FEBRUARY 25, 2014

On-Project Plan

SUMMARY REPORT

PREPARED BY

Klamath Water and Power Agency

KWAPA

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Acronyms and Abbreviations

1902 Act	Reclamation Act of June 17, 1902
BO	biological opinion
ESA	Endangered Species Act
ET	evapotranspiration
Hydrologic Assessment	*Hydrologic Assessment of the Upper Klamath Basin*
ITRC	Irrigation Training and Research Center
KBCC	Klamath Basin Coordinating Council
KBRA	Klamath Basin Restoration Agreement
KDD	Klamath Drainage District
KHSA	Klamath Hydroelectric Settlement Agreement
KID	Klamath Irrigation District
KPSIM	Klamath Project Simulation Model
KWAPA	Klamath Water and Power Agency
LKNWR	Lower Klamath National Wildlife Refuge
NOAA	National Oceanic and Atmospheric Administration
OPP	On-Project Plan
OPPA	On-Project Plan Area
Order	Order of Determination
OWRD	Oregon Water Resources Department
Proposed Program	Proposed On-Project Plan Program
Reclamation	Bureau of Reclamation
TAF	thousand acre-feet
TID	Tulelake Irrigation District
TLNWR	Tule Lake National Wildlife Refuge
TM	technical memorandum
UKL	Upper Klamath Lake
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
USRS	U.S. Reclamation Service

1. Introduction

The Klamath Reclamation Project spans an area within south-central Oregon and north-central California, and provides water to approximately 210,000 acres of agricultural lands (see Figure 1-1). The primary sources of water supply for the Klamath Reclamation Project are Upper Klamath Lake (UKL) and the Klamath River, Clear Lake Reservoir, Gerber Reservoir, and Lost River. The total drainage area, including the Lost River and the Klamath River watershed above Keno, Oregon, is approximately 5,700 square miles. The Klamath Reclamation Project provides water supplies to meet agricultural, environmental, and tribal water needs. These uses can and have been in competition in some years, which in the recent past resulted in substantially reduced supplies for Klamath Reclamation Project irrigators.

In response to continued water supply uncertainty, representatives of diverse communities in the Klamath Basin, working with federal, state, and county governments, tribes, and other interested organizations, developed the Klamath Basin Restoration Agreement (KBRA) and the Klamath Hydroelectric Settlement Agreement (KHSA) to rebuild fisheries, sustain agricultural communities, and resolve longstanding disputes related to the allocation of water resources.

The KBRA includes provisions for development of a "Plan," also referred to as the On-Project Plan (OPP) to align water supply and demand in light of increased water supply certainty with permanent limitation on water diversions. This "Limitation on DIVERSION" establishes the amount of water that can be diverted from the "Settlement Points of Diversion" from the Klamath River system to the OPP Area (OPPA). The diversion limitation is expressed on a sliding scale; more Klamath River water is able to be diverted in wetter years and less in drier years.

Because the Limitation on DIVERSION allows for water being available for fisheries purposes and because water delivery commitments will arise for the Lower Klamath National Wildlife Refuge (LKNWR), Klamath water supplies may not be sufficient in all years to meet irrigation demands in the OPPA. The purpose of the OPP is to address circumstance and identify a solution such that irrigators within the OPPA can "live with" the diversion limitations. The Proposed On-Project Plan Program (hereafter referred to as the Proposed Program) (Klamath Water and Power Agency's [KWAPA] long-term strategy to implement and

Klamath Basin Restoration Agreement and Klamath Hydroelectric Settlement Agreement

The KBRA and KHSA are landmark agreements that were developed and signed by numerous tribal, federal, state, and local agencies and interests to support the use and protection of the water, environmental, and hydropower resources within the Klamath Basin. Both of the agreements were signed in 2010 after many years of negotiation.

The KBRA is intended to result in effective and durable solutions that will restore and sustain natural fish production and provide for full participation in ocean and river harvest opportunities of fish species throughout the Klamath Basin; establish reliable water and power supplies that sustain agricultural uses, communities, and national wildlife refuges; and contribute to the public welfare and the sustainability of the Klamath Basin communities. KBRA Section 15.2 specifies the development of an OPP to be developed by KWAPA to "align water supply and demand" within an area defined as the OPPA.

The KHSA identifies the process for additional studies, environmental review, and a decision by the Secretary of the Interior regarding whether removal of the four dams owned by PacifiCorp will advance restoration of the salmonid fisheries of the Klamath Basin and is in the public interest, which includes consideration of potential impacts on affected local communities and tribes. The KHSA also includes provisions for the interim operations of the dams and the process to transfer, decommission, and remove the dams.

administer the OPP), further described in Technical Memorandum (TM) 7 and Section 7 of this Summary Report, identifies the action items necessary to align water supply and demand for the OPPA to address these potential shortages.

Klamath Water and Power Agency

KWAPA was formed in 2008 as a product of discussions among the Klamath Water Users Association, local irrigators, districts, and others in the community as part of the development and agreement to the KBRA. KWAPA is responsible for the development, implementation, and administration of the OPP, along with obtaining affordable power for irrigators to ensure the economic sustainability of the agricultural community. KWAPA consists of public agency members in Oregon and California, all of whom are contractors of the Bureau of Reclamation (Reclamation) and provide water delivery within areas of the Klamath Reclamation Project.

On-Project Plan Participants

KWAPA formed the OPP Advisory Committee, which includes the following member agencies:

- Ady District Improvement Company
- Enterprise Irrigation District
- Klamath Basin Improvement District
- Klamath Drainage District (KDD)
- Klamath Hills District Improvement Company
- Klamath Irrigation District (KID)
- Malin Irrigation District
- Midland Irrigation District
- Pioneer District Improvement Company
- Poe Valley Irrigation District
- Shasta View Irrigation District
- Sunnyside Irrigation District
- Tulelake Irrigation District (TID)
- Van Brimmer Ditch Company
- Westside Improvement District

Pine Grove Irrigation District is also within the OPPA but is not represented on the OPP Advisory Committee. In addition, Reclamation, U.S. Fish and Wildlife Service (USFWS), Oregon Water Resources Department (OWRD), and U.S. Geological Survey (USGS) provided review and input throughout the development of the OPP.

Limitation on DIVERSION/Settlement Points of Diversion

The "Limitation on DIVERSION" is based on a defined term in the KBRA and identifies a specific quantity of water that can be diverted from the Klamath River system in any given year (based on hydrology) at the Settlement Points of Diversion (discussed below). The Limitation on DIVERSION is based on projections of inflow to UKL and ranges from 378 thousand acre-feet (TAF) to 445 TAF and includes a quantity to be delivered to LKNWR outside Area K (referred to as the "Refuge Allocation" in the KBRA), which ranges from 48 to 60 TAF. Because the applicable DIVERSION amount is known each year by March, availability of water consistent with the limitation provides irrigators with a reliable and certain water supply available for diversion to support a sustainable agricultural community and the national wildlife refuges.

The KBRA also specifies that the total quantity will be increased in drier years by 10 TAF during Phase 2, which is defined by when OWRD receives appropriate notice from the Klamath Basin Coordinating Council (KBCC).

The "Settlement Points of Diversion" are 10 specific diversion locations specified in the KBRA (Appendix E-1) within the OPPA at which water from UKL or the Klamath River is diverted for beneficial use. The Settlement Points of Diversion include the A-Canal as well as specified structures on the Lost River Diversion Channel, Klamath River, and Lake Ewauna. The term "DIVERSION" is defined in the KBRA (Appendix E-1) as the total amount of water diverted from the Settlement Points of Diversion (from the Klamath River system) as identified and calculated under Term 1.a.-c. of Appendix E-1.

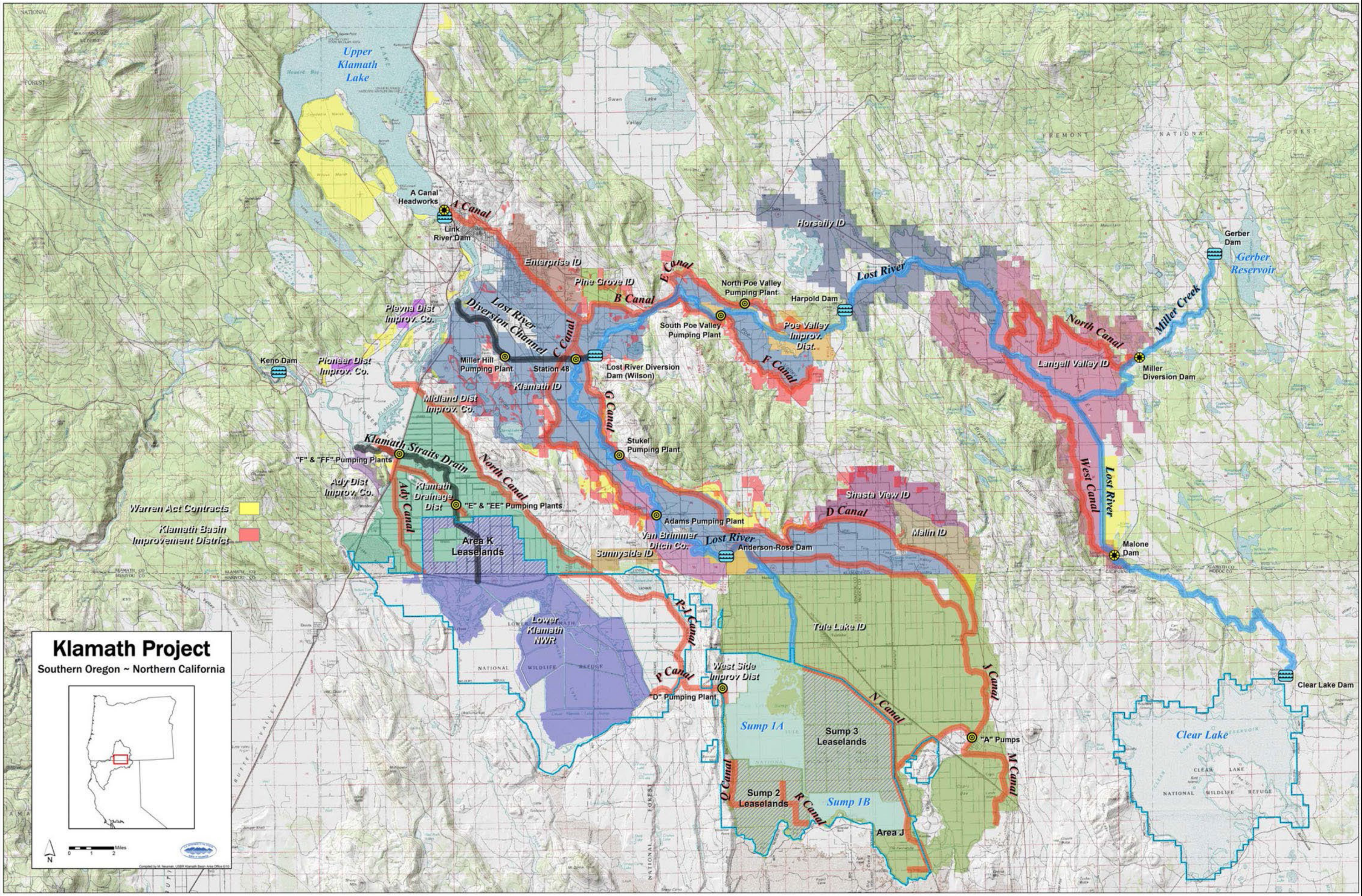

Figure 1-1
Klamath Reclamation Project Location Map
On-Project Plan Summary Report

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On-Project Plan Mission Statement

*Preparation of the OPP was guided by the following **mission statement** developed by the OPP participants:*

Develop, through an open, transparent, and collaborative interdistrict approach, an integrated plan that provides a strategy with various options for aligning water supply and demand consistent with the KBRA to preserve the OPPA agricultural, industrial, and municipal economies, and environmental resources.

Objectives and Goals of the On-Project Plan

The objectives of the OPP are as follows:

- Meet commitments specified in the KBRA.
- Maintain long-term sustainability of Klamath Reclamation Project agriculture.
- Minimize reductions in irrigated agriculture in the OPPA and avoid any uncompensated reduction in irrigated agriculture.
- Ensure equitable treatment among districts, avoid impacts on district operations, and seek opportunities for improved water management operations within and across districts.
- Develop fair, equitable, and transparent strategies for aligning water supply and demand.
- Consider cost effectiveness of alternatives to the overall Klamath Basin economy and minimize third-party impacts.
- Avoid "Adverse Impacts" on groundwater as a result of OPP implementation or administration, as specified in KBRA Sections 15.2.1.A and 15.2.4.A.
- Use groundwater in a long-term and sustainable manner, and address all relevant in-basin groundwater management objectives, including identifying and addressing potential impacts on areas directly adjacent to the OPPA.

The goal of the OPP is to align water supply and demand for the OPPA in light of ultimate limitations on water availability from UKL and the Klamath River, the availability of supplies not affected by such limitations, and delivery commitments for wildlife refuge purposes. KWAPA's goal is to align supply with demand with the least impact on existing and future land use and associated agricultural production.

On-Project Plan Development Approach

The OPP was developed through a series of TMs to accommodate input and guide the development of the Proposed Program. The following TMs (all of which are available from KWAPA under separate cover) are summarized in this Summary Report:

- *TM 1 – Project Goals/Objectives and Approach for Development of the On-Project Plan*
- *TM 2 – Water Supply and Operations for the On-Project Plan Area*
- *TM 3 – Irrigation and Water Requirements Demands for the On-Project Plan Area*
- *TM 4 – Supplemental Water Need of the On-Project Plan Area*
- *TM 5 – Surface Water Flow Path for the On-Project Plan Area*
- *TM 6 – Water Management and Supply Options*
- *TM 7 – Proposed On-Project Plan Program and Implementation and Administration*

2. Water Supplies, Water Rights, and Project Operations

Historical Development of Water Rights in the On-Project Plan Area

Beginning in the nineteenth century, western settlers of the Upper Klamath Basin began to control and use water for irrigation. Initially, this included beneficial use of overflow water. Subsequently, controlled diversion and delivery of water to land by individuals and to serve more than one landowner were undertaken. Diversions from Lower Klamath Lake began as early as 1882, with several other appropriations from the Link River and UKL made before 1905 when the Klamath Reclamation Project was authorized. Figure 2-1 is a 1906 map of the Klamath Reclamation Project area that includes the OPPA. This map reflects “pre-Reclamation Project” development in the OPPA.

The Klamath Reclamation Project was authorized under the Reclamation Act of June 17, 1902 (1902 Act), which sought to bring irrigation to otherwise low-value and unfarmed public lands. In the Klamath Basin, the main area of public land lay beneath the surfaces of Tule Lake and Lower Klamath Lake; therefore, the Klamath Reclamation Project was also envisioned to serve land that was privately held at the time it was authorized. The Klamath Reclamation Project was originally conceived to serve approximately 300,000 acres.

