

Appendix 4D | Historical Agricultural Water Conservation and Transfer Programs

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The Agricultural Water Conservation, Productivity, and Transfers Workgroup (Workgroup) recognized that existing conservation and operational programs, initiated either in the Colorado River Basin (Basin) or in other locations, include components that directly or indirectly benefit agricultural water conservation. To build upon these efforts and potentially expand these concepts, a list of programs was compiled for evaluating best practices and mechanisms based on the knowledge and experience of the Workgroup members. Tables 4D-1 through 4D-5 are not exhaustive lists, but they illustrate the types of programs and mechanisms previously implemented.

TABLE 4D-1 Historical Agricultural Water Conservation and Transfer Programs – Consumptive Use Reduction											
State	Area	Year Initiated	Summary	Acres	Capital Cost ¹ (\$M)	Annual O&M Cost	Cost Share	Funding Support from Outside ² Sources	Annual Water Savings (KAFY ³)	References ⁴ / Notes	Unit Cost (\$/AFY) ¹
AZ	Phoenix Active Management Area (AMA)	1989	Reduction in irrigated acreage has resulted in a decrease in consumptive use. Total agricultural deliveries decreased by 568,000 acre-feet per year (AFY) between 1989 and 2010, due in part to reduction in acreage and in part to implementation of best management practices.	-	-	-	-	-	-	-	-
AZ	Tucson AMA	1970s	The City of Tucson purchased significant farmlands in the 1970s for their water rights. Total agricultural water use declined by about 200,000 AFY in the late 1970s. A significant portion of this is assumed to be due to sale of water rights to Tucson.	-	-	-	-	-	-	-	-
AZ	Wellton-Mohawk Irrigation and Drainage District (WMIDD)	1974	Permanent fallowing. Funding provided by Salinity Control Act (Public Law 93-320).	10,000	-	-	Yes	\$14M	40	-	-

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AZ	WMIDD	1980	Improved varieties of alfalfa, reducing consumptive use while maintaining yield.	25,000	\$0	–	No	–	15	–	–	
AZ	WMIDD	1988	Permanent fallowing. Funding provided pursuant to the Salt River-Pima-Maricopa Indian Community Water Rights Settlement Act (Public Law 100-512).	2,200	\$9	–	Yes	–	8.8	–	\$34	
CA	Imperial Irrigation District (IID)	2003	Annual rotational fallowing program via the Quantification Settlement Agreement, Revised Fourth Amendment to Agreement between IID and San Diego County Water Authority for Transfer of Conserved Water and Inadvertent Overrun and Payback Policy. Varies each year. To be replaced by efficiency programs after 2017.	5,800-34,500	\$50M socio-economic mitigation fund created	\$125/AF	Yes	100%	Up to 200 through 2017	See case study; additional fallowing used for mitigation and payback purposes.	\$60 to 175+	
CA	Palo Verde Irrigation District (PVID)	2005	The Metropolitan Water District of Southern California (MWD)-PVID Forbearance and Fallowing Program. Land is fallowed, and water saved is forborne by PVID. Participants are compensated, and third-party impacts are addressed through a Community Improvement Program.	6,487 to 25,947	\$82.8	\$752/acre in 2014	Yes	100%	33–122	See case study.	\$138 to \$178 based on an assumed range of future water savings and an assumed escalation of payments.	

TABLE 4D-1

Historical Agricultural Water Conservation and Transfer Programs – Consumptive Use Reduction

State	Area	Year Initiated	Summary	Acres	Capital Cost ¹ (\$M)	Annual O&M Cost	Cost Share	Funding Support from Outside ² Sources	Annual Water Savings (KAFY ³)	References ⁴ / Notes	Unit Cost (\$/AFY) ¹
CA	PVID	2008	Deficit irrigation sponsored by MWD.	34	–	~\$200 to \$400 per acre based on hay prices of \$100 to \$200 per ton	Yes	100%	~1.75 AFY/acre	Operation and maintenance cost is due to reduced yield of about 2 tons/acre, production cost savings, and reseeding costs. May 2010 Report: Deficit Irrigation of Alfalfa in the Palo Verde Valley, California. ⁵	–
CO	Little Cimarron River Tributary to Gunnison	2008	Colorado Water Trust has purchased irrigated land and begun to irrigate only in the early season (one cutting). Water saved from additional cuttings remains as instream flow during the remainder of the season, generally starting in July.	177	\$0.95	–	No	0%	~0.13	5.8 cubic feet per second can be donated during the late irrigation season to help meet a downstream instream flow right.	–

¹ Cost per acre-foot is generally calculated as follows: (capital cost/30 years + O&M)/AFY saved. However, individual programs may use different methods, and the costs shown may be from different years. Costs should not be viewed as directly comparable.

