

MEMORANDUM

To:	Planning and Steering Committee Land Use and Water Supply Work Group	cc:	Matt Zidar
From:	Elias Tijerina	Date:	October 6, 2006
Subject:	2005 Existing Conditions And 2030 Baseline Conditions And Assumptions		
Project Reference:	190 – Upper Kings Water Forum IRWMP		

The purpose of this technical memorandum is to:

- Document the project assumptions for the Kings Integrated Regional Water Management Plan (IRWMP), including changes in population, land use and water demands and supply;
- Describe the future baseline conditions that would exist at the end of the planning horizon if no IRWMP were adopted and no water management strategies were implemented in the IRWMP Region;
- Facilitate discussion and consensus by the Upper Kings Water Forum (Forum) on the planning assumptions for the Upper Kings IRWMP Region (IRWMP Region)

DEFINITIONS AND TERMINOLOGY

For purposes of the IRWMP evaluation, the following will apply;

- 2005 defines the Existing conditions,
- The planning horizon will be 25 years from 2005 through 2030,
- 2030 Baseline Conditions are those that would exist at the end of the planning horizon in the absence of the IRWMP.
- The 2005 existing water demand and supply conditions were described in detail in previous technical memorandums (WRIME, 2006 a and b)

A twenty-five year planning horizon was chosen to be consistent with the state's requirements for urban water management plans.

The future hydrologic sequence that will be used to make model runs is the 40-year period from 1964 to 2004. This sequence contains representative wet and dry periods.

The 2030 Baseline Conditions provide a basis for comparison with the 2005 existing conditions. Establishing the 2030 Baseline condition includes making assumptions about land and water use; water supply and demand; groundwater pumping, surface water diversion, delivery and

operations; and water management facilities. The 2030 Baseline conditions also will allow for comparison of IRWMP alternatives, and for testing other assumptions about the future, and is equivalent to the No Action or No Project Alternative as defined in environmental laws.

Planning scenarios may be established to test different assumptions about the future. For example, one likely future scenario would include the conditions that could exist should the San Joaquin Restoration Program be implemented.

The IRWMP will also compare a range of program or project alternatives. Alternatives are to be configured based on combinations of projects and management actions. Performance measures will be developed and used to compare alternatives. Both qualitative and quantitative performance measures will be used to evaluate program alternatives in terms of impacts and benefits. The Kings IGSM outputs will allow for quantitative comparisons using the water budgets and hydrologic performance measures. Examples of performance measures may include:

- Annual or cumulative overdraft or storage depletion
- Stream flow at specific points
- Groundwater underflow between management areas
- Increased recharge at defined locations
- Additional habitat created
- Cost per acre foot of additional yield
- Water quality improvements

APPROACH, DATA SOURCES AND METHODOLOGY

EXISTING CONDITIONS AND 2030 WATER DEMANDS

The 2005 existing water demand were established based on current 2005 water production records, and by calculation using the historical average gallons per capita daily (gpcd) (1964 to 2004) and the 2005 population. The available water production and use records were collected from the individual agencies or from the Department of Health Services (DHS) Drinking Water Program Annual Report and/or the Department of Water Resources (DWR). The Cities of Clovis, Dinuba, Fowler, Reedley, Sanger and Selma had urban water management plans available; however some were not current in which case production records were used. Existing capital facilities plan and Urban Water Management Plans and the County and City general plans were also consulted to develop current and future assumptions for population, land use, and water demand conditions.

Table 1 presents a summary of 2005 existing conditions for the urban areas within the IRWMP region, and also shows the ending year for the planning horizon for the general plans of the cities and counties in the IRWMP Region.

Establishing the future 2030 Baseline Conditions involved forecasting both population and land use. Future 2030 water demands were then calculated based on the forecasted population and land use conditions using per capita water demands or unit water requirements for the future land uses, respectively.

It is important to note the general plan build out year for the cities and counties. Only the cities of Clovis and Dinuba have their general plan build out year to the year 2030. Of the remaining cities, four have plans to 2025 and the remaining cities reach build out sometime within the next 10 years. The 2030 land use assumptions from the general plan were used when available. Future land uses were projected assuming an annual “growth rate” for those general plans that did not extend to 2030.