The Oregon and California legislatures, on January 20 and February 3, 1905, respectively, passed legislation ceding certain lands in Lower Klamath and Tule Lakes to the United States for use by the Klamath Reclamation Project under provisions of the 1902 Act. On February 22, 1905, Oregon enacted legislation to facilitate appropriations for the Klamath Reclamation Project. Construction was authorized by the Secretary on May 15, 1905, in accordance with the 1902 Act, to drain and reclaim lakebed lands of the Lower Klamath and Tule Lakes; store water of the Klamath and Lost Rivers, including storage of water in Lower Klamath and Tule Lakes; divert irrigation supplies; and control flooding of the reclaimed lands. On May 17, 1905, under the Oregon legislation enacted on February 22, 1905, the U.S. Reclamation Service (USRS) – the predecessor agency to Reclamation – prepared a notice of appropriation of all then-unappropriated waters of the Klamath Basin to support the Klamath Reclamation Project. This “blanket filing” was filed with the State Engineer on May 19, 1905. USRS also purchased water rights and pre-existing facilities in the OPPA, some of which were incorporated into the Klamath Reclamation Project.

USRS and other parties constructed facilities for diversion, storage, and conveyance of water. In general, acreage receiving water for irrigation directly from Klamath Reclamation Project facilities gradually increased. By about 1950, the Klamath Reclamation Project provided irrigation service to approximately 200,000 acres, not markedly different than today (as shown on Figure 1-1). Innumerable structures and improvements are involved in water delivery and drainage, whether constructed by Reclamation, districts, or individuals.

Klamath Adjudication

Water rights in Oregon are governed by the State Water Code, which was adopted in 1909 after USRS claims to then-unappropriated waters of the Klamath Basin were made to support the Klamath Reclamation Project in 1905.

The Klamath River Adjudication, begun in 1975, is the legal process by which the State of Oregon quantified and documented the water rights for water from UKL and the Klamath River appropriated before adoption of the State Water Code. The first phase of the adjudication process resulted in an Order of Determination (Order) adopted in March 2013. The Order is the current basis for water rights regulation. Adjudication is now in the second phase, in which challenges to the Order will be resolved by a Klamath County circuit court judge whose final decree will determine pre-1909 Klamath River water rights and federal reserved water rights.

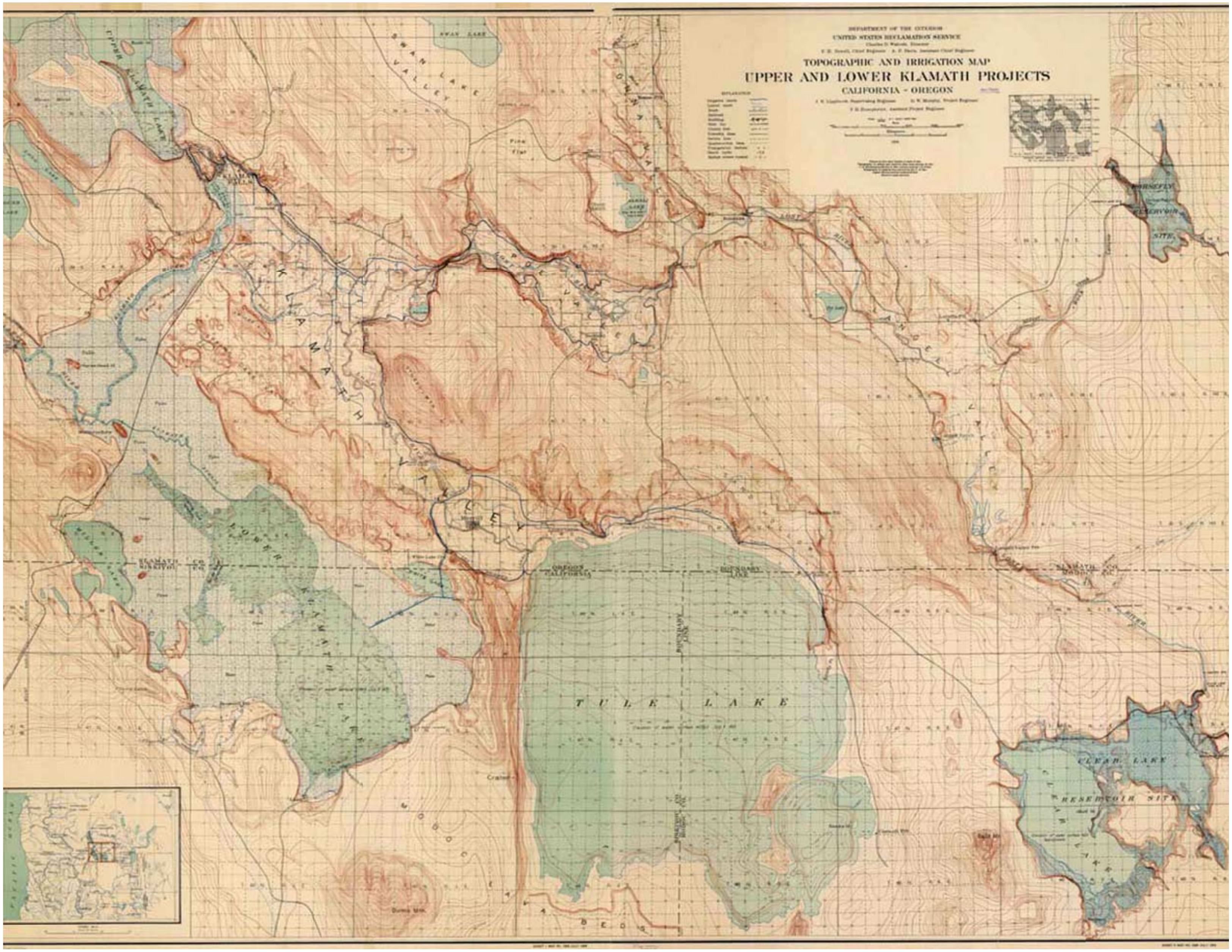


Figure 2-1
Klamath Reclamation Project Prior to Construction of Diversion and Works and Reclaiming of Lands (1906)
On-Project Plan Summary Report

Limitation on DIVERSION

Under the KBRA, "DIVERSION" generally means the combined total amount of Klamath River and UKL water diverted from several locations (the Settlement Points of Diversion). The Limitation on DIVERSION does not apply to other sources of water (including the Lost River). During the March through October period, the Limitation on DIVERSION is based on the forecast net inflow to UKL during April 1 through September 30.

The DIVERSION quantities include amounts based on what is referred to as the "Refuge Allocation." The Refuge Allocation is measured at specific locations identified in the KBRA and ranges from 48 to 60 TAF in the March through October period, depending on the same forecast of April through September inflow to UKL. Consistent with the KBRA, water provided to meet the Refuge Allocation is termed "delivery." The Refuge Allocation is not the entire amount of water that will be delivered to the national wildlife refuges; it is a specific new delivery commitment identified in the KBRA for refuge purposes.

The Refuge Allocation includes water provided for LKNWR wetlands, LKNWR cooperative farming lands, refilling Tule Lake National Wildlife Refuge (TLNWR) sumps after intentional draining by the refuges, refuge-approved Walking Wetlands (1 acre-foot per acre charged to Refuge Allocation), and conveyance losses associated with delivery to Walking Wetlands from bypassing Anderson-Rose Dam and delivery to LKNWR via North Canal (if agreed upon in the future by the refuge manager and KDD).

Figure 2-2 depicts the Phase 1 March through October Limitation on DIVERSION.

The Limitation on DIVERSION during the winter period is 80 TAF, which includes a quantity based on the winter allocation to LKNWR of 35 TAF. The KBCC can notify OWRD that additional winter DIVERSION is acceptable up to a specified quantity, as long as the quantity is authorized pursuant to water rights. The winter Refuge Allocation may be increased up to 60 TAF when available under applicable law, subject to any agreement for delivery of water. This potential increase above the ordinary allocation of 35 TAF will be charged against the summer Refuge Allocation, unless the summer Refuge Allocation is augmented by new storage based on a KBCC recommendation.

The KBRA also identifies the development of the Drought Plan (KBRA Section 19.2) to address particularly dry years (identified as "Drought" and "Extreme Drought" in the Drought Plan). As identified in the KBRA, the Drought Plan (Reclamation, 2011) provides a method by which an Extreme Drought (for KBRA purposes) shall be declared in future years similar to 1992 and 1994, the only two Extreme Drought water years in the period 1961 to 2000. The KBRA provides that the Limitation on DIVERSION can be reduced further, as defined in the Drought Plan, during Extreme Drought years. The Drought Plan also identifies other response measures to address these year types. The KBRA does not require the OPP to directly address further limitations in Extreme Drought years. However, administration of the OPP in such years will, at a minimum, reduce differences between supply and demand.

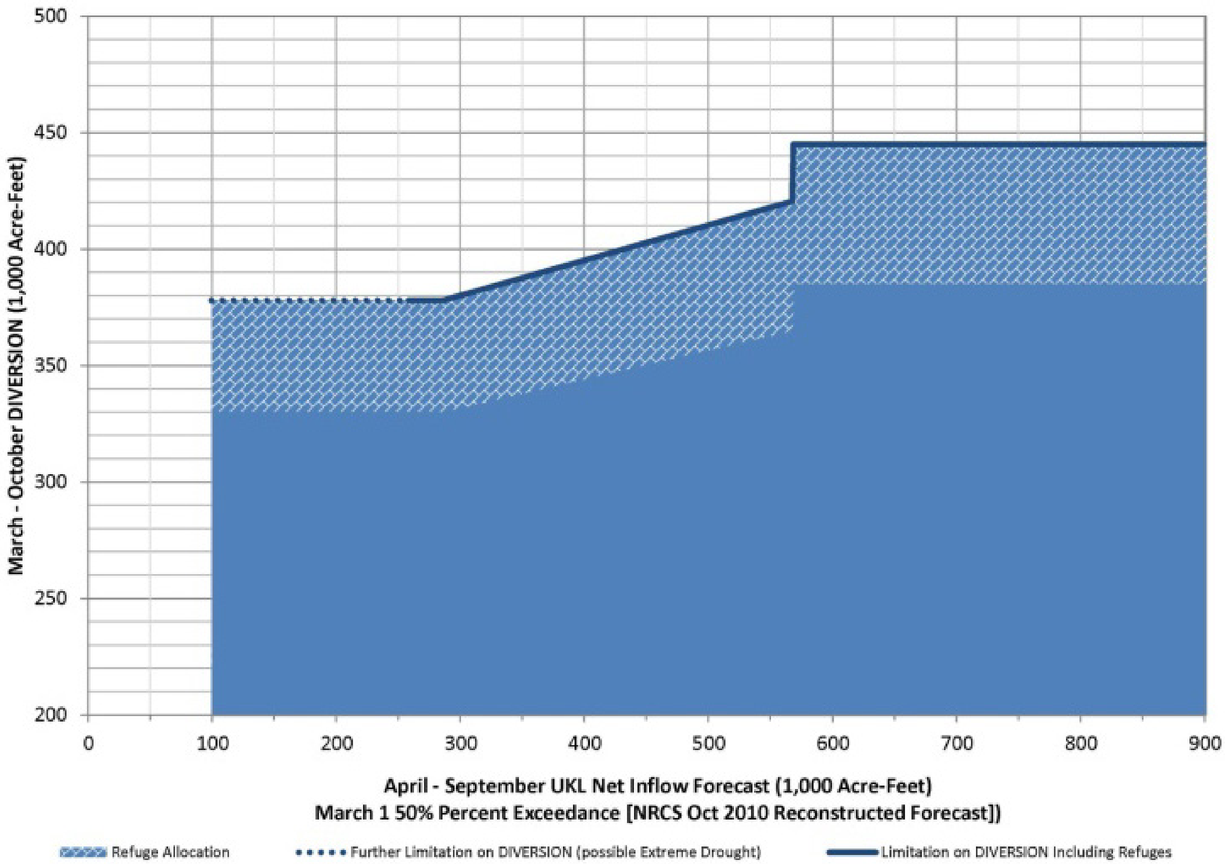
Klamath Reclamation Project Water Supplies, Facilities, and Operation

The Klamath Reclamation Project provides irrigation water for both agricultural and national wildlife refuge lands in the Klamath Basin of south-central Oregon and north-central California, and provides flood control along the Lost and Klamath Rivers downstream of the Klamath Reclamation Project area. Water sources for the OPPA include UKL, Klamath River, Lost River, springs and other streams, precipitation and related soil moisture content, groundwater, and reuse of agricultural drainwater.

Facilities providing water to the OPPA consist of diversions and flow-regulating structures, pumps, and hundreds of miles of irrigation canals, laterals, ditches, and drains. Approximate capacities of these facilities, based on data from Reclamation and the districts that operate the facilities, are documented in TM 2.

FIGURE 2-2

March through October Limitation on DIVERSION



The key delivery systems that provide water to the majority of the water users within the OPPA are operated by KID, TID, and KDD. The KID/TID and KDD systems generally correspond with the Main and Tule Lake Divisions and Lower Klamath Divisions, respectively, of the Klamath Reclamation Project. The remainder of all other districts/areas within the OPPA is served by other delivery systems, all of which use diversions identified as one or more Settlement Points of Diversion.

Operations Relative to the On-Project Plan Area

In general, between the time of authorization of the Klamath Reclamation Project and the early 1990s, Link River Dam and other facilities were operated primarily to furnish water for irrigation. Water was also managed for downstream power generation, subject to Klamath Reclamation Project's irrigation needs.

PacifiCorp's California water right license for Iron Gate Dam and the Federal Energy Regulatory Commission license for Project 2082 (includes Iron Gate Dam) identified minimum flow requirements below Iron Gate Dam by month. However, these requirements pertained only to water that PacifiCorp has rights to for power, and the rights to water for power generation are subordinate to the Klamath Reclamation Project irrigation needs. Therefore, when necessary, a variance would apply to the minimum Iron Gate Dam flows. UKL elevations were also primarily a function of the Klamath Reclamation Project's irrigation needs and downstream power generation.

Agricultural lease lands within the Klamath Reclamation Project and national wildlife refuges (LKNWR and TLNWR) received water deliveries as part of the Klamath Reclamation Project and pursuant to permanent contracts. From the mid-1940s onward, varying amounts of water were available to LKNWR (other than the lease lands) as a result of Klamath Reclamation Project operations.

National Wildlife Refuges and Walking Wetlands

TLNWR and the part of LKNWR commonly referred to as "Area K lands" are within the OPPA. The OPP must also take into account the obligations for delivery of the Refuge Allocation to LKNWR, as identified in KBRA Section 15.1.2.E. Therefore, the circumstances of the two refuges are important to the OPP.

Both LKNWR and TLNWR contain areas leased for agricultural production. All of the irrigation demands in TLNWR and LKNWR Area K lands are to be considered in aligning supply and demand in the OPPA. Water demand for Area K lease lands and water demand for TLNWR will be considered as part of the overall OPPA demand, calculated as part of demand within KDD and TID, respectively.

