City of Arcata
Urban Water Management Plan 2010

Completed: June 2011

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List of Acronyms and Abbreviations

AF	acre-feet
AFY	acre-feet per year
CDPH	California Department of Public Health
CF	cubic feet
City	City of Arcata
CII	Commercial, Industrial, and Institutional
CIMIS	California Integrated Management Information System
CSA	Community Supported Agriculture
CSD	Community Services District
CUWCC	California Urban Water Conservation Council
Service Area	Distribution system (see figure 2)
DMM	Demand Management Measure
DWR	Department of Water Resources
DOF	California Department of Finance
EAP	Emergency Action Plan
EOP	Emergency Operations Plan
ETo	Evapotranspiration
GIS	Geographic Information System
GPCD	Gallons Per Capita Day
HBMWD/District	Humboldt Bay Municipal Water District
HSU	Humboldt State University
JCWD	Jacoby Creek Water District
MGD	million gallons per day
NOAA	National Oceanic and Atmospheric Administration
OP	Operations Plan
PRA	Peak Rate Allocation
PWS	Public Water System
RHNA	Rural Housing Needs Allocation
SCADA	Supervisory Control and Data Acquisition
TRF	Turbidity Reduction Facility
ULTF	Ultra Low Flow Toilet
UWMP	Urban Water Management Plan
UWMP Act	Urban Water Management Planning Act

Introduction

This Urban Water Management Plan (UWMP) for the City of Arcata has been prepared in accordance with the California Urban Water Management Planning Act of 1983 (AB797) (UWMP Act) as amended, including amendments made per the Water Conservation Bill of 2009 (SBX7-7) and AB 1420. The objective of an UWMP is to document an urban water supplier's water supplies and demands, and conservation efforts. According to the UWMP Act, all water suppliers with more than 3,000 connections or distributing more than 3,000 acre-feet per year (AFY) of water shall complete an UWMP every five years. The 2010 UWMP would normally have been due on December 31, 2010, but an extension was granted to provide more time for water suppliers to address new water conservation requirements adopted by the legislature as part of the Comprehensive Water Package. This UWMP contains information required by California Water Code, Division 6, Part 2.6.

The City of Arcata provides water to two public water systems (PWS); the City of Arcata and the Jacoby Creek Waster District (JCWD); collectively referred to as the Service Area. Due to the continuous nature of the two water distribution systems, data from both PWS were combined for calculation of water use and water demand projections. The data used for preparing this report comes primarily from the City's Finance Department billing records and Public Water System Statistics reported annually to the Department of Water Resources (DWR). Figures relating to climate were obtained from the National Oceanic and Atmospheric Administration (NOAA) and the California Integrated Management System (CIMS). Current and projected population figures are based on data from the California Department of Finance (DOF), the US Census Bureau 2000 population data and the City of Arcata Geographic Information System (GIS) Department, and with guidance from the Humboldt County Planning Department. The DWR Guidebook to Assist Urban Water Suppliers to Prepare a 2010 Urban Water Management Plan was used to develop this UWMP. The UWMP Checklist provided in the guidebook has been included in appendix A to support DWR's review process.

Section 1 Plan Preparation

1.1 Agency Coordination

The City of Arcata (City) collaborated with regional urban water suppliers as defined by the UWMP Act and who are wholesale customers of Humboldt Bay Municipal Water District (HBMWD). Each wholesale customer shared resources and information to ensure compatible plans that provide a planning document for individual communities and could be merged if needed to review regional needs.

Coordinating agencies included the City of Eureka, McKinleyville Community Services District (CSD), Humboldt Community Services District, Humboldt County Community Services Development Department, and Humboldt Bay Municipal Water District (Table 1).

The City provided 60-day notice prior to the public hearing to the JCWD, HBMWD, and Humboldt County on its intent to review and update its UWMP as required in Section 10642.

The City of Arcata made its 2010 UWMP available for public review at Arcata City Hall and the Arcata Library and held a public hearing to receive input prior to adoption. Pursuant to Section 6066 of the Government Code

Notice of Public Hearing was published in the Arcata Eye on June 8 and June 15, 2011 and was posted at Arcata City Hall. Public hearing for adoption of the UWMP was held on July 6, 2011 during a regularly scheduled City Council meeting.

Table 1
Coordination with appropriate agencies

Coordinating Agencies	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
Eureka, City of	x	**x**		x			
Humboldt CSD	x	**x**		x			
McKinleyville CSD	x	**x**		x			
Jacoby Creek Water District						x	
Humboldt Bay Municipal Water District	x	x		x	x	x	
Humboldt County Community Services Department	x	x		x		x	

1.2 Plan Adoption, Submittal, and Implementation

The UWMP checklist was used to identify potential areas of "incompleteness" prior to adoption and submittal to DWR. In addition, the City worked with regional partners to in an effort to comment on each other's draft reports.

The 2010 UWMP was adopted as prepared by the City of Arcata City Council on July 6, 2011. Amendments to, or significant changes in, the UWMP shall be adopted and filed in the manner set forth in the UWMP Act.

It is the responsibility of the City of Arcata Director of Environmental Services to implement the City's UWMP in accordance to the schedule set forth in the plan. Within 30-days of submission of the UWMP to DWR the City will make the plan available for review during normal business hours at Arcata City Hall. Within 60-days of submission of the UWMP to DWR the City will provide the JCWD, County of Humboldt, HBMWD, and the California State Library with a copy of the final adopted plan and any subsequent amendments or changes in order to continue our coordinated regional effort.

Appendix B includes a copy of the following documents:

- 60-day notice of UWMP review and update letter
- Certificate of Publication of the Legal Notice of Public Hearing
- City of Arcata's Staff Report for City Council
- Resolution adopting the City's 2010 UWMP

Section 2 System Description

2.1 Service Area Physical Description

Arcata is located on the Northern California Coast. It is in the west-central portion of Humboldt County, six miles north of the City of Eureka, the County Seat. Arcata is situated on the north end of Arcata Bay, which is part of Humboldt Bay, the second largest marine embayment in California. The City was incorporated in 1903 and is situated on a coastal terrace, the lower portions of Fickle Ridge and the west portions of the Arcata Bottoms, between Arcata Bay and the Mad River.

The City of Arcata supplies water to the Jacoby Creek Water District (JCWD) through direct transfer at the Jacoby Creek flow meter located near the southeast city limit. Through contractual agreement with the JCWD the City sells water directly to JCWD customers, owns, maintains and repairs the distribution system, and fulfills all regulatory requirements for the JCWD. The JCWD lies to the south east of City limits. Figure 2 is a map of the water service area and shows the boundaries for the City and JCWD.

Local weather is characterized by moderate temperatures, frequent fog and moderate to heavy precipitation in the form of rain. Ninety-five percent of the mean annual precipitation of 40 inches falls between October and May. Mean annual temperature is 53°F with a yearly average range of 47°F to 59°F. Prevailing winds are from the northwest in the summer and the southwest during the winter. Arcata is in the coastal plains heavy fog belt, characterized by low evapotranspiration (ETo) rates. Figure 1 is a monthly climate summary for the Eureka WSO City weather data gathering station and from the California Integrated Management Information System. The weather station is located south of Arcata.

Figure 1 Monthly Climate Summary for Arcata

Month	Monthly Average ETo (evapotranspiration) (inches/month) for zone	Average Rainfall (inches)	Average Temperatures Min- Max (Fahrenheit)
January	0.93	6.78	41.4-54.4
February	1.40	5.38	42.5-55.5
March	2.48	5.24	43.0-55.5
April	3.30	3.05	44.5-56.4
May	4.03	1.69	47.8-58.7
June	4.50	0.65	50.6-60.8
July	4.65	0.14	52.3-61.9
August	4.03	0.33	53.1-62.9
September	3.30	0.75	51.3-63.0
October	2.48	2.62	48.1-61.1
November	1.20	5.65	44.8-58.0
December	0.62	7.06	41.7-54.8

PAGE LEFT BLANK FOR Figure 2 Map of Service Area

2.2 Service Area Population

Population estimates (Table 2) for this report are for the entire Service Area (Figure 2).

Table 2						
Population — current and projected						
	2010	2015	2020	2025	2030	Data source
Service area population	19,546	20,193	20,863	21,556	22,273	State of California, Department of Finance, E-4 Population Estimates for Cities, Counties and the State, 2001-2010, with 2000 Benchmark. Sacramento, California, May 2010 Census 2000 TIGER/Line Files- Census Blocks

Population estimates were developed primarily with U.S. Department of Finance (DOF) and U.S. Census Bureau data. The distribution system was divided into two groups for population projection calculations; population served within city limits and population served outside of city limits.

In 2010 the population within city limits was estimated at 17,712 by DOF. The City of Arcata 2009 Housing Element anticipates that annual population growth will remain steady at a rate of 0.7 percent. Based on these figures the population within city limits is expected to increase to 20,364 by the year 2030, an increase of 13 percent over the next 20 years.

The population served outside of city limits includes the Jacoby Creek Water District and Pacific Manor, a housing development on the northwestern city limit. Based on City of Arcata GIS Department figures, which are anchored to the 2000 U.S. Census, in 2010 the population served outside of city limits was estimated at 1,834. JCWD is characterized by higher-income households with single-family dwellings on large parcels. The Pacific Manor housing development on the northwestern city limit is not expected to add additional dwelling units. The City anticipates a growth rate of 0.2 percent in the areas served outside of city limits. Based on these figures the population served outside of city limits is expected to increase to 1909 by the year 2030, an increase of 4 percent over the next 20 years.

City policies encourage “infill”; focusing development efforts on existing residentially zoned lands within the City and minimizing development pressures on Arcata’s agricultural lands. Residential developments are increasing in density as a result of a rapid rise in land values. The City encourages efficient land use by allowing flexibility and land-trust opportunities in planned residential developments.

The current coastal zone, resource constraints, and greenbelt will continue to limit outward expansion. Arcata is primarily a residential and university community. Land policies and zoning encourage small businesses, tourism and light manufacturing. Commercial water-use sector growth is projected at 0.25 percent annually through 2030.

Arcata’s primary industrial site, Aldergrove Industrial Park, has limited parcels available for development. The City is continuing to plan for the development of a second redevelopment area, South I Street, located south of

downtown. The Industrial water-use sector is expected to increase by 15 percent by 2020 and 1 percent annually thereafter.

Section 3 System Demands

3.1 Water Demands

Actual water deliveries for 2005 and 2010 are based on City Finance Department billing records. The number of metered accounts in all water sectors increased between 2005 and 2010 however, the volume of water delivered decreased by over 337 acre-feet annually (Table 3 & 4). The decline in water usage may be due in large part to water rate increases implemented during this time frame. .

