help ameliorate the water quality, water supply and biological impacts of environmental degradation.

and wetlands can act to slow and retain stormwater flows and allow the water to recharge groundwater.

The long-term restoration, improvement, and protection of the Region's wetlands would help ameliorate the water quality, water supply and biological impacts of environmental degradation. Because many of the issues involved in wetland restoration and enhancement cut across traditional political and organizational boundaries, success can more easily be accomplished through cooperative planning efforts like the IRWMP that include non-governmental organizations, private landowners, industry, and state and federal government. Education and public outreach will be critical in helping the public understand their role in protection and achieving buy-in on the necessary improvements.

Wetland restoration and enhancement is constrained by existing development over much of the historical wetland areas, private ownership, permanently altered hydrology, and lack of funding for operation and maintenance. Meeting water quality and flood management needs, water supply needs and habitat and recreation targets over the next 20 years will strain the Greater Los Angeles community. Projected growth, a tight fiscal environment, and limits to water supply will all contribute to the difficulty. In today's funding

environment, it is probably not possible that all of the required projects can be completed as single purpose projects. With planning, cooperation, and vision, projects can be integrated to achieve multiple goals. For example, wetlands and riparian habitat projects can provide water quality, groundwater recharge, flood management and recreational opportunities. Integrated projects may be more likely to be funded, in that funding agencies may treat them more favorably, or various fund sources would be available to fund individual elements of projects.

Opportunities for enhancement and creation of the Region's wetlands include: Los Cerritos Wetland Restoration (Bryant, Bixby, and Hellman); Gardena Willows Restoration; Ballona Wetlands Restoration; Colorado Lagoon Enhancement; DeForest-Dominguez Wetlands Restoration; Hansen Dam Recreational Area Wetlands Restoration Project; JWPCP Marshland Enhancement Project, Los Angeles River Headworks Wetlands and Water Protection Project; the Multiuse Wetlands Project at Children's Museum of Los Angeles; Malibu Lagoon; and El Dorado Park Wetlands.

Open Space, Recreation

Recreation and Public Access

Open space used for recreation and public access has the potential to enhance water supply (by preserving or enhancing groundwater recharge and thereby improving water supply reliability) and improve surface water quality, to the extent that these open spaces filter, retain, or detain stormwater runoff (although few existing parks or open spaces include specific features to improve the quality of stormwater runoff, and poorly managed open space has the potential to be a source of sediment which can degrade water quality).

As discussed in Section 3, with a projected population increase of approximately 15.4 percent in the Region, it is estimated that approximately 30,380 acres of additional parks and open space will be needed to meet the minimum recommendation for parkland from the National Recreation and Park Association.

Although much of the remaining open space in the Region is located in the foothills and the mountains, the bulk of the need exists within the densely developed coastal plain and the inland valleys. If new parkland and open space can be created within these urbanized areas, particularly within or near Disadvantaged Communities, then public access to parkland could be improved. To increase open space, the acquisition of land will be necessary. Opportunities for acquisition could include vacant parcels, under-utilized public land, brownfields (when remediation is feasible), and the lands along rivers, creeks or tributaries.

Current plans and proposals for new parks, trails and recreational projects in the Region include: Rio de Los Angeles State Park, Annandale Golf Course Habitat Restoration and Infiltration; Welch Site BMP and Habitat Restoration; Lincoln Heights Freeway Interchange Restoration and BMP; Malibu Linear and Civic Center Legacy Park; Trancas Canyon Park; Las Flores Creek Park; Morris Dam Peninsula Park; Azusa Canyon River Wilderness Park; San Gabriel River Master Plan, (National Park Service) San Gabriel River Watershed Special Resource Study, San Gabriel Canyon Spreading Grounds; Maywood Riverfront Park; San Gabriel River Discovery Center at Whittier Narrows Regional Park; Woodland (Duck) Farm Park; Pio Pico State Historic Park; Paseo del Rio at San Gabriel and Rio Hondo Spreading Grounds; Santa Fe Springs Park Expansion; Downey Landing, City of Downey; Bellflower Riverview Park; Pacoima