As part of USFWS's Walking Wetlands program, some irrigable lands within the OPPA are alternated between crops and flooded wetlands. This program is designed to facilitate mutual benefit between wildlife and agriculture by providing habitat for wildlife during wetland years, which also improves soil conditions for cropping years. For land enrolled in the Walking Wetlands program, 1 acre-foot per acre is "charged" to the separate Refuge Allocation (KBRA Section 15.1.2.E.iii.a.).

In recent decades, operation of the Klamath Reclamation Project has been affected by other demands and legal requirements. For example, in 1988, the shortnose sucker and Lost River sucker, both species that inhabit UKL, were listed as endangered under the Endangered Species Act (ESA). Initially, this did not trigger regulatory conditions that relate to water supply for the Klamath Reclamation Project. However, in 1991, USFWS began to issue biological opinions (BOs) specifying UKL elevations to be maintained for Reclamation to meet obligations under the ESA to avoid jeopardy to listed species. Combined with Extreme Droughts in 1992 and 1994, implementation of the BOs reduced availability of water from UKL in the late part of those growing seasons.

Additionally, in 1997, coho salmon, which occupy parts of the Lower Klamath River Basin, were listed as threatened under the ESA. In this case, the National Oceanic and Atmospheric Administration (NOAA)–National Marine Fisheries Service issued BOs that specify maintenance flows for the Klamath Reclamation Project below Iron Gate Dam for coho salmon (typically, higher than the non-binding flows specified in the PacifiCorp water right and Federal Energy Regulatory Commission licenses previously discussed).

Increased recognition of other rights or interests in the waters of the Klamath Basin and associated federal responsibilities are also factors. In 1997, Reclamation began preparing annual operations plans for the Klamath Reclamation Project that have primarily implemented the ESA UKL elevation and Klamath River flow prescriptions identified by USFWS and NOAA–National Marine Fisheries Service. In 2013, the two agencies completed coordinate BOs that are based on somewhat greater management flexibility in meeting ESA obligations.

Water Quality

Water used in the OPPA must be of suitable quality for irrigation. Other surface water quality concerns within the OPPA include total maximum daily load requirements overseen by the Oregon Department of Environmental Quality and the quality of irrigation water return flows to the Klamath and Lost Rivers as well as LKNWR and TLNWR.

Ongoing regulatory processes may identify or lead to management activities in the OPPA to improve water quality. Implementation of the OPP will avoid actions that would interfere with foreseeable water quality management actions or have significant adverse impacts on water quality.

The amount of groundwater quality data for the study area is generally limited. However, review of available data and historical use of both surface water and groundwater supplies generally indicates that the groundwater is of suitable quality for irrigation purposes.

Surface water supplies and system operations were evaluated in TM 2 in context of deliveries from the measured Settlement Points of Diversion during two specific periods. The evaluation was conducted to understand the differences in supplies and operations before and after constraints were placed on the Klamath Reclamation Project from the full implementation of the ESA as represented in 2001.

The past period (1986 through 2000) includes 2 years (1992 and 1994) that would have been Extreme Drought years pursuant to the Drought Plan of the KBRA. The recent period (2001 through 2010) incorporates operations and water user actions taken with regard to the water bank programs and activities developed to address the ESA and associated climatic conditions that resulted in substantial curtailments in 2001, resulting in less than 100 TAF of deliveries.

Surface Water Resources

Maximum, average, and minimum irrigation diversions for the past and recent periods are shown on Figures 2-3 and 2-4. The data used are from Reclamation's MODSUM Excel spreadsheet dated May 2011 and represent only the agricultural portion, meaning the Ady Canal at the state line is deducted from the Ady Canal diversions. Values shown on the figure represent cumulative Klamath Reclamation Project diversions for the March through October irrigation season to the OPPA.

Variability in surface water supplies available for irrigation in the recent period is illustrated by the gap between the maximum, average, and minimum diversion. This variability arises from hydrologic uncertainty as well as strict operating criteria, and results in overall uncertainty of water supply availability for irrigators.

Groundwater Resources

Changes in water management and environmental restrictions resulting in unreliable surface water supplies over the last decade in the Klamath Reclamation Project have increased use of groundwater resources since 2001.

Volcanic aquifers in the basin can provide a substantial quantity of groundwater to supplement surface water supplies because of their high permeability and vast extent. High-yielding wells in the groundwater basin are generally located where water is needed for irrigation and do not necessarily indicate specific areas of high groundwater conductivity. Wells are generally screened from depths of less than 100 feet to deeper than 2,000 feet.

Klamath Water Bank Programs

Water bank programs and activities have been implemented by Reclamation and KWAPA as necessary in response to the 2001 curtailments. Although referred to by various names, including the Klamath Basin Pilot Water Bank, Water Supply Enhancement Study, and the Water User Mitigation Program, they have included similar activities to extend water supplies including cropland idling, dryland farming, groundwater pumping/substitution, and storage. Hydrologic conditions during the 2002 through 2013 period led to water bank programs being implemented in all years other than 2002, 2008, 2009, and 2011.

FIGURE 2-3
Cumulative March through October Klamath Project Irrigation Diversions (1986 to 2000)

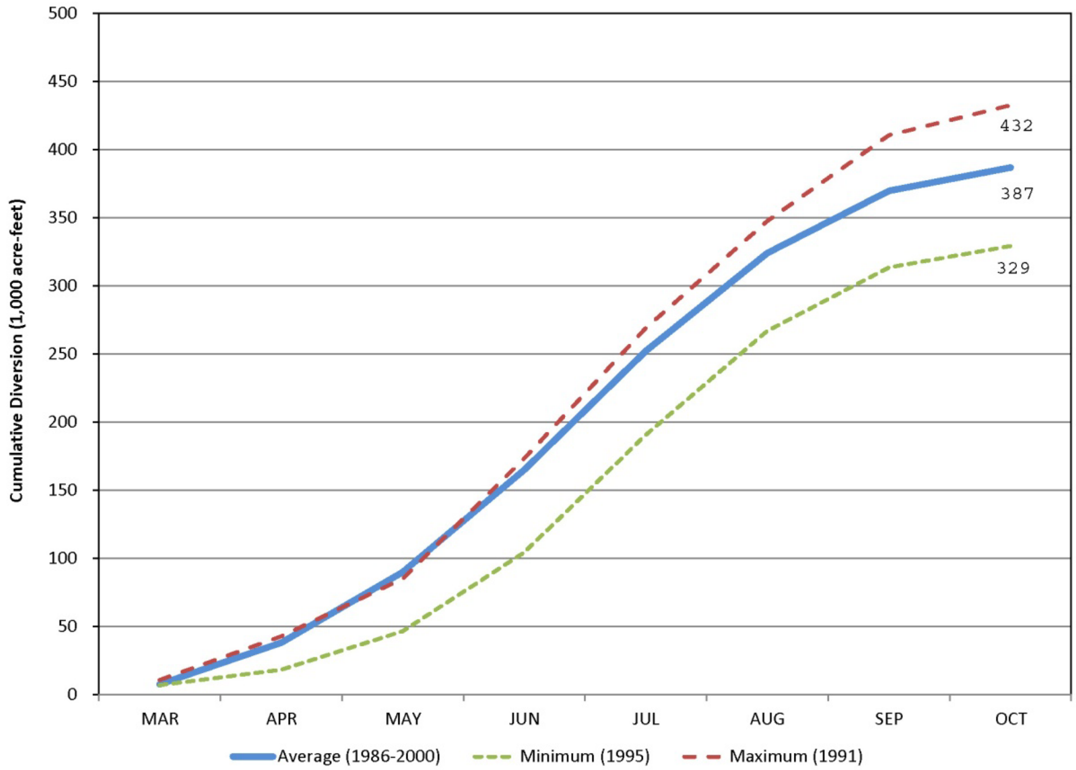
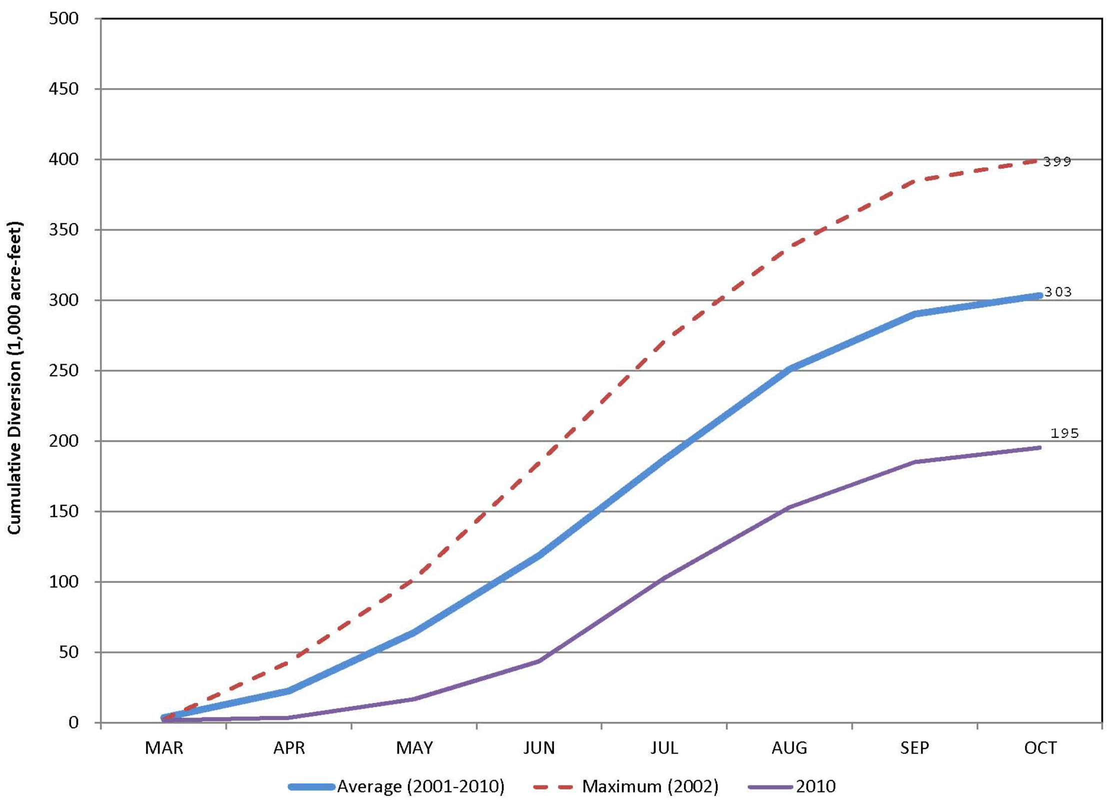


FIGURE 2-4
Cumulative March through October Klamath Project Irrigation Diversions (2000 to 2010)



Historical observations of groundwater levels in response to various pumping regimes provide insight into the long-term viability of groundwater use within the Upper Klamath Basin aquifer system. Past groundwater production rates (prior to 2000) appear to have resulted in little to no appreciable drawdown, except in areas near Bonanza, just northeast of the OPPA. Groundwater production rates increased with the curtailment of surface water supplies and the initiation of water bank programs and activities following 2001. This increase in groundwater production, coupled with the reduced rainfall in drought years, has resulted in seasonal decreases in groundwater levels of 10 to 20 feet, with a total drawdown from 2001 to 2008 of approximately 15 feet. Continued groundwater-level monitoring, climate forecasting, stream/spring-flow monitoring, and groundwater modeling are proposed to support future groundwater use.

Total Potential Water Supply Available

Quantifying all water supplies available for use (including reuse) is difficult because of the co-mingling of water supplies together with the lack of reliable data. Table 2-1 provides an estimate of the range of total supplies available, including Klamath River and non-Klamath River water supply available to the KID and TID portion of the OPPA as estimated in TM 2. The estimated quantity of reuse (drainage inflow and operational canal spill from KID to TID) is based on observations and discussions with district managers and the limited flow data. This approach is further described in TM 2.

TABLE 2-1
Estimated Quantity of the Total Potential Water Supply Available within the On-Project Plan Area

Sources	Estimated Quantity (TAF)
Klamath River[a]	340
Lost River[b]	22 – 185
Other (surface storage, soil moisture, other minor springs/ streams, and groundwater)[b]	110
Precipitation[b]	57 – 85
Reuse[c]	100 – 150
Estimated Total	629 – 870

[a] Average Klamath River diversion to the OPPA for the 2002 through 2009 period.

[b] Values are referenced from the report by Irrigation Training and Research Center (ITRC) of California Polytechnic State University, San Luis Obispo, 2003.

[c] Alternative method of estimating reuse identified in TM 2.

3. Current and Future Water Requirements/Demand

A uniform approach for quantifying crop consumptive use, total on-field water requirements, and district water requirements was used to develop current and future water demands based on current and anticipated future cropping patterns and agricultural land use.

Water demand was evaluated and estimated at the crop, field, and district level, in the context of the following categories:

- **Crop Consumptive Use** – Total seasonal crop evapotranspiration (ET) for March through October (consistent with the KBRA growing season DIVERSION period), which varies depending on hydrologic year and crop type.
- **Total On-Field Water Requirement** – Total seasonal gross irrigation requirement accounting for the following: crop ET, effective precipitation, available soil moisture storage, and field-level irrigation conditions (non-pristine field conditions and irrigation efficiency, both of which affect water delivery).
- **District Water Requirement** – Includes the total on-field water requirement plus water required for system operations including initial system fillup, operational spills, and conveyance seepage/evaporation.

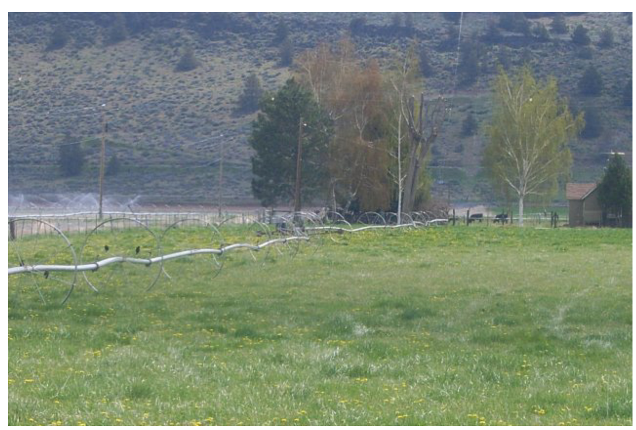
Water demands for each of these three categories were calculated for the irrigated area of each district within the OPPA and aggregated into an overall demand for the OPPA. Demands were calculated for representative low water demand (essentially wet conditions), average water demand, and high water demand (essentially dry conditions) to provide an estimated range of demand for each district and for the OPPA as a whole.

Demand was estimated for the approximate 165,000 acres of agricultural land use within the OPPA as well as TLNWR on the basis of land use information gathered from Reclamation.

TID, KID, and KDD account for more than 80 percent of the irrigated acreage within the OPPA. Ten other districts encompass the remainder of the acreage. TLNWR was included as part of TID. LKNWR is addressed but is not included in the OPPA, although Area K lease lands are included in the OPPA and the KDD demands. Irrigable acreage includes harvested lands, unharvested irrigable lands, acres not irrigated (often fallow agricultural lands), flood fallow/Walking Wetlands, and other lands (turf, lawns, gardens, and other urban landscaping). Non-irrigable acreage includes lands used for nonagricultural purposes such as urban areas, roads, and drains.