Table 3 Water deliveries — actual, 2005					
	2005				
	Metered		Not metered		Total
Water use sectors	# of accounts	Volume	# of accounts	Volume	Volume
Single family	4,526	996.03			996.03
Multi-family	506	380.54			380.54
Commercial	470	377.17			377.17
Industrial	57	72.73			72.73
Institutional/governmental	26	147.00			147.00
Landscape			17	31.06	31.06
Agriculture					0.00
Other			26	8.96	8.96
Total	5,585	1,973.47	43	40	2013.49
Units: acre-feet per year					

Table 4 Water deliveries — actual, 2010					
	2010				
	Metered		Not metered		Total
Water use sectors	# of accounts	Volume	# of accounts	Volume	Volume
Single family	4,904	741.37			741.37
Multi-family	570	415.92			415.92
Commercial	503	283.37			283.37
Industrial	62	60.56			60.56
Institutional/governmental	37	83.00			83.00
Landscape			17	31.06	31.06
Agriculture					0.00
Other			26	8.96	8.96
Total	6,076	1584.22	43	40.02	1624.24
Units: acre-feet per year					

The number of 'not metered' accounts and volume (Tables 3-7) are estimates tabulated in a 2007 water audit using data from January 2004 through December 2005. Landscape water use accounts for landscape irrigation at City-owned parks and road medians. Growth in this water use sector is expected to be minimal (0.25 percent) since an increase will only occur if and when the City installs additional parks and/or road medians. Renovation of existing parks includes low-water use design which may lead to lower water consumption in this sector in the future. "Other" water use is unmetered, authorized water use for firefighting, water main flushing, storm drain and collection system flushing, and process water used at water and wastewater treatment facilities. "Other" water use data presented in tables 3-7 is a rough estimate based on water use in this sector between 2004 and 2005. The volume of "other" water use can fluctuate greatly depending on several factors including the number of fires that occur in a year and the amount of cleaning/maintenance performed on the sewer system.

Projected water use (Tables 3-7) for metered uses was calculated by first calculating the expected number of accounts in each water sector through 2030 and then projecting the water use in each sector based on the number of accounts anticipated. The actual number of accounts for each water sector in 2010 multiplied by the anticipated annual growth rate was used to estimate the number of water accounts through the year 2030. Water use (volume) was calculated by dividing the 2010 actual volume for each water use sector by the number of accounts in each sector in the same year to obtain an average water use per account for each sector. The projected number of accounts in each year of interest was multiplied by the calculated average water use per account to obtain a projected total volume for each water use sector.

Water use in all sectors is expected to grow at a relatively slow pace over the next 20 years (Tables 5-7). The City's General Plan anticipates a 1 percent annual growth rate in both single-family and multi-family dwelling units through 2030 to accommodate the 13 percent population growth expected over the same time period. According to the City's Draft Housing Element in order to keep pace with the Regional Housing Needs Allocation (RHNA) for the City 562 housing units need to be developed by 2014, with 57 percent (321 units) of those units being for extremely low-, very low-, and low-income households. As of 2009, 80 very low- and low-income units have been built in the City.

Based on the City's 2020 General Plan and the 2009 Housing Element there will be at least 585 housing units for low-income families in the City by 2015. If the RHNA trend continues through 2020 and 2025 the number of low-income housing units for low-income households will be approximately 877 and 1169, respectively. The actual number of housing units constructed in the City in the future may be less than projected due to the expectation that the City will reach build out before 2030. Table 8 estimates the projected low-income water demands through 2025. These figures are based on the average residential water use in 2010 and the expected number of low-income housing units needed to meet RHNA goals.

The commercial water use sector is expected to grow at a rate of 0.25 percent. The City does not anticipate any new large scale industrial users however it does expect an increase in light manufacturing in the next 10 years. By 2015 the City expects a 7 percent growth in industrial users, reaching 15 percent by 2020. Subsequently, growth in this sector is expected to slow to a rate of 1 percent per year through 2030. (Tables 5-7)

Institutional/governmental water use is expected to increase at a rate of 0.25 percent annually (Tables 5-7). Humboldt State University is located in the City of Arcata and is one of the largest water accounts. According to the University's website new campus housing opening in fall of 2011 will accommodate 434 residents. Humboldt State University Master Plan indicates that the University may add an additional 500 residences (beds) to meet long term expansion goals (by year 2040).

The City has a significant agriculture industry. The Sun Valley Group is one of the world's largest flower growers. This company's headquarters and largest farm are served by Arcata's water system. Several community supported agriculture (CSA) farms operate in the distribution area. Long-term records for the agriculture water use sector are not available. Agriculture water use is incorporated in to commercial water use and this water sector is expected to have little to no growth over the next 20 years.

Table 5
Water deliveries — projected, 2015

	2015				
	Metered		Not metered		Total
Water use sectors	# of accounts	Volume	# of accounts	Volume	Volume
Single family	5,154	779.19			779.19
Multi-family	599	437.14			437.14
Commercial	509	286.93			286.93
Industrial	66	64.80			64.80
Institutional/governmental	37	84.04			84.04
Landscape			17	32.00	32.00
Agriculture					0.00
Other			26	8.96	8.96
Total	6,365	1652.10	43	40.96	1,693.06

Units: acre-feet per year

Table 6
Water deliveries — projected, 2020

	2020				
	Metered		Not metered		Total
Water use sectors	# of accounts	Volume	# of accounts	Volume	Volume
Single family	5,417	818.93			818.93
Multi-family	630	459.44			459.44
Commercial	516	290.53			290.53
Industrial	71	69.64			69.64
Institutional/governmental	38	85.10			85.10
Landscape			18	33.00	33.00
Agriculture					0.00
Other			26	8.96	8.96
Total	6,672	1723.64	44	41.96	1,765.60

Units: acre-feet per year

Table 7 Water deliveries — projected 2025, 2030, and 2035						
	2025		2030		2035 - optional	
	metered		metered		metered	
Water use sectors	# of accounts	Volume	# of accounts	Volume	# of accounts	Volume
Single family	5,693	860.71	5,984	904.61		
Multi-family	662	482.87	696	507.51		
Commercial	522	294.18	529	297.88		
Industrial	75	73.19	79	76.93		
Institutional/governmental	38	86.17	39	87.25		
Landscape	18	8.96	18	8.96		
Agriculture						
Other	26	41.28	26	41.28		
Total	7,034	1847.36	7,371	1924.42	0	0
Units: acre-feet per year						

Table 8 Low-income projected water demands				
Low Income Water Demands	**2015**	**2020**	**2025**	**2030**
Single-family & Multi-family residential	259	388	517	643
Total	259	388	517	643
Units: acre-feet per year				

The City of Arcata provides water to customers in the Jacoby Creek Water District through contractual agreement. JCWD water use is incorporated into the data presented in tables 3-7. Table 9 shows actual and projected water deliveries to the JCWD. 2005 and 2010 actual water deliveries were calculated using data from City Finance Department records.

Table 9 Sales to other water agencies							
Water distributed	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**	**2035 - opt**
Jacoby Creek Water District	144	151	153	155	156	158	
Total	144	151	153	155	156	158	0

In addition to the actual and projected water demands presented in tables 3-7 the service area has considerable system losses (Table 10). In 2005 and 2010 water losses were 21 percent and 26 percent of total water into the water system, respectively. Future projections of water losses are estimated at 23.5 percent, the average of water loses between 2005 and 2010. A 2007 water audit of the service area concluded over half of the water loses are potentially recoverable leakage. There are no additional water uses employed by the service area.

Table 10							
Additional water uses and losses							
Water use[1]	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**	**2035 -opt**
Saline barriers							
Groundwater recharge							
Conjunctive use							
Raw water							
Recycled water							
System losses	414	412	388	405	424	443	
Other (define)							
Total	414	412	388	405	424	443	0
Units: acre-feet per year							

Water deliveries to the JCWD account for around 6% of total water use by the service area. System losses account for over 17% of total water use. Table 11 summarizes total water use in the service area. Sales to JCWD are not included as a line item in the table because JCWD water use was incorporated in to total water deliveries (Tables 3-7).

Table 11							
Total water use							
Water Use	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**	**2035 - opt**
Total water deliveries (from Tables 3 to 7)	2013	1624	1693	1766	1847	1924	
Sales to other water agencies (from Table 9)							
Additional water uses and losses (from Table 10)	414	412	388	405	424	443	
Total	2,427	2,036	2,081	2,171	2,272	2,367	0
Units: acre-feet per year							

3.2 Baselines and Targets

3.2.1 Baseline Water Usage

The service area does not use recycled water for direct or indirect potable reuse. Therefore the period for determining baseline usage is a 10-year period beginning in 2001 and ending in 2010 (Table 13). During the 10-year baseline period water use ranged from a maximum of 130 GPCD in 2002 to a minimum of 101 GPCD in 2010. Average 10-year base daily per capita water use for the City of Arcata is 119 GPCD (Table 14).

Table 13			
Base period ranges			
Base	**Parameter**	**Value**	**Units**
10- to 15-year base period	2008 total water deliveries	1723.14	*see below*
	2008 total volume of delivered recycled water	0	*see below*
	2008 recycled water as a percent of total deliveries	0	percent
	Number of years in base period[1]	10	years
	Year beginning base period range	2001	
	Year ending base period range[2]	2010	
5-year base period	Number of years in base period	5	years
	Year beginning base period range	2006	
	Year ending base period range[3]	2010	
Units : *acre-feet per year*			

Table 14				
Base daily per capita water use — 10- to 15-year range				
Base period year		**Distribution System Population**	**Daily system gross water use (mgd)**	**Annual daily per capita water use (gpcd)**
Sequence Year	**Calendar Year**			
Year 1	2001	18669	2.354	126
Year 2	2002	18757	2.430	130
Year 3	2003	18869	2.293	122
Year 4	2004	18991	2.319	122
Year 5	2005	19112	2.160	113
Year 6	2006	19132	2.474	129
Year 7	2007	19248	2.336	121
Year 8	2008	19322	2.255	117
Year 9	2009	19439	2.103	108
Year 10	2010	19546	1.983	101
Base Daily Per Capita Water Use[1]				119

Table 15				
Base daily per capita water use — 5-year range				
Base period year		Distribution System Population	Daily system gross water use (mgd)	Annual daily per capita water use (gpcd)
Sequence Year	Calendar Year			
Year 1	2006	19132	2.474	129
Year 2	2007	19248	2.336	121
Year 3	2008	19322	2.255	117
Year 4	2009	19439	2.103	108
Year 5	2010	19546	1.983	101
			Base Daily Per Capita Water Use[1]	115

The 5-year base daily per capita water use for the City of Arcata is 115 GPCD. At the start of the 5-year baseline period water use was 129 GPCD. A steady decline in daily system gross water use and an increasing population resulted in 101 GPCD water use in 2010 (Table 15).

Population calculations are discussed in Section 1. Gross water use, base daily per capita water use, and water use targets were calculated according to DWR methodologies (Part II, Section M, Guidebook to Assist Urban Water Suppliers to Prepare a 2010 Urban Water Management Plan, 2011). Baselines and water use targets were developed specifically for the City of Arcata. Historic Public Water System Statistics submitted to DWR, water sales records from HBMWD, and water billing data from the City Finance Department were used to calculate gross water use, baselines and targets. Calculations for gross water usage are presented in Appendix C.

3.2.2 Water Use Targets

The service area is located in the North Coast Hydrologic Region. 1995-2005 baseline water use for the North Coast region is 165 GPCD, the 2015 Regional Interim Target is 151 GPCD and the 2020 Target for the region is 137 GPCD; all well above Arcata's 10-year Base Daily Per Capita water use of 119 GPCD (Table 14).

