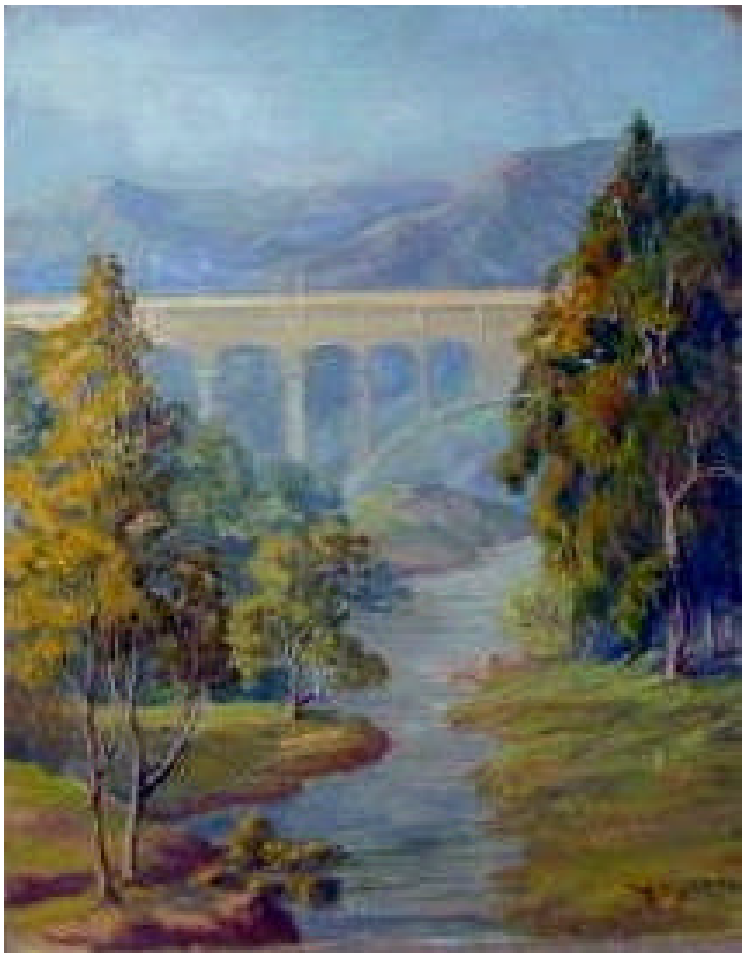
Arroyo Seco Water Resources Issues Paper



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In partnership with North East Trees as part of the CALFED Arroyo Seco Watershed Management Plan & Education Program

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Introduction

The Arroyo Seco, a tributary of the Los Angeles River, is one of southern California's greatest natural treasures. Central to its importance is the water it provides for people and the environment. This paper provides an overview of the major water resource issues affecting the Arroyo Seco watershed and the related aquifer, the Raymond Basin. It summarizes the work completed by the CALFED Arroyo Seco Watershed Management Plan & Education Program and other recent research and planning efforts and suggests programmatic recommendations for water management and quality improvements.

Water Resources in the Arroyo Seco Watershed

Early settlers of the Arroyo Seco watershed relied solely on local streams and wells to sustain their water needs. The region was rich with streams and springs, which bubbled out of the ground especially near the Raymond Fault that bisects the Arroyo between Pasadena, Los Angeles and South Pasadena. (Figure 1) Within twenty years of the establishment of the San Gabriel Valley Orange Grove Association in 1874, the first substantial human settlement in this region, the impacts of agriculture and population growth had put a severe strain on local water resources. By 1898 local residents began a determined campaign to expand water supplies. Some pioneers, such as Abbot Kinney and Theodore Lukens, advocated protecting the forests of the San Gabriel Mountains through watershed management to expand local supplies. In Los Angeles William Mulholland was building subsurface galleries at the confluence of the Arroyo Seco and the Los Angeles River to drain the underground flows of the Arroyo Seco to meet the needs of a growing metropolis. The advent of hydraulic pumps around the turn of the century allowed water agencies to further exploit groundwater resources, but this proved to be only a temporary solution.

In the last one hundred years the communities of the Arroyo Seco watershed have become increasingly reliant on imported sources of water. Chart 1 documents that pattern for the last twenty-five years for Pasadena and Foothill MWD, two of the major water purveyors.

Chart 2 illustrates the pattern in Los Angeles. While it is difficult to isolate source water patterns in Northeast Los Angeles from the rest of that city, the chart demonstrates an increased reliance on purchases of water from the Metropolitan Water District that vary widely from year to year based on rainfall and on conditions in the Owens Valley, the source of much of LA's water supply.

Table 1 illustrates the current dependence of Arroyo Seco watershed communities on imported water supplies.

