Tulelake Irrigation District

Water Management & Conservation Plan

2011 Update

FINAL DRAFT September 2011

TULELAKE IRRIGATION DISTRICT

WATER MANAGEMENT

&

CONSERVATION PLAN

2011 UPDATE

Prepared by

MBK ENGINEERS

FINAL DRAFT

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Introduction

Tulelake Irrigation District (TID) submitted a Water Management and Conservation Plan (WMCP) in accordance with OAR Chapter 690, Division 086. OWRD reviewed the WMCP and found that the WMCP was consistent with the criteria in OAR Chapter 690, Division 086 and issued a Final Order approving the WMCP. In March of 2010, TID along with other districts within the Klamath Project (Project) submitted a request for an extension of time to comply with the Order, which was granted, allowing for an updated WMCP to be submitted by October 1, 2011. This draft WMCP provides an update to the 2003 WMCP including TID's water management and conservation goals and achievements as described in the following six sections. The format has been changed from the 2003 WMCP to follow the review worksheet in order to facilitate an efficient review of this WMCP update. The first five sections contain clarifications or updates to the 2003 WMCP as recommended by OWRD staff and identified on the WMCP Review Worksheet. Section six of the WMCP update provides the history and topography of TID previously included in the WMCP and updated climate data.

Status of the Klamath River Adjudication and KBRA

Following the approval of the 2003 WMCP, TID has continued to be an active participant in the water supply allocation process and the Klamath River Adjudication. The Order of Determination is expected to be available in late 2012. Following the release of the Order of Determination, the adjudicatory judicial process will continue with an uncertain end date. Parallel to the adjudication process the Klamath Water and Power Agency (KWAPA) was formed in 2008 and the Klamath Basin Restoration Agreement (KBRA) was signed in 2010. TID has been an active participant in KWAPA and the implementation of the KBRA, including the development of the On-Project Plan (OPP). The future implementation of the KBRA will provide a known supply of water to the Klamath Project area. In some years, this will be an inadequate supply to meet demands. Thus, the KBRA includes provisions for the development and implementation of the OPP. The purpose of the OPP is to align water supply with demand. The development of the OPP has just begun and is scheduled to be completed in September 2012. The OPP is intended to secure and avoid shortages to KWAPA members, including TID; however, there is uncertainty relative to the specific details of the OPP relative to individual districts at this time.

Section 1 - Water Supplier Description

Located within the Upper Klamath Basin, TID's northern boundary is contiguous to the border between California and Oregon, as shown on Figure 1, and extends from the Oregon-California state line south about 14 miles to the lava beds. TID includes lands in both Modoc and Siskiyou Counties and is bounded on the west by High Rim and Barn Top Mountains and extends east about 12 miles. The exterior boundary includes 96,000 acres. Tule Lake and the Tule Lake National Wildlife Refuge (TLNWR) lie within the boundaries of TID.

The irrigable acreage reflected on the District's landowner database is approximately 64,000 acres, of which approximately 18,000 acres are owned by the United States; with most of this acreage leased to private growers for crop production. These Federal Lease Lands are located in the lowest (generally below an approximate elevation of 4,035 feet above mean sea level) portion of TID. Homesteading of the current Federal Lease Lands was precluded by the 1964 Kuchel Act. In addition to the Federal Lease Lands, the Public Lands include certain areas utilized by the U.S. Fish and Wildlife Service in farming and other uses.

Section 1.1 – Summary of Water Rights and Contracts

Prior to the formation of TID, water was delivered to homesteaders and other landowners by the US Bureau of Reclamation (Reclamation). Following the formation of TID, and the execution of Contract No. 14-06-200-5954 between TID and the United States, TID began providing water service to lands within TID. The Klamath River water rights for the Project are currently being adjudicated by the State of Oregon. Contractually, Reclamation recognizes certain lands within TID as having a higher priority to Project supplies than other lands. TID is an active participant in the ongoing Klamath River Adjudication.

In addition, lands within TID have rights to use water from Lost River. Although some Lost River water rights were adjudicated in 1918, a recent court decision ruled that the 1918 process had not adjudicated water rights in the Project. There is some uncertainty on this issue. Some lands may possess California riparian rights to Lost River or Tule Lake.

Section 1.2 – Source(s) of Water

The majority of TID's surface water supplies are from the Klamath River. The construction of the Project included an intertie between the Klamath River and the Lost River, known as the Lost River Diversion Channel. During the irrigation season, surface water is diverted from the Klamath River at locations on the Lost River Diversion Channel known as Station 48 and the No. 1 Drain. These diversions provide Klamath River flows to TID and other water users. In addition to diversions at Station 48 and the No. 1 Drain, TID receives tailwater from lands located within Klamath Irrigation District (KID) and from other Klamath River water users located north of the California-Oregon State Line. During wetter years, surface water from the Lost River may also be available to TID.

TID operates and maintains a diversion dam on the channel of the Lost River, known as the Anderson-Rose Dam, located less than one mile north of the California-Oregon State Line. The Anderson-Rose Dam is operated to deliver surface water into TID's J-Canal, which distributes water to more than one-half of TID's irrigated lands through turnouts and lateral canals. The J-Canal also conveys water to other canal systems for delivery to other lands within TID. Water not diverted by TID at Anderson-Rose Dam flows through the Lost River and into the Tule Lake Sumps. Water regulated and stored within the Tule Lake Sumps may be diverted or rediverted for irrigation within TID or discharged by TID's D-Pumping Plant to the P-Canal, which serves the Lower Klamath National Wildlife Refuge (LKNWR) and the water users on the P-Canal system of the Project.

The operational spills and tailwater resulting from irrigation within TID are conveyed through TID's extensive drainage system, which utilizes gravity and pumped discharge into portions of the canal system or into the Tule Lake Sumps. The water contained within the Sumps is either reused within TID or discharged at D-Pumping Plant to the P-Canal. The surface water supplies available to TID include natural flow from the Klamath River, stored water from Upper Klamath Lake and Lake Ewauna, natural flow from Lost River during wetter years, and return flows from upstream irrigation, as shown in Table A.

Table A. Sources of Surface Water Inflow (acre-feet).

Year	Klamath River and Lost River Surface Water Supplies[1/]	Upstream Return Flow from Project Water Users		Total Surface Water Supply Inflow (Acre-feet)
		Lost River and Klamath River Return Flow[2/]	KID Return Flow[3/]	
2002	103,281	62,726	65,000	231,007
2003	62,703	63,027	65,000	190,730
2004	74,206	87,002	65,000	226,208
2005	49,953	81,902	65,000	196,855
2006	47,522	101,691	65,000	214,213
2007	67,607	80,532	65,000	213,139
2008	65,308	94,932	65,000	225,240
2009	67,924	85,932	65,000	218,857
Average	62,098	80,646	65,000	207,744

[1/] Measured at Station 48 and No. 1 Drain.

[2/] Measured as the sum of the diversions into the J Canal (at Anderson-Rose Dam) and the spill at Anderson-Rose Diversion Dam less the measured Klamath River water at Station 48 and number 1 Drain. These quantities represent inflow to TID from return flows of upstream Project water users.

[3/] Estimated inflow from KID at D-Canal and Drains 9, 10, 11, 46-C, and 46-N-1-a.

Additional points of inflow represent return flow from KID into TID. As identified above, this includes D-Canal, and drains 9, 10, 11, 46-C, and 46-N-1-a. As further described in the flow measurement portion of this WMCP, TID is currently in the process of updating the measurement devices at the drainage locations; and therefore, inflow measurements are not available. However, historic inflow measurements identify that on average approximately 65,000 acre-feet of additional water supplies are available from KID facilities in a given year. As shown in Table A, reuse of water diverted initially to other areas of the Project represents a major source of supply available in TID, approximately 70% of the surface water supply available on average during the 2002 through 2009 time period. Direct diversion of Klamath River natural flow, Lost River natural flow, and diversion of stored water from Upper Klamath Lake and Lake Ewauna make up the remainder of the available surface water supply.

In 2001, TID drilled 10 groundwater wells within TID to provide supplemental water supplies during dry years. This groundwater is supplemental to TID's surface water supplies. Groundwater is only utilized during dry years within TID and represents a small portion of the total water supplies available in any given year.

Section 1.3 – Water Distribution Facilities

Figure 2 is a map of TID water conveyance facilities. Klamath River water is diverted from the Lost River Diversion Channel at Station 48 gates and Number 1 drain gates. These structures have a capacity of 650 and 100 cfs, respectively.