Calculations for determining the water use target for the service area are presented in appendix C. Method 3 was used to determine the Urban Water Use Target; 95% of the regional 2020 target is 130 GPCD.

The 5-year baseline water use for the service area is 115 GPCD (Table 15). Ninety-five percent of the 5-year baseline GPCD water use is 110 GPCD, which is less than the regional 2020 target. Therefore, the City's 2020 Urban Water Use Target is 110 GPCD and the 2015 Interim Urban Water Use Target is 113 GPCD. According to the calculations presented in this UWMP the service area began meeting its UWMP Water Conservation goal beginning in 2009 and continues to reduce its GPCD water use (Table 14 & 15). Urban Water Use calculations and targets are summarized figure 3.

Figure 3 Urban Water Use Calculated Targets

	GPCD
Arcata Base Daily Per Capita Water Use	119
North Coast Region Statewide Target by 2020	137
95% of Regional 2020 Target/ Urban Water Use Target	130
5-year Base Daily Per Capita Water Use	115
95% of 5-year Base GPCD/ adjusted 2020 Urban Water Use Target	110
Arcata's Interim Target	**113**
Arcata's 2020 Target	**110**

3.3 Water Demand Projections

Water Demand Projections were provided to Humboldt Bay Municipal Water District in five-year increments to 20 years (Table 12).

HBMWD provided the City of Arcata with information that identifies and quantifies existing and planned sources of water as required by UWMP Act regulations. Supply and demand projections are presented in Section 4 System Supplies.

Table 12								
Retail agency demand projections provided to wholesale suppliers								
Wholesaler	**Contracted Volume[3]**	**Peak Rate Allocation (MGD)***	**2010**	**2015**	**2020**	**2025**	**2030**	**2035 - opt**
Humboldt Bay Municipal Water District	n/a	3.25	1819	1,674	1,764	1,865	1,960	

*Note: Peak Rate Allocation has been added to this table and is measured in MGD.

3.4 Water Use Reduction Plan

The City of Arcata is committed to environmental stewardship. The 2020 General Plan states clearly the vision of the community:

> *"We live resourcefully. Sustainability is a way of life. We reduce, reuse, and recycle, continually relearning and redefining as we better understand our local resource base. We are committed to living well, and within Arcata's resource base. Our water, wastewater, energy and land use needs are monitored and adjusted, as we find new ways to minimize consumption. We conserve these resources so they may be enjoyed by the seventh generation."*

The City will use the tools presented in Section 6 Demand Management Measures to implement a Water Use Reduction Plan that should enable the City reduce its per capita water consumption rates even as the City and outlying areas continue to grow.

Section 4 System Supplies

The service area has two water sources. Primary water is purchased from HBMWD and delivered to the Alliance Transfer Station. The City owned Heindon Well is available as an auxiliary domestic water source. Water is delivered through 76.5 miles of water distribution mains and storage reservoirs (tanks) located throughout an area encompassing approximately 10 square miles. The City of Arcata provides water to over 6000 service connections located within the Arcata water system (PWS#1210001) and through agreement with the Jacoby Creek Water District (PWS#1210021).

4.1 Surface Water

Surface water information and data were provided by HBMWD, the regional water wholesaler.

The source of water distributed by HBMWD is from Ruth Lake, which is located in Trinity County. The Mad River R.W. Matthews Dam, located at river mile 79, impounds water in Ruth Lake (Figure 4). The District manages releases from the dam to ensure sufficient supplies downstream throughout the year.

At the District's Essex Operations Center located just northeast of Arcata, water is diverted and pumped to meet demand. Municipal water is pumped from an aquifer beneath the Mad River by four wells, called Ranney wells (Figure 5), situated within the riverbed at depths ranging from approximately 60 to 90 feet. Industrial water is diverted by a surface diversion facility.

Figure 4 – R.W. Matthews Dam and Ruth Lake

Figure 5 – Ranney Wells in Bed of Mad River

The District has appropriative water rights permits from the State Water Resources Control Board through the year 2029 for surface water storage and diversion. Diversion is accomplished in different ways for different uses as mentioned earlier.

4.1.1 Supply

HBMWD's water rights permits allow it to store and divert a combined 75 million gallons a day (MGD) from the Mad River. This totals 84,000 acre-feet per year (AFY), which represents 8.5% of the average annual runoff

(982,600 AFY) of the Mad River Basin for the period from 1963 to 2010 (average annual runoff data provided by USGS at Gage Station 1148100 on the Mad River near Arcata, CA).

Table 16							
Water supplies — current and projected							
Water Supply Sources		**2010**	**2015**	**2020**	**2025**	**2030**	**2035 - opt**
Water purchased from[1]:	**Wholesaler supplied volume (yes/no)**						
Humboldt Bay Municipal Water District	**no**	1,819	1,674	1,764	2,272	1,960	
Supplier-produced groundwater[2]		407	407	407	407	407	
Supplier-produced surface water							
Transfers in							
Exchanges In							
Recycled Water							
Desalinated Water							
Other							
Other							
Total		**2,226**	**2,081**	**2,171**	**2,679**	**2,367**	**0**
Units: acre-feet per year							
[1] Volumes shown here should be what was purchased in 2010 and what is anticipated to be purchased in the future. If these numbers differ from what is contracted, show the contracted quantities in Table 17.							
[2] Volumes shown here should be consistent with Tables 17 and 18.							

HBMWD has long-term contracts in place with each of its seven wholesale municipal customers. These contracts have a 20-year term and will be in place through 2019. Wholesale municipal customers have an opportunity to extend these contracts up to ten years. These contracts define the terms and conditions by which HBMWD provides water service to its customers. HBMWD establishes contracted volumes based on peak allocation requirements with its municipal customers. Each municipal customer is designated a Peak Rate Allocation (PRA) which is measured in MGD. The PRA is the maximum daily use in any given calendar year and is reviewed annually by HBMWD. The PRA may be adjusted during the contract term to ensure the municipal customer demands are fully satisfied.

The PRA for Arcata is 3.25 MGD or 9.97 acre-feet/day, equivalent to 3640 AFY (Table 17). The current PRA exceeds the City's projected total water use through the year 2030 (Table 16). The PRA for Arcata accounts for 4.3 percent of HBMWD's water rights.

	Table 17					
	Wholesale supplies — existing and planned sources of water					
Wholesale sources[1,2]	Contracted Volume[3]	Peak Rate Allocation (MGD)	2015	2020	2025	2030
Humboldt Bay Municipal Water District	n/a	3.25	3640.5	3640.5	3640.5	3640.5
	Units: acre-feet per year					
[1]Water volumes presented here should be accounted for in Table 16.						
	[2]If the water supplier is a wholesaler, indicate all customers (excluding individual retail customers) to which water is sold. If the water supplier is a retailer, indicate each wholesale supplier, if more than one.					
	[3]Indicate the full amount of water					

4.2 Groundwater

The City of Arcata invested in a groundwater source to diversify its water supply and better prepare the service area during emergencies. The investment in a groundwater supply is not in response to supply limits or increased demand. At this time there are no plans to develop additional groundwater resources because existing water resources are adequate to meet the needs of the service area. However, groundwater monitoring tests conducted in 2004 indicated that the development of an additional well at a pumping rate of 0.5 million gallons per day would be successful from the deep aquifer pending further modeling.

The City of Arcata has not adopted any groundwater management plans for this basin. This basin is not adjudicated nor has it been identified as a basin in need of protection from overdraft.

Heindon Well pumps groundwater from Groundwater Basin 1-8.01, Mad River Lowland Subbasin, encompassing an area of 40 square miles. Heindon Groundwater Well is located in the coastal floodplain which stretches from the Freshwater Fault north to the Mad River and to the elevated terrace to the East. The Mad River Floodplain is composed of alluvium underlain by the Hookton Formation.

Initial site investigations identified two separate aquifers. The supply well is screened in the deeper aquifer. Aquifer tests in both 1999 and 2004 indicate that the two aquifers are distinct and that pumping operations in the lower aquifer do not affect the upper aquifer.

Monitoring wells are maintained in both the shallow and deep aquifer. Tests indicate that water supplies in both aquifers are stable and the yield of the lower regional aquifer is sufficient to continuously supply water at a rate of 500,000 gallons per day without depleting the aquifer.

Groundwater in the basin is characterized as magnesium-calcium bicarbonate and calcium-magnesium bicarbonate type waters with high iron concentrations and high localized concentrations of manganese, fluoride and phosphorus (DWR 118). A 2002 study of Heindon Well water quality showed that the groundwater quality produced is within the limits set by primary and secondary drinking water standards, with the sole exception being perhaps corrosivity. Heindon Well water is slightly more corrosive than the City's surface water supply (Langelier Index of -0.25 for groundwater and -0.59 for surface water). Water Quality complaints associated with iron may be due to tuberculation in water pipes dissolving in the presence of the more corrosive groundwater.

Pumping from Heindon Groundwater Well began in 1999 to augment the general water supply; although use of the groundwater well was very sporadic from 1999-2002. In July of 2002 the City began pumping continuously from the groundwater well at a rate of approximately 500,000 gallons per day. Since 2005 average pumping rates have decreased to approximately 350,000 per day. Table 18 shows the annual volume of groundwater pumped between 2006 and 2010. There was no water produced at Heindon Groundwater Well between January 2007 and May 2008 due to equipment failure. The decrease in pumping volume is not due to limitations in the volume available for pumping.

Heindon Groundwater Well will continue to be operated as an auxiliary water supply. If pumping continues at the current rate (Table 16) the percentage of the total water supply supplied by a groundwater source will decrease by nearly 4 percent over the next 20 years as shown in Table 19.

Table 18						
Groundwater — volume pumped						
Basin name(s)	**Metered or Unmetered[1]**	**2006**	**2007**	**2008**	**2009**	**2010**
Mad River Lowland Subbasin	Metered	541	0	193	428	407
Total groundwater pumped		541	0	193	428	407
Groundwater as a percent of total water supply		19.5%	0.00%	7.64%	18.20%	18.30%
Units: acre-feet per year						

Table 19					
Groundwater — volume projected to be pumped					
Basin name(s)	**2015**	**2020**	**2025**	**2030**	**2035 - opt**
Mad River Lowland Subbasin	407	407	407	407	
Total groundwater pumped	407	407	407	407	
Percent of total water supply	19.60%	18.70%	15.20%	17.20%	
Units: acre-feet per year					

4.3 Transfer Opportunities

The City of Arcata supplies water by direct transfer to approximately 550 residential meters in the JCWD. In 2010 the City installed a flow meter at the transfer point however operational difficulties have prevented the City from collecting meter data on the quantity of water transferred to JCWD. To-date, the City uses water meter/billing information to calculate the total volume transferred to JCWD.

The main transmission line for HBMWD crosses through the City of Arcata. The City ties into this line west of Highway 101 (Figure 2). The City is designing a second inter-tie to HBMWD's main transmission line to accommodate distribution and to allow flow in the event of a failure of the original tie-in.

