Interim Core Map Documentation for Ruth's Golden Aster

Version 1

Review Completed: April 2026

Core Map Developer: U.S. Environmental Protection Agency (EPA) Office of Pesticide Programs (OPP)

Species Summary

The Ruth's golden aster (*Pityopsis ruthii*, Entity ID #1036) is a rare plant endemic to short stretches of the Hiwassee and Ocoee Rivers in Polk County, Tennessee. This species grows only in the cracks and crevices found in phyllite or graywacke boulders along the banks of these rivers (FWS, 1992).

The Ruth's golden aster was listed as endangered under the Endangered Species Act (Act) in 1985. Additional information is provided in **Appendix 1**.

Description of Core Map

The core map for the Ruth's golden aster is biological information type, based on known locations (species range with areas outside of the two watersheds where this species is known to occur removed). There is no designated critical habitat for this species.

Figure 1 depicts the resulting interim core map for the Ruth's golden aster. The size of this core map is approximately 147,278 acres. Landcover categories within the core map area are included in **Table 1**. Landcover within the core map is predominantly deciduous, evergreen, and mixed forest, which is consistent with the habitat of this species.

The core map developed for the Ruth's golden aster is considered interim. This core map will be used to develop pesticide use limitation areas (PULAs) that include the Ruth's golden aster. This core map incorporates information developed by the U.S. Fish and Wildlife Service (FWS) and made available to the public; however, the core map has not been formally reviewed by FWS. This interim core map may be revised in the future to incorporate expert feedback from FWS. This interim core map has an "limited" best professional judgment classification to describe major uncertainties/limitations. The map is based on the range described by FWS, with areas removed based on the biological need and known locations of the species. This core map does not replace or revise any range or designated critical habitat developed by FWS for this species.

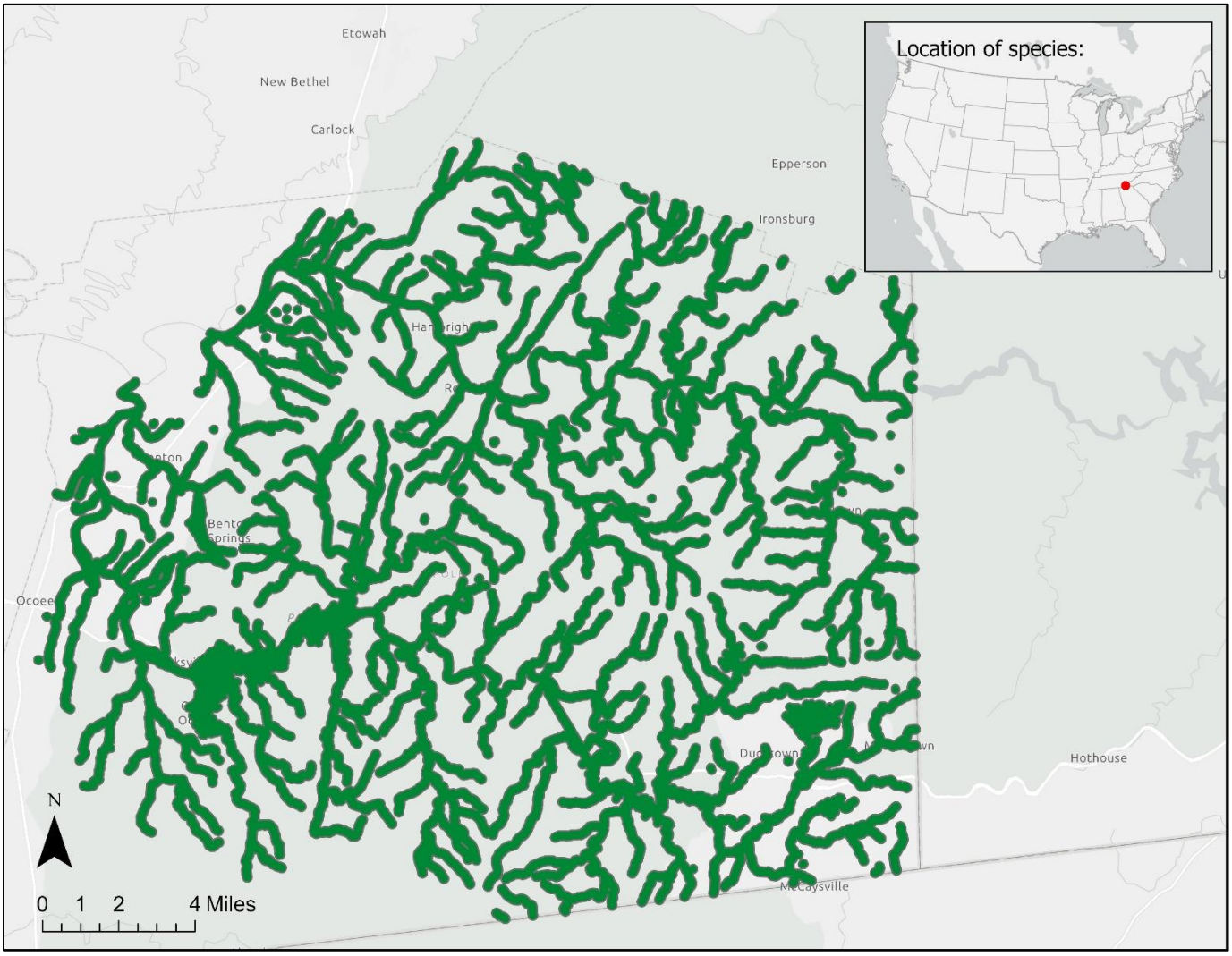

Figure 1. Interim core map for the Ruth's golden aster. The total acreage of the core map is approximately 147,278 acres.

Table 1. Percentage of Interim Core Map Represented by National Land Cover Database (NLCD)[1] Land Covers and Associated Example Pesticide Use Sites/Types.

Example pesticide use sites/types	NLCD Class/Value	% Area
Forestry	Deciduous Forest (41)	19%
Forestry	Evergreen Forest (42)	19%
Forestry	Mixed Forest (43)	42%
Agriculture	Pasture/Hay (81)	8%
Agriculture	Cultivated Crops (82)	1%
Mosquito adulticide, residential	Open space, developed (21)	4%
Mosquito adulticide, residential	Developed, Low intensity (22)	1%
Mosquito adulticide, residential	Developed, Medium intensity (23)	0%
Mosquito adulticide, residential	Developed, High intensity (24)	0%
Invasive species control	Woody Wetlands (90)	1%
Invasive species control	Emergent Herbaceous Wetlands (95)	0%
Invasive species control	Open water (11)	3%
Invasive species control	Grassland/herbaceous (71)	1%
Invasive species control	Scrub/shrub (52)	0%
Invasive species control	Barren land (rock/sand/clay; 31)	1%
Total Acres	Interim Core Map Acres	147,278 acres

Evaluation of Known Location Information

There are four datasets with known location information for this species:

- Descriptions of locations provided by FWS
- Occurrence locations in iNaturalist
- Occurrence locations in Global Biodiversity Information Facility (GBIF)
- Occurrence locations in NatureServe

EPA evaluated these sets of data before selecting the type of and developing the core map. Occurrences in iNaturalist, GBIF, and NatureServe were consistent with the general locations discussed in FWS documentation. However, several known locations reported in GBIF occurred outside of the species range, but with a large amount of uncertainty. **Appendix 1** includes more information on the available known location information.

Approach Used to Create Core Map

EPA compiled available information for the Ruth's golden aster from FWS, as well as observation information available from various publicly available sources (including iNaturalist, NatureServe, and GBIF). The information compiled for the Ruth's golden aster is included in **Appendix 1**.

EPA used this information to identify the core map type, which included a refinement of the species range based on suitable habitat. Influential information that impacted the development of the core map included:

[1] Dewitz, J., 2023, National Land Cover Database (NLCD) 2021 Products: U.S. Geological Survey data release, https://doi.org/10.5066/P9JZ7AO3

- FWS (2023) states that this species is restricted to two populations located along short reaches of the Hiwassee and Ocoee rivers, in Polk County, Tennessee.
    - FWS (1992) states that this species grows only in the cracks and crevices found in phyllite or graywacke boulders along the banks of these rivers.
- Occurrences have appeared outside of the Hydrologic Unit Code (HUC) 10 watersheds for the Hiwassee and Ocoee rivers.
- The entire range of the species was not used as the core map because the range contains areas where the species does not occur. **Appendix 2** provides more details on the Geographic Information System (GIS) analysis and data used to generate the core map.

