

RECLAMATION

Managing Water in the West

Draft

2005-2014 Review of Operating Principles and Project Operations

**Trinidad Lake Project, Colorado
Great Plains Region
Eastern Colorado Area Office**



Executive Summary

This 10-year review of the Trinidad Project (Project) summarizes operational and functional Project activities related to the Operating Principles for the period from November 1, 2004, through October 31, 2014, (2005-2014 review period or 2005-2014 period) and responds to specific issues raised by previous reviews. Previous reviews were concluded in 1988, 1996 and 2010. Open issues carried forward from the 2010 review include: water measurement and gaging, acreage verification, modeling, flood control, determination of irrigation requirement and timeliness of review process.

One object of the Operating Principles is to obtain optimum beneficial use of the water available to the Project as conditions change, operating experience is gained and more technical data become available with time. As with previous reviews that objective is accomplished by reviewing the Project to determine if it was operated, from November 1, 2004, through October 31, 2014, in such a manner as to secure the greatest practicable benefits from the regulation and use of the flows of the Purgatoire River consistent with the laws and policies of the state of Colorado and the United States including the Arkansas River Compact. In addition, included within the Operating Principles are a list of Five Conditions by the State of Kansas. Condition 4 states, in part, that each review should determine the effect, if any, the operation of the Project has had on other Colorado and Kansas water users.

The Operating Principles were amended on December 10, 2004. A full description of the changes made with the 2004 amended Operating Principles was provided in the 2010 review covering the 1994-2004 period. Since December 10, 2004, two more amendments were proposed during the current review cycle (2005-2014). In 2011, the Purgatoire River Water Conservation District (District), on behalf of the City of Trinidad, proposed two changes to the Operating Principles. The first change, if approved, would allow the City of Trinidad's Project water stored in Trinidad Reservoir to be used outside of the District's boundaries, but within of the Purgatoire River Basin. The second change, if approved, would increase the acreage limit that could be removed from irrigation within the Johns Flood Ditch system and would similarly increase the maximum monthly and total annual Project water deliveries available to the City of Trinidad.

The Arkansas River Compact Administration (ARCA) passed Resolution 2012-01 authorizing the signing of the Resolution once the other parties being the District, State of Kansas, U.S. Army Corps of Engineers, and Bureau of Reclamation (Reclamation), had approved. Subsequently, ARCA passed Resolution 2014-3 separating the two amendments contained in Resolution 2012-01; the City of Trinidad has indicated that the first amendment is a low priority. Discussion with the District and Reclamation on amending the Operating Principles for the second amendment continued through the review period, however no additional amendments have been adopted for the Operating Principles during the 2005-2014 review period.

The conclusions and recommendations of this review are summarized below:

1. Although there were dissenting opinions, primarily from the State of Kansas, previous reviews concluded that the Trinidad and Thatcher gages were sufficient to analyze

downstream impacts of the Project. With this review, it is found that the double-mass analysis, as applied, can no longer conclude that the project has no downstream impacts. The Arkansas River Decision Support System (ArkDSS) surface water modeling effort, which includes the Purgatoire River basin in its scope, or a similar type modeling effort, should be a better platform to analyze downstream Project impacts in future reviews.

2. A mainstem gage between the Trinidad and Thatcher gages was added at the end of April 2010. Since then, the new gage is primarily used administratively to assess Project related return flows or bypass flows available (along with tributary inflows further downstream) to meet a senior call or Arkansas River Compact obligation. Additionally, this gage could be used to replace part of the requirement to use the Purgatoire at Thatcher, Luning Arroyo and Von Bremer Arroyo gages for assessing flows past the project. Although insufficient data was available for evaluation during this review period, the site could aid the District in optimizing its use of Project return flows and inform future modeling efforts regarding the Project's impact to downstream users.
3. An acreage verification methodology was developed in 2007. Ongoing adherence to the methodology, including field verifications during the growing and active irrigation season is recommended, with the expectation that such course of action will provide the most accurate information. As technology improves, including any advances in remote sensing techniques, the acreage verification methodology may be adjusted to enhance reporting accuracy even further.
4. An ArkDSS surface water model is slated for development during the 2014-2024 review period. The model's scope emphasizes the finished product will be able to simulate with and without Project existence scenarios, simulate hypothetical modifications to the current Operating Principles and assess the impacts, if any, of the Project and scenarios on flows downstream of the Project area. This platform or a similar modeling effort covering the same scope should become the method used to analyze downstream Project impacts in future reviews.
5. The existing language related to downstream channel capacity (non-damaging flows) in the Operating Principles under Article III covering Flood Control is accurate and sufficient in its description of the general principles of reservoir operation for flood control. Although various correspondence between the Colorado State Engineer and U.S. Army Corps of Engineers have established more prescriptive guidance (Appendix D & E) since the Operating Principles were amended in 2004, the existing Operating Principle language remains valid. No modifications are currently recommended for that section of the Operating Principles.
6. The previous 10-Year Review recommended the use of results provided by the U.S. Geological Survey (USGS) canal loss study ([USGS SIR 2006-5164](#)) and improved canal diversion gage data. The study investigated the difference between the water delivery rate and the crop requirement to inform water management efforts within the District. The study results showed substantial spatial and temporal variability in canal losses and gains,

limiting the ability to apply the findings to on-the-ground improvements that could reduce seepage in high loss segments or improve irrigation water delivery efficiency.

The District, State of Colorado, and Reclamation worked together to upgrade the diversion gages to improve water management, administration and data collection. Six satellite monitoring stations that could collect and transmit real-time data on ditch diversions were installed. Completed in fall 2007, the six stations were operational and providing data by November 2007.

Despite these efforts to optimize the beneficial use of water within the District that occurred during this review cycle, the reported water use within the District exceeded the calculated irrigation requirement by more than twenty percent in 4 of the 10 years of this review cycle.

7. During the current review period (2005-2014), the interested parties participated in annual or, on occasion, biennial processes to address active Project issues. Doing so was instrumental in allowing the 10-year review process and summary report to be drafted in a timely manner. The Operating Principle signatories intend to continue this process and schedule for future review periods.

The Operating Principles signatories should find another lead agency or acquire the services of an independent contractor to take the lead on the 2015-2024 review and future reviews.