² Outside sources are entities not directly participating in the program; these would include federal, state, or other funds.

³ Thousand acre-feet per year.

⁴ All data are provided by Workgroup members through data collection template/process except where noted.

⁵ Bali, K., University of California Cooperative Extension. 2010.

TABLE 4D-2 Historical Agricultural Water Conservation and Transfer Programs – Conveyance System Improvements											
State	Area	Year Initiated	Summary	Acres	Capital Cost ¹ (\$M)	Annual O&M Cost	Cost Share	Funding Support from Outside ²	Annual Water Savings (KAFY)	References ³ / Notes	Unit Cost (\$/AFY) ⁴
AZ	Central Arizona Project (CAP)	1987	Three programs have resulted in delivery losses consistently below 5.5% overall, with four districts that receive 77% of non-Indian CAP water reporting delivery losses of less than 3% in recent years. Programs include: (1) 1987 Base Program–water duties and annual allotments, (2) 1990-2000 Second Management Plan assigning a minimum irrigation efficiency and reduced water duties from Base Program, and (3) 2003 Third Management Plan–implementation of Best Management Practices.	207,497	\$560	Included in capital cost	No	–	–	Acres reported represent the four largest irrigation districts served by CAP. These four districts receive 77% of non-Indian CAP water. Costs estimated based on unit costs applied to acreage.	–
AZ	Wellton-Mohawk Irrigation and Drainage District (WMIDD)	1951	372 miles of concrete-lined canals; 8 miles unlined.	–	\$4.80	\$1M	No	–	–	–	–
CA	Coachella Valley Water District (CVWD)	1980	Construction of a new concrete-lined canal to replace the initial 49-mile unlined section of the Coachella Canal.	–	\$43.6	\$300,000	Yes	\$43.6M	132	Title 1 of Colorado River Basin Salinity Control Act.	–
CA	CVWD	2004	CVWD entered into an agreement with the U.S. and San Diego County Water Authority (SDCWA) for the construction of the 38-mile Coachella Canal Lining Project.	–	\$124	\$555,000	Yes	100%	30.85	See case study http://www.cvwd.org/news/newsarchive/2007_01_08_Canalliningdone.pdf .	\$152

TABLE 4D-2

Historical Agricultural Water Conservation and Transfer Programs – Conveyance System Improvements

State	Area	Year Initiated	Summary	Acres	Capital Cost ¹ (\$M)	Annual O&M Cost	Cost Share	Funding Support from Outside ² Sources	Annual Water Savings (KAFY)	References ³ / Notes	Unit Cost (\$/AFY) ⁴
CA	CVWD	2012	Irrigation Lateral Automation Project. This project was partially (50%) funded by Reclamation through a water conservation grant. The federal cost share is \$120,000.		\$0.33	\$5,000	Yes	50%	0.15	–	\$106
CA	CVWD	1990	CVWD is committed to replacing aging irrigation infrastructure by replacing existing leaking irrigation laterals with polyvinyl chloride (PVC) pipelines. CVWD has also embarked on a Pilot Program to automate the turnouts to irrigation water customers.	–	\$1.50	\$16.5M	No	–	0.075	–	–
CA	Imperial Irrigation District (IID)	1990	Canal lining, reservoirs, lateral interceptors, non-leak gates, system automation, part of IID/Metropolitan Water District of Southern California (MWD) Conservation Agreements and amendments.	–	\$108.2	\$5.385M in 2014	Yes	100%	Volume conserved through 2006. After 2007, volume conserved up to 105 KAF.	See case study.	–
CA	IID	2008	System efficiency conservation program via the Quantification Settlement Agreement (QSA); ramps up through 2026.	–	TBD	TBD	Yes	100%	4-173+	Program ramps up to full implementation in 2023.	TBD
CA	IID	2006	IID entered into an agreement with the U.S. and SDCWA for construction of the 23-mile All-American Canal Lining Project.	–	\$304.5	\$1.2M	Yes	100%, SDCWA and California Dept. of Water Resources	67.7	Project completed in 2009.	\$168