The City of Eureka's transmission lie tees off from HBMWD's main line just east of Highway 101 and runs south through Arcata. Arcata has a water line that ties into the City of Eureka's mainline, just before it leaves the City limits that is available for emergency uses.

There are no planned or potential future water exchanges. Table 20 is not applicable.

4.4 Desalinated Water Opportunities

The Humboldt Bay Region has placed considerable investment into a regional system to provide water from the Mad River through HBMWD. This source has ample capacity to meet the region's growth demands. An additional impediment to desalination along Humboldt Bay is the need for an ocean discharge point to dispose of the brine generated through the process. Given the nature of Humboldt Bay and the active shellfish growing region, such permitting would be difficult. There are no plans to investigate opportunities for desalination.

4.5 Recycled Water Opportunities

The City of Arcata Wastewater Treatment Plant treats wastewater from a collection system that serves the area inside city limits and a portion of the JCWD. The areas of JCWD not served by the City's collection system have private sewer systems (septic tanks). The Arcata Wastewater Treatment Plant has typical primary treatment facilities (i.e., headworks, grit removal, clarifier, and digester), a series of oxidation ponds and treatment marshes, followed by polishing marshes at the Arcata Marsh and Wildlife Sanctuary. There is a significant amount of inflow and infiltration in the collection system.

The City of Arcata currently collects and treats over 3100 acre-feet of wastewater per year and expects this volume to increase as population and water use increase (Table 21). Approximately 50% of this water is recycled through the Arcata Marsh and Wildlife Sanctuary for additional treatment in addition to habitat creation and enhancement and 50% is discharged to Humboldt Bay (Table 22). The City partners with Humboldt State University for water quality, stream monitoring and special research projects associated with our wastewater system and water reuse program.

Table 21							
Recycled water — wastewater collection and treatment							
Type of Wastewater	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**	**2035 - opt**
Wastewater collected & treated in service area	3,040	3,138	3,236	3,334	3,432	3,530	
Volume that meets recycled water standard	3,040	3,138	3,236	3,334	3,432	3,530	
Units: acre-feet per year							

Table 22							
Recycled water — non-recycled wastewater disposal							
Method of disposal	**Treatment Level**	**2010**	**2015**	**2020**	**2025**	**2030**	**2035 - opt**
Surface Water	Secondary	1,660	0	0	0	0	
	Total	1,660	0	0	0	0	0
Units: acre-feet per year							

Table 23							
Recycled water — potential future use							
User type	**Description**	**Feasibility** [1]	**2015**	**2020**	**2025**	**2030**	**2035 - opt**
Agricultural irrigation							
Landscape irrigation[2]							
Commercial irrigation[3]							
Golf course irrigation							
Wildlife habitat							
Wetlands	Arcata Marsh & Wildlife Sanctuary	2.9 million, mulit-phase project; pending approval	3,236	3,334	3,432	3,530	
Industrial reuse							
Groundwater recharge							
Seawater barrier							
Getothermal/Energy							
Indirect potable reuse							
Other (user type)							
Other (user type)							
	Total	0	3,236	3,334	3,432	3,530	0
Units : acre-feet per year							

The City is in Phase 4 of a multi-phase, 280-acre wetland enhancement project adjacent to the Arcata Marsh and Wildlife Sanctuary. The City is proposing upon completion that 100% of treated wastewater flow through the Arcata Marsh and Wildlife Sanctuary to a UV disinfection unit and be discharged into a 35-acre brackish marsh (Table 22). Recycled water will be flushed into Humboldt Bay with receding tidal flows. This project is scheduled for completion in 2015 and is subject to approval by the State Water Resources Control Board. The project is estimated to cost over 2.9 million dollars (Table 23).

The City's 2005 UWMP projected that 57% (1264 AFY) of treated wastewater would be recycled through the wildlife habitat and wetlands in 2010. In actuality, 47% of treated wastewater was recycled through the Arcata Marsh and Wildlife Sanctuary, a volume of 1478 acre-feet (Table 24).

The Arcata Marsh and Wildlife Sanctuary is an internationally renowned as an innovative wastewater treatment technology and the City plans to continue using this facility and to expand the volume of water that can be recycled through it in the future. Table 25 is not applicable because the City has no plans to expand the types of recycled water uses and has not prepared a recycled water master plan.

Table 24		
Recycled water — 2005 UWMP use projection compared to 2010 actual		
Use type	**2010 actual use**	**2005 Projection for 2010[1]**
Agricultural irrigation		
Landscape irrigation[2]		
Commercial irrigation[3]		
Golf course irrigation		
Wildlife habitat		
Wetlands	1,478	1,264
Industrial reuse		
Groundwater recharge		
Seawater barrier		
Getothermal/Energy		
Indirect potable reuse		
Other (user type)		
Other (user type)		
Total	1,478	1,264
Units : acre-feet per year		

4.6 Future Water Projects

There are no legal, environmental, water quality or climatic factors resulting in an inconsistent water supply in the service area. As referenced, the Mad River water source has been very consistent. There is no need to examine replacement of this primary water source. Arcata's contracted Peak Rake Allocation of 3.25 MGD and the Heindon Groundwater Well capacity of 0.5 MGD ensures adequate community water supply. Short-term water

interruption would most likely result from a loss of power or facility failure due to a catastrophic event(s). Several scenarios are addressed within the City's Vulnerability Assessment Plan and the Emergency Response Plan.

The City of Arcata has no future water supply projects to meet projected water supply needs. Table 26 is not applicable.

Section 5 Water Supply Reliability and Water Shortage Contingency Planning

Water supply reliability and water shortage contingency planning information and data for Humboldt Bay Municipal Water District (District) were provided by HBMWD, the regional water wholesaler. Section 5 does not address a supply reliability or shortage at Heindon Groundwater Well because this source of groundwater is intended as an auxiliary source to better prepare the City during emergencies.

5.1 Water Supply Reliability

On average, Ruth Lake begins the water year on October 1 with 31,000 AF of water, 64% of its 48,030 AF capacity. Most rainfall in the area occurs between November and April. In every year but one since 1969, there has been at least one large storm during this period, bringing 4 to 9 inches of rain over a seven-day period. This is almost always sufficient to fill the reservoir to capacity. There has only been one water year (1976/77) in which the reservoir was not filled to capacity. The average reservoir volume on May 1 (the end of the usual rainy season) is approximately 47,700 AF, over 99% of capacity. This storage allows the District to supplement low flows until the rains begin again in the fall. Seasonal or climatic shortages are only likely to occur after two consecutive rainy winter seasons with severely reduced rainfall and runoff (well below 50% of normal). This has not happened in the history of the District.

A historical perspective of the designed safe yield of Ruth Lake is included in Appendix D.

5.1.1 Inconsistent Water Sources

As seen from the discussion of water supplies above, the District's sole source of water (the Mad River) has been very consistent and there is no need to replace or supplement this source. As discussed in section 4.2 studies indicate that Heindon Groundwater well is a consistent source of quality groundwater. There are no factors resulting in inconsistency of supply (Table 29).

Table 29

Factors resulting in inconsistency of supply

Water supply sources[1]	Specific source name, if any	Limitation quantification	Legal	Environmental	Water quality	Climatic	Additional information
Humboldt Bay Municipal Water District	Ruth Reservoir	84,000	0	0	0	0	
Heindon Groundwater Well		560	0	0	0	0	Tests indicate water supply is stable at a pumping rate of 0.5 MGD
Units: acre-feet per year							

5.2 Water Shortage Contingency Planning

5.2.1 Plan Overview and Coordination

5.2.1.1 Overview

The District provides potable water on a wholesale basis from its Domestic Water System to the cities of Arcata, Eureka, and Blue Lake; and to the Humboldt, Manila, Fieldbrook Glendale and McKinleyville Community Services Districts (CSDs). Retail water service is provided to less than 200 customers who are generally located closer to the District's distribution system than to any other municipal water service. Raw water for industrial use from its Industrial Water System is available for any future industrial customer.

Wholesale water is provided to the District's customers under long-term contracts. These contracts specifically assert the District's right, in accordance with the California Water Code, to suspend the water delivery requirements of the contracts if the District's Board declares that an actual or potential water shortage exists, or if all wholesale customers and the District mutually agree to implement this Water Shortage Contingency Plan. During the 1976/77 drought, which was the only declared water emergency in the history of the District, it was the policy and practice of the District to set maximum use targets for its wholesale municipal customers, allowing them to choose how to meet those targets. Since the wholesale industrial customers could not operate effectively at significantly reduced water consumption levels, they were required to repair leaks and increase the efficiency of their water use. A reservoir capacity was set at which all deliveries to the industrial customers would cease. Fortunately, capacity did not fall to that level.

This plan operates on the same principles. The municipalities will retain responsibility for control of allotments provided under the provisions of this plan. Any potential wholesale industrial customers will face the reductions outlined in each action stage. The District's 200 retail customers will be treated in accordance with the action stages of this plan.

5.2.1.2 Coordination

Coordination in implementing this Water Shortage Contingency Plan is assured through the activation of the Water Task Force. The first task force was formed in 1977. This task force would be convened as necessary to address drought conditions or other significant events which could result in a supply shortfall. It is composed of representatives of the District and each of its wholesale customers. The committee's responsibilities include:

1. Review the status of the water supply and forecasts.
2. Recommend specific actions in accordance with this plan and each entity's own water shortage plan.
3. Assure that priority of allocations meets legal requirements of consistency and non-discrimination.
4. Coordinate media releases and public announcements.
5. Coordinate interaction with regulatory agencies such as the California Departments of Water Resources, Fish and Game, and California Department of Public Health.
6. Review and make recommendations about requests for waivers from, or exceptions to, actions taken pursuant to this plan.

5.2.2 Stages of Action

There are five defined drought action stages (Table 35). These stages may be implemented with or without a formal declaration of a water emergency by the District's Board of Directors. In the event circumstances merit or require a declaration of a water shortage emergency, it is the intent of the District to rely on this plan to provide the primary framework to deal with such an emergency. The triggers attached to each stage are not intended to be absolute. Circumstances not currently foreseeable may dictate moving to a higher action stage before the trigger levels for that stage are reached. Conversely, action stage implementation may be postponed or suspended if

there is sufficient natural flow in the river to meet downstream needs. Action stages will be terminated, in consultation with the Water Task Force, as rain, runoff, and lake levels permit.

5.2.3 Stages and Conditions

Table 35 shows the rationing stages to address water supply shortages.

Table 35

Water shortage contingency — rationing stages to address water supply shortages

Stage No.	Water Supply Conditions	% Shortage
Stage 1	Controlled Release from Storage	
Stage 2	Optimizing Available Supply	
Stage 3	General Reduction	10% to 15%
Stage 4	Usage Allocations	16% to 30%
Stage 5	Rationing	50%

As the District, through its Water Resource Planning efforts, plans to service wholesale industrial water users in the future, the following stages and conditions assume that the District still is operating at normal levels prior to loss of its wholesale industrial customers. Without wholesale industrial customers, triggering of these stages would not occur as quickly and there would be lower flow requirements in the river.