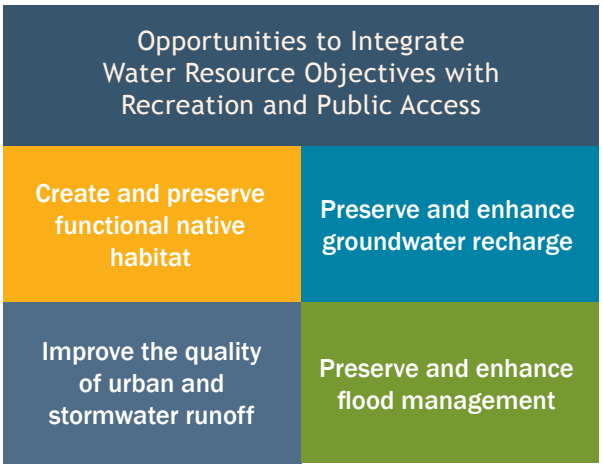


Figure 4-17. Open space used for recreation and public access has the potential to enhance water supply and improve surface water quality.

Wash Greenway Project Parkside Drive Park; South Los Angeles Wetlands Park; Puente Creek Nature Center; Strathern Pit Multiuse Project; North Atwater Creek Restoration and Water Quality Enhancement; Marsh Street Park; Walteria Lake Enhancement; and Lafayette Creek Daylighting.

As new parks or open space are created, these places may also provide opportunities to meet other Regional needs, including:

- Creation or preservation of functional native habitat and habitat linkages;
- Preservation or enhancement of groundwater recharge, to the extent that new parks preserve existing open space or reduce impervious surfaces;
- Improve the quality of urban or stormwater runoff, so that new parks or open space are designed to include runoff quality features, such as vegetated swales, buffers, or other BMPs; and;
- Preserve or enhance flood management; the preservation of open space can avoid potential increases in runoff associated with new development, and reduce runoff if impervious surfaces are reduced.

Sustain Communities

Asset Management

With more than 10 million people residing in a developed area of approximately 1,125 square miles, the infrastructure developed for water, wastewater, and flood protection is significant. To maintain the quality of potable water, the capture and treatment of wastewater, and minimize risks to life and property from flood events, this infrastructure must be maintained, repaired as needed, and replaced or expanded when appropriate.

Traditionally viewed as a form of monetary management, in the past decade, asset management has increasingly replaced traditional assessments of repair and replacement costs. The recently adopted Statewide General Waste Discharge Requirements for Sanitary Sewer Systems, requires the development of Sewer System Management Plans (SSMP) for all publicly owned sewage collection systems greater than one mile in length in California over the next four years, with a goal to protect public health and the environment by reducing the severity and number of sanitary sewer overflow events.

Although the specific components of an asset management program may vary, in general the process consists of the development of an overall strategy, an inventory of assets, an assessment of asset condition, a financial valuation, the establishment of capital and operating budgets, followed by the ongoing maintenance, repair, and replacement of assets.

Public agencies and districts responsible for water, wastewater, and flood protection should implement asset management programs, which will preserve and protect water quality, enhance water supply reliability, and protect the public and environment.

Integrated Planning

This Plan is the most visible evidence of integrated planning in the Region, but it is not the only example. As noted elsewhere, in recent years the potential for a transformation of the watersheds in this Region has emerged, beginning with visions of "restoring" the Los Angeles and San Gabriel Rivers, development of watershed management plans on most of the major tributaries and creeks, and the preparation of IRPs by water and sanitation agencies. These various plans promote integrated efforts to manage resources and recognize

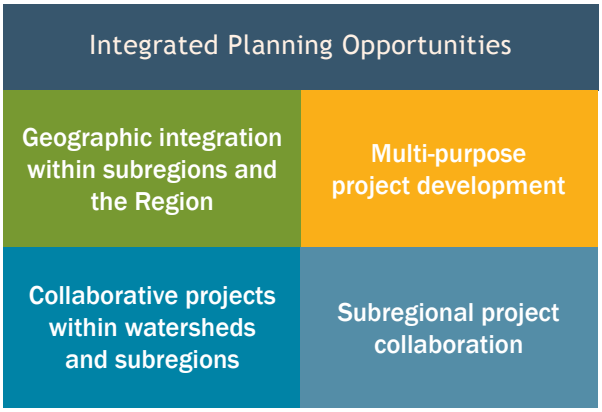


Figure 4-18. The IRWMP has provided an opportunity to integrate planning at the scale of watersheds, subregions, and the Greater Los Angeles County Region.

that water and watershed resources are interconnected.

