HOW POTTER VALLEY PROJECT AFFECTS THE EEL RIVER IN HUMBOLDT COUNTY, CA

ABSTRACT

The Potter Valley Project (PVP) threatens species of the Eel river in multiple ways; blocking potential salmonid habitat, providing habitat for invasive pikeminnow, and most importantly, by interrupting the natural flows of the Eel river by diverting water to the Russian River. This report aims to assess how the Eel River ecosystem might fair with the absence of diversions. Using data from USGS, I found there to be a perceptible increase in stage height of the main stem Eel river without diversions. ArcMap was used to visualize the changes in the Eel river.

INTRODUCTION

The Potter Valley Project was originally constructed in 1922 to provide electricity to residents of Potter Valley through hydropower. The PVP continues to accomplish this goal, however, the amount of power generated, 9.2MW, is minimal and can easily be adopted by nearby hydropower plants (Humboldt County, 2018). Another benefit of the project is the diverted waters, which serve agriculture and recreation in Mendocino and Sonoma counties. On average, the PVP diverts 223.8 acre-feet from the Eel to the Russian River watershed every single day (Lorde et al., 2018). While supporters of the project argue that Sonoma and Mendocino need the diversions for their "diverse organic agriculture" (Water Solutions, 2018), a study conducted by Sonoma County reports that its main crop is wine grapes, generating an astounding $578,312,900 compared to milk ($146,475,400), poultry ($40,823,200), and vegetables ($9,961,300) (Sonoma County, 2018).

The project threatens chinook salmon, SONC Coho salmon, northern California steelhead, lamprey eel, and green sturgeon of the Eel river (Friends of the Eel River, 2018). The PVP is quickly approaching its relicensing date, April 14th, 2022. With the opportunity to stop the relicensing of the project and even to possibly decommission it altogether, residents of Humboldt County (Figure 1) should be made aware of the benefits of decommissioning the PVP.

