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2005

RIVERSIDE PUBLIC UTILITIES

URBAN WATER MANAGEMENT PLAN

PUBLIC REVIEW DRAFT

November 2005

City of Riverside

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Riverside Public Utilities is committed to the highest quality water and electric services at the lowest possible rates to benefit the community.

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City of Riverside
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2005

Urban Water Management Plan

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The Water supplier is a: Municipality
The Water supplier is a: Retailer
Utility services provided by the water supplier include: Water, Recycled Water
Is This Agency a Bureau of Reclamation Contractor? No
Is This Agency a State Water Project Contractor? No

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Acronyms and Abbreviations

^{o}F	Degrees Fahrenheit
ACOE	[United States] Army Corps of Engineers
AF	Acre-foot or acre-feet
AFY	Acre-feet per year
AHHG	Area of Historic High Groundwater
AL	Action Level
AMCL	Alternate Maximum Contaminant Level
amsl	Above mean sea level
ASDWA	Association of State Drinking Water Administrators
ATSDR	Agency for Toxic Substances and Disease Registry
bgs	Below ground surface
BMP	Best Management Practice
CCF	One hundred cubic feet (100 ft^3)
CCL	Contaminant Candidate List
CCR	Consumer Confidence Report
cfs	cubic feet per second
CII	Commercial, Industrial and Institutional
CIP	Capital Improvement Program
COR	City of Riverside
CUWCC	California Urban Water Conservation Council
DBCP	Dibromochloropropane
DHHS	[U.S.] Department of Health and Human Services
DHS	Department of Health Services (California)
DMM	Demand Management Measure
DSM	Demand Side Management
DU	Dwelling Unit
DWR	[California] Department of Water Resources
EMWD	Eastern Municipal Water District
EIR	Environmental Impact Report
EOC	Emergency Operations Center
ERP	Emergency Response Plan
FEMA	Federal Emergency Management Agency
GCC	Gage Canal Company
GEP	Gage Exchange Program
GFT	General Fund Transfer

Acronyms and Abbreviations

GMP	Groundwater Management Plan
GWR	Groundwater Rule
gpm	Gallons per minute
HECW	High Efficiency Clothes Washer
HGCWD	Home Gardens County Water District
HVW	Hidden Valley Wetlands
IRP	Integrated Resources Plan
JMM	James M. Montgomery [Consulting Engineers, Inc.], now MWH
LAFCO	[Riverside County] Local Agency Formation Commission
LGF	Local Generating Facilities
MCL	Maximum Contaminant Level
MDD	Maximum Day Demand
MGD	Million gallons per day
MMM	Multimedia Mitigation
MOU	Memorandum of Understanding
MtBE	Methyl tertiary Butyl Ether
MWD	Metropolitan Water District [of Southern California]
MWH	Montgomery-Watson-Harza Engineering Consultants
NDWAC	National Drinking Water Advisory Council
NPDES	National Pollution Discharge Elimination System
NHSRC	National Homeland Security Research Center
OCWD	Orange County Water District
OEHHA	Office of Environmental Health Hazard Assessment
PBC	Public Benefit Charge
PCE	Tetrachloroethylene
pCi/L	pico Curies per Liter
PHA	Public Health Assessments
PHG	Public Health Goal
PRP	Potentially Responsible Party
ppb	Parts per billion (micrograms per liter - µg/L)
PUD	[City of Riverside] Public Utilities Department
PWS	Public Water System
RCF	[WMWD] Riverside-Corona Feeder [Water Transmission main]
RERC	Riverside Energy Resource Center

Acronyms and Abbreviations

RHWCo	Riverside Highland Water Company
RIX	[City of San Bernardino and City of Colton] Rapid Infiltration extraction Tertiary Wastewater Treatment Plant.
RRWQCP	Riverside Regional Water Quality Control Plant
RPU	[City of] Riverside Public Utilities [Department]
SAWPA	Santa Ana Watershed Project Authority
SBVMWD	San Bernardino Valley Municipal Water District
SBVWCD	San Bernardino Valley Water Conservation District
SCAG	Southern California Association of Governments
SCADA	Supervisory Control and Data Acquisition (system)
SDWA	Safe Drinking Water Act
SMCL	Secondary Maximum Contaminant Level
SOI	Sphere of Influence
SWA	Source Water Assessment
SWAP	Source Water Protection
SWAPP	Source Water Assessment and Protection Plan
SWP	[California Department of Water Resources] State Water Project
SWPP	Source Water Protection Plan
SOI	Sphere of Influence
TCE	Trichloroethylene
TDS	Total Dissolved Solids
TMF	Technical, Managerial and Financial
TOU	Time of Use
UCR	University of California, Riverside
ULFT	Ultra-low Flush Toilet (ULFT)
USAWRA	Upper Santa Ana Water Resources Association
USGS	United States Geological Survey
UST	Underground Storage Tank
UWMP	Urban Water Management Plan
WARN	Water Agency Response Network
WaterISAC	Water Information Sharing and Analysis Center
WHP	Wellhead Protection
WMWD	Western Municipal Water District [of Riverside County]
WSCP	Water Supply Contingency Plan
WSDM	Water Surplus and Drought Management
WSWG	Water Security Working Group
WUE	Water Use Efficiency

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1 AGENCY COORDINATION

1.1 Coordination with Appropriate Agencies

The City of Riverside Public Utilities (RPU) Department coordinated the preparation of this Urban Water Management Plan (UWMP) as required under the UWMP Act (Act). Appendix A.1 is the most recent version of the Act.

1.1.1 Public Participation

RPU held a series of public meetings to discuss this UWMP. Appendix A.2 represents the notices published in advance of each public hearing. A draft UWMP was submitted to the Water Committee of the Board of Public Utilities (Board) for review and comments, and was discussed at that committee's meeting held on November 16, 2005. Legal public notices for each meeting were published in the local newspapers, were posted at City offices, the main branch of the City's library and on City's web site. Copies of the draft UWMP were available at RPU's offices and via download from the City's website. The draft UWMP was revised to reflect comments received from the Water Committee and other stakeholders. The draft Final UWMP was presented to the Board of Public Utilities at a public hearing on December 2, 2005, and to the City Council on December __, 2005.

A copy of the UMWP adopted by the City Council will be forwarded to the California Department of Water Resources and other specified agencies as required by the Act. Appendix A.3 includes a list of the agencies to which copies of the adopted UWMP will be provided. A copy of the adopted UWMP will be posted online at: http://www.riversidepublicutilities.com.

1.1.2 Agency Coordination

RPU directly prepared this UWMP with input from consultants, public review, and planning documents prepared by local and regional planning agencies, water agencies, wastewater agencies, and regional water management agencies (Table 1.1-1). RPU staff coordinated the development of this UWMP with the City's Community Development Department (which includes the Planning Division, as well as the Building and Safety Division), and the Public Works Department. The City's Community Development Department provided data regarding annexations.

RPU completed a Water Master Plan in June 2005 that reviewed and forecasted reliable water supplies and demands for the City through 2025 based on population data provided by the Southern California Association of Governments (SCAG). Data from this study were utilized in this document.

Table 1.1-1
Coordination with Agencies

DWR UWMP Review Table 1 Coordination with Appropriate Agencies							
Check at least one box on each row	**Participated in developing the plan**	**Commented on the draft**	**Attended public meetings**	**Was contacted for assistance**	**Was sent a copy of the draft plan**	**Was sent a notice of intention to adopt**	**Not Involved / No Information**
Other water suppliers							
Western Municipal Water District				X	X	X	
Water management agencies							
San Bernardino Valley Water Conservation District				X			
United States Geological Survey (USGS)				X			
Relevant public agencies							
City of Riverside - Planning Division				X	X	X	
City of Riverside Public Works Department (Wastewater)				X		X	
Riverside County Planning Department					X	X	

RPU is a member agency of the Western Municipal Water District (WMWD) of Riverside County, which in turn is a member agency of the Metropolitan Water District of Southern California (MWD). All water sources for the City are shared in common with certain other urban and agricultural interests in the area. RPU therefore included data in development of this plan from the following agencies:

- The Gage Canal Company (GCC),
- WMWD,
- Regents of the University of California, and
- Mutual Water Companies in which RPU owns shares.

RPU communicates water supply information to the public throughout the year. For example, RPU provides monthly water highlights one of its two monthly Board meetings. These water highlights include data related to daily water production and consumption, peak and average water consumption, and daily temperature and rainfall. RPU regularly encourages public water awareness and water conservation by maintaining a website [http://www.riversideca.gov/utilities/bewaterwise/] dedicated to water conservation and including various links to other conservation-related sites. RPU staff highlights conservation activities at public display booths several times during each year at various events.

1.2 Resource Maximization / Import Minimization Plan (i.e., Water Management Tools to maximize use of Local Resources)

RPU favors the use of local water resources, which are much cheaper, less energy intensive and more reliable than imported water. A key goal for the 2004-07 period,

adopted by the Board is to promote the efficient use of water within the City. Efforts to achieve this goal include, but are not limited to, the following:

- Rate structures to encourage efficiency
- Incentives for water efficiency
- Water and energy efficiency education programs and workshops, and
- A target water use reduction of 20% by RPU's top 10 customers

RPU is primarily dependent on local groundwater for water supplies and plans to meet future water demand from local groundwater and recycled water as much as possible. Sections 2.3 and 2.4 of this UWMP include a description of certain measures implemented to improve groundwater management planning and the reliability of local water supplies. Additional information regarding the measures to maximize the use of recycled water for non-potable purposes are in Section 5 of this UWMP.

RPU relies on many water management tools to maximize the use of local water resources thereby reducing the need for imported water.

The water management tools include the following:

- Groundwater treatment.
- Exchanging of potable water with non-potable water.
- Developing a Source Water Protection Plan.
- Developing a recycled and non-potable water reuse plan.
- Rehabilitating the Riverside Canal to enhance non-potable water use.
- Acquiring additional water rights to increase production from local basins.
- Participating in additional water conservation activities at the Seven Oaks Dam.

These management tools are elaborated upon in other sections of this UWMP.

1.3 UWMP Preparation

This UWMP was prepared by RPU staff, and reviewed by the Board of Public Utilities before being adopted by the City Council. Appendix A.4 shows the City Council resolution adopting the 2005 UWMP.

1.4 City and County Notification and Participation

RPU is a department within the City of Riverside. The citizens of both the City of Riverside and the County of Riverside were provided constructive notice of the proposed review and revision of the City's UWMP. Comments received have been incorporated into this final UWMP.

2. SERVICE AREA, WATER DEMANDS, AND SUPPLIES

2.1 Level of Planning

RPU is the municipally-owned utility that provides potable and recycled water at retail primarily within the City. The City is located within the Santa Ana River Valley approximately 60 miles east of Los Angeles and 100 miles north of San Diego. In 2005, there were about 78.5 square miles within the City limits (Appendix B.1). The primary source of potable water is groundwater from local basins. Some potable water is imported. RPU is a wholesale customer of the WMWD. The WMWD is a member agency of the MWD. Locally produced recycled water is used to meet some non-potable demand.

The California Water Code UWMP Act requires a 20-year projection (through 2025 for the 2005 UWMP). RPU chose to include projections through 2030 in line with other water agencies that are preparing water supply assessments (WSA) and written verifications. Extending the planning horizon of the UWMP through 2030 will allow RPU to utilize UWMP data for preparing a WSA (in accordance with Senate Bill 610) or written verification (Senate Bill 221) between 2006 and 2010 when the next UWMP is due.

2.2 Service Area

2.2.1 Water Service Area

The City began as an agricultural community in 1870. Land use within the City has consistently evolved from agricultural to urban use since 1940. Citrus was the first major industry in the City, although residential and commercial development has overtaken agriculture. Residential land use is the dominant land use within the City. Non-residential land uses include commercial and industrial development, schools, parks, and open space.

Appendix B.1 shows the potable water service area served by RPU. RPU's water service area totals about 74 square miles, of which about 69 square miles are within the City limits. The elevation of the water service area ranges from less than 700 feet to more than 1,700 feet above mean sea level.

Appendix B.1 also shows the areas within the City limits that are served by other water purveyors. Other potable water retailers within the City include WMWD (9 square miles), Eastern Municipal Water District (EMWD, 1 square mile), and the Riverside Highland Water Company (RHWCO, 0.25 square miles).

In 2004, RPU had about 62,000 water service connections, up from 58,538 in 2000.

2.2.2 General Plan 2025

In spring of 2005, the City held numerous public meetings to review the draft General Plan 2025 [http://www.riversideca.gov/planning/genplan2025-2.htm]. Appendix B.2 shows the proposed Land Use Policy Map under the draft General Plan 2025. The General Plan 2025 update anticipates a build-out population of 376,000, with approximately 38,100 new dwelling units (DUs), and 39.6 million square feet of new non-residential development within the City's northern and southern spheres of influence (SOI).

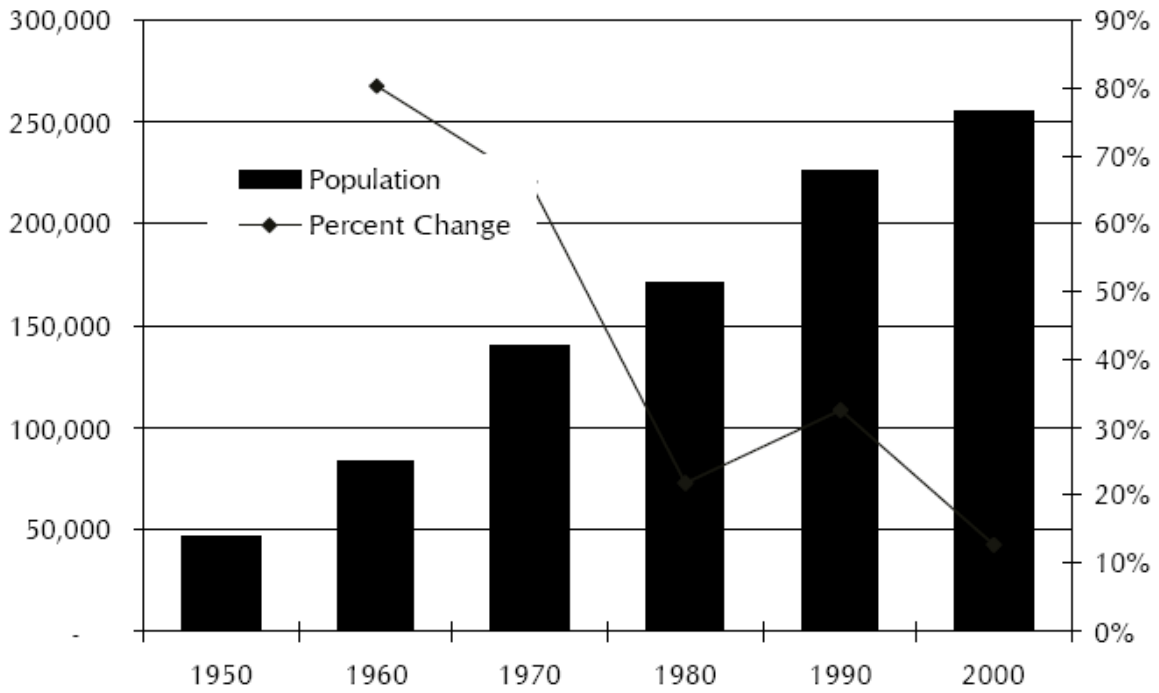
2.2.3 Annexations

Other factors that can potentially influence future population size include further annexations to the City, inter-agency adjustment of water service area boundaries, and Riverside County Local Agency Formation Commission (LAFCO) service boundary recommendations. In the past, the City has expanded its area through annexation. The most intensive expansion of the City occurred during the 1950 through 1970 period when the population tripled and land area increased from approximately 39.2 square miles to 71.5 square miles through annexations.

Appendix B.3 shows the areas being considered for possible annexation into the City and their respective annexation status as of September 2005. Some of the proposed annexations primarily to the north of the City, would fall within the RPU water service area, while others are within the service area of the WMWD.

2.2.4 Current and Projected Population

In 2004, the City's population was 283,247 with an annual growth rate of one percent (City of Riverside Development Department, 2005). A significant portion of the population includes students. There are four universities within the City, with a combined student population of about 40,000. Figure 2.2-1 shows the population growth for the period from 1950 through 2000. After the Second World War, the annual population growth rate was about 8%. In the recent past, the annual growth rate was influenced by economic factors such as recession, and annexations (Section 2.2-3) to the City.



Source: 2005 City of Riverside Draft General Plan 2025

Figure 2.2-1. City of Riverside Population Growth

The population within the City limits was 226,546 in 1990. In 2000, population within the RPU water service area increased to approximately 250,000 compared to a total City population of 259,738 (2000 census figures). The population within the City limits has increased by about 33,000 within the past decade, with a significant proportion being outside of RPU's water service area.