Table 1. 2005 Existing Conditions and Summary of General Plans

Agency		Last Revision/ Adopted	2005 Population ¹	Build out Population	General Plan Area Buildout (acres)	Plan Year
AID	Dinuba	[2007] DRAFT	19,800	40,464	4,863	2040
	Reedley	1993	22,599	30,205	5,053	2012
CID	Fowler	2005	4,729	7,200	4,370	2025
	Kingsburg	1992	11,237	13,800	2,264	2012
	Parlier	1998	12,709	16,650	1,280	2015
	Sanger	2005	22,105	43,000	6,573	2025
	Selma	1997	22,411	37,631	9,674	2015
FID	Clovis	2005	86,015	173,018	47,468	2030
	Fresno	2002	464,727	790,955	67,136	2025
	Kerman	1993	11,455	15,000	1,280	2013
Other	Fresno County	2000	799,407	1,114,403	3,843,200	2020
	Tulare County	2006 DRAFT	390,791		2,983,040	2025

2030 Water Supply

A wide range of documents were reviewed and discussions were held with Forum participants, the water districts and KRCD staff to define potential future water supply and water management assumptions for the 2030 Baseline Conditions. Projects that have already been funded and approved by a specific agency in the IRWMP Region will be part of the future 2030 Baseline Conditions. Additional analysis and discussions are needed to finalize the future

water management and supply assumptions related to operations and deliveries under various alternatives and to confirm the final 2030 Baseline conditions prior to application of the Kings IGSM.

2030 BASELINE WATER DEMAND BASED ON POPULATION FORECAST

The water demands were obtained from adapted Urban Water Management Plans if available. When water demand projections were not available, the water demands were calculated using population forecasts and 2005 or historical average per capita water use (gallons per capita per day = gpcd). For the unincorporated areas without per capita water use information, average gpcd of the cities within the irrigation district was used as a representative value for the area. The population forecast referenced a variety of sources, the Department of Finance, General Plans, and Local Councils of Governments. Table 2 presents the 2005 baseline and projected population for the urban areas of the IRWMP region. The values in bold print are data from General Plan documents. All other values are calculated either by linear interpolation from documented values, or based on an assumed rate of growth for the area.

The rate of population growth for Fresno County as estimated from population forecasts from 2000 to 2030 by the Department of Finance is 1.61% annual average. From the years 1960 to 2000 the rate of growth for Fresno County was 1.97% per year. The City of Fresno uses 1.9% annual average rate of population increase. With a few exceptions the table below assumes an annual growth rate of 1.9% where population projections were not available. The exceptions are the unincorporated areas near the City of Fresno. The area within Pinedale is approximately 17% vacant and is zoned for commercial use. The population projection data or water demand assumptions were not available from the Bakman Water District and it is assumed that the population and water use will remain constant.

The water use per capita may include all uses, including residential, commercial, industrial, schools and governmental. When the area has a higher concentration of industrial use the per capita use tends to be disproportionately higher. This is the case for Malaga WD whose service area is 765 acres and has a reported population of 900 people. The water district provide service to mostly industrial use customers and thus show a use of 845 gpcd as opposed to 221 gpcd found in Kerman with approximately the same service area of 1,687 acres and a population of 8,551. The water use per capita may be categorized by residential only classifications if the water deliveries were metered. Table 3 presents the estimated water use per capita based on baseline demand and population for the IRWMP area.