Discussion of Approaches and Data that were Considered but not Included in Core Map

EPA considered using the species range as the core map; however, it includes all of Polk County, Tennessee, which include large swaths of areas where this species is not expected to occur. EPA also considered refining the core map to the HUC12 level, as described in Figure 1. However, this refinement would not have captured known locations, therefore, the HUC10 watershed level was used as the outer extent. Waterbodies within these watersheds were selected and buffered out to 200m to account for the banks.

Appendix 1. Information Compiled for Species

1. **Recent FWS Documents/Links**
   5 Year Review – 2012
   5 Year Review – 2018
   5 Year Review – 2023
   Recovery Plan – 1992

2. **Background Information**
   - **Status:**
     Listed as endangered on July 18, 1985.

   - **Taxonomy**
     Terrestrial plant

   - **Resiliency, Redundancy, and Representation**
     Not discussed explicitly in the FWS documents reviewed but expected to be low due to the species "limited distribution and its vulnerability to a variety of threats"(FWS, 1992).

   - **Life History**
     - **Habitat**
       FWS (2023) states that this species is restricted to two populations located along short reaches of the Hiwassee and Ocoee rivers, in Polk County, Tennessee. This species grows only in the cracks and crevices found in phyllite or graywacke boulders along the banks of these rivers (FWS, 1992).

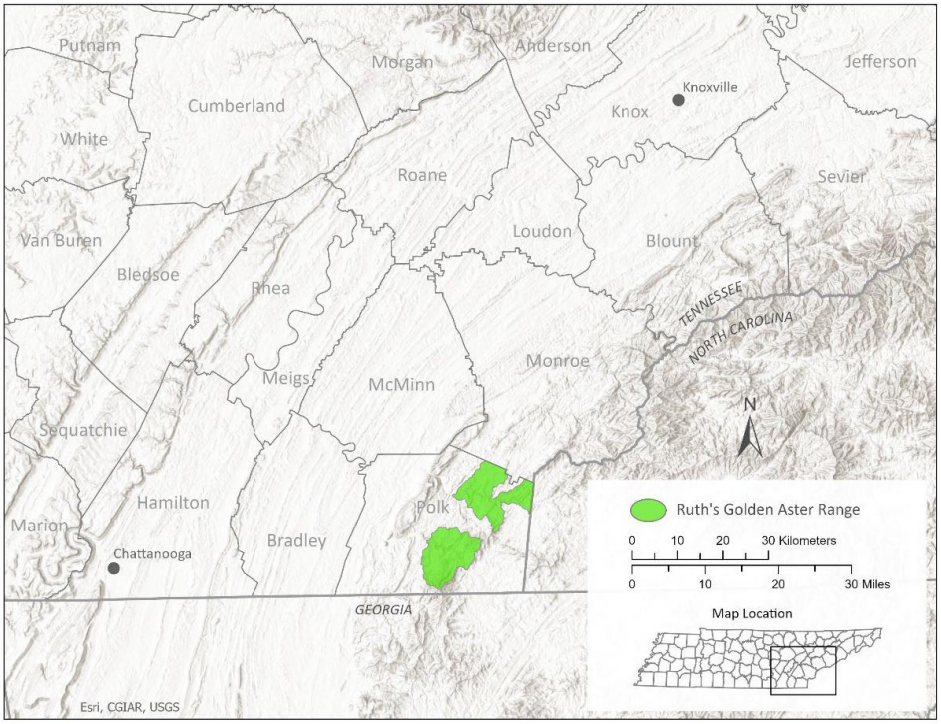

Figure 1. Map of the HUC-12 watersheds, in the Hiwassee and Ocoee river basins, encompassing stream reaches within the known range of *Pityopsis ruthii.* Taken from FWS (2023).

- **Biology**
  FWS (2023) states that this species is an herbaceous, tufted perennial that reproduces through seed or rhizomatous growth, reaching heights of up to one foot.

- **Pollination**
  At the time of the recovery plan, no studies of pollinators or of pollination of this species had been performed (FWS, 1992). Bees have been noted visiting flowers in the field, and it has been suggested that a combination of wind and nonselective foraging by insects could account for a low percentage of pollination (FWS, 1992).

- **Relevant Pesticide Use Sites**

Pesticide threats to the species were not discussed in the FWS documentation for this species.

- **Threats**

The threat of habitat loss due to encroaching vegetation continues to affect many of the sites where plants in the Hiwassee population are located (FWS, 2023). The habitat of the Ocoee population is threatened by proposed road construction for modifications of US Highway 64. Water flow regimes on both rivers have been altered by dam construction, which may have resulted in increased competition from other vegetation, particularly on the Hiwassee River (FWS, 1992).

- **Recovery Criteria**

Viable, self-sustaining populations on the Ocoee and Hiwassee Rivers (FWS, 1992).

3. **Species Range**
   The species range was last updated on January 27, 2018, and encompasses Polk County, Tennessee, which is approximately 283,235 acres.

Figure 2. Species range from https://ecos.fws.gov/ecp/species/105

4. **Critical Habitat**
   FWS has not designated a critical habitat for this species.

5. Additional Known Locations

- **iNaturalist**
  - Searched on 7/28/2025
  - 10 research grade and verifiable observations made between August 2018 – September 2024

- **GBIF**
  - Searched on 7/28/2025
  - 40 observations made between 1997 –2025, 6 observations made since 2020
    - No observations made between 2011 – 2020
    - 32 of the observations were originally published by NatureServe, 8 of the observations were originally published by iNaturalist
  - 5 observations include coordinates

- **NatureServe**
  - Searched on 7/29/2025
  - Results include both documented distribution & results of the generalized habitat model

Appendix 2. GIS Data Review and Method to Develop Core Map

EPA developed the interim core map by refining the species range based on the land cover and elevations where this species is known to occur.

1. **Datasets and Software**

   Datasets used:

   1.1. FWS species range
   1.2. USA States Generalized
   1.3. USA Counties Generalized
   1.4. Watershed Boundary Dataset HUC10s
   1.5. NHDPlus High Resolution

   Software used: ArcGIS Pro, version 3.5.1

2. **Creating the core map**

   2.1. Determining outside extent of the core map

   The species range, readily downloadable from ECOS, was used as the outer extent of the core map. As discussed in Appendix 1, FWS have not designated a critical habitat for this species.

   2.2. Refining species range based on suitable habitat

   A review of FWS's documentation discovered several key aspects of the suitable habitat for this species:

   - FWS (2023) states that this species is restricted to two populations located along short reaches of the Hiwassee and Ocoee rivers, in Polk County, Tennessee.
     - FWS (1992) states that this species grows only in the cracks and crevices found in phyllite or graywacke boulders along the banks of these rivers.

   Therefore, the species range was refined to select these watersheds within Polk County, Tennessee. A review of the known locations determined that the HUC10 level was the appropriate watershed level. HUC12 watershed levels did not encompass all known locations. HUC10 watersheds allowed the species range to be refined while also protecting all known locations.