Klamath water, Lost River water, and return flow are diverted from the Lost River channel at the Anderson-Rose Dam into J-Canal which has a capacity of 800 cfs. Spill at Anderson-Rose Dam flows into Tule Lake. Tule Lake acts as a large regulating reservoir for TID. Water is rediverted from Tule Lake at the following points:

Diversions	Capacity (cfs)
R Canal	76
Q Canal	180
N-12 Canal	100
R Pump	80
Pump 26 [a/]	18

[a/] Pump 26 is not currently operational.

In addition, six private pumps divert or redivert water from Tule Lake for the irrigation of lands, outside of TID, within Improvement District No. 4. These six pumps have a total capacity of 22 cfs.

From Anderson-Rose Dam, J-Canal flows east and then turns south to Newell. The J-Canal then flows westerly around the north side of the Peninsula. The J-Canal has a total length of 23 miles. As shown on Figure 2, there are lands located between the J Canal and the northern boundary of TID. Although these lands are within KID, they are served water from the J-Canal by TID. Similarly, there are lands located in the northeast portion of TID which are between the D-Canal and J-Canal which are served water from the D-Canal by KID. This mutual service occurs under a written contract between TID and KID.

The M-Canal system has a capacity of 130 cfs. This canal system serves lands in the Copic Bay area in the southeast portion of TID. The N-Canal has a capacity of 300 cfs and a length of 11 miles. This canal is used to irrigate the south central portion of TID. The southwest portion of TID is irrigated from the Q and R-Canals. Q-Canal is about four miles long and has a capacity of 180 cfs. R-Canal is about three miles long and has a capacity of 76 cfs.

As previously identified, TID drilled 10 groundwater wells in 2001 in order to provide supplemental water supplies during dry year periods. The location of each of the 10 wells is shown on Figure 2. Table B provides a summary of data for these 10 wells.

Table B. TID Groundwater Well Summary Data.

Groundwater Well No.	Well Capacity (cfs)	Well Horse Power	Well Depth	Well Casing (inches)	Static Water Level (feet)	Pumping Lift (feet)
1	22.3	300	734	24	28	42
2	24.5	600	1,541	16 & 14	41	125
3	17.8	600	1,681	12	42	170
4	24.5	600	1,433	14	36	143
5	20.1	600	1,565	14	36	143
6	11.6	400	2,380	12	29	190
7	9.6	500	2,020	14	56	250
8	8.9	400	1,807	14	38	250
9	15.6	600	2,043	12	38	250
14	27.9	500	567	24	31	73

As further described in this WMCP, TID is in the process of integrating the groundwater wells into the conveyance system to provide flexibility and supplemental water supplies during dry years. Currently, TID has connected the groundwater wells to local (near the well) conveyance canals. TID will continue to develop the canal system and facilities in order to integrate these wells into other portions of the conveyance system in order to improve flexibility and use of these dry year supplemental water supplies.

Section 1.4 – Current Water Use

All use of water is for irrigation; and no water is delivered for domestic or municipal purposes. The following section identifies water supplies available for TID and a description of water reuse and return flows within TID. A more in-depth description of TID's water measurement program is identified in Section 2.2 of this WMCP. In order to describe and quantify water use within TID, Table C provides the surface water use within TID. The total surface inflow comes directly from Table A. Pumping of water from the D-Pumping Plant is assumed to be excess surface water inflow and is subtracted from total surface water inflow to arrive at a net inflow available for use by TID.

As previously identified, TID installed 10 groundwater wells in 2001 in order to provide supplemental groundwater supplies during dry year periods. These quantities of groundwater are included as additional water supplies for delivery within TID as identified in Table C.

Irrigation deliveries are measured at the lateral level and provide the total water delivered into all of TID's canals. Measurement at this (lateral) level includes deliveries into the conveyance system that ultimately are pumped through D-Pumping Plant and are considered through-flow.

Therefore, the estimated irrigation deliveries identified in Table C consist of the deliveries measured at a lateral level minus through-flow at D-Pumping Plant.

The difference between estimated irrigation diversions and the sum of the net surface water inflow and supplemental groundwater inflow represents reuse and any unmeasured inflow, such as subsurface inflow.

Table C. March through October Water Use (Acre-feet).

Year	Total Surface Water Inflow/1	D-Pumping Plant	Net Surface Water Inflow 2/	Supplemental Groundwater Inflow	Estimated Gross Irrigation Deliveries3/	Reuse and Other4/	% Reuse (inc. subsurface flows)
2002	231,007	67,765	163,242	20,046	248,814	133,291	54%
2003	190,730	59,570	131,160	16,752	189,741	101,399	53%
2004	226,208	64,965	161,243	12,859	229,031	119,894	52%
2005	196,855	78,913	117,942	17,412	156,262	99,821	64%
2006	214,213	85,408	128,805	10,003	168,628	115,228	68%
2007	213,139	39,063	174,076	15,299	221,200	70,888	32%
2008	225,240	50,171	175,069	846	223,238	97,494	44%
2009	218,857	27,628	191,229	0	245,817	82,216	33%
Average	207,744	55,803	151,941	11,498	191,679	84,042	44%

1/ Total surface water inflow as identified in Table A.

2/ Total surface water inflow minus D-Pumping Plant.

3/ Estimated Gross Irrigation deliveries to lands within TID are estimated as the total measured deliveries at a lateral level minus through-flow at D-Pumping Plant.

4/ Net surface water inflow plus supplemental groundwater inflow minus total measured deliveries at a lateral level represent an estimate of the reuse within TID.

Based on the above table, it is evident that TID is reusing substantial quantities of water within its service area boundary. Irrigation can occur, and has historically occurred, outside the period shown, but this does not significantly affect the overall percentages.

Section 1.5 – Summary of Major Classifications of Uses and Users

As previously identified, all water delivered within TID is for irrigation; no municipal or domestic water is delivered within TID.

Farm Demographics

There are a total of 924 farm accounts within TID. Of these, 713 are for privately owned lands, 159 are for publicly held leased lands, and 52 are for surplus water.

Wildlife Refuges and Habitat

TID surrounds the TLNWR, which includes Tule Lake and adjacent lands. Many of the lands within the TLNWR are leased for farming, wildlife feed production, and to provide wildlife habitat. In addition, water discharged through the D-Pumping Plant, which is used to control water levels within Tule Lake, provides water to P-Canal lands within the LKNWR. TID does not directly manage the refuges; but delivers the water, provides drainage, and maintains a good working relationship with the refuges.

Section 1.6 – Types of on-Farm Irrigation System Commonly Used

Water users within TID continue to irrigate by two methods, sprinkler and flood (border strips).

Section 1.7 – Crops Commonly Grown, Average and Peak Use

Crop Demographics

Crop types produced within TID during 2002 through 2009 are consistent with those historically grown within TID and continue to include alfalfa, cereal grains, mint, onions, pasture, and potatoes. Changes in the acreage planted of each crop have been driven by market fluctuations and agricultural economics. An increase in acreage planted to higher dollar commodities such as mint, onions, and potatoes has occurred; however, these changes have not resulted in an increase in water demand. The general mix of crops within TID is identified in Table D. The acreages for 2005 were chosen to represent an average distribution of crops within TID during recent years. Cereal grains are categorized as barley, wheat, oats, and rye. Other crops grown within TID include peas, horseradish, and hay (mostly grasses).

Table D. Representative Cropping Pattern (2005)

Crop Type	Acres	Percentage of Total Acres Irrigated
Alfalfa	16,928	26.7%
Cereal Grains	22,578	35.6%
Mint	2,226	3.5%
Onions	2,668	4.2%
Potatoes	7,536	11.9%
Pasture	1,641	2.6%
Other	9,777	15.4%
Total	63,354	100%

1/ Cereal grains consist of acreage planted to barley, wheat, oats, and rye.
2/ Other crops include peas, horseradish and hay (mostly grasses)

Estimate of Net Irrigation Requirement

An estimate of the net irrigation requirements in TID involved the following steps 1) choosing a design year for crop water demand, 2) determining the representative Region and associated net irrigation requirement factor from Oregon State University Extension Bulletin 8530 for crops grown within TID, and 3) calculating the net irrigation requirement (acreage multiplied by net irrigation requirement factor (Bulletin 8530)) for the various crops grown within the design year. Bulletin 8530 was used to estimate net irrigation requirements within TID for the Klamath Area. Limited data exists on estimated net irrigation requirements for lands within Modoc and Siskiyou Counties. Due to the fact that TID is located within the same hydrologic region within the South Central Region of Oregon, values from Bulletin 8530 were used to estimate the net irrigation requirements. The Bulletin 8530 tables for the Klamath Area (Region 18) were utilized to provide a reasonable estimate of the net irrigation requirements for cropland within TID. The Klamath Area is located directly north of TID. Bulletin 8530 for the Klamath Area does not provide data for onions, mint or "other" crop types as identified in the above table. In these cases, values from the Redmond-Madras Area (Region 16) which is also located in the South Central Region of Oregon, north of the Klamath Area, were used to provide an estimate of the net irrigation requirement for these crops.

