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TECHNICAL MEMORANDUM

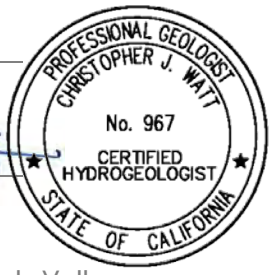
Preliminary Water Demand Review
Ukiah Valley Groundwater Basin
Mendocino County, California
DWR Grant No. 4600011503

Date: December 29, 2017
Project No.: 7746.09

Prepared For: Mendocino County Water Agency

Prepared By: Brian M. Wallace, M.S., M.B.A., E.I.T.
Staff Engineer

Reviewed By: Christopher J. Watt, C.E.G., C.H.G.
Principal



Attachments: Appendix 1: Water Supply Assessment for the Ukiah Valley Area Plan, October 20, 2010

1.0 INTRODUCTION

Based on Mendocino County Water Agency's (MCWA) Water Supply Assessment report dated October, 20, 2010, combined groundwater production for the Ukiah Valley[1] averaged 7,102 acre-feet. Approximately 75 percent is used for residential purposes, 15 percent for commercial, and the remainder for industrial and miscellaneous, with the highest usage occurring in the summer months, due to crop irrigation and residential landscaping. Future water demand projections are typically estimated using one of three predictive methodologies: population based, connection based, and land use based. Population growth and development (housing, industrial, and agricultural) are perhaps the most taxing factors on water demands and should be taken into account when making predictions regarding future water demands. Future demands for 2025, using each method, are presented in this memorandum. It should be noted that the year

[1] The for the purpose of this memorandum, the Ukiah Valley combined water production is based on the following water sources: Calpella County Water District, the City of Ukiah, Millview County Water District, Rogina Water Company, Willow County Water District, and adjacent public water service provider: Redwood Valley County Water District and Hopland Public Utilities District.

2025, was selected because it is the only year in which there is sufficient data to calculate future water demands (MCWA, 2010c).

2.0 PREVIOUS STUDIES

The MCWA 2010 Water Supply Assessment addresses Ukiah Valley's water demand in relation to groundwater capacity. Historical groundwater extraction data inferred for agricultural crop records and municipal groundwater production data from Calpella, Millview, Ukiah, Rogina and Willow. Previous research by D.J. Lewis et. al., 2008, estimated that 8000 acre feet per year of water is used for agricultural purposes. Historical groundwater extraction data indicates that 2,500 to 5,500 acre feet per year of groundwater is used for agricultural purposes. From annual municipal groundwater extraction records it is estimated that 2,000 acre feet per year is used for municipal purposes. Therefore, the combined amount of groundwater used for agricultural and municipal purposes is between 4,500 acre-feet and 7,500 acre-feet per year. Future agricultural water demand are not predicted to increase significantly unless future agricultural lands begin to grow crops with higher water demands (Lewis, DJ et. al., 2008). Municipal groundwater extraction rates are not expected to increase other than in the City of Ukiah. The Ukiah Valley Groundwater Basin (UVGB) has a storage capacity of 90,000 acre feet and except in times of drought it is recharged annually. Based on the availability of groundwater in the UVGB the assessment concluded that the groundwater extraction rates in the UVGB are within sustainable yields.

In Maritza Flores Marquez's Master's Thesis, *Water Mass Balance for the Ukiah Valley Groundwater Basin* (Flores Marquez 2017), the UVGB is characterized in terms of water demand and groundwater capacity. Agricultural water demands were determined through land use trends found in Ukiah Valley, Redwood Valley, and the Ukiah Valley Groundwater Basin. The average agricultural water demand in Ukiah Valley is 7,789 acre feet per year. Water is mostly used for crop water requirements but also for frost protection, post-harvest application, and heat protection. Of the agricultural demand on average, 2,468 acre feet per year is supplied from groundwater and the remaining demand is supplied by surface water. The municipal water demand in Ukiah Valley is averaged at 6,685 acre feet per year; and to meet this demand, 930 acre feet per year is sourced from groundwater and the rest is sourced from surface water. Communities that depend on groundwater the most are the City of Ukiah and Calpella County Water District. It's approximated that the City of Ukiah uses 897 acre feet of groundwater per year and the Calpella County Water District pumps about 33 acre feet per year on average. Including both Ukiah Valley and Redwood Valley 17,947 acre feet of water was used for the entire UVGB. Of that, 7,100 acre feet per year was used for municipal purposes, 10,182 acre feet per year was used for agricultural purposes and 665 acre feet per year of surface water was used for fire protection, fish and wildlife, recreation, and aquaculture. It is estimated the 3,411 acre feet per year was sourced from groundwater and 14,536 was sourced from surface water. After considering groundwater capacity, it was concluded that UVGB water demands have a relatively small dependence on groundwater when compared to the amount of surface water used and that the annual average of groundwater recharge is generally greater than the amount of ground water used to meet municipal and agricultural water demands.

The estimated groundwater usage in Flores Marquez's 2017 Master's Thesis and the UVAP Water Supply Assessment by the MCWA both provided estimates of water usage for agricultural and municipal purposes within Ukiah Valley. Between the two studies there is a correlation in regards to the estimated usage of groundwater and surface water provided for agricultural purposes within the Ukiah Valley. Flores Marquez estimated that the average agricultural demand is 7,789 acre feet per year while MCWA used an estimate

of 8,000 acre feet per year provided by the University of California Cooperative Extension (Lewis, D. et. al., 2008). For agricultural water demand, Flores Marquez reports that 2,468 acre feet per year is from groundwater, while the MCWA assessment reported that 2,500 to 5,500 acre feet per year is from groundwater. To meet municipal water demand Flores Marquez reported that 930 acre feet per year is from groundwater, while the MCWA assessment reported that 2000 acre feet per year is from groundwater. After considering the capacity of the UVGB both studies concluded that groundwater extraction rates are within sustainable yields.

In 2012 The City of Ukiah contracted with Carollo Engineers for developing a Recycled Water Feasibility Study. The study identified potential recycled water uses, stakeholders, and recommended phases (City of Ukiah, 2017). The phases would first serve agricultural needs and then landscape uses. The project cost was estimated at $45 million dollars. In 2015, the State of California Provided the City of Ukiah with a $34 million dollar grant as well as low interest loans. The project was bid in Fall of 2017, and is expected to be completed by the end of 2018. The project will serve 256 acres of vineyards, 361 acre of orchards, 20 acres of pasture, and 11.5 acres of turf (City of Ukiah, 2017). The study assumed water use parameters taking both frost protection and irrigation into consideration. Vineyards were assumed to have a total water demand of 1.3 acre feet per year; pear orchards were assumed to have a water demand of 2.5 acre feet per year; pastures were assumed to have a total water demand of 2.0 acre feet per year; row crops were assumed to have a total demand of 2.0 acre feet per year; and grass was assumed to have a total demand of 2.0 acre feet per year (Recycled Water Feasibility Study, 2012). At full capacity, with sufficient wastewater flows, the City's Waste Water Treatment Plant could provide an annual flow of 3.5 million gallons per day. The project is intended to benefit State water conservation objectives, environmental habitat, reduced surface water diversions from the Russian River, reduced wastewater discharge management costs, improved water supply to agriculture, and demonstrate regional cooperation (City of Ukiah, 2017). Landscapes that the recycled water will serve include golf courses, schools, cemeteries, parks, and ball fields. The water will also be used for dust control and concrete mixing (City of Ukiah, 2016).

3.0 METHODOLOGY

Water demand is calculated using three different methods: population based, connection based, and land use based.

3.1 Population Based Methodology

Population based water demand methodology is estimated by multiplying the total population of the area in question by the average per capita water usage rate. The population of the UVGB area is expected to rise to 35,232 people by 2025, an increase of 198 persons per year, or 0.6 percent, since the 2005 population of 31,272 people. Based on population growth data from the Economic Background Report (EPS, 2007), and water usage rate for Ukiah (City of Ukiah, 2007), Millview County (MCWA, 2010a), and Willow County (MCWA, 2010b), the per capita water usage rate for the Ukiah Valley is approximately 234 gallons per person per day. Using the population based water demand methodology, the water demand for the Ukiah Valley – residential, commercial, and industrial – will increase from 8,219 acre-feet in 2005 to 9,231 in 2025 (MCWA, 2010c).

3.2 Connection Based Methodology

Connection based water demand is calculated by multiplying the projected total number of water service connections in the area by an average annual per connection usage rate. Using three different connection based water demand projections – one based on the number of service connections and reported total annual usage for 2004, a second based on the year of the highest usage between calendar years 1997, and 2006, and a third based on average usage for the same calendar years – the future demand projections for 2025 is an average of 10,853 acre-feet, with a maximum water usage estimated at 11,094 acre-feet (MCWA, 2010c).

3.3 Land Use Based Methodology

A more commonly used methodology is estimating water demands based on land use. Using this method, water demand projections are calculated in a four-step process which first characterizes land use types within the area, then assigns "unit water demand rates" for each land use type, then multiplies the acreage associated with each land use type by the associated unit water demand rate, and finally sums the resulting water demand for each land use type to obtain a total water demand figure for the area in question (MCWA, 2010c). Land use types for the Ukiah Valley include single family, multifamily (duplexes and apartment complexes), commercial, and industrial. The unit water demand rates are presented in their respective units in Table 1.

Table 1. 2025 Land Use Type Water Demands (MCWA, 2010c).

Single Family	Multi-Family	Commercial	Industrial
500 gallons per day per dwelling unit	375 gallons per day per dwelling unit	65.17 gallons per year per square foot	65.17 gallons per year per square foot

These land use based classifications of water usage, known as "per-unit", more effectively reflect the features of specific land use, and are generally more valuable at later stages of the planning process (Land Use, 2007). After applying land use based calculations to the Ukiah Valley, the forecasted future water demand for 2025 is estimated to be 12,371 acre-feet, an increase of 3,425 acre-feet from 2004 demands.

4.0 SUMMARY OF WATER DEMANDS

As presented in Table 2, the three methodologies analyzed in this report present total water demand increases within 25 percent of each other, and are similar to the corresponding 2025, water demand projections of 10,927 acre-feet reported by the Californian Department of Public Health. The total amount of water delivered to users is generally 5 to 10 percent less than the amount of water treated and available, due to leaks, inaccurate meters, pipeline flushing, firefighting, and other undocumented uses. Land Use Based Methodology does not factor in water loss through undocumented uses since it measures the total quantity of water that is actually used and therefore must be added separately (MCWA, 2010c). Water used for fighting wildfires is likely to increase as extreme temperatures rise during summer months.

Table 2. 2025 Water Demands by Methodology

Population Based	Connection Based	Land Use Based
9,231 acre-feet	10,852 acre-feet	12,371 acre-feet

Increased water requirements for crops during dry years result in increased water demands. Increases in water demands for dry years are estimated to be between 15 to 25 percent greater, requiring either voluntary or mandatory water rationing. Ukiah and Millview water purveyors already have dry year demand management strategies in place. As the availability of water decreases in these two areas, the stringency in their requirements increases, beginning with a voluntary conservation rate of 10 to 15 percent. The strategy becomes more rigid as conditions require with the goal for Ukiah and Millview to reduce water usage by 25 percent in the driest of conditions.

Senate Bill x7-7 (SBx7 7), enacted in November 2009, requires the State's retail urban water suppliers who serve more than 3,000 end users, or supply more than 3,000 acre-feet of potable water annually to a municipality, to reduce per capita water usage. The legislation, known as "20 by 2020", set a goal of reducing per capita urban water use by 20 percent by December 31, 2020 (DWR, 2017). Currently, only Ukiah is set to meet these demands, with Millview anticipated to meet them by 2025. Willow, Rogina, and Capella are currently excluded from the requirements of SBx7-7 due to their size. However, it is anticipated that the bill's requirements will be extended to all retail urban purveyors, regardless of size. It is not clear how water purveyors will meet the bill's requirements, but establishment of baseline per capita usage rates are key.

The Russian River offers 503 square miles of drainage in Mendocino County, and flows through the center of Ukiah Valley. With water diversions from the Eel River to the Russian River drainage by the Potter Valley Project (PVP) in 1912, and the construction of the Coyote Dam and Lake Mendocino in 1959, extensive agricultural and urban development in the area became possible. The Russian River and East Fork Eel River makeup the principal surface water supplies for Ukiah Valley, and a significant source of groundwater recharge. But because the Russian River is fully appropriated from July through October, opportunities for additional water supplies from it are limited to capture and storage from high winter stream flows (MCWA, 2010c). Although the area receives ample precipitation, storage facility constraints limit the availability of surface water supply. For flood control purposes, Lake Mendocino is not to refill until the end of the rainy season, when local runoff from the East Fork is greatly diminished. At the beginning of the dry season, diversions from PVP account for the majority of the total inflow to the lake. However, reductions in PVP diversions during dry years significantly impacts water storage in Lake Mendocino (MCWA, 2010c).

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APPENDIX 1

Water Supply Assessment for the Ukiah Valley Area Plan, October 20, 2010

Water Supply Assessment for the Ukiah Valley Area Plan

Prepared by

Mendocino County Water Agency
890 North Bush Street
Ukiah, California 95482

October 20, 2010

TABLE OF CONTENTS

ACRONYMS AND ABBREVIATIONS v
SECTION 1. INTRODUCTION 1-0
1.1 Background 1-0
1.1.1 Statutory Requirements of a Water Supply Assessment 1-0
1.1.2 Overview of Ukiah Valley Area Plan Growth Scenarios 1-0
1.1.3 Scope of Ukiah Valley Area Plan Water Supply Assessment 1-7
1.2 Report Format 1-7
SECTION 2. WATER DEMANDS 2-0
2.1 Existing Water Usage Rates and Patterns 2-1
2.2 Future Water Demand Predictive Methodologies 2-2
2.2.1 Population Based Water Demand Projections 2-2
2.2.2 Connection Based Water Demand Projections 2-3
2.2.3 Land Use Based Water Demand Projections 2-6
2.2.4 Summary of 2025 Water Demand Projections 2-11
2.3 Future Water Demand Estimates for Preferred Project and Alternatives 2-12
2.4 Projected Dry Year and Multiple Dry year Water Demands 2-22
2.5 Water Conservation Requirements Pursuant to 20x2020 Water Conservation Plan 2-24
SECTION 3. SURFACE WATER SUPPLIES 3-0
3.1 Overview of Surface Water Sources and Constraints 3-1
3.1.1 Russian River 3-1
3.1.2 Potter Valley Project 3-4
3.1.3 Lake Mendocino 3-6
3.2 Ukiah Valley Area Water Service Providers 3-13
3.2.1 Mendocino County Russian River Flood Control and Water Conservation Improvement District (RRFC) 3-13
3.2.2 Calpella County Water District 3-14
3.2.3 Millview County Water District 3-14
3.2.4 City of Ukiah 3-18
3.2.5 Rogina Water Company 3-18
3.2.6 Willow County Water District 3-18
3.2.7 Redwood Valley County Water District 3-20
3.2.8 Hopland Public Utility District 3-20
3.3 Assessment of Normal and Dry Year Surface Water Supplies 3-20
SECTION 4. GROUNDWATER SUPPLIES 4-0
4.1 Ukiah Valley Groundwater Basin 4-1
4.1.1 Hydrogeology 4-1
4.1.2 Groundwater Elevations and Availability 4-7
4.1.3 Groundwater Pumping 4-7
4.2 Groundwater Sufficiency 4-8
SECTION 5. POTENTIAL IMPACT OF CLIMATE CHANGE 5-0
5.1 Overview 5-1
5.2 Potential Impacts to Surface Water Supplies 5-1

5.3 Potential Impacts to Groundwater Supplies 5-2
SECTION 6. WATER SUPPLY SUFFICENCY 6-0
6.1 Water Supply Assumptions 6-1
6-2. Comparison of Supply versus Projected Demand 6-1
6-3. Potential Sources of New Water Supplies 6-2
SECTION 7. REFERENCES 7-0
APPENDIX A 8-0
Description of UVAP Land Use Alternatives 8-1

LIST OF TABLES

Table 1-1. Summary of UVAP Land Use Alternatives 1-7
Table 2-1. Total Annual Water Production in Acre-Feet [(a,b)] 2-1
Table 2-2. Total 2008 Monthly Water Production for Millview in Acre-Feet 2-3
Table 2-3. Population Based Water Demand Projections for 2025 2-4
Table 2-4. Connection Based Water Demand Projection for Year 2025 2-6
Table 2-5. Unit Water Demand by Land Use Type 2-8
Table 2-6. Estimated per Capita Water Demands in Gallons per Person per Day (gpd) 2-9
Table 2-7. Land use Based Water Demand Projections for 2025 2-11
Table 2-8. Summary of 2025 Water Demand Projections 2-13
Table 2-9. Future Normal Year Water Demand Projections in Acre-Feet: Preferred Project 2-14
Table 2-10. Future Normal Year Water Demand Projections in Acre-Feet: Alternative A 2-16
Table 2-11. Future Normal Year Water Demand Projections in Acre-Feet: Alternative B 2-18
Table 2-12. Future Normal Year Water Demand Projections in Acre-Feet: No Project 2-19
Table 2-13. Normal Year Incremental Water Demands for 2030 2-22
Table 2-14. Projected Single and Multiple Dry Year Water Demands by UVAP- Alternative 2-24
Table 2-15. Future Normal Year Preferred Project Demand Projections with Implementation of 20x2020 Water Conservation Plan Mandates 2-25
Table 2-16. Normal Year Incremental Water Demands for 2030 With and Without Implementation of SBx77 Water Conservation Mandates 2-26
Table 3- 1. Potter Valley Powerhouse Monthly Releases in Acre-Feet 3-5
Table 3- 2 Summary of RRFC Water Supply Agreements 3-14
Table 3- 3. Summary of Millview Water Rights Supply 3-16
Table 3- 4. Summary of Appropriative Water Rights 3-17
Table 3- 5. Summary of Willow Water Rights Supply 3-18
Table 4- 1. Historical Groundwater Pumping in Acre-Feet 4-8
Table 6- 1. Water Supply Sufficiency by UVA Public Water Service Provider-Preferred Project 6-2
Table 6- 2. Water Supply Sufficiency by UVA Public Water Service Provider-Alternative A 6-4
Table 6- 3. Water Supply Sufficiency by UVA Public Water Service Provider-Alternative B. 6-5
Table 6- 4. Water Supply Sufficiency by UVA Public Water Service Provider - No Project .. 6-7

LIST OF FIGURES

Figure 1-1. Location Map 1-1
Figure 1-2. Preferred Project Land Use 1-2
Figure 1-3. Land Use Alternative A 1-3
Figure 1-4. Land Use Alternative B 1-4
Figure 1-5. No Project land Use Alternative 1-5
Figure 1-6. Water Service Providers in the Ukiah Valley Area 1-8
Figure 3- 1. Hydrologic Features 3-2
Figure 3- 2. Historical Summary of Lake Mendocino Storage Levels 3-6
Figure 3- 3. Source of Lake Mendocino Inflow by Hydrologic Year Type 3-7
Figure 3- 4. Source of Lake Mendocino Inflow by Month 3-8
Figure 3- 5. Lake Mendocino Storage for Selected Years 3-11
Figure 4- 1. Geologic Map 4-2
Figure 4- 2. Geologic Cross Section A-A 4-3
Figure 4- 3. Geologic Cross Section B-B 4-4
Figure 4- 4. Geologic Cross Section C-C 4-5

ACRONYMS AND ABBREVIATIONS

The following acronyms and abbreviations have been used in the SWA.

af	Acre-feet
af/ac/yr	Acre-feet per acre per year
afy	Acre-feet per year
bgs	Below ground surface
BMO	Basin Management Objectives
BOS	Board of Supervisors
Calpella	Calpella County Water District
CEQA	California Environmental Quality Act
City	City of Ukiah
CLP	Cumulative inflow into lake Pillsbury
CVP	Central Valley Project
DOSD	Division of Safety of Dams
DPH	Department of Public Health
Du	Dwelling units
DWR	California Department of Water Resources
EIR	Environmental Impact Report
ET	Evapotranspiration
FERC	Federal Energy Regulatory Commission
GMP	Groundwater Management Plan
gpcd	Gallons per capita per day
gpd	Gallons per day
gpd/du	Gallons per day per dwelling unit
gpy/sf	Gallons per year per building square foot
gpm	Gallons per minute
Kjf	Cretaceous-aged Franciscan Formation
M&I	Municipal and industrial
RRFC	Mendocino County Russian River Flood Control and Water Conservation Improvement District
MCWA	Mendocino County Water Agency
Mgd	Million gallons per day
Mg/L	Milligrams per liter
Millview	Millview County Water District
Msl	Mean sea level
NOAA	National Oceanic and Atmospheric Administration
Project Water	The RRFC's 8,000 acre feet right to water stored in Lake Mendocino.
PVID	Potter Valley Irrigation District
Qp	Continental Basin Deposits
Qt	Pleistocene-aged Terrace Deposits
Qal	Recent Alluvium

Rogina	Rogina Water Company
Redwood Valley	Redwood Valley County Water District
RPA	Reasonable and Prudent Alternative
RWQCB	Regional Water Quality Control Board
SB	Senate Bill
SB 610	California State Senate Bill 610 of 2001
Sf	Square feet
SOI	Sphere of Influence
SWRCB	State Water Resources Control Board
TDS	Total Dissolved Solids
UAF	Unaccounted for
US101	U.S. Highway 101
USACE	United States Army Corps of Engineers
USBR	United States Bureau of Reclamation
UVA	Ukiah Valley Area
UVAP	Ukiah Valley Area Plan
UWMP	Urban Water Management Plan
UWSA	Uniform Water Supply Agreement
Willow	Willow County Water District
WSA	Water Supply Assessment

SECTION 1. INTRODUCTION

1.1 Background

The County of Mendocino has prepared the Ukiah Valley Area Plan (UVAP) to provide long-term policy direction for growth and development in the 60-square mile Ukiah Valley study area (UVA) depicted in Figure 1-1. Adoption and implementation of the UVAP is subject to the California Environmental Quality Act (CEQA) and will require preparation of an Environmental Impact Report (EIR). One of the key issues to be addressed in the EIR is the availability of municipal water supplies for UVAP implementation. This programmatic Water Supply Assessment (WSA), which has been prepared by the Mendocino County Water Agency in accordance with legislation enacted pursuant to Senate Bill 610 (Water Code sections 10910 through 10915), evaluates the available water supplies and the projected water demands associated with the future land use scenarios presented in the UVAP and is intended to serve as a source document for the UVAP EIR. This WSA does not constitute a "will serve" letter or any other form of commitment to supply water. The provision of water service in the UVA will continue to be undertaken in a manner consistent with water purveyor policies and procedures, and existing law.

1.1.1 Statutory Requirements of a Water Supply Assessment

Senate Bill 610 (SB 610) became law in 2002 and is intended to facilitate coordination between land use planning agencies and public water purveyors. More specifically, the purpose of SB 610 is to ensure that there are adequate water supplies within a given area to not only satisfy existing demands, but also the anticipated demands associated with projected growth. Pursuant to SB 610, future water demands are evaluated in five-year increments over a 20-year projection period for normal, single dry, and multiple dry years. By law, a WSA must include quantifications of water entitlements, water rights, and service contracts held by water purveyors, as well as an analysis of any water purveyor plans for acquiring additional water supplies, if existing supplies are deemed inadequate. Additional WSA requirements – preparation of a Groundwater Source Sufficiency Evaluation – apply in situations where groundwater is used at least in part to satisfy existing or future water demands.

