Associated Earth Sciences, Inc. (Jay Chennault)

Thank you for the opportunity to comment on the Draft Guidance Document. Please find the attached comments.

Comments on Water Resources Program Guidance – Determining Irrigation Efficiency and Consumptive Use – Public Review Draft, September 2026, Publication: 26-11-017

Provided by: Associated Earth Sciences, Inc., October 23, 2026

Comments and questions:

1. *Page 2. Definitions: Consumptive Use (CU) - "… includes crop evapotranspiration, metabolic uptake, and water evaporated during irrigation application (e.g., spray, canopy and wind losses, and 10% of runoff)."*

   Is the consumptive use portion of runoff always considered 10%? If not, we suggest removing 10% from the definition of CU, and replace it with "a portion of" or similar.

2. *Page 2. Definitions: Crop Irrigation Requirement (CIR) - " … includes water required for miscellaneous crop requirements such as leaching, frost-protection, and cooling. It does not include water losses from inefficient irrigation systems such as deep percolation, runoff, or wind drift and evaporation."*

   Appendix B, Example 1 states that the CIR is equivalent to WSU's term Net Irrigation Required. However, Appendix B, Example 2 indicates that CIR is calculated simply as the difference between the crop ET (ETc) and effective precipitation (Pe). Where are leaching, frost-protection, and cooling considered in this calculation of the CIR?

   The second part of the definition suggests that deep percolation, runoff, and wind drift evaporation are the result of "inefficient" irrigation systems, when they are all components of most irrigation systems. In fact, the definition of return flows (RF) are any water that returns to the hydrologic system using "reasonably efficient" practices. "Reasonably efficient" is also used in the definition of Total Irrigation Requirement (TIR).

3. *Page 3. Footnote 4: "Shallow groundwater is not often present, and when it is then it is typically a small portion of the water used by a crop and therefore isn't considered here (Hopmans et al, 2002) (USDA, 1997). If Ecology staff are aware of the presence of shallow groundwater when evaluating irrigation water use then they should discuss water table management plans with the applicant, and evaluations of irrigation water needs with senior Ecology staff or irrigation experts."*

   The basis for the statement "shallow groundwater is not often present" is unclear. Does Ecology initiate the recommended discussions of water table management

plans? What does a water table management plan entail? Who is considered an "irrigation expert"?

4. *Page 3.: "The CIR is often estimated for a crop grown under ideal conditions (healthy and well-watered to maximize crop yields). In reality, crops can be grown successfully using less water (under some stress) as long as their soil water content stays above the permanent wilting point (Peters et al, 2013)."*

   This is an important point to emphasize in this document. It also contradicts the new proposed language in Section 3: Evaluation 4) c) of POL-1210 which requires an applicant to provide a significant amount of information at Ecology's request if the proposed water use is "insufficient to meet the proposed change's total crop irrigation requirement". Why is 4)c) of POL-1210 proposed when Ecology recognizes in this document, based on Peters et al (2013), that crops can be successfully grown using less water (under some stress)?

5. *Page 4.: "Ea = CIR/TIR This ratio, usually expressed as a percentage, is useful for expressing the effectiveness of irrigation systems. Where more of the applied water is used consumptively by the crop, the irrigation efficiency will be higher (up to 100%)."*

   It is important to recognize that the Ea can be up to 100%. It would be helpful to understand examples of when Ea = 100%. It has always been understood that utilizing deficit irrigation (e.g. applying less irrigation than the CIR) leads to an increase in Ea. This topic was specifically addressed on page 10 in the previous version of this guidance document: *"Typically, systems that are more efficient than the average will first reduce return flow and then reduce consumptive use of the crop (e.g. deficit irrigation)."* Why was the concept of 100% consumptive use (i.e Ea = 100%) under deficit irrigation removed from the current guidance document?

6. *Page 8.: "... quantifying the inefficiency components (runoff, deep percolation, wind drift and evaporation)...*

   This statement again suggests that these terms are the result of irrigation inefficiency, when they are a typical part of all irrigation systems.

7. *Page 10. Table 1*

   Table 1 appears to replicate Table 1 in Peters (2025). The Washington State University Ag Weather Net Effective Water Use model (https://weather.wsu.edu/models/effective-water-use) presents Ea % for most

irrigation methods. Page 11 of the document states that the Effective Water Use model is the *"...best available science for estimating consumptive use..."* and that *"Ecology staff should use it as the preferred model for estimating consumptive use."* Are the Ea% values presented in the Effective Water Use model acceptable to use?

8. *Page 11:* "*Other data sources, some described below, may also be used for cases where it is shown that they are more accurate. Ecology staff can require evidence showing the validity of estimates, such as water use meter records or crop water use studies.*[13] *POL-1210 Section 4.c."*

   It is unclear how the methods used to calculate irrigation consumptive use are related to POL-1210 Section 4.c., which appears to apply to situations when the calculated consumptive use is less than the CIR (e.g. deficit irrigation).