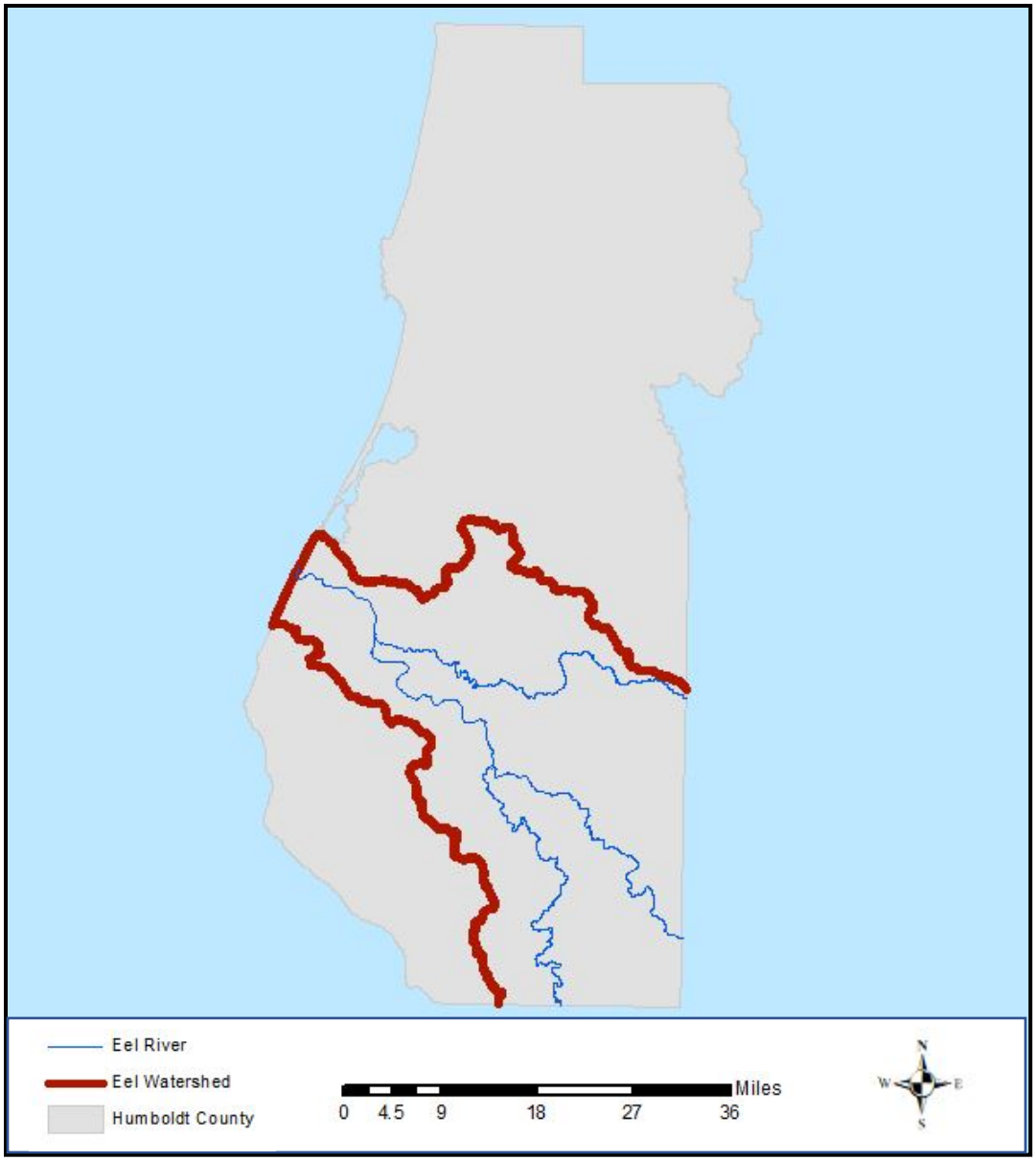

Figure 1 Map of Humboldt County, CA and Eel river.

METHODS

Data used to find the impacts of the PVP on the Eel river within Humboldt County included: the Humboldt County border, Humboldt rivers, and north coast watersheds. These data files were clipped together. Because annual average flowrate data was not associated with the river data file, these values were found using United States Geological Survey websites. The Eel river was then separated into four distinct portions (Figure 2), Miranda, Fort Seward, Scotia, and Bridgeville, due to their association with

the local USGS gauging station. The last section of the river, represented by the city name Fortuna, has no flowrate data available. To compensate for this, the theory of continuity (flow in= flow out) was applied. The projected value for Fortuna was found by adding the flowrates from Bridgeville and Scotia.