8. Article II and Article IV B use the terms “contracted lands” and “contracted acres”, respectively. These terms are not defined in the current version of the Operating Principles and created confusion in how they should be applied during this review cycle. See Appendix H for the District’s perspective of the use of the terms. The Operating Principles should be amended to clarify the use of those terms.
9. On November 1, 2011, a water storage adjustment was made to all accounts in Trinidad Reservoir. An adjustment was necessary due to the implementation of a revised area-capacity table on that date based on a sediment survey performed by the Corps in February 2009. Specific account holders have expressed concern about the equitability of the 2011 adjustment. Article I 4. states that sediment accumulates solely within the Joint Use Pool and by inference that no sediment accumulates in the Flood Pool, the Irrigation and M&I Pool or the Permanent Pool. Further discussions should be held about methods to allocate the impact of future sediment adjustments among all water users benefitting from storage of water in Trinidad Reservoir. If an equitable means of allocation is found, the Operating Principles may need amendment.

Summary of 2010 Report Recommendations

Recommendations and Subsequent Review Cycle Activities

2010 Report Recommendations (1-6)

- 1) Replace the Luning Arroyo and Van Bremer Arroyo gages with a single mainstem gage at a site identified by the State of Colorado Division 2 Office. This will allow better understanding of Project return flows and assist the District to more optimally use Project water.*

Current Review Cycle Actions: A mainstem gage between the Trinidad and Thatcher gages was added at the end of April 2010 ([Purgatoire River at Fishers Crossing](#)). This new gage is primarily used by the Water District 19 Water Commissioner to assess Project related return flows or bypass flows available (along with tributary inflows further downstream) to meet a senior call or Compact obligation. In the future, it could be used to inform any modeling effort, specifically in evaluating any impacts to downstream users from proposed modifications to the Operating Principles.

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- 2) The District and the State of Colorado should use the standardized Acreage Verification System (AVS) to improve the ability of the District to report on irrigated acreage and to increase confidence of other signatory parties in the District's operations.*

Current Review Cycle Actions: In 2007, the acreage verification procedure was completed. Continued adherence to the methodology should provide the most accurate and best available information to all parties. Field verifications should be performed during the growing season within the period of active irrigation. As technology improves, including any advances in remote sensing techniques, the acreage verification methodology may be adjusted to enhance reporting accuracy even further.

- 3) *A technical team should be convened to develop and agree upon a method for determining the water accounting model input data for “late month unusable inflow.” Additionally, the technical team should update the period of study to include a time period of 1958 through the present, or some other representative hydrologic period. The technical team should jointly determine model requirements and design effective modeling studies to answer any outstanding modeling questions.*

Current Review Cycle Actions: An Arkansas River Decision Support System (ArkDSS) surface water model is slated for development during the 2015-2024 review period. The model’s scope (Appendix C, see subtask 4.3 in particular) emphasizes the finished product will be able to simulate with and without Trinidad Project existence scenarios, simulate hypothetical modifications to the current Operating Principles and assess the impacts, if any, of the Trinidad Project and scenarios on flows downstream of the Project area. The development of the ArkDSS model, or similar modeling effort covering the same scope, meets or exceeds the language and intent of the 2010 recommendation which was created to support a much older, less detailed model platform.

- 4) *The 5,000 cfs listed in the Operating Principles [Article III] may not reflect a nondamaging flow given the current condition of the river channel. The parties should continue funding the channel capacity study to determine a nondamaging flow rate that reflects the current condition of the channel. Upon determination of the appropriate rate, Flood Operating Criteria and the Operating Principles should be modified to reflect any adjustment in the rate. Channel maintenance and/or restoration issues should also be addressed.*

Current Review Cycle Actions: The existing language related to downstream channel capacity (non-damaging flows) in the Operating Principles under Article III covering Flood Control is accurate and sufficient in its description of the general principles of reservoir operation for flood control. During the current review period (October 2009) a multi-agency effort, led by Reclamation’s, Technical Service Center Sedimentation and River Hydraulics Group, finalized a technical report titled “Hydraulic Modeling Results for the Purgatoire River and Trinidad Dam, Colorado”. The results of that report are central in the Corps of Engineers’ correspondence with the Colorado State Engineer in Appendix D. Although various correspondence between the Colorado State Engineer and Corps have established more prescriptive guidelines (these documents have been included as reference in this review and are contained within Appendix D and E) since the Operating Principles were amended in 2004, the existing Operating Principle

language remains valid and no modifications are currently needed to that section of the Operating Principles.

- 5) *The District should use the results provided by the U.S. Geological Survey canal loss study and the upgraded canal diversion gage data to improve determination of irrigation requirements. The District should also encourage canal improvements by the member canal companies to reduce seepage in high loss segments. Interested parties should meet and discuss the expectations and resulting operational benefits from development of a real-time irrigation requirement.*

The U.S. Geological Survey (USGS) canal loss study ([USGS SIR 2006-5164](#)) showed substantial variability in canal losses and gains. The inconclusive findings offer limited utility for identifying on-the-ground improvements that would reduce seepage in high loss segments. Still, the District is aware of certain irrigation conveyance improvements and has worked with ditch companies to undertake critical repairs needed throughout the irrigation system. The CWCB has invited the District to take advantage of state and local funding to pursue ditch improvements. These resources are available for implementation of the Arkansas Basin Implementation Plan (BIP) and Colorado's Water Plan (CWP). The 2015 Arkansas BIP identified decaying ditch infrastructure in the Trinidad Project as an important need in the Arkansas River Basin. The CWP included "upgrading irrigation and diversion systems" among endeavors to support agricultural viability. The District secured Water Supply Reserve Account (WSRA) funding from the Arkansas Basin Roundtable and CWCB's statewide WSRA account to implement agricultural ditch infrastructure improvements in 2016 (outside the time of this review). Reclamation has a number of grants available through its [WaterSMART](#) (Sustained and Manage America's Resources for Tomorrow) program focused on improving water conservation and helping resource managers make informed decisions about water use. Such improvements are in concert with the Project's Operating Principles and their pursuit by the District is encouraged.

In an effort to improve water management, administration, and data collection for future Project reviews, the District, State of Colorado, and Reclamation worked together to upgrade the diversion gages. The District worked with ditch companies to improve diversions and erect enclosures for new instrumentation. Reclamation provided \$36,000.00 through a Water Conservation Field Services Program grant for the District to purchase six satellite monitoring stations that could collect and transmit real-time data on ditch diversions. The District provided matching commitment to Reclamation's grant for installation and annual operation and maintenance of the stations. The State of Colorado, Division of Water Resources provided staff for installation and calibration of the stations. The stations were installed in fall 2007 and were operational and providing data as of November 2007. Real-time diversion data is currently available on the District's Web site (http://www.prwcd.org/gage_readings.html) or Colorado's website (<http://www.dwr.state.co.us/SurfaceWater/data/division.aspx?div=2>) for the following six gages: Chilili ([CILDITCO](#)), Enlarged South Side ([SOUDITCO](#)), Hoehne ([HOEDITCO](#)), John Flood ([JOHDITCO](#)), Model Ditch ([MODCANCO](#)) and Picketwire ([PIKEDITCO](#)).