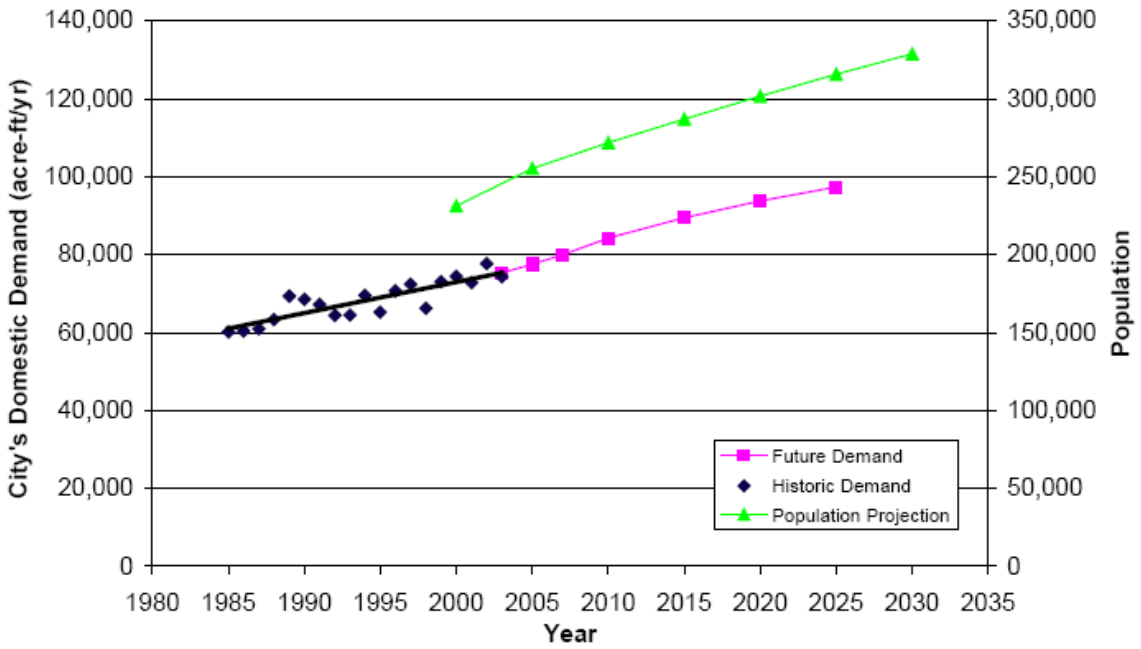
If the proposed draft General Plan 2025 land use policy is fully implemented, the population of the City could grow from approximately 274,000 in 2003 to approximately 353,397 in 2025 based on the Southern California Association of Governments (SCAG) projections that reflect regional and statewide growth trends (Table 2.2-1).

In 2004, RPU contracted with Montgomery-Watson-Harza (MWH) Americas Inc. as engineering consultants to update the Water Master Plan. MWH developed population projections as part of the contract (Table 2.2-1). The annual growth rate shown in Table2.2-1 is on a compound basis over that of the preceding 5-year period. MWH (2005) obtained land use data from the City's Community Development Department (which includes the Planning Department). MWH relied on data provided by the SCAG to project the population of the service area based on land use. MWH (2005) used the population projections, land use data, aerial photography, and specific development information to project water demands for RPU's water service area through 2025. MWH estimated that the population within RPU's water service area could increase to 329,001 by 2030. Figure 2.2-2 shows the projected population growth and water demand as estimated by MWH.

Table 2.2-1
Projected City and Water Service Area Population

Year	Population			Water Demand (acre-feet/year)
	City of Riverside (COR)	RPU Water Service Area (WSA)	Annual Growth Rate	
2005	286,935	255,346	2.1%	77,529
2010	307,847	271,907	1.3%	84,254
2015	323,384	287,066	1.1%	89,494
2020	338,712	301,900	1.0%	93,828
2025	353,397	315,746	0.9%	97,410
2030	367,489	329,001	0.8%	***101,499***
Build-out [1]	376,000			

NOTES:
[1]General Plan 2025 update anticipates a build-out population of 376,000 for COR.
Per capita water demand in 2025 used to estimate demand in 2030.
Source:MWH (2005) City of Riverside Water Master Plan.



Source: Montgomery-Watson-Harza (2005). City of Riverside Water Master Plan.
Figure 2.2-2: Water Demand and Population Growth

2.2.5 Sources of Data

The projected population for RPU's water service area is listed in Table 2.2-2 based on sources of data identified earlier. The sources of data in other sections are identified in the respective section.

Table 2.2-2
Population – Current and Projected for Service Area

DWR UWMP Review Table 2 Population - Current and Projected						
	2005	2010	2015	2020	2025	2030
RPU Water Service Area Population	255,346	271,907	287,066	301,900	315,746	329,001

Source: 2005 RPU Water MasterPlan (MWH) based on data obtained from Southern California Association of Governments.

2.2.6 Climate

Climate is one of the primary factors that influence the demand for water within RPU's water service area. Climatic factors include precipitation, temperature, and evaporative demand. The City is located in the southwest arid area of the United States. The City's climate is characterized by warm to hot and dry summers, and mild winters. The average monthly climatological data for weather stations located within the City limits are tabulated in Tables 2.2-3.

Table 2.2-3
Monthly Average Climatological data for Riverside, UCR

DWR UWMP Review Table 3 Climate						
	January	February	March	April	May	June
Standard Average ETo	2.49	2.91	4.16	5.27	5.94	6.56
Average Rainfall	2.16	2.15	1.75	0.81	0.23	0.07
Average Temperature	54	55.49	57.46	61.41	65.9	71.35

DWR UWMP Review Table 3 (continued) Climate							
	July	August	September	October	November	December	Annual
Average ETo	7.22	6.92	5.35	4.05	2.94	2.56	**56.37**
Average Rainfall	0.04	0.12	0.26	0.32	0.93	1.23	**10.07**
Average Temperature	77.01	77.68	74.40	67.32	59.11	54.31	**64.62**

Data sources: 1948-2004
(1) ETo: CIMIS for station 44 UCR Riverside; http://wwwcimis.water.ca.gov/cimis/frontMonthlyReport.do; 1985-2004
(2) Precipitation: Riverside Citrus Experimental Station; http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?carvrc; 1948-2004
(3) Average Temperature: Riverside Citrus Experimental Station; http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?carvrc; 1956-2004.

The hottest and driest period of the year is from July through September, when the average high temperature exceeds 90°F and demand for water is the greatest. The average monthly temperature ranges from 54°F in winter to about 78°F in summer. It is not unusual to have several consecutive days when the daily high temperature exceeds 100°F.

Annual average precipitation is about 10 inches. Most of the precipitation occurs during the period from November through April, when the demand for water is below average.

2.2.7 Other Demographic Factors

Demographic factors that can influence future water demand include land use, relative proportion of single-family residences to multi-family residences, population density, economic characteristics (e.g., income, employment rate), and the mix of customer types. These factors are discussed below.

Riverside is undergoing several demographic events simultaneously. As shown in Table 2.2-4, the population and per capita income are increasing and the population is ageing. The University of California, Riverside (UCR) is expected to absorb a disproportionately higher share of students because other campuses within the University of California system are constrained in growth. The ethnic composition of the City is also changing and the unemployment rate is decreasing. Many jobs are migrating inland from coastal areas to take advantage of the lower costs. The unemployment rate fell by 42% between 1994 and 2004. The mix of jobs within the City is also changing.

Table 2.2-4
Demographic Statistics

City of Riverside Demographics Statistics						
Year	**Population**	**PerCapita Income $**	**Median Age**	**Unemployment Rate**	**Commercial Construction # of Units**	**Residential construction # of Units**
1994	244,191	**$ 14,528**	29.4	10.6%	1,894	2,503
1995	247,800	**$ 14,751**	31.0	9.9%	1,835	2,268
1996	243,421	**$ 12,497**	31.3	9.1%	1,804	2,417
1997	241,630	**$ 12,567**	31.6	7.8%	1,599	2,654
1998	250,799	**$ 13,481**	31.8	7.0%	1,621	3,053
1999	254,300	**$ 14,093**	32.0	6.2%	1,710	3,074
2000	259,738	**$ 13,825**	32.2	5.3%	1,573	3,694
2001	262,335	**$ 14,241**	32.4	5.2%	1,718	3,747
2002	265,700	**$ 13,687**	31.6	6.5%	1,899	4,099
2003	274,100	**$ 14,137**	32.1	6.8%	1,982	4,444
2004	**277,030**	**$ 14,928**	**30.0**	**6.2%**	**2,153**	**4,145**
Change: 1994 to 2004	13%	3%	2%	-42%	14%	66%

Data source: Table 15 and Table 16 2003 & 2004 Comprehensive Annual Financial Reports, City of Riverside Finance Department

Improved water conservation, conversion of land use from irrigated agriculture to urban use, adoption of less water intensive landscaping, and higher marginal water rates may mitigate some of the effects of these demographic factors on per capita water demand. The median prices of homes continue to increase. Higher prices for homes may result in smaller lot sizes. These factors, cumulatively, can affect the per capita demand for water. The 2005 City of Riverside Water Master Plan predicts up to a 30% drop in per capita water demand for new development primarily due to higher land use densities (MWH, 2005).

2.3 Water Sources

2.3.1 Existing Water Supply Sources

RPU's sources of water include groundwater, imported water, and recycled water. Appendix B.4 represents a simplified schematic of the City's water system and the integration of the various water supply sources. RPU obtains most of its water from local groundwater basins – Bunker Hill (San Bernardino Basin Area), Riverside North and Riverside South (Appendix B.5).

The boundaries of the groundwater basins are similar to those defined in the 1969 Stipulated Judgment No. 78426, Western Municipal Water District of Riverside County, et al. versus East San Bernardino County Water District, et al, Superior Court of the State of California for Riverside County (1969 Judgment attached as Appendix B.6). The adjudicated status of the groundwater basins is discussed in Section 2.3-5.

RPU produces potable water from several wells in the Bunker Hill Basin, Riverside North Basin, and Riverside South Basin (Appendix B.5). RPU has wells in the Arlington Basin, but presently does not produce domestic water from that basin because of its poor quality. Some RPU-owned wells in the Arlington Basin are leased to the Santa Ana Watershed Project Authority (SAWPA). SAWPA operates the Arlington Desalter using 5 wells.

RPU purchases small quantities of treated imported surface water from the WMWD, primarily to meet peak water demands within the higher elevations of the City's water service area during very hot summer days. During emergencies, e.g., major transmission main repairs, RPU sometimes purchases imported water from WMWD.

WMWD is a wholesale purchaser of imported water from the State Water Project (SWP) from the MWD. WMWD has contractual rights to imported water from MWD. Imported water is treated at the Mills Filtration Plant, in Riverside. RPU has a contractual agreement with WMWD for 30 cubic feet per second (cfs) of imported water (Appendix B.7). RPU takes deliveries from WMWD through several service connections (Table 2.3-1).

Table 2.3-1
Wholesale water connections

Water Agency	Connection	Location	Capacity (gpm)	RPU Pressure Zone
A. WHOLESALE FROM Western Municipal Water District (WMWD) TO RPU				
WMWD*	Mills Connection 24-C	Cannon Road	13,400	1600 Zone
WMWD	Van Buren Highline	Mockingbird Canyon Road	13,400	1200 Zone
B. WHOLESALE BY RPU				
Home Gardens County Water District (HGCWD)		Harlow Avenue	1,500	925 Zone

*WMWD: Western Municipal Water District of Riverside County.

Some RPU customers are provided recycled water for uses such as landscape irrigation to reduce demand on potable water (Section 5). The recycled water is sourced from the tertiary treated effluent from the Riverside Regional Water Quality Control Plant (Section 5), which has a capacity of 40 MGD.

RPU and the Gage Canal Company (Gage) jointly pump the Gage and Deberry wells into the Gage Transmission main. Gage diverts some of the water downstream for irrigation. The diversion into the Gage Canal occurs at the Linden booster station. RPU diverts up to an additional 6,000 acre-feet per year from Gage wells in exchange with the Gage Canal Company for non-potable water from some RPU wells in Riverside Basins. There are plans to substitute the exchanged non-potable water with recycled water (Section 5). The non-potable water used in exchange could then be treated to domestic standards. RPU wheels water produced from rights held by the Regents of the University of California in Bunker Hill basin. Table 2.3-2 lists the export rights from Bunker Hill basin for RPU, UCR, and the Gage Canal Company.

Table 2.3-2
RPU Export Rights from Bunker Hill basin

Export Rights - Bunker Hill Basin (as of 2005)	
Source	**acre-feet per year**
RPU	22,299
[1]RPU from Gage stock	15,855
RPU shares in Meeks and Daley	3,010
RPU shares in Riverside Highland Water Company (RHWCo)	333
Univ of California Regents (UCR)	536
Total	**42,033**

[1]RPU share could increase as more shares are transferred.

Table 2.3-3 provides the summary of existing and planned water supplies available to RPU. Additional details regarding the planned water supplies are described in Section 2.3-2.

Table 2.3-3
Existing and Planned (Projected) Water Supplies (acre-feet per year)

DWR UWMP Review Table 4 Current and Planned Water Supplies - AFY						
Water Supply Sources	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**
A. EXISTING (as of 2005)						
Bunker Hill groundwater basin	42,033	42,033	42,033	42,033	42,033	42,033
Riverside (North & South) groundwater basins	24,000	24,000	24,000	24,000	24,000	24,000
Gage Exchange (groundwater)	6,000	6,000	6,000	6,000	6,000	6,000
Total Groundwater	72,033	72,033	72,033	72,033	72,033	72,033
Purchased from Western Municipal Water District	2,300	3,800	5,300	6,800	8,300	9,800
Recycled water	200	200	200	200	200	200
B. PLANNED						
John W. North Water Treatment Plant (Groundwater)	-	10,000	10,000	10,000	10,000	10,000
Riverside groundwater - Downtown Area	-			7,000	7,000	7,000
Additional Gage Exchange (groundwater)	-	5,388	5,388	5,388	5,388	5,388
Reycled water	-	1,000	3,250	5,500	7,750	10,000
Seven Oaks Dam Conservation storage	-	2,000	2,000	2,000	2,000	2,000
C. TOTAL (EXISTING + PLANNED)						
Groundwater	72,033	87,421	87,421	94,421	94,421	94,421
Purchased (Imported) water	2,300	3,800	5,300	6,800	8,300	9,800
Recycled water	200	1,200	3,450	5,700	7,950	10,200
Seven Oaks Dam Conservation storage		2,000	2,000	2,000	2,000	2,000
Total	**74,533**	**94,421**	**98,171**	**108,921**	**112,671**	**116,421**

2.3.2 Planned Water Supply Sources

The identified potential additional new sources of water supplies as listed in Table 2.3-3 are as follows.

- Development of a 10,000 acre-feet John W. North surface water treatment plant near Grand Terrace to treat shallow groundwater in that area.
- Development of an additional 7,000 acre-feet from Riverside downtown area in the future.
- Conservation storage of 2,000 acre-feet at Seven Oaks Dam.
- Recycled water for exchange and replacing use of domestic water for irrigation.

Those projects are further discussed in Section 2.9.

2.3.3 Groundwater Management Plan (GMP)

Many management activities are undertaken in cooperation with local agencies including the WMWD, SBVMWD, SAWPA, and the SBVWCD. The court appointed Western-San Bernardino Watermasters manage and report on the conditions of all the groundwater basins. The SBVWCD (2005) annually publishes an engineering report to determine replenishment requirements for Bunker Hill basin in the ensuing water year.

RPU is cooperating with stakeholders to develop a groundwater management plan for the Bunker Hill basin. In 2005, the SBVMWD applied for a Proposition 50 planning grant to develop a GMP. SAWPA (2002, 2005) prepared an Integrated Regional Water Management Plan for the entire Santa Ana watershed.

SAIC (2004) developed a computer model to evaluate conjunctive use of water released from Seven Oaks Dam for the WMWD and the SBVMWD. The USGS (2005) has developed several computer models for the SBVMWD to use in evaluating water management alternatives in Bunker Hill basin. The USGS established a real-time, network of monitoring wells in Bunker Hill basin that measure groundwater levels. Recent and historic groundwater level monitoring data obtained from the network are available on the Internet.

The SBVMWD has established target ranges for groundwater level management within Bunker Hill basin, and is obligated under the 1969 Judgment to maintain water levels in Colton and Riverside North groundwater basins.

The U.S. EPA, the California Department of Toxic Substances Control, and the California Regional Water Quality Control Board, Santa Ana Region cooperated with local agencies to facilitate the cleanup of groundwater contamination in the basins (Section 6).

2.3.4 Description of Groundwater Basins

RPU produces water from the following groundwater basins: Bunker Hill, Colton, Riverside North, and Riverside South. Many agencies have studied the groundwater basins and provided estimates of basin characteristics. Table 2.3-4 summarizes the typical storage characteristics of each of the basins.

2.3.4.1 Bunker Hill Basin (San Bernardino Basin Area)

The WMWD-SBVMWD Watermaster determined the “safe yield” for Bunker Hill groundwater basin as 232,100 acre-feet based on verified extractions. “Extractions” included surface diversions. The WMWD-SBVMWD Watermaster based the yield for each of the other basins on the verified average extraction during the 1959-63.

The primary source of recharge water to Bunker Hill basin is from runoff from precipitation in the San Bernardino Mountains to the north. A USGS (2005) [http://ca.water.usgs.gov/program/coastal/sanbern/project.html] review of tritium concentrations in water samples from many multiple-depth wells suggests presence of water from recent recharge, i.e., less than 50 years. Hardt and Hutchinson (1980) of the USGS estimated natural recharge of about 37,800 to 251,900 acre-feet per year, averaging about 94,900 acre-feet. Danskin (2005) estimated a mean annual recharge rate of about 174,000 acre-feet (Appendix B.8 and Appendix B.9). Danskin (2005) estimated that gross pumpage averaged about 175,000 acre-feet per year during the same period.

Table 2.3-4
Storage characteristics of Groundwater Basins

Basin	Surface Area	Storage Capacity	*Depth	Yield
	acres	acre-feet (AF)	feet	AF/year
A. Basins RPU uses for potable water				
Bunker Hill	90,000	5,976,000	> 1,200	232,100
Colton	7,700	593,000	> 700	11,731
Riverside North	12,000	660,000	600 - 700	33,729
Riverside South	20,000	986,000	> 400	29,633
TOTAL	**129,700**	**8,215,000**		**307,193**
B. Basins RPU does not use for potable water				
Arlington	14,000	280,000	> 100	

*Depth Maximum potable water bearing depth
Data Sources: 2003 DWR Bulletin 118, 1986 JMM Water Supply Study; WMWD-SBVMWD Watermaster
Safe yield is for Bunker Hill. Other yields are "1959-63 base period" average extraction as verified by the Watermaster.