TABLE 4D-2 Historical Agricultural Water Conservation and Transfer Programs – Conveyance System Improvements											
State	Area	Year Initiated	Summary	Acres	Capital Cost ¹ (\$M)	Annual O&M Cost	Cost Share	Funding Support from Outside ² Sources	Annual Water Savings (KAFY)	References ³ / Notes	Unit Cost (\$/AFY) ⁴
CA	IID	2009	Seepage Recovery Program via the QSA consists of intercepting canal seepage in drains and pumping back into the canals.	–	\$7.29	\$500,000	Yes	–	40	See case study.	\$20-32
CO	Orchard Mesa Irrigation District	2014	Canal System Improvement Project consists of checking structures, regulating reservoir, and other improvements. Saved water is used to augment stream flows to aid in recovery of four endangered fish species.	–	\$16.5	–	Yes	–	17	See case study.	\$32
CO	San Miguel Tributary to Dolores River	2001	A cooperative partnership spearheaded by the Colorado Water Trust rehabilitated a diversion dam that historically dried up the river then spilled excess water downstream, now leaving water in the >1/2 mile reach.	–	–	–	Yes	–	–	Project included rehabilitation of diversion dam, construction of a low-flow channel in the river bed, and installation of a fish ladder.	–
WY	W. Fork of Battle Creek	In progress	The Savery-Little Snake River Water Conservancy District desires to construct a new reservoir to provide a firm supply to agricultural producers.	–	\$7 design; construction TBD.	–	–	–	–	See case study.	–
Multiple	Upper Basin Salinity Control Units Primarily	Salinity Control Act Passed 1974	Reclamation funds off-farm conveyance improvements as part of the Colorado River Salinity Control Program. Canal lining and pipe conversion reduce salinity loading by decreasing deep percolation that mobilizes salts.	–	Over \$400 since 1988	–	Yes (30% of total cost)	–	Not quantified	\$400M does not include cost share http://www.usbr.gov/uc/progact/salinity/	–

¹ Capital costs are specific to the year initiated or time reported. No effort was made to normalize costs to a single year.

² Outside sources are entities not directly participating in the program; these would include federal, state, or other funds.

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⁴ Cost per acre-foot is generally calculated as follows: (capital cost/30 years + O&M)/AFY saved. However, individual programs may use different methods, and the costs shown may be from different years. Costs should not be viewed as directly comparable.

TABLE 4D-3 Historical Agricultural Water Conservation and Transfer Programs – On-Farm Efficiency Improvements											
State	Area	Year Initiated	Summary	Acres	Capital Cost ¹ (\$M)	Annual O&M Cost	Cost Share	Funding Support from Outside ² Sources	Annual Water Savings (KAFY)	References ³ / Notes	Unit Cost (\$/AFY) ₁
AZ	Central Arizona Project (CAP)	1987	Three programs have resulted in irrigation efficiencies of greater than or equal to 80% for the four districts that receive 77% of non-Indian CAP water. See Table 4D-2 for listing of the three programs.	207,497	\$198	Included in capital cost	No	–	–	Acres reported represent the four largest irrigation districts served by CAP. These four districts receive 77% of non-Indian CAP water. Costs estimated based on unit costs applied to acreage.	–
AZ	Wellton-Mohawk Irrigation and Drainage District (WMIDD)	1975	Irrigation system improvements: flood to level basin.	65,000	–	\$15/acre	Yes	–	25–30	–	–
AZ	WMIDD	1975	Advanced irrigation scheduling and funding from Colorado River Basin Salinity Control Act.	60,000	–	–	Yes	–	10–15	–	–
CA	Coachella Valley Water District (CVWD)	2004	Advanced irrigation scheduling.	22,861	–	\$430,000	No	0%	7	–	–

TABLE 4D-3 Historical Agricultural Water Conservation and Transfer Programs – On-Farm Efficiency Improvements											
State	Area	Year Initiated	Summary	Acres	Capital Cost ¹ (\$M)	Annual O&M Cost	Cost Share	Funding Support from Outside ² Sources	Annual Water Savings (KAFY)	References ³ / Notes	Unit Cost (\$/AFY) ₁
CA	CVWD	2007	Through a Water 2025 Challenge Grant, CVWD assisted with the conversion of 240 acres of farmland from furrow irrigation to sprinkler irrigation.	240	\$0.85	–	Yes	–	0.36	–	–
CA	Imperial Irrigation District (IID)	1991	Tailwater pumpback systems and irrigation water management; part of IID/ Metropolitan Water District of Southern California (MWD) 1988 Conservation Agreement.	6,629 as of 1998	\$4.15	\$1,202,000 in 2014	Yes	100%	Amount conserved through 2006. From 2007, up to 3.5.	Final Program Construction Report http://www.iid.com/Modules/ShowDocument.aspx?documentid=4060	–
CA	IID	2013	On-farm efficiency program via Quantification Settlement Agreement schedule.	–	\$285/AF	Grower responsibility	yes	100%	17-130+	Full implementation in 2026 http://www.iid.com/index.aspx?page=600	\$285
CO	Lower Colorado and Lower Gunnison	–	Through salinity and non-salinity Environmental Quality Incentives Program funding, Colorado has converted thousands of acres from flood to furrow/gated pipe (~80% efficiency) and sprinkler irrigation.	8,720	\$0.95	–	–	–	–	–	–
Multiple	Upper Basin Salinity Control Units Primarily	Salinity Control Act Passed 1974	As part of the Colorado River Salinity Control Program, the Natural Resources Conservation Service (NRCS) funds on-farm efficiency projects that help manage salinity.	–	Over \$300 since 1988	–	Yes (30% of total cost)	–	Not quantified; anecdotal evidence suggests water savings	\$300M does not include cost share. http://www.usbr.gov/uc/progact/salinity/	–