- 6) *The [1994-2004] 10-year review was published significantly after the close of the review period. A process for more timely and current discussion and resolution of*

issues should be created. This process should occur approximately annually. Discussion of issues, conclusions, and recommendations created by this process would then be summarized in the following 10-year review document.

A review of the current cycle (2005-2014) was drafted in 2017, about 3 years after the close of the current review period and less than 3 years after the ARCA resolution requesting Reclamation conduct a 10-Year Project Review. This represents an improvement in the production timeliness of the review document over the 1994-2004 period's review. Annual meetings during the current review cycle were held from 2009 through 2014 and significantly reduced the time required to draft a review document.

II. Status of Operating Principles

Additional Rules of Interest to the Project for the Current Review

The Compact Rules Governing Improvements to Surface Water Irrigation Systems in the Arkansas River Basin in Colorado (“Rules”) were developed during this review period. The State of Colorado has summarized these Rules as they relate to the Project as follows (from comments provided by the State of Colorado in Appendix P):

The State Engineer issued these Irrigation Improvement Rules in 2010 and the Division 2 Water Court beginning January 1, 2011, promulgated the Rules. This marked a significant milestone in the State of Colorado’s treatment of irrigation efficiency improvements’ influence on return flows and the associated challenges those improvements hold for compact compliance. The Rules require State approval of on-farm irrigation improvements, such as a change from flood irrigation to sprinkler or drip. There was no application for an improvement change during this review period; there will, however, be such applications and approvals for the next review period. Note that off-farm water transportation efficiency improvements for ditches served by the District do not need to go through the approval process; nonetheless, the Rules play an important role in the context of irrigated agriculture across the Arkansas Basin and should be acknowledged accordingly.

The following citation from [the Basis and Purpose for these Rules](#) characterizes the relationship with the 10-Year Review process:

“In addition, because the Bureau of Reclamation¹ already reviews surface water irrigation in the Purgatoire River Water Conservation District every ten years under the Trinidad Project Operating Principles, for the effect, if any, the operation of the Trinidad Project has had on other Colorado and Kansas water users², the Rules generally do not apply to the improvements within the PRWCD that are already being regulated through that process. Rule 4.F.”

Rule 4.F states:

“These Rules apply to improvements to surface water irrigation systems within the Trinidad Dam and Reservoir Project, except that they do not apply to: (1) increases in off-farm transportation efficiency derived from improved facilities that are considered in the allocation of District Water Supply under the Operating Principles - Trinidad Dam and Reservoir Project (“Operating Principles”) and the Purgatoire River Water Conservancy District Operating Criteria (“Operating Criteria”) or (2) any improvement that becomes expressly approved after the effective date of these Rules by duly-authorized amendment of the Operating Principles.”

¹ Reclamation notes that it has accepted previous ARCA resolutions requesting Reclamation take the lead in the periodic review of the Project’s Operating Principles. However, nothing in the Operating Principles states that Reclamation needs to lead these reviews; only that reviews shall be performed. One of the recommendations of this report is that another agency or an independent contractor take the lead on future 10-year reviews.

² Reclamation notes that, contrary to the State of Colorado’s statement, the current review (2005-2014) lead by Reclamation was not able to determine the effect, if any, the operation of the Project has had on downstream water users.

Project Operations

The 2004 Operating Principles introduced “contract acres” and “contract lands” without defining the meaning of the two terms within the document. Doing so introduced a level of ambiguity for the meaning and intent of some of the language in Article II and Article IV B.1 Geographic Information System (GIS) data were used to develop the annual irrigation reports. Review suggested some parcels were irrigated with Project water in some years during the review cycle that were not included as contracted parcels according to maps of District and ditch company contracts (see comments from the State of Kansas in Appendix P, page 144 and 145). Article II 3 defines District Irrigable Area:

*“District Irrigable Area” means only 19,499 acres of **the contracted lands** lying within the District boundaries. [emphasis added]*

This could be interpreted as implying that the use of Project water on parcels not identified as contracted lands on maps attached to District and ditch company contracts is an excursion from the Operating Principles with the 2004 amendments. The District has stated this is not the intent of the 2004 amendments (Appendix H).

Article IV B.1 starts with the following paragraph:

*The acreage irrigated by the District water supply shall be limited to the District irrigable area, less those lands removed from irrigation. The District irrigable area shall be composed as nearly as practicable of the acreage **identified in contracts with the District under individual ditches**: . . . [emphasis added]*

Again, this could be interpreted that the District irrigable area should be acreages identified in District and ditch company contracts (as nearly as practicable). The District was asked about this potential inconsistency during the development of this 10-year review document and in a letter dated October 6, 2017, the District provided a description (see Appendix H) of the intent of the language changes, as originally proposed by the District and subsequently added during the 2004 amendments. The District states the intent of the 2004 amendment in question was to update the number of acres under the individual ditches (the table contained in Article IV B.1) from the less accurate numbers in the previous version of the Operating Principles. Furthermore, it was not to create a restriction that limits the District Irrigable Area to the precise locations that are identified in the maps attached to the District and ditch company contracts.

A similar issue was previously discussed in the December 1988 Review of Operating Principles (page 41). The issue at that time was a 1985 survey of the irrigable lands by ditch revealed a shift from the Operating Principles Article IV B.1 tabled irrigable acreage distribution. July 8, 1988, comments by the State of Kansas noted concern that there was diversion of water to acreage in excess of the limitations in Article IV B.1. Reclamation concluded in its 1988 final report:

. . .the purpose for specifying the number of acres to be irrigated under each ditch was to satisfy the irrigators within the project area that the distribution of project benefits would be fair. There is no indication that the protection of downstream water rights was a consideration in the distribution of project lands to be served. The limit on the total irrigated acreage of 19,717³ was the primary protection for downstream users.

The District also recommended that the Operating Principles be amended to remove confusion created with the contract acres and contract lands terms. Reclamation concurs with the District's recommendation and has added it to Section V: Conclusions/Recommendation of this report.

Reporting of Lands Actually Irrigated

Prior to February 1 each year, the District is required to report on the lands *actually* irrigated during the growing season of the previous year. The reporting requirement for the lands actually irrigated is a tabulation showing tracts, acreage and location of the lands actually irrigated (Article IV B.2). The lands actually irrigated, as reported by the Colorado and/or District are summarized in Tables 1, 2, 4 and 5 with a few notable exceptions, shown in red italics. Kansas has commented (Appendix P, pages 150-152 and subsequently amended to those values shown on pages 157 and 158) that the 2005-2009 reported acreages are incorrect and has supplied alternate table values. Based upon the documentation provided by the State of Kansas within their comments, Reclamation concluded that the Kansas data for 2005 and 2006 are more accurate, and has used them in Table 1. The 2009 data show both State of Kansas (red italics) and District reported acreage values.