Both the SBVMWD and the San Bernardino Valley Water Conservation District (SBVWCD) are active in recharging Bunker Hill basin within optimal level ranges. The SBVWCD (EDAW, 2004) recharged as much as 104,545 acre-feet annually from stormwater of the Santa Ana River and Mill Creek in 1922. More recently, SBVWCD recharged about 1,750 and 15,622 acre-feet in 2002 and 2003 respectively (EDAW, 2004). Native stormwater has lower levels of total dissolved solids (TDS) and nitrates than imported water. Additional information on water quality issues in the basins can be found in Section 6.

Appendix B.10 shows the conceptual groundwater level contours in Bunker Hill basin during the fall of 2004. Groundwater level in Bunker Hill basin often recovers significantly during periods of above average precipitation (Appendix B.11).

2.3.4.2 Colton Basin

The San Jacinto Fault separates Bunker Hill basin from Colton-Rialto basin. Table 2.3-4 lists some of the characteristics of Colton basin. Subsurface outflow from Bunker Hill to Colton basin ranges from 14,300 to 23,700 acre-feet per year (USGS, 1963). Appendix B.12 shows that Bunker Hill basin underflow accounts for 34% of total recharge of Rialto-Colton basin between 1945 and 1996 (USGS, 2001).

The 1969 Judgment (Appendix B.6) imposes recharge obligations on SBVMWD to maintain water levels within the Colton and Riverside North basins. A significant proportion of flow within Santa Ana River recharges the groundwater aquifer.

2.3.4.3 Riverside-Arlington Basins

Riverside North groundwater basin is bounded to the north by the Colton-Rialto groundwater basin, from which it receives about 22,000 acre-feet of sub-flow annually JMM, 1987). Riverside North basin lies within San Bernardino County and its southern boundary is the county line. Maximum aquifer depth in Riverside North basin ranges from about 600 feet to 700 feet, with water bearing units comprised of sand and gravel deposits. JMM (1987) estimated the groundwater storage capacity in the basin is approximately 660,000 acre-feet (Table 2.3-4).

Appendix B.13 shows the estimated groundwater budget for Riverside and Arlington groundwater basins. Both Riverside North and Riverside South groundwater basins are located within the central portion of the Santa Ana River watershed, and both basins are not adjudicated.

Appendix B.14 shows that the annual groundwater production from Riverside North basin averaged over 30,000 acre-feet in recent years primarily due to increased production by the SBVMWD entities. In comparison, the average pumpage during the base period (1959-63) used in the 1969 Judgment was 33,729 acre-feet per year.

RPU produced an average of 8,000 acre feet of potable water per year from the Riverside North Basin based on the production records from the Van Buren wells and RPU's share of production from Deberry well.

Appendix B.15 shows water levels within some selected RPU wells in that basin. SBVMWD is obligated to maintain a threshold groundwater level under the 1969 Judgment.

Riverside South groundwater basin lies within the County of Riverside and has an estimated storage capacity of 986,000 acre-feet based on an average specific yield of 11% and an area of approximately 20,000 acres (JMM, 1987). Appendix B.16 shows groundwater production from Riverside South groundwater basin since 1971.

The most recent 5 year average annual extraction has exceeded the five year base period (1959-63) average of 29,633 acre-feet. RPU is cooperating with the Santa Ana Watershed Project Authority (SAWPA) to increase the safe yield of the Riverside basins through managed recharged. In the early 2000s, RPU produced about 12,000 and about 7,000 acre-feet per year of potable and non-potable water respectively from wells in the Riverside South Basin.

Groundwater quality and level in the North Orange area are very much influenced by the quality and quantity of water flowing in the Santa Ana River, respectively. Good quality storm water is usually the dominant source of water in the Santa Ana River during the winter season. The North Orange well fields are located within the Riverside North and Riverside South groundwater basins.

Appendix B.17 shows the average monthly static water level in Riverside South groundwater basin. Under the 1969 Judgment, the San Bernardino Valley Municipal

Water District is obligated to maintain water levels within the Riverside and Colton basins.

2.3.5 Adjudication and Water Rights

Bunker Hill groundwater basin is adjudicated. A copy of the judgment is attached as Appendix B.6. The safe yield of Bunker Hill groundwater basin as determined by the WMWD-SBVMWD Watermaster is 232,100 acre-feet per year (Table 2.3-4). RPU export rights from Bunker Hill basin are listed in Table 2.3-2. Since the mid 1980s, the Watermaster permitted additional pumpage from Bunker Hill basin to relief the high groundwater level at some locations within the basin. High groundwater levels in some areas have previously damaged utilities, flooded basements, and could potentially result in liquefaction during earthquakes (Section 4.3).

The WMWD-SBVMWD Watermaster may declare additional surplus water from the Bunker Hill basin on an annual basis based on groundwater conditions in the Area of Historic High Groundwater (AHHG). RPU had benefited from such annual declarations since the early 1980s. In recent years, RPU was allocated about 8,000 acre-feet per year.

Table 2.3-5 summarizes the available groundwater pumping rights by basin for the RPU and the Gage Canal Company. Combined water rights and "verified base period extraction" exceed 80,000 acre-feet per year. Bunker Hill basin is the dominant source, and RPU and Gage Canal Company has exportable extraction rights there, based on the safe yield of that basin (Table 2.3-2).

Table 2.3-5
RPU Groundwater Pumping Rights by Basin

DWR UWMP Review Table 5 Groundwater Pumping Rights - Acre-feet per Year (AFY)		
Basin Name	**Pumping Right - AFY**	**Type of Right**
Bunker Hill Basin[1,2,3,4]	53,421	Adjudicated
Colton Basin[5]	2,418	Historic
Riverside North Basin[5]	10,902	Historic
Riverside South Basin[5]	16,880	Historic
Arlington Basin[6]		Not-adjudicated
Total	83,621	

NOTES:
1. Includes rights held by the Gage Canal Company, the Regents of the Univ. of Calif. and shares in Mutual Water Companies.
2. Does not include Watermaster declared additional "pumpage" for mitigating high groundwater level.
3. RPU can increase rights by purchasing shares from Mutual Water Companies when available.
4. Does not include proposed rights from improved water conservation from the Seven Oaks Dam
5.Figures are not water rights, but base period average annual extraction during the Orange County settlement
6. Basin not adjudicated.

2.3.6 Groundwater Basin Conditions (Overdraft[1] Status)

In California, groundwater management is a local responsibility. It is the responsibility of the local groundwater or water management agency to decide whether a basin is in a condition of overdraft (DWR, 2003). DWR (2003) did not identify any of the basins utilized by RPU as overdrafted, nor projected any to be overdrafted. According to DWR (2003) Bulletin 118 classification, local groundwater basins are located in the Upper Santa Ana Valley (Basin 8.2) of the South Coast Hydrologic Region. Some of the sub-basins of the Upper Santa Ana Valley include: Riverside-Arlington (8-2.03), Rialto-Colton (8-2.04), and Bunker Hill (8-2.06).

Table 2.3-6 shows the status of the various groundwater basins based on the most recent conditions available to RPU in July 2005. All the sub-basins are of "Groundwater Budget Type" A. "Type A – indicates one of the following: (1) a groundwater budget exists for the basin or enough components from separate studies could be combined to give a general indication of the basin's groundwater budget, (2) a groundwater model exists for the basin that can be used to calculate a groundwater budget, or (3) actual groundwater extraction data exist for the basin" (DWR, 2003).

Table 2.3-6

Overdraft Status of Groundwater Basins

Groundwater Basin (see Fig. 2-1)	*Overdrafted?*	*Projected to be Overdrafted?*	*Remarks*
Bunker Hill	No	No	Riverside has specified water rights per adjudication. "High" groundwater level in the pressure zone. SBVMWD implementing ongoing efforts to mitigate "high" groundwater level.
Colton-Rialto	No	No	SBVMWD obligated to maintain water level.
Riverside-North	No	No	SBVMWD obligated to maintain water level.
Riverside South	No	No	High groundwater level in some areas.
Arlington	No	No	Not presently used for domestic supplies.

NOTES:
Under the 1969 Judgment, the San Bernardino Valley Municipal Water District (SBVWMD) is obligated to maintain minimum water levels within the Colton-Rialto and Riverside North basins.

2.3.7 Past Production

The following Table 2.3-7 and Table 2.3-8 provide the historic summary of production of potable and non-potable water from all sources. Total groundwater production reached

[1] The California Department of Water Resources (DWR, 1998) defines groundwater overdraft as the condition of a groundwater basin or sub-basin in which the amount of water withdrawn by pumping exceeds the amount of water that recharges the basin over a period of years, during which the water supply conditions approximate average conditions. SB 221 and SB 610 require water agencies to evaluate available groundwater resources using the most complete and recent information.

over 100,000 acre-feet in 1999 but declined to 88,724 in 2003. Purchased imported water decreased from 5,423 acre-feet in 1990 to less than 50 acre-feet in 1993.

Table 2.3-7
Historical Annual Production of Potable and Irrigation Water (acre-feet/year)

Year	Total Groundwater Production	Imported Water	Total
1990	82,559	5,423	87,982
1991	88,869	602	89,471
1992	80,986	670	81,656
1993	83,249	46	83,295
1994	90,742	179	90,921
1995	84,917	94	85,011
1996	91,721	264	91,985
1997	93,275	256	93,531
1998	83,632	272	83,904
1999	100,065	72	100,137
2000	98,184	365	98,549
2001	92,168	980	93,148
2002	94,610	654	95,264
2003	88,724	1,348	90,209

Data source: MWH(2005), RPU Water Master Plan

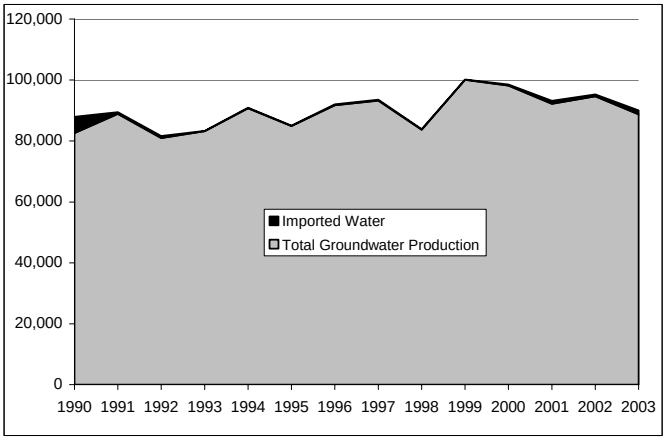


Table 2.3-8
Historical Annual Production of Potable Water (acre-feet/year)

Year	Potable Groundwater Supply (acre-ft/yr)	Imported Water (acre-ft/yr)	Total Potable Supply (acre-ft/yr)	Domestic Delivery to WMWD (acre-ft/yr)	City's Potable Use (acre-ft/yr)	Annualized Trending (acre-ft/yr)
1999	78,015	72	78,087	4,986	73,101	72,187
2000	77,261	365	77,626	3,143	74,483	72,982
2001	74,281	980	75,261	2,472	72,789	73,778
2002	79,572	654	80,226	2,509	77,717	74,574
2003	72,547	1,348	73,895	1,481	72,414	75,369

Data source: MWH(2005), RPU Water Master Plan

Table 2.3-9 summarizes the amount of potable groundwater pumping by basin for the RPU domestic system between 2000 and 2004. Over 95% of the water was obtained from local groundwater basins.

Table 2.3-9
Amount of Potable Groundwater Pumped by RPU 2000 – 2004

DWR UWMP Review Table 6 Amount of Potable Groundwater pumped - AFY					
Basin Name (s)	**2000**	**2001**	**2002**	**2003**	**2004**
Bunker Hill[1]	39,328	40,281	40,363	41,749	41,860
Gage Exchange [2]	5,935	5,585	3,251	2,546	2,000
Other Bunker Hill sources[3]	15,332	12,656	18,357	10,068	0
Riverside North	5,767	5,865	5,494	4,793	6,000
Riverside South	10,899	9,894	12,107	13,391	21,000
Total Groundwater	**77,261**	**74,281**	**79,572**	**72,547**	**70,860**
% of Total Water Supply	**99.5%**	**98.7%**	**99.2%**	**98.2%**	**95.8%**
Total Water Supplies (Ground & Surface water)	**77,626**	**75,261**	**80,226**	**73,895**	**73,948**

1. Supply is based on the RPU's water rights.
2. Received from Gage Canal Company in exchange for delivery of irrigation water.
3. Annual declared water surplus and or extra water purchased from Gage Canal Company.

Table 2.3-10 shows the amount of groundwater pumpage projected between 2010 and 2030. The proportion of groundwater pumpage that is over 75% would decline due to increased contribution from use of recycled water. Note the primary source of the recycled water is local groundwater that had gone through the domestic water system and the sewage treatment plant. As discussed previously, projected pumpage is based on safe yield of the basins or "base period" pumpage, and no adverse impacts on existing groundwater flow directions and water levels are expected. Additional demand in future will be partially met from increased use of recycled water and increased recharge from native stormwater. Many of the wells are connected to regional wellhead treatment facilities, coupled with blending capacity could potentially mitigate some unanticipated incremental contamination (Appendix B.4). Water quality issues are discussed further in Section 6. Recharge operations are to be coordinated to prevent adverse effects on groundwater level and quality in accordance with groundwater level optimal management plan.

Table 2.3-10
Amount of Groundwater Projected to be pumped

DWR UWMP Review Table 7 Amount of Groundwater projected to be pumped - AFY					
Basin Name(s)	**2010**	**2015**	**2020**	**2025**	**2030**
Bunker Hill[1]	48,033	48,033	48,033	48,033	48,033
Riverside Basins (North and South)[2]	34,000	34,000	41,000	41,000	41,000
Total Groundwater	**82,033**	**82,033**	**89,033**	**89,033**	**89,033**
Total Water Supplies	**94,421**	**98,171**	**108,921**	**112,671**	**116,421**
Groundwater as % of Total Water Supplies	**87%**	**84%**	**82%**	**79%**	**76%**

[1]Includes Gage Exchange and recharged yield of Seven Oaks Dam
[2]Includes planned projects (Downtown Riverside and John W. North Treatment Plant)

2.4 Reliability of Supply

RPU water supply sources have been very reliable. Local water agencies are cooperating to further increase the reliability of the groundwater basins (Section 2.3.3 and 2.4.2). In summary, RPU relies on local groundwater resources that have proven very reliable even during multi-year droughts such as 1987-1992 and 1999-2004. To date, RPU has not experienced any major deficiencies in water supply.

RPU can have an advance notice of onset of drought conditions based on groundwater level feedback because most of the precipitation occurs between January and April, while the period of most water demand occurs after the precipitation season, i.e., from June through October. The WMWD-SBVMWD Watermaster also annually independently reviews groundwater conditions to assess the existence of high groundwater conditions. In the 1990s, the Watermaster permitted additional extraction from Bunker Hill basin when groundwater levels were shallower than optimal levels.

2.4.1 Seasonal[2] and Climatic Shortages

DWR (2005) defines a multiple-dry year period as generally "three or more consecutive years with the lowest average annual runoff." In recent years, RPU obtained more than 60% of its water supplies from Bunker Hill groundwater basin. In Bunker Hill basin, 1992, 1994, and 1999 through 2004 were chosen to represent average, single-dry, and multiple dry years respectively (Table 2.4-1) to reflect more recent land use, pumping patterns, and more recent basin management activities.

Table 2.4-1
Basis of Water Year Data

DWR UWMP Review Table 9 Basis of Water Year Data	
Water Year Type	**Base Year(s)**
Average Water Year	1992
Single-Dry Water Year	1994
Multiple-Dry Water Years	1999-2004

Potable water demand in 1992 was 64,443 acre-feet which increased to72,414 acre-feet by 2003 despite several years of below average precipitation. Purchase of imported water also increased during the dry period to meet increased demand from population growth. In 2004, a major cause of the increased purchase of imported water was because of transmission main constraints due to on-going construction of California Department of

[2] DWR (2005) defines "seasonal shortages" as being based "upon the precipitation patterns of individual watersheds and may vary substantially from one year to the next." DWR (2005) defines "climatic shortages" as being based "upon known factors such as El Nino, the Pacific Decadal Oscillation, and Jet Stream variations".

Transportation (Caltrans) and the rehabilitation of Riverside Canal. Caltrans was upgrading the 90-60-215 freeway Interchange that required relocation of some sections of the transmission main.

Table 2.4-2
Supply Reliability

DWR UWMP Review Table 8 Supply Reliability - AF/Year						
			Multiple Dry Water Years			
Source	Average / Normal Water Year	Single Dry Water Year	Year 1	Year 2	Year 3	Year 4
	Historic Year -> 1992	1994	2000	2001	2002	2003
Groundwater	63,773	69,820	77,261	74,281	79,572	72,547
Imported Water	670	179	365	980	654	1,348
Reclaimed Water	0	0	139	133	134	137
TOTAL	**64,443**	**69,999**	**77,765**	**75,394**	**80,360**	**74,032**
% of Normal (1992)	**100%**	**109%**	**121%**	**117%**	**125%**	**115%**

In general, groundwater and reclaimed water are less vulnerable to seasonal climatic changes. RPU had been able to increase production from local groundwater basins during previous droughts.

The 1969 Judgment permits RPU to increase groundwater production by up to 20% in any single year for peaking purposes. Local groundwater supplies account for more than 90% of water supplies of RPU, with more than 60% originating from Bunker Hill basin. Bunker Hill basin is adjudicated. RPU rights were based on the long-term safe yield of Bunker Hill basin that included single-dry and multiple-dry years, and supplies from that basin are very reliable. RPU wells are generally located at the section of the basin, with the greatest thickness of water bearing layers. Planned water supply projects aim to reduce reliance on imported water and increase local groundwater production.

2.4.2 Consistency of Supplies

RPU water supplies are consistently available (Table 2.4-3). In order to maintain and improve existing water supplies, RPU has collaborated with other local water agencies through SAWPA and the Upper Santa Ana Watershed Resources Association (USAWRA) to address the various groundwater management issues that affect the reliability of local water supplies. Typical collaborative efforts include developing groundwater models for the Riverside basin, and conducting source water assessments (SWA).