- **Stage 1 – Controlled Release from Storage**
  This means releasing from storage only the amount of water needed for instream and water supply purposes.
- **Stage 2 – Optimizing Available Supply**

  Reduction of peaking by wholesale industrial customers (if there are any industrial customers), resulting in narrower production ranges and a lower flow requirement in the river.

  General voluntary water conservation measures with the municipalities, including public education efforts encouraging water conservation.

  Consideration to implement Stage 2 will be triggered when the volume in Ruth Lake falls to 65% of capacity (31,200 AF) and the accumulated rainfall in the Ruth area is 70% or less of the historical average (49 inches). Other triggers to be considered are damage to system by flood, earthquake or other destruction; and accidental or intentional toxic spills in supply. The Water Task Force will review the trigger data and make recommendations regarding actual implementation of Stage 2.

- **Stage 3 – General Reduction**
  All wholesale and retail customers of the District will be required to reduce usage by 10% to 15% over the previous two-year average actual use. It is estimated that this will save between 2.7 MGD and 4.0 MGD, or up to 370 AF per month, based on actual usage (including previous average industrial use).

Consideration to implement Stage 3 will be triggered when Ruth Lake reaches 40% of capacity (19,200 AF) and accumulated rainfall is 60% or less of historical average (42 inches). The Water Task Force will review the trigger data and provide input regarding actual implementation of Stage 3.

- **Stage 4 – Usage Allocations**

  Wholesale industrial water usage (if there were any industrial customers) will be limited to a maximum of 80% of the previous two years of actual average use. Each wholesale industrial customer will provide certification that water use is being optimized and that wasteful use of water is not occurring.

  Use allocations reflecting 16% to 30% reductions will be established for the municipalities and retail customers using the previous two years actual average usage. The specific reduction will be determined on a biweekly basis based on rate of supply reduction, weather and other relevant factors. It is estimated that this will save between 4.0 MGD and 6.6 MGD, or up to 610 AF per month over current usage.

  Consideration to implement Stage 4 will be triggered when Ruth Lake reaches 30% of capacity (14,400 AF) and accumulated rainfall is 50% or less of historical average (35 inches). The Water Task Force will review the trigger data and provide input regarding actual implementation of Stage 4.

- **Stage 5 – Rationing**

  Wholesale industrial water usage (if there were any industrial customers) will be limited to the amounts required for human consumption, sanitation, and fire protection. No water will be available for industrial processes. Municipal and retail customer usage will be reduced on a basis of up to 50% as may be determined by the rate of use of available supply and weather conditions. It is estimated that this will save up to 21 MGD, or 1,930 AF per month over current usage.

  Consideration to implement Stage 5 will be triggered when Ruth Lake reaches 25% of capacity (12,000 AF) and accumulated rainfall for the Ruth area continues at 50% or less of historical average (35 inches). The Water Task Force will review the trigger data and provide input regarding the actual implementation of Stage 5.

5.2.4 Projected Effect of Action Stages on Water Supply Durability

A primary goal of any Water Shortage Contingency Plan is to ensure, to the greatest extent possible, that the water supply will last until it can be replenished. To examine how well this plan might achieve that goal, some supply duration analyses have been performed. These analyses compare how long the water supply in the reservoir will last both with and without implementation of the plan. The calculations assume that no rainfall or other inflows to the reservoir occur and do not take into account minimum releases required for fish and wildlife, as these vary throughout the year. These analyses also assumed that the District was operating both its domestic and industrial systems and used a domestic water delivery of 11 MGD and an industrial water delivery of 16 MGD, totaling deliveries of 27 MGD. Flows for other water rights on the river were included; these total 1.585 MGD. Also, the calculations assumed that the action stages were put into effect as soon as the reservoir volume trigger point is reached and that the maximum reductions for each stage are implemented.

The analyses computed the number of days the supplies would last starting from the Stage 2 trigger point, which is when the lake reaches 65% of capacity (31,200 AF). If no reductions were made and the current delivery level of 27 MGD was maintained, this supply would last 352 days.

If the plan were followed as described above, the various stages would be implemented as follows:

- Stage 2 would be implemented immediately. This stage doesn't require any reductions; deliveries would be maintained at the current level of 27 MGD.

- Stage 3 would be reached on day 136 when the reservoir reached 40% of capacity (19,200 AF). This would lead immediately to 15% reductions to both municipal and industrial customers. This would reduce the production rate to 23 MGD.
- Stage 4 would be reached on day 199 when the reservoir reached 30% of capacity (14,400 AF). This would lead immediately to 30% reductions in municipal deliveries and 20% reductions in industrial deliveries. This would reduce the production level to 21 MGD.
- Stage 5 would be reached on day 235 when the reservoir reached 25% of capacity (12,000 AF). This would lead immediately to 50% reductions in municipal deliveries and reduce industrial water usage to amounts required for human consumption, sanitation, and fire protection (called 95% reduction for this analysis). This would reduce the production level to 8 MGD.
- Once in Stage 5, the supplies would last another 493 days, running out on day 728.

So, in this analysis, the duration of supplies more than doubled (from 352 days to 728 days) through the implementation of this Water Shortage Contingency Plan. An increase in normal water deliveries, especially the District's entry into additional wholesale contracts for industrial water, would reduce the duration of the supplies.

If the above analyses were tested with the current scenario of a normal domestic water delivery of 9.90 MGD with no industrial water delivery, the supply would last 885.4 days with deliveries being maintained at 11.49 MGD (including flows for other water rights in the river). Therefore, the District could continue delivering water to its seven municipal customers at a steady rate for approximately 2.42 years without triggering Stage 2 of the Water Shortage Contingency Plan.

5.2.5 Catastrophic Supply Interruption Plan

5.2.5.1 Catastrophic Supply Interruption Plan for the District

The District's Emergency Operations Plan (EOP) provides the overall response procedures for catastrophic supply interruptions. The EOP further provides specific procedures for power outages and for security incidents. The District's Emergency Action Plan (EAP) provides response procedures for catastrophic supply interruptions involving the R.W. Matthews Dam and Reservoir (Ruth Lake) at Ruth, such as an earthquake. The District's Operations Plan (OP) provides procedures for system failures. Hazardous materials incidents are covered by numerous response plans depending on the nature of the incident.

Figure 6 Preparation Actions for a Catastrophe

Possible Catastrophe	Summary of Actions/Plans
Regional Power Outage	Emergency Operations Plan-Power Outage Procedures
System Failure	Operations Plan for Water Supply, Treatment, and Distribution System
Earthquake	Emergency Operations Plan/ Emergency Action Plan (R.W. Matthews Dam at Ruth)
Hazardous Material Spill	Hazardous Materials Response Plans
Acts of Terrorism	Emergency Operations Plan-Security Procedures/ Emergency Action Plan (R.W. Matthews Dam at Ruth)

5.2.5.2 Catastrophic Supply Interruption Plan for the City

The City of Arcata Water System Emergency Response Plan provides response procedures for catastrophic supply interruptions such as an earthquake, an act of terrorism, a flood that infiltrates system facilities and sources, a hazardous chemical spill, a storm that damages the power grid, or a mudslide or earth shift that causes failure of transmission or loss of water in the well or transmission line from HBMWD. The Emergency Response Plan also provides response procedures for routine, minor, and significant emergencies.

5.2.6 Analysis of Revenue Impacts of Reduced Sales During Shortages

5.2.6.1 Analysis of Revenue Impacts of Reduced Sales During Shortages for the District

Each wholesale customer must gage the revenue and expenditure impact of the action stages. The expenditure and revenue impacts on the District are negligible since the wholesale rates are designed to cover costs incurred by the District in producing and distributing the water. Expenditures and revenues for costs directly related to the amount of water produced (e.g. costs for power for pumping) will both decrease as deliveries of water are curtailed.

5.2.6.2 Analysis of Revenue Impacts of Reduced Sales During Shortages for the City

The City's water rate structure is base on the amount of water each customer uses. As water use in the City decreases through both voluntary and mandatory reductions so does the total revenue that the City collects. The City's Emergency Water Shortage Ordinance allows for the establishment of a restricted water rate schedule. This schedule can both penalize customers for consumption above lifeline quantities and increase overall water rates for a period of time to account for the loss in revenue that is still required to maintain our basic facilities.

5.2.7 Prohibitions, Consumption Reduction Methods, and Penalties

5.2.7.1 Prohibitions, Consumption Reduction Methods, and Penalties by the District

As noted earlier in this plan, each wholesale customer is responsible for adopting plans to implement the reductions in water use called for by the action stages outlined above. The District's Board of Directors reserves the right to adopt penalties for non-compliance with various action stages, but feels it is not necessary to do so at this time. Penalties will be considered when a water shortage emergency is actually declared. Effectiveness of this plan will be monitored on a daily basis using continuously metered data from Ruth Lake and the metered connections to all wholesale municipal and industrial customers.

5.2.7.2 Prohibitions, Consumption Reduction Methods, and Penalties by the City of Arcata

In the event of a water shortage, the City would initiate media attention on the water supply situation and implement public water education programs. In the event of a short-term emergency (mainline failure, earthquake) the City is able to isolate each tank either manually or with telemetry. Tank levels are maintained at 80% of capacity and the City estimates 3.6 MG in storage at any given time.

Priorities for use of available potable water during shortages will be based on input from City staff and legal requirements set forth in the California Water Code, Sections 350-358. Priority allocations will be assigned as follows:

1. Minimum health and safety allocations for interior residential needs (includes single-family, multi-family, hospitals, convalescent facilities, retirement and mobile home communities, student housing, fire fighting and public safety).

2. Commercial, industrial, institutional/governmental operations (where water is used for manufacturing and for minimum health and safety allocation for employees and visitors) to maintain jobs and economic base of the community (not for landscape uses).
3. Existing landscaping.
4. New customers, proposed projects without permits when shortage is declared.

Tables 36-38 outline the measures that may be taken by the City to reduce water use during anticipated and declared water shortages.

Table 36

Water shortage contingency — mandatory prohibitions

Examples of Prohibitions	Stage When Prohibition Becomes Mandatory
Using potable water for street washing	When water shortage emergency is declared
Use of potable water for irrigation, landscaping	When water shortage emergency is declared
Use of potable water for washing of outside surfaces as defined by the Ordinance	When water shortage emergency is declared
Allowing potable water to run down guttters	When water shortage emergency is declared
Use of water for any use other than human consumption, sanitary safety, and fire	When water shortage emergency is declared

Table 37

Water shortage contingency — consumption reduction methods

Consumption Reduction Methods	Stage When Method Takes Effect	Projected Reduction (%)
Voluntary Reductions	When water shortage is anticipated	5-10%
Mandatory Prohibitions	When water emergency is declared	30%

Table 38		
Water shortage contingency — penalties and charges		
Penalties or Charges	**Stage When Penalty Takes Effect**	
Penalty for excess use	When water shortage emergency is declared	
Charge for excess use	Based on current municipal code violation fee structure	
Water Service Discontinued	When mandatory prohibitions are in place and not complied with (on a case by case basis)	

5.2.8 Draft Ordinance and Use Monitoring Procedure

5.2.8.1 Draft Ordinance and Use Monitoring Procedure by the District

To determine the actual reductions in use of water during a water shortage, the District will use its Supervisory Control and Data Acquisition (SCADA) system to monitor distribution to its customers on a daily basis.