Reported irrigated acres, "Dryup" acres and total acres by review year are reported in Table 1 (an annual summary of "Dryup" acres by ditch company is available in Appendix I). "Dryup" acres are described within the Operating Principles as the removal of District irrigable land to enable that water to be put to other uses (municipal and industrial or permanent fishery pool purposes).

³ The total acres are now limited 19,499 with the 2004 amendment to the Operating Principles.

Such removal reduces the number of acres allowed to be irrigated with the District water supply (see Appendix B, Operating Principles Article IV B.4(a)(3) and (b)(4)). In accordance with Article II 3 of the Operation Principles, the total acres in Table 1 did not exceed the District Irrigable Area limitation (19,499 acres) during the review cycle.

Previous review cycle reports, including the December 1988 5-Year Review report, have acknowledged the importance of the irrigated acreage limitation as being a critical element in protecting downstream water users and hence, the importance of developing an accurate and defensible acreage verification system methodology, is discussed in more detail below.

The State of Kansas has questioned the accuracy of the 2009 reported District irrigated acres. Correspondence from December 30, 2010 explains their concerns. (See pages 159 – 173 of Appendix P.) In notes supplied within their irrigated acreage submittal for this report, the State of Colorado responded to the State of Kansas’ concerns:

Thirty-eight parcels were identified by the State of Kansas as being irrigated that year that were not declared by the District’s acreage verification protocol. CDWR reviewed each parcel and found that 26 of the 38 parcels were not within the District boundary and did not use Project water for irrigation. Nine of the 38 parcels were identified within the District lands in 2008 but were inadvertently not transferred to the 2009 base layer for District lands in 2009. Those 9 parcels were corrected and their acres were used to revise the 2009 irrigated acreage report. One of the 38 parcels was within the District boundary but had never been identified as such. That information was used to revise the District boundary base layer and added to the revised 2009 irrigation acreage report. The final two parcels were originally reported as “Dryup” acres for 2009, however one of those two remaining parcels may have been subirrigated so the acres associated with that parcel were moved from the “Dryup” category to the irrigated category in the revised version of the 2009 irrigated acreage report.

The revised 2009 values by the State of Colorado and the State of Kansas number are both shown in Table 1.

Table 1. Reported Acres Actually Irrigated, “Dryup” Acres and Total Acres

YEAR	ACRES IRRIG	ACRES DRYUP	TOTAL ACRES
2005	8,015	1,512	9,527
2006	8,510	1,512	10,022
2007	10,044	1,512	11,556
2008	11,785	1,512	13,297
2009	11,796 13,768.7	2,065	13,861 15,833.6
2010	9,076	2,065	11,141
2011	11,119	2,059	13,179
2012	6,673	1,955	8,628
2013	7,870	1,955	9,825
2014	10,437	1,955	12,392

Table 2 shows the total acres (irrigated plus “Dryup” acres) by ditch company within the District for each year in the review cycle from data assembled by the State of Colorado. As described for Table 1, data in Table 2 for 2005 and 2006 were adjusted to use State of Kansas supplied data for those years (denoted by red italics). As previously noted, Colorado and Kansas “dry up” numbers were identical for 2009 but the total acres actually irrigated were different. Both Colorado and Kansas (red italics) values are provided for 2009. Article IV B and IV B.1 create limitations on land and list total acres by ditch company contracted through the District. No excursions from the land limitations are noted in Table 2.

Table 2. Actual Irrigated Acres plus “Dryup” acres by Ditch (2005-2014)

DITCH	2014	2013	2012	2011	2010	2009	2008	2007	2006	2005
BACA	272	315	287	307	188	320 <i>324.1</i>	314	277	<i>289</i>	<i>271</i>
BURNS & DUNCAN	91	91	85	91	0	91 <i>91.2</i>	91	50	<i>76</i>	-
CHILILI	146	156	152	141	136	99 <i>99.4</i>	151	161	<i>163</i>	<i>153</i>
EL MORO	129	157	153	159	133	98 <i>98</i>	162	139	<i>148</i>	<i>140</i>
ENLARGED SOUTHSIDE	4,007	2,800	1,911	4,288	3,622	4,232 <i>4,931.5</i>	4,192	4,421	<i>3,836</i>	<i>3,388</i>
HOEHNE	1,033	1,030	1,056	1,058	1,111	1,093 <i>1,100</i>	1,083	1,186	<i>1,124</i>	<i>1,039</i>
JOHNS FLOOD	1,760	1,694	1,771	1,830	1,888	1,580 <i>1,797.6</i>	1,765	1,780	<i>1,940</i>	<i>1,773</i>
LEWELLING & MCCORMICK	398	418	393	410	230	409 <i>435.5</i>	355	175	-	-
MODEL	3,107	2,219	2,140	3,001	2,751	4,498 <i>5,457.6</i>	3,763	2,311	<i>1,353</i>	<i>1879</i>
PICKETWIRE	1,448	944	679	1,893	1,080	1,440 <i>1,498.7</i>	1,422	1,056	<i>1,093</i>	<i>884</i>
TOTALS (ACRES)	12,392	9,825	8,628	13,179	11,140	13,861 <i>15,834</i>	13,297	11,556	<i>10,022</i>	<i>9,827</i>

Reported Water Usage

The concept of an irrigation requirement within the Operating Principles and the motivation for improvements in efficiency of water use within the District are linked throughout the planning and development of the Project.

The 1964 Irrigation Report on the Trinidad Project, Colorado, an update to the original 1961 Irrigation Report, considers an average water [for irrigation] requirement at a headgate based upon the historic average precipitation for the 33-year study period of that report (1925-1957). The 1964 Irrigation Report calculated the average annual crop water requirement to be 3.1 acre-feet per acre for the period. This value was adjusted to 3.15 acre-feet per acre as found in Contract No. 7-07-70-W0095⁴. Table 3 from the 1964 Irrigation Report is reproduced below as Table 3 in this review. Notes have been added to the original table for explanatory purposes.

From **Table 3**, Reclamation identified and defined three different irrigation requirements in water supply conveyance: crop, farm delivery and diversion headgate. Although not defined in the Operating Principles, the language of the Operating Principles in Article III B.3 and Article III C.2 suggest the particular irrigation requirement referenced is the farm delivery irrigation requirement (as a District-wide total) based on use of the phrase “farm headgate” in each (rather than purposefully selecting to use the phrase “ditch headgate”).