In December 2002, RPU completed source water assessments of the various basins pumped for domestic water. RPU also developed Source Water Protection Plan for the North Orange area to minimize impacts of septic systems on groundwater (see Section 6). In 2002, Riverside City Council adopted an ordinance regarding moratorium on new septic systems in the Highgrove/North Orange area and encouraged the County to adopt similar ordinance.

Table 2.4-3
Factors resulting in inconsistency of supply

DWR UWMP Review Table 10 Factors resulting in inconsistency of supply				
Name of supply	**Legal**	**Environ-mental**	**Water Quality**	**Climatic**
Groundwater	None	None	None	None
Imported water	None	None	None	None

RPU completed several wellhead treatment facilities to treat previously abandoned wells such as Twin Springs, Palmyrita, and Moore-Griffith wells. RPU also increased blending capacity with the construction of a major transmission main from the North Orange well field to the Linden and Evans Reservoirs.

The California Regional Water Quality Control Board, Santa Ana Region through the basin plan established objective levels for nitrates and TDS to protect the beneficial use of water in the basins. Additional measures to increase the safe yields of the basins and improve the reliability of water supplies/distribution were highlighted in Section 1.2 of this UWMP. Potential Responsible Parties (PRPs) have developed Water Supply Contingency Plans to address contamination from point sources. The Water Supply Contingency agreements and/or policies already in place protect RPU from emergencies due to contaminant plumes and other environmental concerns.

2.5 Water Exchanges and Transfers

According to the Water Code definition of short and long-term: short-term is for duration of one year or shorter and long-term is for a duration that is longer than one year. Table 2.5-1 summarizes transfer and exchange opportunities. RPU began a water exchange program with Gage Canal Company in 1991 to augment its domestic supplies. The Gage Exchange Program (GEP) is one of several measures that enabled RPU to reduce the purchase of imported water. Under the GEP, RPU can divert up to an additional 6,000 acre-feet per year for domestic purposes from the Gage Canal at Linden. In exchange, the Gage Canal Company receives up to 8,000 acre-feet per year of non-potable irrigation water (ratio of 1.0 to 1.25) from Riverside and Colton Basins. The capacity of the existing facilities has limited the amount of water exchanged. RPU is planning delivery of recycled water to Gage Canal Company (Section 2.9). This would allow full exchange of Gage's groundwater supply resulting in additional delivery of up to 5,388 acre-feet per year (Table 2.3-3).

Table 2.5-1
Transfer and Exchange Opportunities

DWR UWMP Review Table 11 Transfer and Exchange Opportunities - AF Year					
Transfer Agency	**Transfer or Exchange**	**Short term**	**Proposed Quantities**	**Long term**	**Proposed Quantities**
Gage Canal Company (GCC)	Exchange			X	6,000
GCC Additional exchange	Exchange			X	5,388
Total					**11,388**

2.6 Past, Current and Projected Water Use

All RPU customers are on meters. Table 2.6-1 presents the past, current, and projected water use for the 1995 – 2030 period. The potable water use data in Table 2.6-1 is from the billing records, and the non-potable use is from well production records. All wells are metered. Recycled water sales are also metered and are reported in Table 2.6-5.

Table 2.6-1
Past and Projected Water Deliveries

DWR UWMP Review TABLE 12 - Past, Current and Projected Water Deliveries						
	2000		**2005**		**2010**	
	metered		metered		metered	
Water Use Sectors	# of accounts	Deliveries AFY	# of accounts	Deliveries AFY	# of accounts	Deliveries AFY
Single & Multi family	53,879	42,949	56,627	44,297	59,515	48,019
Commercial	3,990	11,796	4,193	12,167	4,407	13,188
Industrial	366	10,870	385	11,211	404	12,152
Institutional/gov						
Landscape						
Agriculture	236	1,180	248	1,244	261	1,348
other	67	408	70	421	74	456
Total	58,538	67,203	61,523	69,340	64,661	75,164

DWR UWMP Review TABLE12 (continued) - Past, Current and Projected Water Deliveries						
	2015		**2020**		**2025**	
	metered		metered		metered	
Water Use Sectors	# of accounts	Deliveries AFY	# of accounts	Deliveries AFY	# of accounts	Deliveries AFY
Single & Multi family	62,550	50,071	65,740	51,545	67,007	52,538
Commercial	4,632	13,752	4,868	14,157	4,962	14,430
Industrial	425	12,672	447	13,046	456	13,297
Institutional/gov						
Landscape						
Agriculture	274	1,406	288	1,447	294	1,475
other	78	476	82	490	84	499
Total	67,959	78,377	71,425	80,684	72,802	82,239

DWR UWMP Review TABLE12 (continued) - Past, Current and Projected Water Deliveries						
	2030					
	metered					
Water Use Sectors	# of accounts	Deliveries AFY				
Single & Multi family	68,687	53,856				
Commercial	5,086	14,792				
Industrial	467	13,630				
Institutional/gov						
Landscape						
Agriculture	301	1,512				
other	86	512				
Total	74,627	84,301				

Notes: Projections of meter #s assumed constant rate of growth after 2015
Some data are from 2001 RPU UWMP and adjusted 2005 RPU Water Master Plan based on CIS data.

Table 2.6-1 present the past, current, and projected number of connections. The numbers of service meters are projected assuming an increase of 1 percent per year between 2005 and 2015 and a constant rate of growth after 2015 through 2030. The demand projections for each water use sector were based on average delivery per service meter.

The Residential category in Table 2.6-1 includes both the single family and multi-family residential categories. Customer billing records maintained by RPU do not differentiate between single family residential and multi-family residential uses. The average residential use per connection is 0.8 acre-feet per year or 700 gallons per day.

The Agricultural category consists of that portion of the domestic water primarily used for irrigation purposes.

2.6.1 Sales to Other Agencies

The two major wholesale water customers of RPU are the Home Gardens County Water District (HGCWD) and WMWD. HGCWD serves about 800 domestic customers located between Riverside and Corona with a water service area of 232.5 acres. HGCWD is also a wholesale entity of WMWD and can receive water from the WMWD through RPU facilities. HGCWD has its own well and is considered "built-out" and projects the same water demand through the year 2025 ([Riverside County] LAFCO, 2005).

RPU provides (interruptible) domestic supplies to WMWD whenever there is available water supply (Table 2.3-8). WMWD purchased about 3,000 acre-feet of water in 2000 from RPU.

Table 2.6-2
Sales to other agencies

DWR UWMP Review Table 13 Sales to Other Agencies - AF Year							
Water Distributed	**2000**	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**
Home Gardens CWD[1]	305	540	540	540	540	540	540
Western Municipal Water District[2]	3,143						
Total	3,448	540	540	540	540	540	540

1. Home Gardens County Water District - Full Buildout demand = 540 acre-feet/yr (2005 LAFCO MSR)
2. Sales to Western MWD is interruptible and depends on amount of available water.
Sources: 2004 RPU Water Supply Plan and CIS Records. 2005 Riverside County LAFCO Municipal Service Review (MSR)

2.6.2 Additional Water Uses and Losses

Unaccounted for Water

Unaccounted water is the quantity difference between the amount of water locally produced/purchased from wholesalers and the amount of water sold to customers from billing records. In reality distribution system leakage, accounting/metering errors, water theft may explain some of the unaccounted losses within the system. Table 2.6-3 shows that the unaccounted for water ranged from 9% through 20% between 1999 and 2003. An average of 11% for the period is higher than the 8% to 10% typical of other water agencies in Southern California (MWH, 2005). MWH (2005) recommended Water Master plan Capital Improvement Program (CIP), meter and accelerated pipeline replacement program could enable some reduction in the volume of unaccounted for water.

Table 2.6-3
Historic Unaccounted for Water

Year	City's Potable Water Use (AFY)	Total Historic Consumption Domestic Use (AFY)	Water Loss
1999	73,101	64,523	12%
2000	74,483	68,067	9%
2001	72,789	65,164	10%
2002	77,717	62,056	20%
2003	72,414	63,556	12%

Data from City of Riverside 2004 Water Supply Plan

Table 2.6-4 show the projected unaccounted for water and the amount of water production required to meet projected future demand.

Table 2.6-4
Projected Unaccounted for Water

Year	Water Demand (AFY) [1]	Production required to meet demand(AFY) [2]	Recycled water use (AFY) [3]	Production required adjusted for recycled water usage (AFY)	Revised Water Demand (AFY)	Estimated unaccounted for water (AFY)
2005	77,529	77,767	200	77,567	69,880	7,687
2010	84,254	85,231	1,200	84,031	75,704	8,327
2015	89,494	91,048	3,450	87,598	78,917	8,681
2020	93,828	95,858	5,700	90,158	81,224	8,935
2025	97,410	99,835	7,950	91,885	82,779	9,106
2030	101,499	***104,374***	***10,200***	***94,174***	***84,841***	***9,333***

[1]Production from MWH estimates (Table 2.2-1)
[2]Production adjusted for "unaccounted for water", estimated by MWH as averaging 11%;
only the incremental demand over 2003 demand must be increased to account for unaccounted water.
[3]Recycled water use = planned recycled water use + existing recycled water use (200 AFY).

Table 2.6-5 summarizes the additional water uses and losses. Unaccounted-for system losses averaged about 11% between 1989 and 2003 (RPU, 2004).

Table 2.6-5
Additional Water Uses and Losses

DWR UWMP Review Table 14 Additional Water Uses and Losses - AF Year							
Water Use	**2000**	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**
Recycled	139	200	1,200	3,450	5,700	7,950	10,200
Unaccounted-for system losses[1]	6,109	7,687	8,327	8,681	8,935	9,106	9,333
Total	**6,248**	**7,887**	**9,527**	**12,131**	**14,635**	**17,056**	**19,533**

Data sources: 2004 RPU Water Supply Plan, 2005 RPU Water Master Plan (MWH)
[1]Unaccounted losses based on 1989-2003 average of 11% of supplies and adjusted projected Water Mater Plan (MWH, 2005) Demand.

2.6.3 Total Water Use

Table 2.6-6 summarizes the projected total water use. Total water use is projected to exceed 100,000 acre-feet after 2025.

Table 2.6-6
Total Water Use

DWR UWMP Review Table 15 Total Water Use - AF Year							
Water Use	**2000**	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**
Past, current, and projected water deliveries (1)	**67,203**	**69,340**	**75,164**	**78,377**	**80,684**	**82,239**	**84,301**
Sales to other Agencies (2)	**3,448**	**540**	**540**	**540**	**540**	**540**	**540**
Additional water uses (3)	**6,248**	**7,887**	**9,527**	**12,131**	**14,635**	**17,056**	**19,533**
Total (1) + (2) + (3)	**76,899**	**77,767**	**85,231**	**91,048**	**95,858**	**99,835**	**104,374**

Data Sources: (1) DWR UWMP Review Tables 12. (2) Sales to other agencies from Table 13.
(3) From Table 14. Sum of recycled usage and unaccounted water losses.

2.7 Demand Management Measures (DMM)

RPU Department is a signatory to the Memorandum of Understanding (MOU) of the California Urban Water Conservation Council (CUWCC). The discussions regarding DMM are presented in Section 3.

2.8 Evaluation of DMMs not implemented

Section 3 shows that RPU implements all the applicable BMPs of the California Urban Water Conservation Council.

2.9 Planned Water Supply Projects and Programs

The long-range water supply plan identified the following planned water supply projects to increase future supplies:

- Expanded Gage Exchange Program.
- Increased groundwater production from Riverside South basin (downtown treatment, Riverside).
- John W. North Treatment Facilities in Grand Terrace.
- Expanded use of recycled (Section 5) water for non-potable uses.
- Seven Oaks Dam Conservation

The expected yield and schedule from the planned projects are summarized in Table 2.9-1. The projects were also discussed earlier in Section 2.3. Note that all the proposed projects rely on local water sources and mainly include expanding existing operations. Yield from the proposed projects would be consistent because of the historical reliabilities of those local sources.

The proposed downtown treatment facilities will treat water from existing wells (11th Street, Fill, First Street and Cunningham) using GAC and membrane technologies. A proposed transmission main will deliver treated water from the proposed project to RPU distribution system.

The John W. North Treatment Facilities in Grand Terrace will treat non-potable water from existing wells such as the Flume Tract in Colton Basin. Some of the Flume wells were rehabilitated in 2005. The project will be built in 2 phases: (1) a 5 million gallon per day (MGD) facility, and (2) expansion into a 10 MGD facility as demand increases.

Expanding the exchange program with the Gage Canal Company could allow RPU to use the entire water rights of the GCC in the Bunker Hill Basin (11,388 acre-feet per year as of January 2005). GCC would receive non-potable water and/or recycled water from

RPU in exchange. Under the full exchange program, the RPU can obtain up to 49,542 acre- feet from the Bunker basin not including the more than 3,343 acre-feet from shares held in mutual water companies and UCR's 536 acre-feet of water rights.

Additional production of up to 7,000 acre-feet per year from the Riverside downtown area within the Riverside South Basin could require additional wells and treatment for DBCP. RPU will be evaluating the feasibility of increasing production from Riverside South basin.

Table 2.9.1
Future Water Supply Projects

DWR UWMP Review Table 17 Future Water Supply Projects							
Project Name	**Projected Start Date**	**Projected Completion Date**	**Normal-year acre-feet (AF) to RPU**	**Single-dry year yield AF**	**Multiple-Dry Year 1 AF**	**Multiple-Dry-Year 2 AF**	**Multiple-Dry-Year 3 AF**
Seven Oaks Dam	2005	2010	2,000	2,000	2,000	2,000	2,000
Gage Exchange	2005	2010	5,388	5,388	5,388	5,388	5,388
Recycled water	2005	2030	10,000	10,000	10,000	10,000	10,000
John W. North Water Treatment Plant	2005	2010	10,000	10,000	10,000	10,000	10,000
Riverside South (Downtown) Basin Additional	2015	2020	7,000	7,000	7,000	7,000	7,000
		TOTAL	**34,388**	**34,388**	**34,388**	**34,388**	**34,388**

Additional information regarding expanded use of recycled water is in Section 5.

The 1969 Judgment permits RPU to acquire additional water rights through "new conservation." RPU provided some of the funding for conservation storage of water behind the Seven Oaks Dam. WMWD and the San Bernardino Valley Municipal Water District (SBVMWD) filed a water right application with the State Water Resources Control Board for the "newly conserved" water from the dam.

The projected water from Seven Oaks Dam could be recharged into the local groundwater basins for future extractions. RPU (2004) estimated its share of water at over 2,000 acre-feet per year, based on the feasibility report by the U.S. Army Corps of Engineers. In 2004, WMWD and the SBVMWD jointly prepared the draft EIR (SAIC, 2004) to support the water rights application. The water from Seven Oaks Dam could be used directly or recharged into the local groundwater basins for future extractions. The new conservation yield is anticipated to be fully available from 2010.

2.10 Development of Desalinated Water

RPU have no immediate plans for desalination. Nitrates and Total Dissolved Solids (TDS) levels in blended water produced by RPU are lower than their respective Maximum Contaminant Level (MCL) and Secondary MCL (SMCL). SAWPA owns and operates the Arlington desalter to improve groundwater quality in the Arlington basin

using 5 wells in that basin. The Arlington desalter supplies water to the City of Norco. RPU does not produce nor plan to produce potable water from Arlington basin as of 2005. Arlington basin is not adjudicated and is distant downstream of major RPU water reservoirs. Opportunity also exists for RPU to consider desalting Arlington basin when less expensive (and less energy intensive) sources are not adequate to meet demand.

Table 2.10-1
Opportunities for Desalinated Water

DWR UWMP Review Table 18 Opportunities for desalinated water	
Sources of Water	**Check if yes**
Ocean Water	
Brackish ocean water	
Brackish groundwater	X

2.11 Current or Projected Supply Includes Wholesale Water

RPU is a wholesale customer of WMWD. WMWD is a wholesale customer of the Metropolitan Water District of Southern California (MWD). Table 2.11-1 is a summary of the projected purchase of imported water provided by RPU to WMWD. RPU can receive up to 60 cubic feet per second (cfs) of water from the Mills Filtration Plant (Mills) operated by MWD.

Table 2.11-1
Projected Demand provided to Western Municipal Water District

DWR UWMP Review Table 19 RPU demand projections provided to wholesale suppliers - AFY					
Wholesaler	**2010**	**2015**	**2020**	**2025**	**2030**
Western Municipal Water District	3,800	5,300	6,800	8,300	9,800

RPU can take delivery of imported water through three connections:

- Campbell Reservoir connection (up to 30 cfs from Mills),
- Van Buren connection (up to 30 cfs can be delivered to Van Buren and Mockingbird Reservoirs), and the
- Whitegates connection (up to 5 cfs can be delivered at Whitegates as part of the 60 cfs).

MWD has implemented several measures to increase the reliability of its supplies. In 1999, MWD adopted the Water Surplus and Drought Management (WSDM) Plan that describes the management of regional water supplies to achieve the reliability goals. MWD (2004) evaluated the reliability of its water supplies as part of its update of its Integrated Resources Plan (IRP). MWD (2005) fully expects to be 100 percent reliable in meeting all wholesale demand through 2030. MWD (2005) also identified buffer supplies that could supply additional water such as SWP groundwater storage and transfers.

Table 2.11-2 and Table 2.11-3 respectively summarizes wholesaler provided information regarding availability and reliability of supplies.

Table 2.11-2
Western Municipal Water District Quantified Sources of Water

DWR UWMP Review Table 20 Wholesaler identified & quantified the existing and planned sources of water- AFY						
Western MWD sources	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**
MWD-WMWD Wholesale Service	78,024	88,902	101,146	111,837	123,784	134,028

Source: Table 4, Draft 2005 WMWD Urban Water Management Plan

Table 2.11-3
Western Municipal Water District Supply Reliability

DWR UWMP Review Table 21 Wholesale Supply Reliability - % of normal AFY					
	Multiple Dry Water Years				
Wholesaler sources	**Single Dry**	**Year 1**	**Year 2**	**Year 3**	**Year 4**
MWD Supplies	100	100	100	100	100

Source: Table 8, Draft 2005 WMWD Urban Water Management Plan

Table 2.11-4 summarizes the factors that could affect the consistency of wholesale water supplies as identified by the wholesaler. MWD (2005) describes plans to reduce potential shortfalls – including the development of additional storage and new supplies.