Three general approaches to integrated planning have been identified in this Plan: 1) Geographic Integration, which links similar kinds of projects or programs that are geographically separated, but can work together to create a whole that is greater than the sum of its parts; 2) Multi-purpose Projects, where multiple water management strategies are incorporated into individual projects or programs; and 3) Collaborative Projects, which requires agencies, jurisdictions or organizations to work together on collaborative projects or programs which cross jurisdictional boundaries and address multiple water management strategies.

Due to the extensive urban constraints in the Region, the opportunities for implementing water resource projects are constrained by the availability of funding and competing demands for available land to site new projects. Plans, programs, and projects need to integrate multiple water management strategies to meet Regional water resource needs, efficiently use fiscal resources, and provide the public with tangible community benefits.

As the IRWMP will largely be implemented by the individual actions of local agencies, jurisdictions, and organizations, the consistent application of integrated planning will be necessary to assure that the objectives and planning targets established in this Plan are realized.

Land Use Planning

The constitution of the State of California confers responsibilities for land use planning to the cities and counties (for unincorporated areas). The Government Code establishes requirements for the development of General Plans to guide land use decisions, which must include seven required elements: land use, circulation, housing, conservation, open space, noise, and safety. Because of this structure, water resources may be discussed within the conservation element (as relates to water supply and stormwater management), the open space element (as relates to water-based recreation or the use of lands that may protect water supply or enhance groundwater recharge), and the safety element (as relates to flood protection). Thus,

Figure 4-19. The State of California Government Code establishes requirements for the development of General Plans to guide landuse decisions.

most jurisdictions' policies with respect to water resources and their management are typically fragmented throughout several elements. The State of California's General Plan Guidelines (GOPR, 2003) describe the concept of an optional water resources element, which would combine water supply and demand, water quality, wastewater treatment and disposal, watershed features and processes, flood management, and stormwater management.

In 2001, two water supply planning bills were enacted and required greater coordination and more extensive data to be shared between water suppliers and local land use agencies for large development projects and plans. Senate Bill 610 (California Water Code §10631, §10656, §10910, §10912, §10915, §10657) requires a water supply assessment (as part of the California Environmental Quality Act [CEQA] review) for any development project or related land use plan of more than 500 housing units, 500,000 square feet of retail use, 250,000 square feet of office use, 500 hotel rooms, 40 acres, or 650,000 square feet of business park use or a mixed-use project with any combination equal to the scale noted above. Senate Bill 221 (Government Code §66410, et seq.) prohibits any land use agency from approving a subdivision map of more than 500 housing units unless there is written verification from a water provider that a sufficient and reliable water supply is available. Sufficient water supply is defined as adequate water to supply the new growth in normal, dry, and multiple dry years. As large portions of the Region are already developed and most of the remaining developable land is located in the foothills and mountains, few development projects in the Region exceed the thresholds identified in either bill. Thus, the preparation of Water

Supply Assessments or written verifications has been somewhat limited in the Region.

Given the pervasive nature of some NPS pollutants, land use planning, in the form of ordinances, could be used to reduce stormwater runoff volume and/or the discharge of pollutants from development or redevelopment sites. For those portions of the Region within Los Angeles and Ventura Counties, certain development (including automotive repair shops, retail gasoline outlets, restaurants, home subdivisions with ten or more homes, parking lots with 25 or more spaces or are greater than 5,000 square feet in area, single-family hillside residences, and locations within, or directly adjacent, or discharging to, environmentally sensitive areas) require the development of a Standard Urban Stormwater Mitigation Plan (SUSMP), to retain the runoff from storms of approximately 0.75 inches. SUSMP requirements could be amended to require both retention and treatment of runoff with individual jurisdictions extending these requirements to development/redevelopment on smaller sites or additional development types. Existing stream corridors, open spaces, or other valued watershed resources could be protected via ordinance (i.e., a stream protection ordinance) or incentives could be provided to reduce impervious surfaces and increase natural recharge. To address water quality issues, the Orange County Drainage Area Master Plan was followed by the development of watershed action plans and the subsequent amendment of local General Plans to integrate water quality and runoff policies. A more comprehensive approach to natural resource management, which could provide corollary benefits to water resources, is provided by the City of Santa Monica's Sustainable City Plan, which promotes a well-maintained open space system that can support natural functions, wildlife habitat, passive and active recreation, and supports implementation of land use and transportation planning and policies that encourage compact development and mixed-use projects.