5.2.8.2 Draft Ordinance and Use Monitoring Procedure by the City of Arcata

To determine the actual reductions in use of water during a water shortage, the City will use a combination of physical meter reads and SCADA to monitor distribution to its customers on a daily basis. Daily production and delivery figures will be reported to the Water/Wastewater Superintendent, Environmental Services Director, and City Manager. Daily production figures will be compared with weekly production targets to verify whether reduction goals are being met. If reduction goals are not met, the City Manager will notify the City Council so that corrective actions can be taken.

A copy of the City's draft Water Shortage Emergency Ordinance to implement the City's Water Shortage Contingency Plan is attached as Appendix E.

5.3 Water Quality

5.3.1 Humboldt Bay Municipal Water District

As discussed above, drinking water delivered by the District is drawn from wells located in the Mad River. These wells draw water from the sands and gravel of the aquifer located under the riverbed. The gravel and sands through which the water is drawn provides a natural filtration process which yields source water for the District's regional drinking water system that is of very high quality. Furthermore, the results from the District's ongoing water monitoring and testing program indicate that the District's water quality is very high and meets safe drinking regulatory standards, as has consistently been the case over the years.

The only water quality issue occasionally encountered by the District is turbidity. Generally, turbidity in the Ranney Well source water is very low and meets the turbidity standards set by the California Department of Public Health (CDPH). However, during or following severe winter storm events, turbidity in the source water may rise beyond the standards set by CDPH. Turbidity itself is not a health concern. However, in the late 1990s, an extremely heavy "El Nino" rainy season caused a prolonged series of storms that raised turbidity in the source water to such a level that CDPH became concerned that it could interfere with the disinfection process, and therefore, pose a threat to public health. In 1997, CDPH directed all of the Public Water Systems in the Humboldt Bay area (the District and its wholesale municipal customers) to address the wintertime turbidity issue and to meet the turbidity standards established by CDPH. The District initiated a process with its seven municipal customers

to determine the most cost effective way to meet the State's requirement. The solution was to design and construct a regional Turbidity Reduction Facility (TRF). The TRF design capacity is 14 MGD in the wintertime and 21 MGD in the summertime. The TRF was completed in April 2003 and now operates during the winter storm season to reduce higher turbidities in accordance with the State's standards. On October 10, 2003, it was named the *Lloyd L. Hecathorn Turbidity Reduction Facility* in honor of a long-term (24 years) District Board member.

As the District's ongoing water monitoring and testing program indicates that the District's water quality has been and continues to be very high and with the turbidity issued taken care of by the TRF, the District does not foresee any current or projected water supply impacts resulting from water quality (Table 30).

5.3.2 Heindon Groundwater Well

As discussed above, the drinking water pumped by the City at Heindon Groundwater is of very high quality. Water pumped from the deep aquifer exceeds primary and secondary drinking water standards.

The only water quality issue occasionally encountered is red water complaints from customers near the well. Due to a difference in corrosivity of well water and surface water it is thought that tuberculation in distribution lines occasionally break off, causing customers to occasionally received red-colored water. While not a primary health concern, the City is committed to providing its customers with the highest quality water possible. The City has a flushing program in place in areas with historic problems with discolored water.

The City's ongoing water monitoring and testing program indicates that Heindon Groundwater quality has been and continues to be very high quality with the discolored water issues minimized through the water flushing schedules. The City does not foresee any current or projected water supply impacts resulting from water quality (Table 30).

Table 30
Water quality — current and projected water supply impacts

Water source	Description of condition	2010	2015	2020	2030
Mad River Storage and Diversions	Good	0	0	0	0
Heindon Groundwater Well	Good	0	0	0	0

5.4 Drought Planning

As stated in earlier sections, the District has permitted rights for 84,000 AFY of water to supply its wholesale customers. Table 11 shows that the highest projected total water demand for the District's wholesale customers in 2030 (which includes the District's raw water-use goal of 11,200 AFY), is just 30% of this permitted water supply. Therefore, the District's water supply is very reliable and will not be vulnerable to seasonal or climatic shortage. With this in mind, the following sections will provide data for each of the following water year types: normal, single dry, and multi-dry. Supply and demand comparisons for each water year type will also be discussed.

Table 27 captures the specific base water years that each type of water year falls into.

Table 27 Basis of water year data	
Water Year Type	**Base Year(s)**
Average Water Year	1989
Single-Dry Water Year	1977
Multiple-Dry Water Years	1990, 1991, 1992

5.4.1.1 Normal Water Year

During a normal water year, the Ruth Lake area averages 69.8 inches of rainfall, about 173,000 AF of water flow into the reservoir via the Mad River, and the average runoff for the watershed near the District's diversion facilities at Essex is 982,600 AFY (over the entire record period from 1963 to 2010). The average annual runoff data was provided by USGS at Gage Station 1148100 on the Mad River near Arcata, CA. As shown in Table 27, the Water Year ending in 1989 was considered an average water year because the average runoff for the watershed that year was 985,364 AFY, which is close to the average annual runoff for the watershed as provided.

5.4.1.2 Single Dry Water Year

The water year ending in 1977 was the driest recorded for the District, far drier than any other. Rainfall in the Ruth area was 29 inches, or 41% of normal (69.8 inches). Flows into the reservoir were 26,000 AFY, or 15% of normal (173,000 AFY). The runoff for the watershed measured near the District's diversion facilities was 109,107 AFY, or 11% of normal (982,600 AFY). The average reservoir volume for the water year was 21,000 AF, which is 44% of capacity (48,030 AF) and 51% of normal (41,000 AF). The reservoir was drawn to 13,000 AF, or 27% of its capacity (48,030 AF) at the end of the water year.

Fall storms arrived in November 1977 and quickly refilled the reservoir. This water year was severely dry throughout the entire state of California and was a very exceptional year in the District's history:

- In 47 years of records, it was the only year in which rainfall was less than 50% of normal (69.8 inches).
- It was also the only year in which the reservoir was not filled to capacity.
- Total flows into the reservoir via the Mad River were half the value of the next driest year.
- Runoff for the watershed and average reservoir volume were each 60% of the next driest year.

5.4.1.3 Multiple Dry Water Years

The three water years between October 1989 and September 1992 represent the driest multiple years recorded for the District:

- Rainfall for this period averaged 42 inches per year, or 60% of normal.
- Of the three water years, the driest year for rainfall was water year 1990/1991 with 37 inches, or 53% of normal.
- Flows into Ruth Lake via the Mad River averaged 69,000 AFY, or 40% of normal (173,000 AFY).
- The runoff for the watershed above the District's diversion facilities was 371,300 AFY, or 37% of normal (982,600 AFY).
- Despite the diminished rainfall and runoff, rainfall was more than sufficient to refill the reservoir each year.

- Reservoir volume during this period averaged 37,000 AF which is 77% of capacity (48,030 AF) and 90% of normal (41,000 AF).

5.4.1.4 Comparing Supply Reliability with Different Water Year Types

Table 28 shows the runoff amounts for the normal, single dry and multiple dry water years. This table also shows the single dry water year runoff and each of the three multiple dry water years runoff amounts as a percentage of the normal water year's runoff amount. As expected, the single dry water year runoff has the lowest percentage when compared to the percentage of the other three years. However, although the single dry water year runoff amount was only 11.1% of the normal water year amount, this 109,107 AFY is still enough to satisfy the District's permitted supply amount of 84,000 AFY should the District need it. Therefore, the other watershed runoff amounts in the multiple dry water years (ending 1990, 1991, 1992) will also meet the District's permitted supply as well as they are all more than the District's permitted supply amount of 84,000 AFY (Table 28).

Table 28

Supply reliability — historic conditions (AFY)

Average / Normal Water Year	Single Dry Water Year	Multiple Dry Water Years		
		1990	1991	1992
982,600	109,107	571,815	371,340	282,794
Percent of Average/Normal Year:	11.1%	58.2%	37.8%	28.8%

To project multiple dry water year supply conditions into the future, the historic runoff values from the multiple dry water years ending in 1990, 1991 and 1992 were used. These three water years were the only three consecutive multiple dry water years in the District's recent history. Therefore, the watershed runoff for water year 2011 is projected as 571,815 AFY (same as in 1990), for 2012 as 371,340 AFY (same as 1991) and for 2013 as 282,794 AFY (same as in 1992). Since these projected multiple dry water year supply values are the same as the historic values for 1990, 1991 and 1992, the projected watershed runoff amounts will also meet the District's permitted supply as well.

Table 31

Supply reliability — current water sources (AFY)

Water supply sources	Average / Normal Water Year Supply	Multiple Dry Water Year Supply		
		Year 2011	Year 2012	Year 2013
Mad River Storage & Diversions	982,600	571,815	371,340	282,794
Percent of normal year:	100.0%	58.2%	37.8%	28.8%

Table 32 shows the difference between supply and demand as projected in five year increments from 2015 through 2030 under normal water year conditions. Under normal year conditions when the watershed runoff is approximately 982,600 AFY, there is more than enough water to meet the District's permitted water right of 84,000 AFY, and therefore, meet demands. This difference between supply and demand is shown both as a percentage of supply and as a percentage of demand. As a percentage of supply, the difference in 2015 is approximately 85%, which does not include any potential demands for raw water use. The difference as a percentage of supply is reduced in 2030 to approximately 70%. This reduction in 2030 is due to the District's goal of developing new demands for raw water use by 2030. As a percentage of demand, the difference amount was approximately 560% in 2015 and is reduced to approximately 230% by 2030, this is also due to the District's goal of developing new demands for raw water use by 2030. This shows that during the normal year, the District has more than enough supply to meet demand as projected into the future.

Table 32

Supply and demand comparison — normal year (AFY)

	2015	**2020**	**2025**	**2030**
Supply totals (from Table 16)	84,000	84,000	84,000	84,000
Demand totals (From Table 11)	12,762	18,759	19,196	25,271
Difference	71,238	65,241	64,804	58,729
Difference as % of Supply	84.8%	77.7%	77.1%	69.9%
Difference as % of Demand	558.2%	347.8%	337.6%	232.4%

The watershed runoff for the single dry water year was 109,107 AFY as shown in Table 28. As this amount is more than the District's permitted water supply of 84,000 AFY, the District still has the 84,000 AFY of water available as it does during a normal water year. Therefore, Table 33 shows the same calculations as in Table 32 for the normal water year condition showing the supply totals as 84,000 AFY from 2015 through 2030. The data shows that the District has more than enough water supply to meet demand, even in a single dry water year situation.