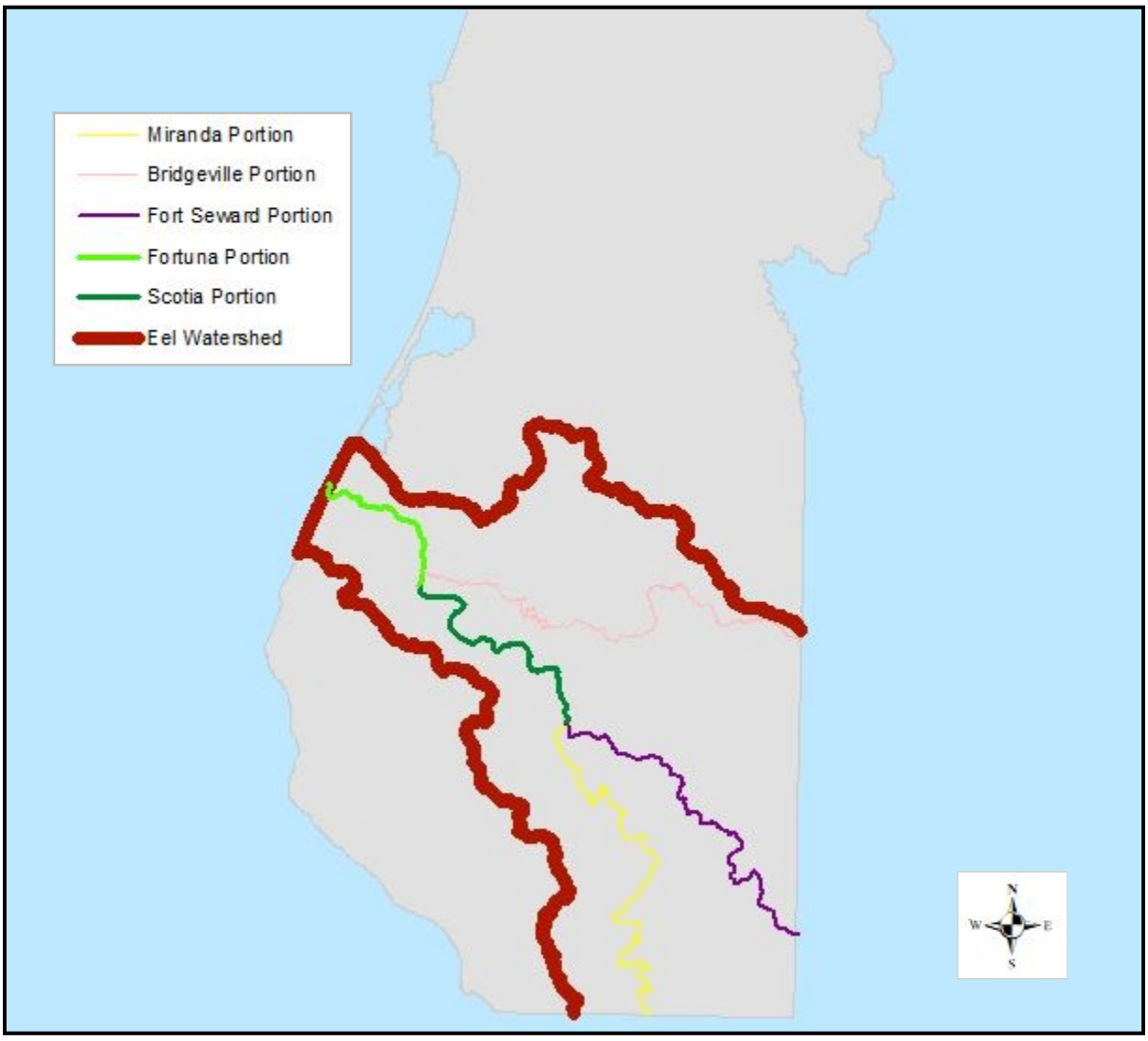

Figure 2 Eel river and analyzed portions distinguished using color.

Spatial attribute queries in ArcMap was the tool most needed to separate the Eel river into the designated sections. Once the river sections were shown as individual data layers, the next step was to find a method to visualize the effect of not diverting water for the PVP.

I decided to use ArcMap's symbology function so that the width of the river portion's symbol would represent the increases in flowrate that would occur if the PVP did not divert water from the Eel. To accomplish this, the amount of water diverted from the Eel was added to each river portion, then a flowrate fraction was found in relation to the largest river portion, Fortuna (Equation 1). Finally, a symbol

width for both diversion flows and non-diversion flows (Equations 2, 3, and 4) was calculated using a base symbology width of 0.2. Calculations were made using Excel. I assumed only the main stem river portions (Seward, Scotia, and Fortuna) would be affected.

Equation 1

$$\text{Flowrate Fraction} = \frac{(Scotia\ flowrate)\ 36307181.10\ (\frac{m3}{day})}{(Fortuna\ flowrate)\ 40021082.77\ (\frac{m3}{day})} = 0.907$$

Equation 2

$$\text{Original Symbol Width} = (Flowrate\ Fraction)\ 0.907 * 0.02 = 0.181$$

Equation 3

$$\text{New Symbol Width} = (Original\ Symbol\ Width)\ 0.181 + ((Original\ Symbol\ Width)\ 0.181 * p) = 0.182$$

Where p = percent diverted from flow

Equation 4

$$\text{Percent Diverted} = (Diversion\ Amount)\ 276052.81(\frac{m3}{day}) \ / \ (Non\text{-}diverted\ Flowrate)\ 36583233.92\ (\frac{m3}{day}) = 0.0074$$

RESULTS

The representative symbology width method did not prove to be a helpful visual aid (Figure 3) as it produced a map that looks nearly identical to Figure 2. Model width increases averaged at 0.00137. Although virtually undetectable in terms of width, further exploration of USGS's website revealed that the Eel would experience raises in river stage, or height (Table 1) if diversions were to cease. Fortuna is not included due to lack of available data.