Implementation of projects designed to capture, treat, and reuse urban and stormwater runoff as part of the implementation of the IRWMP, could require acquisition of land to site those projects. To the extent that acquisition displaces existing uses, cities and counties may consider modification of their general plans to facilitate the accommodation of displaced uses or provide incentives to take advantage of newly created open spaces (e.g., detention basin or natural treatment areas) or recreational areas. Where feasible, general plan modifications should incorporate the concepts articulated in Common Ground from the Mountains to the Sea, and in the SCAG Compass Growth Vision Report, such as mixed-use land use designations with increased density along existing transportation corridors. Cities and counties should also consider providing incentives to private development that promote the inclusion of features that improve surface water quality, enhance groundwater recharge, and reduce water demand.

Constraints to the use of Land Use Planning to enhance the integrated management of water resources include: the lack of fiscal resources to support development of optional general plan elements; the potential for disparities amongst local jurisdictions to subtly affect development patterns (as developers may choose those jurisdictions with less stringent requirements); and the absence of model programs to demonstrate the effectiveness of such measures.

Opportunities to expand the use of Land Use Planning in the integrated management of water resources include: the adoption of natural resource protection measures (e.g., floodplain or stream protection ordinances); the preparation of Water Resource Elements in city and county General Plans; the adoption of Sustainability Plans by jurisdictions, agencies, and organizations; and the SCAG Compass Growth Vision Report.

Watershed Planning

Numerous watershed plans have been prepared in the Region, including the Arroyo Seco Watershed Restoration Feasibility Study, the Ballona Creek Watershed Management Plan, Common Ground, from the Mountains to the Sea, Compton Creek Watershed Management Plan, Dominguez Channel Watershed Management Master Plan, Malibu Creek Watershed Management Area Plan, Rio Hondo Watershed Management Plan, Sun Valley Watershed Plan, and the draft Upper San Gabriel

River Watershed Management Plan. Draft plans are under development for the Tujunga Wash, the Headwaters of the Los Angeles River, and Coyote Creek, along with the Green Visions Plan for Los Angeles County and portions of Orange and Ventura Counties. As noted by the 2005 update of the California Water Plan: "…Los Angeles County [is] the most productive county in the state in terms of watershed planning" (DWR, 2005).

The primary focus of these plans has been improvement of surface water quality, with additional emphasis on preservation of open space, and the promotion of multi-purpose projects. Most of these efforts have been stakeholder-driven, so that the list of recommended actions reflects local concerns and priorities.

Constraints on the development of additional watershed plans include: availability of funding; absence of established stakeholder groups for some of these areas; and a defined minimum scope to assure Regional consistency.

Opportunities for the preparation of new watershed plans include: Burbank (east and west) Wash; Verdugo Wash; the main stems of both the Los Angeles and San Gabriel Rivers (although the respective river Master Plans cover the river corridors and some adjacent lands); Los Cerritos Channel; and numerous smaller watersheds that drain directly to Santa Monica Bay and San Pedro Bay. In addition, this IRWMP could serve to promote regional consistency between both new and existing plans.