Table 2. 2005 Existing and Projected Population

Population		2005	2010	2015	2020	2025	2030	Buildout Year
AID	Cutler	4,510	4,530	4,550	4,999	5,492	6,034	
	Dinuba ^{2,3}	19,297	22,151	24,375	27,387	27,933	34,199	2040
	East Orosi	425	430	435	478	525	577	
	Orosi	8,100	8,800	9,500	10,437	11,467	12,599	
	Reedley ¹	20,756	22,804	25,054	27,527	30,243	33,228	2012
	Subtotal	53,088	58,715	63,914	70,828	75,661	86,636	
CID	Caruthers	2,539	2,789	3,064	3,367	3,699	4,064	
	Fowler ¹	3,979	4,615	5,352	6,208	7,200	7,910	2025
	Kingsburg ¹	9,199	10,107	11,104	12,200	13,404	14,726	2012
	Laton	1,492	1,639	1,801	1,979	2,174	2,388	
	Parlier ¹	11,145	12,245	13,453	14,781	16,239	17,842	2015
	Sanger ²	18,931	23,241	28,531	35,026	43,000	47,243	2025
	Selma ²	19,444	27,050	37,631	41,344	45,424	49,907	2015
	Subtotal	66,728	81,685	100,937	114,904	131,140	144,081	
FID	Bakman WD ⁵	8,500	8,500	8,500	8,500	8,500	8,500	
	Biola	1,252	1,375	1,511	1,660	1,824	2,004	
	Clovis ⁴	89,972	103,189	122,164	135,000	153,382	173,018	2030
	Easton	2,373	2,607	2,865	3,147	3,458	3,799	
	Fresno	475,061	521,940	573,444	630,031	692,202	760,508	2025
	Kerman ¹	8,551	9,395	10,322	11,340	12,459	13,689	2013
	Malaga WD ⁵	900	900	900	900	900	900	
	Pinedale WD ⁵	8,495	8,495	8,495	8,495	8,495	8,495	
	Subtotal	595,104	656,401	728,201	799,074	881,221	970,913	
RCWD	Raisin City	181	199	219	240	264	290	
	Subtotal	181	199	219	240	264	290	
Total		715,102	797,001	893,271	985,047	1,088,286	1,201,920	

1. Data in bold is from General Plan.
2. Population growth rate assumed to be 1.9% beyond GP buildout year.
3. Population projection by interpolation from 2005 to buildout population.
4. Population growth taken from UWMP.
5. Population at or near buildout.

For the purposes of water demand projection to the year 2030, the water use per capita or the acre-foot per capita (as shown in 4 below) is assumed to remain constant. The estimates of demand do not take into account any water conservation efforts by the individual urban areas. The annual water demand are represented as stacked bar graphs for 2005 to 2030 period for the AID, CID and FID areas are presented in Figures 1, 2, and 3, respectively.

Table 3. 2005 Per Capita Water Use

	Agency	Population	Demand (AF)	Annual AF per Capita	Gallons per capita daily (gpcd)
AID	Cutler	4,510	1,137	0.252	225
	Dinuba	19,297	4,637	0.232	207
	East Oroshi	425	107	0.252	225
	Orosi	8,100	2,041	0.252	225
	Reedley	20,756	4,485	0.271	242
	Subtotal/Average	53,088	12,407	0.234	262
CID	Caruthers	2,539	765	0.301	269
	Fowler	3,979	1,027	0.324	289
	Kingsburg	9,199	3,187	0.346	309
	Laton	1,492	450	0.301	269
	Parlier	11,145	2,519	0.244	218
	Sanger	18,931	5,160	0.273	243
	Selma	19,444	6,242	0.321	287
	Subtotal/Average	66,728	19,348	0.290	325
FID	Bakman WD	8,500	4,450	0.253	226
	Biola	1,252	470	0.375	335
	Clovis	89,972	24,481	0.278	248
	Easton	2,373	890	0.375	335
	Fresno	475,061	157,280	0.332	296
	Kerman	8,551	1,687	0.248	221
	Malaga WD	900	1,765	0.947	845
	Pinedale WD	8,495	2,915	0.166	148
	Subtotal/Average	595,104	193,938	0.326	365
	RCWD	Raisin City	181	45	0.248
Subtotal/Average		181	45	0.248	277
Total/Average		715,102	225,738	0.316	280

1. Average water use per capita does not include Malaga WD
2. Water demands not available from UWMP were derived from TM Analysis of Water Demand in Kings Basin (WRIME, 2006).

For the purposes of water demand projection to the year 2030, the water use per capita (gpcd) or the acre-foot per capita (as shown in Table 4 below), is assumed to remain constant. The estimates for demand will not take into account any water conservation efforts by the individual urban areas. The annual water demand are represented as stacked bar graphs for 2005 to 2030 period for the AID, CID, and FID, areas are presented in Figures 1,2, and 3, respectively.