Data sources to assess land use and cropping patterns were derived from Reclamation and cross-checked using other information. The years 2008 and 2009 – years where a water bank was not implemented – were chosen to best represent recent cropping patterns. Alfalfa, grain, and pasture account for approximately 75 percent of total irrigated acreage within the OPPA. Similar cropping patterns are expected in the future because the limited growing season in the basin constrains crop types that can be profitably farmed.

Average representative land use for recent years is shown on Figure 3-1.



Estimating Water Demand

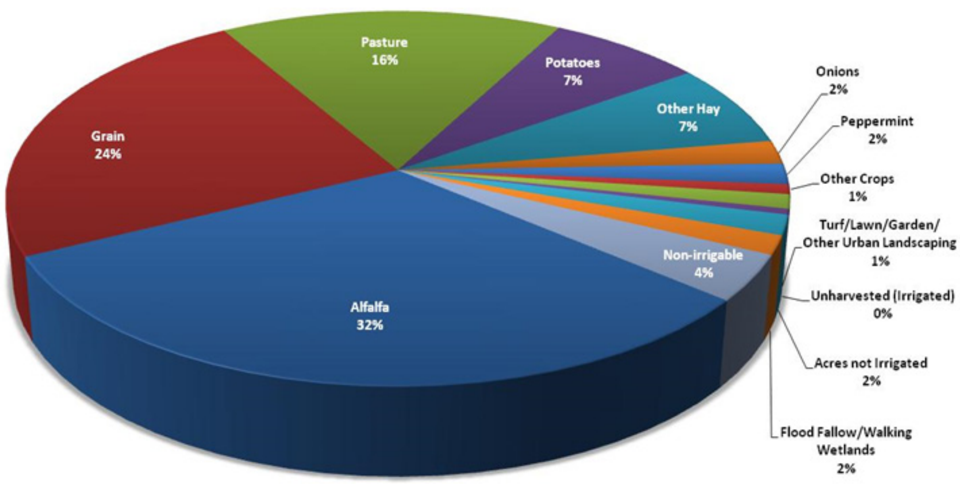
Estimating water demand must account for a number of factors, including water use and demand at the crop, field, and water district level.

Crop consumptive use is defined for the OPPA as the crop water requirement based solely on ET requirements without water stress.

Other factors and their related contribution to overall demand such as precipitation, moisture in the soil, non-pristine field conditions, and irrigation system efficiency are accounted for to determine the total on-field water requirement.

Total district water requirements include the total on-field water requirement in addition to the water needed to account for operational losses such as evaporation and seepage from canals, as well as the water it takes to fill the conveyance system at the beginning of the irrigation system.

FIGURE 3-1
On-Project Plan Area Land Use – Average of Representative Recent Years 2008 and 2009



Other Crops: strawberry rootstalks, horseradish, other vegetables, peas, greens (such as kale and spinach), raspberry, garlic, corn, squash (pumpkin), asparagus, canola, grapes (vine), and apples
Grain: barley (feed and malt), wheat, oats, and other cereals
Non-irrigable: non-agriculture

Source: Reclamation 2008 and 2009 ModCrop Data

Total district-level requirements accounting for crop ET, on-field requirements, and district-level factors (for example, conveyance seepage and operational spills) for all districts within the OPPA are estimated to range from approximately 480 TAF for a low-demand year (generally wet climate conditions) to approximately 680 TAF for a high-demand year (generally dry climate conditions).

Overall water demand is met through more than just direct use of Klamath River water supply. All available sources (including precipitation and the Lost River), as well as reuse of water throughout the OPPA, contribute to meet total demand.

4. On-Project Plan Area Supplemental Water Need

The quantity of water required in years where the limitation of DIVERSION is projected to be unable to meet demand was termed "supplemental water need" for the purposes of the OPP. The determination of the supplemental water need includes both a maximum seasonal (March through October) and monthly supplemental need, taking into consideration the current and available future supplies, estimated demands, and the Limitation on DIVERSION, exclusive of the Refuge Allocation quantity (330 to 378 TAF).

As shown on Figure 4-1, in many years there is no projected supplemental water need (that is, the quantity of water identified in the Limitation on DIVERSION met the estimated future demand). The maximum quantity of supplemental water need is estimated to be approximately 100 TAF (occurring in 1991). This maximum supplemental water need is assumed to represent the maximum expected future supplemental water need within the OPPA. However, this calculation does not take into account further diversion limitations for years designated as Extreme Drought in the Drought Plan (KBRA Section 19.2).

Supplemental Water Need = Estimated Demand – Limitation on DIVERSION

Evaluation of seasonal and monthly historical diversions for the Klamath Reclamation Project showed significant variability in diversions from month to month. Accordingly, the historical DIVERSION from the Klamath River to the OPPA was evaluated and analyzed to determine the quantity and pattern of historical DIVERSION as the first method of estimating future demands. A second method of estimating demand calculated estimates developed by Reclamation as input into the Klamath Project Simulation Model (KPSIM). KPSIM demands were developed by correlating historical Klamath River diversions to areas A1 (KID/TID Delivery System), A2 (KDD Delivery System), and LKNWR with Klamath Falls precipitation. This KPSIM demand does not include the portion of the "Other Delivery System," located west of the railroad tracks parallel to Highway 97.

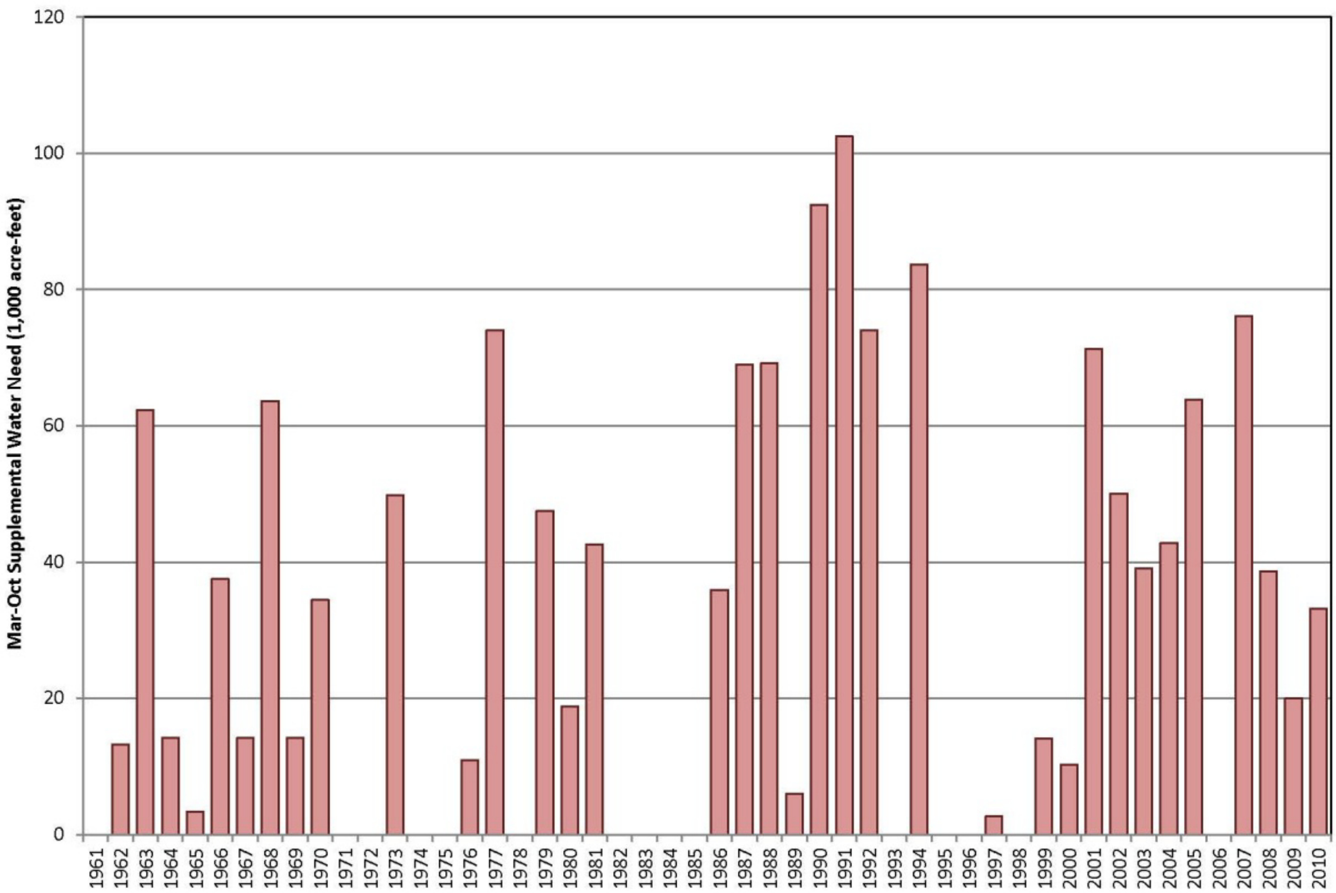
For planning purposes, the historical pattern of diversions was assumed, and monthly cumulative diversions were calculated. On the basis of these assumptions, the maximum seasonal supplemental water need was calculated as the difference between the estimated demand and the Limitation on DIVERSION.

Figure 4-1 shows the estimated supplemental water need for the 1961 through 2000 period (March through October), had the Limitation on DIVERSION been in place.

The objective of the analysis, using historical hydrology, was to estimate the maximum supplemental water need that may occur under the Limitation on DIVERSION. Calculation of a maximum seasonal supplemental water need provides an estimate of the quantity and magnitude of supplemental water needed for future planning efforts and development of the OPP. However, identifying the total seasonal supplemental water need may not be entirely adequate for the development of the OPP and future planning efforts in complying with the Limitation on DIVERSION. Therefore, the maximum supplemental water need on a monthly basis was analyzed to help define potential operations and planning efforts.

Because of the variability in historical diversion, a dry-year average representing the six driest years on record was calculated (for 1987, 1988, 1990, 1991, 1992, and 1994) to determine the maximum monthly supplemental water need. On the basis of this monthly analysis, the maximum monthly shortage for agriculture is approximately 45 to 55 TAF for a given month. This maximum supplemental water need would have occurred in the past operations in April, May, June, or July, had the Limitation on DIVERSION been in place. This maximum represents a worst-case irrigation season (March through October) monthly supplemental water need.

FIGURE 4-1
Estimated Maximum March through October Supplemental Water Need as Compared to the Limitation on DIVERSION, Exclusive of Any Refuge Allocation



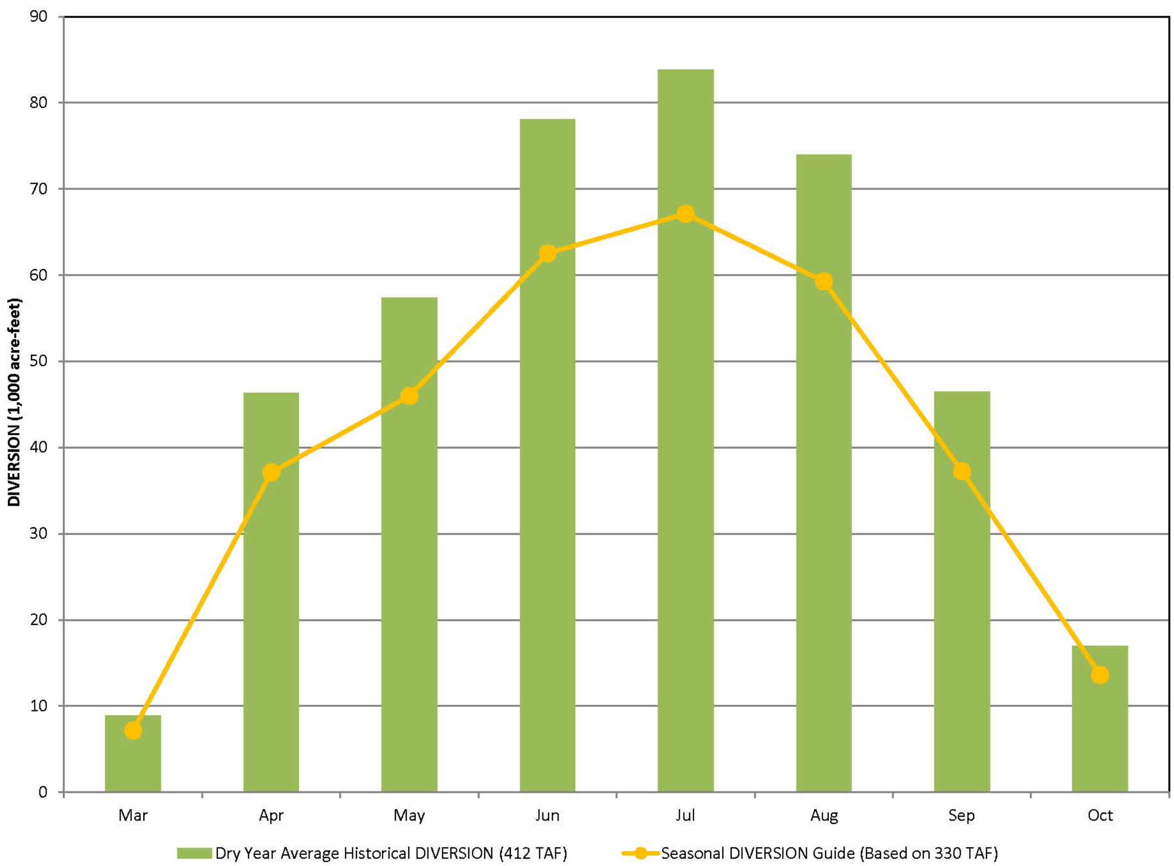
As a planning tool, this dry-year average was combined with the Limitation on DIVERSION to develop a seasonal DIVERSION Guide. The seasonal DIVERSION Guide provides an informal upper threshold for DIVERSION based on the Limitation on DIVERSION, exclusive of any Refuge Allocation, of 330 TAF. Figure 4-2 provides a comparison between the estimated seasonal DIVERSION Guide and the dry-year average historical DIVERSION to the OPPA.

The difference between the seasonal DIVERSION Guide (based on 330 TAF) and the dry-year average historical DIVERSION illustrates an estimated supplemental water need that may occur during drier year types within the OPPA. Based on this example, the supplemental water need, calculated as the difference between the cumulative historical dry-year average DIVERSION (412 TAF) and the cumulative seasonal DIVERSION Guide (330 TAF) is equal to 82 TAF.

In practice, the OPP will provide the tools to account for the difference between the historical DIVERSION and the curve representing the DIVERSION Guide. In addition, the cumulative DIVERSION would be monitored throughout the March through October period relative to the seasonal DIVERSION Guide to assist in operating within the Limitation on DIVERSION. This seasonal DIVERSION Guide would function strictly as a planning tool to evaluate how DIVERSION to the OPPA during a given year compares to historical DIVERSION patterns applied to the Limitation on DIVERSION allowing for the Operations Committee to recommend shifting of DIVERSION from one month to the next, as appropriate to comply with the Limitation on DIVERSION.