The California Irrigation Management Information System (CIMIS) Station Tule Lake FS No. 91, located at the University of California Field Station, spans a period of record of 20 years (1991-2010) and contains annual total reference crop evapotranspiration data (ETo) for these years. The 2005 season was chosen for estimating the net irrigation requirements because the total annual ETo in 2005 was ranked sixth out of 20 years, representing a 70% probability that the ETo for that year was greater than or equal to approximately 70% of the seasons. Typically an 8 out of 10 year (or 80% probability) is used for WMCPs to provide an estimate of the representative ET within a district; however, crop data was not available during the years identified by the 80% probability ranking distribution.

Table E identifies the estimated net irrigation requirements (inches) for 7 out of 10 years, as identified in Bulletin 8530 for crops grown within TID. The tables from Bulletin 8530 take into account effective precipitation; and therefore, the values identified below are the net irrigation requirements for a 70% probability year. As identified below, the maximum estimated net irrigation requirement occurs in July for all crops.

Table E. Estimated Net Irrigation Requirements (inches) for 7 out of 10 years (Bulletin 8530).

Crop Type	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Total (inches)
Alfalfa	0	0	2.01	4.76	6.61	5.2	0	0	18.58
Cereal Grains	0	0	1.22	4.21	8.23	6.02	0.87	0	20.55
Mint	0	1.42	4.06	6.22	7.24	1.18	0	0	20.12
Onions	0	0.63	2.68	4.57	7.2	5.79	1.77	0	22.64
Potatoes	0	0	0.71	2.91	7.95	6.65	4.25	0.75	23.22
Pasture	0	2.28	3.82	5.08	7.09	5.71	4.02	0.91	28.91
Other	0	1.26	4.29	5.98	6.18	0	0	0	17.71

Table F identifies the net irrigation requirements for a representative year (2005). Table E was converted to acre-feet by multiplying the above monthly net irrigation requirements from Bulletin 8530 by the 2005 crop acreages for TID. During 2005, TID's net irrigation requirement peaked in July at 38,740 acre-feet. The annual total net irrigation requirement was estimated to be 106,610 acre-feet.

Table F. Estimated Net Irrigation Requirements for 2005 (Acre-Feet).

Crop Type 2005	Crop Acreage 2005	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Total (Acre-Feet)
Alfalfa	16,928	0	0	2,840	6,710	9,320	7,340	0	0	26,210
Cereal Grains	22,578	0	0	2,300	7,920	15,480	11,330	1,640	0	38,670
Mint	2,226	0	260	750	1,150	1,340	220	0	0	3,720
Onions	2,668	0	140	600	1,020	1,600	1,290	390	0	5,040
Potatoes	7,536	0	0	450	1,830	4,990	4,180	2,670	470	14,590
Pasture	1,641	0	310	520	690	970	780	550	120	3,940
Other	9,777	0	1,030	3,500	4,870	5,040	0	0	0	14,440
Total	63,354	0	1,740	10,960	24,190	38,740	25,140	5,250	590	106,610

Estimate of Gross Irrigation Requirements at the Farm Level

Dividing net irrigation requirements by irrigation efficiency provides an estimate of the gross water requirements at the field level. As previously identified, water users within TID continue to irrigate by two methods, sprinkler and flood (border strips). Specific on-farm evaluations to determine actual irrigation efficiencies are not available at this time; and therefore, a district wide estimate of 70% is used based on observations by TID personnel and published industry values. Based on the assumed irrigation efficiency, the peak monthly demand, and total gross annual demand for irrigation in 7 out of 10 years within TID was estimated and is provided in Table G.

Table G. Estimated Peak/Gross Irrigation Demand Requirements for 7 out of 10 years based on crop acreage planted in 2005.

Estimated Peak/Gross Irrigation Requirements	Estimated (Acre-Feet)
Peak Monthly Demand (July)	55,340
Total Gross Annual Demand (7 out of 10 years)	152,300

Section 1.8 – Operation and Maintenance Program

Operations

All water users must order water for delivery and advise the water office or ditch tender when water should be shut off. This requirement applies to gravity diverters and those who pump water for sprinkler systems.

TID has a drainage system for its irrigated lands. This drainage system maintains the water table below the root zone and also provides for flows being returned to the irrigation system.

Tule Lake Primary Sump is operated in accordance with rules and regulations set forth under the governing Biological Opinion to protect endangered sucker fish. There are also sump elevation restrictions established by US Fish and Wildlife Service. These rules provide that the elevation between May 1 and September 1 shall be 4,034.60 feet. Beginning on September 1, the water level in the sump shall be allowed to rise to an elevation of 4,034.75 feet on October 10, which shall be maintained until November 1. Beginning on November 1, the sump level shall be lowered to 4,034.0 feet, which shall be maintained until January 1. Between January 1 and April 30, the sump shall be operated for flood control purposes in accordance with the procedures described in the rules and regulations.

In addition to providing irrigation water, drainage, and maintaining lake levels, TID performs a flood control function. When storm water accumulates in Tule Lake at a rate that D-Pumping Plant cannot maintain the water at a safe level, water is flooded over leased lands to prevent flooding of private lands.

Maintenance

Maintenance is performed on the conveyance and drainage system on an as-needed basis or during the non-irrigation season, i.e., fall, winter, and early spring months. Maintenance consists of removing excess vegetation and moss, removal of accumulated sediment from canals, repair or replacement of water level control structures and delivery facilities, repair of geomembrane lining, and replacement of high loss regions of canals with pipeline. Maintenance and repair on trash screen facilities, water recovery pumps and electrical motors and their related controls is also routinely performed, or as necessary to effectively and efficiently deliver water to TID customers.

Section 2 –Water Conservation Element

The following section identifies and provides an update to TID's water conservation goals, water conservation measures implemented, and other TID efforts to efficiently manage water deliveries within TID. TID continues to work diligently to provide a sustainable and reliable water supply to landowners within its service area. Many of the water conservation measures identified in the 2003 WMCP have been implemented and are on-going elements of TID's water conservation goals, as further described below. In addition, Figure 3 shows the location of conservation measure improvements identified in Table H.

Section 2.1 – Progress Report on Conservation

The following table lists the conservation measures implemented following the approval of the 2003 WMCP. Additional conservation measures along with on-going conservation programs are further described in Section 2.6 of this WMCP update.

Table H. Progress Report on Water Conservation Measures.

Conservation Measure	Description
Canal Lining	Length (feet)
J-7 Geomembrane lining	800 feet
J-79-a Geomembrane lining	300 feet
M-Canal Geomembrane lining	7,050 feet
M-2 Geomembrane lining	11,500 feet
Total	***19,650 feet***

Conservation Measure	Description
Canal Pipelining	Length (feet)
M-2-b HDPE pipeline	2,900 feet
M-2-d HDPE pipeline	4,100 feet
M-2-e HDPE pipeline	1,060 feet
M-4 HDPE pipeline	1,260 feet
N-16-a HDPE pipeline	4,660
N-17-a HDPE pipeline	9,420
N-17-c HDPE Pipeline	1,962
N-Extension HDPE pipeline	7,680
R-1-a HDPE pipeline	1,100
Total	***34,142 feet***
Groundwater Supply	Integration Location
Well No. 1	J-1 Canal
Well No. 2	J-1
Well No. 3	J-1-a
Well No. 4	J-6
Well No. 5	J-10
Well Nos. 6, 8, and 9	J-Canal
Well No. 7	D-Canal
Well No. 14	South N-Canal
Trash Screen Installation - Location	
Q Canal - Near Pump W	
J-1 Canal Below Headworks	
Pumping Plant No. 3	
Pumping Plant No. 5	
A Pumping Plant	
Energy Audits	Location
VFD Controller	Pump 12

Section 2.2 – Water Measurement Program

Inflow

As described in the Water Source(s) section of this WMCP, the majority of inflow to TID is measured and includes water from all sources. TID participated in a Reclamation funded program to improve the inflow measurement to TID from KID. As a result, SonTek Ultrasonic Doppler Flow Meters were installed within five drainage canals from KID, replacing the weir configuration historically used to estimate inflow. Unfortunately, the measurement and monitoring program through Reclamation was discontinued. Due to the replacement of the previous method of inflow measurement, TID does not have inflow measurements from this source. However, based on historic records of inflow from KID, it is estimated that total inflow from these five drainage canals and D-Canal is approximately 65,000 acre-feet per year. TID is currently evaluating the potential to redeploy the devices and begin measuring and monitoring inflow at these locations. TID will continue to work with the Reclamation to improve inflow measurement from upstream irrigators, specifically inflow into TID from KID.