Table 2.11-4
Factors resulting in inconsistency of supplies from Western Municipal Water District

DWR UWMP Review Table 22 Factors resulting in inconsistency of wholesaler's supply				
Name of supply	**Legal**	**Environment**	**Water Quality**	**Climatic**
MWD	Competition for new supplies	Endangered species	Contamination of supply. More stringent water quality standards	Drought conditions

Source: Table 10, Draft 2005 WMWD Urban Water Management Plan

As described earlier, RPU is implementing several measures to maximize the use of local water resources and reduce reliance on imported water. Purchase of imported water is anticipated to be limited to during emergencies and localized drought.

3 WATER DEMAND MANAGEMENT

3.1 DMM Implementation

RPU Department is a signatory to the Memorandum of Understanding (MOU) of the California Urban Water Conservation Council (CUWCC). RPU participates in local and regional demand side management (DSM) programs.

RPU is providing the annual reports filed with the CUWCC identifying water demand management measures implemented, or scheduled for implementation, to satisfy the requirements of subdivisions (f) and (g) of California Water Code Section 10631.

RPU submitted the information regarding BMP Activity Reports and coverage reports electronically to CUWCC. BMP Activity Reports for 2003-04, 2001-02 are attached as Appendix C.1 and C.2 respectively. Appendix C.3 is the coverage report for 2001-02.

4 WATER SHORTAGE CONTINGENCY PLAN

4.1 Stages of Action

RPU has implemented several measures to improve the reliability of the water system since the last update of the Urban Water Management Plan (Section 2). RPU has also developed additional water supplies that will reduce the severity and frequency of potential shortages (Section 2). RPU has developed several programs for addressing short-term water shortages including purchasing imported water from the WMWD.

Table 4.1.1 describes the various water shortage stages and their respective typical triggering conditions. Water rationing may be voluntary or mandatory depending on the causes, severity, and expected duration of shortage, groundwater levels, and the availability of alternate supplies. During the 1987-92 drought, voluntary reductions in water usage up to 7% occurred because customers responded to conservation messages from adjacent communities within the same mass media-market as RPU. Mandatory rationing may be necessary to achieve higher reduction goals. RPU may declare a water shortage emergency depending on the severity of the shortage. Prohibitions and consumption reduction methods are discussed later in Section 4.4. Appendix D.1 is the adopted water shortage Ordinance.

Table 4.1-1
Water Supply Shortage Stages and Conditions

DWR UWMP Review Table 23 Water Supply Shortage Stages and Conditions RATIONING STAGES				
Stage No.	**Water Supply Conditions**	**Supply Shortage (%)**	**Reduction Goal (%)**	**Rationing Type**
1	First and second year of a drought	5	5	Voluntary
2	Third and Fourth year of drought	10	10	Mandatory
3	Fifth and sixth year of a drought	20	20	Mandatory
4	Multi-year (>=7) extreme drought	50	50	Mandatory

4.2 Estimate of Minimum Supply for Next Three Years

For RPU, the most appropriate driest three-year historic sequence is from 2000-2002 mainly because:

- Precipitation was below normal during the period.
- The period best reflects the most recent hydrogeological situation within local groundwater basins and higher water demand that reflected population growth.

Table 4.2.1 are the projected minimum water supply for the next three years.

Table 4.2.1
Estimated 3-year Minimum Water Supplies

DWR UWMP Review Table 24 Three-Year Estimated Minimum Water Supply - AF Year					
Source of Water	**Normal**	Projected ->	**2006**	**2007**	**2008**
		Historic Year Based on ->	**2000**	**2001**	**2002**
Bunker Hill groundwater basin	41,860		39,328	40,281	40,363
Gage Exchange (Bunker Hill basin)	6,000		5,935	5,585	3,251
Other Bunker Hill[1]	11,095		15,332	12,656	18,357
Riverside North basin	6,000		5,767	5,865	5,494
Riverside South basin	12,000		10,899	9,894	12,107
Groundwater Total	**76,954**		**77,261**	**74,281**	**79,572**
Recycled water[2]	**140**		**139**	**133**	**134**
Purchased Imported water			**365**	**980**	**654**
Domestic Delivery to Western MWD[3]			**(3,143)**	**(2,472)**	**(2,509)**
Total	**77,094**		**74,622**	**72,922**	**77,851**

Data source: 2004 RPU Water Supply Plan

NOTES

[1]Equals Annual Watermaster declared surplus water (annual declaration not a firm supply) from Bunker Hill Basin and purchased water.

[2]Additional reclaimed water over and above historic amounts would be available as delivery infrastructure develops.

[3]From Western Municipal Water District. No further sales anticipated during 2006-2008.

4.3 Catastrophic Supply Interruption Plan

Among the major hazards that can degrade the quality and/or impact the quantity of water available to RPU water system include regional power outages, earthquakes, liquefaction (high groundwater level), floods, chemical spills, groundwater contamination, and terrorist acts (Table 4.3-1). Some of those hazards could also adversely impact the distribution systems, such as the major transmission mains, or reservoirs. Interruptions to water supplies from any of the above mentioned hazards may be limited to days or even months, except for groundwater contamination, which could last several years.

Actions taken to prepare for a catastrophe include the following:

- Establishing criteria for a proclamation of water shortage (Section 4.1).
- Developing alternate sources of water supplies (Section 2.9).
- Establishing contacts and mutual aid agreement with other agencies (Section 4.3.7).
- Establishing an Emergency Response Team/Coordinator.
- Preparing an Emergency Response Plan (ERP).
- Developing public awareness programs.

RPU has implemented many measures that reduced the vulnerability of the water system to the aforementioned hazards. Many of the measures implemented are appropriate to

several of the hazards and are summarized in Table 4.3-1 and discussed further in following sections. In 1995, RPU prepared an Emergency Response Plan. In 2004, RPU updated the Emergency Response Plan as required under the U.S. Public Health Security and Bioterrorism Preparedness and Response Act of 2002 (PL 107-188).

The RPU ERP may be activated whenever any of the following conditions exist:

- Regional Power Outage
- Natural Disasters such as earthquake, flood, etc.
- Loss of Transmission Mains or other major facilities.
- Water quality issues involving a "boil water" order or other contamination.
- Emergency curtailment.
- Disturbance affecting nearby utilities.
- Terrorist activities.
- Hazardous spills.

Table 4.3-1
Possible Catastrophes Discussed

DWR UWMP Review Table 25 Preparation Actions for a Catastrophe	
Possible Catastrophe	**Summary of Action to Prepare for Catastrophe[1]**
Regional power outage	Added additional local power sources including some renewable energy. Improved reliability of transmision and distribution systems.
Earthquake	Increased local reservoir emergency storage. Installed new transmission mains to connect local wells to Central City reservoirs.
High groundwater level / Liquefaction	Assisted in mitigation high groundwater level in Bunker Hill basin.
Floods	Relocated wells from flood plains. Upstream Seven Oaks Dam reduces flooding risk.
Groundwater Contamination	Developed Water Supply Contingency Plan. Installed wellhead treatment. Prepared Source Water Assessment for wells. Developed Source Water Protection Plan. Negotiated agreements with responsible parties to pay for future cleanup.
Terrorism/Sabotage	Vulnerability Assessment (VA) and Emergency Response Plan. Implemented VA recommendations.

[1]In addition to preparing an ERP.

The ERP will guide damage assessment, record keeping, prioritization of repairs, and coordination with other City Departments. The goal is returning to normal operations as soon as practicable.

Typical RPU actions during voluntary rationing include public information campaign and media outreach to encourage conservation. Typical emergency response actions to the above listed possible catastrophes may include one or more, but not limited, to the following:

- Assemble crisis management teams at pre-designated locations and Emergency Operations Center (EOC).
- Assess and document damaged facilities. Repair or reactivate as appropriate.

- Assess for signs of contamination, i.e., increase the frequency of monitoring.
- Deactivate contaminated sources.
- Install additional treatment facilities.
- Community outreaches e.g., public education, media outreach, boil water advisories.
- Coordination with other City Departments, and other government agencies.
- Seek mutual aid assistance.
- Drain contaminated reservoirs as quickly as possible.

An assessment of each listed catastrophe and summarized description of previous responses and/or actions undertaken to prepare for such catastrophe follow.

4.3.1 Regional Power Outages

RPU provides both water and electricity within the City of Riverside. RPU was not severely impacted by the electrical power crises in 2001. RPU is a municipal owned utility. RPU maintains a diverse power supply portfolio that includes long term base load and local generating facilities (LGF). LGF includes the 440 kilo watts (kW) of solar power, 40 megawatts (MW) Springs 'peaker' power plant, and the new 96 MW Riverside Energy Resource Center (RERC) power plant, which will come online in 2006 (Section 5). Long-term base load of 266 MW includes very near power sources such as landfills and the Salton Sea Geothermal. In 2005, total available capacity to meet peak summer demand was 597 MW compared to a peak record power demand of 544 MW (July 2005) or about 10% reserve capacity. RPU is upgrading transmission facilities and reviewing load shedding and emergency restoration procedures to minimize outage time. In summary, RPU is less vulnerable to Regional power outages.

Some wells in Bunker Hill basin (Waterman system) are powered by electricity provided by Southern California Edison. During electrical power outages, RPU can still produce some potable water because most of the Gage wells and Garner B, and some booster stations are powered by gas engines or can also be powered by gas engines. The water distribution system is entirely within the RPU electric service territory. Most of the pressure zones within the distribution system are fed by gravity from reservoirs (MWH, 2005). The 2005 Water Master plan (MWH, 2005) sized distribution system reservoirs using several criteria including emergency storage capacity of at least 150 percent of average day demand or 88% of the maximum day demand (MDD). RPU is most likely to have some water in storage to meet an average day demand.

4.3.2 Earthquakes

Riverside is located close to active earthquake faults such as the San Andreas, and San Joaquin. Earthquake poses potential significant risks to the RPU water system, and could potentially result in water supply shortages and disruptions to the transmission/distribution systems. Groundwater produced from wells in San Bernardino area is conveyed using two major transmission mains that cross several earthquake faults before blending within the Linden and Evans Reservoirs in Riverside.

Riverside has experienced some earthquakes in the past, with neither significant water supply shortages nor disruptions. Table 4.3-2 is a list of some of the major earthquakes in Southern California during the last twenty years. Stronger earthquakes can result in major water service disruptions either due to facility damage, or to power outages. In some cases, harmful microorganisms could migrate into the distribution system because of pipe breaks and/or damage to water disinfection facilities. It could take several days (or more) to restore the water system to the community at large depending on the severity of damage, especially after the first 72 hours after a serious quake.

Table 4.3-2
Major Earthquakes in Southern California since the 1990s

Major Earthquakes in Southern California since the 1990s		
Date	**Name**	**Magnitude**
Feb-90	Upland	5.5
Jun-91	Sierra Madre	5.8
Apr-92	Joshua Tree	6.1
Jun-92	Landers	7.6
Jun-92	Big Bear	6.7
Jan-94	Northridge	6.8
22-Feb-03	Big Bear	5.4
16-Jun-05	Yucaipa	4.9

4.3.3 High Groundwater Level (Liquefaction)

Another potential hazard related to earthquake is soil liquefaction. Liquefaction is a phenomenon that occurs in loose, saturated, granular soils when subjected to long duration, strong ground shaking. High groundwater levels shallower than the threshold (between 30 and 50 feet below ground surface) may at some locations increase the potential for liquefaction during very strong earthquakes. Some of the wells in the North Orange area of Riverside are located in areas prone to liquefaction. Some RPU wells located in the pressure zone of Bunker Hill groundwater basin, where groundwater levels occasionally are shallower than the threshold in some areas, may also be vulnerable to liquefaction. Some segments of the major water transmission mains from Bunker Hill groundwater basin are located within the potential liquefaction zone. RPU is in the process of upgrading some sections of the Waterman Transmission Main. The proposed Riverside-Corona Feeder (RCF) Transmission main to be built by WMWD from Bunker Hill basin through Riverside to Corona could also be used to convey water to RPU distribution system during emergencies.

RPU cooperatively with other local water agencies (the Upper Santa Ana Watershed Association, USAWRA) developed and implemented a "high groundwater" mitigation plan (Section 2). The "high groundwater" mitigation plan being implemented will help reduce potential for liquefaction in the Bunker Hill basin. Similar reductions in liquefaction potential may occur in the North Orange area because of increased

groundwater production from the area after the construction of wellhead treatment facilities (Section 6).

4.3.4 Floods

Some RPU wells are located within the flood plains of the Santa Ana River, and thus vulnerable to flooding. For example, in 1995, floods washed away the superstructure of Gage 21 well. The sub-surface well bore was subsequently properly abandoned. Gage 98-1 well replaced Gage 21 well, with funding assistance from the Federal Emergency Management Agency (FEMA). The other wells most vulnerable to flooding include some Warren Tract wells. Some of the Warren Tract wells were replaced upstream with Cooley J well. The recently completed Seven Oaks Dam upstream will reduce the magnitude, frequency and vulnerability of wells to flooding, while increasing available water rights.

Potential hazards from floods are not limited to physical damage and/or loss of water infrastructure. Curriero, Frank C. *et al.* (2001), found that more than half of the waterborne disease outbreaks in the United States in the past 50 years were preceded by heavy rainfall. Outbreaks due to surface water contamination, which accounted for approximately 24 percent of all outbreaks, were more associated with extreme precipitation occurring during the month of the outbreak and one month prior, while outbreaks due to groundwater contamination, which accounted for approximately 36 percent of all outbreaks, were more associated with extreme precipitation occurring within a three month lag preceding the outbreaks.

RPU has implemented many measures in order to minimize adverse impacts of flooding on groundwater contamination. For example, RPU increased the thickness of well seals for newer wells to greater depths than required by the State of California water well standards. RPU also screens newer wells generally deeper than 400 feet below ground surface. Additional chlorination stations (Section 6) were added further upstream of the major transmission mains thereby increasing the disinfection contact time. Prior to 2003, wells in the North Orange area used to pump directly into the distribution system. The North Orange wells were connected by a major transmission main to the Linden and Evans Reservoirs for increased disinfection contact time.

4.3.5 Groundwater Contamination

Potential hazards that could result in groundwater contamination include migrating contaminant plumes, chemical spills, agricultural return drainage, leaky underground storage tanks (USTs), and septic systems. Chemical spills, and leaking USTs initially tend to affect small number of wells, whereas contaminant plumes, agricultural return drainage, and septic systems may impact regional aquifers extensively.

Previous improper waste disposal practices have created many groundwater plumes that have degraded and will continue to impact Riverside wells (Section 6). Groundwater contamination may interrupt water supplies for significantly extended period. However,

groundwater contamination/chemical spills may sometimes have Potentially Responsible Parties (PRP) who can be made to pay mitigation costs. PRPs are mitigating groundwater contamination due to organic solvents thus assuring continued availability and reliability of water supplies affected by those plumes (RPU, 1999).

In 2001, RPU reached agreement with the manufacturers of the pesticide dibromochloropropane (DBCP) that have contaminated wells in the Riverside groundwater basins. Under the agreement, DBCP manufacturers agree to pay the capital costs and 40 years of operating and maintenance costs of facilities to remove DBCP from production wells. RPU was reimbursed for Granular Activated Carbon (GAC) treatment plants that enable RPU to produce additional water from wells previously abandoned to contamination.

In the late 1980s and early 1990s, water produced from wells connected to the Waterman Transmission main was used to blend impaired water produced from the Gage wells to meet potable drinking water standards. However, water quality within the Gage Canal has improved since the Air Force and Lockheed constructed wellhead treatment facilities, and the replacement of the most contaminated Gage wells with deeper wells (Gage 92-1, Gage 92-2, Gage 92-3, and Gage 98-1). Those treatment facilities are expected to remove additional contaminants, such as DBCP.

In 1999, RPU prepared a Water Supply Contingency Plan (WSCP) that addressed the potential water quality issues facing the City of Riverside (Riverside), especially from the Crafton-Redlands plume(s). The WSCP (Section 6) also included Contingency Plans for addressing issues related to more stringent water quality regulations. The California Department of Health Services approved the WSCP.

4.3.6 Terrorist Acts

In 2003, RPU completed the mandated Vulnerability Assessment (VA) and in 2004 updated the ERP.

4.3.7 Mutual Aid Agreement and Emergency Water Connections to other Agencies

RPU is a member of the USAWRA that has assisted its members in developing mutual aid agreements for use during emergencies. Table 4.3-3 shows the inter-ties between water systems that can be used to deliver water from other purveyors to assist Riverside during short-term emergencies. RPU is also a member of the Water Agency Response Network (WARN).

Table 4.3-3
Water Systems Connections

Agency	Agency/Name	Location	Capacity (gpm)	Emergency /Imported	Direction	Riverside Pressure Zone
WMWD	Mills Connection 24-C	Cannon Rd	13,400	Imported	To Riverside	1600 Zone
WMWD	Van Buren Highline	Mockingbird Canyon Rd	13,400	Imported/ Wholesale	To/From Riverside	1200 Zone
WMWD	Warmington	Warmington St	1,000	Emergency	From Riverside	1100 Zone
Home Gardens		Harlow Av	1,500	Wholesale	From Riverside	925 Zone
Corona		Sampson Av	1,500	Emergency	To/From Riverside	925 Zone
San Bernardino		North of Sixth St	2,000	Emergency	To/From Riverside	Gravity
East Valley WD		Sixth St near Pedley	4,000	Emergency	From Riverside	Gravity
WMWD	Lusk Highland (Box Springs)	Sycamore Canyon Blvd	1,500	Emergency	To Riverside	1600 Zone
WMWD	Praed/Lake Knolls	Lake Knoll Park	1,500	Emergency	To Riverside	1400 Zone
California Filter Plant		Shelby Dr	4,000	Emergency	To Riverside	Gravity
WMWD	Whitegates	Near Whitegates 2 Res	1,100	Emergency	To Riverside	1750 Zone

Source: MWH (2005) RPU Water Master Plan

4.4 Prohibitions, Penalties and Consumption Reduction Methods

4.4.1 Prohibitions

During a mandated reduction, the RPU will intensify its water conservation programs, especially public education. RPU promotes efficient water use including non-potable uses such as landscaping and irrigation (Chapter 19.67 of the Riverside Municipal Code). Recycled water from the wastewater treatment plants may be used for street cleaning.