The winter water period (November through February) historical diversions were also evaluated to determine if supplemental water would have been needed in the winter months to meet demand. As described in TM 2, the winter period

FIGURE 4-2
Comparison of the Dry-Year Average DIVERSION to the Seasonal DIVERSION Guide



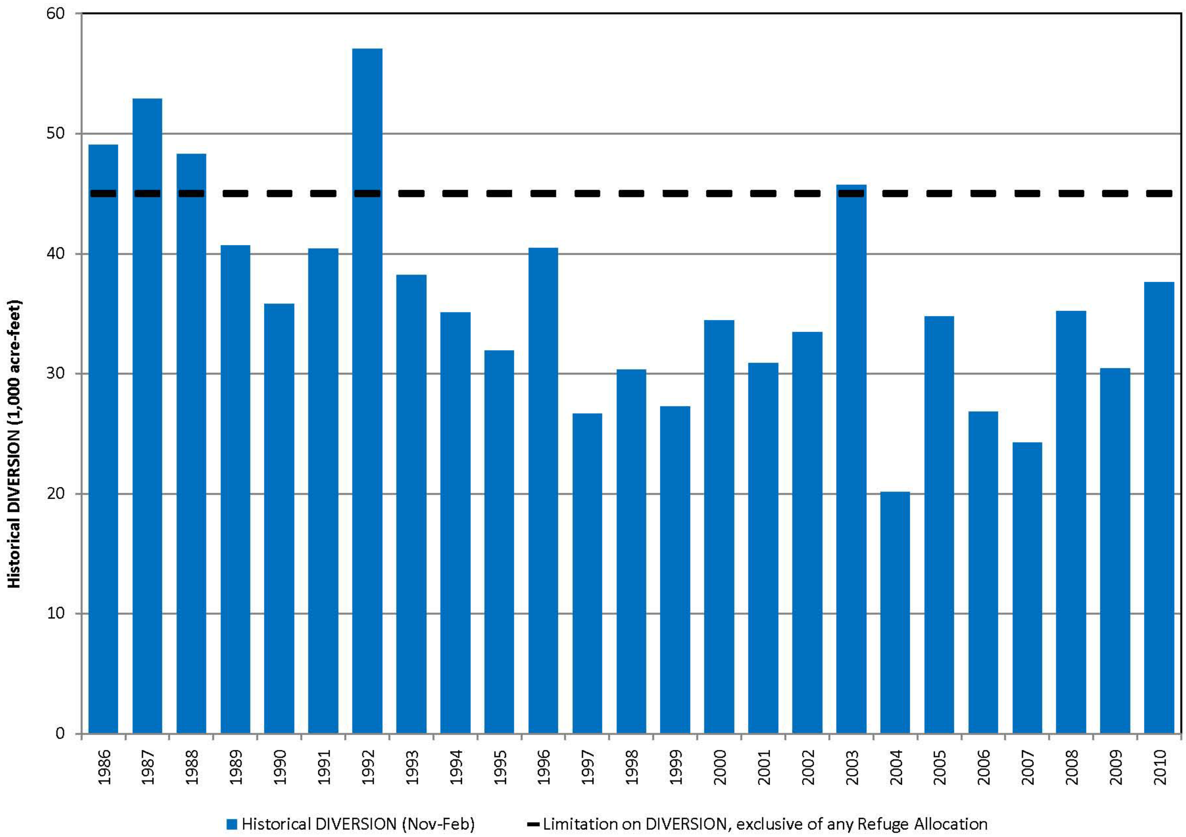
(November through February) Limitation on DIVERSION is 80 TAF, including the Refuge Allocation of 35 TAF. Although this quantity may be increased at some point, the above quantities were used, given the potential increase is assumed to be an increase in the Refuge Allocation and not irrigation water available to the OPPA.

Figure 4-3 shows the historical DIVERSION to the OPPA together with the 45-TAF winter period Limitation on DIVERSION, exclusive of any Refuge Allocation. As identified on Figure 4-3, in recent years, little or no supplemental water was needed to meet winter diversions. A supplemental water need has not been calculated for the winter period as it is understood that management and use of the available quantity under the Limitation on DIVERSION will be adequate to satisfy demand. Water users will need to coordinate, communicate, and cooperate to divert water during the winter period to comply with the winter Limitation on DIVERSION.

Proposed On-Project Plan Operations Committee

Coordination, communication, and cooperation will be important to monitor and report DIVERSION of Klamath River water pursuant to the KBRA. The measured Settlement Points of Diversion (A-Canal, Station 48, Miller Hill Pumping Plant, North Canal, and Ady Canal) represent over 95 percent of the DIVERSION and are operated by KID, TID, and KDD. A working group or "Operations Committee" made up of individuals from these entities to work with KWAPA to provide the monitoring and reporting will be useful, and can also inform the coordination contemplated under KBRA Section 15.1.1.A.ii. pertaining to tracking DIVERSION through the irrigation season. In addition, TID operates D-Plant, which serves one of the two existing delivery points for LKNWR of the Refuge Allocation. The other existing delivery point for the LKNWR is the Ady Canal at the state line. KDD and the LKNWR have a contractual arrangement for using the Ady Canal for deliveries to the LKNWR. Thus, an Operations Committee made up of representatives of these three districts, using the information presented in the TMs, is recommended to monitor and report DIVERSION and Refuge Allocation deliveries.

FIGURE 4-3
Historical November through February Diversion to the On-Project Plan Area for the Period 1986 through 2010



5. Surface Water Flow Path

The term "flow path" is defined as an approach to identify and evaluate surface water flows at a macro level in the context of the defined OPPA subregions. The subregions evaluated and the connections between them are shown on Figure 5-1.

The purpose of a surface water flow path is to assist with decisions to support improved water management, increased conservation and efficiency, and/or a mechanism to prioritize the water supply and demand management options described in Section 6.

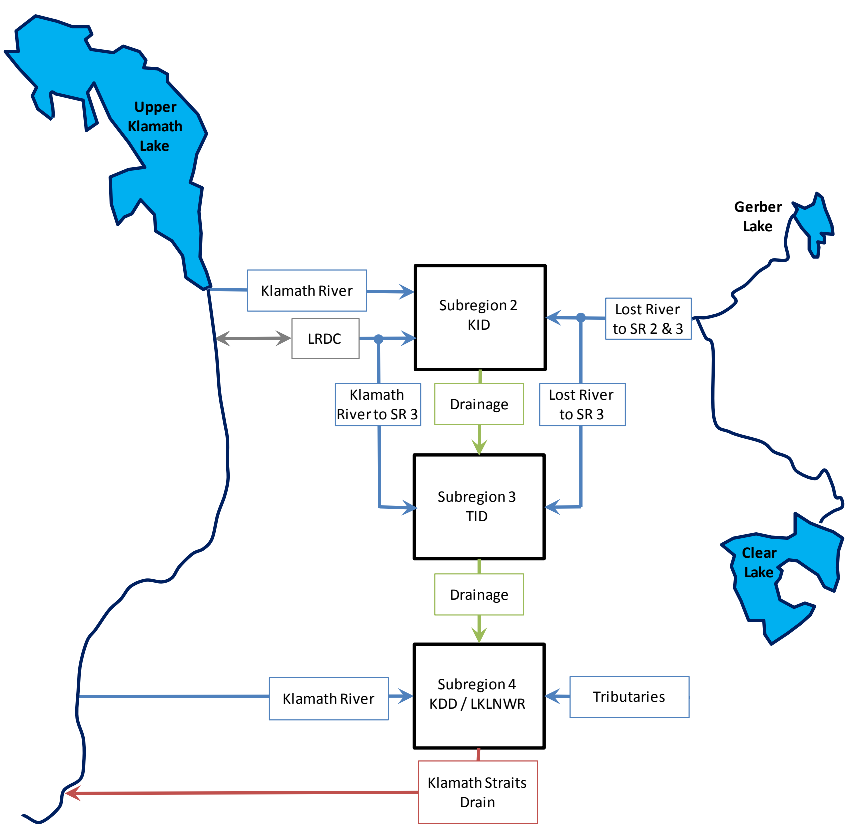
An understanding of flow paths, particularly with respect to significant changes in flow magnitude, is helpful for making decisions relative to development and implementation of the OPP. For example, a recent change in magnitude of a key component of the surface water flow path, such as reduced D-Plant pumping, may suggest that operational changes have already occurred and no further change or action should be taken to incentivize further change as part of the OPP.

Potential reasons for changes in flow path components include significant investment in on-farm and/or district conservation projects (for example, conversion to sprinkler irrigation and lining/piping of canals) since 2001 and the increasing power costs within the OPPA beginning in 2007. How full tariff power costs (in both Oregon and California), which started in 2013, will affect the individual flow path components is not yet known.

Irrigation Training and Research Center Hydrologic Assessment

Previously compiled reports and data were reviewed and used in the development of the OPPA surface water flow path. The *Hydrologic Assessment of the Upper Klamath Basin* (Hydrologic Assessment) performed in early 2003 by ITRC on behalf of the Klamath Basin Area Office, is the most comprehensive and current report available.

FIGURE 5-1
Schematic of the Subregions of the On-Project Plan Area



The Hydrologic Assessment covers the 1999 through 2001 calendar years. Although the uncertainty of the data and values used was recognized by ITRC, the document provided valuable information from which conclusions were drawn including the following:

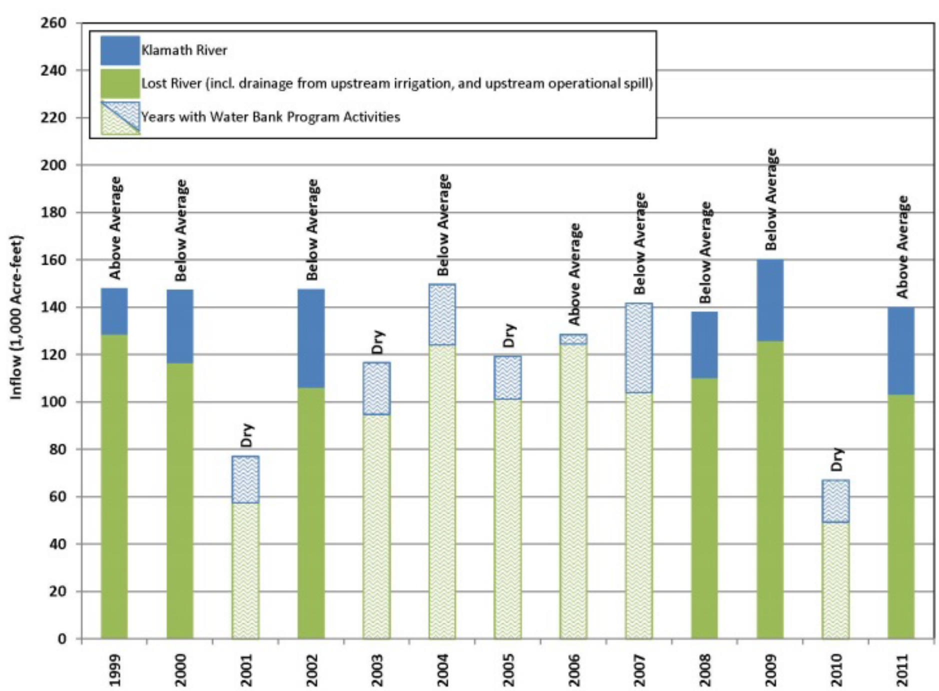
- Significant amounts of irrigation water cannot be made available to the Klamath River by traditional water conservation activities such as canal lining and improved field irrigation efficiencies. Almost all on-farm and district conveyance inefficiencies are recycled internally within the Klamath Reclamation Project or are returned back to the Klamath River.
- Because almost all of the diverted surface irrigation water is consumed as ET, increasing the flows to the Klamath River during critical late-summer months can only be accomplished by actions to decrease ET such as one or more of the following:
  - Reducing irrigated agricultural acreage
  - Reducing irrigated wetland acreage
  - Replacing surface irrigation water with groundwater
  - Increasing surface storage for irrigation water

Key Flow Path Observations

Using existing reports and information (which as identified above are rather limited), the following key observations were made with respect to current conditions/operations and the development of water management options:

- Recent data indicate Klamath River diversions into the KID/TID system (Subregions 2 and 3) have decreased. Similarly, reduced pumping at D-Plant has occurred. On the basis of these findings, the opportunity for increased recirculation may be minimal in the KID/TID system under the KBRA and OPP, depending on the future effects of increased power costs.
- Lost River flows at Harpold Dam into the KID/TID system (Subregions 2 and 3) varied widely during March through October 1999 and 2000. However, the Lost River flow was minimal in both years at a time corresponding to the irrigation demand during May through September.
- Drainwater from upstream irrigation practices and upstream operational spills represents a majority of the water supply to TID. TID supplements these supplies with diversions from the Lost River Diversion Channel at Station 48. Only a small portion of available surface water supplies at Anderson Rose Dam and J-Canal is identified as Klamath River water (originally diverted at Station 48) pursuant to the KBRA and Limitation on DIVERSION. Figure 5-2 identifies the inflow into TID (Subregion 3) by water source.
- Recent data indicate a reduction of drainwater, and upstream operational spill available to TID in the Lost River corresponds with a similar increase in diversions at Station 48 of Klamath

FIGURE 5-2
Surface Water Inflow to Tulelake Irrigation District (Subregion 3) during the March through October Period (1999 to 2011)



River water. Considering this and reduced D-Plant pumping, drainwater from KID to TID at the state line drains has likely been reduced. Figure 5-3 shows the reduction in D-Plant pumping in recent years.