TID measures inflow from supplemental groundwater supplies which are currently integrated into a portion of the conveyance system. TID intends to integrate the supplemental groundwater supplies into the J-Canal and other portions of the conveyance system to increase conveyance system flexibility during dry year operations. TID will continue measuring supplemental groundwater supplies.

Deliveries – Lateral Level

TID currently measures total irrigation deliveries within the district as the sum of the inflow to the lateral canal systems; J-Canal System, M and South N System, Q and R System, and North N System. This allows TID to manage water deliveries and estimate the total irrigation deliveries at a lateral level.

In addition, TID measures flows at control gates and turnouts into laterals. TID monitors spills from laterals at least twice a day to make adjustments at the headworks, but spills are not quantified.

Drainage

As previously described, a large amount of the water delivered to these canal systems is reused within TID by pumping drain water back into the conveyance system at key locations. Drainage pumping is measured at all drain pumps within TID. Discharge from Tule Lake through D-Pumping Plant is also measured.

Section 2.3 – Other Conservation Measures

As identified in Table H, TID has identified a number of conservation measures that have been implemented following the approval of the 2003 WMCP. An evaluation of additional conservation measures implemented within TID is further described in Section 2.6 of this WMCP update. In addition, TID is proactively implementing programs to improve water management and water use efficiency, including a Global Information System (GIS) mapping program to map the conveyance system. This effort, through GeoSpatial Solutions, will provide TID the means to incorporate field boundaries and annual cropping patterns into the map interface for TID’s use in water use and planning efforts.

Section 2.4 –Goals for Improving Water Management

The two major water problems within TID are reliability of water supply and preventing an adverse salt balance. Other problems include system losses and improving system operations and water use efficiency. The following section identifies some proposed solutions relative to the water supply reliability within TID, including the integration of supplemental groundwater supplies for use during dry year periods and improving delivery system efficiency. In addition, TID's short and long term water management goals are identified in this section.

Water Supply Reliability

The water supply available to TID has always been variable due to weather conditions and variable return flows from upstream Project water users. However, in the year 2001, a dry year, an additional factor was introduced which was the result of an administrative decision to not deliver agricultural water in the Project. This decision was made by Reclamation under the Endangered Species Act (ESA). Dependability of a water supply is now even more critical than in the past. As previously identified, in 2009 the KBRA was signed. The signing of the KBRA will provide for an assurance of the amount of water available to Project irrigators based on forecasted inflow into Upper Klamath Lake. Uncertainty still exists as to how the Project water users will operate to remain within their annual water supply allocation. Although many of the factors which directly affect the reliability of the water supply are not within its direct control, TID is working with KWAPA, local groups, irrigation districts, and others to ensure a more equitable and reliable allocation of water for the Project. TID also is actively engaged in the Klamath River Adjudication, which should further define the available water supplies.

Because much of its water supply is return flow from other Project water users, TID will continue to work closely with other Project water users to ensure that water conservation measures result in reduced diversions from the Project.

System Losses

TID will continue to monitor its system to define areas where it can reduce losses and improve operational flexibility. As further described in Section 2.6, a Canal Lining Feasibility Study was conducted in 2006, which provided TID with recommendations as to those reaches of high losses. TID will continue reviewing this study and may conduct additional studies to evaluate the cost and benefit of future canal pipeline projects. However, due to the Project efficiency described in Section 2.5, TID intends to focus on irrecoverable losses in order to not adversely affect the overall high Project efficiency.

Monitoring the Salt Balance

Soil salinity within TID must continue to be monitored. This will allow TID to take actions necessary to prevent an unfavorable salt balance. TID will continue to be an active participant in salt balance studies to monitor and evaluate the need for future actions.

The following tables identify TID's short and long term water management goals and potential delivery system improvements aimed at improving water management and efficiency.

Short Term Water Management Goals

TID anticipates actively pursuing funding for the short term water management goals identified in Table I for implementation over the next five (5) years.

Table I. Short Term Water Management Goals.

Program	Description
Water Supply Reliability - Supplemental Groundwater Supply	TID will continue to integrate the groundwater wells into the conveyance system to improve flexibility and water supply reliability during dry years.
Water Measurement – Inflow Measurement from KID	TID recognizes the need to measure inflow into the district from upstream sources. TID will continue to work in partnership with Reclamation in order to measure inflow from KID.
Trash Screen Installation	TID will continue to evaluate the need to install additional trash screens at key locations within TID.
Energy Audits	TID will continue to perform pump efficiency tests on pumps within TID to evaluate energy use and efficiency. In addition, TID will explore funding opportunities to install additional VFD controllers on pumps within the water supply recovery system to decrease energy use and improve operational efficiency.
Information and Education Program	TID will continue to work with Project water users, Reclamation, the Intermountain Reservoir and Extension Center, and ITRC to facilitate information and education programs to improve the management and use of water delivered.
Continuing Programs	TID conducts continuing programs to ensure that TID's system operates efficiently while minimizing losses. These include maintenance of the canal system together with weed control in the canals and on the canal banks, pump rehabilitation, and salt balance monitoring.

Long Term Water Management Goals

TID continues to explore and evaluate the long term water management goals identified in Table J for implementation over the next ten (10) years.

Table J. Long Term Water Management Goals.

Program	Description
Water Supply Reliability	Water supply reliability is the most critical problem facing TID. Actions regarding water supply from the Project and the Klamath River Adjudication are not within the control of TID. However, TID intends to continue to be an active participant in working with KWAPA, Project water users, and other interests to resolve these issues.
Automated Controls	TID is currently in the process of updating existing automated control structures. TID will continue to evaluate the need to install additional automated controls to improve operational efficiency.
Telemetry	TID is currently in the process of updating existing telemetry equipment. TID will continue to evaluate the need to install telemetry at new sites for improved operational efficiency.
Pipeline Installation	TID continues to explore funding opportunities to install additional reaches of pipeline to reduce irrecoverable losses in high loss reaches within the conveyance system.
Funding Opportunities	TID will continue to explore funding opportunities to improve operational efficiency and decrease energy consumption.

Section 2.5 – Improving Water Use Efficiency

A 1998 Reclamation draft report entitled, "Klamath Project Historical Water Use Analysis", prepared by Davids Engineering, determined the overall effective efficiency of the Lower Klamath Basin as a whole is between 90 and 95 percent. The efficiency is a result of available tailwater and lateral losses for uses within the Project. This report concluded that little could be gained through increased on-farm efficiency within the Project area. The report also stated that careful consideration should be taken prior to implementing various water use efficiency measures since they would reduce supplies to downstream water users; and therefore, potentially impact and reduce the overall Project efficiency.

Reuse of water within TID is causing additional concentration of salts within the soil profile with each reuse of water (see "Simulating Spatially Distributed Water and Salt Balances" by L. Mateos, C.A. Young, W.W. Wallender and H.L. Carlson; Journal of Irrigation and Drainage Engineering, Sep/Oct 2000; Vol. 126, No. 5). It, therefore, is important to recognize that greater reuse would further concentrate salts within the soil profile.

As evident in the Klamath Project Historical Water Use Analysis Report, the Project has an overall high efficiency. In addition, due to the salt balance concerns stated above, TID continues to monitor and maintain outflow through D-Plant in order to minimize adverse effects of salt buildup and provide sufficient flows to LKNWR. Due to these considerations, TID has maintained an annual assessment of lands within TID at a cost per acre. The overall high efficiency and concerns relative to salt balances within TID have not provided a benefit for the adoption of a rate structure that incentivized on-farm conservation measures. TID continues to facilitate educational programs promoting on-farm conservation and improved water management on a district and on-farm basis emphasizing the need for reduced Project diversions (Klamath River) without adverse impacts to downstream users or an increased salt balance. TID will evaluate the need to adopt a rate structure that supports and encourages on-farm water conservation as the need arises.

Section 2.6 – Evaluation of Water Conservation Projects

Conservation has assisted TID in meeting this goal by providing flexibility of water supplies available to TID and the Project. TID will continue to implement water conservation measures in order to improve water use efficiency, keeping in mind the goal of reduced diversions from the Klamath River. Many of the conservation projects are on-going efforts, as further described below.

Water Recovery System

As previously discussed, a large portion of TID's surface water supply comes from a water recovery system that reuses water originally diverted to lands within TID, KID, and other Project areas. Some of this water is diverted by gravity, but a majority is diverted through a total of 36 pumping plants which have been installed to recover irrigation return flows.