Appendix D.1 and Appendix D.2 are adopted water shortage and “No-Waste” Ordinances, respectively for the City of Riverside. The RPU ordinances include prohibitions against wasteful water use practices. Water Rule #15 and Riverside Municipal Code Section 13.04.120 prohibits running waste water upon streets: "It is unlawful for any Person using water for irrigation, domestic or other use or purpose, to run any waste water or allow the same to run onto or upon any public street in the City, but each person must care for and dispose of his own waste water."

Water Rule #9 regarding water shortages states “In the event of any actual or threatened shortage of water supply, and during the period of such shortage, the Water Utility shall apportion the available supply of water among its Customers in the most equitable manner possible to continue service fairly and without discrimination, except that preference shall be given to such service as is essential to the public interest and to the

preservation of life and health." The rationing process is in stages depending on the severity of the drought (Table 4.1-1). RPU has a water-rationing plan - the first stage encourages voluntary rationing. As the drought becomes more severe, there might be reduction in sales of water to outside agencies and more aggressive distribution of non-potable water for non-potable uses.

Table 4.4-1
Mandatory Prohibitions

DWR UWMP Review Table 26 Mandatory Prohibitions	
Examples of Prohibitions	**Stage When Prohibition Becomes Mandatory**
Allowing water to run on streets	All
Street/sidewalk cleaning	
Leaking fixture replacement	All

4.4.2 Consumption Reduction Methods

Table 4.4-2 is the summary of consumption reduction methods. As discussed earlier public awareness campaign can achieve some reduction in demand (voluntary rationing). RPU also offers rebates to encourage structural conservation, i.e., reduce water demand (ultra-low flush toilet replacements, high efficiency washing machines, etc.). RPU has a water rate structure that promotes water efficiency (Section 4.4.3).

Table 4.4-2
Consumption Reduction Methods

DWR UWMP Review Table 27 Consumption Reduction Methods		
Consumption Reduction Methods	**Stage When Method Takes Effect**	**Projected Reduction (%)**
Public education	All	7
Water efficiency pricing	All	7
Voluntary rationing	1	7
Mandatory rationing	2 through 4	Up to 50%
Plumbing fixture replacement	All	
Demand reduction program	All	

The reduction goal would be to balance supply and demand. See Section 4.6 details regarding the mechanism for monitoring reductions in consumption.

4.4.3 Penalties

RPU maintains a tiered commodity water rate and seasonal water rates to encourage efficient water use [http://www.riversidepublicutilities.com/waterrules.htm] in addition to a fixed monthly charge based on meter size. Table 4.4-3 shows the "quantity rate" for a residential RPU customer (SCHEDULE WA-1) within the City of Riverside. Notice that the marginal rate nearly doubles after usage exceeds 1,500 cubic feet per month.

Table 4.4-3
Tiered and Seasonal Water Rates

SCHEDULE WA-1 Quantity Rate within City of Riverside Effective Date: June 1, 2005					
	Potable Water Quantity	**June-October**		**November - May**	
First	1,500 cubic feet per month	$	0.62	$	0.62
	1,600 - 3,500 cubic feet per month	$	1.26	$	1.14
	3,600 - 6,000 cubic feet per month	$	1.52	$	1.22
All over	6,000 cubic feet per month	$	1.92	$	1.31

The water waste ordinance includes penalties for excessive water usage. According to Water Rule #15, "Whenever it appears to the Director that water delivered by the Water Utility is being used in violation of the terms of this Rule, he [/she] shall give written notice to the person so wasting water of his [/her] intention, after a reasonable time to be therein stated, to shut-off the water supply to the Person's Premises."

Table 4.4-4
Penalties and Charges

DWR UWMP Review Table 28 Penalties and Charges	
Penalties or Charges	**Stage When Penalty Takes Effect**
Tiered water rates	All
Higher seasonal water rates	All
Water wastage (Water Rule #15)	All

4.5 Analysis of Revenue Impacts of Reduce Sales During Shortages

For the 2003-2004 fiscal year gross revenues from water sales totaled over $49.6 million and operating expenses exceeded $33.8 million[1]. Water retail sales and wholesale sales account for about 62% of total revenues. Reduction in water sales due to shortages could affect both revenue and expenses.

[1] Riverside Public Utilities Department - 2003-2004 Financial Statements

4.5.1 Revenue Impacts

RPU typical water rate includes the following components: a fixed monthly charge, a prorated commodity charge based on consumption with increasing marginal rates and adjustments for seasonality, energy factor adjustment, a surcharge for customers not within city limits, and a Water Conservation and Reclamation surcharge. Table 4.5-1 includes summaries of potential measures that RPU can implement to mitigate some revenue impacts due to shortages. Revenue from fees such as fixed monthly charges, development related fees, and backflow protection program would not be impacted by reduction in water usage due to droughts.

Table 4.5-1
Potential Measures to overcome revenue impacts

DWR UWMP Review Table 29 Proposed measures to overcome revenue impacts	
Names of measures	**Summary of Effects**
Rate adjustment	Increase revenue
Use of existing reserves	Decreases reserve
Refinance existing bonds or issue new bonds	Decrease expenses

RPU has many options to cushion reduction in revenues due to reduced demand by its retail customers. RPU maintains reserves that can offset minor revenue impacts. Riverside Water Financial Plan reserve levels reached $9 million by July 2004 of which $1.8 million is reserved as revenue contingencies due to weather. That level of reserves ($9 million) amounts to about 29% of wholesale ($0.149 million) and retail water sales ($30.5 million) in fiscal year ending June 2004.

RPU could revise its water rules, reserve levels, and rates to specifically address significant reductions in water sales due to mandatory rationing as needed. For example, RPU could also raise water rates to maintain reserve levels required by bond covenants. Other potential measures include refinancing or rescheduling of existing bonds (if lower rates can be obtained).

4.5.2 Expenditure Impacts

Some expense categories such as purchased energy, treatment costs, operations and maintenance (O&M) and contribution to the City general fund would be less because of reduced pumpage and/or revenues. RPU estimated a reduction in energy costs of $350,000 per year assuming a 10% reduction in water demand. RPU can reduce or avoid some water treatment related costs by choosing to operate wells that require the least amount of treatment. RPU could also pump the most efficient wells to further reduce energy costs. RPU could investigate additional energy savings from switching to cheaper rate schedules based on time of use (TOU) by taking advantage of distribution system reservoir storage (Section 4.3.1).

Expenditure for purchased water would be reduced significantly if not totally eliminated. Purchased water costs about $525 per acre-foot in 2005 or about $525,00 per year saving for each 1,000 acre-feet reduction in purchased water (Table 2.3-3). Expense categories such as depreciation, interest expense and maintenance would remain fairly the same or experience slight reductions. It is anticipated that expenditure on water conservation would increase to induce significant reductions in water demand due to multi-year drought. Water conservation budget is also funded from the Water Conservation and Reclamation Surcharge on water bills.

Table 4.5-2 summarizes potential measures that RPU can implement to mitigate some revenue and expenditure impacts.

Table 4.5-2
Potential Measures to Overcome Expenditure Impacts

DWR UWMP Review Table 30 Proposed measures to overcome expenditure impacts	
Names of measures	**Summary of Effects**
City Council could reduce general fund transfer (GFT)	Reduce
Reduce or eliminate amount of purchased [imported] water	Reduce
Delay some capital expenditure	Reduce
Reduce energy costs by utilizing reservoir operations for Time of Use (TOU) rates	Reduce

4.6 Draft Ordinance and Use Monitoring Procedure

Appendix D.1 is the water shortage ordinance. RPU has mechanisms in-place (Table 4.6-1) for monitoring compliance with actual mandated reductions, some of which were discussed earlier in Section 4.4. Water sales to customers are metered and billed monthly. RPU implements a meter maintenance program to assure accuracy. Collected revenues from water sales are incorporated into the monthly financial reports produced by the RPU Finance Section. RPU customer billing system simultaneously reports water usage for current and previous years in bills sent to customers. The billing software can be used to evaluate compliance with mandated reductions.

Table 4.6-1
Water Use Monitoring Mechanisms

DWR UWMP Review Table 31 Water Use Monitoring Mechanisms	
Mechanisms for determining actual reductions	**Type data and quality of data expected**
Monthly meter reading	Water usage in ccf. Good quality.
Comparison of current usage with last year's usage	% reduction in usage. Good quality.

RPU has capability to determine reductions in either or both of the water production and consumption. In 2004, RPU completed a major upgrade of the SCADA system of the water distribution system. All production wells are metered, and monitored. The upgrade to the SCADA system is capable of recording potable water production and water levels within potable water reservoirs. Water levels of selected wells are regularly monitored and charted. Flow meters installed at pump stations and booster stations can be read automatically through the SCADA system to determine usage.

RPU operates a water quality-blending model that optimizes water quality for selected parameters within the distribution system. That model determines optimal daily production and is run everyday to determine pumpage operations to assure full compliance with water quality regulations. RPU closely monitors daily production, and files annual reports with the Western-San Bernardino Watermasters that administer the 1969 Judgment on water rights. The Western-San Bernardino Watermasters file annual reports with the Superior Courts that oversee the 1969 Judgment. The annual recordations are also forwarded to the California State Water Resources Control Board.

5. RECYCLED WATER PLAN

5.1 Coordination

Table 5.1-1 lists the Agencies that were contacted and/or assisted in providing data and/or review regarding this recycled water plan.

Table 5.1-1
Participating Agencies

DWR UWMP Review Table 32 Participating agencies	
AGENCIES	**Participated**
Water Agencies	
City of Riverside Public Utilities Department	Yes
Wastewater agencies	
City of Riverside Public Works Department	Yes
Planning Agencies	
City of Riverside Planning Department	Yes

5.2 Wastewater Quantity, Quality and Current Uses Water

5.2.1 Wastewater Collection and Treatment Systems

The City of Riverside Public Works Department operates and maintains a municipal wastewater treatment plant – the Riverside Regional Water Quality Control Plant (RRWQCP). The City also operates and maintains the wastewater collection system. The wastewater collection system includes over 1,100 miles of gravity sewers ranging in size from 6 to 48 inches in diameter. Appendix E.1 shows a schematic of the wastewater collection system. The average daily wastewater inflow to the RRWQCP is currently about 33 million gallons per day (MGD). The current capacity is about 40 MGD and the ultimate master planned capacity is 60 MGD.

The service area of the RRWQCP extends beyond the water service area of RPU (Section 2). RRWQCP facilities now provide primary, secondary, and tertiary treatment to sewage effluents from the City of Riverside, and other unincorporated areas of Riverside County served by the Jurupa, Rubidoux, and Edgemont Community Services Districts.

5.2.2 Wastewater Collected and Treated

Table 5.2-1 shows the historic and projected volumes of recycled water in acre-feet per year. The projected flow to the plant includes historical growth, increased flows from Jurupa Community Services District and up to 4.4 MGD from the Highgrove area.

Table 5.2-1
Annual Volume of Recycled Water

DWR UWMP Review Table 33 Wastewater Collection and Treatment - AF Year							
Type of Wastewater	**2000**	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**
Wastewater collected and treated in RRWQCP[1] Service	35,533	37,214	42,707	45,509	48,311	51,113	53,916
Volume that meets recycled water standard	35,533	37,214	42,707	45,509	48,311	51,113	53,916

[1]RRWQCP - Riverside Regional Water Quality Control Plant
Data for years 2005 through 2030 are projected and were obtained from the City of Riverside Public Works Department

5.2.3 Methods of Wastewater Disposal

Discharge of tertiary effluent (recycled water) occurs at five locations within Reach 3 of the Santa Ana River. A portion of the tertiary effluent is diverted for recycled water use and the remaining to the Hidden Valley Wetlands. Table 5.2-2 summarizes how treated wastewater is discharged. The Hidden Valley Wetlands (HVW) is used for additional wastewater treatment (nitrogen removal).

Table 5.2-2
Disposal of Treated Wastewater

DWR UWMP Review Table 34 Disposal of treated wastewater (non-recycled and recycled) acre-feet per year								
Method of disposal	**Treatment Level**	**2000**	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**
Diverted to Hidden Valley Wetlands (HVW)	Tertiary	13,451	11,209	12,330	12,330	12,330	12,330	12,330
Discharge to Santa Ana River	Tertiary	22,082	26,005	30,377	33,179	35,981	38,783	41,586
		35,533	**37,214**	**42,707**	**45,509**	**48,311**	**51,113**	**53,916**

Effluent flowing downstream of Prado dam is available for groundwater recharge by downstream water agencies.

5.2.4 Current Uses of Recycled Water

Table 5.2-3 shows the current uses of recycled water include release downstream to meet legally mandated downstream discharge obligations.

Table 5.2-3
Recycled water uses– Actual and Potential

DWR UWMP Review Table 35 Recycled Water Uses - Actual and Potential (AFY)								
User Type	**Treatment Level**	**2000**	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**
Golf Course	Tertiary	139	140	140	140	140	140	140
Landscape (Urban Forest)	Tertiary	1	2	2	2	2	2	2
Downstream discharge obligations[1]	Tertiary	15,250	15,250	15,250	15,250	15,250	15,250	15,250
Wetlands & Wildlife Habitat	Tertiary+nitrates	13,451	11,209	12,330	12,330	12,330	12,330	12,330
Industrial	Tertiary	126	126	126	126	126	126	126
RERC Power Plant[2]	Tertiary			110	110	110	110	110
Other recycled water use	Tertiary		60	823	3,079	5,328	7,575	9,825
	Total	**28,967**	**26,787**	**28,781**	**31,037**	**33,286**	**35,533**	**37,783**

[1]Prado settlement -1969 Judgment. Some of the effluent flowing downstream of Prado dam is used for groundwater recharge.
[2]RERC = Riverside Energy Resource Center

The Prado settlement (Superior Court, 1969) requires RRWQCP to annually discharge 15,250 acre-feet (13.38 MGD) of effluent (adjusted for quality but not less than 13,420 acre-feet) into the Santa Ana River to assist the Western Municipal Water District (WMWD) in meeting its discharge obligations downstream of Prado Dam. The discharged tertiary effluent blended with other flows within the Santa Ana River naturally replenishes downstream aquifers. Some downstream water agencies such as the Orange County Water District (OCWD) divert flow from the Santa Ana River to spreading basins to facilitate additional replenishment of their aquifers.

RPU sells a portion of the tertiary effluent for non-potable purposes where economically feasible (Table 5.2-3). RPU purveys about 140 acre-feet of recycled water for irrigation of a golf course, landscape median on Van Buren/Jurupa and to a commercial user. The planned use of recycled water by the Riverside Energy Resource Center (RERC) is discussed in Section 5.3. RPU is proposing a Recycled Water Agricultural Program to deliver some of the tertiary effluent to the Gage Canal Company and Western Municipal Water District (Section 5.3.6).

5.3 Potential and Projected Use, Optimization Plan with Incentives

5.3.1 Potential Uses of Recycled Water

Potential uses of recycled water within the RPU Service Area include agricultural irrigation (Gage Exchange), landscape irrigation, wildlife habitat enhancement, wetlands (HVW), industrial reuse, and groundwater recharge. Table 5.2-3 shows that RPU and Public Works Department are currently using a portion of the tertiary effluent for many of the identified potential uses. Additional discussions on other potential uses can be found in following sections.

5.3.2 Technical and Economic Feasibility of Serving the Potential Uses

In 1992, RPU and the Public Works Department jointly hired James M. Montgomery Consulting Engineers, Inc. (JMM) to prepare a Recycling Master Plan. JMM (1992) estimated available recycling water quantity, market assessment, and the development of a core distribution system. In 1995, RPU staff analyzed the alternatives and compared them with other existing water sources. Table 5.3-1 and 5.3-2 summarize the reuse alternatives including those identified by JMM.

Table 5.3-1
Recycled water Reuse Alternatives

Alternative	Capital cost	Total annual cost	Yield (AF)	$/acre-foot
Parks & Freeway	$8.28m	$0.79m	850	930
JMM[1] Core system	$45.00m	$4.41m	11,000	600
Rancho La Sierra Golf Course	$4.04m	$0.53m	1,210	431
Airport/La Sierra	$10.68m	$1.44m	2,000	798

[1]JMM now Montgomery-Watson-Harza
Source: RPU 1995 data on recycled water reuse.

Table 5.3-2
Cost effectiveness of Recycled water Alternatives and other programs

Alternative	Water Source	Capital cost	Yield (AF)	$/acre-foot
A: New non-potable distribution system				
Parks & Freeway	RRWQCP[1]	$8.28m	850	930
JMM[2] Core system	RRWQCP[1]	$45.00m	11,000	600
Rancho La Sierra Golf Course	RRWQCP[1]	$4.04m	1,210	431
Airport/La Sierra	RRWQCP[1]	$10.68m	2,000	798
B: New booster stations and transmission lines				
Gage Canal	RIX[3]	$9.34m	12,100	218
Gage Canal	RRWQCP[1]	$12.74m	12,100	210
C: Existing programs				
Gage Exchange	Wells	$0.67m	6,000	90

[1]RRWQCP = Riverside Regional Water Quality Control Plant
[2]JMM now Montgomery-Watson-Harza
[3]RIX = [City of San Bernardino and City of Colton] Rapid Infiltration eXtraction TertiaryPlant.
Source: RPU 1995 data on recycled water reuse.