3. **GIS Process Used**

   3.1. Selecting Polk County Tennessee

   The Ruth's golden aster is only found within Polk County, TN. Therefore, the following steps were used to create a layer of Tennessee's boundaries to make data processing more efficient:

   Added the USA States Generalized layer and used the Select Features tool to select Tennessee:

   Select Layer by Attributes (tool):

   - Input rows: *USA States Generalized*
   - Selection type: *New Selection*
   - Expression: Where State Name is equal to Tennessee
   - Output, saved by right clicking on the input layer, selecting "Data" from the dropdown menu, then "Export Features": *Tennessee*

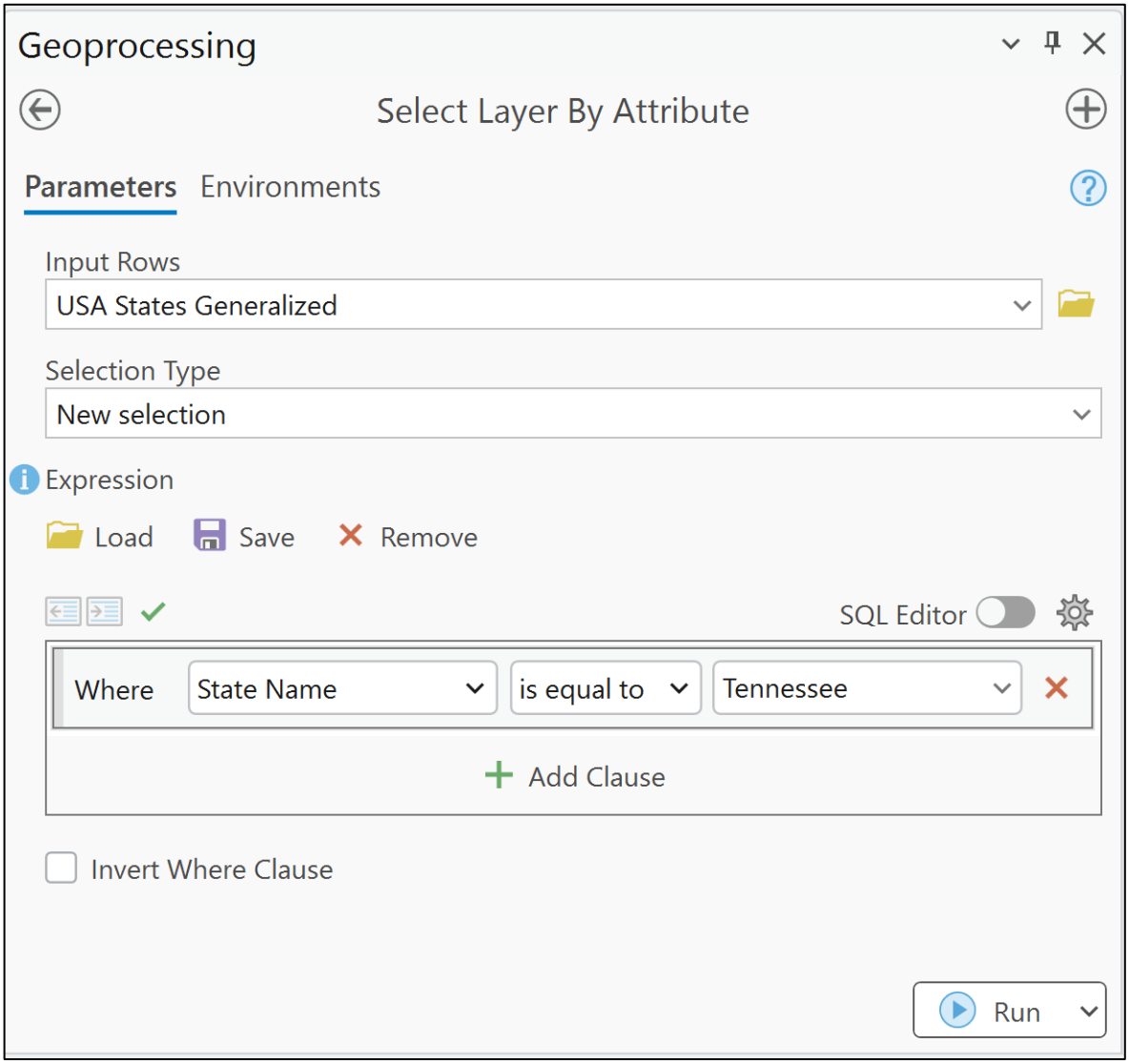

Figure 3. Screenshot of the setup of the *Select Features* tool.

The Tennessee layer was then used to clip *USA Generalized Counties* layer to select counties within Tennessee:

Clip (tool):

- Input features: *dtl_county*
- Clip features: Tennessee
- Output features: *TN_counties*

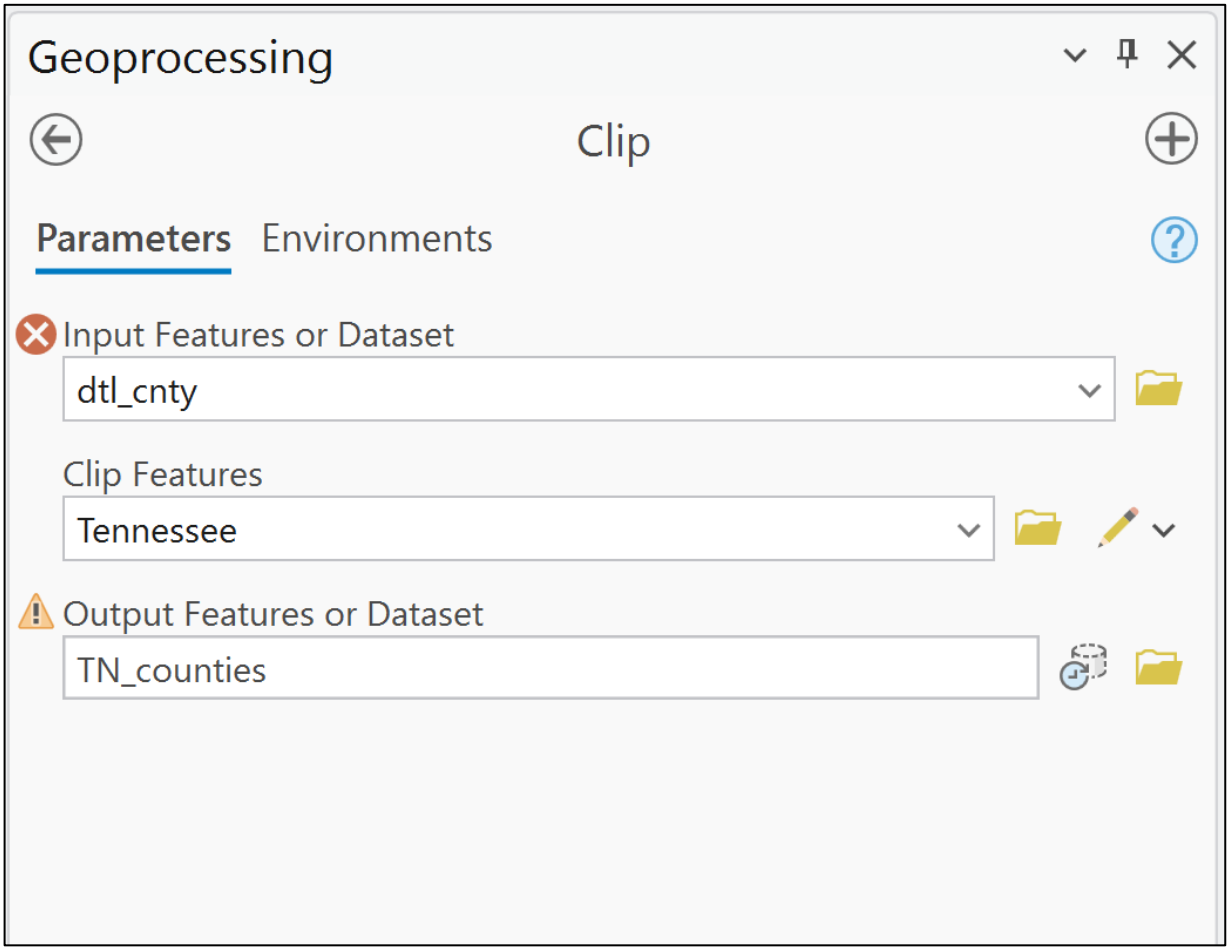

Figure 4. Setup of the *Clip* tool.