9. *Page 12: 5.1 Determining Consumptive Use from Total Water Use and Page18. Appendix A.*

   This section and the flow chart in Appendix A suggest that the consumptive use calculated by using meter records or power records is independent of the crop CIR. Is this correct? The methods described also do not include any evaluation of the water right limitations including Qa, Qi, or period of use. Is that correct?

10. *Pages 13-14: 5.2 Determining Consumptive Use from ET Models: "Some, not all, reference ET models add the consumptive use from the irrigation system inefficiencies (%Evap from Table 1) to the CIR to provide the total consumptive use from irrigation. Where consumptive use is not provided, use the %CU from Table 1 to estimate the total consumptive use from CIR or ET..."*

    This suggests that if using the Effective Water Use model, which does provide Ea% (and therefore CU%), the values contained in the model for Ea% should be used instead of Table 1, correct? The methods using the ET Models also do not include any evaluation of the water right limitations including Qa, Qi, or period of use. Is that correct?

11. Page 20: Appendix B: Sample Calculations: Example 1

    After the CU is calculated, a calculation of the actual irrigation system efficiency (Ea%) is described as an "extra step". Is this extra step required? If so, it should be presented in the flow chart in Appendix A.

In the example calculation, the measured water use 35.8 ac-ft is multiplied by the %CU from Table 1 for a traveling big gun sprinkler (93%). The "extra step" indicates a calculated Ea of 79%. However, the 93% CU is based on an average Ea of 59% and a average evaporation of 34% (59% + 34% = 93%). The result of the example calculation is that the above average Ea (79%) only reduces evaporation (a consumptive use) but does not reduce return flow (nonconsumptive use). Why would increasing the application efficiency only reduce evaporation and not also reduce return flow? The example calculation indicates that 7% return flow is maintained when the application efficiency increases. This approach is contrary to what is stated on page 10 of the previous version of this guidance document: *"Typically, systems that are more efficient than the average will first reduce return flow and then reduce consumptive use..."* (emphasis added). This approach is also contrary to how consumptive use and return flow are considered in the literature. One example: *"Consumption of water is always calculated first, then any remaining water either becomes surface-water or percolates through the root zone to groundwater as deep percolation."* (U.S. Geological Survey documentation of the MODFLOW-One-Water Hydrologic Flow Model (OWHM), USGS Techniques and Methods 6-A60 – Appendix 4. Consumptive Use and Evapotranspiration in the Farm Process, p. 233). Is it correct to present an example where return flow is calculated first, then the remaining water is considered consumptive?

How would the calculation of CU change if the CIR was 5.5 inches? In this case, the "extra step" would calculate an Ea of 51% - which is within the irrigation efficiency range for a Big Gun listed in Table 1 (50-70%) and therefore the irrigation would be considered reasonable and non-wasteful. So, both crops, one with a CIR of 8.4 inches and one with a CIR of 5.5 inches, would have the same consumptive use of 33.3 acre-feet. Is this correct?

How would the calculation of CU change if the CIR was equal to or greater than the TIR (e.g. a CIR of 10.74 inches)? In this case, the "extra step" would calculate an Ea of 100%. If the Ea% is 100%, then the CU% would also be 100%, meaning the CU would = 35.8 acre-feet. It this correct?

How would the calculation of CU change if the water right was limited to a withdrawal of 32 acre-feet per year?

12. Page 21: Appendix B: Sample Calculations: Example 2

The example is using The Effective Water Use model hosted on the WSU AgWeatherNet website. The model reports an Ea of 80% for center pivot mid-elevation spray. Is it acceptable to use and Ea of 80% rather than the 79% from Table 1?

How would the calculation of CU change if the water right was limited to an annual diversion of 200 acre-feet? How would the calculation of CU change if the monthly water use was limited by the water right Qi to less than the monthly CIR for a particular crop/year? How would the calculation of CU change if the period of use of the water right prevented irrigation during months where the Effective Water Use model indicated irrigation is needed?

13. Page 23: Appendix B: Sample Calculations: Example 3

If the intent is to utilize the OpenET method to calculate ACQ, the example should be expanded to demonstrate that the calculation of CU needs to be repeated for the 5-year ACQ period, like Example 2 shows.

How would the calculation of CU change if the water right was limited to Qa of 100 acre-feet? How would the calculation of CU change if the monthly water use was limited by the water right Qi to less than the monthly estimated CU or total use? How would the calculation of CU change if the period of use of the water right prevented irrigation during months where the OpenET ET values and the monthly Pe estimates from the Effective Water Use model indicate consumptive use is occurring?

General Comment:

The document must provide guidance when water use is limited by the water right. How should total use, consumptive use, and irrigation efficiency be calculated when the water right authorizes less water than the TIR or CIR calculated using the guidance? Recently in WRIA 1, Ecology utilized a method for calculating consumptive use for a water right change using a different methodology than those described in this or the previous version of this guidance document. The permit writer utilized this undocumented methodology to address the fact that the water right Qa was less than the TIR. The methodology used deviated from the methods used in the applicant's change application supporting document, documented Ecology procedures, Ecology guidance, previously approved water right changes, and published literature, and resulted in significantly less water available for future use by the applicant. The guidance must address how water right attributes are incorporated into the determination of consumptive use to avoid this type of confusion in the future.