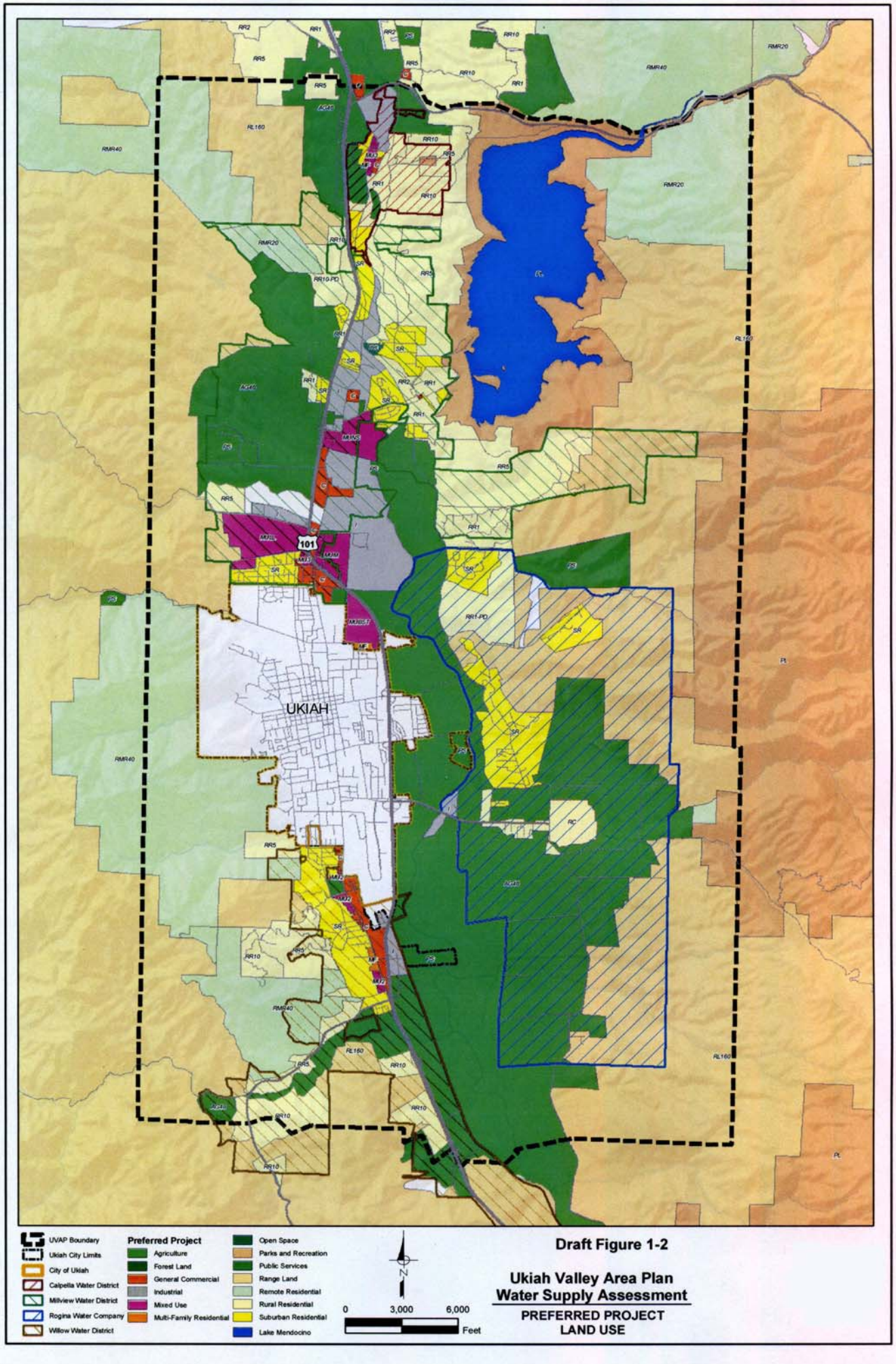
1.1.2 Overview of Ukiah Valley Area Plan Growth Scenarios

The UVAP includes four future land use scenarios; the Preferred Project (Figure 1-2), Alternative A (Figure 1-3), Alternative B (Figure 1-4), and the No Project Alternative (Figure 1-5). The No Project Alternative reflects land use designations specified by the current County General Plan and constitutes the "least growth" scenario. Alternative B, followed by Alternative A, and the Preferred Project represent increasingly greater urban growth scenarios – at least with respect to the number of single-family and multi-family units, and commercial development. Table 1.1 summarizes the projected buildout for the Preferred Project and alternative development scenarios. A detailed description of each alternative is provided in Appendix A. This WSA evaluates the water needs associated with each of the four growth scenarios.

Figure 1-1

Ukiah Valley Area Plan
Water Supply Assessment

LOCATION MAP



Draft Figure 1-2

Ukiah Valley Area Plan
Water Supply Assessment

PREFERRED PROJECT LAND USE

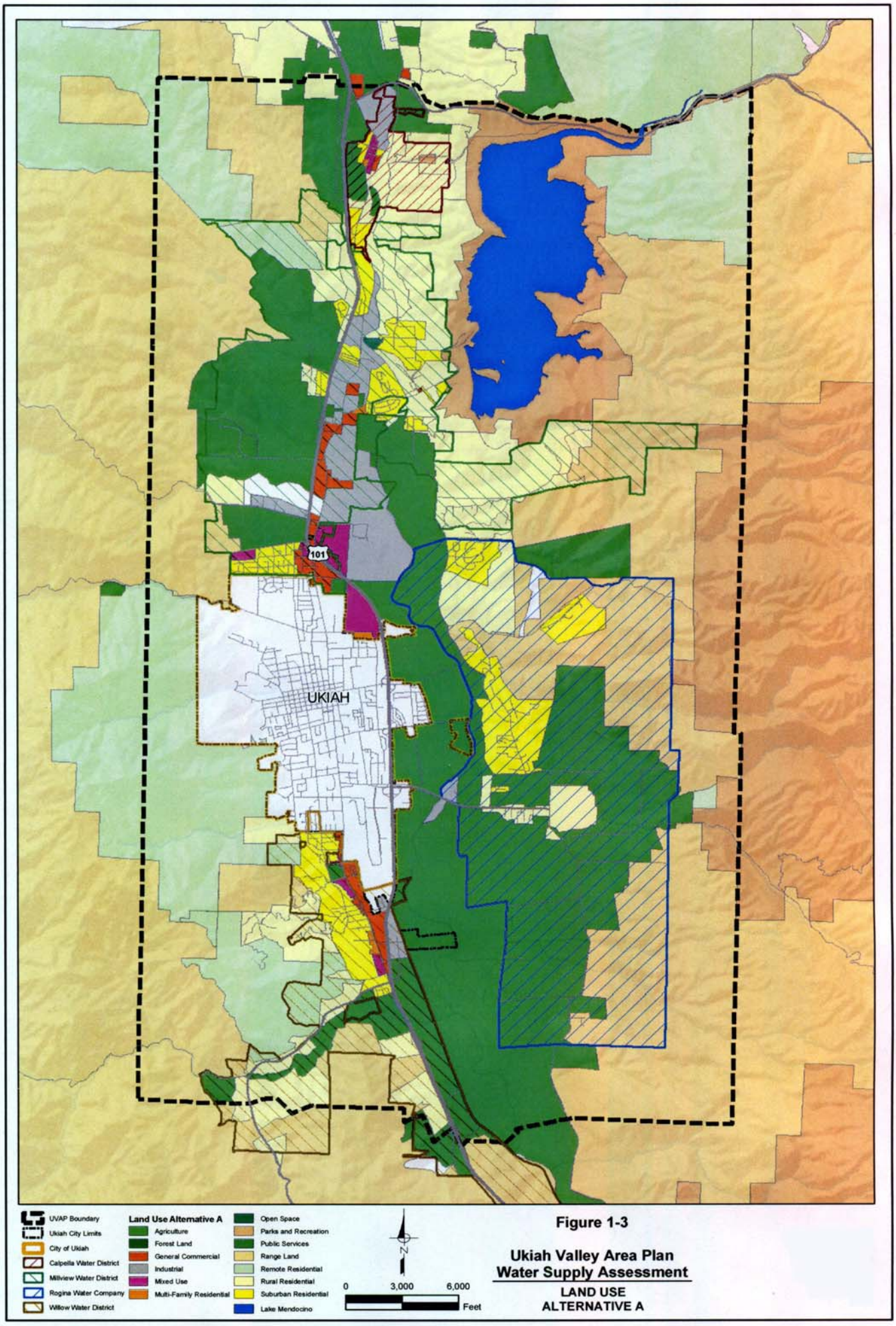


Figure 1-3

Ukiah Valley Area Plan
Water Supply Assessment

LAND USE
ALTERNATIVE A

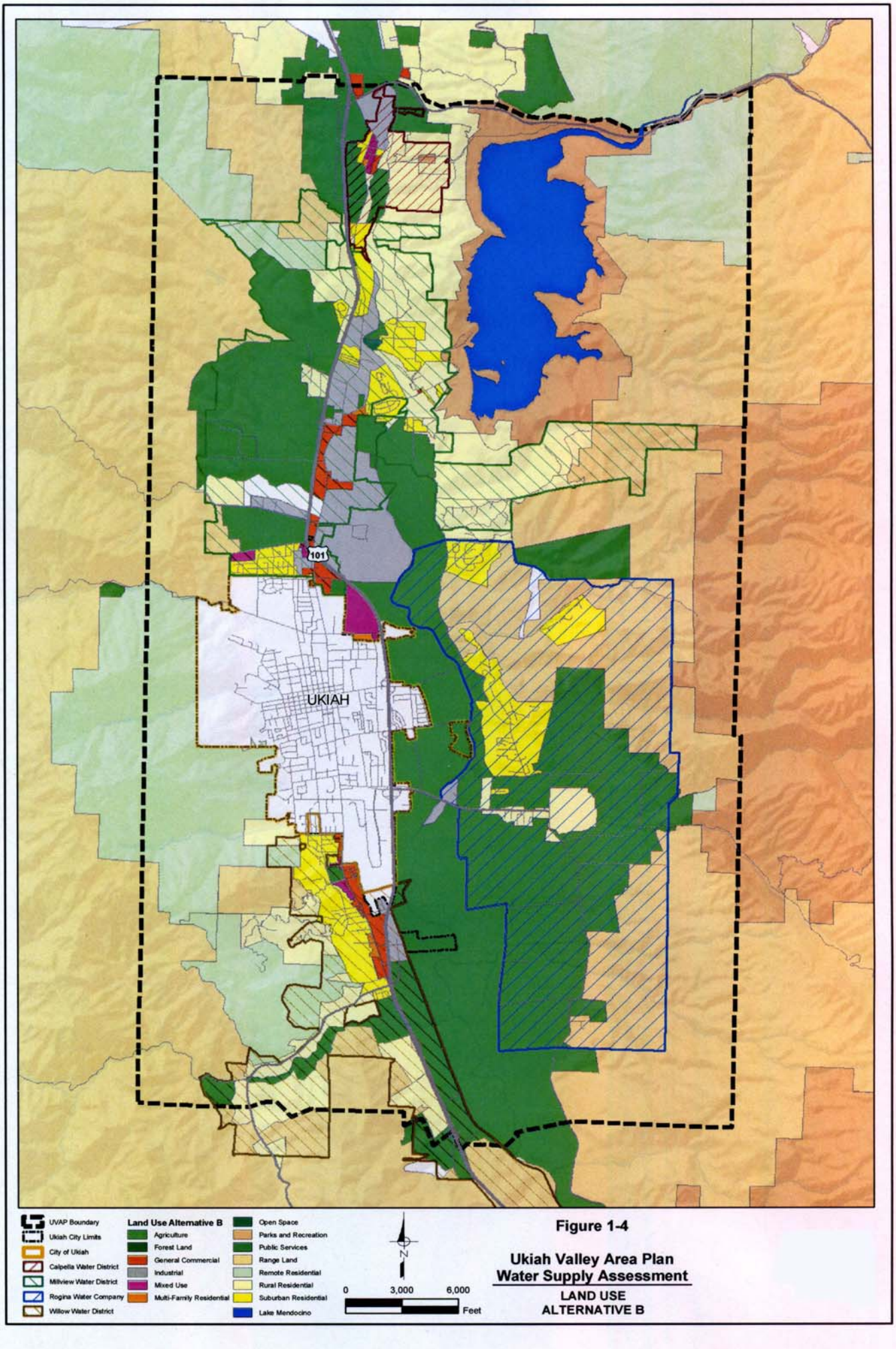


Figure 1-4

Ukiah Valley Area Plan
Water Supply Assessment

LAND USE
ALTERNATIVE B

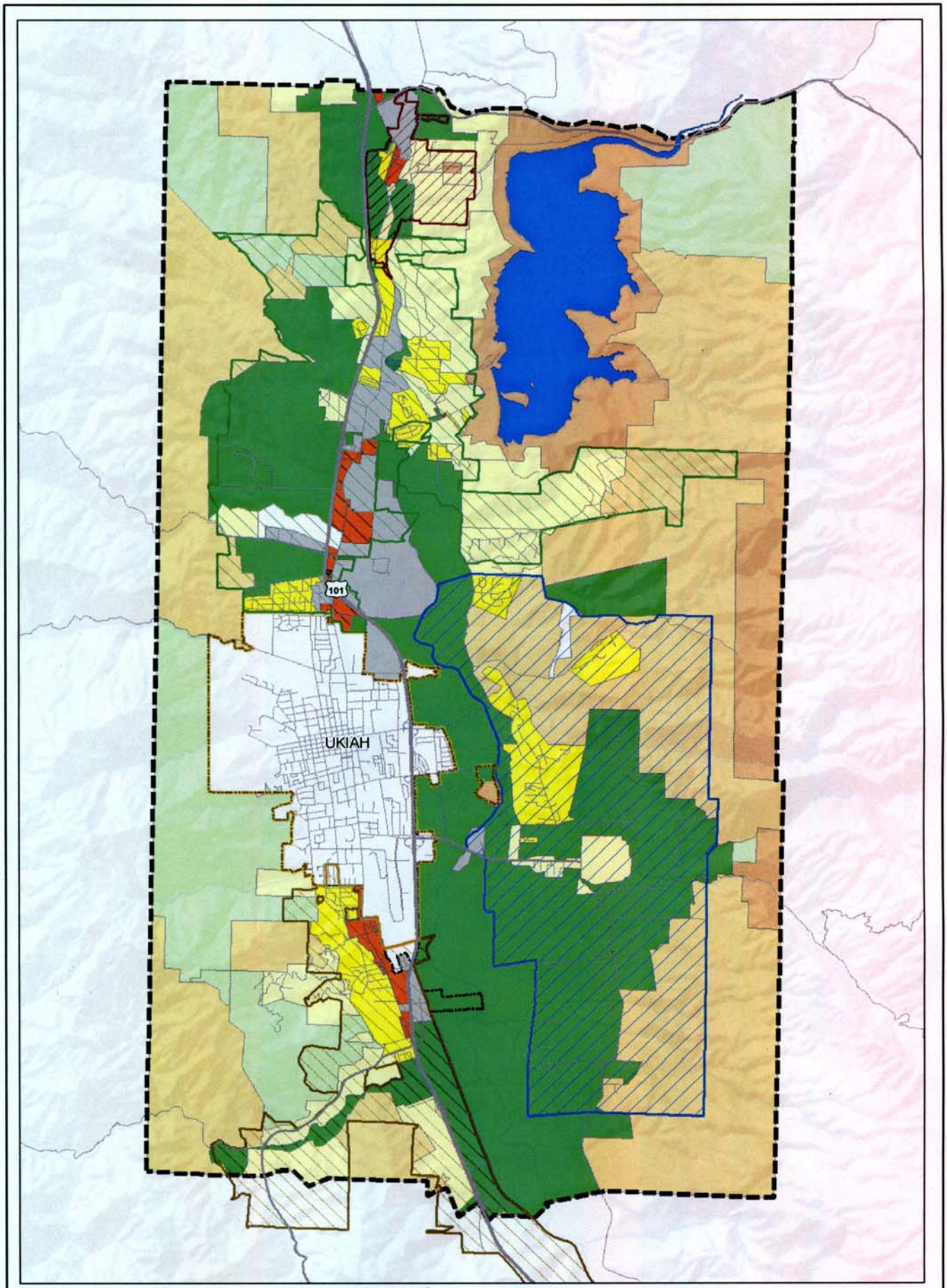


Figure 1-5

Ukiah Valley Area Plan
Water Supply Assessment

NO PROJECT
LAND USE ALTERNATIVE

Table 1-1. Summary of UVAP Land Use Alternatives [a]

	Maximum Number of Single-Family Units	Maximum Number of Multi-Family Units	Maximum Commercial Development (square-feet).	Maximum Industrial Development (square-feet).
Preferred Project	2,756	3,268	4.60 million	2.40 million
Alternative A	1,966	2,576	3.90 million	2.56 million
Alternative B	1,745	1,631	2.18 million	3.20 million
"No Project" Alternative[b]	1,508	869	1.80 million	3.73 million

(a) Includes buildout potential within City of Ukiah
(b) Current General Plan land use designations

1.1.3 Scope of Ukiah Valley Area Plan Water Supply Assessment

The UVAP WSA provides a programmatic level assessment of the UVA urban water supplies. Five public water systems; the Calpella County Water District (Calpella), Millview County Water District (Millview), Willow County Water District (Willow), City of Ukiah (Ukiah) and Rogina Water Company (Rogina) are located in the UVA (Figure 1-6) and would collectively provide essentially all of the water required for UVAP implementation. The water supply capabilities of the aforementioned public water systems as well as three additional water service providers; the Mendocino County Russian River Flood Control and Water Conservation Improvement District (RRFC), a wholesaler to the above five UVA public water service providers; the Hopland Public Utilities District, located immediately south of the UVA and a user of RRFC water supplies; and the Redwood Valley County Water District (RVCWD), located immediately north of the UVA and also a user of RRFC water supplies, are reviewed as a part of this WSA.

1.2 Report Format

The format of this report has been patterned after the SB 610 statutory requirements specified by Water Code sections 10910 through 10915 and consists of the following seven sections:

- Section 1. Introduction
- Section 2. Water Demands
- Section 3. Surface Water Supplies
- Section 4. Groundwater Supplies
- Section 5. Potential Impact of Climate Change
- Section 6. Water Supply Sufficiency
- Section 7. References

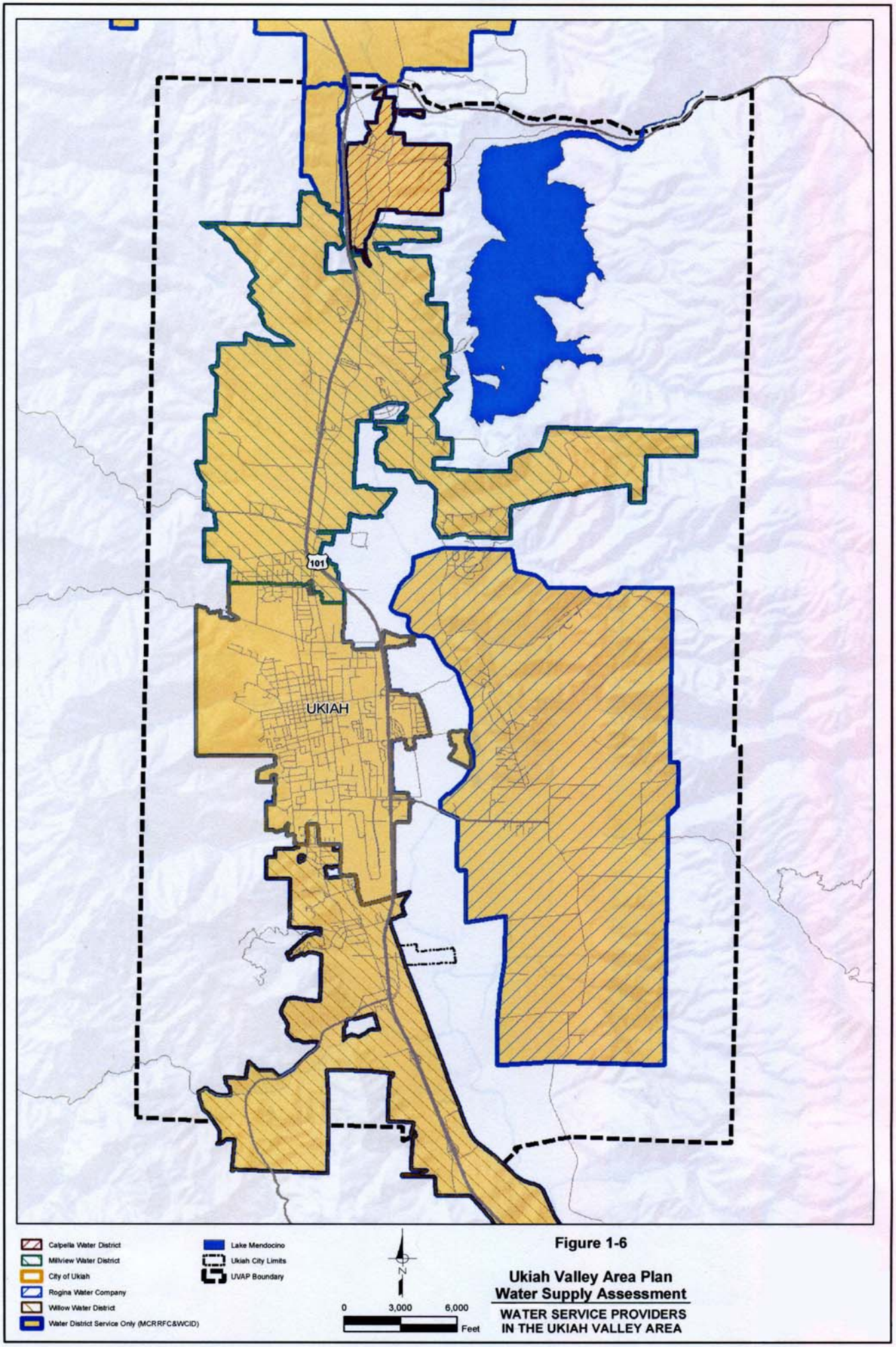


Figure 1-6

Ukiah Valley Area Plan
Water Supply Assessment

WATER SERVICE PROVIDERS IN THE UKIAH VALLEY AREA

SECTION 2. WATER DEMANDS

Future water demands are typically estimated by characterizing existing water usage rates and patterns, assessing whether or not these usage rates and patterns will change in the future, and applying the projected usage rates to anticipated population growth rates or land use changes. The aforementioned approach was used to derive the water demand estimates presented here.

This chapter begins with the characterization of existing water usage rates and patterns in the UVA, followed by a brief discussion of three predictive methodologies for estimating future water demands, a comparison of future UVA water demand estimates derived from each of the three future water demand predictive methodologies and the selection of a preferred predictive methodology for the UVAP Water Supply Assessment, and concludes with a discussion of future water demand predictions – using the preferred predictive methodology - for the Preferred Project, Alternative A, Alternative B, and the No Project alternative.

2.1 Existing Water Usage Rates and Patterns

Between 2000 and 2009 total water production in the UVA – the combined production of Calpella, Millview, Ukiah, Rogina, and Willow – ranged from 5,451 acre-feet in 2009 to 7,679 acre-feet in 2002, and averaged 7,102 acre-feet (Table 2-1). In each year Ukiah accounted for roughly 50 percent of the total water produced, while Millview and Willow accounted for approximately 25 and 15 percent of total water production, respectively. During the period of record the region experienced severe drought conditions from 2007 through 2009 and well below average precipitation in 2002. Conditions were particularly challenging in 2009, when Lake Mendocino water levels receded to record lows and mandatory rationing – a 50 percent reduction in water use – was instituted by the Mendocino County Board of Supervisors. Given the preponderance of dry years and associated circumstances, the average annual UVA water production figure of 7,098 acre-feet for the 2000 – 2009 time frame is probably not indicative of current annual usage in a "typical" year. Water usage in 2004 – a year of near average precipitation and a year in which no extraordinary efforts to conserve water occurred – is considered to be a more realistic and the best available representation of current average annual water production in the UVA.

Under existing conditions approximately 75 percent of the water produced by the five public water service providers – Calpella, Millview, Ukiah, Rogina and Willow - is used for residential purposes, while commercial uses account for approximately 15 percent of the total production, and the balance - approximately 10 percent – is used for industrial and miscellaneous purposes. As illustrated by the monthly water use data presented in Table 2-2, water usage rates in the UVA are typically highest in the summer, when outdoor landscaping and agricultural crops require irrigation, and lowest during the rainy season, when water consumption is frequently limited to indoor uses.

Table 2-1. Total Annual Water Production in Acre-Feet [a,b]

Water Purveyor	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Calpella										
Production	34	33	30	36	35	33	33	—	—	—
Imported Water from Millview	68	71	80	79	84	81	87	—	—	—
Total System Demand	102	104	110	115	119	114	120	112	109	88
Millview										
Production	1,503	1,517	1,514	1,474	1,608	1,490	1,775	1,576	1,549	1,019
Water sold to other Water Purveyors	126	80	83	74	86	80	133	82	104	60
Total System Demand	1,377	1,437	1,431	1,400	1,522	1,410	1,642	1,494	1,445	959
Ukiah										
Production	4,224	4,069	4,163	3,872	4,130	3,756	3,831	3,743	3,713	3,064
Rogina										
Production	642	694	687	632	668	563	635	625	625	529
Willow										
Domestic Production	1,066	1,106	1,182	1,101	1,137	1,013	1,067	943	929	762
Agricultural Production	119	94	106	0	73	61	0	60	76	49
Total System Production	1,185	1,200	1,288	1,101	1,210	1,074	1,067	1,003	1,005	811
Total Production	7,530	7,504	7,679	7,120	7,649	6,917	7,295	6,977	6,897	5,451

(a) Source: California Department of Public Health (2007), Ukiah (2007), California Department of Water Resources Public Water System Statistics (2007, 2008, 2009)
(b) Includes water lost by leakage, pipeline flushing, or otherwise unaccounted for losses (UAF Water)

Due to somewhat differing land use activities - most notably the relative percentages of residential, commercial and industrial uses, and differences in residential housing densities - there are subtle differences in the annual as well as seasonal water usage patterns exhibited by the various UVA water service providers.

Table 2-2. Total 2008 Monthly Water Production for Millview in Acre-Feet

Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
78	74	87	106	170	186	207	209	172	147	78	70

2.2 Future Water Demand Predictive Methodologies

Future water demands are typically estimated using one or a combination of three predictive methodologies; population based, connection based, or land use based (Johnson and Loux, 2004). Each methodology has its strengths and weaknesses. The population based and to a lesser extent the connection based predictive methodologies require comparatively little and for the most part readily accessible data, but are generally less reliable predictors of future water demands. Conversely, the data requirements of the land use based predictive methodology are comparatively high, but the resulting output typically more reliable. For comparison purposes, future water demand estimates for the UVA were developed for a single year – 2025 – using each of the above mentioned predictive methodologies. 2025 is the only year in which there are sufficient data to calculate future water demands using each of the three predictive methodologies. A summary of the three predictive methodologies and the resulting future water demand projections, as applied to the UVA, is presented below.