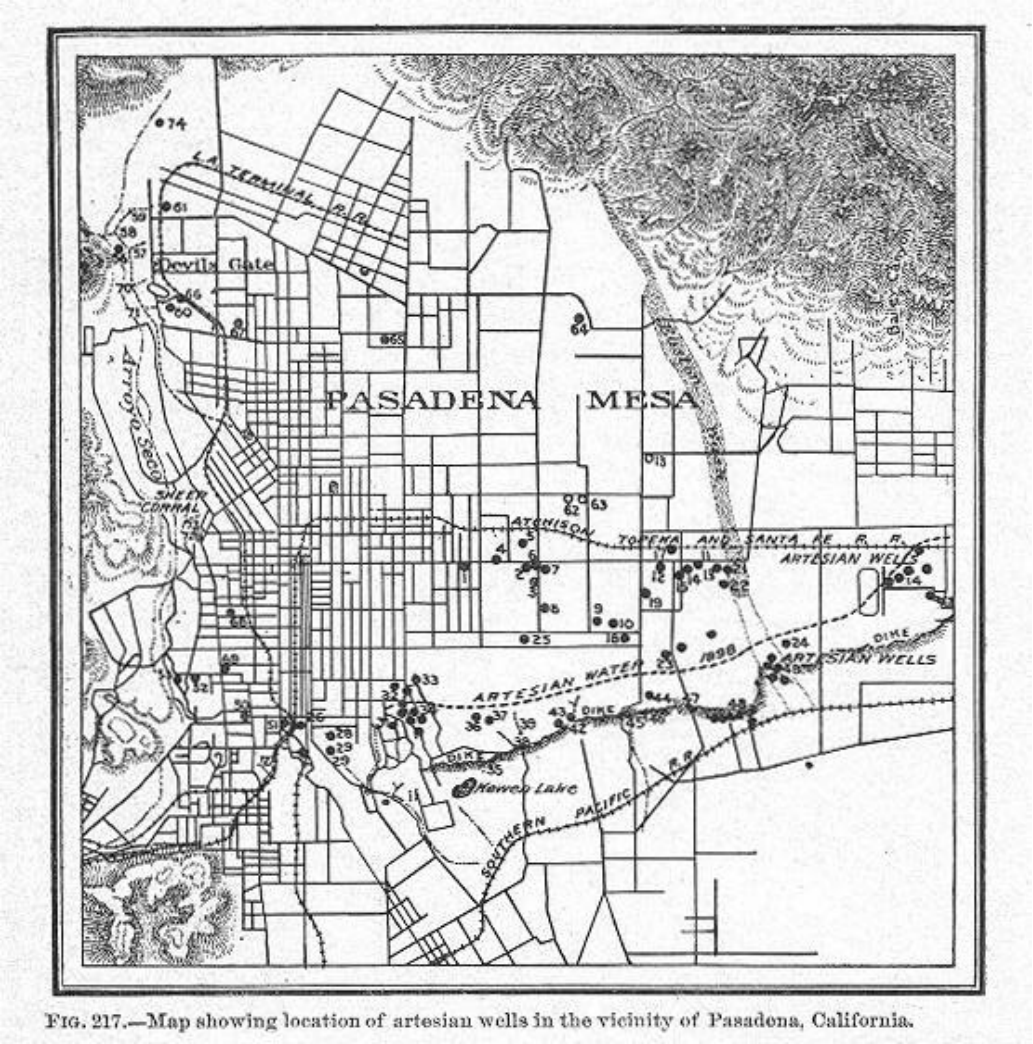


FIG. 217.—Map showing location of artesian wells in the vicinity of Pasadena, California.