Table 33
Supply and demand comparison – single dry year (AFY)

	2015	**2020**	**2025**	**2030**
Supply totals	84,000	84,000	84,000	84,000
Demand totals	12,762	18,759	19,196	25,271
Difference	71,238	65,241	64,804	58,729
Difference as % of Supply	84.8%	77.7%	77.1%	69.9%
Difference as % of Demand	558.2%	347.8%	337.6%	232.4%

For the multiple dry water year scenario, Table 31 projects the multiple dry water year supply amounts as 571,815 AFY (for 2011), 371,340 AFY (for 2012), and 282,794 AFY (for 2013). As these supply amounts are larger than the District's permitted supply amount of 84,000 AFY, the District is able to maintain its water supply during these consecutive dry water years as well. Therefore, Table 34 also shows the District's water supply projections for multiple dry water years as its permitted amount of 84,000 AFY for 2015 through 2030. The data shows that the District has more than enough water supply to meet demand, even during multiple dry water years.

Table 34

Supply and demand comparison — multiple dry-year events (AFY)

		2015	2020	2025	2030
Multiple-dry year first year supply	**Supply totals**	84,000	84,000	84,000	84,000
	Demand totals	12,762	18,759	19,196	25,271
	Difference	71,238	65,241	64,804	58,729
	Difference as % of Supply	84.8%	77.7%	77.1%	69.9%
	Difference as % of Demand	558.2%	347.8%	337.6%	232.4%
Multiple-dry year second year supply	**Supply totals**	84,000	84,000	84,000	84,000
	Demand totals	12,762	18,759	19,196	25,271
	Difference	71,238	65,241	64,804	58,729
	Difference as % of Supply	84.8%	77.7%	77.1%	69.9%
	Difference as % of Demand	558.2%	347.8%	337.6%	232.4%
Multiple-dry year third year supply	**Supply totals**	84,000	84,000	84,000	84,000
	Demand totals	12,762	18,759	19,196	25,271
	Difference	71,238	65,241	64,804	58,729
	Difference as % of Supply	84.8%	77.7%	77.1%	69.9%
	Difference as % of Demand	558.2%	347.8%	337.6%	232.4%

Section 6 Demand Management Measures

Water conservation is defined as any action taken to reduce water consumption or loss of available supply for use. Demand management refers to a subset of conservation methods a water supplier may undertake to reduce demand on the water system. The UWMP Act requires a description of fourteen specified conservation and demand management measures (DMM). Preference in the UWMP Act is given to those measures offering lower incremental costs and those that do not expand or require additional water supply. The UWMP Act also requires that economic and non-economic factors, including environmental, social, health, customer impact and technological, be considered in the evaluation. However no specific guidance on evaluation methodology is given.

The service area and the surrounding region is one of the few geographical regions in California with a local abundance of water. This has meant that droughts, while just as severe climatically, have not led to the same level of supply shortfall experienced in other areas. However, residents are very aware and concerned about the importance of water conservation. Per capita water use for all service area residents, agriculture, and industry is 102 gallons per capita daily (GPCD)(calculated in 2010 when 724 MG served a population of 19,546) compared to a State average of 253 GPCD (California baseline 1995-2005). Per capita water use likely benefits from the relatively wet and cool climate. Individual agricultural and landscaping water needs are often provided through precipitation events rather than municipal water.

Residents posses a high commitment to environmental awareness and are active participants in various resource and planning discussions. Many individuals have integrated water conservation as part of their lifestyle without government involvement and are committed to preserving and protecting the natural environment. Water conservation is a vital element of the City's Greenhouse Gas Reduction Plan as pumping water is a major producer of greenhouse gases via electricity use. The plan includes education and outreach on a variety of conservation measures. Water conservation is a priority measure for reducing total energy use in Arcata. Figure 7 summarizes Arcata's water conservation program and the status of each DMM.

Figure 7 Summary of Arcata's Water Conservation Program

Measure	Current Status	Planned Actions
DMM A – Water Survey Program Residential Users	Scheduled for Implementation	2012/2013 – develop literature and checklist for residents to evaluate their potential water savings
DMM B – Residential Plumbing Retrofits	Scheduled for Implementation	2012/2013 – research funding options for retrofit kits
DMM C – System Water Audits, Leak Detection, Repair	Implemented and Scheduled for Implementation	Continue leak detection and repair, and implementation of water audit recommendations
DMM D – Metering with Commodity Rates & Retrofit of Existing Connections	Implemented	Continue replacement of leaking and old water meters
DMM E – Large Landscape Conservation Program and Incentives	Implemented & Scheduled for Implementation	Continue to provide literature to large landscape customers. 2011/2012 fiscal year – meters at City-owned facilities regularly read, maintained and repaired.

DMM F – High Efficiency Washing Machine Rebate Programs	Scheduled for Implementation	2012/2013 fiscal year – research funding options 2013/2014 fiscal year – implement program if funding is available
DMM G – Public Information Program	Implemented	Continue program
DMM H – School Education Program	Implemented	Continue program
DMM I – Conservation Program for Commercial, Industrial, and Institutional Accounts	Scheduled for Implementation	2011/2012 fiscal year – meters at City-owned facilities regularly read, maintained and repaired; propose water audit projects to Humboldt State University students/classes
DMM J – Wholesale Agency Assistance Program	Implemented	Continue participation
DMM K – Conservation Pricing	Implemented	None
DMM L – Water Conservation Coordinator	Scheduled for Implementation	On-going tracking of DMM actions
DMM M – Water Waste Prohibition	Implemented	None
DMM N – Residential Ultra Low Flow Toilet Replacement Program	Scheduled for Implementation	2012/2013 fiscal year – research funding options 2013/2014 fiscal year – implement program if funding is available

6.1.1 DMM A – Water Survey Program for Single-Family & Multi-Family Residential Customers

There are two types of water survey programs. The first type is a relatively simple, low-cost checklist designed for customers to use by themselves. The second type of water survey program, while more thorough, is expensive, requires certified auditors to conduct the survey, and poses a risk of liability to the City. The City has opted to pursue options for designing a checklist for customers to use in evaluating their potential water savings. The program will include a residential plumbing retrofit component that fulfills the requirements of DMM B.

In the 2012/2013 fiscal year the City will research options for development of a water survey program either by City staff or in collaboration with Humboldt State University (HSU) students/classes. Program development will include creation of a checklist and informational literature and retrofit plumbing kits. Retrofit kits may include faucet aerators, low-flow shower heads, toilet flushless bladder displacement bags, and rain sensors for irrigation systems.

Implementation costs for a water survey program could be kept to a minimum if funding for the program is provided by the City. Costs would be expected to increase if the program is funded through a grant as this may require more administrative hours to apply for and manage grant funding. In addition to funds, resources needed to implement this DMM include personnel to manage the program; creation of a checklist and informational literature and program advertisement.

Major costs for this program are expected to be for the costs associated with the plumbing retrofit kits, cost is dependent on appliances included in kit. To keep cost down “custom kits” may be distributed to residents based on the results of their survey. Typical retrofit costs are presented Figure 8.

Figure 8 Estimated Plumbing Retrofit Costs

Appliance	Cost per Item	Quantity Provided	Total Cost
Sink Aerator	$2	2	$4
Toilet Flushless Bladder Displacement Bag	$4	2	$8
Low-flow Showerhead	$15	1	$15
Rain Sensor for Irrigation System	$30	1	$30
		Total Retrofit Kit Cost	$57

The U.S. Department of Energy estimates that incorporating low-flow fixtures into a home can result in a water savings of 25-60%. The number of households that are able to be accommodated in this program is unknown at this time and will be dependent on funding.

6.1.2 DMM B – Residential Plumbing Retrofit

The City plans on implementing this DMM in conjunction with DMM A –Water Survey Program for Residential Customers. See DMM A for details.

6.1.3 DMM C – System Water Audits, Leak Detection, and Repair

During the 2005/2006 fiscal year the City contracted with an engineering firm to complete a system-wide water audit. The 2007 Draft Water Audit estimates a one year cost savings of approximately $118,500 from recoverable leakage. Recommendations from the 2007 Water Audit are incorporated into DMMs D, I, and N.

In 2010 the City could not account for 26% of the water purchased and produced. Staff will evaluate unaccounted for water annually. It is the City's goal to reduce the amount of unaccounted for water to the American Water Works Association standard of 10%. Continued work on leak detection and repair, and meter servicing and calibration will reduce the amount of water lost in the system.

The City has meters on all customer services and sources in the service area. All new meters have leak detecting indicators. Due to the water distribution system's age and area seismic activities, the City routinely monitors for leaks, conducts distribution system repair and meter calibration (delivery, production, and customer meters) activities. On average, water division crews spend about 250 days surveying approximately 76 miles of main and laterals per year. Water division crews also conduct valve exercises to ensure that interconnections with adjacent utilities are working properly.

Distribution system improvements are based upon a water system evaluation study in conjunction with the Arcata Fire Protection District to ensure the City's ability to respond to fire protection demands. The City raised water rates by 43% in July of 2005 in an effort to generate capital to ensure proper maintenance, emergency reserve, and assistance on long-term capital replacement/repairs.

6.1.4 DMM D - Metering with Commodity Rates & Retrofit of Existing Connections

All customer service connections are metered, including separate meters for single-family residential, commercial, industrial, and institutional facilities. Many City-owned buildings and parks are equipped with meters. The City tracks use by the Fire Department and for street sweeping activities. Water conservation is promoted through a tiered pricing system for single-family residential connections and a high block rate usage for all other connections.

As propeller-type meters age they tend to underreport water usage. Accurate water meters ensure fairness in billing to system customers and recovery of costs for the City. The City has an aggressive meter replacement program. Meters 3-inches and larger are regularly maintained and tested by the Public Works Department. Residential meters and meters smaller than 3-inches are replace when they are suspected of leaking or misreading.

The 2007 water audit suggests that much of the unaccounted for water losses in the service area could be accounted for by installing and reading meters at all parks, roadway median landscape areas, and City-owned facilities. This is addressed in detail in Section 6.1.5 - DMM E.

6.1.5 DMM E – Large Landscape Conservation Programs and Incentives

The City encourages landscape metering through its rate structure for business, commercial/agricultural and institutional customers. The purpose of this DMM is to provide the customer with a determination of how much water should be used to irrigate the land appropriately while maintaining conservation practices. The water system has less than 10 large public accounts consisting primarily of schools and City-owned parks. The City currently provides irrigation customers with education handouts.

Humboldt State University and The City of Arcata are the two largest landscape irrigation users and facility managers.

Beginning in the 2011/2012 fiscal year water meters at City parks and facilities will be added to the regular meter reading schedule and shall be maintained and repaired as necessary. Records of water use at City parks and facilities will provide personnel with information needed to determine if facilities are being over-watered and for leak detection. The City has budgeted to meter water usage at the wastewater treatment facility and corporation yard in the 2011/2012 fiscal year. Beginning in the 2011/2012 fiscal year the City will evaluate the Capital Expense Fund for feasibility of using a portion of the Fund to install or replace meters at all City-owned facilities by 2013.

Installation of new meters and replacement of defunct meters will cost around $250-$750 per meter according to the California Urban Water Conservation Council (CUWCC). The CUWCC also estimates that metering a facility can reduce water consumption by 20%. Based on these figures, implementation of this DMM would equate to 1.9 million gallon reduction in annual water use at City facilities.