⁴ The difference is most likely the result of rounding for the “Consumptive Use Requirement of Crops” term shown in Table 3. The 1964 Irrigation Report truncated the value to the nearest tenth of an acre-foot per acre. The Contract likely rounded to the nearest hundredth of an acre-foot per acre (2.32 rather than 2.3 acre-feet per acre).

The Purgatoire River Water Conservancy District Operating Criteria (amended and restated February 2008) under Part B – Allocations, Subpart 3, identifies the farm headgate as establishing the irrigation requirement, but the allotment of water is set at the diversion for the ditch headgate on the river.

The allotment shall be expressed as the total volume of water in acre-feet available at the river for the lands lying under each of the ditch systems so as to provide, with an allowance for the canal and lateral losses of the individual ditch systems, each acre of the District irrigable area an equitable share at the farm headgate . . .

Table 3. Computed Average Annual Water Requirements for the Project, Based on the Period 1925-1957, as Published in the Reclamation 1964 Irrigation Report

	acre- feet/acre	Notes
Consumptive Use Requirement of Crops	2.3	computed by Lowry-Johnson method for crops associated with irrigated acres
Effective precipitation	0.78	average effective precipitation for 1925-1957
Crop irrigation requirement	1.52	= consumptive use requirement of crops minus effective precipitation
Farm losses (30%)	0.65	= farm delivery requirement minus crop irrigation requirement
Farm delivery requirement	2.17	= crop irrigation requirement / (1 - 0.3)
Canal and lateral losses (30%)	0.93	= diversion requirement at headgate minus farm delivery requirement
Diversion requirement at headgate	3.10	= farm delivery requirement / (1 - 0.3)

In addition, both the 1961 and 1964 Irrigation Reports recognize the importance of the variability of annual precipitation in the “effective precipitation” term from in Table 3. As stated in the December 1988 Trinidad Project, Colorado, Review of Operating Principles (Page 42),

Since the [P]roject plan provided for including the precipitation that falls on the project irrigated lands in the determination of the headgate requirement, the actual headgate requirement will vary from year to year depending on the amount of precipitation.

And as explained in the December 1988 Review of Operating Principles Trinidad Project (page 42),

Page 7 of the 1961 [Irrigation Report] states “Under proper water administration, it is assumed irrigation headgate diversions with Trinidad Reservoir in operation would be limited at all times to ideal crop requirements in order to minimize the project effect on downstream water users.”

The term “ideal”, in the sense of the 1961 Irrigation Report, would be supplying only that amount of water needed by the crop, while accounting for the effective precipitation of the season and adjusting for transport efficiencies from the ditch headgate to the farm field and the on farm losses once delivered to the farm field (as was performed in Table 3).

The 1964 Irrigation Report states (page 4),

The objective of the [D]istrict’s water administration will be to improve the effectiveness of water use [over the “without-Project” condition] by: (1) limiting the service area to 19,717⁵ acres of irrigable land, and (2) restricting water deliveries to the seasonal crop requirement.

The 2004 amended Operating Principles were developed, in part, from the results of the Irrigation Report and the conclusions of previous Operating Principle reviews. Article III B.3 supports those stated results and findings as:

All water deliveries to the District irrigable area, less those lands removed from irrigation, will be limited during the irrigation season to the irrigation requirements at the farm headgate as determined by the District. Allowances for canal and lateral losses on the individual ditch systems will be determined by the District.

Since seasonal effective precipitation is not known ahead of time, optimal administration of water would be to minimize the difference in the ideal crop requirement and the actual quantity of water delivered by the District. Doing so approaches optimum beneficial use of the water available to the Project and minimizes the impact, if any, to downstream users.

Table 4 summarizes the total number of acres irrigated and the total diversions for each year in the review cycle from data assembled by the State of Colorado and the State of Kansas (red italics). “Dryup” acres not included.

Table 4. Lands Actually Irrigated and Total Diversions (2005-2014)

TOTALS BY YEAR			
	Acres Irrigated	Total Diversion AF	AF/AC
2014	10,437.1	40,026.36	3.84
2013	7,870.4	31,135.96	3.96
2012	6,673.4	23,216.44	3.48
2011	11,119.2	23,099.13	2.08
2010	9,075.5	52,018.09	5.73
2009	11,795.6	43,943.53	3.73
	<i>13,769</i>		<i>3.19</i>
2008	11,785.2	50,260.37	4.26
2007	10,043.7	61,643.64	6.14
2006	<i>8,509.5</i>	25,837.01	<i>3.04</i>
2005	<i>8,014.9</i>	49,725.54	<i>6.20</i>
Period Total	95,262.80	400,906.07	
Averages:	9,526.28	40,090.61	4.21

⁵ Amended to 19,499 acres with the 2004 Operating Principles

Table 5 shows the same acreage, broken down by irrigation ditch as reported by the State of Colorado and submitted by Kansas (red text). (See Appendix J for State of Colorado-provided annual water diversions by the project and priority water by ditch company.)

Table 5. Actual Irrigated Acres and Total Diversions by Ditch (2005-2014)

Year	Baca		Chillili		El Moro		Enlarged Southside		Hoehne	
	Acres Irrigated	Total Diversion	Acres Irrigated	Total Diversion	Acres Irrigated	Total Diversion	Acres Irrigated	Total Diversion	Acres Irrigated	Total Diversion
		A.F.		A.F.		A.F.		A.F.		A.F.
2014	272	1,249.6	146	1,344.5	129	459.7	4,007	14,507.2	1,033	5,286.9
2013	315	1,173.5	156	1,286.9	157	406.4	2,800	8,109.4	1,030	5,307.0
2012	287	1,131.3	152	748.1	153	320.9	1,911	3,700.2	1,056	5,221.2
2011	307	1,195.1	141	1,435.5	159	543.5	4,288	2,862.3	1,058	5,269.9
2010	188	1,148.9	136	1,031.8	133	598.3	3,622	17,605.2	1,111	5,113.4
2009	320	1,146.9	99	1,370.2	98	539.0	4,232	13,465.0	1,093	5,146.7
2008	314	1,075.0	151	1,218.0	162	530.4	4,192	14,776.6	1,083	5,331.1
2007	277	1,293.6	161	1,039.0	139	476.3	4,421	24,993.5	1,186	5,082.2
2006	289	949.5	163	927.5	148	362.7	3,836	7,997.8	1,124	5,149.0
2005	271	1,228.8	153	846.6	140	710.4	3,388	17,652.4	1,039	5,314.2
TOTALS BY DITCH:	2,840.7	11,592.4	1,458.5	11,248.2	1,419.1	4,947.6	36,397.5	125,669.6	10,813.1	52,221.7
Mean:	284.07	1,159.24	145.85	1,124.82	141.91	494.76	3,669.75	12,566.96	1,081.31	5,222.16
AF/AC:	4.08		6.54		3.49		3.42		4.83	