Figure 1 - 1899 USGS Map of Local Artesian Conditions

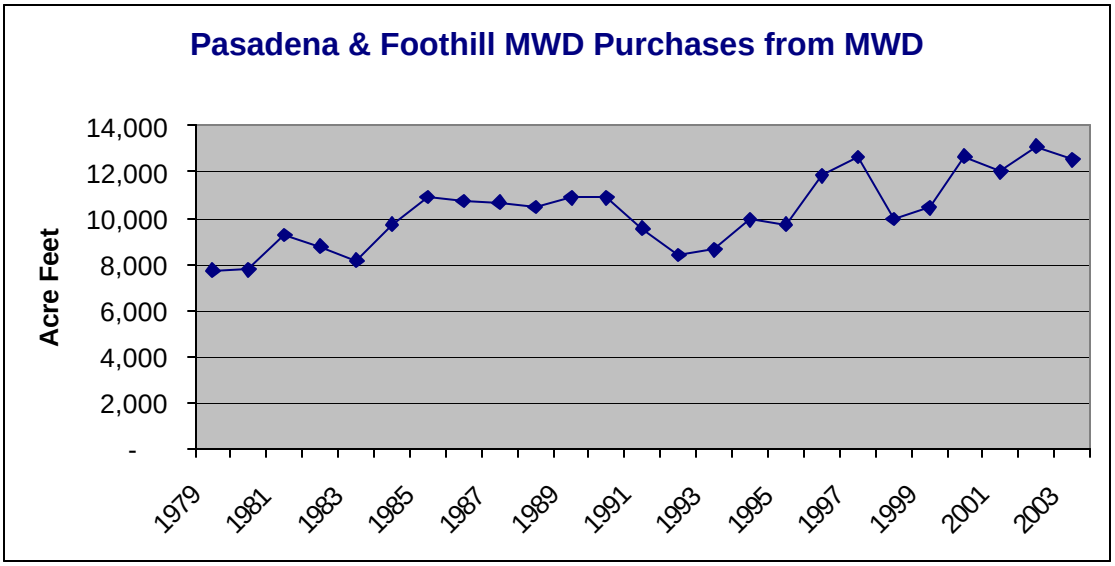


Chart 1 – Pasadena & Foothill MWD Purchases of Imported Water

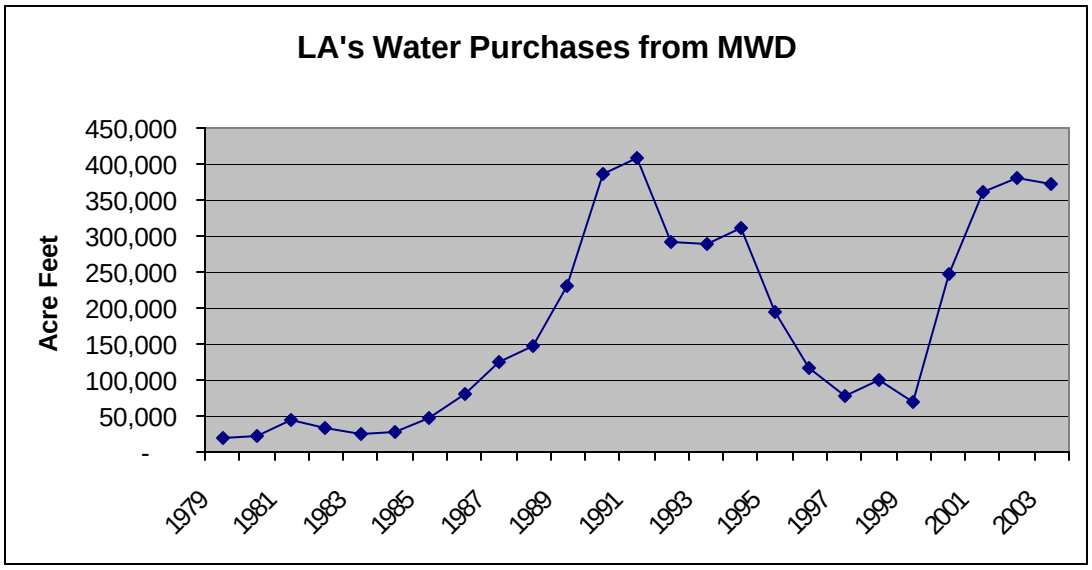


Chart 2 – Los Angeles Water Purchases

Table 1 –Arroyo Seco Watershed Water Sources

City	Population	Sales	Imports	% Imports
NE Los Angeles	78,598	8,547	8,547	100%
South Pasadena	8,089	2,456	2,456	100%
La Cañada	14,131	5,363	4,265	80%
Pasadena	44,839	10,622	7,883	63%
Altadena	21,305	3,671	1,944	53%
Total/Average	166,962	30,659	25,095	79%

For most of the last hundred years, local residents thought that imported water was the answer to population growth and development in the region. Los Angeles built the Owens Valley Aqueduct and participated with Pasadena and other communities in developing the Colorado River Aqueduct and the State Water Project, but these three massive engineering feats have not sated the demand for imported water. In recent years increased awareness of the environmental problems caused by those water systems and escalating competition for water supplies in the Southwest have make it clear that the imported systems cannot guarantee reliability and sustainability for our region. The region must learn how to conserve and manage local water resources better.

Water Budget

"A Water Budget for the Arroyo Seco Watershed" has recently been developed as part of the CALFED Arroyo Seco Watershed Management Plan & Education Program to

provide a better understanding of how water is used in our region and what can be done to promote conservation and better management of this invaluable resource. This document evaluates the Arroyo Seco Watershed, its inputs and outputs.

This purpose of "A Water Budget for the Arroyo Seco Watershed" is to analyze the factors that influence water use in the Arroyo Seco Watershed in order to develop a program that will ensure wise use of local water resources and a reduction of our reliance on imported water sources such as the State Water Project and the Colorado River. This watershed budget is a valuable tool and a framework for determining how we can better manage local water resources. It illuminates many of the key water issues that face local residents and decision-makers:

- The need to protect our watershed and its precious environment;
- The critical importance of water quality to our region; and
- The need for comprehensive conservation and water management programs to reduce per capital consumption and water imports.

The Arroyo Seco Watershed Budget is a tool to promote a better understanding of local water use and better management of the water resources of the Arroyo Seco. The approach is a relatively simple, straightforward evaluation of all the components of the hydrologic cycle and human interaction with it. More detailed and sophisticated techniques, employing Geographic Information Systems and other analytical tools, can be used to refine this budget to help the public and planners understand the effects of future management options. A more rigorous technical study of groundwater resources in the Raymond Basin is now being conducted by Geoscience Support Services for the Raymond Basin Management Board. Both of these analyses can be useful tools for policy makers and the public to ensure that water is used wisely.