- Although it appears KDD and Area K lands have reduced diversions significantly, given the volume of water returned to the Klamath River at Pumps F and FF, opportunity exists for improved efficiency and greater recirculation (pending water quality concerns) within KDD (and Area K lands) and LKNWR, which would benefit the OPP and the Limitation of DIVERSION. Figure 5-4 shows the breakdown of return flows to the Klamath River from KDD and Area K and LKNWR.
- LKNWR has increased Klamath River diversions via Ady Canal, coincident with a reduction in D-Plant pumping (that is, delivery to LKNWR via P Canal). Figure 5-5 shows delivery to LKNWR according to water source.
- There was greater availability of surface flow data at key locations within the Klamath Reclamation Project for use in ITRC's Hydrologic Assessment for 1999, 2000, and

FIGURE 5-3
Recent D-Plant Pumping during the March through October Period (1999 to 2011)

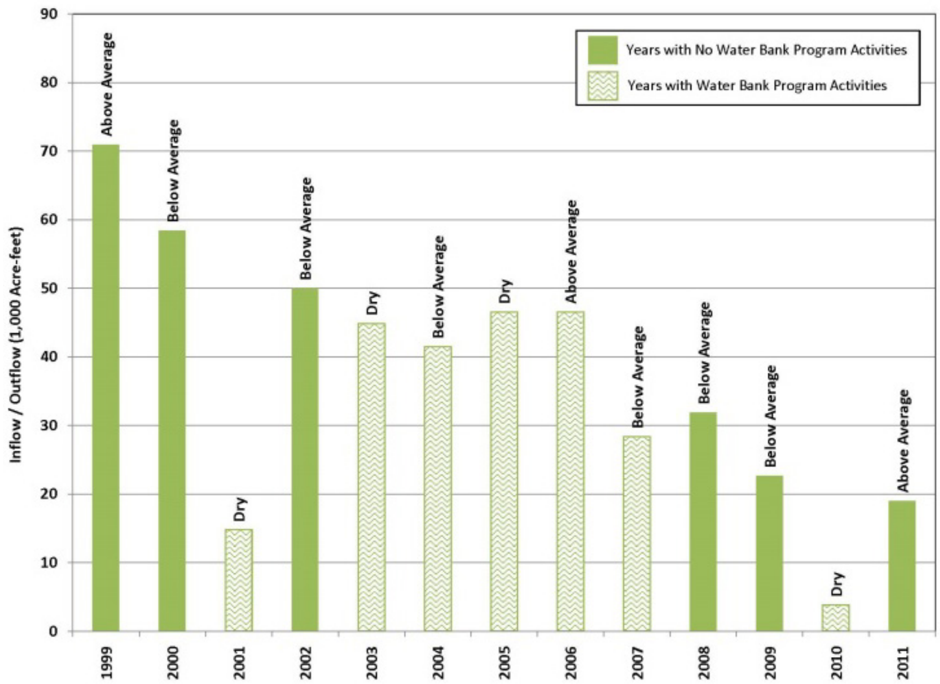
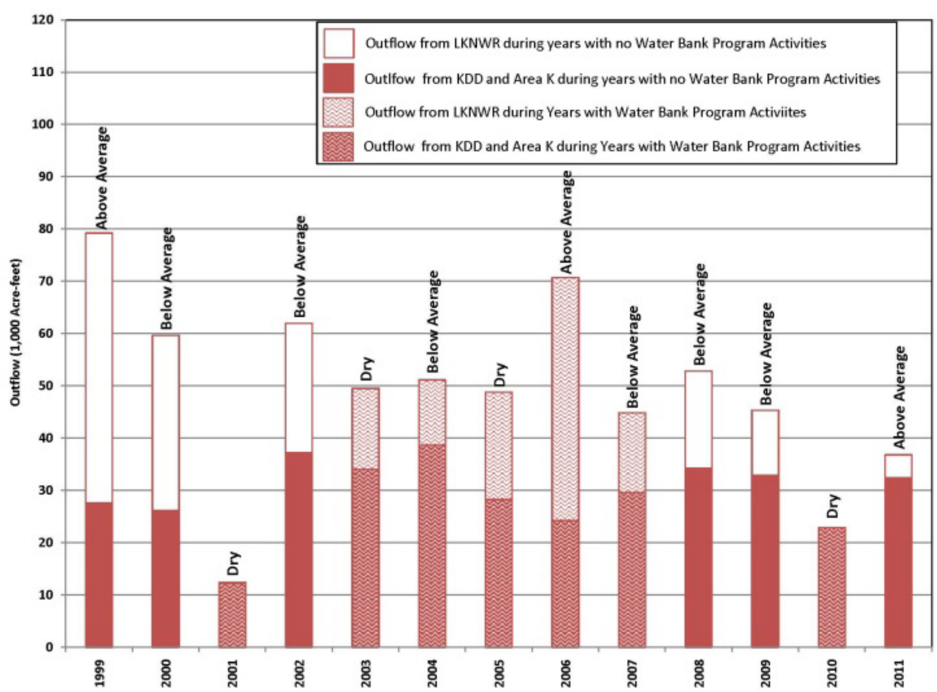
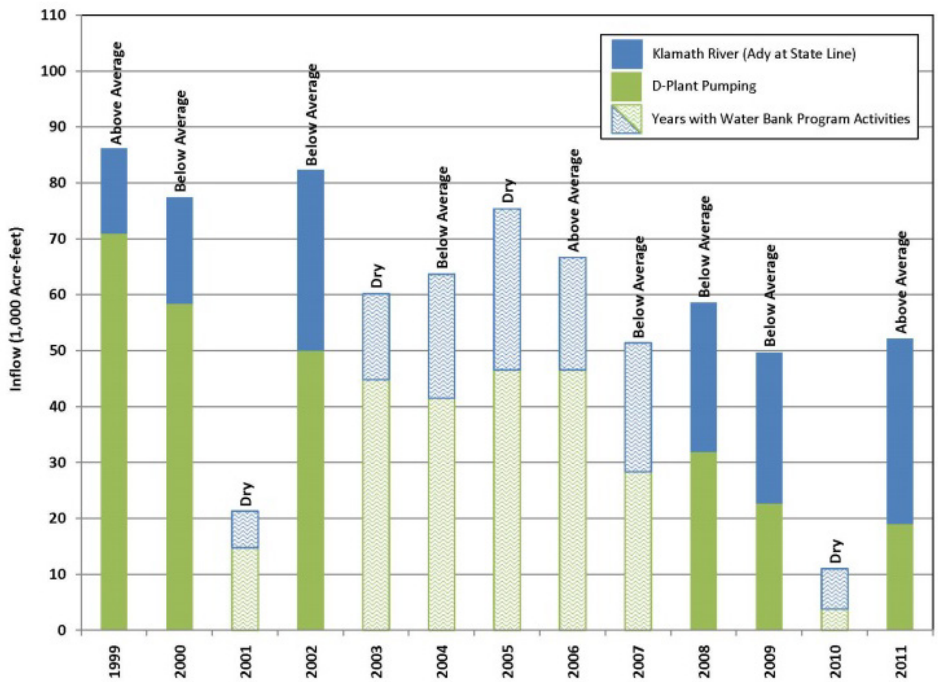


FIGURE 5-4
Return Flows to the Klamath River from Klamath Drainage District and Lower Klamath National Wildlife Refuge (Subregion 4) Measured at the Klamath Straights Drain at the State Line and Pumping Plants F and FF during the Period March through October (1999 to 2011)



2001. Data at some of those locations are no longer available (state line drains and Harpold Dam), and those data would have been useful in evaluating post-2001 surface water flows and operations. In addition, added and appropriate measurement, monitoring, quality control, and timely access to surface water flow data will be critical to the irrigation district managers and water users within the OPPA to improve water management and timing and to make informed decisions.

FIGURE 5-5
Inflow from the Klamath River and D-Plant to the Lower Klamath National Wildlife Refuge during March through October (1999 to 2011)



- As the USGS groundwater models become more developed and understood, an evaluation of the groundwater interaction with the conveyance system and sensitivity should be made relative to potential OPP options.

6. Water Management and Supply Options

The following five categories of potential water management options were identified to assist in meeting supplemental water need to align supply and demand:

- Water conservation and efficiency
- Storage
- Groundwater substitution/development
- Other
- Demand management

This section describes the screening process used to evaluate each of the options, describes each option and summarizes the rationale applied to each option to determine the final ranking, and provides a summary table showing the ranking of each option.

Evaluation Criteria

Nine criteria were used to evaluate and rank the potential water management options based on the overall objectives of the OPP itself. All criteria must be satisfied for an option to be advanced for further consideration (failure to satisfy even one criterion deemed that option unacceptable for the purposes of the OPP). The nine criteria are as follows:

- **Provides verifiable benefit to align water supply and demand for the OPPA** – The option must be capable of providing a verifiable reduction in diversion of water from UKL and Klamath River to assist in meeting the KBRA diversion limitation for a given water-year type.
- **Sustainability of agriculture and related economy** – The option must provide water supply reliability sufficient to sustain a healthy agricultural sector and avoid substantial impacts on the local economy.
- **Consistency with legal and regulatory requirements** – The option must be implementable with respect to being in compliance with all existing laws, regulations, or contracts (including KBRA), or require a relatively minor revision in such requirements that would allow for implementation.
- **Affordability** – The option must further the objective of aligning demand with Klamath water supply availability in a manner that is commensurate with the cost, considering the relative cost of alternative options, and is consistent with reasonably anticipated funding availability.
- **Durability and implementability** – The option must be capable of providing verifiable and affordable reductions in diversion from UKL and the Klamath River for the duration of the desired period of time and assure all associated administrative requirements are reasonable and not overly burdensome or complex.
- **Flexibility** – The option must have, or not unduly limit, the capability of the OPP to be adjustable over time including providing for agreement terms and/or capital expenditures that can be revised and implemented in the short and long term.
- **Equitability** – The option must provide for fair treatment of all growers and districts in the OPP (including the federal lease lands), assure opportunities for willing participation including associated agreements and costs, and avoid impacts that are not acceptable for individual district operations.
- **Protection of water rights** – The option must not result in injury to existing water rights holders.
- **Environmental and third-party impacts and benefits** – The option must comply with applicable environmental laws and not involve unacceptable environmental impacts, and minimize impacts on third-party users (non-OPP participants) including avoidance of Adverse Impact on various spring/spring complexes as identified and defined in KBRA Section 15.2.4.

Option Ranking Approach

Each option was ranked into one of four levels of acceptability as described on Figure 6-1.

FIGURE 6-1
Option Ranking Approach

Options Evaluated

The options considered within each of the five water management categories are summarized below. A summary table shows the final ranking at the end of each category of options discussion.

Water Conservation and Efficiency Options

Numerous studies and reports have been prepared that suggest the Klamath Reclamation Project is efficient when viewed as a projectwide system. At a projectwide level, there are minimal opportunities for reducing diversions from the Klamath River or UKL without reducing consumptive use, replacing surface water with groundwater, or increasing surface storage. However, a water conservation or water use efficiency improvement action that reduces irrecoverable loss, such as evaporation or nonproductive riparian vegetation that also reduces diversions from the Klamath River or UKL (or that "stretches" the supply available to irrigation), would assist in meeting the goals identified in the OPP. Opportunities for recirculation of surface water flows within the OPPA and to LKNWR were identified as potentially beneficial for the purposes of the OPP.

A key consideration in determining the acceptability of a given option was that an option must be capable of reducing Klamath River diversions. The three categories of options selected for further review for the purposes of the OPP provide some certainty as to a reduction in Klamath River diversions. A water conservation or water use efficiency measure that reduces deep percolation to the usable groundwater basin may or may not be viewed as beneficial to meet the objectives of the OPP. In addition, an action that results in a reduced diversion at one location (such as A-Canal) but results in an equal increased diversion at another location (such as Station 48) does not serve the purpose of the OPP.

From an individual entity's standpoint, a particular water conservation and efficiency measure may be beneficial, even though it may not meet the objectives of the OPP. The individual entity may benefit through reduced power cost, reduced maintenance and repair costs, and improved internal management. Therefore, it is assumed that individual entities will continue to pursue water conservation and water use efficiency measures as they have in the past. KWAPA will need to be aware of these measures to assist the districts in operating within the Limitation on DIVERSION and the implementation of the OPP.

Option 1. Canal Lining and Pipeline Installation

Under this option, KWAPA would provide funding for canal lining or pipeline installation based on the costs of the proposed installation and associated water savings. Specific locations for canal lining and pipeline installations would be coordinated with district and entity staff within the OPPA and prioritized based on the potential for reduced Klamath River diversions.

This option was ranked as marginally acceptable because of the significant initial investment and uncertainty relative to the reduction in groundwater recharge. Such projects may be pursued by irrigation districts and individuals outside the OPP if determined worthwhile at the on-farm and/or district level.

Option 2. Recirculation

Opportunities for recirculation of surface water flows within the OPPA and to LKNWR were identified as beneficial to meet demands following a review of the surface water flow path of the OPPA.

Two specific recirculation options that represent the greatest potential for reduced Klamath River diversions include recirculation of Tule Lake Sump 1A and the Klamath Straits Drain flow to LKNWR. Both were considered conditionally acceptable.

Option 3. Water Management Actions

Much data exist within the OPPA relative to flow measurement. However, currently, there is no central repository for the data, nor is there a defined system for quality control or assurance to verify the accuracy of the data.

The following water management actions could aid in understanding real-time flows and were evaluated for inclusion in the OPP:

- Improved existing control structures and automation
- Improved and updated supervisory control and data acquisition
- Installation of operational interties
- Installation of re-regulating reservoirs
- Updated pumping plants and installation of variable-frequency drives

The moderate cost for the potential amount of water savings and need to implement options in concert with other water management objectives resulted in these options being considered marginally acceptable.

Overall Water Conservation and Efficiency Options Ranking		
Option 1: Canal Lining and Pipeline Installation	Option 2: Recirculation	Option 3: Water Management Actions

Storage Options

Water storage generally refers to the capture of water during times of surplus for subsequent beneficial use during times when supply is inadequate to meet demand. Currently the OPPA relies significantly on the storage in UKL.

The storage category of options evaluated whether potential new storage is a reliable and substantial means to assist in achieving the overall objectives of the OPP.

Many potential storage options within the Klamath River Basin (and the OPPA) have been analyzed and evaluated. For the purposes of the OPP, only those storage projects viewed as most viable (by Reclamation) were considered. These include the following:

- **Option 1A**. Aquifer storage and recovery upstream of the OPPA
- **Option 1B**. Aquifer storage and recovery within the OPPA
- **Option 2A**. Surface water storage upstream of the OPPA
- **Options 2B**. Surface water storage within the OPPA

All of the storage options were ranked as unacceptable. Water availability analyses show obtaining water rights for the diversion and storage of water is difficult. In addition, the costs associated with developing a storage project (for example, the costs for feasibility analysis, environmental studies, and permitting) are significant. Finally, the time required to advance storage options would exceed the implementation schedule of the KBRA.

Although storage options were determined to be infeasible for the purposes of the OPP, KWAPA will continue to assess opportunities to investigate viable storage projects through partnerships with others as appropriate.

Overall Storage Options Ranking			
Option 1A: ASR Options Upstream of the OPPA	Option 1B: ASR Options within the OPPA	Option 2A: Surface Water Storage Options Upstream of the OPPA	Option 2B: Surface Water Storage Options within the OPPA

Groundwater Substitution/ Development Options

The groundwater substitution/development category of options is intended to provide an additional water supply during dry years. This category of options is considered a preferred method (in comparison to land idling or other demand management options) to assist in meeting the supplemental water need of the OPPA.

All options included in the evaluation are predicated on the assumption that a mutually agreeable compensation agreement could be negotiated with a given landowner or well owner.

Options in this category would make groundwater available for consumptive use to meet a significant portion of the supplemental water need when surface water supplies could not meet full demand. Quantitative groundwater pumping assessments were conducted, including evaluation of historical pumping, past water bank practices, and ground-water optimization assessments conducted by USGS.

The resulting groundwater options were developed based on the physical, legal, political, and practical limitations of pumping the aquifers that supply the OPPA, as well as the potential aquifer responses to groundwater pumping configurations.