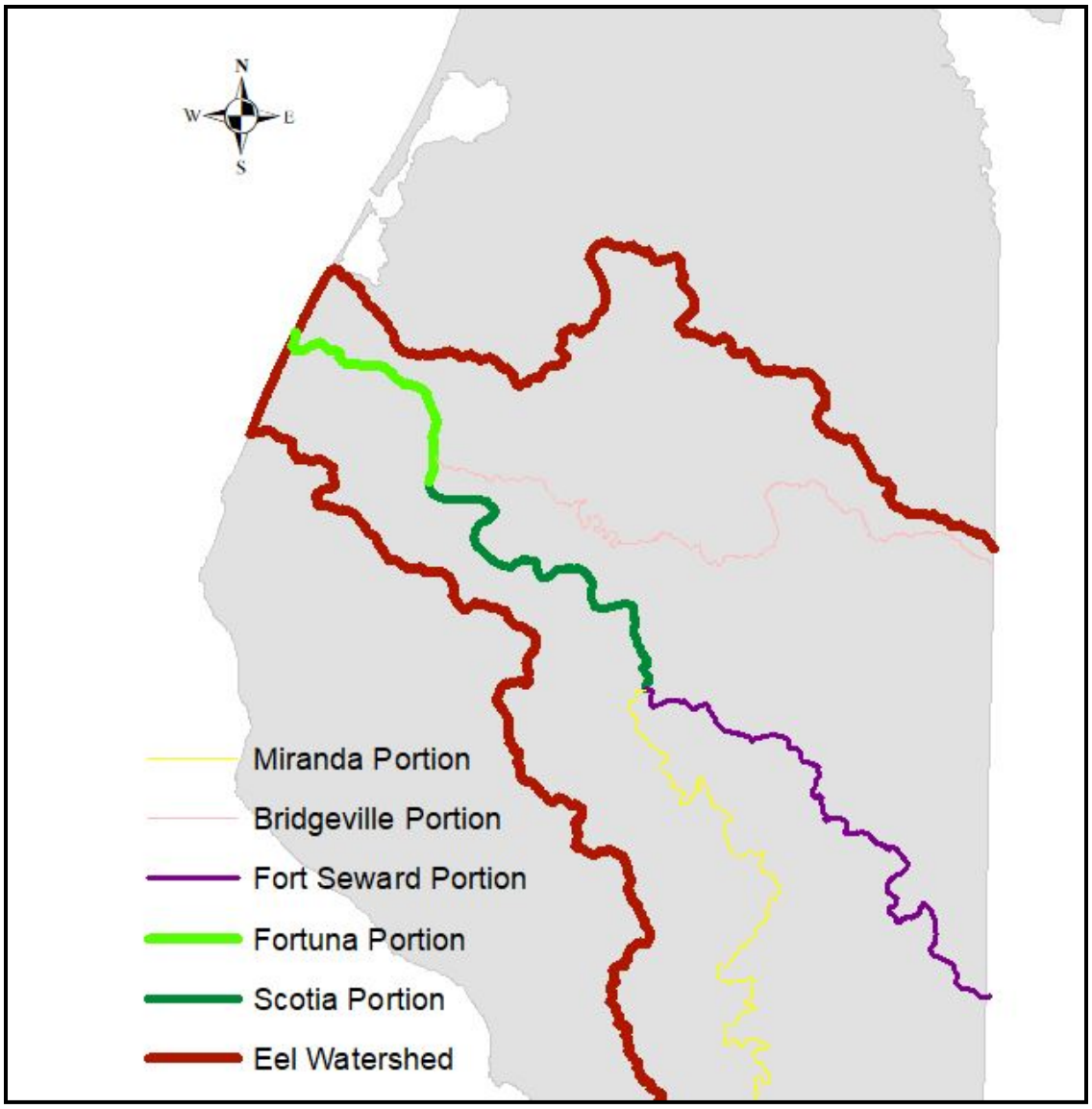

Figure 3 Map created using adjusted symbol width values for the main stem Eel river sections.

Location	Stage height with diversions	Stage height without diversions
Scotia	15.99	16.02
Seward	14.81	14.86

Table 1 USGS data revealing increases in stages of portions of the main stem Eel river under the case of no diversion.

DISCUSSION AND CONC LUSION

Due to ArcMap's limited ability to read up to only two decimal places and the relatively small amount of water being diverted from the Eel river compared to its staggering size, the benefits of stopping diversions from the Eel river were undetectable. Although this method did not work for visualizing the benefits that would come to the Eel River if the PVP were to be decommissioned and diversions stopped, this report does reveal the benefits in theory and further research should be conducted to confirm these benefits.

ACKKNOWLEDGEMENTS

Data Set	**Description**	**Spatial Reference System/Projection**	**Data Source**	**Link to Data Source**
CNTYOUTL.shp	Outline of Humboldt County, CA	NAD_1927_StatePlane_California_I_FIPS_0401	Humboldt County GIS Data Download	https://humboldtgov.org/276/GIS-Data-Download
nhd24kst_I_ca023.shp	Rivers in Humboldt County	NAD_1983_UTM_Zone_10N	USDA NRSC GIS Gateway	https://datagateway.nrcs.usda.gov/
nc_hydro_unit	Watersheds in North Coast Resources Partnership boundary	GCS_WGS_1984	NCRP	https://northcoastresourcepartnership.org/data/ http://library.humboldt.edu/humco/holdings/Sathrum/nwcalmaps.htm#vegetation

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USGS. (2018). Water-Year Summary for Site USGS 11475000 Eel River at Fort Seward, CA

USGS. (2018). Water-Year Summary for Site USGS 11477000 Eel River at Scotia, CA

USGS. (2018). Water-Year Summary for Site USGS 11476500 South Fork Eel River near Miranda, CA

USGS. (2018). Shift-adjusted Rating Table 11475000 Eel River at Fort Seward, CA

USGS. (2018). Shift-adjusted Rating Table 11477000 Eel River at Scotia, CA