Table 4. Projected Water Demand (Acre-feet) Based on Population

Water Demand Based on Population		AF per Capita	2005	2010	2015	2020	2025	2030
AID	Cutler	0.252	1,137	1,142	1,147	1,260	1,384	1,521
	Dinuba	0.232	4,637	5,136	5,652	6,350	6,477	7,929
	East Orosi	0.252	107	108	110	120	132	145
	Orosi	0.252	2,041	2,218	2,394	2,630	2,890	3,175
	Reedley ¹	0.271	4,485	6,181	6,791	7,462	8,198	9,007
CID	Caruthers	0.301	765	840	923	1,014	1,114	1,224
	Fowler	0.324	1,027	1,494	1,733	2,010	2,331	2,561
	Kingsburg	0.346	3,187	3,501	3,846	4,226	4,643	5,101
	Laton	0.301	450	494	543	596	655	720
	Parlier	0.244	2,519	2,990	3,285	3,609	3,965	4,357
	Sanger	0.273	5,160	6,335	7,777	9,547	11,720	12,877
	Selma	0.321	6,242	8,683	12,080	8,278	9,094	9,992
FID	Bakman WD ¹	0.253	4,450	4,450	4,450	4,450	4,450	4,450
	Biola	0.375	470	516	567	623	684	752
	Calwa	0.375	345	379	417	458	503	553
	Clovis	0.278	24,481	28,665	33,936	37,501	42,608	48,062
	Easton	0.375	890	978	1,075	1,181	1,298	1,426
	Fresno	0.362	157,280	188,863	207,500	227,976	250,473	275,189
	Kerman	0.248	1,687	2,326	2,555	2,807	3,084	3,389
	Malaga WD ¹	0.947	1,765	1,765	1,765	1,765	1,765	1,765
Pinedale WD ¹	0.166	2,915	2,915	2,915	2,915	2,915	2,915	
RCWD	Raisin City	0.248	45	49	54	60	65	72

Assumptions:

1. Water consumption per capita will not change due to population at or near buildout.
2. Per capita water use for unincorporated areas is assumed to be average of cities within irrigation district.