From the Tennessee counties layer, Polk County was then able to be selected using the *Select Layer by Attribute* tool:

Select Layer by Attributes (tool):

- Input rows: *TN_counties*
- Selection type: *New Selection*
- Expression: Where Name is equal to Polk
- Output, saved by right clicking on the input layer, selecting “Data” from the dropdown menu, then “Export Features”: *TN_counties_Polk*

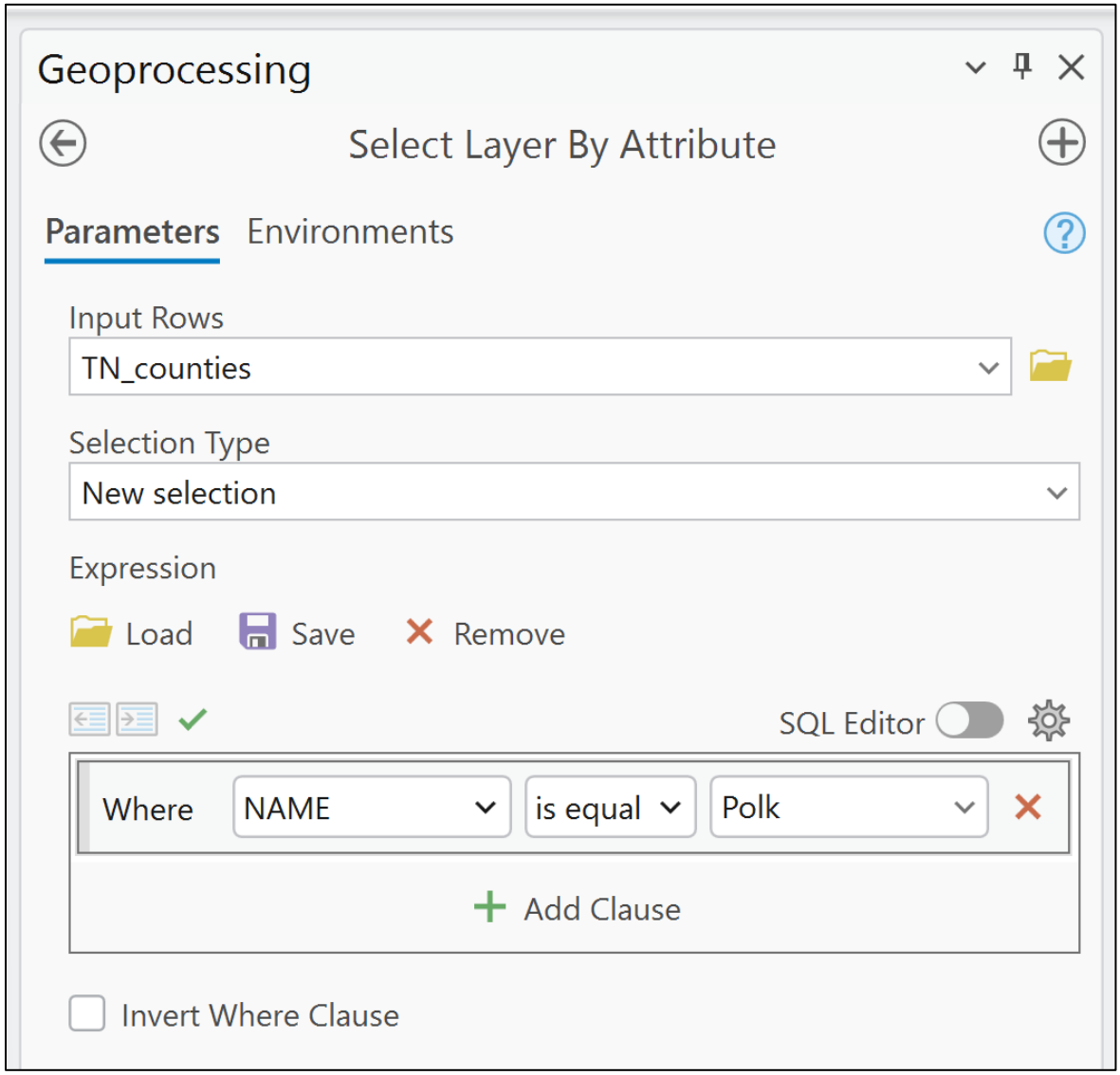

Figure 8. Set up of the *Select Layer by Attribute* tool.

3.2. Selecting HUC10 watersheds

The HUC10 watersheds where the Ruth's golden aster is known to occur was selected using the following steps:

HUC10 watersheds that occur within Tennessee were selected using the Select Layer by Attribute tool:
Select Layer by Attributes (tool):

- Input rows: *HUC10*
- Selection type: *New Selection*
- Expression: Where States contains the text TN
- Output, saved by right clicking on the input layer, selecting "Data" from the dropdown menu, then "Export Features": *TN_HUC10_ExportFeatures*

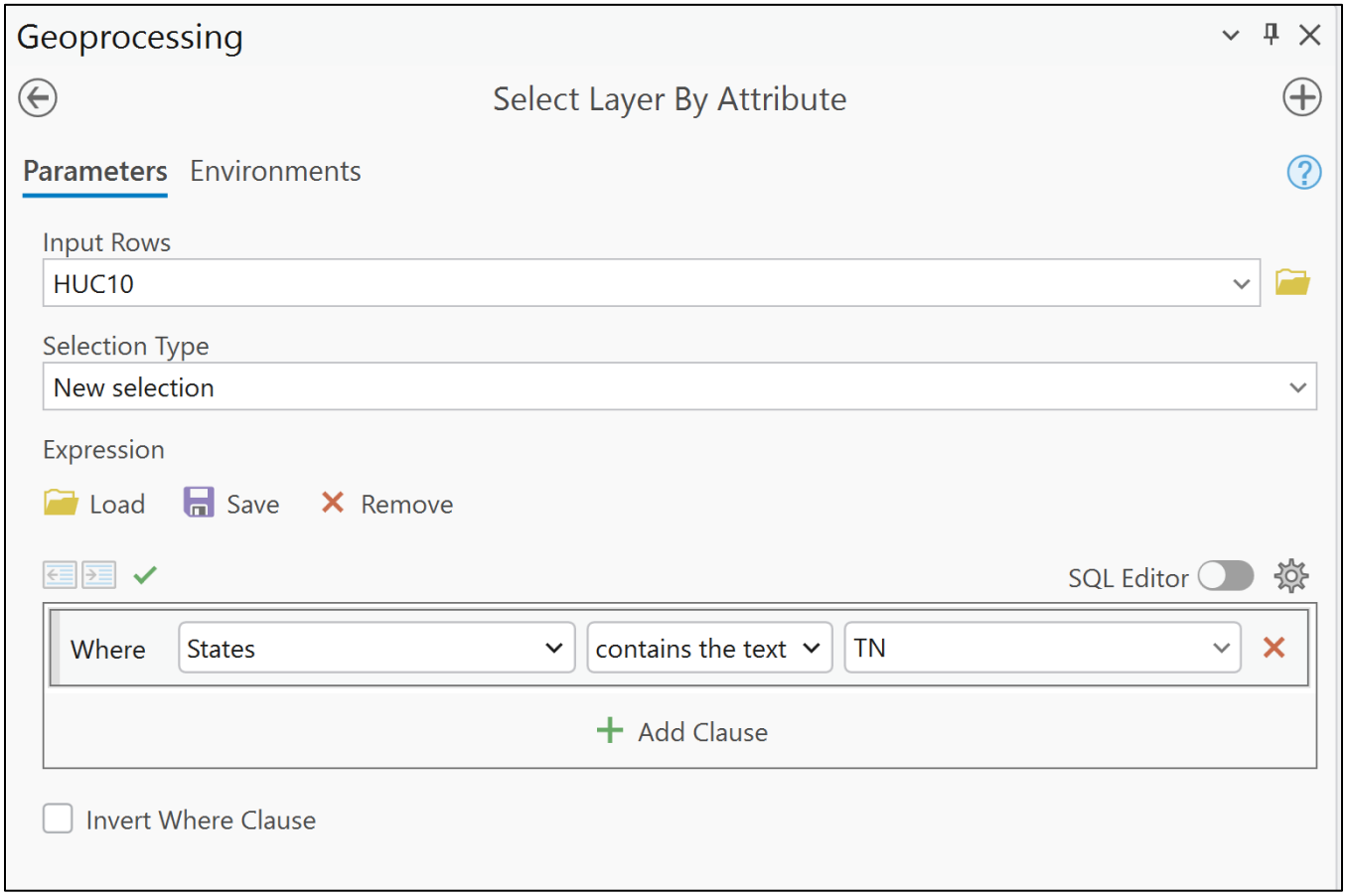

Figure 5. Setup of the *Select Layer by Attribute* tool.