Groundwater Substitution Options

Option 1. Maximize Pumping Using Existing Wells Consistent with Current Configuration, Regulations, and Practices

Under this option, well owners would be paid (or otherwise incentivized) to substitute groundwater from existing wells for surface deliveries on their own lands or pump groundwater for delivery to other lands (for an irrigation season), consistent with California and Oregon water rights, regulations, and current practices. This option was ranked as acceptable, provided that costs for pumping groundwater are not prohibitive and that groundwater levels are monitored to ensure the impacts of OPP-based pumping are acceptable.

Option 2. Maximize Groundwater Pumping Consistent with California Law along the Oregon Border

Under this option, well owners would be paid (or otherwise incentivized) to either substitute groundwater from existing wells for surface deliveries on their own lands or pump groundwater for delivery to other lands (for an irrigation season), consistent with California and Oregon water rights and regulations. OWRD water table drawdown limitations that legally apply only to Oregon wells would not limit the groundwater pumping in California near the state line. This voluntary action has been taken recently by TID but is not a legal requirement.

This option was ranked as unacceptable for the OPP because of the issues associated with equitability, water rights, and environmental and third-party impacts. This option favors state-line wells, has consequences for exercising Oregon groundwater rights, and would likely lower groundwater levels in Oregon to the point of regulatory intervention.

Option 3. Interpretation and Revision of OWRD Regulations in Oregon

Under this option, KWAPA would coordinate with OWRD to allow interpretation (or potentially revision) of existing OWRD groundwater regulations to produce additional groundwater to meet the supplemental water need. This option includes several possible actions regarding the interpretations or revisions to OWRD regulations, but would not seek changes in the long-term drawdown limits in Oregon.

This option was ranked conditionally acceptable, provided that regulatory approval is obtained, costs for pumping groundwater are not prohibitive, and groundwater levels are monitored to ensure the impacts of OPP-related pumping are acceptable.

This option involves KWAPA paying well owners and landowners at select locations within and directly adjacent to the OPPA to not pump groundwater during wet years (or possibly all years). The option would provide additional opportunity for recharge of the groundwater basin and provide opportunities to potentially increase pumping within the OPPA in subsequent years. If possible, the well owner and landowner would be offered surface water during wet years as a substitute for groundwater.

Option 4. Decrease Pumping within and Directly Adjacent to the OPPA to Increase Recharge

Because no reductions in DIVERSIONS would likely result, this option was considered marginally acceptable. Additional infrastructure necessary to provide surface water to background groundwater irrigators would likely be cost prohibitive and could require the expansion of the OPPA.

Overall Groundwater Substitution Options Ranking			
Option 1: Maximize Pumping Using Existing Wells Consistent with Current Configuration, Regulations, and Practice	**Option 2: Maximize Groundwater Pumping Consistent with California Law along Oregon Border**	**Option 3: Interpretation and Revision of OWRD Regulations in Oregon**	**Option 4: Decrease Pumping Within and Directly Adjacent to the OPPA to Increase Recharge**

Groundwater Development Options

Option 5. Movement of Well Capacity to Strategic Locations within the OPPA

This option would pay well owners and landowners at strategic locations within the OPPA to relocate wells with limited yields (due to interference from surrounding wells) to alternate locations farther away from existing pumping wells. Wells selected for this option would be wells in Oregon that are permitted to pump more groundwater than they can achieve at either current location (due to interference from surrounding wells).

This option was ranked as conditionally acceptable, provided that costs for new wells and operational costs for pumping groundwater are not prohibitive and that groundwater levels are monitored to make certain the impacts of OPP-based pumping are acceptable. This option may be only applicable in Oregon, as substitution of groundwater rights is not an issue in California.

Option 6. Installation of New Wells within the OPPA

This option would pay well owners and landowners or districts to install new wells or install KWAPA-owned wells at strategic locations within the OPPA. The installation of a significant number of new wells within the OPPA is unlikely because OWRD considers groundwater resources in Oregon to be over-allocated, and issuance of groundwater rights or permits by OWRD that would provide significant amounts of water appears unlikely. Furthermore, the capacity of existing wells in California appears to be adequate to meet anticipated demand so the installation of new wells does not appear warranted.

This option was ranked as unacceptable in Oregon because the issuance of new groundwater rights that provide significant amounts of water is considered unlikely. This option was ranked as marginally acceptable in California, where the current distribution and capacity of groundwater wells appears sufficient to supplement the Klamath River diversions to California water users.

Overall Groundwater Development Options Ranking	
Option 5: Movement of Well Capacity to Strategic Locations within the OPPA	**Option 6: Drill New Wells and Obtain New Water Rights within the OPPA**

Other Measures Options

The KBRA commits KWAPA to consider and evaluate “any other applicable measures.” These options include water transfers, permanent change to groundwater for some uses in the OPPA, water acquisitions, voluntary transactions, and phreatophyte control. The options in this category were determined to have varying degrees of acceptability.

Option 1. Water Transfers

This option entails KWAPA pursuing or facilitating transfers of water rights from other consumptive uses to use in the OPPA. Under state law, there are procedures to transfer elements of water right, including the point of diversion and place of use, from one place of use to another.

This option was ranked as marginally acceptable because of the uncertainties with regulatory processes, future water rights determinations, and resultant lack of predictability of quantity available. In addition, further consideration must be given to areas that could be adversely affected by a transfer.

Option 2. Additional Surface Water Availability

This option evaluated the potential for surface water user shift to groundwater use. These additional surface water supplies could reduce the reliance on surface water and thereby allow for these supplies to be diverted within the OPPA. This option was considered conditionally acceptable given it could provide verifiable additional water supplies that may be obtainable from a cost standpoint without encountering major impediments.

Option 3. Water Acquisition

This option is considered a stand-alone option to represent acquiring a new water right through application to the state for a permit. This option was ranked as unacceptable because of the low likelihood that it would increase water availability for the OPPA when needed, the likely regulatory uncertainty, and potential third-party concerns. New water rights would have a priority date junior to other water rights.

Option 4. Voluntary Transactions

Voluntary transactions are identified by the KBRA as a measure to be considered and evaluated for the OPP. Many options already discussed involve voluntary transactions, but this specifically titled option is included because the specific terms of the KBRA require it. Depending on the nature of any specific voluntary transactions, this option can meet each evaluation criterion and is, therefore, ranked as acceptable.

Option 5. Other Applicable Measures

Under this option, KWAPA or another party would pursue a program to remove vegetation in facilities that may increase ET in the OPPA. This option is considered a subset of conservation. It would require frequent mechanical removal or chemical application. The quantity of water that would be made available under this option is uncertain, but is not expected to be large. A program would need to be developed to systematically reduce or eliminate vegetation. Controls would be implemented on a recurring basis in many future years, and the existing and potential environmental constraints are uncertain. This option was considered conditionally acceptable.

Overall Other Measures Options Ranking						
Option 1: Water Transfers	**Option 2: Additional Surface Water Availability (Permanent Switch of Supply from Surface Water to Groundwater)**			**Option 3: Water Acquisitions**	**Option 4: Voluntary Transactions**	**Option 5: Other Applicable Measures**
	Option 2A: Reames Golf & Country Club, Inc.	**Option 2B: Strawberry Growers**	**Option 2C: Suburban Areas**			**Vegetation Control**

Demand Management Options

The demand management category of options included actions that would reduce or shift in time the use of irrigation water by agricultural users through a variety of means, ranging from crop shifting to land idling. This category of options is considered a last resort but necessary in drier years to assist in meeting the supplemental water need and provide for the continued sustainability of agriculture in the OPPA.

By design and intent, a demand management option would reduce agricultural consumptive use of Klamath River water during the targeted period. Demand management options would provide incentives to growers to reduce acreage irrigation, shift to a crop that consumes less water, or alter planting and irrigation timing to reduce consumption during targeted periods.

All demand management options assume that a mutually agreeable compensation arrangement can be negotiated with the participating landowner.

Option 1. Full-Year Land Idling

Under this option, the landowner would forego irrigation for a full year or full irrigation season. Growers/landowners would be required to idle only in years when supplemental water needs could not be fully met by other non-demand management options.

This option has been used successfully each year since the inception of the Klamath water bank in 2002, and was ranked as conditionally acceptable given a long-term arrangement would be developed, which would be more challenging than the current 1-year arrangements. Verification would be similar to what is being done by KWAPA annually and would be developed to support a long-term approach.

Option 2. Partial-Year Land Idling

This option would require the participating landowner to forego irrigation of land in the program during part of the irrigation season. Contracts would be developed with willing participants and could be made with various contract types. Other aspects of this option would be similar to full-year land idling.

Similar to Option 1, this option ranked as conditionally acceptable given a long-term arrangement would be developed. The verification and administrative processes would also need to be improved to support a long-term agreement.

Option 3. Crop Shifting

This option would require a grower/landowner to grow a crop with lower consumptive use than the grower was intending to plant. KWAPA would need to establish a reliable method for determining the difference in consumptive use between the originally intended crop and the agreed-upon substitute crop.

This option was ranked as marginally acceptable because of the anticipated difficulty in growers shifting to crops that would substantially change water use, given the limiting nature of the Upper Klamath Basin climate.

Overall Demand Management Options Ranking		
Option 1: Full-Year Land Idling	Option 2: Partial-Year Land Idling	Option 3: Crop Shifting

7. Proposed On-Project Plan Program and Implementation/Administration Stages

The Proposed Program is KWAPA's long-term strategy to align water supply and demand in the OPPA in light of the Limitations on DIVERSION. It has been formulated based on the efforts of TMs 1 through 6 and is essentially the OPP's action plan to meet the estimated supplemental water need.

The implementation and administration of the Proposed Program will be conducted in stages. Implementation and Administration, as well as supporting efforts, including surface water and groundwater measurement and monitoring, are important components of the Proposed Program and will be integrated in both the Implementation and Administration Stages. In addition, KWAPA and Reclamation will prepare a joint Environmental Impact Report/Statement during the Implementation Stage.

Proposed On-Project Plan Program

The Proposed On Project Plan Program (Proposed Program) includes the following key components:

1. Pursue certain water conservation and efficiency projects to reduce demand.
2. Facilitate the use of groundwater in a sustainable manner as necessary to meet the supplemental water need.
3. As a last resort and as KWAPA determines necessary to ensure groundwater sustainability, compensate landowners to reduce demand through demand management activities (temporary cropland idling).
4. Implement activities on a willing participant basis. The OPP will not require any landowner to take/not take any action unless they choose to do so.

Table 7-1 identifies the primary categories of options capable of assisting in meeting supplemental water need each year (as required depending on hydrology) and the estimated "target" quantities for each.

Proposed On-Project Plan Program Blocks

The concept of blocks was developed to provide a suggested approach to guide the Implementation Stage of the Proposed Program and to assist in knowing how best to use the categories of options and the target water supply identified in Table 7-1. The block approach provides guidance related to the pursuit of activities within the OPPA (including lease lands) in the context of timing and water supply source. Table 7-2 provides an overview of the blocks and associated timing concept.

TABLE 7-1
Estimated Target Quantities of Water to Be Made Available by the Proposed On-Project Plan Program

Category of Options	Quantity
Water Conservation and Efficiency and Other Selected Measures (Permanent[a])	Up to 20 TAF
Groundwater Substitution (Intermittent[b])	50 to 75 TAF
Demand Management (Intermittent[b])	Up to 30 TAF
Total	**Up to 125 TAF**

[a] "Permanent" designation identifies that this category of options would generally assist with meeting the supplemental water need every year.

[b] "Intermittent" designation identifies that this category of options would assist with meeting the supplemental water need when called upon for forbearance of surface water delivery. This would occur in years where a supplemental water need has been identified that is greater that the quantity covered by water conservation and efficiency and other selected measures.

TABLE 7-2
Summary of Proposed On-Project Plan Program Blocks

Time Period to Define and Establish Quantity	Block	Estimated Quantity	Source	Description
2015 – 2017	A	Up to 20 TAF	Water Conservation and Efficiency and Other Selected Measures	▪ Recent water conservation efforts and activities ▪ Recirculation (Klamath Straits Drain to LKNWR, and Tule Lake Sump 1A) ▪ Permanent shift from surface water to groundwater on limited acreage
2015 – 2021	B	Up to 50 TAF	Groundwater	▪ Groundwater substitution quantity based on the dry-year average in accordance with the USGS optimization model
	C	Up to 25 TAF	Groundwater	▪ Additional pumping to reach peak pumping in dry-year optimization scenario in accordance with the USGS optimization model
	D	Up to 30 TAF	Demand Management	▪ Full- and partial-year temporary land idling

As a first priority (Block A), recent conservation efforts will be quantified, and specific conservation and efficiency projects are proposed to be designed, constructed, and operated in a manner that would permanently decrease future supplemental water need. Additionally, part of this block includes entering into agreements with willing participants to incentivize a permanent shift from surface water to groundwater use in limited geographic areas. The total amount of water presently anticipated under this block toward reducing future supplemental water need is estimated to be up to 20 TAF.

The use of options within the groundwater substitution and demand management categories (Blocks B, C, and D) to help meet supplemental water need would increase if options within Block A and associated agreements could not be fully implemented.

Confirmation of the quantity of water produced by conservation and efficiency projects will require the improved ability to track water use to support future decisions regarding Blocks B, C, and D. In support of this need, improvements to the existing surface water measurement and monitoring network/approach will be implemented as part of the Proposed Program.

Long-Term Agreements

A variety of agreements will be necessary to implement and administer the Proposed Program. For example, an agreement for installation of a functional and effective conservation measure might require an agreement with an irrigation district, and an agreement for groundwater substitution or demand management would be made with a landowner or well owner.

KBRA Section 14.3 contemplates the ability to manage available funds flexibly during OPP implementation. However, it is assumed that, under the overall structure of the KBRA, agreements or at least the majority of agreements would be long term. This is because the Limitation on DIVERSION would be permanent, the KBRA provides that KWAPA is to be in a position to accomplish the purpose of the OPP by a certain date (expected to be in 2022 unless changed), and the funding to support implementation and administration is generally aligned with this time schedule (KBRA Sections 15.2.2.B.i., 15.3.1.A, and 15.3.8).

Under a long-term agreement, a participant would agree to a given action within an agreed-upon multiple-year span. The agreement would specify the circumstances within the multiple-year agreement under which KWAPA could exercise an agreed-upon frequency or circumstance to require a given action (such as forbearance from irrigation or groundwater substitution, or control of those activities, but only on agreed-upon terms). Long-term leases, land or facility purchases, or similar agreements are considered unlikely, but have been retained as potential approaches to provide flexibility in evaluating and implementing such agreements on a limited basis.

Avoidance of Groundwater "Adverse Impact"

Under KBRA Section 15.2.4, KWAPA is to avoid or remedy "Adverse Impact," which is defined as a 6 percent reduction in the flow of various identified springs or spring complexes as a result of groundwater use. The baseline for evaluating OPP pumping effects is pumping at year 2000 levels (both inside and outside the OPPA). If adding OPP pumping to that baseline causes a 6 percent change in the spring flow, an Adverse Impact is assumed to occur. Although KWAPA does not have regulatory authority over groundwater, it has the ability to decide whether to enter into agreements with willing landowners that will incentivize the use of groundwater (such as a contract allowing KWAPA to call surface water use on a property) or whether to approve certain arrangements that will result in groundwater use (such as approving, in a given year, a called landowner or lessee's proposed offset of use that would result from groundwater pumping).