TID installed a variable frequency drive (VFD) controller on one pump within the water recovery system (Pump 12) in order to improve energy use efficiency and decrease energy costs. TID is researching future funding opportunities to install additional VFD controllers at key locations within the conveyance and drainage system to improve the efficiency of the water recovery system.

Automated Controls

The installation of automated control structures improves delivery system timing and efficiency. These automated control structures include check structures to control water levels within the canal system and gates which control flows. In addition, TID is replacing automated control structures already in place in order to improve distribution system efficiency and maintain infrastructure reliability.

Telemetry

Telemetry equipment is installed on 16 of TID's automated control structures. This allows TID personnel to monitor and/or control water levels and flows at these structures from TID's office. TID continues to update telemetry equipment on an as-needed basis within the conveyance system and continues to pursue funding opportunities for additional telemetry locations.

Canal Lining and Piping

In 2006, a Canal Lining Feasibility Study was published identifying high loss regions within TID's service area and recommended areas for additional geomembrane lining installation. As identified in the Progress Report section of this WMCP update, the District lined a total of 19,650 feet with geomembrane lining. The installation of the geomembrane resulted in reduced seepage losses within these high loss reaches within the conveyance system. However, the maintenance associated with the geomembrane lining has proven problematic in some areas within TID. Tearing of the geomembrane lining due to equipment falling into the canal, or the clearing of debris from the canal by heavy machinery during annual maintenance has resulted in a significant amount of time and expense spent repairing the damaged areas. In addition, rodent and animal activity has also contributed to continual maintenance and repairs.

Due to the many issues experienced with the geomembrane lining, TID pursued installing pipe. TID applied for a Reclamation program which provided Hancor N-12 HDPE pipe for installation along high loss reaches of the conveyance system. TID obtained the pipe from Reclamation and completed the installation. In some cases, TID provided the pipe to individual farmers within the service area, specifically the Copic Bay region for installation by landowners. TID has currently installed an additional 34,142 feet of pipe which have resulted in reduced losses. Figure 3 identifies those reaches of the conveyance system that have been lined or piped within TID.

Trash Screen Installation

TID has installed five automated trash screens at key locations within the conveyance and drainage system in order to minimize damage to pump facilities and improve system efficiency. These installations have removed vegetation along with other debris that has caused significant damage to TID pumps. Figure 3 identifies the location of trash screens within TID. An additional trash screen is located at the R-Canal headworks, which is owned by the U.S. Fish and Wildlife Service and operated by TID.

Energy Audits

TID continues to perform pump efficiency tests on pumps within TID in order to verify pump performance and evaluate the need for pump replacement and repair. TID installed a VFD controller at Pump 12 in order to improve energy efficiency. The installation of additional VFDs would decrease energy consumption and costs and improve energy use efficiency.
TID is exploring funding opportunities available through PacifiCorp for the installation of VFD controllers on pumps at key locations within the conveyance system.

Educational Programs

TID continues to be actively involved in various educational programs and works with other Project water users, Reclamation, the Intermountain Reservoir and Extension Center, University of California, and the Irrigation Training and Research Center (ITRC) at California Polytechnic State University, San Luis Obispo.

For example, TID has arranged for a Canal Operators, Short Course to be presented by the ITRC to the Project water users. This was co-sponsored by Reclamation. This short course provided Project canal operators with information on control and measuring devices for irrigation systems. Design and installation problems also were covered together with practical applications. TID continues to facilitate these educational opportunities and encourages district staff and Project water user participation. In addition, TID's continued cooperation with the Intermountain Reservoir and Extension Center On-Farm Efficiency Program has provided for on-farm efficiency improvements. TID has also worked cooperatively with Intermountain Research and Extension Center to evaluate salt balances within the district and concerns associated with the high reuse of tailwater within TID. The district will continue working with these entities to facilitate educational programs for staff and Project water users.

Funding Opportunities

TID continues to pursue funding opportunities for improved water conservation and water management within TID. As previously described, TID is evaluating the opportunity to obtain additional funding for the installation of VFD controllers on pumps at key locations within the district. In addition, TID will continue to research funding opportunities for the installation of automated control structures, telemetry, and flow measurement.

Section 2.7 – Conservation Measure Implementation Schedule

As described in the short and long terms water management goals, TID is actively pursuing funding for the implementation of the short term goals within the next five years. TID will continue to evaluate its long term water management goals and anticipates implementation over the next ten years, contingent on available funding. TID will evaluate the feasibility of the short and long term goals identified in the WMCP on an annual basis and make adjustments as necessary to achieve its overall water management goals.

Section 2.8 – Program for Evaluations of Conservation Projects

Due to the high Project efficiency of water use, it is important for TID and other Project water users to focus conservation efforts on water savings that would result in reduced Project diversions from the Klamath River. TID will continue to work with KWAPA and other Project water users to develop a program to monitor and evaluate the effectiveness of conservation measures implemented and identify if they provide for reduced diversions. TID will explore the need to implement an additional program to evaluate the effectiveness of conservation projects as the need arises.

Section 3 – Water Allocation and Curtailment Element

Historically, water supplies were sufficient to meet needs within the District. Reclamation adopted a Drought Plan in 1992 which provides for allocation of water in times of shortage based on contract priorities. However, this plan assumes early announcements of overall project water availability. Past years of shortage within the project have made planning within TID extremely difficult. For example, in 1992, shortages were announced late in the summer, and TID responded to manage the supply under the circumstances. In April 2001, it was announced that there would be no Klamath water; then in July, 70,000 acre-feet was delivered to the Project as a whole. Over the past decade, greater uncertainty relative to Project deliveries has been experienced by Project irrigators, including TID. Landowners within TID have participated in water bank programs in order to decrease Project demand.

There are general requirements of California law pertaining to administration of shortage. In general, TID seeks to use a rotation system for a normal water shortage. Development of detailed rules and regulations is difficult in light of uncertainties associated with operation of the Klamath Project. However, through the development of the OPP, a process will be defined in which Project irrigators will have a better understanding of how to best manage the water supply allocation. In addition, the OPP will provide a framework for KWAPA to implement programs, such as water banks, during years when surface water supplies are insufficient to meet normal demand.

If TID is presented with a water supply shortage, it will follow California irrigation district law to appropriately share the available supply with TID landowners. (Water Code Sections 22250 – 22252.3). Also, in circumstance of insufficient overall supply, water rental agreements are limited; and there are contractual priorities with respect to other Reclamation contractors to whom TID delivers water.

TID proposes to review its curtailment plan and develop specific rules and regulations for this plan following the development of the OPP. Hopefully, there will be a clearer understanding regarding potential Project shortages to allow TID to develop a plan which can address anticipated natural shortages.

Section 4 – Water Supply Element

Section 4.1 – Long Range Water Demand Projections

TID does not anticipate a change in long-range water demand projections. TID has no intent to provide deliveries for municipal or domestic uses; and therefore, projected demand will remain constant and is based on agricultural deliveries within TID.

Section 4.2 – Projected Water Needs and Reliability of Water Supplies

TID's main goal continues to be the realization of a reliable water supply for the Project, and TID in particular. In order to attain this goal, TID will continue to be actively involved in KWAPA and the development of the OPP.

Section 4.3 Potential Water Sources

TID drilled 10 groundwater wells in 2001 in order to provide a supplemental water supply during dry years to land within its service area. TID developed a conjunctive use plan in order to integrate groundwater supplies into its surface water system during years of surface water shortages. TID continues to make infrastructure improvements to integrate the groundwater and surface water system. It is important to emphasize, the use of groundwater wells within TID remains a supplemental supply for use during dry years and periods of surface water curtailment. TID does not intend to utilize groundwater as a supplemental source during each and every year. TID continues to work cooperatively with the California Department of Water Resources (Ca. DWR) in order to monitor groundwater elevations within the groundwater wells. As part of this cooperation, TID has enrolled in the California Statewide Groundwater Elevation Monitoring (CASGEM) authorized by SBX7 6, enacted in November 2009. Through these efforts TID and Ca. DWR will continue to evaluate the potential effects and sustainability of groundwater use within Tule Lake.

The potential exists to integrate private wells into TID's WMCP and conveyance system. As a result of recent surface water curtailments within the Klamath Basin, TID and individual landowners within its service area have participated in water bank programs. TID will evaluate the benefits of potential integration of individual groundwater wells into the conveyance system, as necessary to meet demand.

TID intends to adopt a resolution of intent to develop a groundwater management plan (AB 3030 Plan) as authorized by the California Water Code. In addition, though the Groundwater Efficiency Use Analysis Project and the On-Project Plan, KWAPA has begun evaluating and analyzing groundwater use efficiency within the Klamath Basin, including TID. Additional projects are underway within the Klamath Basin to estimate sustainable groundwater yield and provide a better understanding of the effects of groundwater pumping within the Project area.