Figure 1. AID Urban Area Water Demand 2005 to 2030

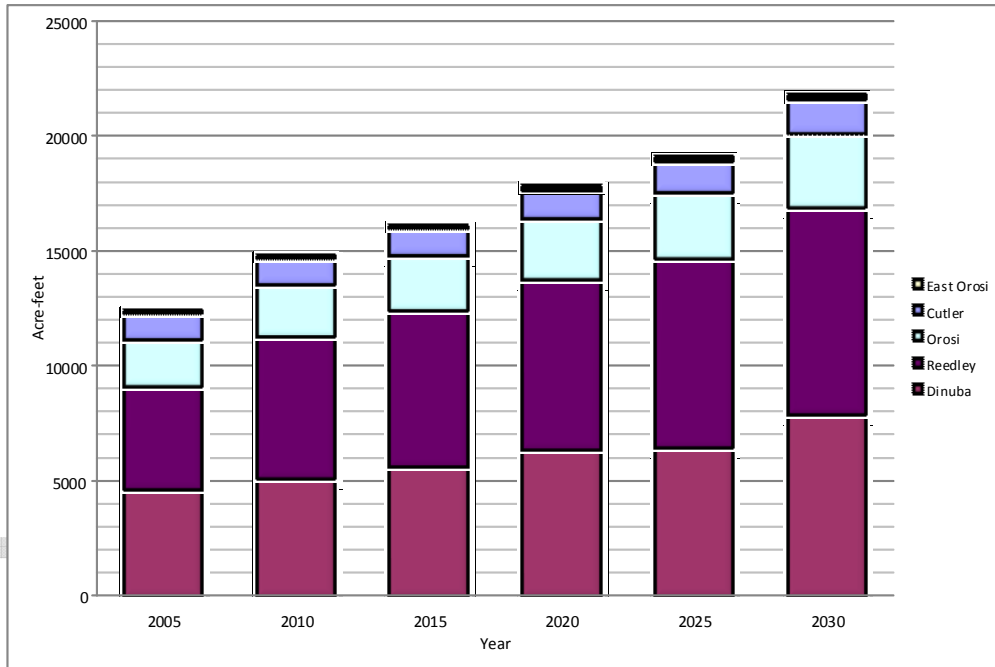


Figure 2. CID Urban Area Water Demand 2005 to 2030

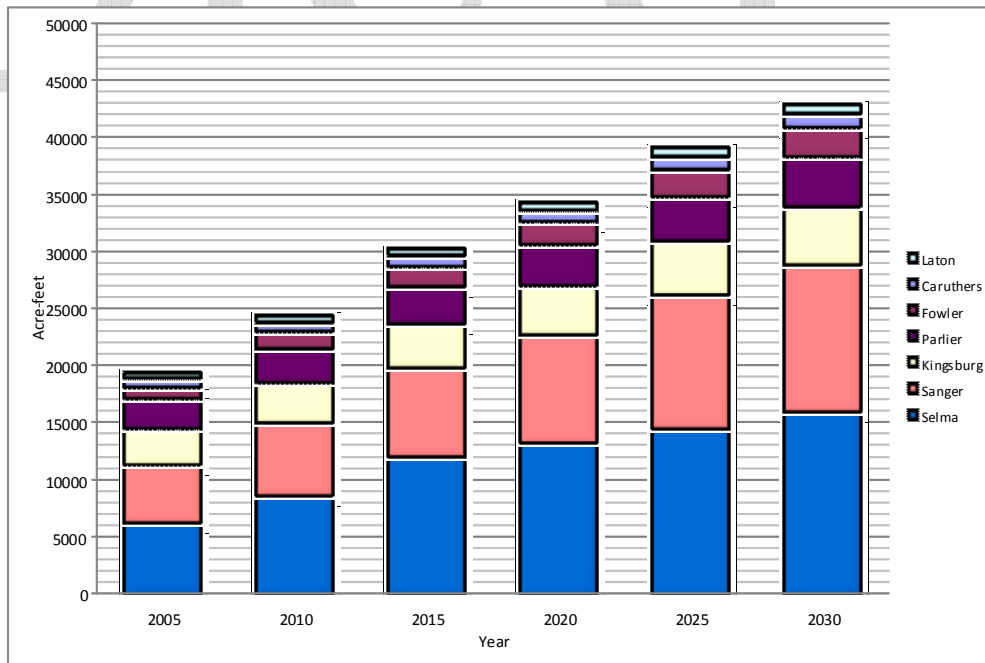
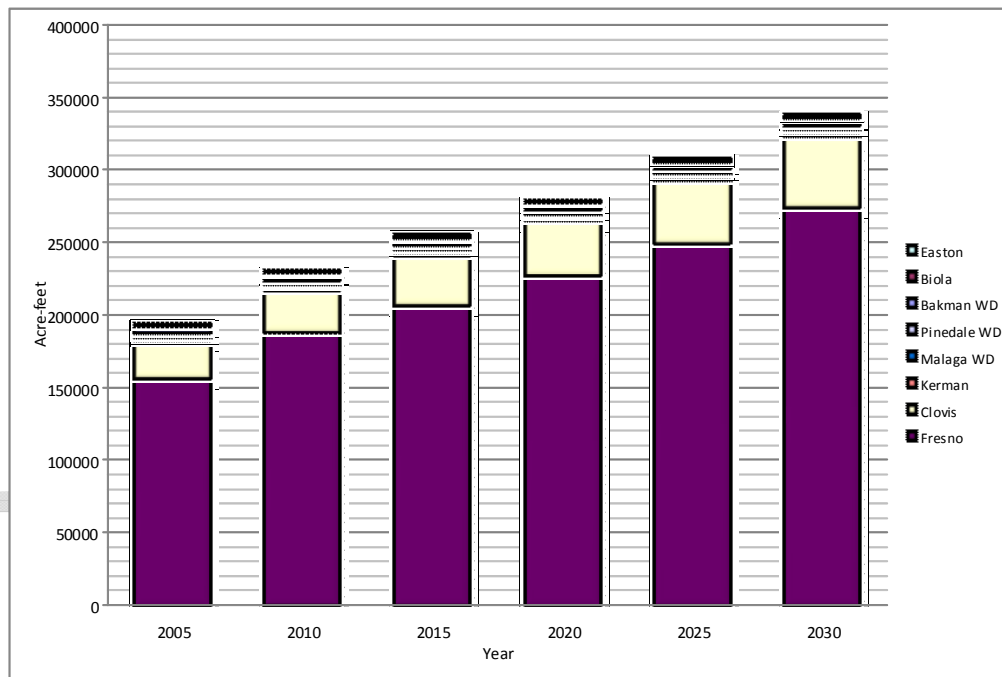


Figure 3. FID Urban Area Water Demand 2005 to 2030



2030 BASELINE LAND USE AND WATER DEMAND

Definition of 2030 Baseline land use conditions is needed for purposes of comparison with existing conditions and other future water supply alternatives, and is necessary for evaluating water budgets with the model. Land that is converted from agricultural uses relying on surface water to urban uses relying on groundwater will influence the water budget and groundwater conditions.

