



## 2021 Annual Presumptive Stream Depletion Factor (PDF) Evaluation Report Hydrologic Institutional (H-I) Model Area, Arkansas River Basin

August, 2021

### 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 2021 Annual PDF Evaluation, the Colorado Division 2 Engineer has concluded 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 2022. 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%
2022	<b>36.0%</b>

*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 2021 PDF Evaluation. The GWAM model was used to determine idealized 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. Annual and ten-year sums of accretions and depletions for PDF values of 35.0% and 36.0% are shown in the following table.

The 2021 PDF Evaluation indicated that supplemental PDFs of both 35.0% and 36.0% produced no cumulative shortfall to usable stateline flows over any 10-year period, and as such either would be acceptable under the Amended Appendix A.4. However, Amended Appendix A.4 item 5.b states that the Colorado State and Division Engineers can implement PDF values that are higher than those indicated by the evaluation particularly if there is a risk of a shortfall in the 10-year compact accounting. The Colorado Division 2 Engineer has determined that the PDF for supplemental flood/furrow irrigation should remain at 36.0% for administration of replacement plans in year 2022.

**2021 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	2001	-819	-944			
2	2002	-1011	-1166			
3	2003	1213	1108			
4	2004	-205	-290			
5	2005	-420	-502			
6	2006	-501	-610			
7	2007	-579	-654			
8	2008	-1761	-1863			
9	2009	-1593	-1716			
10	2010	5	-80	2001-2010	-5671	-6717
11	2011	207	108	2002-2011	-4645	-5665
12	2012	2177	2096	2003-2012	-1457	-2403
13	2013	1146	1079	2004-2013	-1524	-2432
14	2014	1108	1047	2005-2014	-211	-1095
15	2015	-244	-287	2006-2015	<b>-35</b>	-880
16	2016	-3076	-3238	2007-2016	-2610	-3508
17	2017	-14191	-14526	2008-2017	-16222	-17380
18	2018	-1086	-1120	2009-2018	-15547	-16637
19	2019	496	435	2010-2019	-13458	-14486
20	2020	1126	1049	2011-2020	-12337	-13357

*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  
PDFs of 35.0% and 36.0% do not indicate any shortfall and therefore are both sufficient*