Section 4.4 – Comparison of Potential Water Sources

Surface water deliveries represent TID's primary water supply source. The development of a supplemental groundwater supply during dry years has provided additional water supplies and improved operational flexibility within TID during periods of surface water shortages. However, the increased cost associated with groundwater pumping makes groundwater supplies a less desirable option for TID. In addition, the uncertainty relative to sustainable groundwater basin yield is also a factor in the evaluation of potential water sources. TID's main goal is to provide a reliable water supply to landowners within TID. Surface water will continue to be the main water supply source for TID and supplemental groundwater will be pumped on an as needed basis during periods of reduced surface water supplies or as needed to improved operational flexibility and efficiency.

Section 4.5 – Evaluation of the Effects of Long Range Water Needs

As previously identified, TID does not anticipate a change in long-range water demand projections. TID has no intent to provide deliveries for municipal or domestic uses; and therefore, projected demand will remain constant and is based on agricultural deliveries and other contractual obligations within TID.

Section 5 – Additional WMCP Requirements

Section 5.1 – List of Affected Governments, Copy of Comments

Consistent with OAR 690-056-0225(5) TID submitted a draft WMCP 30 days prior to submitting a draft plan to OWRD to the following entities;

1. Modoc County
2. Siskiyou County
3. City of Tule Lake
4. Siskiyou County Flood Control and Water Conservation District
5. Lassen-Modoc County Flood Control and Water Conservation District

No comments were received from the local affected government agencies listed above.

Section 5.2 – Submittal of Updated Plan

The development and implementation of the OPP will allow irrigation districts within the Project a greater certainty as to water supplies available. In addition, the OPP will provide for a future mechanism to address Project water shortages. Individual WMCPs prepared by districts will be incorporated in the OPP development and future implementation will follow district water management and conservation goals and objectives. Although there is uncertainty relative to the specific outcome of the OPP; it is understood that a holistic approach to water management would provide the greatest benefit to Project irrigators. Therefore, individual WMCPs and their associated updates will be incorporated into the OPP development.

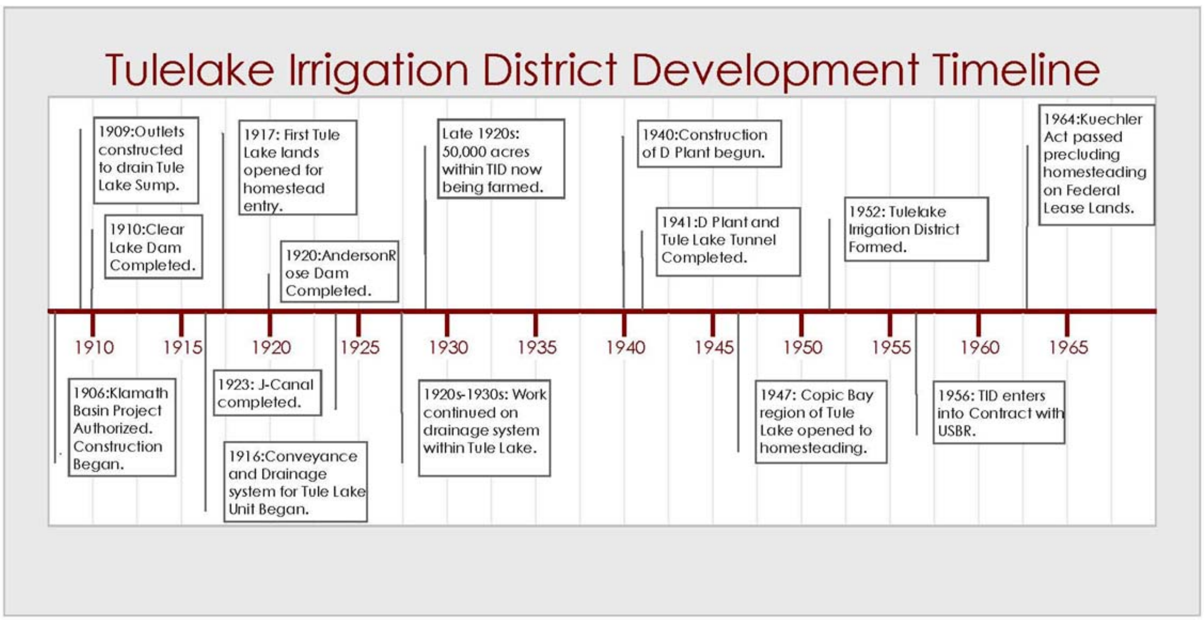
Section 6 – Background

The following section provides a brief history and description of TID. Much of this information is contained in TID's 2003 WMCP. Information has been added throughout this section to address comments provided by OWRD following the review of the 2003 WMCP. Figure A provides a timeline for the construction and development of TID.

History

Prior to the authorization of the Klamath Project by the Secretary of the Interior and construction of the Klamath Project in 1906, most of the lands located within the current boundary of the District were submerged during certain times of the year, depending upon hydrologic conditions. The submergence of this land created a body of water known as Tule Lake. In October 1909, two outlets were constructed at the southern end of Tule Lake and reclamation of lands submerged by Tule Lake began. The flow to drain Tule Lake into the lava beds continued until 1912 when the level of the lake became too low to continue utilizing the outlets.

Figure A. Tulelake Irrigation District Development Timeline.



Construction of the Klamath Basin Project continued during the early 1900s, and by 1910 Clear Lake Dam was completed. By the spring of 1912, the Lost River Diversion Dam and Channel were complete. These facilities diverted water from the Lost River to the Klamath River and reduced flows into Tule Lake. In 1916, work began on the Tule Lake unit with the construction of a distribution and drainage systems for exposed lands along the northern portion of Tule Lake. By 1916, approximately 5,900 acres within the previously submerged region of Tule Lake had been exposed. In 1917, the first Tule Lake lands opened to homestead entry. By 1921, the exposed lakebed had increased to about 20,000 acres.

In 1920, Anderson-Rose Dam was constructed. Work also began on the J-Canal which was completed in 1923. During the 1920s and 1930s, work continued on the distribution levee and drainage systems within the Tule Lake area. By 1923, the continued diversion of Lost River water into the Klamath River and diversion for irrigation resulted in approximately 85,000 acres of the previously 90,000 acres of submerged Tule Lake being available for farming. During the late 1920s, as much as 50,000 acres were being farmed.

Reclaimed lands were made available to settlers, and homesteaded under public notices issued from the 1920s to 1940s. Lands were typically leased to private individuals prior to homestead entry.

In 1940, work began on the D-Pumping Plant. This pumping plant and the Tule Lake Tunnel were completed in November 1941. During World War II, about 44,000 acres owned by the United States within Tule Lake were leased for farming. The Copic Bay region of Tule Lake was opened to homesteading in 1947 and 1948. By the 1950s, about 44,000 acres had been homesteaded.

In 1950, Reclamation required the organization of an irrigation district in the Tule Lake area. By 1952 the Tulelake Irrigation District (TID) had been formed and was holding regular meetings. On September 10, 1956, TID entered into a contract with USBR for repayment of the construction charges and to transfer to TID the operation and maintenance of the facilities used to deliver water to TID lands.

Terrain

The topography of TID is extremely flat with some exception in the northeast portion. This is shown on Figure 4, titled TID Topography. Most of the lands within TID are within the original historical bed of Tule Lake, with the lowest portion being near the current Tule Lake sump.

The topography facilitates efficient management of water supplies. The supply canals are located near the boundaries and most water from these canals and laterals flows toward Tule Lake. The topography also directs drainage and return flows toward Tule Lake. From Tule Lake, water is rediverted for additional use.

Soils

The predominant soil type within TID is Tulebasin mucky silty clay loam. As defined by NRCS, Tulebasin soils are generally 60 inches deep. The first 14 inches is a mucky silty clay loam. The following 18 inches is generally silty clay which is followed by another 28 inches of either silty clay or silty clay loam. Drainage is very poor and the depth to the water table is typically less than one foot if not ponded. Because of the poor drainage characteristics of the soil, landowners must carefully regulate application of irrigation water. The biggest challenge in the majority of TID is maintaining the water table below the root zone.

Climate

The average elevation within TID is about 4,030 feet. The climate is cold in winter with mild summer temperatures. Typically, the growing season begins in mid–April and ends in early October. Summer temperatures average about 60 degrees with some highs above 90 degrees.

Below freezing temperatures can and do occur in the summer at night. The average winter temperatures range from the low 30s to occasional lows below –10 degrees. Although there is normally a growing season of 100 days, there is no month that is frost free.