RPU chose to expand Gage exchange (Section 2) because it was more cost effective.

In 2003, Parsons Engineering Consultants (Parsons) prepared a Recycled Water Phase I Feasibility Study and Citywide Masterplan. Parsons developed a more detailed plan including validating future demands. Parsons Engineering Consultants (Parsons, 2003) updated the projected volume of available wastewater determined by JMM (1992) and identified potential customers for optimal use of recycled water within the City of Riverside (Table 5.3-3). RPU reviewed the Recycled Water Masterplan to evaluate the feasibility of expanding the use of the recycled water. Recycled water could replace potable water currently used for irrigation of other golf courses and parks, reducing the demand on potable water.

Parson (2003) evaluated the cost effectiveness and benefits of using recycled water. The annual costs for recycled water ranges from $264 to $409 per acre-foot, depending on the financing option. Parsons (2003) estimated that an annual non-potable reuse potential of 20,400 acre-feet within the City and which does not include demands within the City's 15,000-acre southerly sphere of influence. The estimated capital costs for citywide distribution system is $65 million (2003 dollars).

Table 5.3-3
Assessment of Direct Non-potable Reuse Market

Recycled Water Average Annual Demand Assessment of Direct Non-potable Reuse Market		
	Reuse Potential (Acre-feet/year) Existing Establishment	Future Establishment
A Within the City Limits		
Landscape Irrigagation		
Cemeteries	253	
Colleges/Universities/Schools	2,256	176
Golf Courses	1,335	400
Parks	1,744	895
Miscellaneous	268	270
Freeway Irrigation and City Greenbelts	793	100
Industrial - Landscape Irrigation	422	
Minor Potential Users	1,000	
Subtotal - Landscape Irrigation	**8,071**	**1,841**
Industrial Process/Commercial		
Commercial	500	300
Industrial - Processes	86	850
Subtotal - Industrial Process/Commercial	**586**	**1,150**
Total Within City Limits	**8,657**	**2,991**
Total Existing and Future	**11,648**	
B Additional Users Along City's Northerly Boundary	1,310	
C Potential User's Along City's Southerly Boundary	1,360	
D Potential Gage Canal Agricultural Irrigation Usage	6,000	
Grand Total (A + B + C + D)	**20,318**	

Source: Parsons (2003)

5.3.3 Projected Use of Recycled Water in Service Area

Parsons (2003) estimated that about 18 MGD (20,400 acre-feet per year) of water is available for non-potable uses and groundwater recharge after adjusting for downstream discharge obligations from Prado settlement and potential evaporation losses within the HVWEP.

Table 5.2-3 and Table 5.3-1 show the actual and planned sales of recycled water through 2030. RPU projects purveying approximately 1,200 acre-feet per year of recycled water by 2010, and an additional 9,000 acre-feet per year by 2030 (Table 5.3-4).

Table 5.3-4
Projected Recycled Water Uses – Actual and Potential

DWR UWMP Review Table 36 Projected Future Use of Recycled Water in Service Area - AF Year					
	2010	2015	2020	2025	2030
Projected use of Recycled Water	1,200	3,450	5,700	7,950	10,200

RPU is developing a peaking power plant known as the Riverside Energy Resource Center (RERC) on a 16- acre site adjacent to the RRWQCP. The RERC is projected to require about 32 MG per year of recycled water (about 107 acre-feet, Table 5.2-3).

5.3.4 Comparison of Projected Usages

The RPU 2000 UWMP projected use of about 2,000 (1,861+139+1) acre-feet of recycled water for non-potable uses by 2005 (Table 5.3-5). The projected volume did not include committed discharges to support wetlands nor downstream discharge obligations. In 2005, an estimated 268 (140+2+126) acre-feet of recycled water would be used. The expanded use of Gage Exchange, as explained earlier, was then more cost effective than recycled water reuse.

Table 5.3-5
Comparison of Projected Recycled Water Usage (2000 UWMP and 2005 UWMP)

DWR UWMP Review Table 37 Recycled Water Uses - 2000 Projection compared with 2005 actual - AFY				
User type	2000 UWMP Projection for 2005	2004 actual use	2005[1] UWMP Projected use	Difference between 2000 UWMP & 2005 UWMP Projections
Golf Course	139	137	140	1
Landscape (Urban Forest)	1	2	2	2
Downstream discharge obligations (1)	15,250	15,250	15,250	-
Wetlands & Wildlife Habitat	13,451	10,088	11,209	(2,242)
Industrial	126	126	126	-
Other recycled water use	1,861	0	60	(1,801)
Total	**30,827**	**25,603**	**26,787**	**(4,040)**

[1]Full data for 2005 were not available when this report was prepared. UWMP = Urban Water Management Plan

Since 2000, RPU has invested in additional planning to increase use of recycled water to meet increasing demand that followed the recession of the early 2000s. RPU completed Recycled Water Phase I Feasibility and Citywide Master plan (Parsons, 2003).

5.3.5 Incentive Programs to Encourage Use of Recycled Water

Establishing standards for the use of recycled water is one of policies included in the City draft General Plan 2025. Appendix E.2 is the Recycled Water Reuse ordinance. RPU has experience developing marketing and incentive programs for services it provides such as electricity, and water. In May 2004, City Council adopted a resolution establishing recycled water rates (Appendix E.3). Existing customers are charged a commodity rate of $0.30 per hundred cubic feet (ccf), which is lower than the $0.93 per ccf for existing customers under the irrigation metered service (WA-3). Table 5.3-6 shows projected use of recycled water in acre-feet expected from such incentives.

Table 5.3-6
Methods to Encourage Recycled Water Use

DWR UWMP Review Table 38 Methods to Encourage Recycled Water Use					
	AF of use projected to result from this action				
Actions	2010	2015	2020	2025	2030
Financial incentives & Revised recycled/non-potable water rules	1,200	3,450	5,700	7,950	10,200
Total	**1,200**	**3,450**	**5,700**	**7,950**	**10,200**

5.3.6 Plan for Optimizing the Use of Recycled Water

Discussions in earlier sections included plans for optimizing the use of recycled water. Under the proposed Recycled Water Agricultural Program, the RPU would design and construct a recycled water distribution system, consisting of pipelines and booster stations to serve existing agricultural operations, wholesale nurseries and other agencies. Effluent from the RRWQCP would be incrementally diverted from the plant and delivered to two open concrete lined canals for delivery to the Gage Canal Company (Gage Exchange) and the Western Municipal Water District for subsequent delivery to end users. Both agencies currently use local groundwater and have existing facilities to serve non-potable customers.

The Plan identifies a market of approximately 20,400 acre-feet per annum for agricultural operations. Planned facilities include approximately 35,000 linear feet of 36-42 diameter pipeline, 11,000 linear feet of 24-30 diameter pipeline, a 1,000 horsepower booster pumping station, and turnout and control structures for delivery of water to the canals.

6 WATER QUALITY IMPACTS ON RELIABILITY

6.1 Introduction

In 2001, the Board of Public Utilities formally adopted "non-detect at the tap" as the primary treatment goal for man-made contaminants such as trichloroethylene (TCE), dibromochloropropane (DBCP). In October 2002, the Board of Public Utilities adopted the goal of safeguarding the supply and quality of RPU water resources for the next 100 years. One of the key programs involves developing a source water protection plan for the North Orange well fields (Section 6.5). Over the years, RPU has developed the technical (including legal), managerial and financial (TMF) capacity and experience to implement management strategies to satisfactorily address water quality concerns including treatment without impairing long-term reliability.

6.2 Quality of Water Sources

As discussed earlier in Section 2, the sources of water include groundwater, imported water, and recycled water. RPU produces groundwater from the following local basins: Bunker Hill basin, Riverside North, and Riverside South basins. Production from some of the wells is treated at wellhead or regional treatment facilities prior to delivery to the major transmission mains (Appendix B.4). The wells are spatially distributed within the groundwater basins.

Production from the wells and/or treatment facilities is blended and chlorinated within the major transmission mains prior to distribution from the Linden and Evans reservoirs. The blending and the treatment make the system water less vulnerable to contamination at individual wells.

RPU (2005) regularly monitor the quality of its water sources. More than 14,000 samples were analyzed in 2004. Annually, RPU distributes summary reports on the quality of its water to its customers (i.e., CCR - Consumer Confidence Report). Appendix F.1 shows the typical concentration of blended water. The quality of the blended water RPU meets all applicable drinking water standards.

6.2.1 Groundwater Quality

In general, the natural quality of water in local groundwater basins is very good and reliable (RPU, 2004). There are many contaminant plumes migrating within the local basins. Groundwater contaminant plumes and on-going mitigation programs are discussed in Section 6.3.

Hamlin et al (2002) found "most samples of ground water in the Inland Basins [Bunker Hill, Riverside North and South] were a calcium-bicarbonate type, which may reflect the quality of recharge originating in pristine, high-altitude areas of the adjacent San Gabriel and San Bernardino Mountains." Hamlin et al (2002) identified some of the other factors that influence local groundwater quality as: recharge from the Santa Ana River, discharge of treated wastewater to the river, and use of imported water in the basin.

TDS and nitrates are some of the many water quality parameters that can represent the quality of the groundwater basins. Appendix F.2 and Appendix F.3 respectively show the distribution of TDS and nitrates in some selected wells in Bunker Hill groundwater basins, the primary source of drinking water for RPU. Both figures show spatial variations in groundwater quality. Appendix F.4 shows the typical TDS values for RPU owned wells in all groundwater basins from 1990. The blended concentration of TDS of system water ranged between 330 mg/L and 410 mg/L during the reported period.

6.2.2 Imported Water Quality

Imported water purchased is surface water from the State Water Project (SWP) that is treated at the Metropolitan Water District (MWD) owned Mills Filtration Plant in Riverside prior to delivery to RPU by the WMWD. SWP water quality is maintained and governed by the standards established by the California Department of Water Resources (DWR). The salinity (TDS) of SWP delivered to WMWD is usually less than 300 mg/L, but was as high as 430 mg/L during the 1977 drought (WMWD, 2005). DWR and/or MWD regularly conduct sanitary surveys and monitor the quality of the water according to the applicable standards and regulations. MWD completed a source water assessment of SWP in 2002.

WMWD (2005) does not project water supply changes due to water quality (Table 6.2.1). RPU does not project changes in SWP water quality will affect water management strategies because imported water is further treated at the Mills plant prior to distribution.

Table 6.2-1
Water Supply Changes Due to Water Quality

WMWD UWMP Table 39 Current & projected water supply changes due to water quality - percentage						
Water Source	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**
Potable: SWP	0%	0%	0%	0%	0%	0%

Source: WMWD Draft 2005 UWMP

6.2.3 Recycled Water Quality

Regarding the quality of recycled water, the Riverside Regional Water Quality Control Plant (RRWQCP, Section 5) treats effluent to tertiary standards and monitors the quality to ensure compliance with the NPDES permit. Appendix F.5 is the typical effluent water quality from the RRWQCP.

6.2.4 Projected Water Quality Impacts

Table 6.2-2 summarizes the assessment of likely impacts of how water quality could affect water management strategies and supply reliability. There is no water quality impacts projected to impact RPU sources of water between now and 2030, i.e., 100% of each of the water sources would be available. Reliability concerns other than those due to quality are covered in Section 7 of this UWMP, while Section 4 describes the contingency and implementation plan for handling water shortages.

Table 6.2-2
Projected RPU Water Supply Changes Due to Water Quality

DWR UWMP Review Table 39 Current & projected water supply changes due to water quality - percentage						
Water Source	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**
Bunker Hill - Gage system wells	0%	0%	0%	0%	0%	0%
Bunker Hill - Waterman system wells	0%	0%	0%	0%	0%	0%
Riverside - North Basin	0%	0%	0%	0%	0%	0%
Riverside - South Basin	0%	0%	0%	0%	0%	0%
Imported water[1] - (Western Municipal Water District)	0%	0%	0%	0%	0%	0%
Recycled Water	0%	0%	0%	0%	0%	0%

[1]From Table 6.2-1.

6.3 Water Quality Management Measures

Potential hazards that could impact the quality of groundwater from local basins include migrating contaminant plumes (Appendix F.6), chemical spills, agricultural return drainage, leaky underground storage tanks (USTs), and septic systems. Chemical spills, and leaking USTs initially tend to affect small number of wells, whereas contaminant plumes, agricultural return drainage, and septic systems may impact regional aquifers extensively.

Previous improper waste disposal practices created many groundwater plumes that have degraded and could continue to impact RPU wells. RPU implemented several measures to address groundwater contamination that affected its water sources. Some of the implemented measures included the following:

- Well replacement
- The development of a water quality blending optimization model
- The development of a Water Supply Contingency Plan (WSCP)
- Wellhead treatment pilot studies
- Preparation of a water treatment feasibility study, wellhead treatment
- The construction of a water transmission main from the North Orange well field to the Linden-Evans reservoirs to further improve blending capacity.

RPU was able to improve the quality of its domestic water by successfully implementing a comprehensive strategy that emphasized pollution prevention and source water

protection. Increased implementation of demand side management (DSM) measures such as water recycling, water conservation would further reduce the need to rely on poorer quality sources of water.

RPU developed a blending optimization model to ensure compliance with all mandatory health-based drinking water regulations. In 1993, RPU completed a *Water Treatment Feasibility* Study (Boyle Engineering, 1993). In 1999, the California Department of Health Services (DHS) approved the WSCP developed by RPU (Appendix F.7). The WSCP (RPU, 1999) addressed the best strategy for addressing the various water quality parameters of immediate and future concern and pending drinking water regulations including arsenic, radon, and perchlorate.

RPU collaborated with Federal, state, and local regulators overseeing cleanup of groundwater plumes and provided assistance, where necessary. Potentially responsible parties (PRPs) have or are mitigating groundwater contamination plumes such as the Norton Air Force Base, Rialto (perchlorate), Santa Fe, and Crafton-Redlands (Appendix F.6). The PRP for Crafton-Redlands plume constructed wellhead treatment facilities to treat TCE and perchlorate in that plume. Some treatment facilities can also remove additional organic compounds. U.S. EPA installed some barrier wells and treatment facilities designed to intercept the Newmark and Muscoy plumes upstream of RPU wells (Appendix F.6).

RPU monitored cleanup measures, and where necessary initiated and funded cooperative monitoring of water quality parameters near/within suspected plumes. RPU assisted the Agency for Toxic Substances and Disease Registry (ATSDR) of the U.S. Department of Health and Human Services (DHHS) in conducting *Public Health Assessments* (PHAs). ATSDR (1998) concluded that *"radiological contaminants detected in Norton AFB drinking water wells and Riverside drinking water wells downgradient of Norton do not pose a health hazard."*

In 2001, RPU reached agreement with the manufacturers of the pesticide dibromochloropropane (DBCP) that have contaminated wells in the Riverside groundwater basins. Under the agreement, DBCP manufacturers agree to pay the capital costs and 40 years of operating and maintenance (O&M) costs of facilities to remove DBCP from impacted production wells.

RPU has steadily increased the installed capacities of water treatment facilities to mitigate contamination. RPU has trained and certified water operators to appropriate levels commensurate with the level of planned and installed water treatment facilities and as required by the amendments to the SDWA in 1996.

6.4 Source Water Assessment (SWA)

In 1996, Congress amended the SDWA to include source water protection as part of the multiple-barrier approach to protecting the quality of drinking water delivered to consumers. The amendments required public water systems (PWS) to conduct Source Water Assessment (SWA) and develop an optional protection plan (DHS, 2000). Source water protection is the leading first barrier of the multiple-barrier approach to protecting the quality of drinking water. Other elements of the multi-barrier protection framework include source water treatment (including disinfection); distribution system integrity (including cross-connection control programs); and public information (CCR).

RPU (2000) completed the SWA for wells located in the Riverside North and Riverside South basins. RPU collaborated with other agencies through the USAWRA and the San Bernardino Valley Water Conservation District to conduct SWA for wells in Bunker Hill basin.

6.5 Source Water Protection Plan (SWPP)

In May 1965 there was a severe outbreak of gastroenteritis in the City during which about 18,000 residents were affected (Ross and Creason, 1966). Boring et al., (1971) reported that the illnesses resulted from exposure to salmonella typhimurium in purveyed water.

RPU (2000) SWA suggested that the groundwater in the North Orange and Highgrove areas i.e., Riverside North and Riverside South groundwater basins) area is vulnerable to contaminants associated with septic systems, such as nitrates, chemicals, and harmful pathogens. RPU (2002) completed the optional SWPP for wells located in that area Appendix F.8 is the City ordinance prohibiting new septic systems in the protected area illustrated in Appendix F.9.

The new transmission main from the North Orange area, installed wellhead/regional treatment facilities, and installation of additional chlorination facilities upstream coupled with an effective groundwater protection plan significantly reduces the potential for similar incidence.

7 WATER SERVICE RELIABILITY

7.1 Projected Normal Water Year Supply and Demand

RPU extraction rights in Bunker Hill basin is based on the long-term safe yield of that basin. Extractions from other basins are based on "historic rates." RPU projects sufficient normal supplies for all groundwater basins. Extractions from all the groundwater basins are regularly monitored by Court appointed Watermasters (Superior Court of the State of California for the County of Orange, 1969). MWD (2005) UWMP projects sufficient supplies to meet demands of member agencies including WMWD. WMWD is the wholesale supplier of imported water to RPU. Appendix G.1 is the projected multi-dry year supply capability for MWD through 2030.

7.1.1 Provision of This Section to City And County Within Water Service Area.

The UWMP Act requires providing this information to any city or county within your service area within 60 days of submission of the UWMP to DWR. RPU is an agency of the City of Riverside. RPU Water Service Area (WSA) is within Riverside County. A copy of the adopted UWMP shall be sent to Riverside County (Appendix A.3).

