

Critical Water Resources for Flathead County

Final Report
Flathead Lakers
Flathead Basin Commission
Flathead County

by

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The Flathead Lake Biological Station in conjunction with the Flathead Basin Commission and the Flathead Lakers has developed criteria for mapping critical water resources for water within Flathead County. This analysis will be transmitted to the Flathead County Planning staff and GIS staff, and will provide Flathead County with key data needed for the County's proposed Development Predictability Map scheduled for development in 2009. Prior to the formal adoption of the Development Predictability Map, the GIS data provided can be used to guide development and assist both the Planning Board and County Commissioners in making informed land use decisions.

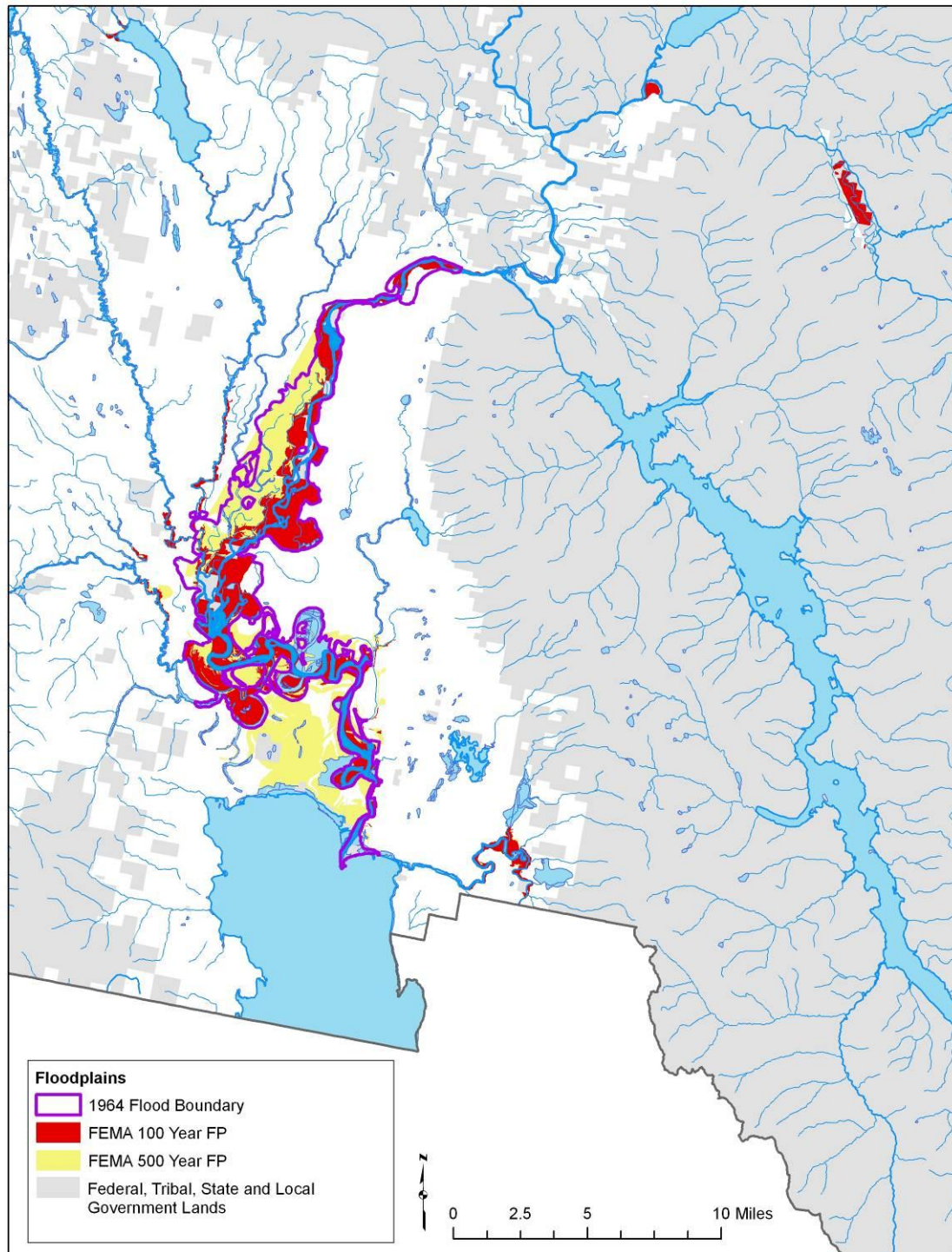
The critical water resources analysis included spatial data pertaining to slopes, floodplains, wetlands, streams, riparian areas, and groundwater. Some of the analysis for Flathead County was limited to private lands (Shallow Groundwater analysis map). Listed below are descriptions for each map and the criteria used in the analysis.

Floodplain maps

The 1964 flood extent was digitized from USGS maps documenting the flood extent along the main stem of the Flathead River. The 1964 flood extent is limited to the Flathead River from Columbia Falls to Flathead Lake. The limited extent reflects available aerial photography at the time of the flood. The 100 and 500-year FEMA flood maps show that flooding along the lower Whitefish River, the Stillwater River, Ashley Creek and other streams associated with the Flathead River, in addition to the Flathead River, may also occur, even if not shown in the 1964 flood map.