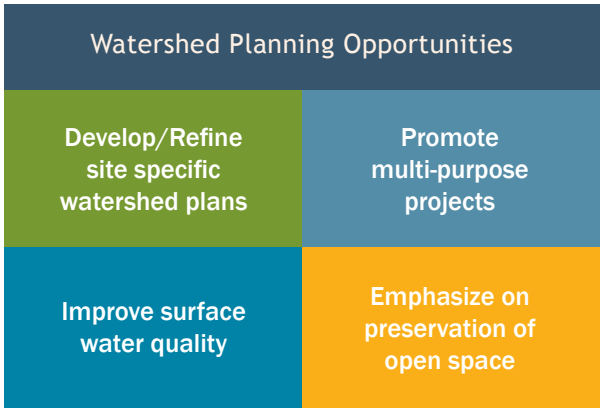


Figure 4-20. As noted by the 2005 update of the California Water Plan: "...Los Angeles County [is] the most productive county in the state in terms of watershed planning." (DWR, 2005).

4.3 Opportunities for Integration

Opportunities to integrate individual water management strategies with other strategies are identified below and summarized in Table 4-3. For those water management strategies that are identified as having a potential for substantial expansion in the Region (in Section 4.2 above) specific opportunities to integrate with other strategies are identified below.

Water Supply

Desalination

Desalination projects could be integrated with strategies to: 1) Improve and Protect Water Quality (as desalination projects would provide a high-quality source of water); 2) Water and Wastewater Treatment (as desalination is one form of water treatment); 3) Water Supply Reliability (as desalination can provide a source of additional water that is not subject to seasonal or yearly variation); and 4) Water Transfers (as desalinated water could either be transferred to other locations or could free up other supplies for subsequent transfer).