2.2.1 Population Based Water Demand Projections

The calculation of population based water demand projections is based on the assumption that future water demands can be estimated by multiplying the total population of a given geographic area by an average per capita water usage rate. The accuracy of the population based water demand projections is dependent upon the accuracy with which population growth can be estimated and the assumption that current or historic average per capita water usage rates will remain unchanged in the future. A key and implicit assumption is that land use patterns – the relative percentages and types of residential, commercial and industrial water uses – will remain constant over time.

The population based water demand projections for the UVA are derived from population growth data compiled by the Economic Background Report (EPS, 2007) and per capita water usage rates reported for Ukiah (Ukiah, 2007), Millview (MCWA, 2010a), and Willow (MCWA, 2010b). Between 2005 and 2025 the population of the UVA, including those areas that are not currently within one of the five public water service areas, is expected to increase by 3,960 persons, from 31,272 persons in 2005 to 35,232 persons in 2025 - an annual population growth rate of 0.6 percent, or 198 persons per year.

For the purposes of this analysis, an average per capita water usage of rate of 234 gallons per person per day was used. The average per capita water usage rate for this analysis (234 gallons per person per day) represents the weighted average of the average per capita water usage rates for Ukiah (228 gallons per person per day), Millview (247 gallons per person per day) and Willow (235 gallons per person per day). As previously noted, under existing conditions Ukiah, Millview and Willow provide approximately 50 percent, 25 percent, and 15 percent of the municipal water used in the UVA, respectively. Per capita water usage rates for each of the three public water service providers were computed by dividing total annual usage by the corresponding population of the service area, and therefore include all uses; residential, commercial and industrial occurring within the service area (see analysis of land use based water demand projections for a discussion of residential per capita water use).

The population based water demand projections indicate that between 2005 and 2025 water demands in the UVA will increase by 1,012 acre-feet, for a total water demand of 9,231 acre-feet (Table 2-3).

Table 2-3. Population Based Water Demand Projections for 2025

Year	Population[(a)]	Total Demand in Acre-Feet[(b)]
2005	31,372	8,219
2025	35,232	9,231

(a) Source: Economic and Planning Systems, Incorporated (2007)
(b) Based on an average per capita water demand of 234 gpd

2.2.2 Connection Based Water Demand Projections

The calculation of connection based water demand projections relies on the premise that future water demands can be estimated by multiplying the total number of future water service connections in a given geographic area by an average annual per connection usage rate. The accuracy of connection based water demand projections is dependent upon the accuracy with which the number of future water service connections can be estimated and the assumption that current or historic average annual per connection water usage rates will remain unchanged in the future. A key and implicit assumption is that land use patterns – the relative percentages and types of residential, commercial and industrial water uses – will remain constant over time.

Connection based water demand projections for the UVA are presented in Table 2-4 and are derived from future water service connection estimates for 2025 and average annual usage rate per connection data compiled by the California Department of Public Health (CDPH, 2007) and Ukiah (2007). Three connection based water demand projections, using three different average annual per connection usage rate factors, were computed for each water service provider - one based on the number of service connections and reported total annual usage for 2004, another based on the year of highest usage between calendar years 1997 and 2006, and a third based on average usage for calendar years 1997 through 2006.

All future water service connection estimates compiled by the CDPH are based on projected population growth estimates developed by the Mendocino County Planning Team (2005) for the draft UVAP. In the case of Ukiah, both the future water service connection estimate for 2025 and the average annual usage rate per connection data were obtained from the 2005 City of Ukiah Urban Water Management Plan (Ukiah, 2007).

The three total 2025 connection based water demand projections for the UVA range from 10,611 acre-feet to 11,094 acre-feet. These totals do not include those areas that are within the UVA but not within one of the five public water purveyor service areas. Areas outside of the existing public water purveyor service areas ("out of district areas") are for the most part rural properties that rely on privately developed and owned water sources. Despite the omission of out of district areas, the connection based water demand projections presented in Table 2-4 are useful in that they provide a means of comparing future water demand projections, by predictive methodology, for each of the five public water service providers.

Table 2-4. Connection Based Water Demand Projection for Year 2025

Water Purveyor	Projected Population Growth Rate (%)	Connection Usage Rate Scenario(a) (acre-feet per connection)			2025 Water Demands in Acre-Feet			
					Number of Connections[f]	Connection Usage Rate Scenario		
		2004	Average[b]	Maximum[d]		2004	Average	Maximum
Calpella	3.3	0.77	0.71	0.77	266	205	189	205
Millview	4.4	1.05	1.1	1.02	2,734	2,871	3,007	2,789
Ukiah	1.0	0.73	0.71[c]	0.77[e]	6,947	5,071	4,932	5,349
Rogina	0.9	0.69	0.67	0.73	1,150	794	771	840
Willow	2.4	1.17	1.12	1.25	1,529	1,789	1,712	1,911
Totals					12,626	10,730	10,611	11,094

(a) Source: California Department of Public Health (2007), City of Ukiah (2007).
(b) Average per connection usage rate for calendar years 1997-2006 unless otherwise noted.
(c) Average per connection usage rate for calendar years 2000-2006.
(d) Maximum per connection usage rate for calendar years 1997-2006 unless otherwise noted.
(e) Maximum per connection usage rate for calendar years 2000-2006.
(f) Source: Mendocino County Planning Team (2005), City of Ukiah (2007).

2.2.3 Land Use Based Water Demand Projections

Land use based water demand projections are typically calculated in a three-step process that begins with the characterization of land use types within a given geographic area, followed by the assignment of "unit water demand rates" for each land use type. Water demands are subsequently computed by multiplying the acreage associated with each land use type by the associated unit water demand rate, and summing the resulting water demands for each land use type to obtain a total water demand figure for the geographic area in question. Unlike the connection and population based water demand predictive methodologies, which assume a fixed land use development pattern (i.e., no change in the percentage of residential versus commercial versus industrial land uses over time), the land use based predictive methodology can readily account for changing land use patterns, such as those projected to occur within the UVA.

For the purposes of this analysis future land uses within the UVA were characterized and grouped into four categories; single family, multifamily, commercial, and industrial. Additional land use categories, such as rural residential, would have been desirable. Unfortunately, the paucity of applicable data precluded any further differentiation of land use types. Unit water demand rates for the single family (500 gallons per day per dwelling unit), multifamily (375 gallons per day per dwelling unit), commercial (65.17 gallons per year per square foot), and industrial (65.17 gallons per year per square foot) land uses within the UVA were derived from a combination of sources and are summarized below in Table 2-5.

Single Family

As illustrated by the data presented in Table 2-5, the UVA's single family unit demand rate of 500 gallons per day per dwelling unit (gdp/du) and to a lesser extent the 375 gdp/du multifamily unit demand rate used in this study are generally higher than the corresponding unit demand rates for other communities in the region, and with respect to single family homes, reflects in part, the preponderance of large rural residential lots in the UVA. The relatively high usage rate for single family residential – 500 gdp/du – equates to an average daily per capita consumption rate of 200 to 179 gallons per person per day (gpd), assuming an average home occupancy of 2.5 to 2.8 persons per home. By comparison, average daily per capita residential consumption rates for the combination of all residential types – single family, multifamily, rural residential – are estimated to be approximately 180 gpd for Ukiah and Millview, and about 170 gpd for Willow (Table 2-6).

Consistent with statewide trends, roughly half of the residential water use within the UVA is attributable to outdoor landscaping purposes (ConSol, 2010; MCWA, 2010a; MCWA, 2010b). In view of the on going statewide trend toward smaller single family residential lots with less landscaping, it is anticipated that the majority of the single family residential homes to be built pursuant to the UVAP will also exhibit somewhat smaller lots with less landscaping, and therefore, the 500 gpd/du figure used to characterize future single family residential water demands in the UVA is most likely a conservative estimate in that it potentially overstates future water demands.

Table 2-5. Unit Water Demand by Land Use Type

	Single Family Residential (gpd/du)	Multiple Family Residential (gpd/du)	Commercial, (gpy/sf)	Industrial (gpy/sf)
City of American Canyon[a]	335	210	56.6	56.6
City of Calistoga[a]	236		85	
City of St. Helena[b]	339	232	90	135
City of Santa Rosa[c]	289			
City of Willits [d]	241			
Willow[e]	508			
Town of Yountville[a]	312	172	70	
City of Fresno[f]			14.97	14.97
Sacramento County[g]			20.58	20.58
Projected UVAP Demand	500	375	65.17	65.17

(a) West Yost & Associates (2005)
(b) West Yost & Associates (2007)
(c) City of Santa Rosa (2006)
(d) West Yost & Associates (2007)
(e) California Department of Public Health (2007)
(f) West Yost & Associates (2008)
(g) Sacramento County Water Agency (2006)

Table 2-6. Estimated per Capita Water Demands in Gallons per Person per Day (gpd)

Willow	167[(a)]
Millview	180[(b)]
Ukiah	182[(c)]

(a) Computed as the fraction of total annual use attributed to residential water uses, divided by the total population of the District.

Assumptions:

Total Annual Use = 1,210 acre-feet (394,460,000 gallons)
Residential Use = 71 percent of total annual use
District Population = 4,600 persons

(b) Computed as the fraction of total annual use attributed to residential water uses, divided by the total population of the District.

Assumptions:

Total Annual Use = 1,522 acre-feet (496,172,000 gallons)
Residential use = 73 percent of total annual use
District Population = 5,500 persons

(c) Computed as fraction of reported total per capita use attributed to residential use.

Assumptions:

Total per Capita Use = 228 gpd (Ukiah, 2007)
Residential Use = 80 percent of total annual use

Multifamily

Information describing multifamily residential water usage in the UVA is not readily available (Ukiah, 2007; MCWA 2010a; MCWA 2010b) and therefore, for the purposes of this study, the characterization of multifamily residential water usage rates for the UVA is heavily based on statewide trends. As a general rule, due to their disproportionately lower outdoor landscaping water demands, multifamily residential units tend to exhibit lower usage rates than single family residential units. This trend is illustrated by the single family and multifamily residential water usage data presented in Table 2-5, which shows multifamily water usage rates ranging from 68 to 55 percent of corresponding single family residential usage rate. The extent to which multifamily residential water usage rates are lower than the corresponding single family residential units depends in part on the type and density of multifamily residential housing involved, which can range from a simple duplex to a multistory apartment complex. Although the number of multifamily residential units to be constructed pursuant to UVAP implementation is well defined, the type of multifamily residential housing is not. Therefore, for the purposes of this study, the multifamily residential water usage rate is simply defined as 75 percent of the corresponding single family residential water usage rate – 75 percent of 500 gpd/du figure. As previously noted, the estimated 500 gpd/du water usage rate for single family housing in the UVA is believed to be conservatively high. Accordingly, the estimated 375 gpd/du water usage rate for multifamily residential housing in the UVA is also believed to be conservatively high and potentially overstates water usage.

Commercial

Information describing commercial water usage patterns in the UVA is limited and not readily available. Consequently, for the purposes of this study the characterization of commercial water usage rates for the UVA is heavily based on statewide trends. Commercial water usage rates, like those for multifamily residential, are highly dependent upon the type of commercial development involved. As illustrated by the commercial water use data presented in Table 2-5, commercial water usage rates can vary by nearly an order of magnitude – from 15 gallons per year per square foot (gpy/sf) to 90 gpy/sf. Although the square-footage of commercial development to be constructed pursuant to UVAP implementation is reasonably well defined, the type of commercial development – i.e., shopping malls versus office space – is not. For the purposes of this study, a relatively high commercial water usage rate of 65.17 gpy/sf was selected to characterize future commercial water use in the UVA.

Historically, commercial land use activities have constituted a relatively small fraction of the overall municipal and industrial water demands in the UVA – with a similar trend anticipated in the future. Consequently, although the future commercial water usage rate used in this study may lack precision, it is not likely to skew or significantly degrade the precision of the total future water demand estimates for any of the four UVAP growth scenarios.

Industrial

Information describing industrial water usage patterns in the UVA is also limited and so as in the case of the aforementioned commercial water usage rates, the characterization of industrial water usage rates for the UVA is heavily based on statewide trends. Industrial water usage rates, even more so than commercial water usage rates, are highly dependent upon the type of industrial activities involved. As illustrated by the industrial water use data presented in Table 2-5, industrial water usage rates can vary by an order of magnitude – from as little as 15 gallons per year per square foot (gpy/sf) to in excess of 135 gpy/sf. For the purposes of this study, a moderately high commercial water usage rate of 65.17 gpy/sf was selected to characterize future industrial water use in the UVA.

Historically and particularly in recent years, industrial land use activities have constituted a relatively small fraction of the overall municipal and industrial water demands in the UVA – with a similar trend anticipated in the future. Consequently, although the future industrial water usage rate used in this study may lack precision, it is not likely to skew or significantly degrade the precision of the total future water demand estimates for any of the four UVAP growth scenarios.

Unaccounted For Water

Due to system leaks, inaccurate meters, pipeline flushing, firefighting and other undocumented uses the total quantity of raw water that is treated and available for distribution is typically slightly greater – generally by 5 to 10 percent - than the total quantity of water that is actually delivered to water users and ultimately consumed. The difference between what is initially treated and available for distribution (total water production) versus what is actually recorded as being consumed (net water production) is defined as

"unaccounted for water" (UAF). Information describing prevailing UAF loss rates for the five public water systems in the UVA is limited. Ukiah's UAF losses reportedly average three percent (Ukiah, 2007) and the available data suggest that the UAF losses for the remaining four public water systems are typically on the order of five to 10 percent. Therefore, for the purposes of this study a UAF loss rate of three percent was used to estimate UAF losses associated with future water demand predictions for Ukiah, while a UAF loss rate of eight percent was used to estimate the UAF losses associated with the future water demand predictions for the remaining four public water systems.

Unlike the population and connection based future water demand predictive methodologies, which extrapolate total water production figures such as those presented in Table 2-1 to estimate future water demands, the land use based future water demand predictive methodology utilizes net water production figures – the total quantity of water that is actually used for residential, commercial, industrial and other beneficial purposes. Accordingly, the UAF water losses, which are inherently incorporated into the population and connection based water demand predictions, are not implicitly included in the land use based demand predictions and therefore, must be added separately in order to accurately define future water demands using the land use based future water demands predictive methodology

Land use based water demand projections for the UVA are presented in Table 2-7 and indicate that between 2004 and 2025 water demands in the UVA will increase by 3,425 acre-feet, for a total water demand of 11,074 acre-feet.

Table 2-7. Land use Based Water Demand Projections for 2025

Purveyor	Total 2004 Water Production (acre-feet)	2025 Incremental demand Increase (acre-feet)	UAF water (acre-feet)	Total 2025 Demand (acre-feet)
Calpella	119	125	10[(a)]	254
Millview	1,522	1,465	117[(a)]	3,104
Ukiah	4,130	360	12[(b)]	4,502
Rogina	668	148	12[(a)]	828
Willow	1,210	503	39[(a)]	1,752
Not in a District	0	1,787	144[(a)]	1,931
Total	7,649	4,388	334	12,371

(a) Calculated as 8 percent of 2025 demand increase
(b) Calculated as 3 percent of 2025 demand increase

2.2.4 Summary of 2025 Water Demand Projections

The aggregate 2025 water demand projections for the UVA are all within 25 percent of each other and range from a high of 12,371 acre-feet using the land use based predictive methodology to a low of 9,231 acre-feet using the population based predictive methodology. Similarly, the projected incremental increase in water demands - the increase in water demands associated with UVAP implementation – ranges from approximately 1,600 acre-feet to 4,700 acre-feet (Table 2-8). Neither the total current water production nor the 2025 connection based water demand projection include water usage estimates for the "Not in a District" areas of the UVA (data for Not in a District areas is included in the 2025 population based water demand projection but not differentiated from the future water demands associated with the five public water service providers). However as demonstrated by the 2025 land use based future water demand projections, the projected 2025 water demands associated with the Not in a District areas are relatively modest – on the order of fifteen percent of the total projected 2025 UVA water demand – and therefore it appears unlikely that their omission would significantly skew the overall 2025 connection based water demand estimates for the UVA.

Two of the future water demand predictions – the per connection and land use based predictions – are very similar and compare favorably with the corresponding 2025 water demand projection (10,927 acre-feet) reported by the California Department of Public Health (CDPH, 2007). The fact that similar results were obtained from all three future water demand predictive methodologies, coupled with their similarity to the corresponding and independently derived 2025 water demand projection by the CDPH, suggests that the water usage rates used to compute the land use based future water demand projections for this study are reasonable. In view of the water demand projection results obtained for 2025 and the inherit ability of the land use based predictive methodology to account for spatially and temporally variable land use patterns, all subsequent future water demand predictions for the UVA, for the Preferred Project, Alternative A, Alternative B, and the No Project Alternative, were calculated using the land use based predictive methodology.

Table 2-8. Summary of 2025 Water Demand Projections

Purveyor	Current[(a)] Water Production (acre-feet)	Population Based (acre-feet)	Connection Based (acre-feet)	Land Use Based (acre-feet)
Calpella	119	N/A	204	254
Millview	1,522	N/A	2,871	3,104
Ukiah	4,130	N/A	5,071	4,502
Rogina	668	N/A	794	828
Willow	1,210	N/A	1,789	1,752
Not in a District	N/A	N/A	N/A	1,931
Total	7,649	9,231	10,730	12,371

(a) Current water production, based on 2004 actual usage data

(N/A) No data Available

2.3 Future Water Demand Estimates for Preferred Project and Alternatives

Future water demands for the UVAP Preferred Project, Alternative A, Alternative B, and the No Project Alternative – based on the land use based predictive methodology and the UVA land use based usage rates presented in Table 2-5 - are presented in Table 2-9 through Table 2-12. All future water demand predictions are computed as the prevailing water demands, defined as the reported water usage for 2004, plus the incremental increase in water demands attributable to UVAP implementation.

Implementation of the UVAP is projected to increase 2030 water demands in the UVA by as much as 6,100 acre-feet, from 7,649 acre-feet to 13,744 acre-feet. Nearly half of the additional demand, approximately 2,600 acre-feet under the Preferred Project, is attributed to increased residential and multifamily water demands. A summary of the projected incremental increase in water demands through 2030, by land use type and UVAP growth scenario, is presented in Table 2-13.

The water demand figures presented in Table 2-9 through 2-13 are for a normal hydrologic water year and represent the future water demands that would occur under prevailing water demand management activities. As discussed in section 2.3.3, recent state legislation – SBx7-7 - mandates implementation of demand management measures that will reduce urban per capita water consumption by 20 percent, by the year 2020. The mandated per capita water demand reductions associated with SBx7-7 have not been incorporated into the future UVA water demand projections presented in Tables 2-9 through Table 2-13.

Table 2-9. Future Normal Year Water Demand Projections in Acre-Feet: Preferred Project

	2010	2015	2020	2025	2030
Calpella County Water District					
2004 Production	119	119	119	119	119
Incremental Demand					
Single Family	11	29	47	64	82
Multifamily unit	8	22	36	50	64
Commercial	2	5	8	11	14
Industrial	0	0	0	0	0
UAF Losses (8%)[a]	2	4	7	10	13
Total Required Production[b]	**142**	**179**	**217**	**254**	**292**
Millview County Water District					
2004 Production	1,522	1,522	1,522	1,522	1,522
Incremental Demand					
Single Family	77	204	332	460	587
Multifamily unit	79	210	341	472	603
Commercial	34	90	146	202	258
Industrial	55	145	241	331	421
UAF Losses (8%)[a]	20	52	84	117	150
Total Required Production[b]	**1,787**	**2,223**	**2,666**	**3,104**	**3,541**
City of Ukiah					
2004 Production	4,130	4,130	4,130	4,130	4,130
Incremental Demand					
Single Family	6	15	24	34	43
Multifamily unit	28	76	122	170	217
Commercial	26	69	113	156	262
Industrial	0	0	0	0	0
UAF Losses (3%)[a]	2	6	9	12	16
Total Required Production[b]	**4,192**	**4,296**	**4,398**	**4,502**	**4,668**
Rogina Water Company					
2004 Production	668	668	668	668	668
Incremental Demand					
Single Family	25	66	107	148	189
Multifamily unit	0	0	0	0	0
Commercial	0	0	0	0	0
Industrial	0	0	0	0	0
UAF Losses (8%)[a]	2	5	9	12	15
Total Required Production[b]	**695**	**739**	**784**	**828**	**872**

Table 2-9. (Continued)

	2010	2015	2020	2025	2030
Willow County Water District					
2004 Production	1,210	1,210	1,210	1,210	1,210
Incremental Demand					
Single Family	39	105	170	236	302
Multifamily unit	33	87	142	196	251
Commercial	12	32	51	71	90
Industrial	0	0	0	0	0
UAF Losses (8%)[(a)]	7	17	29	39	51
Total Required Production[(b)]	**1,301**	**1,451**	**1,602**	**1,752**	**1,904**
Not in District					
2004 Production	0	0	0	0	0
Incremental Demand					
Single Family	27	72	116	161	206
Multifamily unit	10	26	42	58	74
Commercial	3	9	14	20	26
Industrial	260	689	1,119	1,548	1,978
UAF Losses (8%)[(a)]	23	65	105	144	183
Total Required Production[(b)]	**323**	**861**	**1,396**	**1,931**	**2,467**
Total UVAP Required Production	**8,440**	**9,749**	**11,063**	**12,371**	**13,744**

(a) Calculated as 8 percent of Incremental Demand.
(b) Total required production calculated as the sum of 2004 production, incremental demand, other demands (if shown), and UAF losses.
(c) Calculated as 3 percent of Incremental Demand.

Table 2-10. Future Normal Year Water Demand Projections in Acre-Feet: Alternative

	2010	2015	2020	2025	2030
Calpella County Water District					
2004 Production	119	119	119	119	119
Incremental Demand					
Single Family	11	29	47	64	82
Multifamily unit	8	22	36	50	64
Commercial	2	5	8	11	14
Industrial	0	0	0	0	0
UAF Losses (8%)[a]	2	4	7	10	13
Total Required Production[b]	**142**	**179**	**217**	**254**	**292**
Millview County Water District					
2004 Production	1,522	1,522	1,522	1,522	1,522
Incremental Demand					
Single Family	30	79	128	177	226
Multifamily unit	50	134	218	302	386
Commercial	27	73	119	165	210
Industrial	75	204	329	453	583
UAF Losses (8%)[a]	15	39	64	88	112
Total Required Production[b]	**1,719**	**2,051**	**2,380**	**2,707**	**3,039**
City of Ukiah					
2004 Production	4,130	4,130	4,130	4,130	4,130
Incremental Demand					
Single Family	6	15	24	34	43
Multifamily unit	28	76	122	170	217
Commercial	26	69	113	156	262
Industrial	0	0	0	0	0
UAF Losses (3%)[a]	2	6	9	12	16
Total Required Production[b]	**4,192**	**4,296**	**4,398**	**4,502**	**4,668**
Rogina Water Company					
2004 Production	668	668	668	668	668
Incremental Demand					
Single Family	25	66	107	148	189
Multifamily unit	0	0	0	0	0
Commercial	0	0	0	0	0
Industrial	0	0	0	0	0
UAF Losses (8%)[a]	2	5	9	12	15
Total Required Production[b]	**695**	**739**	**784**	**828**	**872**

Table 2-10. (Continued)

	2010	2015	2020	2025	2030
Willow County Water District					
2004 Production	1,210	1,210	1,210	1,210	1,210
Incremental Demand					
Single Family	39	105	170	236	302
Multifamily unit	33	87	142	196	251
Commercial	12	32	51	71	90
Industrial	0	0	0	0	0
UAF Losses (8%)[(a)]	7	17	29	39	51
Total Required Production[(b)]	**1,301**	**1,451**	**1,602**	**1,752**	**1,904**
Not in District					
2004 Production	0	0	0	0	0
Incremental Demand					
Single Family	16	43	70	97	124
Multifamily unit	0	0	0	0	0
Commercial	3	9	14	20	26
Industrial	260	689	1,119	1,548	1,978
UAF Losses (8%)[(a)]	23	58	97	131	170
Total Required Production[(b)]	**302**	**799**	**1,300**	**1,796**	**2,298**
Total UVAP Required Production	**8,351**	**9,515**	**10,681**	**11,839**	**13,073**

(a) Calculated as 8 percent of Incremental Demand.
(b) Total required production calculated as the sum of 2004 production, incremental demand, other demands (if shown), and UAF losses.
(c) Calculated as 3 percent of Incremental Demand.