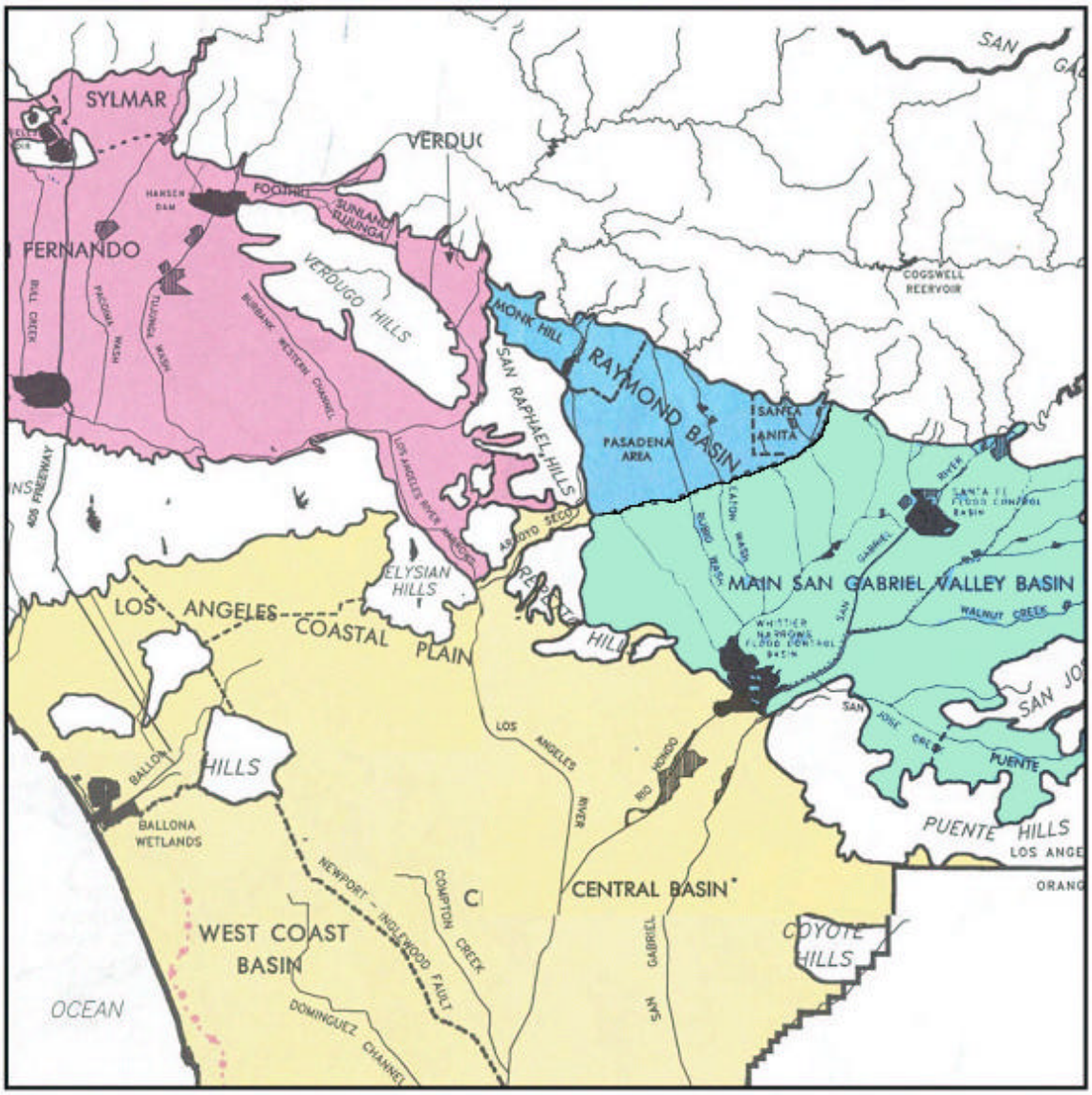


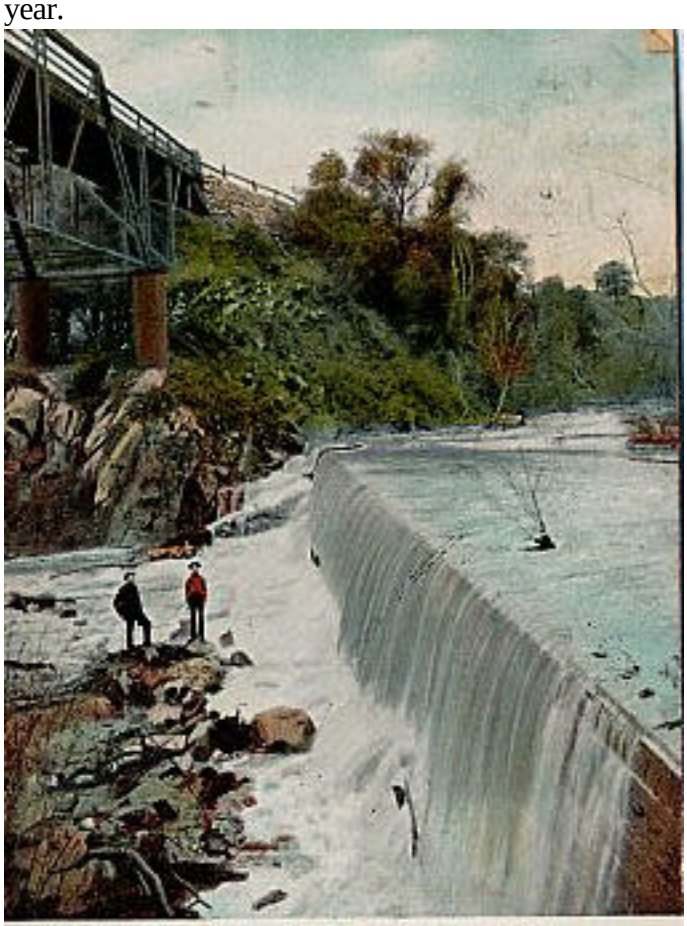
Figure 2 - Groundwater Basins of the Los Angeles Metropolitan Area

Aquatic Impacts of Water Diversions

Since the first diversions of water from the Arroyo Seco and other local streams for agriculture and people began in the 1860s, little attention has been given to the effects of water diversions on fish and wildlife.

Trout and other fish were once abundant in the Arroyo Seco. In 1893 Charles Holder in "All About Pasadena" wrote about riding his horse along with Arroyo Seco stream with trout darting from his horse's hoofs. As late as 1920 the cook at Annandale Country Club used to catch trout beneath the Colorado Street Bridge for tasty breakfasts. The construction of Devil's Gate Dam (1920) and the channelization of the Arroyo stream (1934-1947) destroyed stream and habitat conditions from the dam south to the Los Angeles River. There are still native trout in the upper watershed that may be genetically

linked to the steelhead which once migrated in and out of the Arroyo Seco. But Pasadena's water intake and spreading facilities are currently not adequately screened, and many downstream migrating fish and other aquatic species are being killed every year.



Devil's Gate, Water Supply of Pasadena, Cal.

In the Preliminary Report of the Arroyo Seco Watershed Restoration Feasibility Study, biology consultants Matt Stoecker and Verna Jigour reported that they found no trout downstream of the USGS Gaging station despite suitable pool structure and water temperatures in the area. An employee of Pasadena Water and Power verified that a large number of trout are trapped in the water facilities in the spring each year.

This downstream spring migration is typical of anadromous steelhead behavior and may suggest that some trout are attempting to migrate to the sea. It is even possible that some may make the migration to Long Beach where they reach the Pacific ocean Pacific during flood periods, but upstream migration to upper Arroyo Seco is not currently possible due to the channelization and barriers to migration in the Los Angeles River and the Arroyo Seco.

Modifying Pasadena's diversion dam and intake facilities to allow upstream and downstream fish migration would be an important step to improving conditions for aquatic and terrestrial species in the Arroyo Seco.

Operations and Maintenance of Spreading Facilities

The Hahamongna Watershed Park Master Plan, approved by the Pasadena City Council on September 29, 2003, envisions expanding spreading basins on the east side of Devil's Gate reservoir from 13 to 21 acres in addition to massive grading and resculpting of the area to expand flood capacity.

The Hahamongna Master Plan, as approved, includes:

- expanding the spreading basins in the area from 13 to 21 acres,
- massive grading and reshaping the basin to expand flood capacity, and

- a series of athletic fields, roads and parking lots.

While city staff and the City Council removed some more objectionable elements of the plan due to public concerns, the plan still fails to address one critical question: Can water in Hahamongna, the most important area for water resource in our area, be managed in a more environmentally sensitive way, while enhancing local water supplies?

The intent of the expansion of the spreading basins is to capture additional streamflow from the Arroyo Seco and enhance water conservation. While this expansion will consume an additional nine acres of rare alluvial scrub habitat, it has not been documented that there is adequate water to justify the new spreading facilities. Questions have also been raised about the whether the percolation basins are a good mechanism for water conservation in that area.

