



2020 Annual Presumptive Stream Depletion Factor (PDF) Evaluation Report Hydrologic Institutional (H-I) Model Area, Arkansas River Basin

August, 2020

Introduction and Summary

Presumptive depletion factors, or PDFs, are used by the Colorado Division of Water Resources Division 2 in the administration of water replacement plans in the Arkansas River Basin to relate amounts of groundwater pumping from a well to amounts of stream depletions. Colorado's 1996 Use Rules define groundwater-only PDFs for flood and sprinkler irrigation. However, Amended Appendix A.4 of the Kansas v. Colorado decree directs the state of Colorado to conduct an annual evaluation of the PDF for supplemental flood/furrow irrigation following the annual update of the Hydrologic Institutional Model (H-I Model).

For the 2020 Annual PDF Evaluation, Colorado concludes that a supplemental flood/furrow irrigation PDF of **36.0%** is most appropriate and should be used by Division 2 for replacement plans in year 2021. PDFs for supplemental flood/furrow irrigation for recent water replacement plan years are shown in the following table.

Presumptive Depletion Factors for Water Replacement Plan Years

Replacement Plan Year	PDF for Supplemental Flood/Furrow Irrigation
2012	39.0%
2013	38.1%
2014	36.5%
2015	36.0%
2016	35.5%
2017	36.0%
2018	36.0%
2019	36.0%
2020	36.0%
2021	36.0%

Note: Other PDFs are 50% for sole-source flood/furrow, 75% for sprinkler, and 100% for drip irrigation

Methods and Results

Amended Appendix A.4 provides a methodology framework for the annual PDF evaluations, but the methodology is updated and more fully described in a report titled "Annual Presumptive Stream Depletion Factor (PDF) Evaluation Methodology for the Hydrologic Institutional Model Area, Arkansas River Basin, Colorado" (PDF Evaluation Methodology, 2015 revised 2020). The



methodology incorporates updates to the H-I Model; primarily those acknowledging higher groundwater irrigation application efficiencies from sprinkler and drip systems.

The process described in the PDF Evaluation Methodology Document was followed to complete the 2020 PDF Evaluation. The GWAM model was used to determine idealized reach replacements given PDF values which were provided to a modified version of the HI model with a revised update file. Annual depletions and accretions to usable stateline flow were estimated from historic (with actual pumping and ideal replacements represented) and compact (without pumping or replacements) runs of the modified HI model. Supplemental irrigation PDFs were tested until the minimum PDF was found which produced no cumulative shortfall to usable stateline flows over any 10-year period. Annual and ten-year sums of accretions and depletions for the limiting PDF values are shown in the following table.

2019 PDF Evaluation Results

Year of Review Period	Calendar Year	Annual Usable Stateline Depletions (+)/ Accretions (-) (acre-feet)		10-Year Period	10-year Sum of Usable Stateline Depletions (+) / Accretions (-) (acre-feet)	
		SF.PDF: 35.0%	SF.PDF: 36.0%		SF.PDF: 35.0%	SF.PDF: 36.0%
1	2000	-321	-377			
2	2001	-779	-904			
3	2002	-946	-1134			
4	2003	1224	1127			
5	2004	-191	-273			
6	2005	-409	-490			
7	2006	-488	-598			
8	2007	-573	-646			
9	2008	-1754	-1856			
10	2009	-1573	-1699	2000-2009	-5810	-6850
11	2010	24	-60	2001-2010	-5465	-6533
12	2011	223	124	2002-2011	-4463	-5505
13	2012	2185	2104	2003-2012	-1332	-2267
14	2013	1151	1084	2004-2013	-1405	-2310
15	2014	1110	1049	2005-2014	-104	-988
16	2015	-242	-285	2006-2015	63	-783
17	2016	-3073	-3234	2007-2016	-2522	-3419
18	2017	-14279	-14617	2008-2017	-16228	-17390
19	2018	-1122	-1157	2009-2018	-15596	-16691
20	2019	494	435	2010-2019	-13529	-14557

*Note: indicated PDF is for supplemental flood/furrow irrigation
PDF of 50% sole-source flood/furrow, 75% for sprinkler, and 100% for drip irrigation used
PDF of 35.0% indicates shortfall in bold and is insufficient while PDF of 36.0% is sufficient*