Table 2-11. Future Normal Year Water Demand Projections in Acre-Feet: Alternative B

	2010	2015	2020	2025	2030
Calpella County Water District					
2004 Production	119	119	119	119	119
Incremental Demand					
Single Family	9	24	39	54	69
Multifamily unit	8	22	36	50	64
Commercial	2	5	8	11	14
Industrial	0	0	0	0	0
UAF Losses (8%)[(a)]	2	4	7	9	12
Total Required Production[(b)]	**140**	**174**	**209**	**243**	**278**
Millview County Water District					
2004 Production	1,522	1,522	1,522	1,522	1,522
Incremental Demand					
Single Family	29	78	127	176	225
Multifamily unit	18	47	76	105	135
Commercial	9	23	38	53	67
Industrial	155	419	679	938	1,203
UAF Losses (8%)[(a)]	17	47	74	103	130
Total Required Production[(b)]	**1,750**	**2,136**	**2,516**	**2,897**	**3,282**
City of Ukiah					
2004 Production	4,130	4,130	4,130	4,130	4,130
Incremental Demand					
Single Family	6	15	24	34	43
Multifamily unit	28	76	122	170	217
Commercial	26	69	113	156	262
Industrial	0	0	0	0	0
UAF Losses (3%)[(a)]	2	6	9	12	16
Total Required Production[(b)]	**4,192**	**4,296**	**4,398**	**4,502**	**4,668**
Rogina Water Company					
2004 Production	668	668	668	668	668
Incremental Demand					
Single Family	20	53	86	120	153
Multifamily unit	0	0	0	0	0
Commercial	1	3	5	7	8
Industrial	0	0	0	0	0
UAF Losses (8%)[(a)]	2	4	8	11	13
Total Required Production[(b)]	**691**	**728**	**767**	**806**	**842**

Table 2-11 (Continued)

	2010	2015	2020	2025	2030
Willow County Water District					
2004 Production	1,210	1,210	1,210	1,210	1,210
Incremental Demand					
Single Family	40	107	174	241	308
Multifamily unit	17	45	74	102	131
Commercial	15	40	65	90	115
Industrial	0	0	0	0	0
UAF Losses (8%)[(a)]	6	15	25	34	44
Total Required Production[(b)]	**1,288**	**1,417**	**1,548**	**1,677**	**1,808**
Not in District					
2004 Production	0	0	0	0	0
Incremental Demand					
Single Family	13	36	58	81	103
Multifamily unit	0	0	0	0	0
Commercial	0	0	0	0	0
Industrial	260	695	1,130	1,565	2,000
UAF Losses (8%)[(a)]	21	59	97	134	168
Total Required Production[(b)]	**294**	**790**	**1,285**	**1,780**	**2,271**
Total UVAP Required Production	**8,355**	**9,541**	**10,723**	**11,905**	**13,149**

(a) Calculated as 8 percent of Incremental Demand.
(b) Total required production calculated as the sum of 2004 production, incremental demand, other demands (if shown), and UAF losses.
(c) Calculated as 3 percent of Incremental Demand.

Table 2-12. Future Normal Year Water Demand Projections in Acre-Feet: No Project Alternative

	2010	2015	2020	2025	2030
Calpella County Water District					
2004 Production	119	119	119	119	119
Incremental Demand					
Single Family	9	25	40	55	71
Multifamily unit	8	20	33	45	58
Commercial	2	7	11	15	19
Industrial	0	0	0	0	0
UAF Losses (8%)[a]	2	4	7	9	12
Total Required Production[b]	**140**	**175**	**210**	**243**	**279**
Millview County Water District					
2004 Production	1,522	1,522	1,522	1,522	1,522
Incremental Demand					
Single Family	25	66	107	149	190
Multifamily unit	1	2	3	4	5
Commercial	12	33	54	74	95
Industrial	140	365	596	826	1,056
UAF Losses (8%)[a]	14	38	62	84	108
Total Required Production[b]	**1,714**	**2,026**	**2,344**	**2,659**	**2,976**
City of Ukiah					
2004 Production	4,130	4,130	4,130	4,130	4,130
Incremental Demand					
Single Family	6	15	25	34	44
Multifamily unit	31	84	136	188	241
Commercial	34	91	148	206	263
Industrial	18	47	76	105	135
UAF Losses (3%)[a]	3	7	12	16	20
Total Required Production[b]	**4,222**	**4,374**	**4,527**	**4,679**	**4,833**
Rogina Water Company					
2004 Production	668	668	668	668	668
Incremental Demand					
Single Family	20	53	86	120	153
Multifamily unit	0	0	0	0	0
Commercial	0	0	0	0	0
Industrial	0	0	0	0	0
UAF Losses (8%)[a]	2	4	7	10	12
Total Required Production[b]	**690**	**725**	**761**	**798**	**833**

Table 2-12. (Continued)

	2010	2015	2020	2025	2030
Willow County Water District					
2004 Production	1,210	1,210	1,210	1,210	1,210
Incremental Demand					
Single Family	37	99	161	223	285
Multifamily unit	8	21	35	48	62
Commercial	8	22	36	50	64
Industrial	0	0	0	0	0
UAF Losses (8%)[(a)]	4	12	18	26	33
Total Required Production[(b)]	**1,267**	**1,364**	**1,460**	**1,557**	**1,654**
Not in District					
2004 Production	0	0	0	0	0
Incremental Demand					
Single Family	13	36	58	81	103
Multifamily unit	0	0	0	0	0
Commercial	0	0	0	0	0
Industrial	260	695	1,130	1,565	2,000
UAF Losses (8%)[(a)]	21	59	97	134	168
Total Required Production[(b)]	**294**	**790**	**1,285**	**1,780**	**2,271**
Total UVAP Required Production	**8,327**	**9,454**	**10,587**	**11,716**	**12,846**

(a) Calculated as 8 percent of Incremental Demand
(b) Total required production calculated as the sum of 2004 production, incremental demand, other demands (if shown), and UAF losses.
(c) Calculated as 3 percent of Incremental Demand

Table 2-13. Normal Year Incremental Water Demands for 2030 (all quantities in acre-feet)

	Preferred Project	Alternative A	Alternative B	No Project
Residential	1,409	966	901	846
Multifamily	1,209	918	547	366
Commercial	650	602	466	441
Industrial	2,399	2,561	3,203	3,191
UAF Water	428	377	383	353
Totals	6,095	5,424	5,500	5,197

2.4 Projected Dry Year and Multiple Dry year Water Demands

During dry years the need for municipal water in the UVA typically increases, particularly for outdoor landscaping. However, as discussed in Section 3.0, the available supply decreases and water rationing, either voluntary or mandatory, is needed to ensure that there are sufficient supplies for at least the most essential uses. In the absence of demand management measures, single dry and multiple dry year UVA water demands are estimated to be approximately 15 to 25 percent greater than normal year demands.

The two largest public water purveyors in the UVA, Ukiah and Millview, have adopted generalized dry year demand management strategies to address water availability during drought conditions (Ukiah, 2007; Millview, 2010). In each case increasingly stringent water usage requirements are established in stages – three stages - as the availability of supplies decreases. Both dry year demand management strategies employ an initial stage in which voluntary conservation – on the order of 10 to 15 percent – is requested. Implementation of subsequent stages is determined as circumstances dictate and in each case, is intended to lead to water usage restrictions that will reduce total water consumption by approximately 25 percent. A summary of the projected water supply requirements of the various UVAP growth scenarios, assuming implementation of 15 or 25 percent conservation mandates, is presented in Table 2-14.

As discussed in Section 3.0, due to severe water storage constraints there is limited opportunity to store or "carryover" water supplies for multiple years. Consequently, in any given year the availability of the region's water supply is largely determined by the hydrologic conditions of that year. The "year-to-year" nature of the region's water supply limits the options available for managing multiyear droughts and as a result, multiyear droughts are managed, for the most part, as a succession of single year droughts.

Table 2-14. Projected Single and Multiple Dry Year Water Demands by UVAP Alternative

Hydrologic Condition	Percent Reduction	Water Demands in acre-feet				
		2010	2015	2020	2025	2030
Preferred Project						
Normal Year	0	8,440	9,749	11,063	12,371	13,744
Multiple Dry Year	15	7,174	8,287	9,404	10,515	11,682
Single Dry Year	25	6,330	7,312	8,297	9,278	10,308
Alternative A						
Normal Year	0	8,286	9,339	10,397	11,448	13,073
Multiple Dry Year	15	7,043	7,938	8,837	9,731	11,112
Single Dry Year	25	6,215	7,004	7,798	8,586	9,805
Alternative B						
Normal Year	0	8,355	9,541	10,723	11,905	13,149
Multiple Dry Year	15	7,102	8,110	9,115	10,119	11,177
Single Dry Year	25	6,266	7,156	8,042	8,929	9,862
No Project Alternative						
Normal Year	0	8,327	9,454	10,587	11,716	12,846
Multiple Dry Year	15	7,078	8,036	8,999	9,959	10,919
Single Dry Year	25	6,245	7,091	7,940	8,787	9,635

2.5 Water Conservation Requirements Pursuant to 20x2020 Water Conservation Plan

Senate Bill x7-7 (SBx7 7) became law in 2009 and requires the State's retail urban water purveyors to reduce urban per capita water usage by 10 percent on or before December 31, 2015; and by 20 percent by December 31, 2020. Pursuant to SBx7 7, retail urban water purveyors are defined as a water supplier, either publicly or privately owned, that directly provides potable municipal water to more than 3,000 end users or supplies more than 3,000 acre-feet of potable water annually for municipal purposes. Currently, only Ukiah meets the State's criteria for retail urban water purveyors. However, it is anticipated that by 2025 Millview, the second largest retail urban water purveyor in the UVA, will also meet the State's criteria and be subject to SBx7 7. Although current law excludes Willow, Rogina and Calpella from the requirements of SBx7 7 it is anticipated that at some point in the future the law will be amended to include all retail urban water purveyors, regardless of size.

Although relatively straight forward in theory, the process by which retail urban water purveyors will demonstrate compliance with SBx7 7 has not been fully vetted. Key issues include the establishment of baseline per capita usage rates from which a 20 percent reduction in per capita usage will be measured and appropriate exemptions for those entities that have already achieved significant reductions prior to SBx7 7. Consequently, the likelihood of all retail urban water purveyors actually achieving the water conservation savings mandated by SBx7 7 remains unclear.

As illustrated by the projected water demand data presented in Table 2-15 and Table 2-16, implementation of the water conservation mandates imposed by SBx7-7, by all retail urban water purveyors in the UVA, would substantially reduce the amount of "new water" needed for UVAP implementation – water conserved by existing users would provide in part the water needed for UVAP implementation. In the case of the Preferred Project, the incremental increase in water demands – i.e., the need for new water supplies – would be reduced by approximately 55 percent, from 6,095 acre-feet to 3,347 acre-feet in 2030.

Table 2-15. Future Normal Year Preferred Project Demand Projections with Implementation of 20x2020 Water Conservation Plan Mandates
(all quantities in acre-feet)

	2010	2015	2020	2025	2030
Calpella County Water District	114	143	174	203	234
Millview County Water District	1,430	1,778	2,133	2,483	2,833
City of Ukiah	3,354	3,437	3,518	3,602	3,734
Rogina Water Company	556	591	627	662	698
Willow County Water District	1,041	1,161	1,282	1,402	1,523
Not in District	258	689	1,117	1,545	1,974
Total UVAP Required Production	6,753	7,799	8,851	9,897	10,996

Table 2-16. Normal Year Incremental Water Demands for 2030 With and Without Implementation of SBx77 Water Conservation Mandates [(a)]

Preferred Project		Alternative A		Alternative B		No Project	
Without SBx77	With SBx77	Without SBx77	With SBx77	Without SBx77	With SBx77	Without SBx77	With SBx77
6,095	3,347	5,424	2,809	5,500	2,870	5,197	2,628

(a) 2030 future water demand estimates derived from land-use based future water demands predictive methodology and assuming normal year hydrology conditions.

SECTION 3. SURFACE WATER SUPPLIES

The UVA's surface water supply is derived from runoff in the Russian River and adjacent Eel River drainages. Much of the available supply is stored in facilities that are owned and operated by either the Pacific Gas and Electric Company (PG&E) or the United States Army Corps of Engineers (USACE) for predominately non-water supply purposes. Although the UVA and surrounding region typically receive substantial precipitation, institutional constraints associated with the operation of existing storage facilities, and diversions from the Russian River in general, limit the availability of surface water supplies. This chapter begins with an overview of the available surface water supplies, followed by a review of the "water supply portfolios" associated with each of the five public water service providers located in the UVA and two adjacent public water service providers; the Redwood Valley County Water District and the Hopland Public Utilities District, and concludes with an assessment of the normal and dry year water supplies currently available to the UVA and for UVAP implementation.

3.1 Overview of Surface Water Sources and Constraints

The principal surface water features, as they pertain to the UVA surface water supply, are the Russian River, the Potter Valley Hydroelectric Project (PVP), and Lake Mendocino (Figure 3-1). A description of each feature is presented below.

3.1.1 Russian River

The Russian River drainage encompasses 1,485 square miles in Mendocino and Sonoma counties, 503 square miles of which are located in Mendocino County (Philip Williams and Associates et. al., 1997). The headwaters of the Russian River drainage are located south and south east of Willits, where the West and East forks of the Russian River originate, respectively. The two forks converge approximately three miles north of Ukiah to form the Russian River main stem, which flows through the center of the Ukiah Valley and the UVA.

Historically, the Mendocino County portion of the Russian River was dry or nearly dry in the summer and fall, but often with substantial stream flow in the winter and spring. Water diversions from the Eel River to the Russian River drainage by the PVP, which began in 1912 and subsequently increased with the completion of Scott Dam and Lake Pillsbury (discussed elsewhere), converted the East Fork and to a lesser extent the Russian River main stem downstream of the East and West forks into perennial water courses, and increasingly reliable sources of water. The construction of Coyote Dam and Lake Mendocino 1959 completed the transformation of the Russian River main stem into a perennial water course and allowed for extensive agricultural and urban development in Mendocino and Sonoma counties.

Today, the Russian River, in conjunction with the PVP and Lake Mendocino, constitutes the principal surface water supply for the UVA and a significant source of

groundwater recharge for the Ukiah Valley. However, the Russian River is now fully appropriated from July through October and with the exception of high winter stream flows, fully appropriated in the winter and spring (SWRCB, 1997). Accordingly, opportunities to obtain additional water supplies in the Russian River drainage are generally limited to projects that capture and store high winter
stream flows.

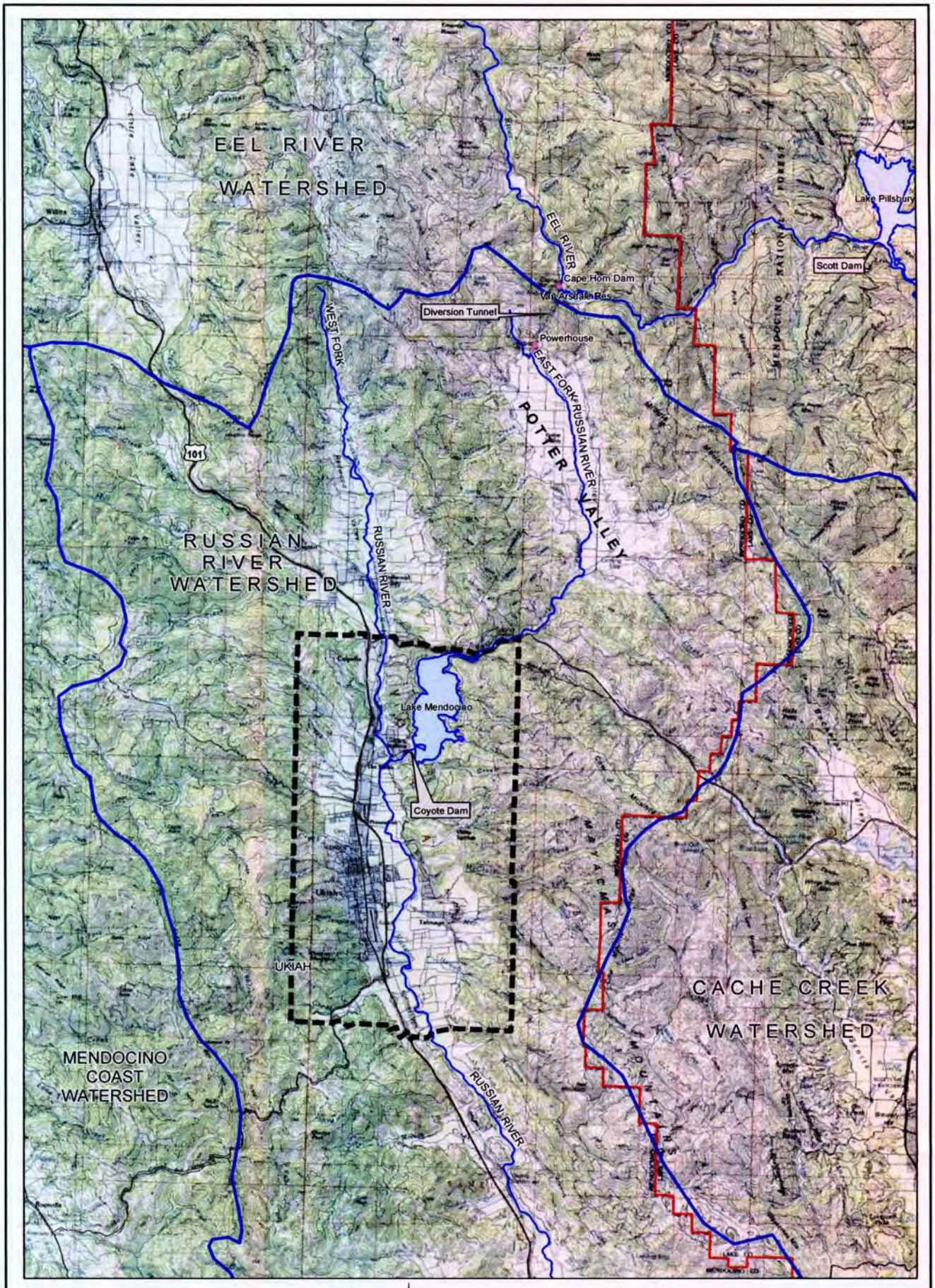


Figure 3-1

Ukiah Valley Area Plan
Water Supply Assessment

HYDROLOGIC FEATURES

3.1.2 Potter Valley Project

The 9.4 megawatt Potter Valley Hydroelectric Project - owned and operated by PG&E - consists of two water impoundments on the Upper Eel River; Scott Dam and Lake Pillsbury, and Cape Horn Dam and Van Arsdale Reservoir; and a diversion tunnel and powerhouse located on the East Fork. Water is stored in Lake Pillsbury, where it is subsequently released and flows approximately twelve miles downstream before being impounded at Van Arsdale Reservoir, where a portion is re-diverted, by way of tunnel, into the powerhouse located at the headwaters of the East Fork, and ultimately discharged to the East Fork. Project operations began in 1912 and have transformed the historically seasonal East Fork into a perennial stream, which has allowed for the development of irrigated agriculture in Potter Valley and has historically provided a significant source of water for agricultural and urban uses in the Ukiah Valley and surrounding region.

The operation of the PVP has been a source of controversy on the North Coast for many years and the subject of extensive and continuing litigation (Langridge, 2002; FERC, 2002; FERC, 2009). Historically, the PVP diverted approximately 160,000 acre-feet from the Upper Eel River to the East Fork. However, in 2004 the Federal Energy Regulatory Commission (FERC) amended the hydroelectric license for the PVP pursuant to a Biological Opinion issued by the National Marine Fisheries Service (NMFA) on November 26, 2002 (NMFS, 2002). Implementation of the Biological Opinion has significantly reduced diversions to the Russian River.

The Biological Opinion, which addressed the effects of the PVP on salmon and steelhead in the Eel River, concluded that operation of the PVP, as proposed by PG&E, would likely "…jeopardize the continued existence of southern Oregon/Northern California Coho Salmon, California Coastal Chinook Salmon, and Northern California Steelhead", and therefore in accordance with federal law, included a "reasonable and prudent alternative" (RPA) designed to modify project operations, so as to avoid jeopardizing the above listed fish species. The findings of the Biological Opinion and implementation of the RPA has been the subject of considerable debate and controversy. Key points of contention include the adequacy of the RPA with respect to the protection of salmon and steelhead fish species in the Eel River, and the degree to which agricultural and urban water supplies in the Russian River drainage have been and will continue to be reduced as a result of RPA implementation.

The Final Environmental Impact Statement (FEIS) prepared in support of the PVP license amendment concluded that implementation of the RPA would reduce diversions to the Russian River by an average of 15 percent (FERC, 2000). Implementation of the RPA and more specifically, operation of Lake Pillsbury and the application of the criteria dictating PVP water diversions, has not occurred as anticipated in the FEIS. As demonstrated by recent PVP operations data presented in Table 3-1, water diversions to the Russian River have actually been reduced by as much as 60 percent, and it is now apparent that implementation of the RPA and the criteria that dictates PVP water diversions, as currently crafted and interpreted, reduces annual diversions to the Russian River by an average of 40 to 50 percent. The reduced PVP diversions have had a significant impact on storage levels at Lake Mendocino and in turn the availability and reliability of the Lake Mendocino water supply.

Table 3- 1. Potter Valley Powerhouse Monthly Releases in Acre-Feet[(a)]

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Annual Total
Average (1923-1983)	13,167	13,054	13,601	14,125	13,660	14,499	13,739	13,461	11,223	11,410	11,367	12,505	155,811
Water Year													
1976	18,250	17,710	17,610	8,280	5,640	7,250	6,720	4,540	5,120	6,320	5,960	12,840	116,240
1977	16,480	15,860	7,500	3,490	650	1,580	1,130	2,400	2,890	3,720	3,600	1,850	61,150
2003	5,500	5,950	6,220	7,930	7,930	13,980	16,250	15,370	17,680	10,480	9,210	9,340	125,840
2004	10,980	9,600	16,830	18,270	14,620	16,860	10,640	8,760	8,080	7,380	8,300	8,160	138,480
2005	7,210	7,020	11,780	16,090	14,420	14,470	13,200	9,660	9,210	8,900	8,390	7,880	128,230
2006	7,490	5,590	3,460	11,010	12,330	9,160	12,240	13,780	8,420	8,380	8,210	8,310	108,380
2007	11,080	2,670	8,150	9,720	6,630	4,600	3,656	6,663	7,700	7,980	7,992	6,609	83,450
2008	4,078	2,604	2,670	9,116	7,700	4,451	4,278	6,284	7,771	8,001	7,986	6,617	71,556
2009	4,140	2,710	2,739	2,658	1,521	4,854	4,251	6,825	7,740	7,986	7,988	6,468	59,880
2010	4,038	2,870	3,038	6,208	12,729	5,640	4,155	6,877	7,628	7,969	8,010	7,510	76,672

(a) Source: Data for Water Years 1923-1983: United States Army Corps of Engineers (1986)
Data for Water Years 2002-2010: California Data Exchange Center; Station ID: "PVY"; Station ID: "PVP"

3.1.3 Lake Mendocino

Lake Mendocino and Coyote Valley Dam – a federal facility constructed by the USACE in 1959 – is located on the East Fork, approximately one mile upstream from the confluence with the West Fork and approximately three miles north of Ukiah. Lake Mendocino provides storage for flood control, municipal and industrial water supplies, recreation, and power generation, and is the principal water storage facility for the UVA's surface water supply.

Reservoir Operations

The maximum storage capacity of Lake Mendocino is 122,000 acre-feet, a portion of which – 50,000 acre-feet - is reserved for flood control purposes during the months of November through at least February, and more typically through March. The balance of the storage capacity is potentially available for water supply storage (SWRCB, 1961). Beginning in October, any water remaining in the flood control pool (i.e., that portion of the reservoir storage capacity reserved for flood control purposes) is released so that maximum reservoir storage does not exceed 72,000 acre-feet on November 1. Between November and at least February reservoir releases are made pursuant to the USACE's water control manual, so as to maintain reservoir storage at 72,000 acre-feet and retain the balance of the reservoir storage capacity for the periodic capture and controlled release of flood waters (USACE, 1986). At the conclusion of the flood control season the reservoir is allowed to partially refill, assuming there is sufficient runoff to do so, and storage is increased, historically to a maximum capacity of approximately 91,000 acre-feet. However, a provision in the reservoir operations criteria, which was exercised for the first time in 2010, allows for the storage of up to 116,000 acre-feet for water supply purposes in the summer and fall (USACE, 1986). A summary of historic lake levels, by month, is presented in Figure 3-2.

Because Lake Mendocino is not allowed to substantially refill until the end of the rainy season, when local runoff in the East Fork is greatly diminished, much of the water entering the lake and contributing to the summer and fall water supply originates from the Eel River, by way of the PVP. Historically, PVP diversions accounted for approximately half of the total inflow to Lake Mendocino in wet years, slightly over half in normal years, and the majority of the total annual inflow in dry years (Figure 3-3 and Figure 3-4).