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TABLE 4D-4 Historical Agricultural Water Conservation and Transfer Programs – Transfers, Exchanges, or Acquisitions ¹							
State	Area	Year Initiated	Agreement	Transfer Amount (KAFY)	Transfer from, Water Use	Transfer to, Water Use	References¹/Notes
AZ	Wellton- Mohawk Irrigation and Drainage District	1988		22	Ag	M&I	From following program above.
CA	Imperial Irrigation District (IID) to the Metropolitan Water District of Southern California (MWD) to MWD	1990	1988 IID/MWD Conservation Agreement as amended; 1989 Approval Agreement, as amended; 1989 Agreement to Supplement Approval Agreement, as amended.	107	Ag	M&I	Water made available is from water conservation programs listed above. 107 KAFY is average amount of water made available 1998-2002.
CA	IID to MWD to Coachella Valley Water District (CVWD)	2003	1988 IID/Agreement Amendment, 1989 Approval Agreement Amendment.	20	Ag	Ag/M&I	Gives CVWD annual call rights on up to 20 KAF of the IID/MWD Conservation Agreement volume; extends term of the agreements to 2041 or 270 days after the termination of the Quantification Settlement Agreement (QSA), whichever is later.
CA	IID to MWD	2007	1988 IID/MWD Conservation Agreement Amendment.	Up to 85	Ag	M&I/Ag	Contractually fixes the annual variable volume at 103.5-105 KAF (less the volume that CVWD retains call rights to).
CA	IID to San Diego County Water Authority (SDCWA)	2003	1998 IID/SDCWA Agreement for Transfer of Conserved Water, as amended.	Up to 200	Ag	M&I	Term runs through 2047 with a mutual 30-year renewal option. Implementation ramps up through 2021 to 200 KAF; 100 KAF transferred in 2013.
CA	IID to CVWD	2003	2003 IID/CVWD Agreement for Acquisition of Conserved Water.	50–103	Ag	Ag/M&I	IID transfers 103 KAF from 2026 through 2047; MWD assumes 50 KAF of the transfer obligation starting in 2048. Implementation begins in 2008 and ramps up to 103 KAFY through 2026; 26 KAF transferred in 2013.
CA	IID to SDCWA, MWD, and San Luis Rey Settlement Parties	2006	2003 Allocation Agreement (All-American Canal Lining Project and Coachella Canal Lining Project).	96.2 in 2013	Ag	M&I	110 years; allocation of water for the benefit of the San Luis Rey Settlement Parties never terminates.
CA	Palo Verde Irrigation District (PVID) to MWD	2005	2004 PVID/MWD Forbearance and Following Program Agreement and Landowner Agreements for Following in PVID.	33 to 122	Ag	M&I	Water made available is from MWD-PVID Forbearance and Following Program above.

¹ All data are provided by Workgroup members through the data collection template/process except where noted.

TABLE 4D-5 Historical Agriculture Conservation and Transfer Programs – Other / Multiple											
State	Area	Year Initiated	Summary	Acres	Capital Cost ¹ (\$M)	Annual O&M Cost	Cost Share	Funding Support from Outside ² Sources	Annual Water Savings (KAFY)	References ³ / Notes	Unit Cost (\$/AFY) ¹
CA	Imperial Irrigation District (IID)	1940	Other programs described in Tables 30 and 35 of the 2007 IID Water Conservation Plan.	Not quantified	Not quantified	Not quantified	No	No	143.25	http://www.iid.com/Modules/ShowDocument.aspx?documentid=4598	–
CA	IID	1990	12-Hour Delivery, part of IID/Metropolitan Water District of Southern California (MWD) 1988 Conservation Agreement.	–	\$0.00	\$4,360,000 in 2014 through Nov	No	–	Approx. 21,700 AFY (portion of 105)	Source: Final Program Construction Report http://www.iid.com/Modules/ShowDocument.aspx?documentid=4060	\$201
UT	Ferron	2006	While fundamentally a salinity control project, this project included conveyance system improvements and on-farm irrigation system improvements (conversion to sprinkler).	Not quantified						See case study.	–
UT	Various	1947	Revolving Construction Loan program has been involved with over 1,400 water projects, resulting in improved farmland efficiencies, increased farmland productivity and yields, as well as improved water quality and water conservation.	Not quantified						See case study.	–

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² Outside sources are entities not directly participating in the program; these would include federal, state, or other funds.

³ All data are provided by Workgroup members through data collection template/process except where noted.