As part of the Hahamongna Planning, Pasadena sponsored a study of the hydrology of that area completed by the prominent hydrology firm of Philip Williams and Associates (PWA). The PWA report recommends a more environmentally sensitive approach to water management and enhancing rare habitat in the Hahamongna area. The PWA study advises that a braided natural stream through the Hahamongna basin would be more effective in capturing local water and percolating it into the groundwater basin beneath than expanding the spreading basins. Natural cycles of disturbance and multiple stream channels would create more edge habitat and favorable conditions to support wildlife. Such an approach would also protect rare alluvial scrub and riparian habitat and restore the natural beauty of the area.

A technical assessment is needed to study how to balance water diversions with habitat and stream protections in the Arroyo as it emerges from the San Gabriel Mountains. Such a review should evaluate recharging the Raymond Basin aquifer with surface flows in the natural stream channel through the Hahamongna basin at the mouth of the Arroyo rather than through percolation ponds. The PWA study has raised new concerns related to the quantification of water rights and water quality impacts of such an approach. The participation of the Raymond Basin Management Board and Pasadena Water and Power Department along with habitat and wildlife experts will ensure that the watershed management plan will optimize water conservation and reduce reliance on imported water, while planning the protection and restoration of the invaluable habitats and wildlife present in the Arroyo Seco watershed.

Water Quality

Human activity has seriously degraded the water resources of the Arroyo Seco. The main percolation zone into the Raymond Basin aquifer, underlying the upper part of the watershed, is now a Superfund site with toxic contamination resulting from rocket testing many decades ago. Volatile organic chemicals and perchlorate have caused the closure of nine of Pasadena's 15 wells and four more wells of other local agencies. In addition algae, fecal coliform and trash contaminate the surface water of the Arroyo Seco.

The JPL Contamination

Jet Propulsion Laboratory (JPL) is a 176-acre site in northwest Pasadena. Situated at the mouth of the Arroyo Seco canyon immediately adjacent to Hahamongna Watershed Park and Pasadena's groundwater recharge basins, this area is of great importance for drinking water resources. The U.S. Army developed and operated JPL between 1945 and 1957. In 1958, jurisdiction was transferred to the National Aeronautics and Space Administration (NASA). The California Institute of Technology, through a contract with NASA, conducts research and development at JPL in the areas of aeronautics, space technology, and space transportation.

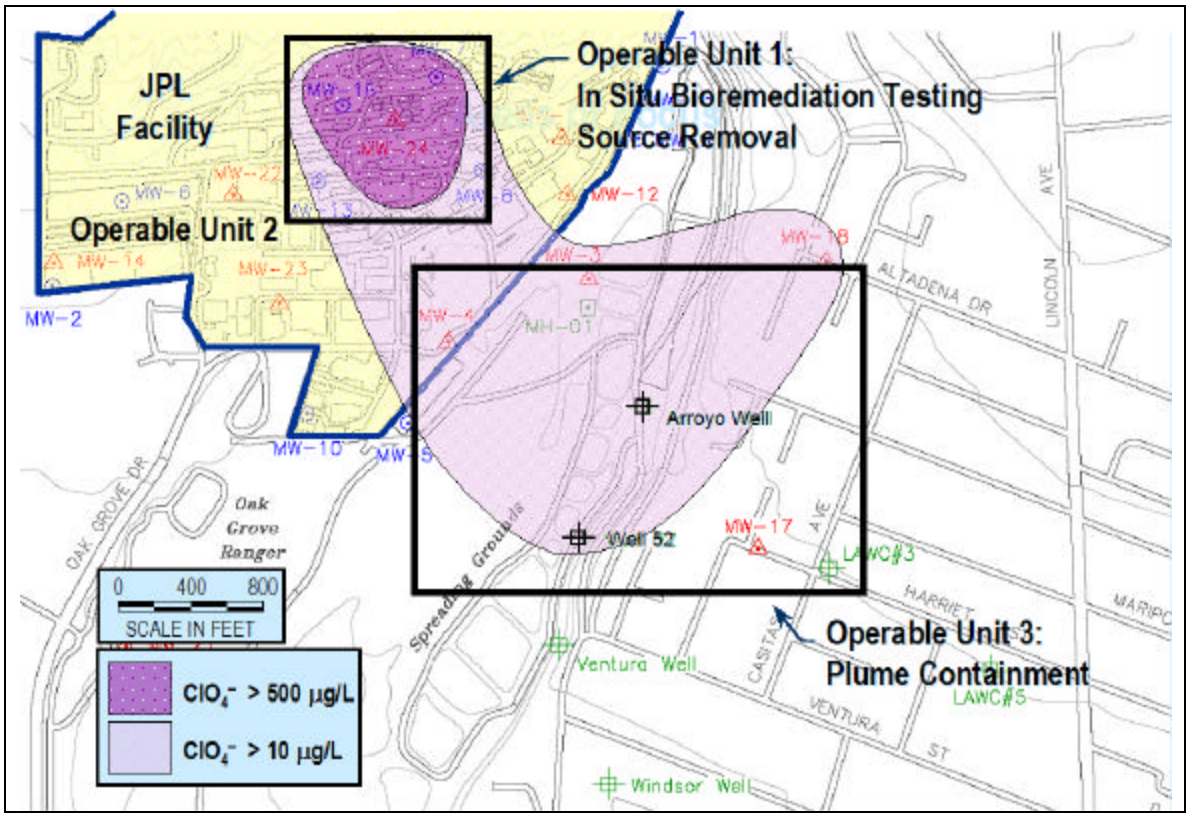


Figure 3 - Map of JPL Perchlorate Contamination in the Arroyo Seco

Sources of contamination at the site include approximately 35 seepage pits where liquid and solid wastes were disposed of, a settling chamber in the JPL storm drain system, contaminated soil excavated from part of that system, and an area where waste solvents were dumped into three separate holes. Hazardous substances located at JPL include waste solvents, solid rocket fuel propellants, cooling tower chemicals, sulfuric acid, freon, mercury, and chemical laboratory wastes.