Figure 3-2. Historical Summary of Lake Mendocino Storage Levels

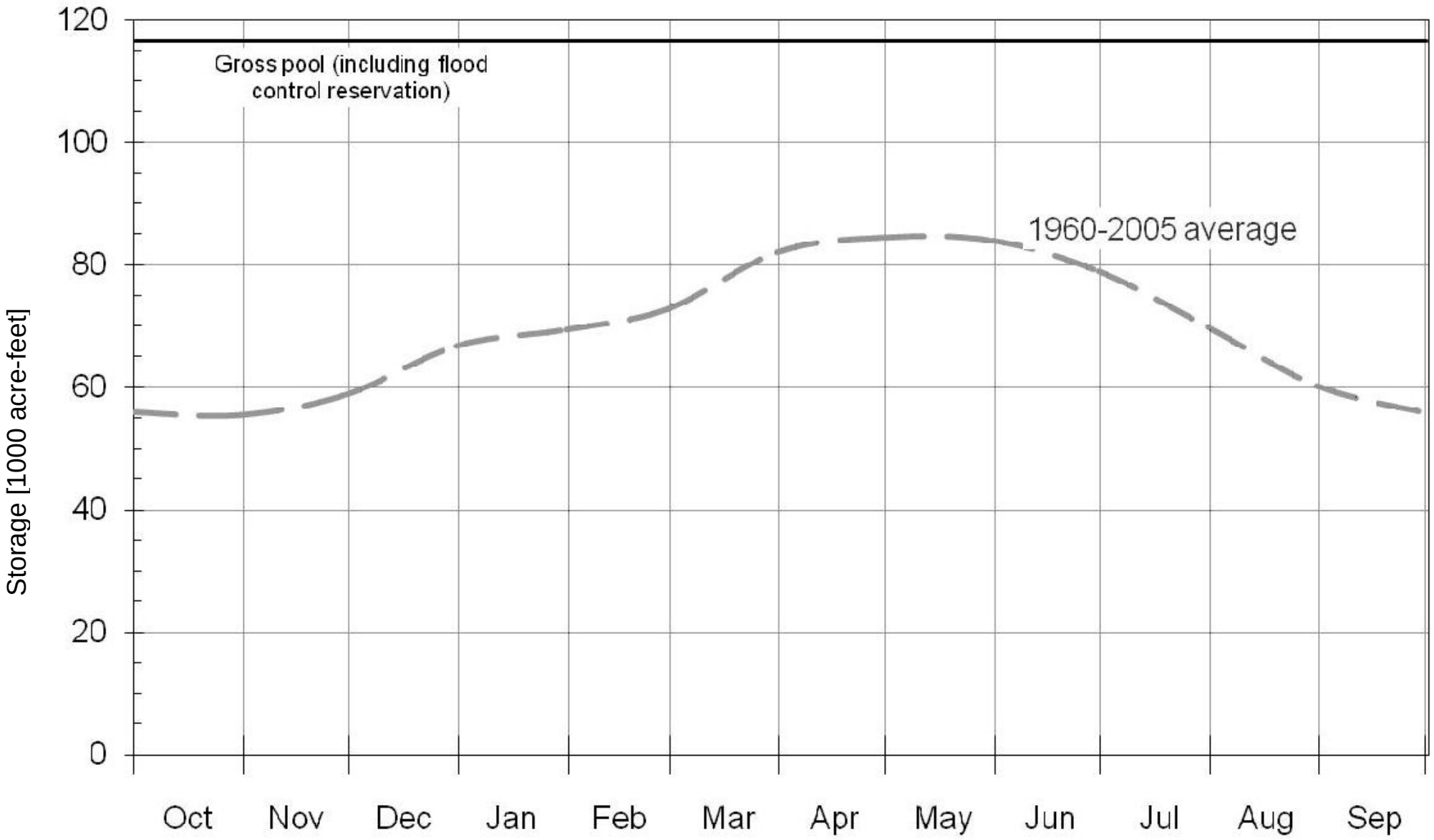


Figure 3-3. Source of Lake Mendocino Inflow by Hydrologic Year Type
(Pre 2004 Potter Valley Project FERC Decision)

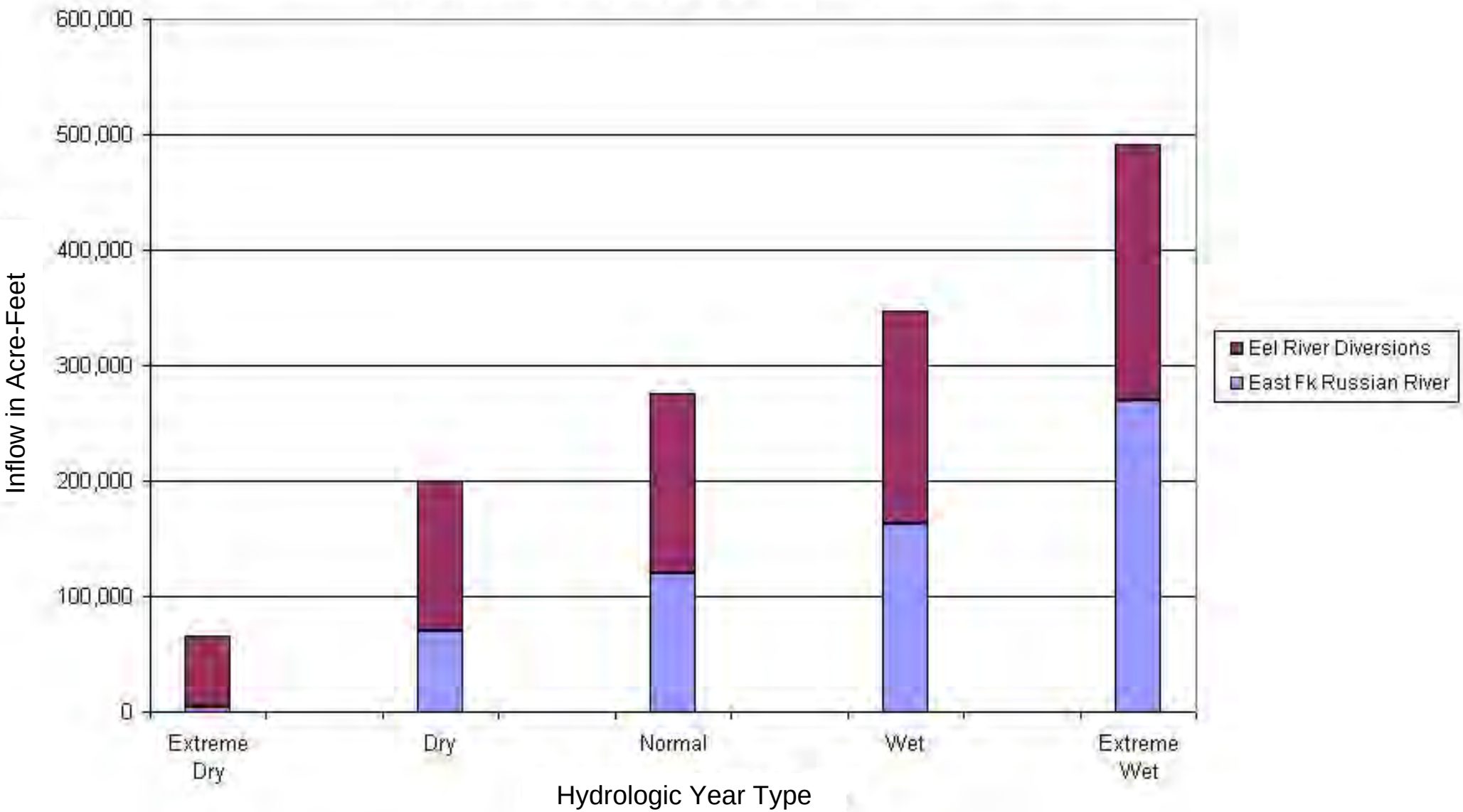
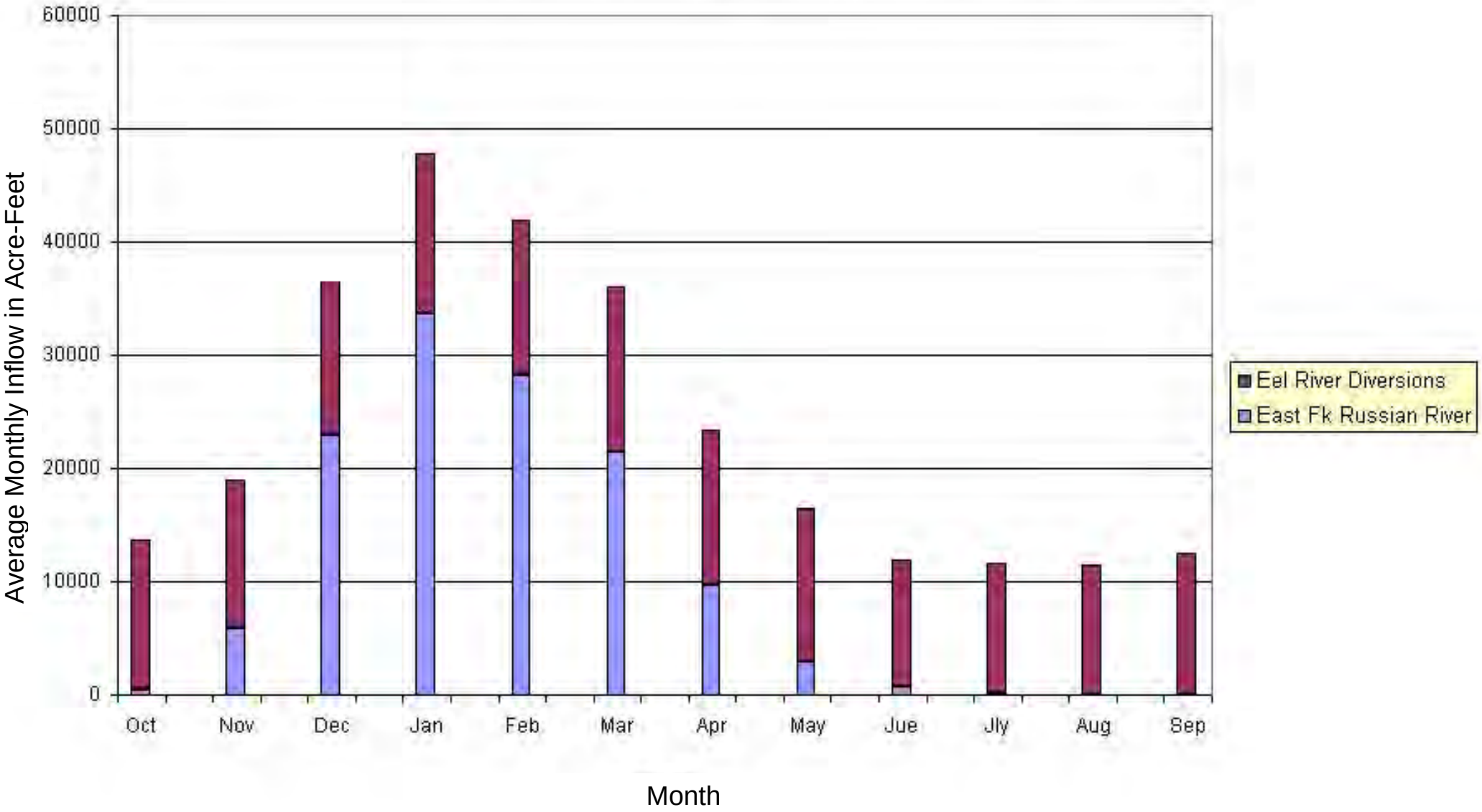


Figure 3-4. Source of Lake Mendocino Inflow by Month
(Pre 2004 Potter Valley Project FERC Decision)



Accordingly, any reduction in PVP diversions, particularly in dry years, can significantly impact water storage in Lake Mendocino. PVP operations data indicate that since 2007, implementation of the RPA for the PVP has reduced inflow to Lake Mendocino, during the six-month-long period beginning in April and continuing through September, by an average of approximately 30,000 acre-feet (Table 3-1).

The operation of Lake Mendocino has also been the subject of a Biological Opinion, which was released by NMFS on September 24, 2008 (NMFS, 2008) and as in the case of the Biological Opinion for the PVP, analyzes the impact of project operations on salmon and steelhead. The Biological Opinion prepared by NMFS concluded that continued operation of Lake Mendocino, as proposed by the USACE and the Sonoma County Water Agency, could jeopardize the continued existence of Central California Coast (CCC) steelhead, CCC Coho salmon, and California Coastal Chinook salmon, and therefore prescribes an RPA (Russian River RPA) that the USACE and Sonoma County Water Agency have begun to implement in lieu of historic reservoir operation protocols.

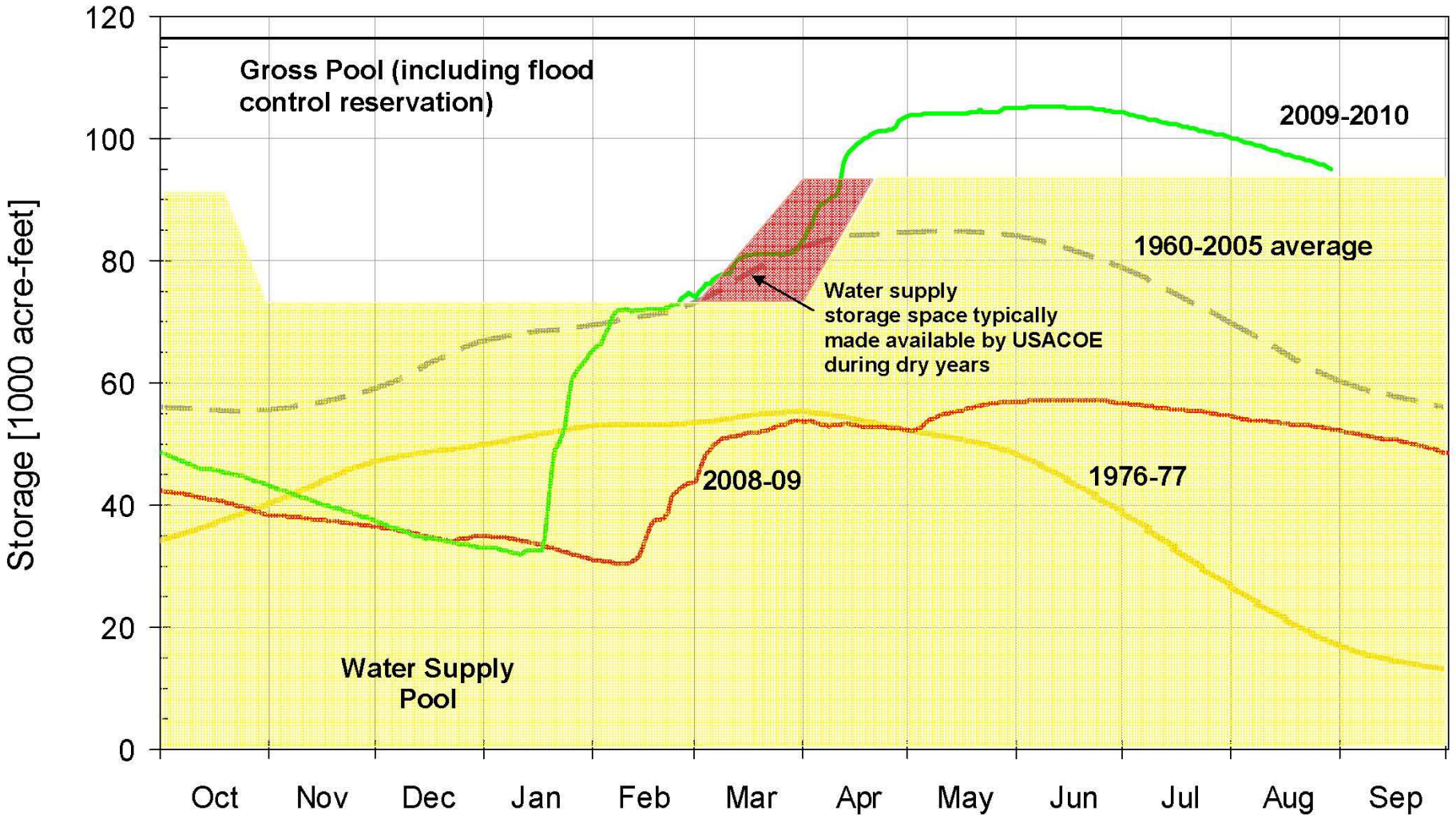
The Russian River RPA, the scope of which includes operations at Warm Springs Dam in Sonoma County and the management of the Russian River estuary at Jenner, generally prescribes a reduction in minimum instream flows downstream of Lake Mendocino, which in most years will result in the retention of additional storage, approximately 20,000 acre-feet between May and October, at Lake Mendocino – partially offsetting the storage lost due to the reduction of Eel River diversion by the PVP. However, a notable exception occurs during dry and extremely dry years. No change – no further reduction of minimum instream flows – is prescribed by the Russian River RPA for dry and extremely dry years. Consequently, in dry and extremely dry years, such as those that occurred in 1976 and 1977, and more recently in 2007 through 2009, Lake Mendocino storage will not benefit from implementation of the Russian River RPA and will continue to experience the full impact of the RPA for the PVP.

Impact of PVP and Russian River RPAs

The impact of the PVP and Russian River RPAs is generally illustrated by the reservoir storage data for the 1977, 2009 and 2010 water years (Figure 3-5). In 1977, the second and most severe year of the record setting 1976-1977 drought, nearly all of the inflow entering Lake Mendocino was attributable to PVP diversions. Based on stream flow records for the adjacent West Fork, it is estimated that runoff from within the East Fork drainage provided less than 5,000 acre-feet of the total Lake Mendocino inflow for the 1977 water year. If not for the PVP diversions, - 61,150 acre-feet - Lake Mendocino would have been dry for much of 1977.

The 2009 water year was also a dry year, though not to the degree of 1977. Based on stream flow records for the West Fork, it is estimated that runoff from within the East Fork accounted for approximately 55,000 acre-feet of the total inflow to Lake Mendocino. During the first half of the 2009 water year (October through March) PVP diversions were roughly 40 percent of corresponding 1977 diversions and less than 25 percent of historical – pre 2004 FERC Decision – averages (see Table 3-1). Lake Mendocino

Figure 3-5. Lake Mendocino Storage For Selected Years



storage declined to historic lows before the onset of mid season rains and disastrous conditions were averted in the summer and fall through a temporary reduction of minimum instream flow requirements, pursuant to a petition filed by the Sonoma County Water Agency to the SWRCB, and to a lesser extent the implementation of extreme mandatory water conservation measures (SWRCB, 2009).

The 2010 water year began with a continuation of the dry conditions experienced in 2009, then improved substantially with the arrival of significant rains in January, 2010. Overall, total runoff for the 2010 water year was slightly above average. Lake Mendocino storage in February and March was at or very near historic averages, then increased to record highs as a result of the Sonoma County Water Agency's request, which USACOE granted, to increase storage beyond the 91,000 acre-foot threshold. In past years and without this request, maximum storage would have been maintained at or near 91,000 acre-feet. Consequently, the summer began with record high storage despite PVP diversions that were still only about half of historic averages (see Table 3-1). Storage levels remained at historically high levels through July, due in large part to the implementation of the in-stream flow requirements prescribed by the Russian River RPA (SWRCB, 2010a).

Although limited, the available data suggest that the impact of the Potter Valley Project's RPA on Lake Mendocino storage will be largely, but not completely, offset through implementation of the revised minimum instream flow regime specified by the Russian River RPA. As previously noted, in normal years implementation of the Russian River RPA will reduce minimum instream flow requirements downstream of Lake Mendocino by 60 cubic feet per second (cfs) in the summer and fall, for a potential savings of 20,000 acre-feet. Conversely, based on recent PVP operations data, it appears that implementation of the RPA for the PVP, as currently crafted and interpreted, will reduce summer and fall inflow by an average of 30,000 acre-feet per year. During dry and critically dry years Lake Mendocino will continue to experience the full impact of the RPA for the PVP and as a result, there will be a pronounced decrease in Lake Mendocino storage during dry and critically dry years, as was observed in the 2009 water year.

Water Rights

The appropriative water rights for Lake Mendocino were filed on January 28, 1949 and established a key priority date for appropriative water right holders in the Russian River drainage – Pre 1949 versus Post 1949 rights (Beach, 2002). Collectively, the Pre 1949 appropriative water rights comprise approximately 8,000 acre-feet, much of which is obtained by direct diversion and subject to the availability of stream flows during the authorized diversion season – typically the summer and fall. Historically, in critically dry years there were times when no water was available for some if not all of the Pre 1949 appropriators because the water, even with the ongoing PVP diversions, wasn't physically present in the quantities needed to satisfy on going demands.

Although junior to the Pre 1949 rights, the water rights associated with Lake Mendocino allow for substantial storage – sufficient storage to accommodate water needs during critically dry periods. Accordingly, there are times when nearly all, if not all, of the water in the Russian River is solely attributable to Lake Mendocino releases and the water

rights associated with Lake Mendocino. It is the ability to provide water, even in times when little or no water is legally available to Pre 1949 water right holders, that makes Lake Mendocino an essential element of the region's dry and critically dry year supply.

Safe Yield

Pursuant to State Water Resources Control Board Water Right Decision 1030, the Lake Mendocino supply was apportioned as follows: 8,000 acre-feet for use in Mendocino County, and 37,522 acre-feet for use in Sonoma County. The above quantities were allocated on the basis of the lake's water supply potential, as determined by a "safe yield analysis" conducted in the 1950's, when the Lake Mendocino project was first conceived (Beach, 2002). The safe yield analyses that were conducted at that time were based on the available stream flow records and prevailing PVP operations, and predate the 2004 Potter Valley FERC Decision, the 2008 Biological Opinion for the Russian River, and are not necessarily reflective of current technology, such as improved stream flow monitoring, that can enhance the efficiency of reservoir operations.

A re-analysis of the Lake Mendocino Project's safe yield, which could potentially occur as a part of the forthcoming water right hearings associated with the re-opening of Water Right Decision 1610 (SWRCB, 2010b), could result in a somewhat different determination of the lake's water supply potential. It is possible that such a re-analysis would reveal the availability of additional supplemental supplies, but more likely, due in part to implementation of the RPA for the Potter Valley Project, conclude that the current allocations can only occur with the acceptance of more frequent water supply deficiencies during dry and critically dry years.

3.2 Ukiah Valley Area Water Service Providers

3.2.1 Mendocino County Russian River Flood Control and Water Conservation Improvement District

The Mendocino County Russian River Flood Control and Water Conservation Improvement District (RRFC) encompasses most but not all of the UVA (portions of Millview and Willow are not within the RRFC boundaries). The RRFC was formed to serve, along with the Sonoma County Water Agency, as the local sponsor for the development of Coyote Dam and Lake Mendocino. Pursuant to water right permit 12947B, the RRFC is authorized to divert 8,000 acre-feet per year for domestic, municipal, irrigation and recreational purposes within the RRFC service area. This water is diverted and sold as raw water to public water systems, where it is subsequently treated for municipal use, and to private agricultural entities for irrigation and frost protection purposes. As of 2010 all but approximately 500 acre-feet of the 8,000 acre-foot supply has been contracted to public water systems and agricultural entities. The balance is considered surplus water and is currently sold to the Redwood Valley County Water District (Redwood Valley), where it is used for municipal and agricultural purposes. A summary of the RRFC active water supply contracts is presented in table 3-2.

Table 3- 2 Summary of RRFC Water Supply Agreements
(All Quantities in Acre-Feet)

	Annual Contract Amount
Ukiah	800
Willow	515
Millview	1,520
Calpella	51
Rogina	192
Hopland[(a)]	400
Sub Total:	**3,478**
Agricultural Users[(b)]	4,029
Grand Total	**7,507[(c)]**

(a) Not located in the UVA
(b) Includes agricultural users not in the UVA
(c) The difference between the allocated supply and the maximum quantity available (8,000 acre-feet) is considered surplus to the needs of the RRFC water contractors and has historically been sold to the Redwood Valley County Water District.

3.2.2 Calpella County Water District

The Calpella County Water District (Calpella), the smallest of the five public water service providers, is located within the northwest corner of the UVA and currently provides water to approximately 140 residential and 25 commercial connections in the community of Calpella and surrounding area. Calpella's water supply consists of groundwater from a single groundwater well with a rated capacity of 25 gallons per minute (40 acre-feet per year), and surface water – 51 acre-feet - purchased from the RRFC and wheeled to Calpella by Millview. Limited emergency water supplies are available via an intertie with Redwood Valley. Calpella does not own or operate any water treatment facilities. Water treatment services for surface water are provided on a continuing basis by Millview.

3.2.3 Millview County Water District

The Millview County Water District (Millview) provides water service to approximately 1,300 residential connections and 210 commercial connections within a 8.5 square-mile service area, and wheels treated water to Calpella. The District is located between Calpella and Ukiah. Millview's raw water supply consists of surface water diverted from the Russian River pursuant to water rights held by the district, and a water supply contract with the RRFC. Limited emergency water supplies are available via an intertie with Ukiah.

Millview's water right portfolio currently consist of five appropriative water rights and as discussed below, could include two additional water rights, pending the outcome of on going negotiations and litigation. The most significant of the five existing water rights allows for the direct diversion of up to 1,440 acre-feet per year between November 1 and

July 1, at a maximum diversion rate of three cubic feet per second (cfs), and whenever stream flows in the Russian River equal or exceed 150 cfs at the point of diversion. The remaining four water rights allow for seasonal direct diversions that collectively provide up to 82 acre-feet per year. A summary of Millview's water rights supply, by month, is presented in Table 3-3 and Table 3-4.

