Project topic: Assessing the contribution of controlled drainage using drainage and diking district ditch networks to crop water requirements and water storage

Proposed research (What): Irrigators in some irrigation, drainage, and diking improvement districts in lowland areas within the Skagit River basin utilize check dams in irrigation and drainage ditches to control drainage and store water from precipitation within the districts. The Washington State Department of Ecology has determined that the Drainage Improvement District statute (RCW 85.08) provides districts with the authority to use water developed by a district and entirely confined within that district for irrigation without a water right as long as the drainage system discharges directly to saltwater (Department of Ecology, 2010). Irrigators may directly pump water stored behind these check dams for overhead irrigation or seepage from the ditches may raise the groundwater elevation and thereby increase capillary rise and contribute to meeting crop water requirements. Neither the physical quantity of water that can be stored in the ditch networks nor the relationship between ditch water levels, groundwater elevations, and capillary rise into the root zone have been quantified.

Value of the research (Why): Controlled drainage creates a water supply for irrigators that is not subject to the 2001 Instream Flow Rule (Chapter 173-503 WAC) and it may reduce reliance on other water sources. This may be particularly important for irrigators that hold interruptible water rights, that is, water rights that are junior to the 2001 Instream Flow Rule. Additionally, if controlled drainage can decrease the requirement for irrigation with big gun and boom cart sprinklers by increasing capillary rise, this may lead to reduced evaporative losses and lower consumptive use.

General methodology (How): To determine the maximum physical storage capacity of the drainage and irrigation ditch networks, elevation and location data for the check dams from a ground-level survey could be paired with remote-sensing data (e.g., LIDAR) to create a detailed digital elevation model (DEM). Completion of the DEM should be easily achievable within the timeframe dictated. Assessment of the impacts of controlled drainage on groundwater levels and the contribution of capillary rise to root zone soil moisture would likely require field research and mechanistic modeling. Field research would entail monitoring groundwater levels and soil moisture in multiple paired fields, with and without controlled drainage, using shallow piezometers and soil water potential sensors installed at increasing distances from the ditch or drainage tiles. Intact soil cores could be taken to measure the unsaturated hydraulic conductivity, and this field and lab data could be used with HYDRUS 1-D or another similar model to estimate the contribution of capillary rise to root zone soil moisture. The available time for this project would only allow for a single season of field data collection, but collecting additional years of data may be possible through competitive extramural funding sources or if the Joint Legislative Task Force is renewed and wishes to continue this work.

Data uses and impacts: These results will help the Legislative Task Force and stakeholders better understand the impacts that controlled drainage currently has on overhead irrigation requirements and the timing and quantity of water pumped from the Skagit River for agricultural irrigation. Furthermore, this work may identify opportunities to alter the management of these check dams to maximize water productivity. Members of the Skagit Basin Supply and Demand Analysis project team have also suggested that quantifying the physical storage in the ditch networks would be particularly important if the DHSVM surface model is extended to below Mount Vernon and that quantifying storage could improve the understanding of potential future fish benefits and sources of potential conflict or compromise between fish habitat and agricultural water demand.

Reference

Department of Ecology. (2010). Letter to the Swinomish Indian Tribal Community and the Western Washington Agricultural Association. https://wsuniv.maps.arcgis.com/home/item.html?id=b6a2bf5bafd741d898820fcf21b98a2a