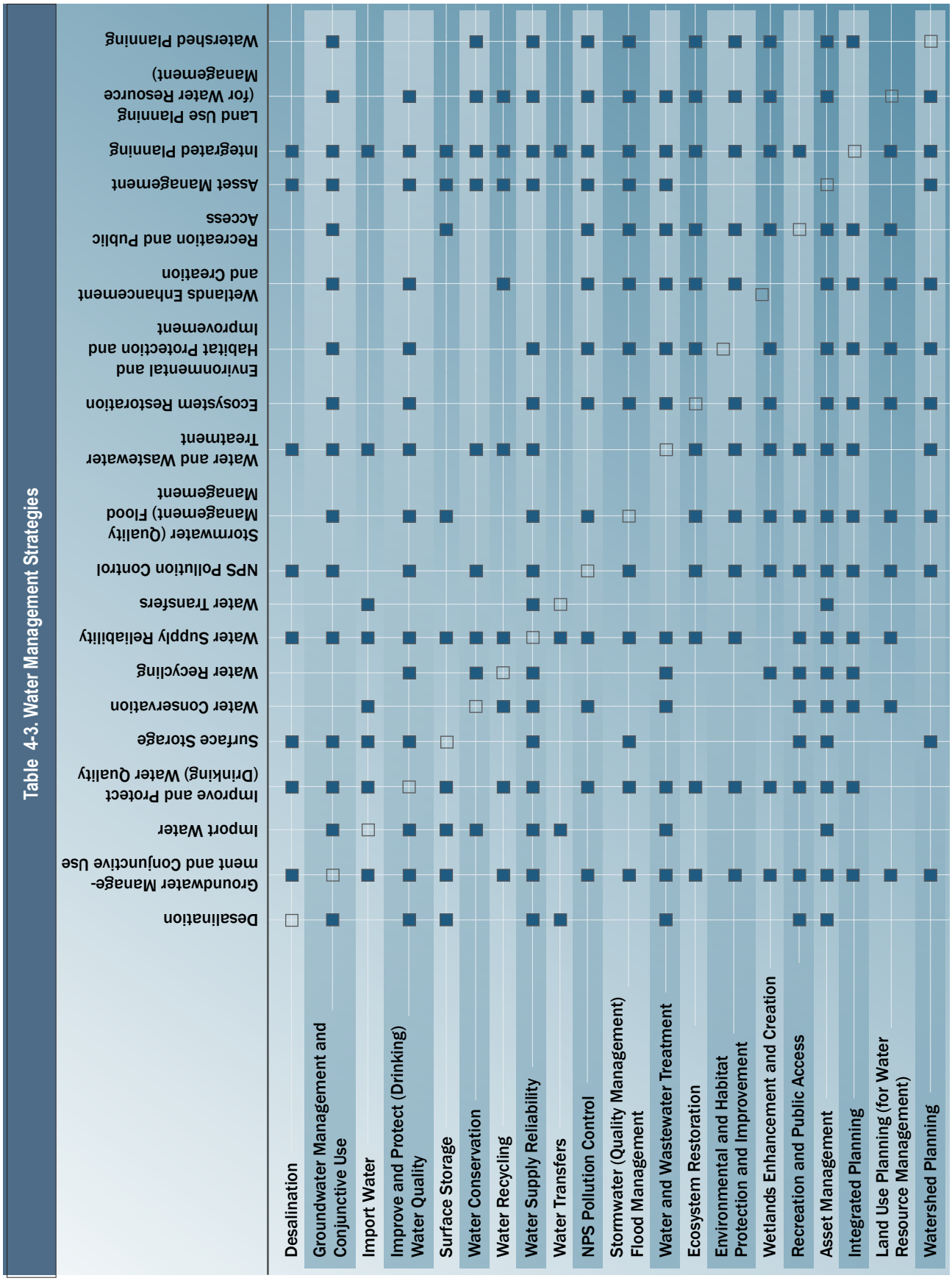
Water Transfers

Water Transfers may be integrated with: 1) Desalination (as desalinated water could either be transferred to other locations or could free up other supplies for subsequent transfer); 2) Import Water (as a likely source of the water); and 3) Water Supply Reliability (as an augment water supplies).

Stormwater and Flood Management

Stormwater and Flood Management projects and programs can be integrated with: 1) Asset Management (for the maintenance, repair and replacement of flood protection facilities); 2) Ecosystem Restoration (promoting retention of stormwater); 3) Environmental and Habitat Protection and Improvement (promoting retention of stormwater); 4) Groundwater Management and Conjunctive Use (which would benefit from

Table 4-3. Water Management Strategies



the recharge of treated runoff); 5) Improve and Protect Water Quality (through improved stormwater quality); 6) Land Use Planning (via policies and ordinances which support improved surface water quality); 7) NPS Pollution Control (which would reduce the presence of some contaminants in stormwater); 8) Recreation and Public Access (as stormwater quality management facilities that utilize natural treatment methods may provide passive recreational opportunities); 9) Surface Storage (as storage facilities provide opportunities to manage runoff, particularly during flood events); 10) Watershed Planning (for watershed-based approaches to improving surface water quality and preserving flood protection levels); 11) Water Supply Reliability (as improved surface water quality may expand recharge of runoff); and 12) Wetlands Enhancement and Creation (as wetlands can remove contaminants and retard runoff).

Habitat

Ecosystem Restoration

Ecosystem Restoration projects and programs can be integrated with: 1) Environmental and Habitat Protection and Improvement (as a component of such programs); 2) Groundwater Management and Conjunctive Use (by promoting or preserving natural recharge); 3) Improve and Protect Water Quality (by preserving or restoring natural processes that enhance surface water quality); 4) Land Use Planning (via

General Plan policies or ordinances that promote restoration); 5) NPS Pollution Control (by promoting natural processes which sequester or remove contaminants in stormwater); 6) Recreation and Public Access (by enhancing passive recreation opportunities in restored ecosystems); 7) Stormwater and Flood Management (by promoting retention of stormwater); 8) Watershed Planning (as a potential open space goal in such plans); 9) Water Supply Reliability (by promoting retention of stormwater and natural recharge); and 10) Wetlands Enhancement and Creation (if appropriate for the ecosystem being restored).

Environmental and Habitat Protection and Improvement

Environmental, Habitat Protection and Improvement projects and programs provide opportunities to integrate with: 1) Ecosystem Restoration (as a component of such programs); 2) Groundwater Management and Conjunctive Use (by promoting or preserving natural recharge); 3) Improve and Protect Water Quality (by preserving or restoring natural processes that enhance surface water quality); 4) Land Use Planning (via General Plan policies or ordinances that promote restoration); 5) NPS Pollution Control (by promoting natural processes which sequester or remove contaminants in stormwater); 6) Recreation and Public Access (by enhancing passive recreation opportunities in restored habitat); 7) Stormwater and Flood Management (by promoting retention of stormwater); 8) Watershed Planning (as an open space goal in such plans); 9) Water Supply Reliability (by promoting retention of stormwater and natural recharge); and 10) Wetlands Enhancement and Creation (if appropriate for the ecosystem being restored).