The HUC10 watersheds within Tennessee where then clipped to Polk County's boundaries using the *Clip* tool:

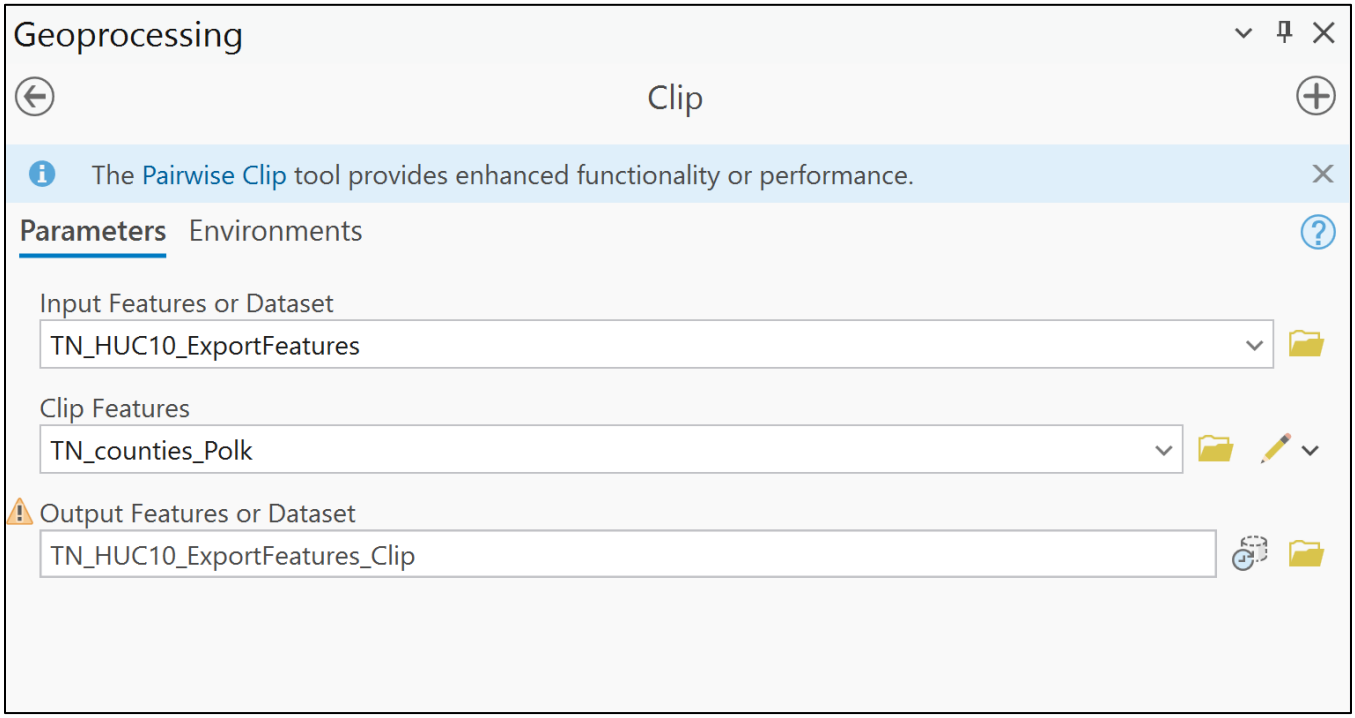

Figure 6. Set up of the *Clip* tool.

Since there were only 6 attributes, the Ocoee River and Spring Creek-Hiwassee River watershed where manually selected and exported into a new layer. The *Dissolve* tool was used to remove the watershed boundaries and create a final polygon for the extent of the interim core map.

3.3. Selecting streams, lakes, ponds, reservoirs, and estuaries within the Ocoee River and Spring Creek-Hiwassee River watersheds

The interim core map was further refined by clipping the NHDPlus High Res dataset to the outer extent of the created in the following steps, selecting rivers and streams within these watersheds, and then buffering the waterbodies out 200m to account for the banks.

The waterbody and flowlines layers within the NHDPus High Res were clipped to the outer extent using the *Clip* tool:

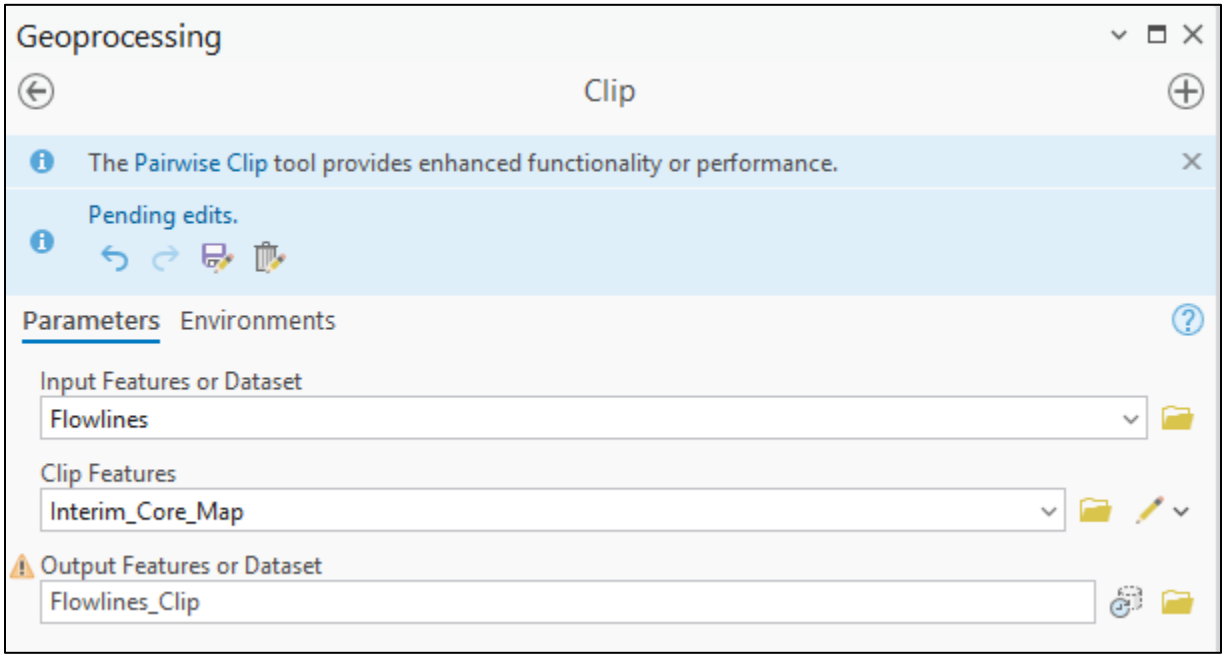

Figure 7. Set up of the *Clip* tool for the *Flowlines* layer.