Millview is currently in negotiations to purchase water rights held by Masonite for the company's former mill site, just north of Ukiah. If successful, these negotiations could increase Millview's water supply by approximately 4,000 acre-feet. However, the validity of the Masonite water right has been contested by multiple parties and it is unclear whether or not the ongoing negotiations will be successful. Similarly, Millview is engaged in negotiations that could lead to the acquisition of a pre-1914 water right of up to 1,400 acre-feet, but again, the validity of this right has been contested and is the subject of on going litigation. For the purposes of this WSA, both the Masonite water right purchase and the pre-1914 water right purchase are characterized as potential water sources that could become available at some point in the future.

All five of Millview's current appropriative water rights are junior to those of Lake Mendocino and the Pre 1949 water right holders, and therefore, there can be times during extended dry or critically dry years when there is insufficient flow in the Russian River to lawfully exercise these rights. Accordingly, Millview purchases water – 1,520 acre-feet per year – from the RRFC to ensure adequate supplies during extended dry periods. Millview has expressed a desire to obtain additional RRFC water supplies – approximately 500 acre-feet. The acquisition of these additional RRFC water supplies is reportedly in progress and will be subject to CEQA review (personal communication with Tim Bradley, Millview General Manager). For the purposes of this WSA, the supplemental RRFC water supply Millview is attempting to acquire is characterized as a potential water supply that could become available at some point in the future.

Table 3- 3. Summary of Millview Water Rights Supply
(all quantities in acre-feet)

Application Number	Priority Date	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total
A003601	**8/20/1923**	0	0	0	0	0	10.7	11.1	5.4	0	0	0	0	27.2
A017587	**5/8/1957**	184.5	168.1	184.5	178.5	184.5	178.5	0	0	0	0	178.5	184.5	1,442
A022005B	**12/17/1964**	0	0	0	0	20.9	20.2	20.9	20.9	0	0	0	0	83
A022306	**10/6/1965**	0	0	0	0	13.5	13.1	13.5	13.5	13.1	6.5	0	0	73
A023817	**6/29/1971**	0	0	1.3	2.4	1.2	0	0	0	0	0	0	0	5
Totals:		184.5	168.1	185.8	180.9	220.1	222.5	45.5	39.8	13.1	6.5	178.5	184.5	1,630

Table 3- 4. Summary of Appropriative Water Rights

Water Purveyor	Application	Permit	License	Source[a]	Priority Date	Permitted Maximum Diversion Rate, cfs[b]	Water Right Face Value, acre-feet	Period of Diversion	Purpose of Use
Ukiah	A015704	12952		RRUF	1/25/1654	20	14,480	1/1 - 12/31	Municipal
Willow	A015721	9891	6793	RRUF	2/10/1954	1	724	1/1 - 12/31	Municipal
	A017232	13935		RRUF	8/10/1956	3	1,440	11/1 - 7/1	Municipal
Millview	A003601	1711[c]	492	RR	8/20/1923	0.18	27	6/1 - 8/15	Agricultural
	A017587	13936[c]	Pending	RRUF	5/8//1957	3	1,440	11/1 - 7/1	Domestic and Municipal
	A022005B	15198	009821B	RR	12/17/1964	0.34	7	5/1 - 9/1	Irrigation
	A023817	16468	10896	RR	6/29/1971	0.04	5	3/15 - 5/15	Frost Protection
	A022306	15186	9481	RR	10/6/1965	0.22	43	5/1 - 10/15	Irrigation. Potential Conversion to Municipal

Notes:
(a) RR=Russian River
RRUF=Russian River Underflow
(b) cfs=cubic feet per second
(c) The State Water Resources Control Board has prohibited diversions under License 492 and Permit 13936 until the District's petitions for change have been reviewed and approved

3.2.4 City of Ukiah

The City of Ukiah (Ukiah) is the largest public water service provider in the UVA, providing roughly half of the UVA public water supply. The City, which is located between Willow to the south and Millview to the north, provides water service to approximately 5,800 connections. Ukiah's raw water supply is obtained from groundwater, Russian River underflow, and a water supply contract with the RRFC. Limited emergency water supplies are available via interties with Millview and Willow.

The City's existing water right allows for the direct diversion of up to 14,480 acre-feet per year, at a maximum diversion rate of 20 cfs, from January 1 through December 31 of each year. Pursuant to Water Right Decision 1030, a portion of Ukiah's water right – 2,027 acre-feet per year, at a maximum diversion rate of 2.8 cfs – is classified as a Pre 1949 water right that is senior to the Lake Mendocino water right. While the balance – 12,453 acre-feet per year, at a maximum diversion rate of 17.2 cfs – is characterized as a Post 1949 water right. In either case, there are times during extended dry and critically dry years when there is insufficient surface or underflow to lawfully exercise these rights. Accordingly, the City purchases water – 800 acre-feet per year – from the RRFC to augment groundwater sources and to ensure adequate supplies during extended dry periods.

3.2.5 Rogina Water Company

The Rogina Water Company (Rogina) is a private entity that provides water service to approximately 990 residential service connections within a 9 square-mile service area located approximately one-half mile east of Ukiah. Rogina's water supply consists of surface water – 400 acre-feet per year – purchased from the RRFC, and four groundwater wells, at least some of which may be drawing from Russian River underflow as opposed to percolating groundwater (CDPH, 2007).

3.2.6 Willow County Water District

The Willow County Water District (Willow) provides water service to approximately 990 residential and 60 commercial connections within a 4 square-mile service area located immediately south of Ukiah, within the southwest portion of the UVA. Willow's raw water supply is obtained from the Russian River pursuant to water rights held by the district, and a water supply contract with the RRFC. Limited emergency water supplies are available via an intertie with Ukiah.

The district's water right portfolio consist of an appropriative water right that allows for the direct diversion of up to 1,400 acre-feet per year between November 1 and July 1, at a maximum diversion rate of three cfs, whenever stream flows in the Russian River equal or exceed 150 cfs at the point of diversion; and a second appropriative water right that allows for the diversion of up to 728 acre-feet per year, at a maximum diversion rate of one cfs, from January 1 through December 31. Both appropriative water rights are junior to those of Lake Mendocino and the Pre 1949 water right holders and therefore, there can be times during extended dry and critically dry years when there is insufficient flow in the Russian River to lawfully exercise these rights. Accordingly, the district purchases 515 acre-feet per year from the RRFC to ensure adequate supplies during extended dry periods (Table 3-4 and Table 3-5).

Table 3- 5. Summary of Willow Water Rights Supply
(all quantities in acre-feet)

Application Number	Priority Date	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total
A015721	2/10/1954	61.5	56.0	61.5	59.5	61.5	59.5	61.5	61.5	59.5	61.5	59.5	61.5	724.5
A017232	8/10/1956	184.5	168.1	184.5	178.5	184.5	178.5	0	0	0	0	178.5	184.5	1,441.6
Totals:		246	224.1	246	238	246	238	61.5	61.5	59.5	61.5	238	246	2,166.1

3.2.7 Redwood Valley County Water District

The Redwood Valley County Water District (Redwood Valley) is located immediately north of the UVA and does not provide water to the UVAP study area. However, the district withdraws water directly from Lake Mendocino, which is located in the UVA, and purchases surplus water from the RRFC – water that could be used to satisfy future water demands of the UVA public water service providers and other RRFC water contractors.

Redwood Valley currently delivers approximately 750 acre-feet for residential and commercial uses, and 1,450 acre-feet for agricultural purposes – a combined total annual demand of 2,200 acre-feet per year. The district's water supply is tenuous and consists of a largely un-exercisable right to divert up to 4,900 acre-feet directly from Lake Mendocino, between November 1 and April 30 of each year, and surplus water supplies from RRFC and the Sonoma County Water Agency. Water diversions made pursuant to the district's Lake Mendocino water right can only occur in instances when stream flows in the Russian River main stem, as measured at the confluence of the East and West forks, exceed 150 cfs and Lake Mendocino storage exceeds 72,000 acre-feet – a relatively narrow window of opportunity that is estimated to be as much as 70 days in wet years, but as little as one or two days in dry years (MCWA, 2004).

By definition, the water being sold to Redwood Valley by the RRFC and the Sonoma County Water Agency are surplus to the on going needs of the two respective organizations. Implementation of the UVAP and/or, as in the case of Rogina and Calpella, a determination that on going groundwater extractions are, for regulatory purposes, diversions of Russian River underflow (see Section 4.0), could eliminate existing surpluses and deprive Redwood Valley of an essential supply. Although there is arguably no obligation to do so, it is also conceivable that in order to protect the health and safety of the district's residents, a policy decision is made whereby the RRFC's surplus water supplies that are currently being used for residential and commercial purposes are formally allocated to Redwood Valley, which would preclude the RRFC surplus water supply from being used to meet, at least in part, future water demands in the UVA.

3.2.8 Hopland Public Utility District

The Hopland Public Utility District (Hopland) is located south of the UVA and like Redwood Valley, does not provide water to the UVAP study area. However, Hopland purchases water – up to 400 acre-feet per year – from the RRFC and as a long standing RRFC customer is arguably entitled to contract for additional RRFC water supplies, should the RRFC make additional supplies available. Hopland currently provides water to approximately 350 service connections, as well as a nearby tribally owned casino. Current annual water demands are estimated on the order of 350 acre-feet.

3.3 Assessment of Normal and Dry Year Surface Water Supplies

During normal hydrologic years there has historically been sufficient stream flows in the Russian River for the UVA public water service providers to fully exercise their respective

surface water rights, or in the case of Ukiah, to the full extent necessary to meet on going demands. Collectively, the surface water rights of the five UVA public water service providers constitute a maximum instantaneous diversion rate of approximately 28 cfs, the majority of which – 20 cfs – is attributable to Ukiah. Similarly, there has historically been sufficient storage in Lake Mendocino to satisfy all RRFC contractual entitlements during normal years. Neither the availability of natural surface stream flows nor the ability of Lake Mendocino to provide the RRFC's 8,000 acre-foot entitlement is expected to be significantly reduced in future normal hydrologic years.

During dry and particularly critically dry years the availability of natural surface stream flows is greatly diminished. As previously discussed, prior to the construction of Coyote Valley Dam and Lake Mendocino, portions of the Russian River typically went dry or nearly dry, in dry and critically dry years. In extremely dry years, such as 1976 and 1977, none of the Pre 1949 much less the Post 1949 water rights – including those held by the various UVA public water service providers – could be considered a reliable supply. Exactly which water rights would be un-exercisable, and for how long, would depend on the prevailing hydrologic conditions. In the absence of a water rights adjudication, in which the rights of each water holder are substantiated and monitored by a water master, a more precise determination of the available natural surface water supply in dry and critically dry years cannot be made. For the purposes of this WSA it is assumed that none of the surface water rights held by the various UVA public water service providers are legally exercisable during the months of July through October of critically dry years or for extended dry periods.

During the summer and fall of dry and particularly critically dry years, Lake Mendocino is the only significant, reliable source of surface water in the UVA. Although the reservoir has generally been able to provide full contractual allocations – i.e., the RRFC's entire 8,000 acre-foot allocation – in dry and critically dry years, it is important to note that the reservoir and more specifically the water supply allocations that were prescribed in Water Right Decision 1030 (SWRCB, 1961), were predicated on the assumption that water supply deficiencies would occur during critically dry years (Beach, 2002). Water Right Decision 1610 (SWRCB, 1986) includes provisions whereby the Sonoma County Water Agency must reduce diversions from Lake Mendocino whenever lake storage is less than 30,000 acre-feet. In 2009, in response to unprecedentedly low storage levels created in part by the reduction of Eel River diversions by the PVP, the SWRCB imposed a 50 percent mandatory rationing requirement on the Lake Mendocino water users in Mendocino County (SWRCB, 2009).

Unfortunately, until a reanalysis of the reservoir safe yield is conducted, an analysis that at a minimum accounts for the recently implemented RPA's for the PVP and the Russian River, it will remain unclear as to how frequently and the extent to which water supply deficiencies can be expected in future dry and critically dry years. For the purposes of this WSA and until more definitive information is available, it is assumed that Lake Mendocino water supply deficiencies of 25 percent, and in extreme cases 50 percent, will continue to occur in future dry and critically dry years.

SECTION 4. GROUNDWATER SUPPLIES

4.1 Ukiah Valley Groundwater Basin

The 56 square-mile Ukiah Valley groundwater basin, designated as groundwater basin 1-51 by the Department of Water Resources (DWR, 2004), is located in southeastern Mendocino County and encompasses the Ukiah and adjacent Redwood valleys (Figure 4-1). Although there are anecdotal reports of localized overdrafting, the basin as a whole is reportedly not experiencing overdraft conditions (DWR, 2004). As discussed elsewhere, the most significant issue regarding the Ukiah Valley groundwater basin is not the potential for overdrafting, but whether or not all or at least most of the "groundwater" in the basin is, for legal purposes, underflow from the Russian River and associated tributaries. This section summarizes the principal hydrogeologic features of the Ukiah Valley groundwater basin, groundwater elevation and historical pumping trends, and concludes with a discussion of the basin's potential to provide a potable water supply.

4.1.1 Hydrogeology

The Ukiah Valley groundwater basin lies within the Coast Range geomorphic province. The geology of the Ukiah and adjacent Redwood valleys is composed of four principal geologic units; the Cretaceous-aged Franciscan Formation, the Pliocene and Pleistocene Continental basin deposits, Pleistocene Terrace deposits, and Quaternary Recent Alluvium (Figure 4-1 through Figure 4-4).

Franciscan Formation (Kjf)

The Franciscan Formation, the oldest of the Ukiah Valley's four geologic units, underlies the entire Ukiah Valley groundwater basin and comprises the ridges that surround the valley (DWR, 2004). In general, the Franciscan Formation, which consists of consolidated marine rocks, sandstone, siltstone, shale, chert, serpentine, greenstone, and schist is not considered to be a particularly reliable or economically significant source of groundwater.

Continental Basin Deposits (Qp)

The Continental basin deposits overlie the Franciscan Formation in the Ukiah and Redwood valleys and consist primarily of poorly sorted, heterogeneous mixtures of gravel, sand, silt, and the predominate material – clay. The thickness of the Continental basin deposits ranges from essentially zero along the margins of the two valleys to as much as 2,000 feet in the Ukiah Valley floor. Clay occurs both as beds, as much as several tens of feet thick, and as interstitial material between sand and gravel. The high clay content and poor sorting result in low permeability. However, porosity is high due to the lack of cementing. Because permeable materials are interbedded with impermeable clays, groundwater occurs under confined conditions.

Wells completed in the continental deposits typically produce water slowly – 0.75 to 50 gallons per minute. Dry holes are not uncommon. In summary, due to their thickness,

areal extent and porosity, the Continental basin deposits store substantial quantities of water, but due to low permeability yields water slowly to wells (USGS 1965; USGS, 1968).

Terrace Deposits (Qt)

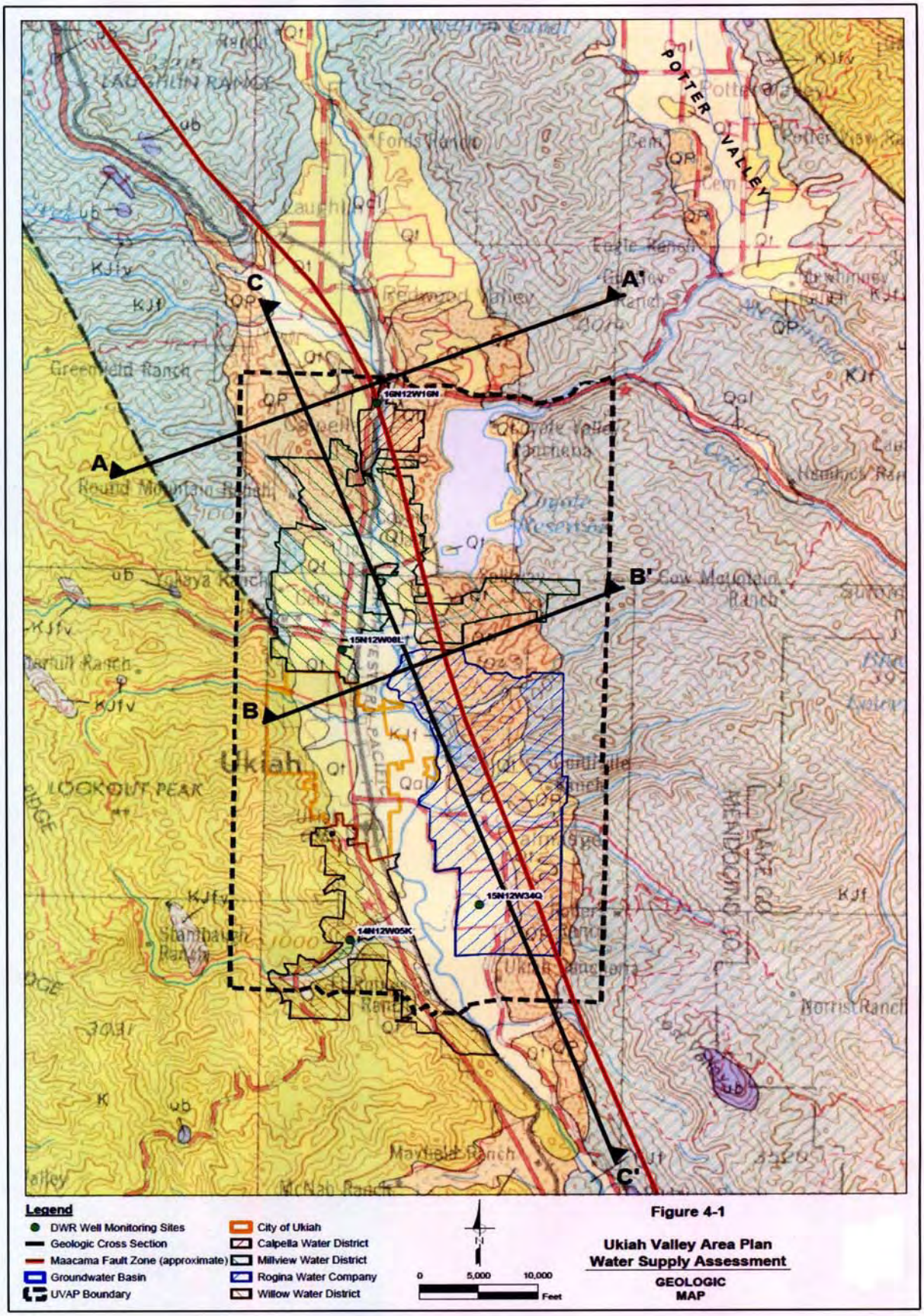
The Pleistocene-aged Terrace deposits overlie the Continental basin deposits and occur discontinuously along the edges of the Ukiah Valley, on both sides of the Russian River, and more continuously throughout Redwood Valley (DWR, 2004). The thickness of the Terrace deposits range from essentially zero along the margins of the two valleys to over 100 feet thick in portions of the Ukiah Valley (USGS, 1968). The Terrace deposits are generally unconsolidated and lithologically similar to the Continental basin deposits, but contain less silt and clay. Consequently, the permeability of the Terrace deposits is somewhat higher than the corresponding Continental basin deposits. Groundwater occurs under confined as well as unconfined conditions, depending on site specific lithology. Wells completed in terrace deposits generally yield one to 10 gallons per minute, however, yields as high as 100 gallons per minute have been reported (USGS, 1968). In general, the Terrace deposits are not considered to be a major source of groundwater because they are relatively thin and exhibit comparatively low permeabilities.

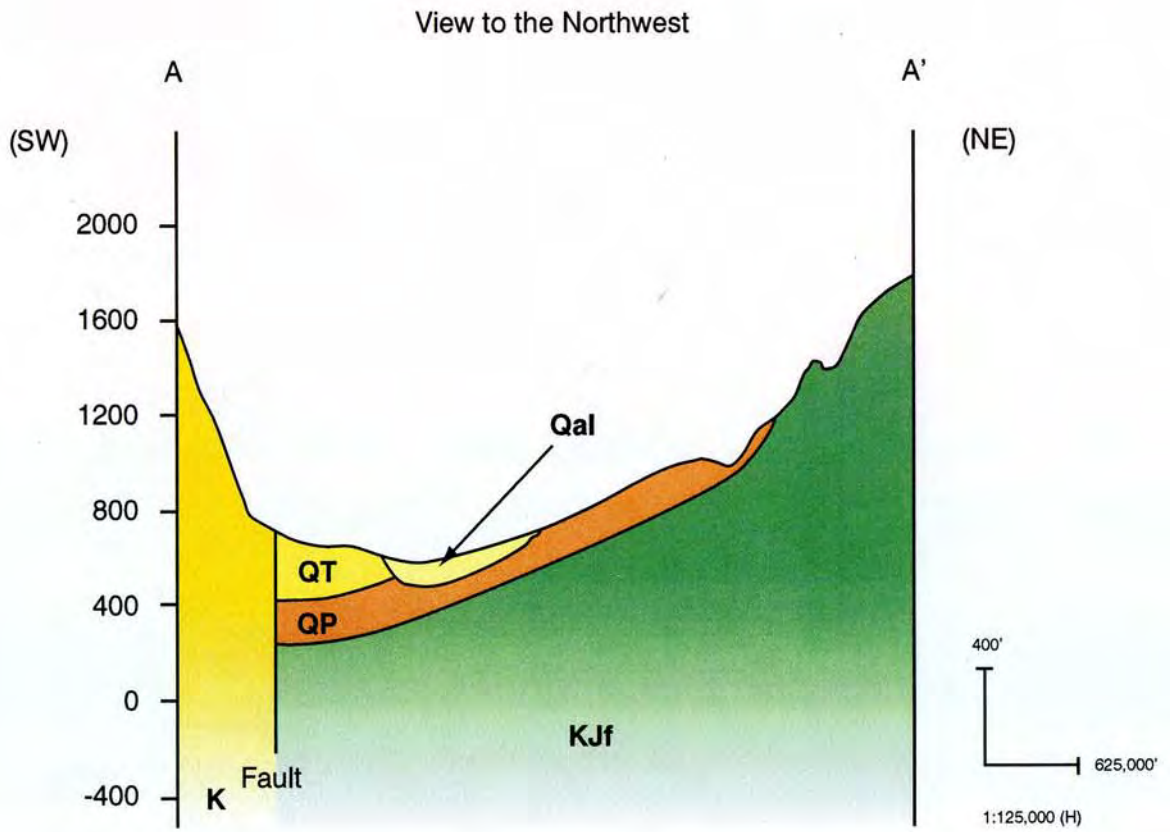
Recent Alluvium (Qal)

Recent Alluvium deposits typically occur as narrow bands along tributary streams and the West Fork of the Russian River in Redwood Valley, and throughout the comparatively wide floodplain of the Russian River, in the Ukiah Valley. In general, the Recent Alluvium deposits range in thickness from 10 to over 100 feet and consist of unconsolidated gravels, sands, silts, and to a lesser extent clay (DWR, 2004). The porosity and permeability of the Recent Alluvium deposits is typically high, groundwater occurs under unconfined conditions. Wells completed in the Recent Alluvium deposits, particularly east of the Russian River and south of Talmage, reportedly yield as much as 1,200 gallons per minute (DWR, 2004).

The high porosity and permeability of the Recent Alluvium allows for considerable recharge by precipitation (USGS, 1965; USGS, 1968). Due to the close proximity to the Russian River, water readily moves between the Recent Alluvium deposits and active river channel. The Recent Alluvium deposits constitute the most productive aquifer in the Ukiah Valley and can provide sufficient water for sustained pumpage from municipal and irrigation wells. However, as discussed in section 4.1.2, institutional constraints related to the differentiation of percolating groundwater versus underflow may seriously limit the future availability of this supply.

Figure 4- 1. Geologic Map



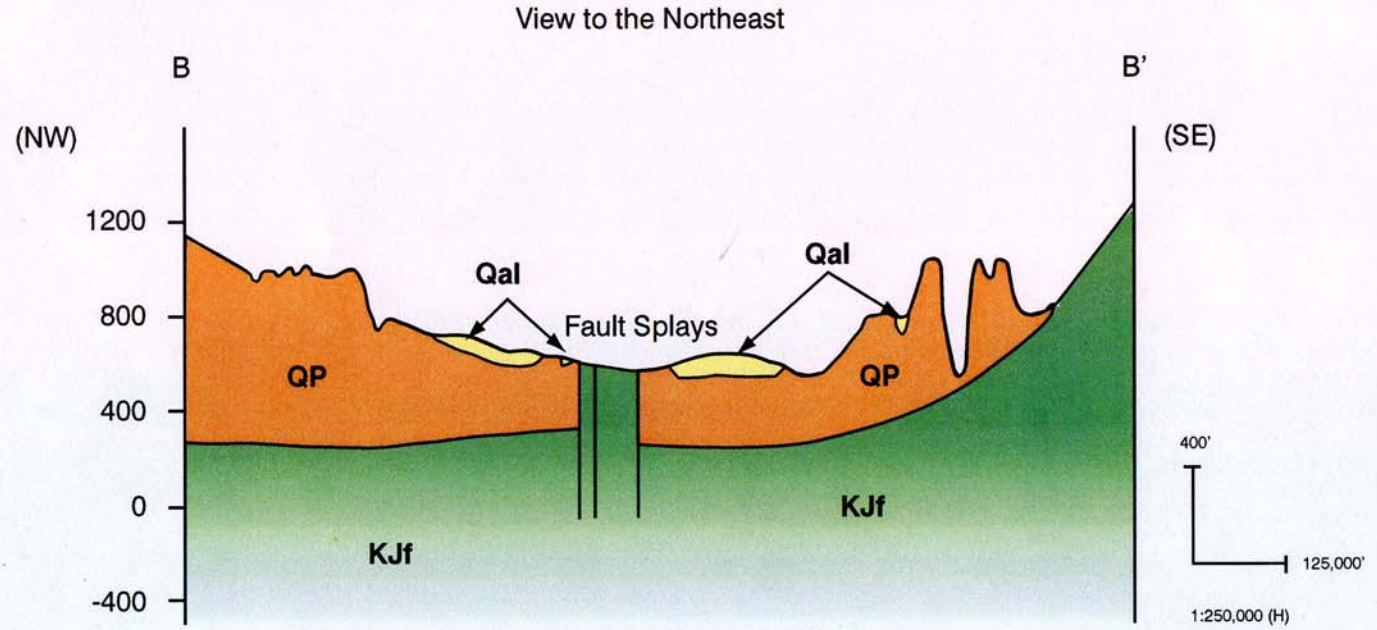


Note:
Refer to Figure 4-1 for cross section locations.
Refer to text for explanation of geologic symbols.