The USGS role in assessing Adverse Impact is specifically identified in the KBRA, and the USGS groundwater model was used to evaluate the potential for Adverse Impact. A pumping scenario was evaluated assuming potential pumping levels greater than identified as part of the Proposed Program. Impacts on KBRA-identified springs and spring complexes were less than 1 percent, with impacts on most of the listed springs being close to zero. Absent significant new information, KWAPA will consider that groundwater use as part of the Proposed Program anywhere within the OPPA will not result in Adverse Impacts. Although greater quantities may not result in Adverse Impact, there have not been specific simulations that relate directly to that issue. KWAPA anticipates that constraints other than avoidance of Adverse Impact will be more relevant to the implementation and administration of the Proposed Program. KWAPA intends to continue working with USGS in the use of the current model (or future revised/updated USGS models).

In addition to projects proposed as part of the water conservation and efficiency category, supplemental water need will be met through the sustainable use of groundwater. Agreements with willing landowners will be required to incentivize the forbearance of surface water use. If a landowner has access to groundwater, it is assumed the landowner may use the groundwater in years in which KWAPA "calls" on the surface water (although the landowner will not be obliged to irrigate).

Groundwater could provide up to 50 TAF as required (Block B) and up to 75 TAF in dry years (Block C). Under the Proposed Program, use of groundwater will take into account a regional distribution approach developed in coordination with USGS in consideration of the geographic location of pumping and relative impacts on regional supply. Use of the USGS model confirmed that pumping the total quantity identified in Blocks B and C would not result in Adverse Impact to the springs and spring complexes identified in KBRA Section 15.2.4.

Groundwater use will be monitored using the existing monitoring network. Improvements to the network (as identified as part of the evaluation to be conducted with OWRD and California Department of Water Resources as part of the Proposed Program) will be identified and implemented as necessary, and the USGS groundwater model will be used and calibrated to supplement the on-the-ground monitoring effort as necessary.

In general, demand management (Block D) remains a "last resort" action that, on the basis of historical hydrology and KBRA terms, should be necessary relatively infrequently. In years where the combined effects of conservation and efficiency measures and groundwater use under the OPP are deemed to be insufficient to meet supplemental water need, landowner agreements will be called upon to temporarily idle lands.

The quantities of water estimated to be made available within each of the categories identifies up to a total of 125 TAF to align water supply and demand. As previously stated, and as further described in TM 7, the supplemental water need is anticipated to range from approximately 0 to 100 TAF. The identification of up to a total water quantity of 125 TAF is intended to allow for sufficient redundancy to administer the Proposed Program each year in a sustainable manner and consistent with the OPP goals and objectives.

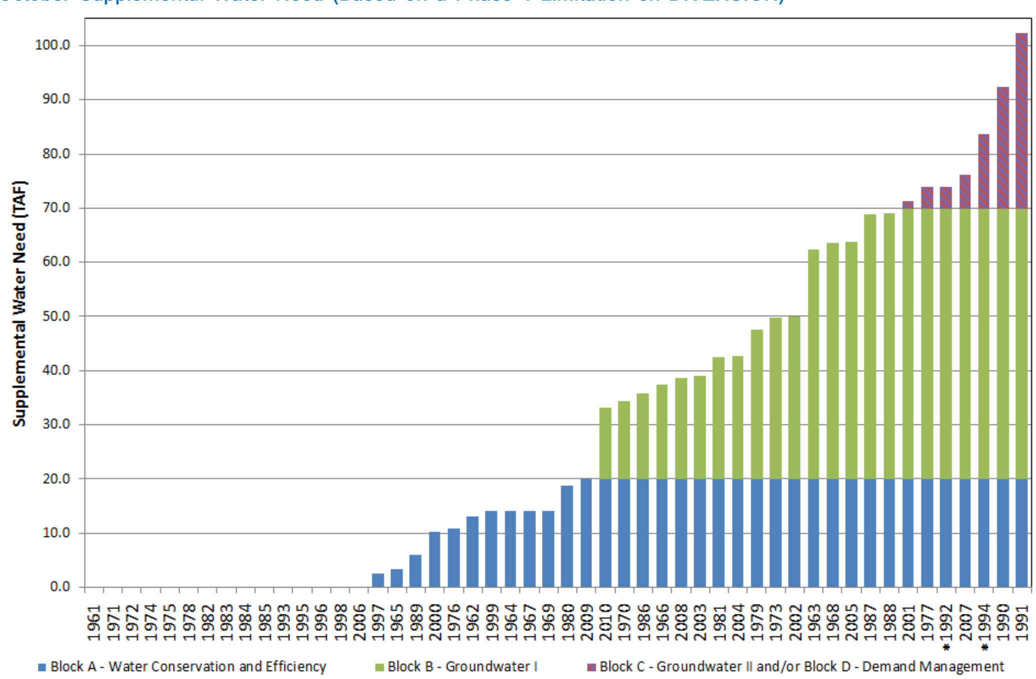
Once in place, landowner agreements will provide KWAPA the ability to call on contracts to reduce surface water use in future years (that is, in a year that a contract is called, a given parcel of land cannot be irrigated with surface water). Agreements are anticipated to allow the continued use of wells on those lands having the ability to be served by a well, unless otherwise agreed to with the landowner. Agreements may include flexibility to allow irrigation of land that would otherwise be fallowed if the landowner arranges an offset of the land's consumptive use for that year, with the approval of KWAPA and the affected district. Calls may cover a full irrigation season or part of a season.

In any given future year, lands within TLNWR and LKNWR that are within the OPPA (including, specifically, the lease lands) could also be called, up to the percentage of total Area K and TLNWR acres equal to the percentage of non-Area K and LKNWR acres in the OPPA being called in that year. Called lease land acres would have the ability to irrigate if the lessee arranged for its demands to be met with groundwater pumping, directly or indirectly, if approved by KWAPA and the affected district in the given year.

The quantities identified in each block were applied to the estimated March through October supplemental water need for 1961 to 2010. Figure 7-1 provides the potential frequency of the blocks on the basis of current estimated quantities for the Proposed Program and historical hydrology.

Assuming historical hydrology in accordance with Figure 7-1 and assuming that 20 TAF could be made available from Block A, Block B would be used in approximately 50 percent of the years to some degree. In accordance with Figure 7-1, the combination of Blocks A and B could meet the estimated supplemental water need in most years. The call on Blocks C and D in terms of priority and quantity would be based on considerations of minimizing local groundwater pumping impacts as well as demand management. Because of the uncertainties associated with determining the priority of these blocks in an annual program (such as hydrology, previous year's program, and groundwater basin response to pumping), Figure 7-1 identifies these years as interchangeable or a mixed call to meet the supplemental water need.

FIGURE 7-1
Anticipated Ability of Proposed On-Project Plan Program Blocks to Meet Estimated March through October Supplemental Water Need (Based on a Phase 1 Limitation on DIVERSION)[a,b]



[a] The asterisks on the figure denote Extreme Drought years, when additional conditions and tools are in place, as identified in the Drought Plan of the KBRA.

[b] Not all water identified in Blocks C and D is needed to meet the supplemental water need, but it is important to address uncertainties (hydrology, previous year's program, and groundwater basin response to pumping) in an annual program.

Funding and Cost

Funding for implementation and administration is addressed in the KBRA. KBRA Section 15.2.1.C also provides that if, during implementation, KWAPA determines that funding is not sufficient, the KBCC will identify whether further funding is needed. Ultimately, KWAPA cannot implement the Proposed Program without sufficient funds. If funding received is not adequate to implement the OPP, KBRA Section 15.3.8.B provides a mechanism to extend the deadline for implementation until adequate funding has been received.

Projecting costs for the implementation and administration of the Proposed Program is challenging.

Uncertainties in implementation costs and the perpetual nature of the administrative and operational costs required projecting a range of costs. Project costs were grouped into the following four categories:

- Project management/administration
- Technical assistance (KWAPA and outside services including legal and engineering design)
- Capital costs of construction projects (recirculation projects)
- Costs to enter into contracts/agreements with local and private entities

Table 7-3 summarizes the estimated costs to implement and administer the Proposed Program. Numerical estimates are in 2015 dollars and are based on the descriptions and assumptions provided. Costs for contracts/agreements with willing landowners to incentivize groundwater pumping and temporary land idling as needed to assist in meeting supplemental water need in perpetuity have not been estimated at this time. Those costs will likely be substantial.

Implementation Stage

The Implementation Stage will focus on making the necessary agreements, constructing facilities, and coordinating as necessary with the refuge manager to allow for implementation of the Proposed Program to meet supplemental water need each year as necessary. Implementation of the Proposed Program will include the following activities:

- Infrastructure improvement evaluation and refinement, design, and installation
- Development and negotiation of landowner agreements

TABLE 7-3
Summary of Estimated Proposed On-Project Plan Program Cost

	Million $	
Elements of Cost	**Low**	**High**
Project Management/Administration	21	35
Outside Technical Assistance (during Implementation Stage)	4	7
Capital (recirculation projects)	10	14
Enter into Contracts/Agreements	TBD	TBD

Note: The following cost assumptions and methods are used and/or need to be evaluated to develop cost estimates:

- Costs are expressed as a range to reflect the uncertainty associated with the estimates.
- All costs are in 2015 dollars to reflect an expected year of initial program implementation.
- Costs estimated prior to 2013 are escalated to 2013 using a standard construction cost index, the Reclamation Composite Construction Cost Trend.
- All costs are further escalated for inflation to 2015 using expected inflation rate of 2 percent per year (Federal Reserve Bank of Philadelphia, 2013).
- Ongoing operations and management costs are discounted back to 2015 using a real (inflation-adjusted) discount rate of 1.5 percent (Federal Reserve Bank of St. Louis, 2013).
- A work year was assumed to contain 2080 hours.

- Surface water and groundwater measurement and monitoring (including identification and installation of improved measurement approaches and devices) and associated technical evaluation to support the Administration Stage
- Refinement and implementation of a groundwater monitoring program to understand local impacts and avoid Adverse Impacts defined in KBRA Section 15.2.4

The last two items may be conducted by KWAPA, Reclamation, or USGS (or jointly) with KWAPA informed by the products of these efforts.

Actions taken during this stage will not only assist toward the ultimate implementation of the Proposed Program, but will also inform KWAPA of the long-term projected annual supplemental water need given the recommended infrastructure improvements may permanently reduce this need.

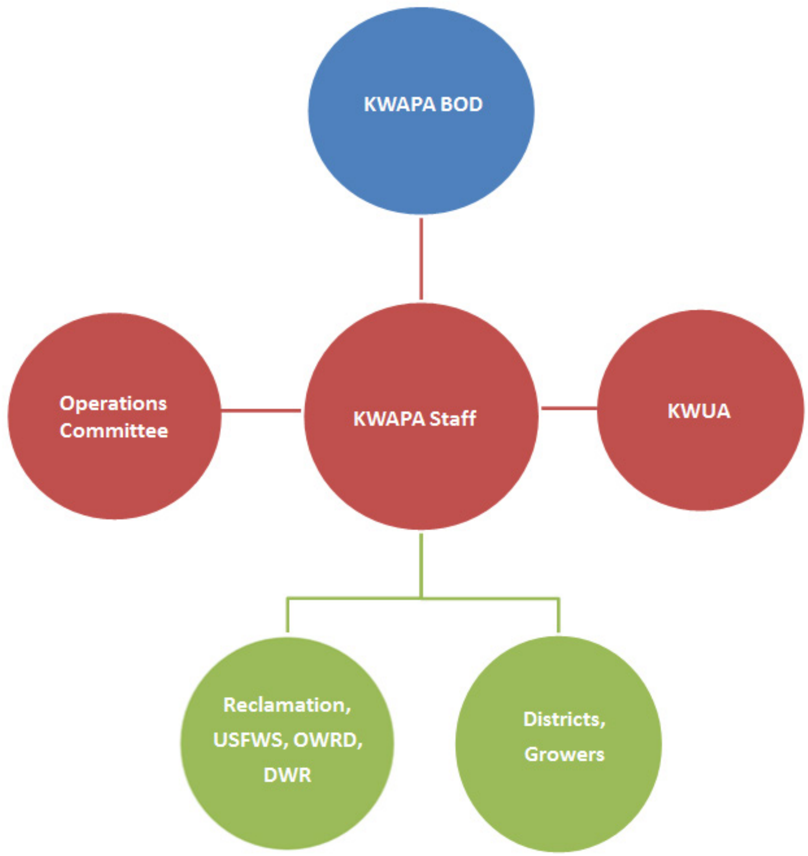
Administration Stage

The Administration Stage of the Proposed Program will occur after implementation has been completed and will include identification of the supplemental water need each year and how best to meet the need for a given year using the improvements, agreements, and tools developed during the Implementation Stage. Administration of the Proposed Program will require coordination and input among parties and stakeholders annually to support KWAPA in the decision-making process to determine the following:

- Annual supplemental water need (if any)
- Which contracts and lands to call upon (accounting for previous year's hydrology and associated calls)
- Review and use of ongoing monitoring/ reporting

Figure 7-2 provides a schematic of the proposed structure and coordination efforts.

FIGURE 7-2
Example Coordination Chart for the Administration of the On-Project Plan



Decisions each year as to which contract(s) and land to call upon will be determined on the basis of a review of what quantity of water is needed (supplemental water need), how the Proposed Program was operated during the previous years, and input from the technical staff and Operations Committee. Input will include review and analysis of effects of previous year(s) groundwater pumping. Surface water and groundwater measurement and monitoring will inform the identification of supplemental water need as well as ensure DIVERSIONS are tracked properly.

The lessons learned through the Implementation Stage to support the administration of the Proposed Program will provide valuable insight into the administration process. Allowing for flexibility and adaptability in administration will be important to ensure the sustainability of the actions for the

Proposed Program and considerations to potential future adjustments, as necessary, to meet the goals and objectives of the OPP.

Following the determination of the Limitation on DIVERSION on March 1 of each year, KWAPA (with input from the Operations Committee) will determine the supplemental water need, if any. As necessary, the contractual arrangements procured in the Implementation Stage will be called upon to meet demand.

The call on contractual arrangements and land will need to take into account the lessons learned in the Implementation Stage along with previous year's administration of the Proposed Program. For example, if a field was idled the previous year, and sufficient redundancy is in place to idle fields in a different location within the OPPA to meet demand, that field (and contract) may not be called upon to participate in that year's program. Similarly, arrangements resulting in groundwater use will be based on the regional distribution considerations further verified during the Implementation Stage.

To the extent the Proposed Program has been implemented and may be administered before any limitation on DIVERSION is in effect, KWAPA will follow a similar approach to administration.

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