The urban water use per acre was determined for the various city and county areas using the 1999-2000 land use survey from DWR and available water supply data. The 1999-2000 DWR land use maps are the most recent data available and were used to represent the 2005 existing land use conditions. The urban land use information for 2005 existing conditions within the cities is shown below in Table 5. Maps of land use were presented in the Historical Water Demand Technical Memorandum. The boundaries area used to calculate the current and projected land use acreage was based on the sphere of influence (SOI) maps obtained from the Local Agency Formation Commission (LAFCO) and do not necessarily reflect the general plan boundary. The SOI was used because it was readily available in a usable format. Therefore, the sum of the urban acreage shown below is the total acreage designated as urban within the SOI. The total urban acreage used to calculate an urban water duty factor does not include the land designated as urban vacant since vacant land does not have an associated water demand.

Table 5. 2005 Urban Land Use by Agency

Land Use		Residential (acres)	Commercial/ Industrial (acres)	Landscaped (acres)	Total Urban Area (acres)	Vacant (acres)	Vacant %
AID	Cutler	560	15	51	626	14	2%
	Dinuba	1,631	110	61	1,802	450	25%
	East Orosi	36	6	-	43	-	0%
	Orosi	261	46	16	323	41	13%
	Reedley	1,949	180	175	2,304	225	10%
CID	Caruthers	338	12	32	382	29	8%
	Fowler	702	185	0	887	527	59%
	Kingsburg	1,315	227	91	1,633	197	12%
	Laton	257	-	62	318	30	10%
	Parlier	751	20	73	844	149	18%
	Sanger	1,867	113	97	2,077	244	12%
	Selma	2,287	132	203	2,622	500	19%
FID	Bakman WD	1,191	1	15	1,206	135	11%
	Biola	99	35	5	139	-	0%
	Clovis	10,016	282	367	10,666	1,560	15%
	Easton	462	-	9	471	22	5%
	Fresno	25,423	14,443	2,304	42,170	28,958	69%
	Kerman	846	54	75	975	65	7%
	Malaga WD	108	1,148	44	1,300	0	0%
	Pinedale WD	1,038	-	17	1,054	175	17%
RCWD	Raisin City	46	16	-	61	-	0%

1. Based on DWR GIS land use files for Fresno (2000) and Tulare County (1999).
2. City of Fresno Land use data from Draft Phase I, Urban Water Demands (West Yost Assoc., 2006).

The general plans or other readily available documents were used to determine the 2030 baseline land uses shown in Table 6. Where general plans did not extend to the 2030 planning horizon the following approach was used to forecast land use. For the cities with land use projections to the year 2025, the average annual growth from 2005 to 2025 was used to project the land use from 2025 to 2030. For all other areas, the urban land acreage was calculated using the population based 2030 baseline water demand (AF) divided by the calculated 2005 water duty (AF/acre). This method of deriving the urban acreage assumes a constant water duty from 2005 to 2030.

Table 6. 2030 Baseline Water Duty Comparison

Agency		2005			2030		
		Water Demand (AF) ³	Urban Area (Acres) ⁴	Calculated Water Duty (AF/Acre)	Water Demand (AF) ³	Urban Area (Acres) ⁴	Calculated Water Duty (AF/Acre)
AID	Dinuba	4,637	1,802	2.57	7,929	3,082	2.57
	Reedley	4,485	2,304	1.95	9,007	4,627	1.95
	AID Unicorp.	2,642	991	2.67	4,841	1,816	2.67
	Subtotal	11,763	5,097	2.31	21,778	9,525	2.29
CID	Fowler	1,027	887	1.16	2,561	3,755	0.68
	Kingsburg	3,187	1,633	1.95	5,101	2,614	1.95
	Parlier	2,519	844	2.98	4,357	1,460	2.98
	Sanger	5,160	2,077	2.48	12,877	6,343	2.03
	Selma	6,242	2,622	2.38	16,020	6,730	2.38
	CID Unicorp.	797	700	1.14	1,944	1,707	1.14
	Subtotal	18,931	8,763	2.16	42,860	22,609	1.90
FID	Clovis	24,481	10,666	2.30	48,062	19,931	2.41
	Fresno	157,280	45,017	3.49	275,189	90,698	3.03
	Kerman	1,687	975	1.73	3,389	1,958	1.73
	FID Unicorp.	10,915	4,171	2.62	11,860	4,532	2.62
	Subtotal	194,363	60,829	3.20	338,500	117,119	2.89
RCWD	RCWD Unicorp.	45	61	0.73	72	98	0.73
	Subtotal	45	61	0.73	72	98	0.73
Total/Average		225,102	74,750	3.01	403,209	149,351	2.70