Figure 4-2

Ukiah Valley Area Plan
Water Supply Assessment

DRAFT GEOLOGIC CROSS SECTION A-A'

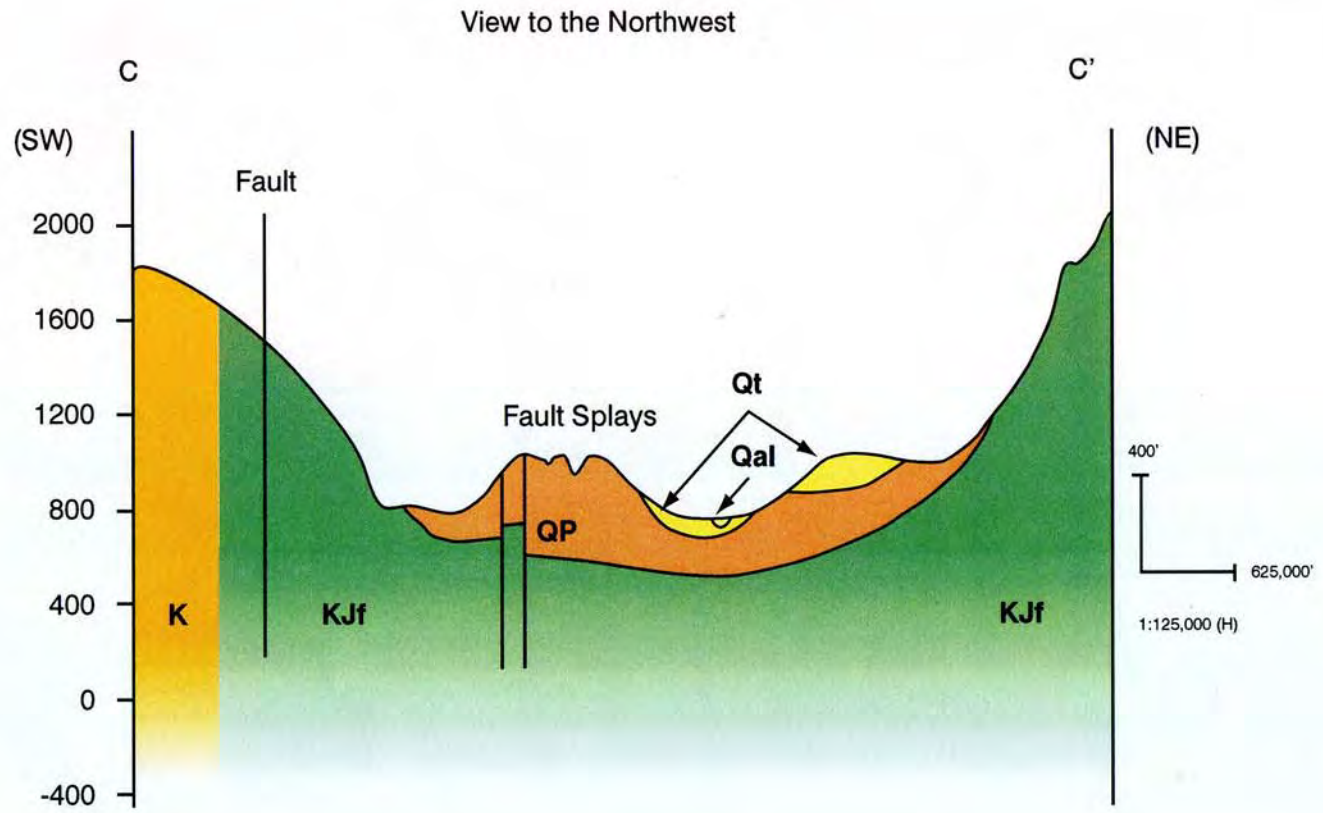


Note:
Refer to Figure 4-1 for cross section locations.
Refer to text for explanation of geologic symbols.

Figure 4-3

Ukiah Valley Area Plan
Water Supply Assessment

DRAFT GEOLOGIC CROSS SECTION B-B'



Note:
Refer to Figure 4-1 for cross section locations.
Refer to text for explanation of geologic symbols.

Figure 4-4

Ukiah Valley Area Plan
Water Supply Assessment

DRAFT GEOLOGIC CROSS SECTION C-C'

4.1.2 Groundwater Elevations and Availability

The Ukiah Valley groundwater basin reportedly has a usable storage capacity of 90,000 acre-feet and is fully recharged each year, except in years when precipitation is less than approximately 60 percent of normal (USGS, 1968). The principal sources of recharge for the Ukiah Valley groundwater basin are precipitation and to a lesser extent surface water infiltration (USGS, 1968). Although relatively limited, the available data indicate that groundwater elevations have remained stable since at least the 1960s, declining somewhat during periods of drought but then quickly recovering to pre-drought levels (DWR 2004; USGS, 1968). Average seasonal fluctuations range from 5 to 15 feet, with groundwater elevations generally highest in March or April, immediately after the winter rains, and lowest in the month of October, just prior to the onset of the next rainy season.

Groundwater typically moves from the margins of the Ukiah Valley to the Russian River, then southerly, toward Sonoma County. The movement of groundwater in the vicinity of the Russian River is highly variable, both spatially and temporally. Groundwater elevation data for shallow wells near the Russian River indicate that there are locations and times when surface water from the Russian River infiltrates the adjacent aquifer and by legal definition, constitutes underflow that is subject to the jurisdiction of the SWRCB. Within recent years the SWRCB has asserted that all of the groundwater in the Ukiah Valley, including groundwater associated with the deeply underlying Continental basin deposits, is underflow. While it is clear from the available data that there are locations and times where underflow occurs, the available data are arguably insufficient to support the contention that virtually all groundwater in the Ukiah Valley is by definition underflow – unless the definition of underflow is expanded.

A regulatory determination that all groundwater in the Ukiah Valley is underflow could create considerable uncertainty, not only with regard to the region's groundwater supply, but the surface water supply as well. In such a scenario individuals and entities that are currently extracting groundwater – or thought they were – could be required to file for appropriative water rights, which would be junior to all existing appropriative water rights and given the SWRCB's previous determination that the Russian River drainage is fully appropriated in the summer and fall (SWRCB, 1998), would, even if they were granted, most likely prohibit the continuation of extractions in the summer and fall. Accordingly, the demand for surface water sources – to replace groundwater – would likely increase. In at least some instances the only economically viable source of water available to rural properties in the Ukiah Valley is groundwater and therefore, the deprivation of the groundwater supply could have significant economic consequences for the Ukiah Valley and the county as a whole

4.1.3 Groundwater Pumping

Historical groundwater extraction data for Ukiah Valley are limited and therefore must be inferred from agricultural crop records and municipal groundwater production data reported by Calpella, Millview, Ukiah, Rogina and Willow. The University of California Cooperative Extension (D.J. Lewis et. al., 2008) estimates that each year approximately 8,000 acre-feet of water is consumptively used for agricultural purposes in the Ukiah Valley. The available data are limited but suggest that a portion of this total – 2,500 acre-feet to

5,500 acre-feet – is derived from groundwater sources. Similarly, recent annual municipal groundwater extraction records indicate that each year approximately 2,000 acre-feet of groundwater is used for municipal purposes (Table 4-1), and therefore, the combined total groundwater extraction rate for the Ukiah Valley – the combination of agricultural and municipal uses - is estimated to be between 4,500 acre-feet and 7,500 acre-feet per year.

Because nearly all of the irrigable land in the Ukiah Valley is already in production, future agricultural water demands are not expected to increase appreciably unless there is a pronounced shift toward crops with higher water demands (D.J. Lewis et. al., 2008). Similarly, other than Ukiah, which anticipates increasing groundwater extractions by approximately 800 acre-feet, from 1,075 acre-feet in 2006 to 1,875 acre-feet by as soon as 2010 (Ukiah, 2007), no substantial increase in future municipal groundwater extraction rates is currently planned.

Table 4- 1. Historical Groundwater Pumping in Acre-Feet [(a)]

Water Purveyor	2000	2001	2002	2003	2004	2005	2006
Calpella	34	33	30	36	35	33	33
Millview	0	0	0	0	0	0	0
Ukiah[(b)]	340	810	906	1,030	976	1,048	1,075
Rogina	642	694	687	632	668	563	635
Willow[(c)]	N/A	N/A	N/A	N/A	N/A	N/A	N/A

(a) Source: California Department of Public Health (2007) unless otherwise noted.
(b) Source: Ukiah (2007)
(c) Willow does not distinguish between Russian River underflow and percolating groundwater.

4.2 Groundwater Sufficiency

Based on the available data it appears that the Ukiah Valley groundwater basin is not in overdraft conditions and that current groundwater extraction rates remain well within sustainable yields. As previously discussed, groundwater elevations have been reasonably steady since the 1960's. In view of the comparatively large storage capacity of the Ukiah Valley groundwater basin, relative to existing groundwater extraction rates and the relatively modest projected incremental increase in water demands, less than 4,300 acre-feet by 2030, it would appear that there is sufficient groundwater to satisfy the UVA water service provider's future demands. However, the SWRCB's assertion that virtually all of the groundwater in the Ukiah Valley is underflow creates considerable uncertainty as to the institutional availability of this supply, and therefore, at least for now, it is assumed that none of the groundwater in the Ukiah Valley is available for future growth.

SECTION 5. POTENTIAL IMPACT OF CLIMATE CHANGE

5.1 Overview

California's climate is expected to change considerably over the next 50 years and while these changes cannot be predicted with precision or certainty, there is general consensus that in the future, California will continue to experience a Mediterranean-type climate, but with more extreme conditions and a continuing reduction in winter snows (Luers et. al., 2008; Moser et. al., 2009; California Natural Resources Agency, 2009). By 2050 the average annual temperature of the state is projected to rise approximately 2 to 4 degrees Fahrenheit, and over time the total faction of precipitation that falls as snow to decrease, with a corresponding but not necessarily commensurate increase in precipitation as rain. Most climatic projections forecast comparatively little change in the overall annual amount of precipitation, but instead a tendency toward greater winter and lower spring precipitation totals.

Based on the projected climatic changes, it is anticipated that the opportunities to capture and store water for urban and agricultural purposes will become increasingly limited, to what is expected to become a shorter but more intense rainfall period in the winter months. Water demands, particularly for agricultural purposes, are expected to increase as a result of longer and potentially drier conditions during the spring and summer (DWR, 2008; DWR, 2009).

5.2 Potential Impacts to Surface Water Supplies

Because most of the runoff in the Russian River and Eel River drainages already originates as rainfall versus snow, the projected reduction in future snow accumulations is not expected to significantly impact the UVA's surface water supplies. However, the projected diminution of late season rains, which can provide a significant source of inflow to Lake Mendocino and blunt early season irrigation demands, is of concern. Likewise, any expansion of the irrigation season, due to increasing temperatures or the total number of dry days is problematic, as it would most likely increase water demands. In addition to impacting Lake Mendocino storage, a diminution of late season rains could reduce the availability of natural stream flows currently being diverted by UVA public water service providers in the spring and summer, pursuant to existing water rights. Although limited, the available data suggest that the impact of the projected climatic changes on Lake Mendocino storage could be mitigated, at least in part, through a modification of reservoir operations – changes that would allow for the retention of more water earlier in the spring and what has traditionally been considered late winter.

5.3 Potential Impacts to Groundwater Supplies

The Ukiah Valley groundwater basin is currently fully recharged each year, except in critically dry years, and groundwater extractions appear to be well within sustainable yields. Consequently, the projected reductions in annual precipitation are not likely to significantly impact the UVA's groundwater supply. Even with somewhat reduced annual precipitation totals, it appears likely that the Ukiah Valley groundwater basin will continue to be fully recharged each year, except possibly in critically dry years.

SECTION 6. WATER SUPPLY SUFFICIENCY

6.1 Water Supply Assumptions

The ability of each UVA public water service provider to meet existing and projected future water demands varies and is a function of the relative amounts and sources of water that comprise their respective "water supply portfolios". Water supplies that are available in reasonable quantities during extended dry and critically dry years, such as percolating groundwater or the RRFC's Lake Mendocino supply, are particularly valuable. Conversely, groundwater extracted from the Recent Alluvium or surface water rights for diversions in the late summer and fall are much less reliable and therefore of lower value.

This water supply sufficiency analysis is based on a comparison of the projected future water demands of each UVA public water service provider, as characterized in section 2.0, and their respective water supplies, as characterized in section 3.0 and section 4.0, and relies on the following assumptions regarding the availability of the various water sources during normal, single dry, multiple dry and critically dry years:

Normal and Single Dry Years

Water Source	Availability
RRFC Lake Mendocino Supply	100 %
Surface Water/Underflow rights	100%
Percolating Groundwater	100%

Multiple Dry and Critically Dry Years

Water Source	Availability
RRFC Lake Mendocino Supply	75%
Surface Water/Underflow rights	not available July through October
Percolating Groundwater	100%

6-2. Comparison of Supply versus Projected Demand

The sufficiency of each UVA public water service water provider's water supply, as determined from the comparison of available supplies versus projected demands, is summarized in Table 6-1 through Table 6-4 and discussed below.

Calpella

The Calpella County Water District's current water supplies are barely sufficient to meet existing water demands and clearly insufficient to satisfy the projected future demands associated with UVAP implementation. Based on the projected water demands and assuming that in the future the district's groundwater supplies are classified as underflow, versus percolating groundwater, it is estimated that an additional 200 to 250 acre-feet supply would be needed to satisfy the projected 2030 water demands associated with implementation of the UVAP's Preferred Project land use alternative. Somewhat lesser amounts would be required to satisfy the projected 2030 water demands associated with implementation of the UVAP's other land use alternatives.

Table 6- 1. Water Supply Sufficiency by UVA Public Water Service Provider-Preferred Project (all quantities in acre-feet)

	2010	2015	2020	2025	2030
Calpella County Water District					
Water Demands					
Table 2-9 (no 20x20 conser)	142	179	217	254	292
With 20x20 conservation	114	143	174	203	234
Water Supply					
Normal/Single Dry Year					
Lake Mendocino	51	51	51	51	51
Groundwater[(a)]	40	40	40	40	40
Totals:	**91**	**91**	**91**	**91**	**91**
Extended/Critical Dry Year					
Lake Mendocino	38	38	38	38	38
Groundwater[(a)]	40	40	40	40	40
Totals:	**78**	**78**	**78**	**78**	**78**
Millview County Water District					
Water Demands					
Table 2-9 (no 20x20 conser)	1,787	2,223	2,666	3,104	3,541
With 20x20 conservation	1,430	1,778	2,133	2,483	2,833
Water Supply					
Normal/Single Dry Year					
Lake Mendocino	1,520	1,520	1,520	1,520	1,520
Surface Water Rights	1,522	1,522	1,522	1,522	1,522
Totals:	**3,042**	**3,042**	**3,042**	**3,042**	**3,042**
Extended/Critical Dry Year					
Lake Mendocino	1,140	1,140	1,140	1,140	1,140
Surface Water Rights[(b)]	1,525	1,525	1,525	1,525	1,525
Totals:	**2,665**	**2,665**	**2,665**	**2,665**	**2,665**
City of Ukiah					
Water Demands					
Table 2-9 (no 20x20 conser)	4,192	4,296	4,398	4,502	4,668
With 20x20 conservation	3,354	3,437	3,518	3,602	3,734
Water Supply					
Normal/Single Dry Year					
Lake Mendocino	800	800	800	800	800
Groundwater[(c)]	1,895	1,895	1,895	1,895	1,895
Underflow Rights[(d)]	7,240	7,240	7,240	7,240	7,240
Totals:	**9,935**	**9,935**	**9,935**	**9,935**	**9,935**
Extended/Critical Dry Year					
Lake Mendocino	600	600	600	600	600
Groundwater[(b)]	1,895	1,895	1,895	1,895	1,895
Underflow Rights[(d)]	5,430	5,430	5,430	5,430	5,430
Totals:	**7,925**	**7,925**	**7,925**	**7,925**	**7,925**

Table 6-1 continued

	2010	2015	2020	2025	2030
Rogina Water Company					
Water Demands					
Table 2-9 (no 20x20 conser)	695	739	784	828	872
With 20x20 conservation	556	591	627	662	698
Water Supply					
Normal/Single Dry Year					
Lake Mendocino	400	400	400	400	400
Groundwater[(e)]	200	200	200	200	200
Totals:	**600**	**600**	**600**	**600**	**600**
Extended/Critical Dry Year					
Lake Mendocino	300	300	300	300	300
Groundwater[(e)]	200	200	200	200	200
Totals:	**500**	**500**	**500**	**500**	**500**
Willow County Water District					
Water Demands					
Table 2-9 (no 20x20 conser)	1,301	1,451	1,602	1,752	1,904
With 20x20 conservation	1,041	1,161	1,282	1,402	1,523
Water Supply					
Normal/Single Dry Year					
Lake Mendocino	515	515	515	515	515
Surface Water Rights	2,166	2,166	2,166	2,166	2,166
Totals:	**2,681**	**2,681**	**2,681**	**2,681**	**2,681**
Extended/Critical Dry Year					
Lake Mendocino	386	386	386	386	386
Surface Water Rights[(f)]	1,922	1,922	1,922	1,922	1,922
Totals:	**2,308**	**2,308**	**2,308**	**2,308**	**2,308**
Not in District					
Water Demands					
Table 2-9 (no 20x20 conser)	323	861	1,396	1,931	2,467
With 20x20 conservation	258	689	1,117	1,545	1,974
Water Supply					
Normal/Single Dry Year					
Lake Mendocino	0	0	0	0	0
Groundwater	0	0	0	0	0
Totals:	**0**	**0**	**0**	**0**	**0**
Extended/Critical Dry Year					
Lake Mendocino	0	0	0	0	0
Groundwater	0	0	0	0	0
Totals:	**0**	**0**	**0**	**0**	**0**

(a) Existing groundwater source assumed to be percolating groundwater.
(b) Assumes no water available for diversion from July through August (see Table 3-4).
(c) Source: Ukiah, 2007.
(d) Assumes that existing water right permit 12952 will ultimately be licensed for one-half permit's face value (14,480 acre-feet per year, 20 cfs maximum diversion rate).
(e) Assumes some of existing groundwater supply will continue to be classified as percolating groundwater.
(f) Assumes no water available for diversion from July through August (see Table 3-5).

Table 6- 2. Water Supply Sufficiency by UVA Public Water Service Provider- Alternative A (all quantities in acre-feet)

	2010	2015	2020	2025	2030
Calpella County Water District					
Water Demands					
Table 2-10 (no 20x20 conser)	142	179	217	254	292
With 20x20 conservation	114	143	174	203	234
Water Supply					
Normal/Single Dry Year					
Lake Mendocino	51	51	51	51	51
Groundwater[(a)]	40	40	40	40	40
Totals:	**91**	**91**	**91**	**91**	**91**
Extended/Critical Dry Year					
Lake Mendocino	38	38	38	38	38
Groundwater[(a)]	40	40	40	40	40
Totals:	**78**	**78**	**78**	**78**	**78**
Millview County Water District					
Water Demands					
Table 2-10 (no 20x20 conser)	1,719	2,051	2,380	2,707	3,039
With 20x20 conservation	1,375	1,641	1,904	2,166	2,431
Water Supply					
Normal/Single Dry Year					
Lake Mendocino	1,520	1,520	1,520	1,520	1,520
Surface Water Rights	1,522	1,522	1,522	1,522	1,522
Totals:	**3,042**	**3,042**	**3,042**	**3,042**	**3,042**
Extended/Critical Dry Year					
Lake Mendocino	1,140	1,140	1,140	1,140	1,140
Surface Water Rights[(b)]	1,525	1,525	1,525	1,525	1,525
Totals:	**2,665**	**2,665**	**2,665**	**2,665**	**2,665**
City of Ukiah					
Water Demands					
Table 2-9 (no 20x20 conser)	4,192	4,296	4,398	4,502	4,668
With 20x20 conservation	3,354	3,437	3,518	3,602	3,734
Water Supply					
Normal/Single Dry Year					
Lake Mendocino	800	800	800	800	800
Groundwater[(c)]	1,895	1,895	1,895	1,895	1,895
Underflow Rights[(d)]	7,240	7,240	7,240	7,240	7,240
Totals:	**9,935**	**9,935**	**9,935**	**9,935**	**9,935**
Extended/Critical Dry Year					
Lake Mendocino	600	600	600	600	600
Groundwater[(b)]	1,895	1,895	1,895	1,895	1,895
Underflow Rights[(d)]	5,430	5,430	5,430	5,430	5,430
Totals:	**7,925**	**7,925**	**7,925**	**7,925**	**7,925**

Table 6-2. Continued

	2010	2015	2020	2025	2030
Rogina Water Company					
Water Demands					
Table 2-10 (no 20x20 conser)	695	739	784	828	872
With 20x20 conservation	556	591	627	662	698
Water Supply					
Normal/Single Dry Year					
Lake Mendocino	400	400	400	400	400
Groundwater[(e)]	200	200	200	200	200
Totals:	**600**	**600**	**600**	**600**	**600**
Extended/Critical Dry Year					
Lake Mendocino	300	300	300	300	300
Groundwater[(e)]	200	200	200	200	200
Totals:	**500**	**500**	**500**	**500**	**500**
Willow County Water District					
Water Demands					
Table 2-10 (no 20x20 conser)	1,301	1,451	1,602	1,752	1,904
With 20x20 conservation	1,041	1,161	1,282	1,402	1,523
Water Supply					
Normal/Single Dry Year					
Lake Mendocino	515	515	515	515	515
Surface Water Rights	2,166	2,166	2,166	2,166	2,166
Totals:	**2,681**	**2,681**	**2,681**	**2,681**	**2,681**
Extended/Critical Dry Year					
Lake Mendocino	386	386	386	386	386
Surface Water Rights[(f)]	1,922	1,922	1,922	1,922	1,922
Totals:	**2,308**	**2,308**	**2,308**	**2,308**	**2,308**
Not in District					
Water Demands					
Table 2-10 (no 20x20 conser)	302	799	1,300	1,796	2,298
With 20x20 conservation	242	639	1,040	1,437	1,838
Water Supply					
Normal/Single Dry Year					
Lake Mendocino	0	0	0	0	0
Groundwater	0	0	0	0	0
Totals:	**0**	**0**	**0**	**0**	**0**
Extended/Critical Dry Year					
Lake Mendocino	0	0	0	0	0
Groundwater	0	0	0	0	0
Totals:	**0**	**0**	**0**	**0**	**0**

(a) Existing groundwater source assumed to be percolating groundwater.
(b) Assumes no water available for diversion from July through August (see Table 3-4).
(c) Source: Ukiah, 2007.
(d) Assumes that existing water right permit 12952 will ultimately be licensed for one-half permit's face value (14,480 acre-feet per year, 20 cfs maximum diversion rate).
(e) Assumes some of existing groundwater supply will continue to be classified as percolating groundwater.
(f) Assumes no water available for diversion from July through August (see Table 3-5).