Wetlands Enhancement and Creation

Wetlands Enhancement and Creation projects and programs may be integrated with: 1) Ecosystem Restoration (as a form of restoration); 2) Environmental and Habitat Protection and Improvement (consistent with the enhancement and creation of wetlands); 3) Groundwater Management and Conjunctive Use (as wetlands may promote natural recharge); 4) Improve and Protect Water Quality (as constructed wetlands can be used to remove contaminants from runoff); 5) Land Use Planning (via policies or ordinances which enhance or create wetlands); 6) NPS Pollution Control (as natural processes may sequester or remove stormwater pollutants); 7) Recreation and Public Access (as creation and enhancement of wetlands may provide passive recreational opportunities); 8) Stormwater and Flood Management (as wetlands can remove contaminants and retard runoff); 9) Water and Wastewater Treatment (as wetlands may be used

to improve the quality of treated stormwater or wastewater); 10) Water Recycling (as constructed wetlands could be used to improve the quality of recycled water); and 11) Watershed Planning (via watershed-based approaches to habitat issues such as wetlands).

Open Space, Recreation

Recreation and Public Access

Recreation and Public Access may be integrated with: 1) Asset Management (as the future retrofit of recreational spaces could be designed to provide stormwater quality benefits); 2) Ecosystem Restoration (by enhancing passive recreation opportunities in restored ecosystems); 3) Environmental and Habitat Protection and Improvement (by enhancing passive recreation opportunities in restored habitat); 4) Groundwater Management and Conjunctive Use (as recharge facilities may provide passive recreation opportunities); 5) Land Use Planning (via policies which support development of recreational spaces that enhance water resources); 8) NPS Pollution Control (to the extent that recreational space may contain features which improve surface water quality); 9) Stormwater and Flood Management (as stormwater quality management facilities that utilize natural treatment methods may provide passive recreational opportunities); 10) Surface Storage (as such facilities may provide recreational opportunities); 11) Watershed Planning (as the open space preservation typically promoted by most watershed plans may preserve or enhance passive recreational opportunities); and 12) Wetlands Enhancement and Creation (as creation and enhancement of wetlands may provide passive recreational opportunities).

Sustain Communities

Asset Management

Asset management programs could be implemented for water, wastewater, stormwater and flood management systems, and could be integrated with the following strategies: 1) Desalination; 2) Groundwater Management/Conjunctive Use; 3) Improve and Protect Water Quality; 4) NPS Pollution Control; 5) Stormwater and Flood Management; 6) Surface Storage; 7) Water and Wastewater Treatment; 8) Water Conservation; 9) Water Recycling; and 10) Water Supply Reliability. In addition, the implementation of asset management programs for recreational facilities (per the Recreation and Public Access strategy) could also provide integration opportunities as the future retrofit of recreational spaces could be designed to provide water resource benefits.

Land Use Planning

Land Use Planning can be integrated with water resource management via the inclusion of a general plan water element, or: 1) Ecosystem Restoration (via policies and ordinances which support restoration); 2) Environmental and Habitat Protection and Improvement (via policies and ordinances which support habitat protection and improvement); 3) Groundwater Management and Conjunctive Use (via policies and ordinances which support natural recharge and protection of groundwater quality); 4) Improve and Protect Water Quality (via policies and ordinances which support natural protection of surface and groundwater quality); 5) NPS Pollution Control (via policies and ordinances which support natural recharge and protection of groundwater quality); 7) Recreation and Public Access (via policies which support development of recreational spaces that enhance water resources); 8) Stormwater and Flood Management (via policies and ordinances which support improved surface water quality); 9) Water Conservation (via policies and ordinances which reduce water consumption); 10) Water Recycling (via policies or ordinances which promote utilization of recycled water where appropriate); 11) Watershed Planning (via policies which support application of watershed approaches to resource management issues); 12) Water Supply Reliability (via policies and ordinances which support groundwater recharge, water conservation, and water recycling); and 13) Wetlands Enhancement and Creation (via policies or ordinances which enhance or create wetlands).