Year	Johns Flood		Model		Picketwire		Burns & Duncan		Lewelling McCormick	
	Acres Irrigated	Total Diversion	Acres Irrigated	Total Diversion						
		A.F.		A.F.		A.F.		A.F.		A.F.
2014	984	6,908.2	1,928	4,245.2	1,448	4,056.2	91	419.2	398	1,549.6
2013	919	5,561.8	1,040	3,782.3	944	3,425.8	91	369.4	418	1,713.4
2012	996	3,106.3	961	5,321.2	679	2,025.6	85	239.3	393	1,402.3
2011	1,027	5,112.2	1,744	3,135.2	1,893	1,875.0	91	267.1	410	1,403.2
2010	1,149	6,601.2	1,425	12,981.8	1,080	6,034.3	0	0.0	230	903.2
2009	841	4,413.7	3,172	10,719.9	1,440	5,523.2	91	200.4	409	1,418.5
2008	1,103	6,259.9	2,913	14,090.8	1,422	5,631.4	91	249.1	355	1,098.0
2007	1,117	7,181.2	1,462	14,210.3	1,056	7,136.2	50	0.0	175	231.2
2006	1,940	3,733.8	1,353	3,626.7	1,093	3,090.0	76	0.0	-	0.0
2005	1,173	5,674.3	1,879	11,768.4	884	6,530.5	-	0.0	-	0.0
TOTALS BY DITCH:	11,848.8	54,552.6	17,877.6	83,881.9	11,938.8	45,328.1	667.2	1,744.6	2,787.3	9,719.5
Mean:	1,184.88	5,455.26	1,787.76	8,388.19	1,193.88	4,532.81	66.72	174.46	278.73	971.95
AF/AC:	4.60		4.69		3.80		2.61		3.49	

A procedure was established in the December 1988 Review of Operating Principles Trinidad Project (page 44), which used a methodology developed in the 1961 Irrigation Report to compare headgate diversions to the irrigation requirement using reported acres actually irrigated, growing season precipitation and assumed transport losses to calculate the latter. That procedure was applied for the current review period *except* the precipitation information from CoAgMet HNE01 station was used for the growing season precipitation term rather than the original precipitation station data which had been supplied from the Town of Model and the Trinidad Airport. Table 6

displays the calculated headgate requirement in acre-feet per acre for each year in the current review period following the previously established methodology.

Table 6. Annual calculated headgate requirement (2005-2014)

Year	Calculated Headgate Requirement (AF/AC)
2014	3.47
2013	3.66
2012	4.03
2011	3.94
2010	3.65
2009	2.87
2008	3.27
2007	3.24
2006	3.02
2005	3.44
Average	3.46

Using 2007 as an example, the reported acres actually irrigated by the State of Colorado was 10,043.7 acres (State of Kansas data show 9,520.8 acres in their comments – see Appendix P). Mid-April through October total precipitation at the HNE01 station was reported to be 9.31 inches and the effective precipitation was calculated to be 8.6 inches for the season (0.715 feet), or about 92% of the observed precipitation for that season. Substituting the resulting effective precipitation in Table 3, the ditch headgate requirement was calculated to be 3.24 acre-feet per acre for that year. The reported water use from Table 4 was 6.14 acre-feet per acre. Even if it was assumed that no effective precipitation occurred during an irrigation season the headgate requirement would calculate to be 4.6 acre-feet per acre. From this it seems clear that, for at least the 2007 irrigation season, the water deliveries to the District irrigable area were not limited to the irrigation requirements which is an excursion from Article IV B.3 of the Operating Principles. Reported diversions exceeded the calculated headgate requirement by more than twenty percent in 4 of the 10 years in this review period when comparing Table 4 to Table 6.

Reporting of Lands Expected to be Irrigated

The first paragraph of Article IV B.2 was added to the Operating Principles with the 2004 amendments and states in part:

The District shall provide notice each year, prior to June 1, to the State of Kansas, the Bureau of Reclamation, . . . of lands expected to be irrigated. Such notice shall include a map and a tabulation of said lands, both showing tracts, their acreage and location.

Providing such information prior to the primary portion of the irrigation season so that,

Any interested party may conduct field inspections related to the District Irrigable Area . . .

thereby improving the transparency of the District’s operations to interested parties and enhancing the accountability related to operations.

A review of the information available to Reclamation of the acres expected to be irrigated by ditch by year produced a map and tabulation in hard copy form for 2005 and 2006. Of the other years in the review cycle, only electronic summaries of total acres intended to be irrigated by ditch by year could be located for 2009, 2010, 2011 and 2013. Information associated with 2007, 2008, 2012 and 2014 reports could not be readily located for this review. PRWCD was asked to summarize the data available in their records for this report. Table 7 shows the results of the acres expected to be irrigated for the 2005-2014 reporting period as reported by PRWCD for this review. The State of Kansas has noted some discrepancies between Table 7 and the values reported to them during the review period. The differences are explained in their comments in Appendix P, page 149. Reclamation has created an improved method of storing annual summarizes provided to them beginning in WY2017 for the benefit of subsequent 10-year review documents.

Table 7. Summary of Acres Expected to Irrigated by Year (2005-2014)

DITCH	YEAR									
	2005	2006	2007	2008 ¹	2009	2010	2011	2012	2013	2014
BACA	311	311	311	311	304	306	311	306	306	306
BURNS & DUNCAN	88	88	88	88	88	88	88	88	88	88
CHILILI	300	300	300	300	300	300	300	300	300	300
EL MORO	164	164	164	164	164	164	164	164	164	164
ENLARGED SOUTHSIDE	5,850	5,850	5,850	5,840	5,850	5,850	5,850	5,850	5,850	5,850
HOEHNE	1,200	1,200	1,200	0	1,200	1,200	1,200	1,200	1,200	1,200
JOHN FLOOD	2,170	2,170	2,170	2,170	1,420	2,170	2,170	2,170	2,170	2,170
LEWELLING & MCCORMICK	359	359	359	359	359	359	359	411	411	411
MODEL	4,846	4,846	6,177	5,122	5,122	6,177	6,170	6,177	6,177	6,177
PICKETWIRE	2,100	2,100	2,100	2,100	2,100	2,100	2,100	2,100	2,100	2,100
TOTAL	17,388	17,388	18,719	16,454	16,907	18,714	18,712	18,766	18,766	18,766

PRWCD Notes: Data taken from PRWCD annual allocation calculation spreadsheets. Values influenced by individual ditch's incentive for greater allocation amounts.
 1. Hoehne value incorrect. Value should have been approximately 1,200 acres.