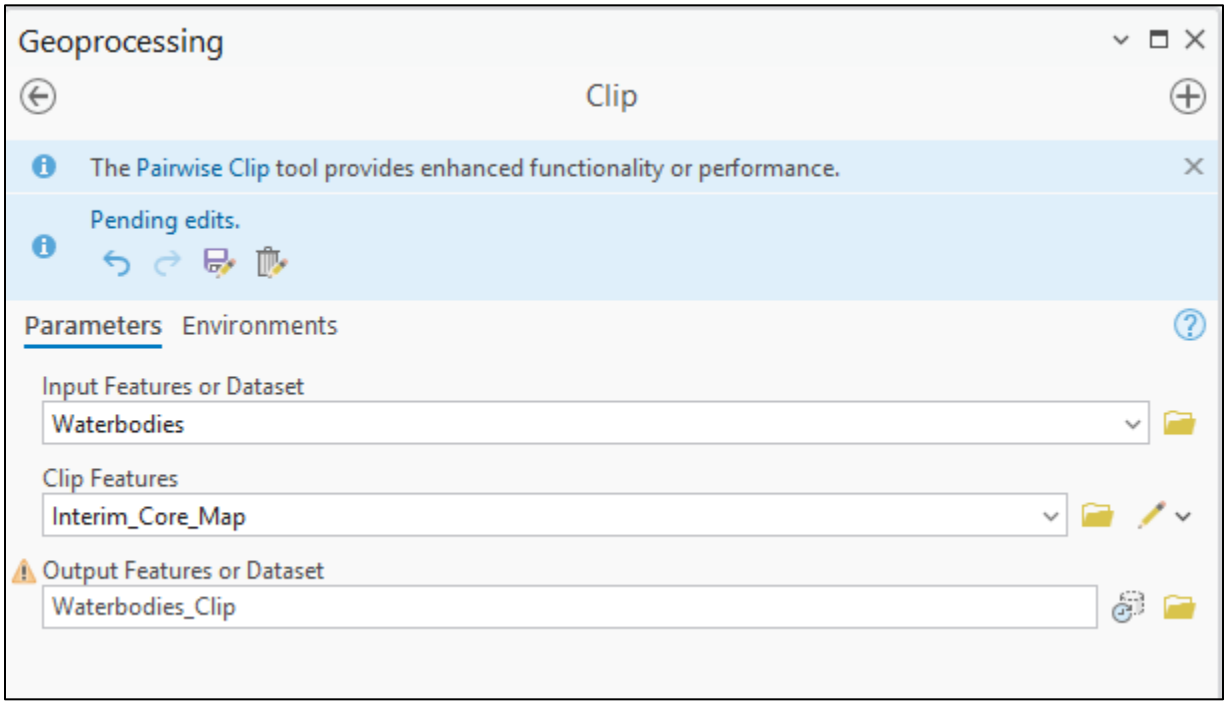

Figure 8. Set up of the *Clip* tool for the *Waterbodies* layer.

The *Select by Layers* tool was used to select the *Lakes, Ponds, Reservoirs, Estuaries, and other Waterbodies* and *Rivers and* Streams feature classes from the *Waterbodies* layer and to select the *Artificial Path* and *Perennial* feature classes from the *Flowlines* layer. The attribute tables did not include descriptive feature classes or codes, therefore, visual confirmation was done to ensure the correct feature classes were selected.

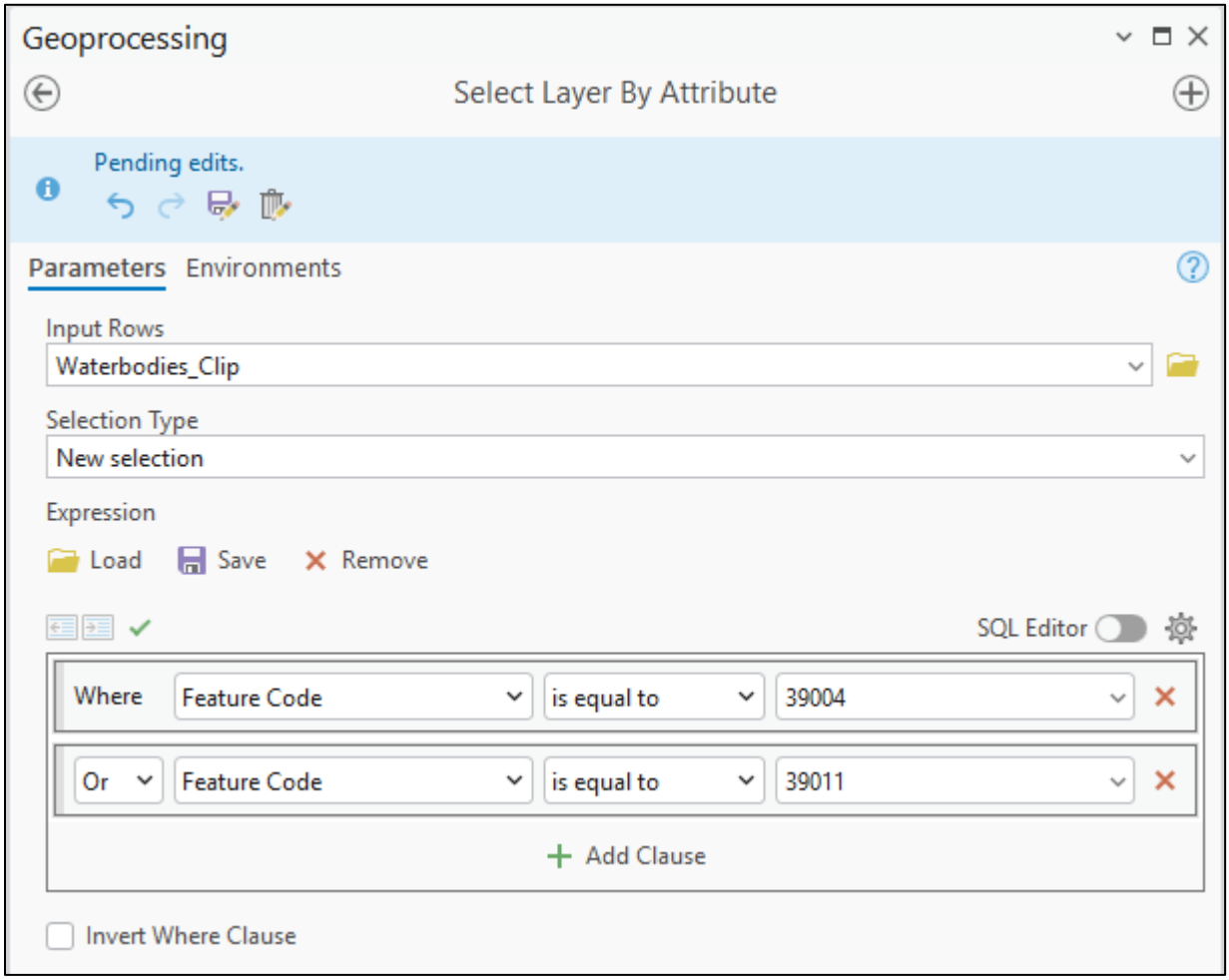

Figure 9. Set up of the *Select Layer by Attribute* tool for the Waterbodies layer.

