



2022 Annual Presumptive Stream Depletion Factor (PDF) Evaluation Report Hydrologic Institutional (H-I) Model Area, Arkansas River Basin

July, 2022

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 2022 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 2023. 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 | 36.0% |
| 2023 | 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 2022 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 2022 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 2023.

2022 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 | 2002 | -1030 | -1182 | | | |
| 2 | 2003 | 1200 | 1098 | | | |
| 3 | 2004 | -217 | -300 | | | |
| 4 | 2005 | -432 | -512 | | | |
| 5 | 2006 | -520 | -627 | | | |
| 6 | 2007 | -592 | -667 | | | |
| 7 | 2008 | -1777 | -1888 | | | |
| 8 | 2009 | -1620 | -1739 | | | |
| 9 | 2010 | -11 | -96 | | | |
| 10 | 2011 | 193 | 96 | 2002-2011 | -4806 | -5817 |
| 11 | 2012 | 2171 | 2091 | 2003-2012 | -1605 | -2544 |
| 12 | 2013 | 1142 | 1076 | 2004-2013 | -1663 | -2566 |
| 13 | 2014 | 1105 | 1044 | 2005-2014 | -341 | -1222 |
| 14 | 2015 | -246 | -288 | 2006-2015 | -155 | -998 |
| 15 | 2016 | -3080 | -3242 | 2007-2016 | -2715 | -3613 |
| 16 | 2017 | -14199 | -14531 | 2008-2017 | -16322 | -17477 |
| 17 | 2018 | -1086 | -1120 | 2009-2018 | -15631 | -16709 |
| 18 | 2019 | 496 | 435 | 2010-2019 | -13515 | -14535 |
| 19 | 2020 | 1126 | 1049 | 2011-2020 | -12378 | -13390 |
| 20 | 2021 | 1112 | 1044 | 2012-2021 | -11459 | -12442 |

*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*