Reservoir Operations Review

Area-Capacity Table Adjustment: Impact on Storage Accounts

On November 1, 2011, a proportional water storage adjustment was made to all accounts in Trinidad Reservoir based upon each account’s volumetric storage at the end of the day on October, 31, 2011. Adjustment was necessary due to the implementation of a revised area-capacity table based on a sediment survey performed by the Corps in February 2009 (see Appendix G for 1999 versus 2009 survey results). The daily accounting file for Trinidad Reservoir on that date (<http://www.dwr.state.co.us/div2/tras/11012011.htm>) indicates 180.35 acre-feet was released from the Model Pool, 228 acre-feet was released from the Joint Use Pool and 1,474.64 acre-feet was released from the Permanent Pool for a total release of 1,882.99 acre-feet.. In fact, no water was actually 'released' from the reservoir to the Purgatoire River from any of the accounts referenced in the Operating Principles on that day. The only 'release' that

occurred was in the sense that the reported volumes were *removed* proportionally from the accounts to offset the sediment accumulation impact from the newly adopted area-capacity table and a ‘release’ was the only mechanism within the accounting system to make the necessary adjustment to the storage contained within the accounts.

Interestingly, the Operating Principles are silent on the method of water storage account adjustments. The Operating Principles do state under Article I 4 that sediment accumulation occurs within the Project’s Joint Use Pool. It follows that the only accounts that should be adjusted for sediment accumulation reside in the Joint Use Pool. The Model Pool volume and the Permanent Pool volume do not shrink due to sediment accumulation because sediment was never intended to reside in those pools (during the life of the Project). However, this strict interpretation of the Operating Principles – only the accounts that reside in the Joint Use Pool should be adjusted for sediment accumulation – is an interpretation that would yield undesirable results. With the introduction of ‘dry-up acres’ to the Operating Principles (Article IV B.4) and the Irrigation Improvement Rules discussed in Section II of this report, summer and winter return flow accounts are created within the Joint Use Pool to maintain historic return flow patterns for water users downstream of those sites. If the State of Colorado had held to a strict interpretation of the Operating Principles with their November 1, 2011, accounting correction for sediment accumulation, the storage in the entire Joint Use Pool would have been zeroed out negatively impacting the historic return flow patterns to downstream users for the remainder of the non-irrigation season.

Comments have been received from the City of Trinidad (Appendix P, page 174) that a more equitable means of achieving water storage adjustments are needed in the future. Reclamation also recommends that a procedure be developed, prior to the end of the next 10-year review cycle, and consistent with the Operating Principles, to address how to make those account adjustments due to sediment accumulation in the reservoir. That recommendation has been added to the Conclusions and Recommendations section of this 10-year review.

Stock Water Operations

Total stock water diversions for the review cycle by ditch are displayed in Table 8.

Table 8. Total Stock Water Diversions by Ditch for 2005-2014 (units are acre-feet)

	Review Period Total (AF)
	2004-2014
Baca	138.97
Chilili	0.00
El Moro	95.87
Southside	1,820.66
Johns	698.77
Picketwire	2,499.53
Model	282.45
Total	5,536.25

Non-irrigation season total annual stock water diversions by ditch are shown in Table 9. From the information in Table 9 and in accordance with Article IV D.2.(a) of the Operating Principles, not more the 1,200 acre feet were diverted in any one non-irrigation season during the review cycle.

Table 9. Total Annual Stock water Diversion by Ditch (units are acre-feet)

Ditch	Acre Feet									
	2004 - 2005	2005 - 2006	2006 - 2007	2007 - 2008	2008 - 2009	2009 - 2010	2010 - 2011	2011 - 2012	2012 - 2013	2013 - 2014
Baca	3.97	7.77	15.87	20.19	23.88	10.64	23.23	10.31	19.50	3.61
Chilili	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
El Moro	2.14	10.16	15.87	16.68	4.74	6.61	15.13	10.35	8.97	5.22
Southside	233.78	284.04	0.00	0.00	311.41	234.85	361.19	195.29	200.10	0.00
Johns	46.12	87.60	0.00	112.74	60.58	37.94	120.26	75.83	144.89	12.81
Picketwire	143.80	362.47	198.33	216.24	293.95	158.37	344.93	147.93	314.28	319.23
Model	0.00	0.00	0.00	0.00	0.00	0.00	282.45	0.00	0.00	0.00
Total	429.81	752.04	230.07	365.85	694.56	448.41	1147.19	439.71	687.74	340.87

Stock water diversions by month by ditch are contained in Appendix J for the 2005-2014 review cycle. From Appendix K, two different April stock water diversions in two different calendar years are noted (2010-2011 and 2013-2014 non-irrigation season). In each case, the City of Trinidad was performing wastewater treatment plant work during March which precluded a March stock water diversion by the ditches and forced the March stock water diversion into April. Daily stock water diversion by ditch are provided in Appendix K by ditch. Appendix L show that stock water diversions were complete by April 14 in 2011 and April 11 in 2014 for the two instances of April stock water diversions. Article IV D.2.(a) of the Operating Principles states:

During the non-irrigation season the District may provide and annual allowance for stock watering purposes of not more than 1,200 acre-feet measured at the headgates of Project ditches. . . Any water accumulated but not released for stock watering purposes as of April 1 shall be accounted as part of the annual District storage right.

Therefore, technically, reservoir releases for stock water purposes should not occur after April 1. In both April stock water release cases, the irrigation season as determined annually by the District, had not been opened yet. So by the definitions in Article II 9 and 10, the April stock water releases occurred during the non-irrigation season.

Flood Pool Accounting

Trinidad Reservoir storage never entered the flood pool during the review cycle. As a result, there is no flood pool operations review or flood accounting to summarize for the 2005-2014 period.

Specific comments were provided for this review related to the loss of flow measurement accuracy for 2004 and 2017 flood flow releases (acknowledging neither occurred within this review period). The State of Colorado and Kansas have asked that should the inverted bucket

gage and the secondary gage fail during flood flow releases, the Purgatoire River at Trinidad gage be used, as adjusted by measured tributary inflows above that gage, to control flood releases.