In the early 1980s the Pasadena Water & Power Department and Lincoln Avenue Water Company detected significant levels of volatile organic chemicals such as trichloroethylene and carbon tetrachloride in their groundwater sources that come from the Monk Hill subbasin of the Raymond Basin aquifer. Lincoln Avenue Water Company

closed two wells due to volatile organic contaminants in 1987. Pasadena closed four municipal wells between 1985 and 1990. In 1990 Pasadena installed a closed aeration carbon filter treatment system, funded by JPL, to remove the contaminants from the water. The Lincoln Avenue Water Company also installed a treatment system on its wells.

In 1997 elevated levels of percholorate, a rocket fuel accelerant that may have detrimental effects on pregnant women and infants, were detected in local wells. Perchlorate can block iodine from entering the thyroid gland, which could result in a decrease in production of thyroid hormones.

When the perchlorate was first detected locally, Pasadena promptly closed four wells to protect consumer health. In 2002 when the California DHS reduced the action level to 4 parts per billion, Pasadena closed an additional five wells due to high concentration of perchlorate. Lincoln Avenue Water Company has also lost wells because of perchlorate.

The JPL contamination has traveled off site and affected local groundwater supplies in the Hahamongna area. JPL estimates that approximately 120,840 people live within 4 miles of the site; an estimated 68,000 people obtain drinking water from municipal wells within 4 miles of the site.

The JPL contamination site was declared a Superfund Site in 1992. JPL and NASA are now finalizing plans to treat and cleanup the remaining contamination.

Status of Cleanup Efforts

NASA has recently initiated the cleanup of the perchlorate and volatile organic chemical contamination on the JPL campus. A biological treatment process will be used to neutralize the high levels (30,000 parts per billion) of perchlorate onsite, but Pasadena and NASA are still negotiating over treatment of the drinking water wells that have been shutdown.

On March 12, 2004 the California Office of Environmental Health Hazard Assessment established the public health goal (PHG) for perchlorate in drinking water at 6 ppb. This PHG is a goal and not a standard. The California Department of Health Services will now establish a primary drinking water standard (state maximum contaminant level, or MCL), which will take into account economic factors and technical feasibility.

The PHG is seen as an important benchmark nationally because there are no existing state or federal drinking water standards for perchlorate. The action level for perchlorate in drinking water in California has been 4 ppb, the current detection limit. Pasadena, Lincoln Avenue Water Company and most municipal water systems throughout California have been closing wells that do not meet the action level.

Nationally, EPA's standard-setting process is moving more slowly. That agency designated perchlorate a non-regulated contaminant in 1999, but the establishment of a federal health-based standard is still several years away. In January 2002 EPA issued the

Draft Toxicological and Risk Characterization for Perchlorate, which indicated that there may be adverse impacts to sensitive populations at levels of 1 ppb and lower. The National Academy of Sciences (NAS) is now conducting an evaluation of that study and of the perchlorate problem. This review may help guide efforts to study the health effects of perchlorate.

NASA's cleanup efforts are important steps forward in limiting the spread of the contamination, but as long as local drinking water wells remain closed because of the perchlorate contamination, water resources in the Arroyo Seco remain severely challenged.

Expanding Water Conservation Programs

Renewed attention needs to be devoted by water agencies, community organizations and the public to develop effective water conservation programs resulting in measurable decreases in the reliance on imported water.

A series of educational tools and events emphasizing conservation have been developed as part of the Arroyo Seco Watershed Management and Restoration Project, sponsored by North East Trees and the Arroyo Seco Foundation. These have included a six-week overview of watershed issues called "Watershed U," the Living Lightly guide developed by North East trees and new organization forms, such as the Council of Arroyo Seco Agencies (CASA) and the Council of Arroyo Seco Organizations (CASO).

The Arroyo Seco Watershed Budget, which was also developed by that same project, and other modeling programs can be invaluable tools to identify patterns of high and wasteful consumption of water in order to style the most efficacious conservation targets. In some areas of the Arroyo Seco watershed per capita consumption is as high as 322 gallons per day (gpd), while in others it is as low as 95 gpd.

A "Source Water Awareness Program," emphasizing awareness of our local watershed as well as the distant watersheds, such as the Bay Delta ecosystem, that are affected by local water use, can be another effective tool. The Arroyo Seco Foundation has recently established a watershed coordinator post to pursue such a program. The watershed coordinator will work with local water agencies to improve water management practices, conjunctive use and conservation. For consumers, the primary focus will be on outdoor water use, including landscaping, irrigation systems and the use of native and water conserving plants. The program will also encourage the use of weather sensitive irrigation practices and controllers, utilizing such resources as the website http://www.bewaterwise.com and landscape irrigation suppliers. Other tasks in this objective will include four public forums in different parts of the watershed concentrating on the Bay Delta Program and how local water use impacts the Bay Delta Ecosystem.

Monitoring and Enhancing Water Quality

The Arroyo Seco Watershed Management Plan and Education Program has developed another invaluable tool, a manual for a citizen's water quality monitoring program entitled "Developing a Citizen's Water Quality Monitoring Program in the Arroyo Seco." The Arroyo Seco watershed coordinator will train a group of volunteers called the Arroyo Seco Stream Team to develop a reliable database of water quality parameters in the watershed. The County of Los Angeles Department of Public Works has committed to conduct the initial sampling and establishment of baseline conditions for the watershed, and the watershed coordinator will work with them to complete that process. Then the Arroyo Seco watershed coordinator will recruit and train more than twenty-five volunteers who will each sign a contract to conduct regular water quality monitoring for a minimum of two years. An online system for collecting and distributing information about the water quality program will make the data readily available to the public and serve as an educational tool. The watershed coordinator will also work with water agencies and the Regional Water Quality Control Board to educate the public about local sources of contamination and how they can be effective in improving water quality. Two major workshops will be held during a three-year period to promote the application of rainfall retention and storm water best management practices. This will be coupled with the Source Water Awareness public education campaign to educate about how residents and business affect aquatic life and drinking water quality.