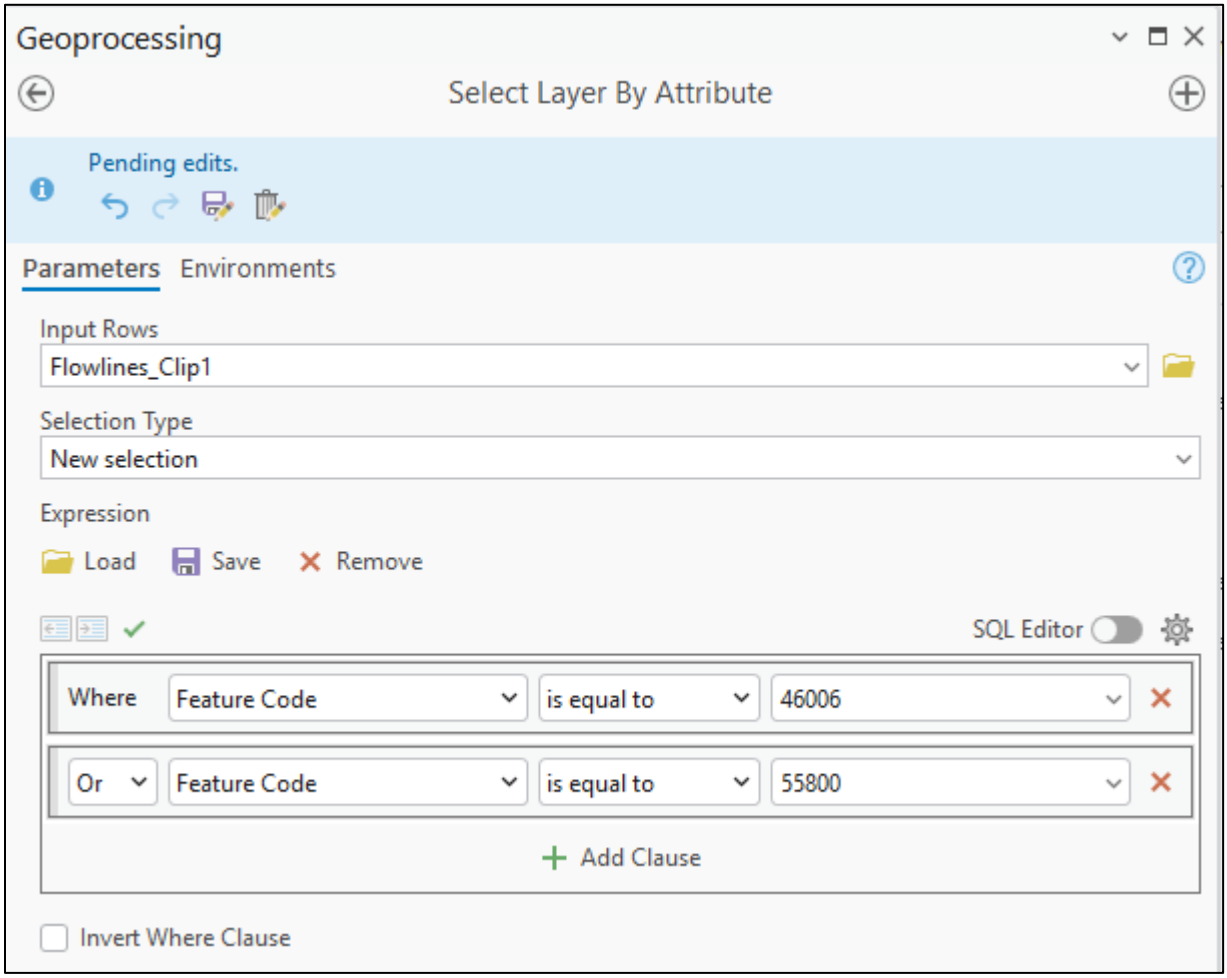

Figure 10. Set up of the *Select Layer by Attribute* tool for the *Flowlines* layer.

The *Buffer* tool was used to add a 200 m buffer around the various waterbodies.

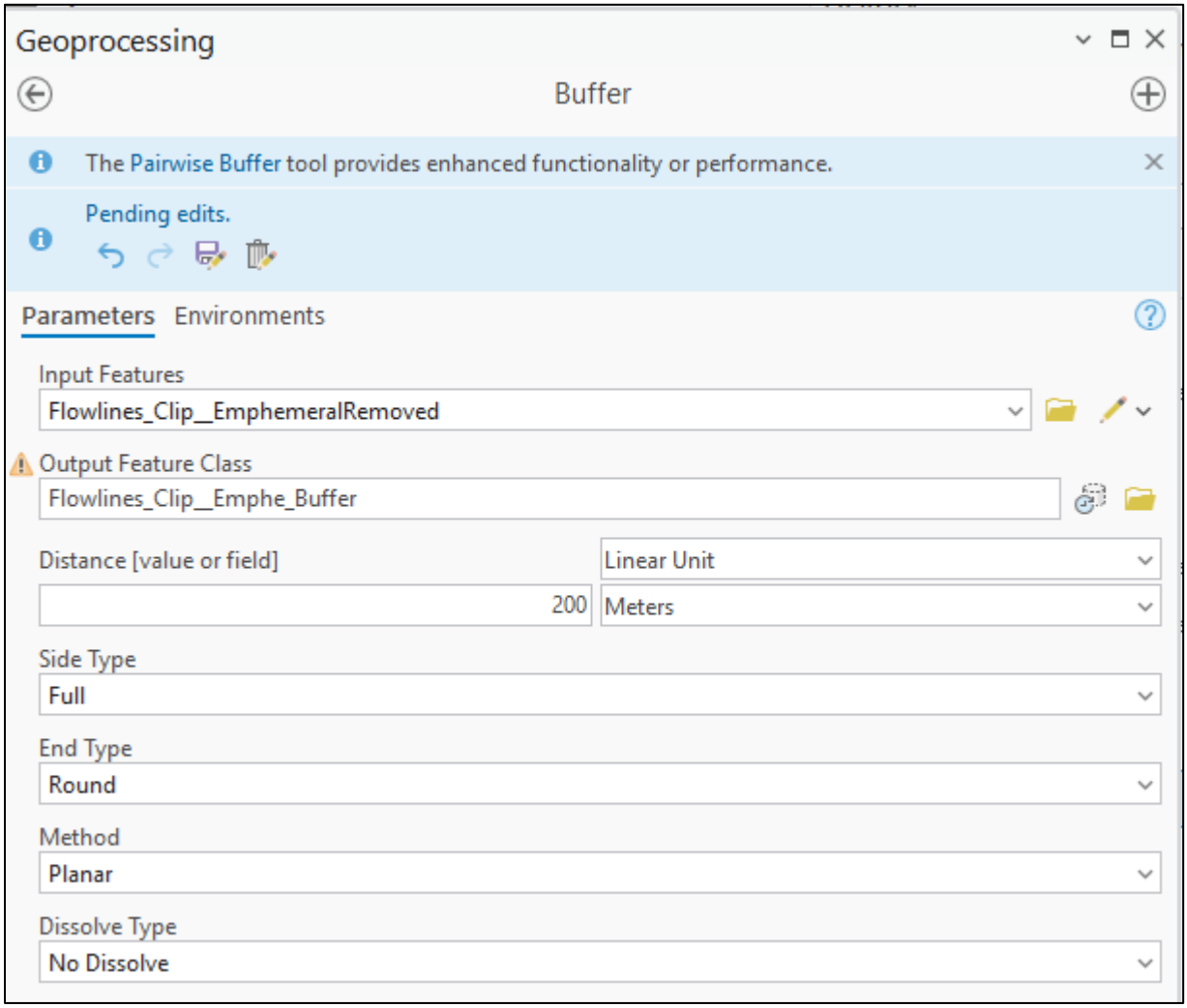

Figure 11. Set up of the *Buffer* tool for the clipped Flowlines layer.