V. Conclusions and Recommendations

Project Impact to Downstream Users

Although there were dissenting opinions, primarily from the State of Kansas, previous reviews concluded that the Trinidad and Thatcher gages were sufficient to analyze downstream impacts of the Project. With this review, it is found that the double-mass analysis, as applied, can no longer conclude that the project has no downstream impacts. A better method to evaluate downstream impacts is a surface water model, rather than the double-mass analysis using the Trinidad and Thatcher gages as was performed in previous 10-year reviews.

Recommendation: A modeling effort called ArkDSS, which includes the Purgatoire River Basin and Project Area, is currently under development by the State of Colorado. The model's scope emphasizes a capability to simulate 'with' and 'without' Project existence scenarios, the ability to simulate hypothetical modifications scenarios to the current Operating Principles prior to their implementation and assess the resulting impacts, if any, on flows downstream of the Project area on water users. ArkDSS or similar type of model covering the same scope should become the platform used to analyze downstream impacts of the Project in future reviews.

The signatories to the Project should consider acquiring the services of an independent contractor and assigning the responsibility of determining the effect, if any, the operation of the Project has had on downstream users to said contractor.

Water Measurement and Gaging

A mainstem gage between the Trinidad and Thatcher gage sites was added in April 2010.

Recommendation: This new gage at Fishers Crossing is primarily used by the Water District 19 Water Commissioner to assess Project related return flows or bypass flows available (along with tributary inflows further downstream) to meet a senior call or Compact obligation. In the future, the gage can be used to inform the ArkDSS modeling effort, or similar type modeling effort, specifically for hypothetical scenario evaluation of any proposed modifications to the Operating Principles, regarding impacts to downstream users.

Acreage Verification

An acreage verification system was developed in 2007 and has been used to enhance the accuracy of acres reported by the District. The reporting includes tracts, acreage and locations of lands irrigated in each year subsequent to the acre verification system development in accordance with Article IV B.2 of the Operating Principles.

Recommendation: The annual field verification of the randomly sampled subgroup of acres should be performed during the growing season during periods of active irrigation. With any applicable improvement or innovations to remote sensing or sampling techniques, the current acreage verification system should be adjusted, if the result would enhance the accuracy of reporting.

Flood Control

The existing language contained in Article III of the Operating Principles was reviewed by all signatories to the Principles during the current cycle. At this time, the current language was deemed accurate and sufficient in its description of the *general* principles of reservoir operation for flood control.

Recommendation: More prescriptive guidelines (provided in Appendix D and E) regarding flood control operations have been established between the Colorado State Engineer and the U.S. Army Corps of Engineers since the Operating Principles were amended in 2004. However, the existing Operating Principles language remains valid and no modifications to Article III are currently recommended.

Irrigation Requirement

Although efforts were made during the current review cycle to determine canal losses within the Project area with the intent of optimizing water delivery within the District, due to the marked variability found by USGS in their study, [USGS SIR 2006-5164](#), the utility of the results is limited in its application for irrigation scheduling within the District.

In addition, another effort to improve the management of water deliveries was completed during the current review cycle. To improve water management, administration, and data collection, the District, State of Colorado, and Reclamation worked together to upgrade the diversion gages. The District worked with ditch companies to improve diversions and erect enclosures for new instrumentation. Reclamation provided \$36,000 through a Water Conservation Field Services Program grant for the District to purchase six satellite monitoring stations that could collect and transmit real-time data on ditch diversions. The District provided matching commitment to Reclamation's grant for installation and annual operation and maintenance of the stations. The State of Colorado, Division of Water Resources provided staff for installation and calibration of the stations. The stations were installed in fall 2007 and were operational and providing data as of November 2007.

Despite those efforts to optimize the beneficial use of water within the District that occurred during this review cycle, the reported water use within the District exceeded the calculated irrigation requirement by more than twenty percent in 4 of the 10 years of this review cycle.

Recommendation: The CWCB has invited the District to take advantage of state and local funding to pursue ditch improvements. These resources are available for implementation of the Arkansas Basin Implementation Plan (BIP) and Colorado's Water Plan (CWP). The 2015 Arkansas BIP identified decaying ditch infrastructure of the Trinidad Project as an important need in the Arkansas River Basin. The CWP included

“upgrading irrigation and diversion systems” among endeavors to support agricultural viability. Reclamation has a number of grants available through its [WaterSMART](#) (Sustained and Manage America’s Resources for Tomorrow) program focused on improving water conservation and helping resource managers make informed decisions about water use. Such improvements are in concert with the Project’s Operating Principles and their pursuit by the District is encouraged.

Future Review Process Lead and Improvements

Being the lead agency for Operating Principle reviews takes significant time and resources. Reclamation led the first four reviews of the Operating Principles: 1979-1984, 1985-1994, 1995-2004 and 2005-2014.

A review of the current cycle (2005-2014) was drafted in 2017, about 3 years after the close of the current review period, an improvement in the production timeliness of the review document over the 1994-2004 period. Annual meetings during the current review cycle were held from 2009 through 2014.

Recommendation 1: The Operating Principles signatories should find another lead agency or acquire the services of an independent contractor to take the lead on the 2015-2024 review and future reviews.

Recommendation 2: Continue holding Project review meetings at least biennially to allow continuity in discussion of any issues related to the Project, group consensus on any resolutions drawn from issue discussion and development of recommendations. The implementation of this process, since at least 2009, has been shown to improve the speed with which a 10-year review document can be drafted by reducing the level of contention that can occur with issues that are only reviewed once each 10-year review cycle.

Contracted Lands/Acres Terms in the Operating Principles as Amended in 2004

Article II and Article IV B use the terms “contracted lands” and “contracted acres”, respectively. These terms were introduced without being defined in the current version of the Operating Principles and created some confusion in how they should be applied during this review cycle.

Recommendation: The Operating Principles should be amended to clarify the intent and the use of the terms “contracted lands” and “contracted acres”.

Review Method of Accounting Adjustments Due to Sediment Accumulation

On November 1, 2011, a water storage adjustment was made to all accounts in Trinidad Reservoir. An adjustment was necessary due to the implementation of a revised area-capacity table on that date based on a sediment survey performed by the Corps in February 2009. Specific account holders have expressed concern about the equitability of the 2011 adjustment. Article I 4 states that sediment accumulates solely within the Joint Use Pool and by inference that no sediment accumulates in the Flood Pool, the Irrigation and M&I Pool or the Permanent Pool.

- **Recommendation:** Further discussions should be held about methods to allocate the impact of future sediment adjustments among all water users benefitting from storage of water in Trinidad Reservoir. If an equitable means of allocation is found, the Operating Principles may need amendment to accommodate it. Target any revisions prior to the next round of sediment reallocation or the end of the 2015-2024 review cycle, whichever comes first.