Groundwater Management

The adjudication of the Raymond Basin in the 1940s was a historic step forward in the management of groundwater resources, but recent studies indicate that the management program is not reaching the sustained yield goal that was its original underpinning. Pumping was to be balanced by natural replenishment, but a recent Geoscience Support Services baseline technical report found:

> "Despite increases in spreading, the volume of ground water in storage within the Raymond Ground Water Basin has decreased by 112,600 acre-ft from 1983 to 2002, although the decrease was less pronounced during the period from 1991 to 2002. Between 1991 and 2002, the volume of ground water in storage decreased by approximately 46,100 acre-ft while it decreased by approximately 66,500 acre-ft from 1983 to 1991."

This overdraft of about 5,600 acre feet per year, in a basin with a capacity of 1.45 million acre feet, has occurred during the same period of time as local water agencies have established storage accounts amounting to more than 50,000 acre-feet in the basin, offsetting an even more serious decline in groundwater levels

Overdrafting of groundwater can cause environmental problems, including land subsidence, habitat reduction, and adverse groundwater quality impacts, but it also leads inevitably to further reliance on imported supplies.

The Geoscience Support Services baseline groundwater assessment of the Raymond Basin is part of a comprehensive assessment of groundwater management and storage the firm is developing on behalf the Raymond Basin Management Board. The work is intended to resolve key issues about the potential for groundwater storage and the water quality impacts of conjunctive use. Geoscience has reviewed past groundwater models and is now developing a revised groundwater model to provide reliable data for better management of the basin. The preliminary report, "Draft Technical Memorandum on Evaluation of the Effects of the Current Long Term Storage Program for the Raymond Ground Water Basin" dated July 7, 2003 has updated water balance data and provided a revised estimate of the storage capacity of the Raymond Basin. The "Baseline Ground Water Assessment for the Raymond Basin Final Report" of February 2, 2004 includes a review of the effects of recent storage programs, recommended steps for the development of a basin-wide monitoring program for the collection of geohydrologic data within the Raymond Ground Water Basin, and an investigation of existing conjunctive use operations within the Raymond Ground Water Basin and development of a strategy for future conjunctive use and groundwater storage opportunities.

The Geoscience assessment should provide the technical basis for substantial improvements in groundwater management in the Raymond Basin.

Increased Groundwater Storage

The next major step in the historical development of water resources in our region is the Raymond Basin Conjunctive Use Program (RBCUP). Conjunctive use, the coordinated use of surface supplies and groundwater resources with imported water, is a water resources management methodology that can optimize water resources while reducing the environmental stress often associated with water importation. The RBCUP, now being developed by local water agencies and the Metropolitan Water District, will provide MWD with storage capacity of up to 75,000 acre-feet in the Raymond Basin to improve regional water reliability. MWD will replenish the Raymond Basin with the water to be stored. In most years MWD will leave the water in storage, but in dry years it will pump up to 25,000 acre-feet from the aquifer. The Raymond Basin Management Board and the MWD are now evaluating the environmental impacts of the project. The Geoscience work provides invaluable data for making that Raymond Basin conjunctive use program work.

The CALFED Model

The CALFED Program offers a model for watersheds like the Arroyo Seco. CALFED is a federal and state consortium established to develop and implement a long-term comprehensive plan to restore ecological health and improve water management in region where the Sacramento and San Joaquin Rivers systems come together and join the San Francisco Bay. This is the critical hub of California's water system, which serves more than 20 million Californians including the residents of the Arroyo Seco watershed.

The CALFED Program has developed an array of projects and approaches to expand water supplies and ensure efficient use of the resource, similar to the program that needs to be implemented in the Arroyo Seco watershed.

A well-constructed conservation and watershed management program in the Arroyo Seco could produce measurable water supplies for the residents of the Arroyo Seco watershed that will increase local reliability and relieve a small part of the environmental stress on the Bay Delta ecosystem. This program should emulate CALFED goals, such as:

- Maximize use of available water supplies through conservation, water recycling, and water quality improvements.
- Increase the flexibility of water systems at the state, federal and local level through improvements in conveyance, storage and water project operations.
- Develop groundwater and surface water storage projects to boost flexibility and provide additional supplies for agriculture, urban and environmental use.

A Program for Expanding Water Resources

Stream Restoration

The availability of imported water and the threat of floods in our semi-arid region led planners to undervalue the rainfall that falls upon our watershed. Instead of husbanding precious water resources, streams are treated as nuisances or threats. More than ten thousand acre-feet a year of runoff that should replenish the groundwater is efficiently diverted into pipes, culverts, and storm drains where it is whisked away to the ocean. The main Arroyo Seco stream, which transports an average of 7,000 acre feet per year from the upper mountain watershed and an additional 3,000 acre feet of runoff from the inhabited section of the watershed, has been transformed into a concrete channel with only limited interaction with the water table.

Rainwater Retention

Runoff in the lower urbanized section of the watershed amounts to an average of 3300 acre-feet per year. Local rainfall retention programs, such as the Standard Urban Stormwater Mitigation Plan (SUSMP) program mandated by the Los Angeles Regional Water Quality Control Board, can recover a significant amount of this water. The SUSMP program requires that new developments retain or treat the first ¾-inch of a 24-hour rainfall event in order to reduce the amount pollutants transported to rivers, streams and the Pacific Ocean. The SUSMP standards have been developed to improve water quality, but they could also have a significant water supply impact in the Arroyo Seco Watershed because 75% of all rainfall in the watershed occurs in storms of ¾-inch or less.

Cleaning Up Contamination

A large number of wells in the Arroyo Seco Watershed have been closed due to contamination, particularly in the critical percolation zone at Hahamongna as the streams descends from the San Gabriel Mountains and enters the urbanized plain of the Arroyo Seco. Volatile organic chemicals, nitrates and perchlorate have knocked the wells out, forcing Pasadena and Lincoln Avenue Water Company to increase their purchase of imported water at considerable expense. Cleaning up this contamination should be the first priority of local water agencies to protect public health and water reliability.