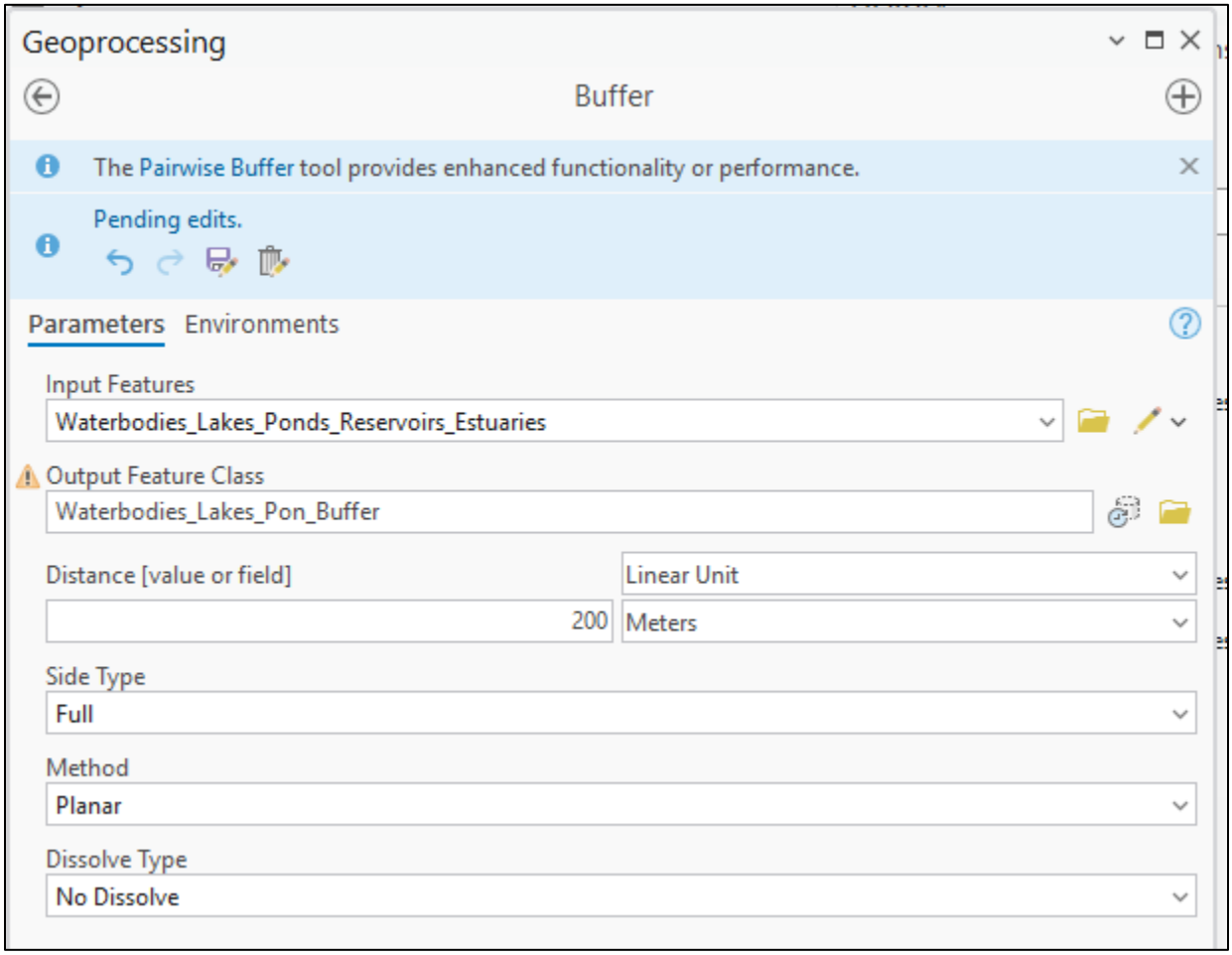

Figure 12. Setup of the *Buffer* tool for the clipped Waterbodies layer.

The final Flowlines and Waterbodies layers were then merged and the interior boundaries dissolved to create the final interim core map.

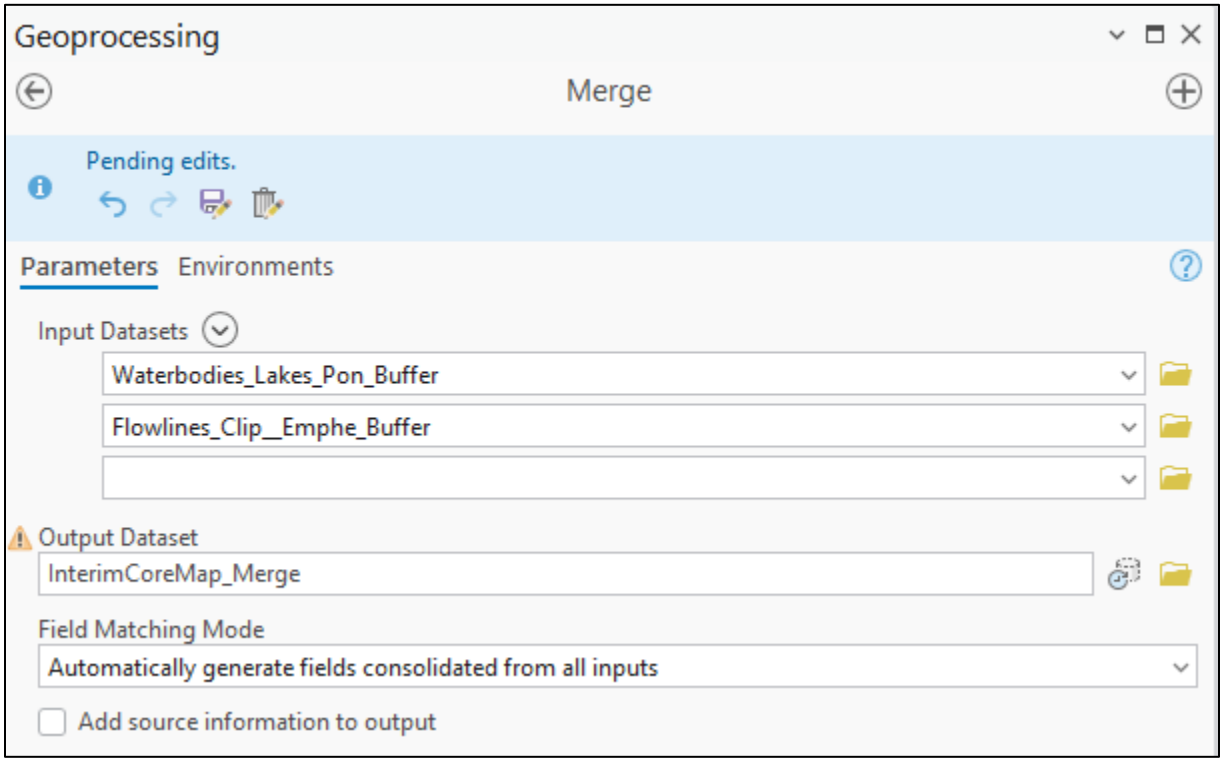

Figure 13. Set up of the *Merge* tool.

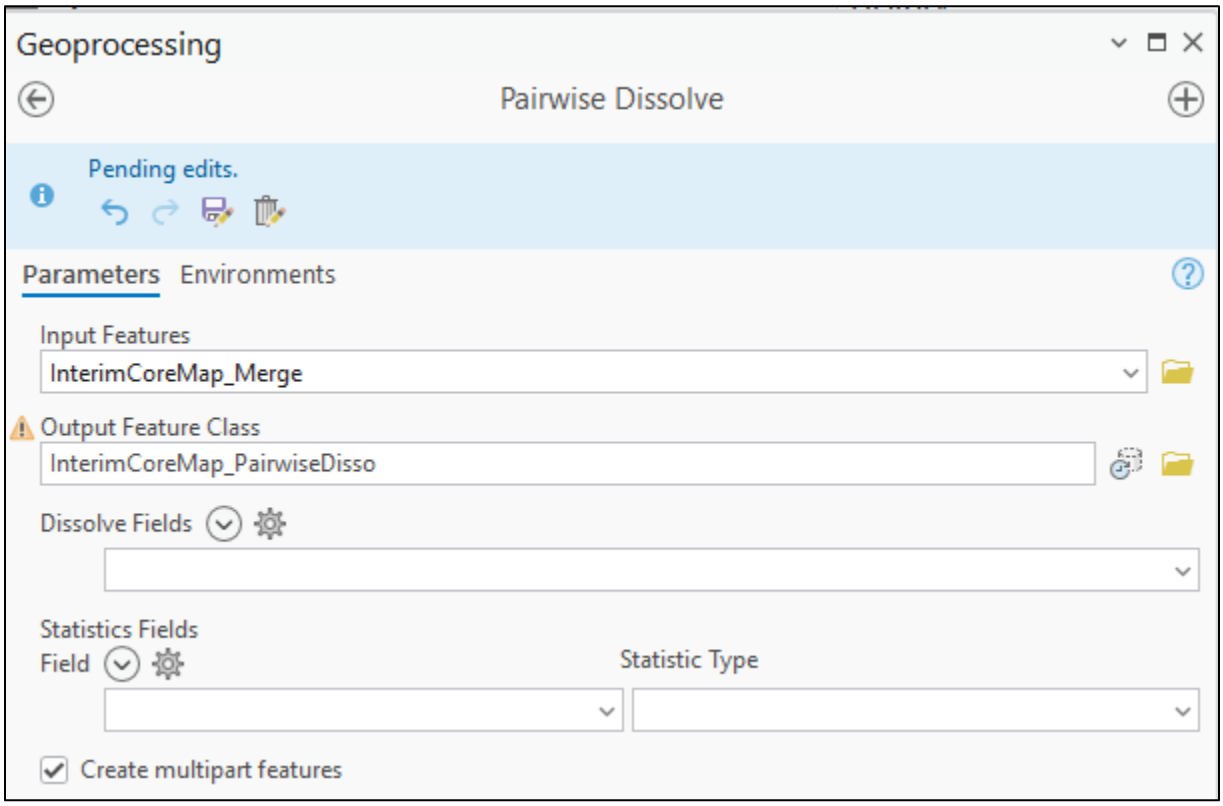

Figure 14. Set up of the *Pairwise Dissolve* tool.

References

FWS, 1992. *Recovery Plan for Ruth's Golden Aster (Pityopsis ruthiiI*. June 11, 1992. Southeast Region, U.S. Fish and Wildlife Service.

FWS, 2023. *Ruth's Golden Aster (Pityopsis ruthii) 5-Year Status Review: Summary and Evaluation*. July 2023. Tennessee Ecological Services, Southeast Region, US Fish and Wildlife Service.