Table 6- 3. Water Supply Sufficiency by UVA Public Water Service Provider- Alternative B (all quantities in acre-feet)

	2010	2015	2020	2025	2030
Calpella County Water District					
Water Demands					
Table 2-11 (no 20x20 conser)	140	174	209	243	278
With 20x20 conser)	112	139.2	167.2	194.4	222.4
Water Supply					
Normal/Single Dry Year					
Lake Mendocino	51	51	51	51	51
Groundwater[(a)]	40	40	40	40	40
Totals:	**91**	**91**	**91**	**91**	**91**
Extended/Critical Dry Year					
Lake Mendocino	38	38	38	38	38
Groundwater[(a)]	40	40	40	40	40
Totals:	**78**	**78**	**78**	**78**	**78**
Millview County Water District					
Water Demands					
Table 2-11 (no 20x20 conser)	1,750	2,136	2,516	2,897	3,282
With 20x20 conservation	1,400	1,709	2,013	2,318	2,626
Water Supply					
Normal/Single Dry Year					
Lake Mendocino	1,520	1,520	1,520	1,520	1,520
Surface Water Rights	1,522	1,522	1,522	1,522	1,522
Totals:	**3,042**	**3,042**	**3,042**	**3,042**	**3,042**
Extended/Critical Dry Year					
Lake Mendocino	1,140	1,140	1,140	1,140	1,140
Surface Water Rights[(b)]	1,525	1,525	1,525	1,525	1,525
Totals:	**2,665**	**2,665**	**2,665**	**2,665**	**2,665**
City of Ukiah					
Water Demands					
Table 2-11 (no 20x20 conser)	4,192	4,296	4,398	4,502	4,668
With 20x20 conservation	3,354	3,437	3,518	3,602	3,734
Water Supply					
Normal/Single Dry Year					
Lake Mendocino	800	800	800	800	800
Groundwater[(c)]	1,895	1,895	1,895	1,895	1,895
Underflow Rights[(d)]	7,240	7,240	7,240	7,240	7,240
Totals:	**9,935**	**9,935**	**9,935**	**9,935**	**9,935**
Extended/Critical Dry Year					
Lake Mendocino	600	600	600	600	600
Groundwater[(b)]	1,895	1,895	1,895	1,895	1,895
Underflow Rights[(d)]	5,430	5,430	5,430	5,430	5,430
Totals:	**7,925**	**7,925**	**7,925**	**7,925**	**7,925**

Table 6-3. Continued

	2010	2015	2020	2025	2030
Rogina Water Company					
Water Demands					
Table 2-11 (no 20x20 conser)	690	725	761	798	833
With 20x20 conservation	552	580	609	638	666
Water Supply					
Normal/Single Dry Year					
Lake Mendocino	400	400	400	400	400
Groundwater[e]	200	200	200	200	200
Totals:	**600**	**600**	**600**	**600**	**600**
Extended/Critical Dry Year					
Lake Mendocino	300	300	300	300	300
Groundwater[e]	200	200	200	200	200
Totals:	**500**	**500**	**500**	**500**	**500**
Willow County Water District					
Water Demands					
Table 2-11 (no 20x20 conser)	1,288	1,417	1,548	1,677	1,808
With 20x20 conservation	1,030	1,134	1,238	1,342	1,446
Water Supply					
Normal/Single Dry Year					
Lake Mendocino	515	515	515	515	515
Surface Water Rights	2,166	2,166	2,166	2,166	2,166
Totals:	**2,681**	**2,681**	**2,681**	**2,681**	**2,681**
Extended/Critical Dry Year					
Lake Mendocino	386	386	386	386	386
Surface Water Rights[f]	1,922	1,922	1,922	1,922	1,922
Totals:	**2,308**	**2,308**	**2,308**	**2,308**	**2,308**
Not in District					
Water Demands					
Table 2-11(no 20x20 conser)	294	790	1,285	1,780	2,271
With 20x20 conservation	235	632	1,028	1,424	1,817
Water Supply					
Normal/Single Dry Year					
Lake Mendocino	0	0	0	0	0
Groundwater	0	0	0	0	0
Totals:	**0**	**0**	**0**	**0**	**0**
Extended/Critical Dry Year					
Lake Mendocino	0	0	0	0	0
Groundwater	0	0	0	0	0
Totals:	**0**	**0**	**0**	**0**	**0**

(a) Existing groundwater source assumed to be percolating groundwater.
(b) Assumes no water available for diversion from July through August (see Table 3-4).
(c) Source: Ukiah, 2007.
(d) Assumes that existing water right permit 12952 will ultimately be licensed for one-half permit's face value (14,480 acre-feet per year, 20 cfs maximum diversion rate).
(e) Assumes some of existing groundwater supply will continue to be classified as percolating groundwater.
(f) Assumes no water available for diversion from July through August (see Table 3-5).

Table 6- 4. Water Supply Sufficiency by UVA Public Water Service Provider - No Project (all quantities in acre-feet)

	2010	2015	2020	2025	2030
Calpella County Water District					
Water Demands					
Table 2-12 (no 20x20 conser)	140	175	210	243	279
With 20x20 conservation	112	140	168	194.4	223.2
Water Supply					
Normal/Single Dry Year					
Lake Mendocino	51	51	51	51	51
Groundwater[(a)]	40	40	40	40	40
Totals:	**91**	**91**	**91**	**91**	**91**
Extended/Critical Dry Year					
Lake Mendocino	38	38	38	38	38
Groundwater[(a)]	40	40	40	40	40
Totals:	**78**	**78**	**78**	**78**	**78**
Millview County Water District					
Water Demands					
Table 2-12 (no 20x20 conser)	1,714	2,026	2,344	2,659	2,976
With 20x20 conservation	1,371	1,621	1,875	2,127	2,381
Water Supply					
Normal/Single Dry Year					
Lake Mendocino	1,520	1,520	1,520	1,520	1,520
Surface Water Rights	1,522	1,522	1,522	1,522	1,522
Totals:	**3,042**	**3,042**	**3,042**	**3,042**	**3,042**
Extended/Critical Dry Year					
Lake Mendocino	1,140	1,140	1,140	1,140	1,140
Surface Water Rights[(b)]	1,525	1,525	1,525	1,525	1,525
Totals:	**2,665**	**2,665**	**2,665**	**2,665**	**2,665**
City of Ukiah					
Water Demands					
Table 2-12 (no 20x20 conser)	4,222	4,374	4,527	4,679	4,833
With 20x20 conservation	3,378	3,499	3,622	3,743	3,866
Water Supply					
Normal/Single Dry Year					
Lake Mendocino	800	800	800	800	800
Groundwater[(c)]	1,895	1,895	1,895	1,895	1,895
Underflow Rights[(d)]	7,240	7,240	7,240	7,240	7,240
Totals:	**9,935**	**9,935**	**9,935**	**9,935**	**9,935**
Extended/Critical Dry Year					
Lake Mendocino	600	600	600	600	600
Groundwater[(b)]	1,895	1,895	1,895	1,895	1,895
Underflow Rights[(d)]	5,430	5,430	5,430	5,430	5,430
Totals:	**7,925**	**7,925**	**7,925**	**7,925**	**7,925**

Table 6-4. Continued

	2010	2015	2020	2025	2030
Rogina Water Company					
Water Demands					
Table 2-12 (no 20x20 conser)	690	725	761	798	833
With 20x20 conservation	552	580	609	638	666
Water Supply					
Normal/Single Dry Year					
Lake Mendocino	400	400	400	400	400
Groundwater[(e)]	200	200	200	200	200
Totals:	**600**	**600**	**600**	**600**	**600**
Extended/Critical Dry Year					
Lake Mendocino	300	300	300	300	300
Groundwater[(e)]	200	200	200	200	200
Totals:	**500**	**500**	**500**	**500**	**500**
Willow County Water District					
Water Demands					
Table 2-12 (no 20x20 conser)	1,267	1,364	1,460	1,557	1,654
With 20x20 conservation	1,014	1,091	1,168	1,246	1,323
Water Supply					
Normal/Single Dry Year					
Lake Mendocino	515	515	515	515	515
Surface Water Rights	2,166	2,166	2,166	2,166	2,166
Totals:	**2,681**	**2,681**	**2,681**	**2,681**	**2,681**
Extended/Critical Dry Year					
Lake Mendocino	386	386	386	386	386
Surface Water Rights[(f)]	1,922	1,922	1,922	1,922	1,922
Totals:	**2,308**	**2,308**	**2,308**	**2,308**	**2,308**
Not in District					
Water Demands					
Table 2-12 (no 20x20 conser)	294	790	1,285	1,780	2,271
With 20x20 conservation	235	632	1,028	1,424	1,817
Water Supply					
Normal/Single Dry Year					
Lake Mendocino	0	0	0	0	0
Groundwater	0	0	0	0	0
Totals:	**0**	**0**	**0**	**0**	**0**
Extended/Critical Dry Year					
Lake Mendocino	0	0	0	0	0
Groundwater	0	0	0	0	0
Totals:	**0**	**0**	**0**	**0**	**0**

(a) Existing groundwater source assumed to be percolating groundwater.
(b) Assumes no water available for diversion from July through August (see Table 3-4).
(c) Source: Ukiah, 2007.
(d) Assumes that existing water right permit 12952 will ultimately be licensed for one-half permit's face value (14,480 acre-feet per year, 20 cfs maximum diversion rate).
(e) Assumes some of existing groundwater supply will continue to be classified as percolating groundwater.
(f) Assumes no water available for diversion from July through August (see Table 3-5)

Millview

The Millview County Water District's current water supplies are sufficient to meet existing water demands and the projected future water demands for all four UVAP land use alternatives; in normal, dry, critically dry and extended dry years, through 2020. Additional water supplies will be needed to satisfy projected water demands beyond 2020 – as much as 170 to 880 acre-feet by 2030 for the Preferred Project, and somewhat lesser amounts for implementation of any of the remaining three UVAP land use alternatives.

Ukiah

The City of Ukiah's current water supplies are sufficient to meet the existing and projected future water demands associated with the implementation of any of the UVAP's four land use alternatives; in normal, critically dry and extended dry years, even in the event that the City's percolating groundwater supply were to be classified, for regulatory purposes, as underflow.

Rogina

The sufficiency of the Rogina Water Company's water supply, now and in the future, hinges on whether or not, for regulatory purposes, the Company's groundwater supply is considered underflow as opposed to percolating groundwater. Currently, Rogina asserts that at least some of the company's wells are drawing from percolating groundwater sources as opposed to underflow. In the absence of percolating groundwater, the only other water source currently available to Rogina is the company's 400 acre-foot water supply contract with RRFC – an amount that is insufficient to satisfy existing, much less the projected future water demands. For the purposes of this WSA it is assumed that all of the Rogina groundwater wells are drawing from Russian River underflow and therefore, do not constitute a reliable source of water for future growth. Accordingly, based on the projected water demands and the current 400 acre-foot supply provided by RRFC, it is estimated that an additional 480 acre-foot supply will be needed to satisfy the 2030 projected Preferred Project and Alternative A water demands. Somewhat lesser amounts would be required to satisfy the 2030 water demands associated with the remaining two UVAP land use alternatives.

Willow

The Willow County Water District's current water supplies are sufficient to meet the existing and projected future water demands associated with the implementation of any of the UVAP's four land use alternatives; in normal, critically dry and extended dry years. The ability to meet future water demands in critically dry and extended dry years is heavily dependent on the expectation that sufficient stream flows – either surface stream flows or as underflow - will be available for diversion during all but the months of July through October, in critically dry and extended dry years.

Not in District

There is currently no allocated water supply to meet the projected future water demands – as much as 2,000 to 2,500 acre-feet - of the "Not in District" areas. Providing water to these areas is potentially problematic. Ideally, the Not in District areas would be annexed to the service areas of existing public water service providers. However, in many cases the option of annexation may be precluded by technical, financial and/or policy

constraints. Alternatively, Not in District areas could continue to be rely on privately owned and operated groundwater wells. However, as noted in section 4.0, the availability of groundwater supplies is questionable given the State Water Resources Control Board's on going assertions that all groundwater in the Ukiah Valley is underflow.

Based on the comparison of available supplies and projected demands presented in Table 6-1 through Table 6-4, current UVA water supplies are insufficient to fully implement any of the UVAP's four land use alternatives through the 2030 planning horizon. Implementation of the UVAP's Preferred Alternative, the most water intensive of the four alternatives, will require additional water supplies – as much as 1,610 acre-feet to augment the combined existing supplies of Calpella, Millview and Rogina, and as much as 2,500 acre-feet to create a supply for the anticipated growth associated with the Not in District areas. Aggressive water conservation, pursuant to SBx7 7, could reduce - by approximately 50 percent- but will not by itself eliminate the projected 2030 water supply shortfall for the UVA.

Theoretically, a portion of the needed supply could be provided by Ukiah and Willow, both of which appear to possess water supplies that exceed their respective projected 2030 water demands. However, it is assumed that both entities would be inclined to apply their respective excess water supplies toward any additional water demands that may develop within their service areas, beyond the 2030 planning horizon, rather than reallocating the available resource to other water service providers in the UVA. As noted in section 3.0, the RRFC currently sells water to Redwood Valley and Hopland. While this water could conceivably be used to augment the UVA's water supply, doing so would be at the expense of Redwood Valley and Hopland, and would simply redistribute the UVA's water supply shortage within a larger region of Mendocino County.

6-3. Potential Sources of New Water Supplies

In view of current trends regarding the characterization of groundwater resources, vis-à-vis the distinction between percolating groundwater and underflow, it appears that high winter stream flows represent the only remaining significant source of new water supplies for the UVA. As noted in Section 3.0, the Russian River main stem and associated tributaries are already fully appropriated between July and October. However, significant water supplies can still be obtained during intense winter storm events, assuming sufficient water storage capacity is made available. In many instances the development of additional storage capacity is cost prohibitive. One of the more promising options is the raising and/or reoperation of Coyote Dam to increase Lake Mendocino water storage by as much as 77,000 acre-feet. The raising of Coyote Dam, assuming it is even financially and technically feasible, could take decades to complete. However, reoperation of the existing facility is considerably less complicated and although it would most likely provide a relatively modest increase in the overall water supply – perhaps on the order of 5,000 acre-feet – it is an option that could be implemented relatively quickly and cheaply, and would address the projected 2030 UVA water supply shortage.

Other storage options that have or are currently being investigated include small off-stream storage facilities – on the order of 500 to 1,500 acre-feet – such as the proposed

Mendocino College Reservoir, a 500 to 1,500 acre-foot storage facility located north of Ukiah and west of Millview, and the proposed Calpella Reservoir, a 100 to 500 acre-foot storage facility located near Calpella and immediately east of the Russian River.

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APPENDIX A

Description of UVAP Land Use Alternatives

Comparison of Land Use Differences Between the 2010 UVAP Alternatives

	Land Use Change from the existing General Plan	Preferred Project	Land Use Alt. 'A'	Land Use Alt. 'B'
1	Changes 1 acre of AG-40, 4.3 acres of SR, & 11.4 acres of C to 16.7 acres of MU-3. ✱	YES	YES	YES
2	Changes 2.25 acres of split C/SR (0.75/1.5 acres), with existing apartments, to 2.25 acres of SR. ◈ [1]	YES	YES	YES
3	Changes 43 acres of AG-40 to RR-1, south of Calpella on Eastside Calpella Road. ◈	YES	YES	NO
4	Redesignates 12.6 acres of AG-40, where the Calpella Sewage Treatment ponds are, to 12.6 acres of PS ◈	YES	YES	YES
5	Changes 8 acres of AG-40 to 8 acres of RR-1. ◈	YES	YES	NO
6	Changes a 2 acre parcel on the west side of North State from R-1 to SR . ◈	YES	YES	NO
7	Changes 93 acres already designated RR-10 and 53 acres of AG-40 to 146 acres RR-10-PD ◈	YES	YES	NO [2]
8	Connects two discontinuous RMR-20 areas by redesignating the intervening 8.5 acres of RL-160 parcels between them to RMR-20 ◈	YES	YES	YES [3]
9	Changes 81 acres of active agricultural production from RL-160 to AG-40 ◈	YES	YES	YES
10	Changes 12.5 acres of AG-40 parcels on Antoni Lane to RR-10 ◈	YES	YES	NO
11	Redesignates 5 acres of developed AG-40 parcels to RR-1 at the northwest corner of Eastside Calpella Road and Lake Mendocino Drive ✱	YES	YES	YES
12	Redesignates 4.9 acres of developed AG-40 land to multifamily residential use (SR with an R-3 Zoning). ✱	NO	YES	YES
13	Redesignates 4.9 acres of developed AG-40 and 3.6 acres SR to 8.5 acres of Mixed uses (MUNS) in the same area identified in #12. ✱	YES	NO	NO
14	Changes 9.3 acres of industrial land (I) north of the intersection of North State Street and Parducci Road to commercial (C). ✱	YES	YES	NO
15	Changes 56 acres of AG-40 land south of Lake Mendocino Dr. north of the Mendocino Redwood Company mill site to mixed uses (MUNS) ✱	YES	NO	NO
16	Converts the vacant 29 acres of industrial (I) land east of north State St and the NPRR railroad tracks to mixed uses (MUNS) ✱	YES	NO	NO
17	Changes 24 acres of vacant and occupied commercial parcels and 1 acre of Ag-40 on both sides of North State St. south of Lake Mendocino Drive to 25 acres mixed uses (MUNS). ✱	YES	NO	NO
18	Changes 15.6 acres of RR-1 on both sides of Tollini Lane from to SR (12K min lot size). ◈ ✪	YES	YES	NO
19	Redesignates 39 acres of commercial (C) lands on North State St. to industrial (I). ✱	YES	YES	YES
20	Redesignates the 79 acre Masonite (west) site from (I) to (MUM) to allow a mix of development types ✱	YES	YES	NO
21	Converts the 187 acre Lover's Lane north agricultural area from AG-40 to mixed use with a residential use with a residential focus (MU-3).✱	YES	NO	NO
22	Converts17 acres of AG-40, south of the Lover's Lane parcels to Mixed use (MU-3). ✱	YES	YES	YES
23	Redesignates the 10.8 acres of mostly-vacant industrial (I) and 3.7 acres of commercial (C) of the Lover's Lane area to create 14.5 acres of mixed use (MU-3). ✱	YES	YES	YES
24	Converts the remaining 4.97 acres of the industrial (I) area, west of North State St. and north of Empire Dr., to general mixed use (MU-2). ◈	YES	YES	NO
25	Changes 62.8 acres of industrial (I) designation in the Brush St. Triangle to allow for mixed use development (MUBST). ✱	YES	YES	NO
26	Changes 74.7 acres of industrial (I) designation in the same area as #25 above to 38.8 acres of commercial (C) and 35.9 acres of mixed use (MUBST). ✪	NO	NO	YES
27	Changes the industrial (I) designation on the 2-acre parcel to (MUBST) at the intersection of Brush St. and US-101. ✱	YES	YES	NO
28	Changes the industrial (I) designation on the same 2-acre parcel identified in #27 to (C). ◈ ✪	NO	NO	YES
29	Redesignates the 10.8-acre RCHDC-owned property south of Brush St from industrial (I) to allow for multifamily uses (SR with an R-3 zoning). ✱	YES	YES	YES
30	Converts the 267 acres of RL-160 to RR-1-PD. ✱	YES	YES	NO
31	Redesignates the northern 18.7 acres of the City-owned ballfields at the east end of Gobbi St. from PL to PS. ◈	YES	YES	YES
32	Changes the northwestern and southwestern corners (5.7 acres) General Commercial (C) and 0.5 acres of SR to allow for 6.2 acres of mixed uses (MU-2) ✱	YES	YES	YES
33	Redesignates the 13.6-acre site occupied by Grace Hudson Elementary School from commercial (C) to PS. ✱	YES	YES	YES
34	Change the 9.9 acres of general commercial (C) and 2.2 acres of SR parcels, south of Grace Hudson, to allow for 12.1 acres of mixed uses (MU-2). ✱	YES	YES	YES
35	Redesignates a 4 acre parcel south of Plant Road along South State St. from Industrial to Commercial.✱	YES	YES	YES
36	Removed as it has already been change to SR with R-3 zoning to allow for mutlifamily development. ✱ [1]	YES	YES	YES
37	Redesignates the 6.1 acres of C and 15.9 acres of SR to 10 acres of SR and 12 acres of MU-2. ✱	YES	YES	NO
38	Redesignates the same 22 acres in #37 on the west side of State St, north of Stipp, to 10 acres of SR and 12 acres of general commercial (C) only. ✪	NO	NO	YES
39	Redesignates the western 69 acre portion of a large split-zoned parcel from RL-160 to RMR-40 match its eastern portion. ◈	YES	YES	YES
40	Change 78.6 acres of RR-5, 3.7 acres of Ag-40, and 0.2 acres of RL-160 to 82.5 acres of AG-40. ◈ ✪	YES	YES	NO
41	Convert a 30.6 acres RR-10 parcel along US-101 north of Burke Hill Rd to RL-160. ◈ ✪	YES	YES	NO

Notes

Numbers 12 and 13, 25 and 26, 27 and 28 and 37 and 38 refer to two different options for the same physical locations. All area calculations approximate.

In order to preserve the land zoned R-3, the proposed land use change for number 24 was changed from C to MU, and the acreage in numbers 37 & 38 were reduced to remove the land zoned R-3.

✱ Originated from the 2007 UVAP process
◈ Originated from the 2003 UVAP process
✪ Other origins (owner request, staff/consultant input or community suggestion)

Please refer to attached map for approximate locations

[1] Rezoning under existing General Plan Designation
[2] Land Use Alternative 'B' keeps the RR-10 designation where it already exists.
[3] Land Use Alternative 'B' only redesignates 10 acres to create a contiguous RMR-20 area.

CALPELLA
THE FORKS
PINOLEVILLE RANCHERIA
CITY OF UKIAH
Lake Mendocino
Coyote Dam
GUIDIVILLE RANCHERIA
Vichy Springs
TALMAGE
Ukiah City Hall
Ukiah Airport
Sewage Treatment Facility
LANDS OF YOKAYO Band of Pomo Indians
NORTH STATE STREET
LAKE MENDOCINO DRIVE
CENTRAL AVENUE
ROAD A
ROAD B
MARINA DRIVE
East Fork Russian River
Cold Creek
York Creek
HENSLEY CREEK ROAD
REDEMEYER ROAD
Howard Creek
DEER WOOD DRIVE
ORR SPRINGS ROAD
EL DORADO ROAD
LOW GAP ROAD
PERKINS STREET
GOBBI STREET
SOUTH STATE STREET
OAK MANOR DRIVE
BABCOCK LANE
JOE RILEY PARK
VICHY SPRINGS ROAD
WATSON ROAD
VICHY HILLS DRIVE
WILDER HILL ROAD
SANFORD RANCH ROAD
RUSSIAN RIVER
McClure Creek
North Fork Mill Creek
Doolin Creek
Howard Creek
OLD RIVER ROAD
GIELO LANE
RUDDICK-CUNNINGHAM ROAD
Robinson Creek
Morrison Creek
Hensley Creek
Ackerman Creek
Orr Creek
Mason Creek
Dooley Creek
Howard Creek
Gilmore Creek
20
101
222
253

PREFERRED NEW LAND USE DESIGNATIONS

MAP CHANGE NUMBER	PREFERRED NEW LAND USE DESIGNATIONS	
1	MIXED USE: LOVERS LANE	MU-3
2	SUBURBAN RESIDENTIAL	SR
3	RURAL RESIDENTIAL	RR-1
4	PUBLIC SERVICE	PS
5	RURAL RESIDENTIAL	RR-1
6	SUBURBAN RESIDENTIAL	SR
7	RURAL RESIDENTIAL - PLANNED DEVELOPMENT	RR-10-PD
8	REMOTE RESIDENTIAL	RMR-20
9	AGRICULTURAL	AG-40
10	RURAL RESIDENTIAL	RR-10
11	RURAL RESIDENTIAL	RR-1
12	SUBURBAN RESIDENTIAL	SR
13	MIXED USE NORTH STATE STREET	MUNS
14	COMMERCIAL	C
15	MIXED USE NORTH STATE STREET	MUNS
16	MIXED USE NORTH STATE STREET	MUNS
17	MIXED USE NORTH STATE STREET	MUNS
18	SUBURBAN RESIDENTIAL	SR
19	INDUSTRIAL	I
20	MINED USE MASONITE	MUM
21	MIXED USE: LOVERS LANE	MU-3
22	MIXED USE: LOVERS LANE	MU-3
23	MIXED USE: LOVERS LANE	MU-3
24	MIXED USE: GENERAL	MU-2
25	MIXED USE BRUSH STREET TRIANGLE	MUBST
26	COMMERCIAL / MIXED USE BRUSH STREET TRIANGLE	C / MUBST
27	MIXED USE BRUSH STREET TRIANGLE	MUBST
28	COMMERCIAL	C
29	SUBURBAN RESIDENTIAL	SR
30	RURAL RESIDENTIAL - PLANNED DEVELOPMENT	RR-1-PD
32	MIXED USE: GENERAL	MU-2
33	PUBLIC SERVICE	PS
34	MIXED USE: GENERAL	MU-2
35	COMMERCIAL	C
37	MIXED USE: GENERAL	MU-2
38	COMMERCIAL	C
39	REMOTE RESIDENTIAL	RMR-40
40	AGRICULTURAL	AG-40
41	RANGE LAND	RL-160

1 Designation Change To The Existing General Plan

Ukiah Valley Planning Area

City of Ukiah

Tribal Land

Freeway

Railroad

River And Tributaries

Local Roads

EXISTING LAND USE

Agricultural

Commercial

Industrial

Public Land

Public Service

Range Land

Remote Residentail

Rural Residential

Rural Community

Suburban Residential

N

0.5 0.25 0 0.5 Miles

Figure 3.1 Areas with Land Use Designation Changes

Source: Mendocino County Planning & Building Services

This map is provided as a visual display of County information.
Reasonable effort has been made to ensure the accuracy of the map and data provided, nevertheless some information may not bew accurate.

June 2010