The average annual precipitation at the California Irrigation Management Information System (CIMIS) Station Tule Lake FS No. 91 located at the University of California Field Station is approximately 12.1 inches. The majority of the precipitation is from October through April.

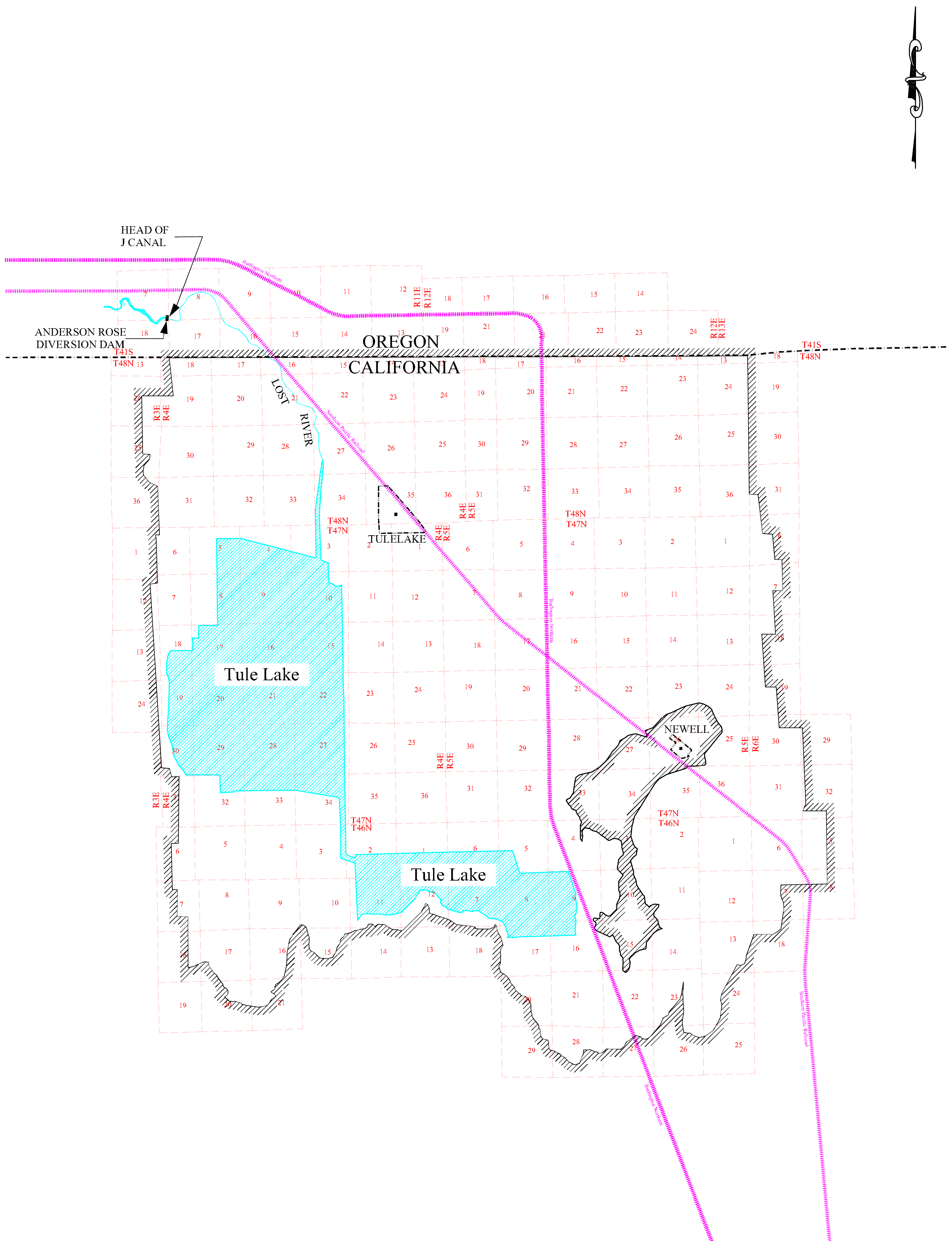
Table K gives the average precipitation and average minimum and maximum monthly temperatures for the 21-year period 1990 through 2010 at the CIMIS Tule Lake FS No. 91 Station.

Table K. Climate Data

	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Avg. Temp (º F)	40	34	39	44	52	59	66	64	57	46	36	30
Min. Temp. (º F)	8	18	23	28	36	42	49	48	39	29	21	15
Max. Temp (º F)	55	60	68	75	83	88	93	95	88	80	73	54
Avg. Precip. (inches)	1.2	1.0	1.0	1.3	1.3	0.8	1.5	0.4	0.4	0.8	1.2	1.4

List of Attached Figures

Figure 1. Boundary
Figure 2. Conveyance System Map
Figure 3. Progress Report on Water Conservation Measures
Figure 4. Topography



FINAL DRAFT

Legend
Boundaries
City Boundaries
Railroads

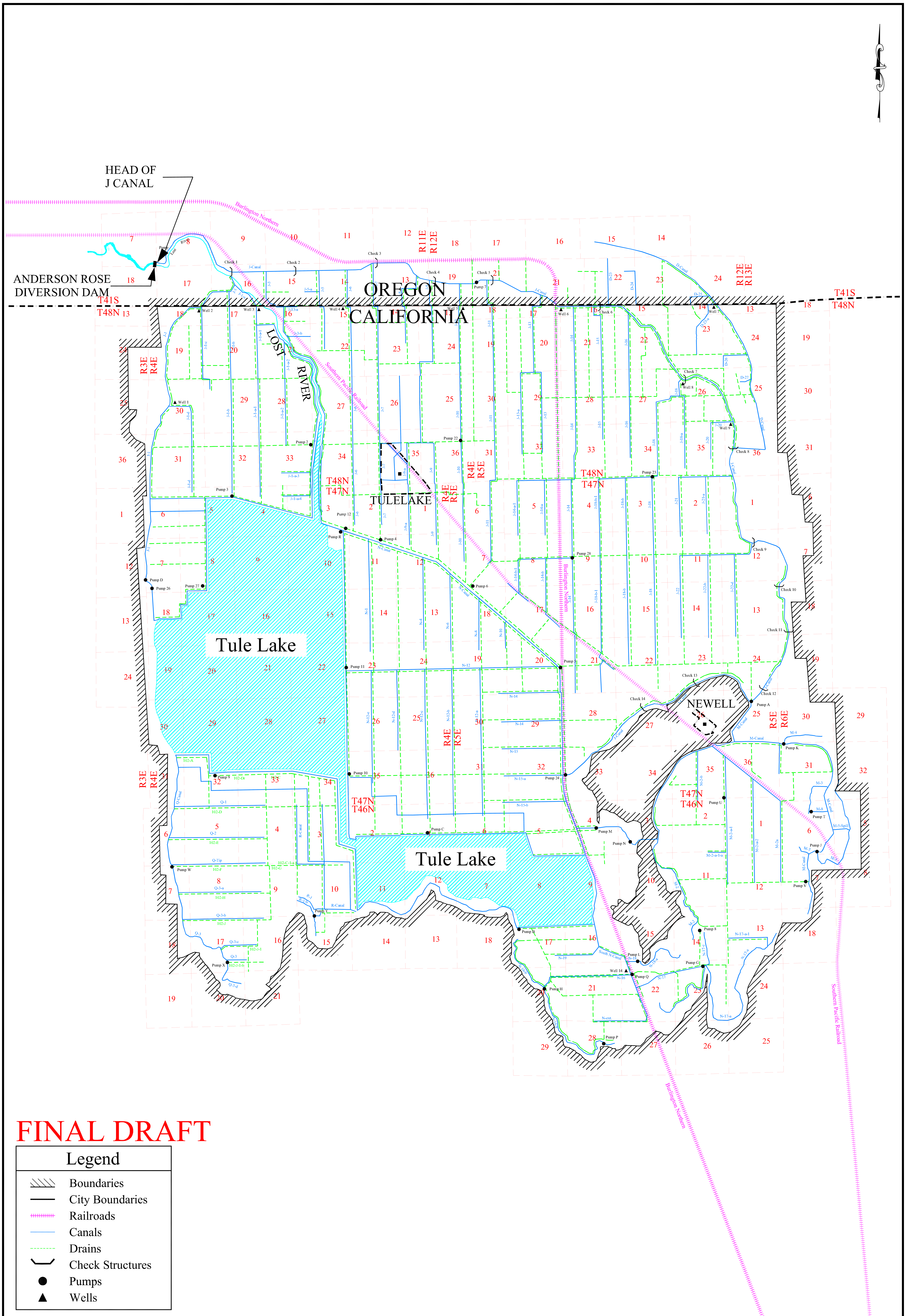
SCALE: 1" = 2 miles
JOB NUMBER: 5201
REQUESTED BY: SH
DRAWN BY: PE
DATE: August 2011

Bar Length On Original Drawing equals One Inch. Adjust Scale Accordingly.