1. From Table 4.
2. From Table 5.
3. 2030 Water Demand from reported UWMP or population based demand projection.
4. 2030 Acreage from General Plans or calculated using 2030 population based demands and 2005 historic water duty.
5. Fresno values from Draft Phase I, Urban Water Demands (WYA, June 2006).
6. Assumes 2% urban growth from 2025 to 2030 for plans build out to 2025.

The average water duties were calculated for the 2005 existing and the 2030 baseline water demands shown on Table 6. The 2005 water duties range from 0.73 acre feet per acre (af/acre) in Raisin City to 5.61 af/acre in Oroshi (included in AID unincorporated area). Such a large variation in values is a result of the unique land use make up. The comparison between the water duties 2005 and 2030 shows an increase in water demand per acre. Such an increase could occur as a result of increased population density or more intensive water use.

PROJECTED WATER SUPPLY

To define the future 2030 Baseline, No Project Conditions the currently planned water supplies were identified through review of existing general plans, capital facilities plans, available UWMPs, or by discussions at the Forum. Table 7 below shows the anticipated water supply sources for the cities and unincorporated areas. It is assumed that all urban demands not met through delivery of surface water or use reclaimed water are met with groundwater pumping.

With the exception of the Cities of Clovis and Fresno, the urban areas in IRWMP Region are predominantly dependent on groundwater. The City of Clovis and Dinuba also use recycled water as a source of water supply for some non-potable water uses. All other urban areas are assumed to supply groundwater equal to their water demand. The Cities of Clovis and Fresno have three developed sources of water supply including surface water, groundwater, and reclaimed water. Since 2004, the cities have used treated surface water from the Kings River and/or the Federal Central Valley Project (Fresno only) to meet a portion of the city's water demand.

The FID and City of Clovis have two planned projects currently under construction, the Waldron Pond and the wastewater treatment and reclamation plant. The Waldron Pond banking project is estimated to produce 9,000 AF per year, and may be expanded by 3,000 AF per year. The recycled water from the treatment plant will produce approximately 9,410 AF by 2030 to meet non-potable demands for landscaped irrigation. The details of these projects may be found in the City of Clovis water master plan.

The sources of surface water historically delivered to water users in the Region were evaluated in the Water Supply Technical Memorandum and are to be further evaluated during the feasibility study. Sources of surface water historically used in the Region include:

- Kings River entitlements and uncontrolled flood water.
- Central Valley Project (CVP) Class 1 and Class 2 Contracts delivered from the San Joaquin down the Friant Kern Canal to the City of Fresno and FID, respectively.
- CVP 215 flood water purchased by Kings stakeholders.

Table 7. 2030 Baseline Projected Urban Water Supplies and Sources

2030 Water Supplies		Forecasted Demand	Supply					Total
			SW Delivery	GW Pumping	Banking	Exchange	Recycled	
AID	Dinuba	7,929		8,285			1,120	9,405
	Reedley	9,007		9,820				9,820
	Unicorp.	4,841		6,475				6,475
	Subtotal	21,778		24,580			1,120	25,700
CID	Fowler	2,561		3,676				3,676
	Kingsburg	5,101		6,366				6,366
	Parlier	4,357		6,184				6,184
	Sanger	12,877		14,243				14,243
	Selma	16,020		22,890				22,890
	Unicorp.	1,944		2,019				2,019
	Subtotal	42,860		55,376				55,376
FID	Clovis	48,062	39,828	13,092	9,000	871	9,410	72,201
	Fresno	275,189	212,642	156,842			13,800	383,284
	Kerman	3,389		4,697				4,697
	Unicorp.	11,860		19,035				19,035
	Subtotal	338,500	252,470	193,666	9,000	871	23,210	479,217
RCWD	Raisin City	72		172				172
	Subtotal	72		172				172
Total/Average		403,209	252,470	273,794	9,000	871	24,330	560,465