Native Landscaping

Landscape irrigation is the major factor that contributes to the wide divergence of per capita water consumption in the Arroyo Seco Watershed. Typically more than half the consumption in a single-family detached house in our region will be for outdoor irrigation, primarily for lawns and exotic plants better suited to other climatic regions. The native plants that once predominated in our region have adapted to the natural cycle of wet and dry years, thriving in the heat and dry weather like camels in the desert. They are perfectly suited to our climate, and can be beautiful additions to local landscapes while significantly reducing outdoor water use.

Recycled Water

Reclaimed wastewater is now being used extensively throughout Southern California primarily for landscape irrigation and industrial applications, but not yet in the Arroyo Seco Watershed.

Wastewater from the upper Arroyo Seco Watershed goes to the facilities of the Los Angeles County Sanitation District near Whittier Narrows where it is treated. Some of it replenishes Central Basin, a groundwater aquifer in southern Los Angeles County. In the Northeast Los Angeles portion of the watershed, wastewater is shipped to the Los Angeles Glendale Water Reclamation Plant near the intersection of the Golden State and Ventura Freeways.

Pasadena made arrangements ten years ago to receive to recycled water from the Los Angeles/Glendale reclamation plant, and a pipeline now brings the water as far as Scholl Canyon at the western boundary of Pasadena. The plumbing and facilities needed to distribute the water to Brookside Golf Course and other large irrigation users in Pasadena, however, have not been completed. Even a modest recycling program can increase local water supplies by 3%.

Conjunctive Use

Groundwater storage and management are critical elements of an effective water conservation strategy. The Raymond Basin Conjunctive Use Program (RBCUP), in development for the past fifteen years, has lagged because of uncertainties about water

rights and the potential spread of contamination in the basin. The failure of the current management program to provide for adequate replenishment of the aquifer ought to underscore the importance of moving to a more comprehensive conjunctive use program that can optimize water resources while reducing the environmental stress often associated with water importation. The Raymond Basin Management Board's careful study of current groundwater conditions and management should provide the technical basis and reassurance for moving ahead to a new era of groundwater management for the Raymond Basin.

Consumer Education

For many decades the residents of our region have taken water for granted, but we now face a mounting water crisis. A growing population is met with diminished imported supplies, contaminated local water sources and an expanding per capita consumption that exceeds that of most communities in Southern California. Local water agencies need to step up their water conservation programs by educating the public about the water situation and offering the public incentives and motivation to use water more wisely.

A key component of an effective consumer education program is to let the residents of the Arroyo Seco Watershed know how their water use affects the local environment as well as distant parts of California and the West. It is important that the residents of our region know of the environmental challenges that face the Sacramento and San Joaquin Rivers and San Francisco Bay because a significant part of our water supplies and that of 20 million other Californians flows through that hub. It is a powerful motivation for local residents to know about the work of the CALFED Bay Delta Program to restore the ecological health and water supply reliability of those rivers and our state.

Water waste and inefficient use can no longer be tolerated. The residents of the Arroyo Seco must join with their fellow Californians to develop a new ethic and practice of stewardship of water and our precious environmental resources.

Summary

Water is the essential ingredient that has made possible the quality of life in the Arroyo Seco watershed. The early settlers realized that and made remarkable efforts to tap and manage local water resources. Now in our era that need has not changed.

The Arroyo Seco watershed represents an outstanding opportunity for the region to demonstrate a collaborative, integrated approach to the management of vital natural resources. This is a relatively small (46.6 square mile) watershed that spans six jurisdictions, including the Angeles National Forest, the unincorporated community of Altadena, and the cities of La Cañada Flintridge, Pasadena, South Pasadena, and Los Angeles. The outstanding level of cooperation among the agencies and organizations working together in the Arroyo Seco Watershed can lead to a model management program in a high profile, diverse watershed. A renewed emphasis on using water wisely can reap great benefits.

Appendix I – Recommendations Contained in the Water Resources Section of the Arroyo Seco Watershed Restoration Feasibility Study

Possibilities for Augmenting or Supplementing Local Supply In the Arroyo Seco Watershed

Recommendations

The final recommendations for water resources are targeted toward improving the water supply:

- Protect and preserve foothill lands to enhance percolation into the groundwater basin and to prevent aggravated runoff.
- Promote comprehensive conservation and implement best management practices throughout the watershed to improve water quality and reduce consumption.
- Expand water conservation and recycling programs through the watershed.
- Create conjunctive use of groundwater basin for enhanced storage during wet periods and for use during dry periods.
- Develop upper watershed reforestation and revegetation programs to reduce sediment flow and improve local retention.
- Naturalize the stream in Hahamongna for greater percolation and habitat benefits and reconsider the use and expansion of the spreading basins.
- Complete a sediment management study for Devil's Gate Dam basin.
- Review the functionality and effects of the upper basin flood control structures such as debris basins and check dams.

Source: ***Arroyo Seco Watershed Restoration Feasibility Study, Water Resources Technical Report, page 37, May 19, 2002***

Appendix II: Sources of Charts, Figures and Tables

Chart 1	A Water Budget For the Arroyo Seco Watershed prepared by Tim Brick, Arroyo Seco Foundation, September 18, 2003
Figure 1	21st U.S. Annual Geological Survey - Part IV – Hydrography, F.H. Newell, 1899
Chart 2	A Water Budget For the Arroyo Seco Watershed prepared by Tim Brick, Arroyo Seco Foundation, September 18, 2003
Table 1	A Water Budget For the Arroyo Seco Watershed prepared by Tim Brick, Arroyo Seco Foundation, September 18, 2003
Figure 2	Annual Report 2002-2003, Raymond Basin Management Board
Figures 3	CERCLA Program at NASA's Jet Propulsion, A Powerpoint Presentation, NASA, October 2002.