7.1.2 Comparison of Projected Normal Supply

As explained in Section 2, RPU has developed additional supplies since 1992 that was identified earlier as the historic "normal" year. 2005 is a better representative of prevailing "normal" year resource (groundwater, imported water, recycled water) mix than 1992.

Table 7.1-1 compares the projected normal water supply to projected normal water supply over the next 25 years, in 5-year increments. Projected normal water supply will reach about 116,000 acre-feet by 2030, or 56% more water than in 2005.

Table 7.1-1
Projected Normal Water Supply

DWR UWMP Review Table 40 Projected Normal Water Supply - AF Year					
	2010	2015	2020	2025	2030
Supply[1]	94,421	98,171	108,921	112,671	116,421
% of year 2005	127%	132%	146%	151%	156%

[1]Data from DWR UWMP Review Table 4

Projected normal water supply for 2005 is **74,533** acre-feet (1)

7.1.3 Comparison of Projected Normal Demand

Table 7.1-2 compares the projected normal water demand to projected 2005 normal demand. Annual water demand would increase by about 34% between 2005 and 2030, i.e., from about 78,000 acre-feet in 2005 to about 104,000 acre-feet in 2030.

Table 7.1-2
Projected Normal Water Demand

DWR UWMP Review Table 41 Projected Normal Water Demand - AF Year					
	2010	2015	2020	2025	2030
Demand[1]	85,231	91,048	95,858	99,835	104,374
% of year 2005	**110%**	**117%**	**123%**	**128%**	**134%**

[1]From DWR UWMP Review Table 15

Projected normal water demand for 2005 is **77,767** acre-feet

7.1.4 Comparison of Projected Normal Demand and Supply

Table 7.1-3 compares the projected normal water demand to projected normal water supply and demand over the next 25 years, in 5-year increments. Available projected supply exceeds projected demand through 2030. The projected annual "surplus" would increase from about 9,000 acre-feet in 2010 to about 12,000 acre-feet by 2030.

Table 7.1-3
Projected Normal Water Demand

DWR UWMP Review Table 42 Projected Supply and Demand Comparison - AF Year					
	2010	2015	2020	2025	2030
Supply Totals[1]	94,421	98,171	108,921	112,671	116,421
Demand Totals[2]	85,231	91,048	95,858	99,835	104,374
Difference	9,190	7,123	13,063	12,836	12,047
Difference as % of Supply	**10%**	**7%**	**12%**	**11%**	**10%**
Difference as % of Demand	**11%**	**8%**	**14%**	**13%**	**12%**

[1]Data from DWR UWMP Review Table 40. [2]Data from DWR UWMP Review Table 41

7.2 Projected Single-Dry-Year Supply and Demand Comparison

7.2.1 Projected Single-Dry-Year Supply

Not all water sources would be equally affected by a single-dry year. Groundwater and recycled water would not be significantly affected. Net amount of imported water is assumed to be zero, i.e., amount of water sold to the Western Municipal Water District would equal the amount of water purchased from the District for operational reasons. Table 7.2-1 and Table 7.2-2 present the projected available water supplies by sources during a single-dry year.

Table 7.2-1
Normal and Single Dry Year Water Supplies

Normal and Single dry year Current and Planned Water Supplies - (acre-feet/year)						
Water Supply Sources	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**
NORMAL YEAR (EXISTING + PLANNED - Data from DWR UWMP Table 4)						
Groundwater	72,033	87,421	87,421	94,421	94,421	94,421
Imported water	2,300	3,800	5,300	6,800	8,300	9,800
Recycled water	200	1,200	3,450	5,700	7,950	10,200
Desalination	-	-	-	-	-	-
Other - Seven Oaks Dam Conservation storage	0	2,000	2,000	2,000	2,000	2,000
Normal Year Total	**74,533**	**94,421**	**98,171**	**108,921**	**112,671**	**116,421**
SINGLE DRY YEAR (EXISTING + PLANNED)						
Groundwater	72,033	87,421	87,421	94,421	94,421	94,421
Imported water	-	-	-	-	-	-
Recycled water	200	1,200	3,450	5,700	7,950	10,200
Desalination	-	-	-	-	-	-
Other - Seven Oaks Dam Conservation storage	0	2,000	2,000	2,000	2,000	2,000
Single-dry year Total	**72,233**	**90,621**	**92,871**	**102,121**	**104,371**	**106,621**

Assumptions for single dry year: Net imported water = 0 (sales to Western MWD = purchases from Western MWD).

Table 7.2-2
Projected Single Dry Year Water Supplies

DWR UWMP Review Table 43 Projected single dry year Water Supply - AF Year					
Projected	**2010**	**2015**	**2020**	**2025**	**2030**
Single dry year supply[1]	**90,621**	**92,871**	**102,121**	**104,371**	**106,621**
Normal year supply[2]	94,421	98,171	108,921	112,671	116,421
% of projected normal	**96%**	**95%**	**94%**	**93%**	**92%**

Data sources: [1]From Table 7.2-1. [2]From DWR UWMP Review Table 42.

7.2.2 Projected Single-Dry-Year Demand

Table 7.2-3 summarizes projected demand assuming a 5% drop in demand due to voluntary conservation and/or rationing (Table 4.1-1).

Table 7.2-3
Projected Single Dry Year Water Demand

DWR UWMP Review Table 44 Projected single dry year Water Demand - AF Year					
Projected Demand	**2010**	**2015**	**2020**	**2025**	**2030**
Normal[1]	85,231	91,048	95,858	99,835	104,374
Single dry year	80,970	86,495	91,066	94,843	99,155
% of projected normal	**95%**	**95%**	**95%**	**95%**	**95%**

[1]Data from DWR UWMP Review Table 15.

7.2.3 Projected Single-Dry-Year Demand and Supply

Table 7.2-4 summarizes projected demand and supply for a single-dry-year.

Table 7.2-4
Projected Single Dry Year Water Supply and Demand Comparison

DWR UWMP Review Table 45 Projected single dry year Supply and Demand Comparison - AF Year					
Projected	**2010**	**2015**	**2020**	**2025**	**2030**
Supply (1)	90,621	92,871	102,121	104,371	106,621
Demand (2)	80,970	86,495	91,066	94,843	99,155
Difference (1) - (2)	9,651	6,376	11,055	9,528	7,466
Difference as % of Supply	**11%**	**7%**	**11%**	**9%**	**7%**
Difference as % of Demand	**12%**	**7%**	**12%**	**10%**	**8%**

Data sources: (1) and (2) from DWR UWMP Review Tables 43 and 44 respectively.

7.3 Projected Multiple-Dry-Year Supply and Demand Comparison

7.3.1 Multi-dry-period ending 2010

RPU relies mainly on groundwater sources that have proven very reliable even during multi-year droughts. The following assumption applies in determining available water supplies during multi-dry years: amount of imported water purchased or sold nets out (i.e., sales to Western MWD = purchases from Western MWD).

Table 7.3-1
Projected Supply Multi-Dry Period Ending 2010

DWR UWMP Review Table 46 Projected supply during multiple dry year period ending in 2010 - AFY					
	2006	**2007**	**2008**	**2009**	**2010**
Normal year	78,111	81,688	85,266	88,843	94,421
Multi-dry year	**77,811**	**81,088**	**84,366**	**87,643**	**92,921**
% of projected normal	**100%**	**99%**	**99%**	**99%**	**98%**

Table 7.3-1 summarizes projected water supplies.

Table 7.3-2 summarizes projected water demand assuming implementation of demand management programs described in Section 4.

Table 7.3-2
Projected Demand Multi-Dry Period Ending 2010

DWR UWMP Review Table 47 Projected demand multiple dry year period ending in 2010 - AFY					
	2006	**2007**	**2008**	**2009**	**2010**
Normal year demand	79,260	80,753	82,245	83,738	85,231
Multi-Dry-year Demand	**75,297**	**76,715**	**74,021**	**75,365**	**68,185**
% of projected normal	**95%**	**95%**	**90%**	**90%**	**80%**

Table 7.3-3 compares projected water supply with demand.

Table 7.3-3
Projected Supply and Demand Comparison During Multi-Dry Period Ending 2010

DWR UWMP Review Table 48 Projected Supply and Demand Comparison during multiple dry year period ending in 2010- AFY					
	2006	**2007**	**2008**	**2009**	**2010**
Supply totals	77,811	81,088	84,366	87,643	92,921
Demand totals	75,297	76,715	74,021	75,365	68,185
Difference	2,514	4,373	10,345	12,279	24,736
Difference as % of Supply	3.2%	5.4%	12.3%	14.0%	26.6%
Difference as % of Demand	3.3%	5.7%	14.0%	16.3%	36.3%

7.3.2 Multi-Dry-Period Ending 2015

Same earlier assumptions apply in determining available water supplies. Table 7.3-4 summarizes projected water supplies.

Table 7.3-4
Projected Supply Multi-Dry Period Ending 2015

DWR UWMP Review Table 49 Projected supply during multiple dry year period ending in 2015 - AFY					
	2011	**2012**	**2013**	**2014**	**2015**
Normal year	95,171	95,921	96,671	97,421	98,171
Multi-dry year	**91,071**	**91,521**	**91,971**	**92,421**	**92,871**
% of projected normal	**96%**	**95%**	**95%**	**95%**	**95%**

Table 7.3-5 summarizes projected water demand assuming implementation of demand management programs described in Section 4.

Table 7.3-5
Projected Demand Multi-Dry Period Ending 2015

DWR UWMP Review Table 50 Projected demand multiple dry year period ending in 2015 - AFY					
	2011	**2012**	**2013**	**2014**	**2015**
Normal year demand	86,395	87,558	88,721	89,884	91,048
Multi-Dry-year Demand	**82,075**	**83,180**	**79,849**	**80,896**	**72,838**
% of projected normal	**95%**	**95%**	**90%**	**90%**	**80%**

Table 7.3-6 compares projected water supply with demand.

Table 7.3-6
Projected Supply And Demand Comparison During Multi-Dry Period Ending 2015

DWR UWMP Review Table 51 Projected Supply and Demand Comparison during multiple dry year period ending in 2015- AFY					
	2011	**2012**	**2013**	**2014**	**2015**
Supply totals	91,071	91,521	91,971	92,421	92,871
Demand totals	82,075	83,180	79,849	80,896	72,838
Difference	8,996	8,341	12,122	11,525	20,033
Difference as % of Supply	9.9%	9.1%	13.2%	12.5%	21.6%
Difference as % of Demand	11.0%	10.0%	15.2%	14.2%	27.5%

7.3.3 Multi-Dry-Period Ending 2020

Same earlier assumptions apply in determining available water supplies. Table 7.3-7 summarizes projected water supplies.

Table 7.3-7
Projected Supply Multi-Dry Period Ending 2020

DWR UWMP Review Table 52 Projected supply during multiple dry year period ending in 2015 - AFY					
	2016	**2017**	**2018**	**2019**	**2020**
Normal year	100,321	102,471	104,621	106,771	108,921
Multi-dry year	**94,721**	**96,571**	**98,421**	**100,271**	**102,121**
% of projected normal	**94%**	**94%**	**94%**	**94%**	**94%**

Table 7.3-8 summarizes projected water demand assuming implementation of demand management programs described in Section 4.

Table 7.3-8
Projected Demand Multi-Dry Period Ending 2020

DWR UWMP Review Table 53 Projected demand multiple dry year period ending in 2020 - AFY					
	2016	**2017**	**2018**	**2019**	**2020**
Normal year demand	92,010	92,972	93,934	94,896	95,858
Multi-Dry-year Demand	**87,409**	**88,323**	**84,541**	**85,407**	**76,687**
% of projected normal	**95%**	**95%**	**90%**	**90%**	**80%**

Table 7.3-9 compares projected water supply with demand.

Table 7.3-9
Projected Supply And Demand Comparison During Multi-Dry Period Ending 2020

DWR UWMP Review Table 54 Projected Supply and Demand Comparison during multiple dry year period ending in 2020 - AFY					
	2016	**2017**	**2018**	**2019**	**2020**
Supply totals	94,721	96,571	98,421	100,271	102,121
Demand totals	87,409	88,323	84,541	85,407	76,687
Difference	7,312	8,248	13,880	14,864	25,434
Difference as % of Supply	7.7%	8.5%	14.1%	14.8%	24.9%
Difference as % of Demand	8.4%	9.3%	16.4%	17.4%	33.2%

7.3.4 Multi-Dry-Period Ending 2025

Same earlier assumptions apply in determining available water supplies. Table 7.3-10 summarizes projected water supplies.

Table 7.3-10
Projected Supply Multi-Dry Period Ending 2025

DWR UWMP Review Table 55 Projected supply during multiple dry year period ending in 2025 - AFY					
	2021	**2022**	**2023**	**2024**	**2025**
Normal year	109,671	110,421	111,171	111,921	112,671
Multi-dry year	**102,571**	**103,021**	**103,471**	**103,921**	**104,371**
% of projected normal	**94%**	**93%**	**93%**	**93%**	**93%**

Table 7.3-11 summarizes projected water demand assuming implementation of demand management programs described in Section 4.

Table 7.3-11
Projected Demand Multi-Dry Period Ending 2025

DWR UWMP Review Table 56 Projected demand multiple dry year period ending in 2025 - AFY					
	2021	**2022**	**2023**	**2024**	**2025**
Normal year demand	96,654	97,449	98,244	99,039	99,835
Multi-Dry-year Demand	**91,821**	**92,576**	**88,420**	**89,135**	**79,868**
% of projected normal	**95%**	**95%**	**90%**	**90%**	**80%**

Table 7.3-12 compares projected water supply with demand.

Table 7.3-12
Projected Supply And Demand Comparison During Multi-Dry Period Ending 2025

DWR UWMP Review Table 57 Projected Supply and Demand Comparison during multiple dry year period ending in 2025 - AFY					
	2021	**2022**	**2023**	**2024**	**2025**
Supply totals	102,571	103,021	103,471	103,921	104,371
Demand totals	91,821	92,576	88,420	89,135	79,868
Difference	10,750	10,445	15,051	14,786	24,503
Difference as % of Supply	10.5%	10.1%	14.5%	14.2%	23.5%
Difference as % of Demand	11.7%	11.3%	17.0%	16.6%	30.7%

7.3.5 Multi-Dry-Period Ending 2030

Same earlier assumptions apply in determining available water supplies. Table 7.3-13 summarizes projected water supplies.

Table 7.3-13
Projected Supply Multi-Dry Period Ending 2030

[DWR UWMP Review Table 58] Projected supply during multiple dry year period ending in 2030 - AFY					
	2026	**2027**	**2028**	**2029**	**2030**
Normal year	113,421	114,171	114,921	115,671	116,421
Multi-dry year	**104,821**	**105,271**	**105,721**	**106,171**	**106,621**
% of projected normal	**92%**	**92%**	**92%**	**92%**	**92%**

Table 7.3-14 summarizes projected water demand assuming implementation of demand management programs described in Section 4.

Table 7.3-14
Projected Demand Multi-Dry Period Ending 2030

[DWR UWMP Review Table 59] Projected demand multiple dry year period ending in 2030 - AFY					
	2026	**2027**	**2028**	**2029**	**2030**
Normal year demand	100,742	101,650	102,558	103,466	104,374
Multi-Dry-year Demand	**95,705**	**96,568**	**92,302**	**93,119**	**83,499**
% of projected normal	**95%**	**95%**	**90%**	**90%**	**80%**

Table 7.3-15 compares projected water supply with demand.

Table 7.3-15
Projected Supply And Demand Comparison During Multi-Dry Period Ending 2030

[DWR UWMP Review Table 60] Projected Supply and Demand Comparison during multiple dry year period ending in 2030 - AFY					
	2026	2027	2028	2029	2030
Supply totals	104,821	105,271	105,721	106,171	106,621
Demand totals	95,705	96,568	92,302	93,119	83,499
Difference	9,116	8,703	13,419	13,052	23,122
Difference as % of Supply	8.7%	8.3%	12.7%	12.3%	21.7%
Difference as % of Demand	9.5%	9.0%	14.5%	14.0%	27.7%

8 ADOPTION AND IMPLEMENTATION OF UWMP

8.1 Adoption

See Section 1.3. A copy of the adoption resolution is attached to this UWMP (Appendix A.4).

8.2 Public Participation[1]

A special effort was made to include community and public interest groups. Legal public notices for each meeting were published in the local newspapers, posted at City offices and library and on City web site. RPU solicited inputs, data, comments and information from many stakeholders in preparing this UWMP. RPU regularly holds Board meeting in which the public is invited to participate. In addition, RPU and COR maintain a public website with links to reports and conservation related resources. Copies of the draft UWMP were available at RPU Office and on the website. Final copy of the adopted UWMP would be posted online at: http://www.riversidepublicutilities.com.

8.3 Review of 2000 UWMP DMM Implementation Plan

RPU reviewed the BMP implementation plan and determined that all of the applicable BMP's listed in that UWMP are being implemented (See Section 3). RPU is not a wholesale agency and does not implement BMP 10 "Wholesale Agency Assistance Programs." RPU is a member agency of Western Municipal Water District (WMWD), which in turn is a member agency of Metropolitan Water District (MWD) of Southern California. MWD implements BMP 10. RPU implements some DMM measures in cooperation with Western MWD and MWD. Appendix H.1 is a summary of the Water Conservation Incentive Program in WMWD general service area. RPU also promotes water conservation locally.

8.4 Review of 2000 UWMP Recycled Water Implementation Plan

See Section 5.3.4

[1] Government Code section 6066. *Publication of notice pursuant to this section shall be once a week for two successive weeks. Two publications in a newspaper published once a week or oftener, with at least five days intervening between the respective publication dates not counting such publication dates, are sufficient. The period of notice commences upon the first day of publication and terminates at the end of the fourteenth day, including therein the first day.*

8.5 Filing and distribution of UWMP

Appendix A.3 (see Section 1) lists the agencies that will be mailed copies of the adopted UWMP. RPU will provide copies of its 2005 UWMP to DWR within 30 days of adoption. RPU will make the 2005 UWMP available for public review within 30 days of filing it with DWR.

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