6.1.6 DMM F – High Efficiency Washing Machine Rebate Program

The intent of this DMM is to provide customers with incentives to replace old washing machines with newer, more efficient models. The incremental costs of high efficiency washers (front-load, horizontal axis) has been about $250 per unit over that of a traditional top-load model with cost differentials coming down over time. Typical customers can save $135 per year in energy, water and wastewater costs. Energy Star appliances use over 50% less water than traditional washers.

The City will review funding options for a High Efficiency Washing Machine Rebate Program for residential (single & multi-family dwellings) during the 2012/2013 fiscal year. Funding options will be reviewed to determine if it is feasible to obtain grant money for the program or to fund such a program through the City's Water Fund. If it is determined to be an economically feasible program the City anticipates that it will offer a $40 rebate to water customers who purchase high efficiency washers and estimates that 10 washers will be replaced each year the program is implemented. If funding is available this program is planned for commencement in the 2013/2014 fiscal year.

Implementation costs for a rebate program could be kept to a minimum if funding for the program is provided by the City. Costs would be expected to increase if the program is funded through a grant as this may require more administrative hours to apply for and administer grant money. In addition to rebate funds, resources needed to implement this DMM include personnel to manage the rebate program; creation of requirements, procedures, and applications to document rebates awarded; and program advertisement costs.

By offering a $40 rebate to 10 customers per year over a 5 year period the City will incur a cost of $2000 (excluding administrative costs). Assuming that a high efficiency machine uses 18 gallons per load less than a top-load model and the average American family washes 400 loads per year there is an estimated water savings of 7,200 gallons per year per rebate. Over a 5 year period 1.08 million gallons can be saved by implementing this DMM.

6.1.7 Public Information Programs

The City provides water conservation information to the public through a wide variety of public outreach tools: information booths at conferences, fairs and community events; flyers, newsletters and billing inserts; website and printed materials to the media. City water bills show cubic feet of water used per day for billing cycle compared to the same billing cycle as the previous year

The Arcata Environmental Services Department's Energy Program is designed in part to assist with the implementation of the goals and strategies outlined in the Community Greenhouse Gas Reduction Plan. One of these goals is to decrease community water usage (and therefore reduce greenhouse gas emissions via saved pumping energy). The City has a 0.75FTE Energy Specialist that assists in the development of the Energy Program. The Energy Program often collaborates with HSU classes to develop energy saving programs, media, and information. Most recently a video was created to educate residents on potential water and energy savings steps they can easily implement at home; the video can be viewed at http://www.cityofarcata.org/departments/environmental-services/energy. Strategic Energy Innovations, a non-profit, has applied for a grant on behalf of the City of Arcata and HSU to fund future projects like the video described above.

This DMM cannot be reduced to quantitative terms but is considered an essential compliment to other conservation measures and develops a water conservation consciousness among water users. .

6.1.8 DMM H - School Education Programs

This DMM is intended to promote water conservation within local schools. The City has a 0.80FTE Environmental Program Manager that assists in the development of educational programs. Presentations and information are provided directly to teachers for their use in the classroom. The City's Arcata Marsh Interpretive Center provides watershed, water and wastewater educational outreach activities to local elementary, high school and university students.

The City of Arcata Parks and Recreation Department has three summer day camps for that incorporate water conservation into the curriculum; the Young Explorers Science Camp (ages 4-6), Marsh Explorers Camp (ages 7-9) and Natural Resources Science Camp (ages 9-12).

The City has also assisted with the establishment of several organic garden/outdoor classrooms to teach students effective water management strategies as well as environmentally sound horticultural practices. The City is looking for a site to develop a water conserving (xeriscape) garden/park that can provide interpretative assistance to City residents and schools.

The cost for implementing educational programs varies on the type and scale of the program. This DMM cannot be reduced to quantitative terms.

6.1.9 DMM I – Conservation Program for Commercial, Industrial, and Institutional (CII) Accounts

Under this DMM, conservation programs are to be tailored to the needs of CII customer's indoor and outdoor water uses. Arcata has very few water intensive commercial accounts. Humboldt State University and The City of Arcata are the two largest landscape irrigation users and facility managers. DMM E addresses the water conservation plan for City-owned parks and facilities.

Beginning in the 2011/2012 fiscal year the City's Energy Program Specialist will propose commercial and industrial water audits to Humboldt State University students/classes looking for collaborative projects with the City of Arcata. In this way the City can keep DMM implementation costs low while giving students the opportunity to research, design, and implement water audit programs.

6.1.10 DMM J – Wholesale Agency Programs

HBMWD and its wholesale customers work together to identify options to reduce water waste, improve water use efficiency, and educate the end users about conservation practices. These efforts occur during the monthly "Muni-Meetings" coordinated and hosted by the District. The municipal customers attend these monthly meetings, which are the forum that is intended to foster this type of partnership between the retail agencies and HBMWD.

Examples of recent coordination efforts are described below:

- HBMWD recently hosted an UWMP development workshop series at which an expert in the field of UWMP development presented.

- HBMWD provides educational material and water use data to the wholesale customers for distribution to the end users, to assist the wholesale agencies in understanding their demand.

- Conservation topics are discussed at the monthly Muni-Meetings and, when practical, HBMWD assists the wholesale agencies with the development of their respective UWMPs.

6.1.11 DMM K – Conservation Pricing

Water conservation is encouraged through a pricing system that rewards customers who use less water with financial incentives, while high water users are charged a higher rate. The City's water rate structure was historically a combination of a baste rate (meter rental) and block usage that first ascended, then declined slightly in greater volume. While this structure provided water conservation encouragement to the majority of our customers (95% of customers use less than 2,500 cubic feet (CF) per month), it did not encourage the large volume customers to conserve. In 2005 the City restructured its water rate to retain the ascending block structure for all water usage below 2,500CF/month level and switched to a uniform consumption rate for the City's larger customers to promote further water conservation.

Currently the City has an ascending three-tiered pricing system for single-family residential dwellings. All other service connection types are charged a uniform consumption rate equal to the highest-tier rate for single-family residential dwellings.

Only a portion of water use for a residence can be considered discretionary, generally a portion used for landscaping, excess showering periods and the like. Most use is simply a basic function of existence. At the point discretionary use has been wrung out of the system due to marginal cost of water, another rate tier is unlikely to reap much conservation savings. Further, such tiers can be considered discriminatory against larger families, which could have a low per capita use but a large individual consumption relative to another household.

Additionally, California's Proposition 218 requires water rates to be developed on a cost of service basis. In other words, the top tier of the water rate must have a reasonable relationship to the avoided cost of service for marginal supply.

This DMM has been implemented. A water rate increase and/or additional tier rates will be considered as the cost of providing water service increases.

6.1.12 DMM L – Water Conservation Coordinator

In compliance with this DMM, the City has designated the Deputy Director of Environmental Services as the Water Conservation Coordinator, whose responsibilities include program management, tracking, planning and reporting on implementation of the DMMs. The City shall staff and maintain the designation of Water Conservation Coordinator and shall provide that function with the resources necessary to implement demand management measures. Implementation of this DMM shall commence upon adoption of this plan.

6.1.13 DMM M – Water Waste Prohibition

The City has a water waste prohibition incorporated into its Municipal Code. Section Vii.3-7, 7741 of the Arcata Municipal Code states:

> *"No customer shall permit leaks or waste of water. Where water is wastefully or negligently used on a customer's premises, seriously affecting the general service, the Public Works Department may discontinue the service if such conditions are not corrected".*

No further action will be taken by the City on this DMM.

6.1.14 DMM N – Residential Ultra-Low Flush Toilet (ULFT) Replacement Program

All new construction in the City must comply with the California Plumbing Code and California Green Building Standards (Ordinance 1409, effective 4/1/2011). Code standards require a 20% reduction in water use through the installation of low flow fixtures including residential and non-residential toilets with a flow rate of 1.6 gallons per flush. A natural replacement rate in the range of 3-4 percent per year is expected to eventually replace all of the older high water use models. ULFT rebate programs accelerate replacement rates.

Direct distribution programs have the highest cost-effectiveness but don't necessarily reach all potential customers. Rebate programs are generally effective but have a higher incidence of "free ridership" where some customers would be replacing a toilet anyway and receive the rebate. Regardless, savings for these programs have been show to be up to 60 gallons per day for a family of four. Higher savings are found in higher density housing and commercial/industrial settings. Savings persist as toilet life is generally about 25 years.

The City will review funding options for a ULFT rebate program during the 2012/2013 fiscal year. Funding options will be reviewed to determine if it is feasible to obtain grant money for the program or to fund such a program through the City's Water Fund. If it is determined to be economically feasible the City anticipates a $40 rebate for each ULFT replacement in a residence and estimates that 20 toilets will be replaced per year. If economically feasible the City will maintain a ULFT rebate program for a minimum of one year beginning in the 2013/2014 fiscal year.

Implementation costs for a rebate program could be kept to a minimum if funding for the program is provided by the City. Costs would be expected to increase if the program is funded through a grant as this may require more administrative hours to apply for and administer grant money. In addition to rebate funds, resources needed to

implement this DMM include personnel to manage the rebate program; creation of requirements, procedures, and applications to document rebates awarded; and program advertisement costs.

A one year ULTF rebate program will cost the City $800 (excluding administrative costs). Replacing 20 existing toilets with ULFT could save a family of four nearly 22,000 gallons per year. Considering that a typical single-family dwelling unit in Arcata has 2.6 residents, a one year replacement program could result in a water savings 7.1 million gallons for the lifetime (25 years) of the replacement toilets.

Section 7 Climate Change

7.1 Climate Change

In the California Water Plan (2009), an assessment of the impacts of global warming on the State's water supply was conducted using a series of computer models that incorporated decades of scientific and historic research. Model results indicate increased temperature, reduction in Sierra Nevada mountain snow depth, early snow melt, and a rise in sea level. These changing hydrological conditions could affect future planning efforts, which are typically based on historic conditions.

Difficulties that may arise include:

- Hydrological conditions, variability, and extremes that are different than current water systems were designed to manage
- Changes occurring too rapidly to allow sufficient time and information to permit managers to respond appropriately
- Special efforts or plans required to protect against surprises
- Uncertainties

In July 2006, DWR issued "Progress on Incorporating Climate Change into Management of California's Water Resources," as required by Executive Order S-3-05, which instituted biennial reports on potential climate change effects on several technical resource areas, including water resources. This report describes the progress made in incorporating current climate change data and information into existing water resources planning and management tools and methodologies. The report, whose purpose is to demonstrate how various analytical tools currently used by DWR could be used to address issues related to climate change, focuses on assessment methodologies and preliminary study results from four climate change scenarios.

Future studies will include DWR working with other agencies to incorporate climate change information into the management of the State's water resources. Additional climate change scenarios will be developed and analyzed, with the goal of providing them to water resource planners to utilize in making water operations and management decisions. DWR states that the preliminary results in this current report are not sufficient by themselves to make policy decisions regarding water resources.

Recently, the HBMWD has made inquiries to the local NOAA office in regards to the impacts of global warming to our local water supply at Ruth Lake. Our water supply gets replenished mostly through precipitation and does not rely heavily on snow melt as with other parts of California. The Meteorologist in Charge stated that there are currently no computer models to model the impacts of global warming in our region.