Tulelake Irrigation District WMCP 2011 Update

Figure 1 - Location Map

MBK ENGINEERS
1771 Tribute Road, Suite A
Sacramento, California 95815
Phone: (916) 456-4400 • Fax: (916) 456-0253



Tulelake Irrigation District WMCP 2011 Update

Figure 2 - Conveyance System Map

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1771 Tribute Road, Suite A
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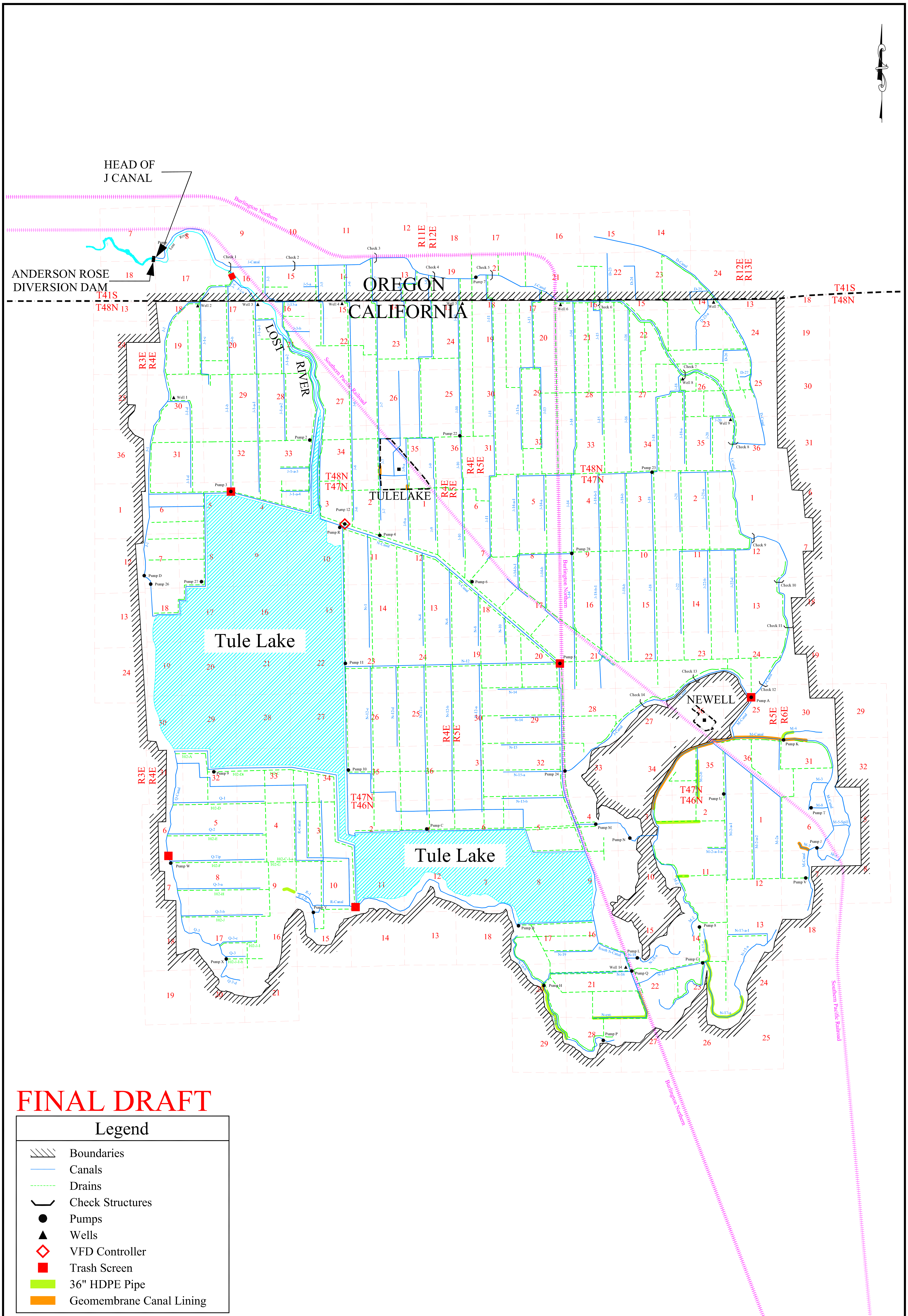

Tulelake Irrigation District WMCP 2011 Update

Figure 3 - Progress Report on Conservation Measures

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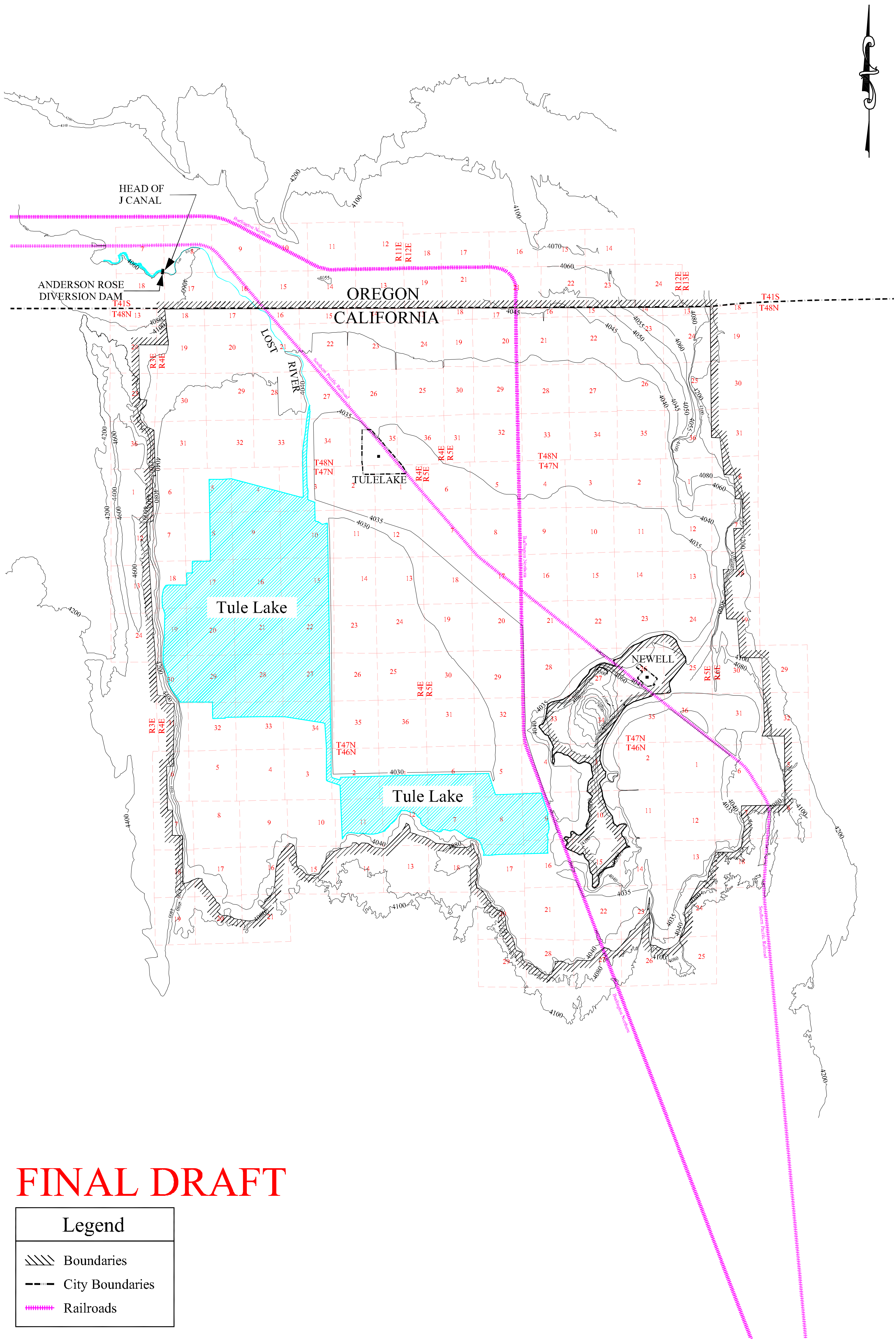
FINAL DRAFT



Tulelake Irrigation District WMCP 2011 Update

Figure 4 - Topography Map

SCALE: 1" = 2 miles
JOB NUMBER: 5201
REQUESTED BY: SH
DRAWN BY: PE
DATE: August 2011

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