In addition, the FEMA Q3 Flood Data maps are included. Q3 Flood Data are captured from the actual Flood Insurance Rate Maps at publication scale, but the digital data have horizontal control specifications consistent only with 1:24,000 scale mapping. When using desk-top mapping or Geographic Information Systems (GIS) software, the user can view or print the digital Q3 Flood Data at large scales (i.e., 1:500 or 1:1,000); however, the data will have the horizontal control of only the 1:24,000 scale map. Thus the position of the floodplain boundaries may have an error of +/- 40 feet approximately.

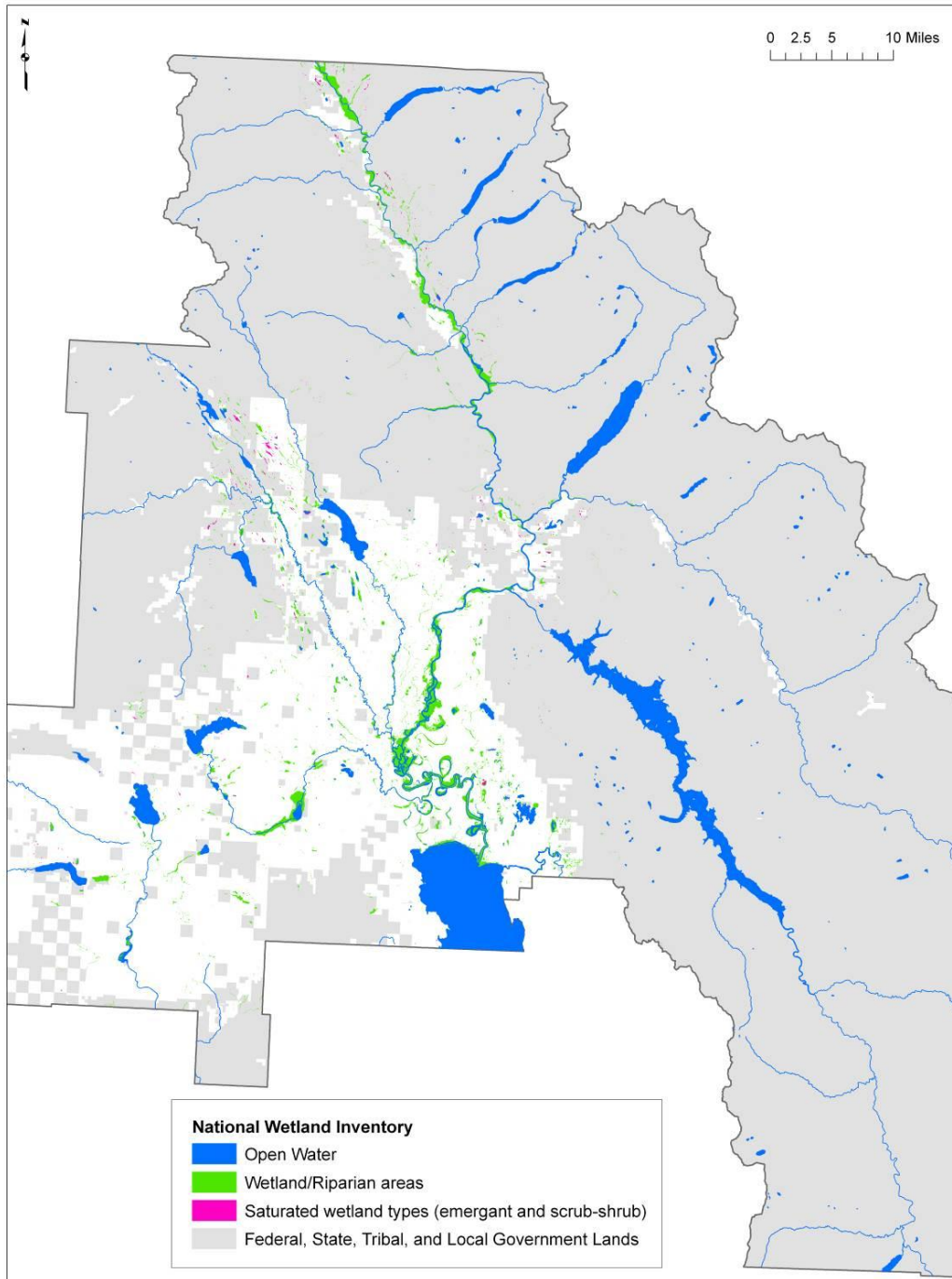
See http://nris.mt.gov/nsdi/nris/fema_dfirm.html for additional information



National Wetland Inventory (NWI) Map

The latest NWI data were obtained from Linda Vance at the Natural Heritage Program. Saturated wetlands are highlighted (palustrine emergent and palustrine shrub-scrub) because they are rare wetland types found in Flathead County.

See http://nris.mt.gov/nsdi/nris/nwi_poly.html for additional information



Depth to Water Table Maps

Two depths to water table maps were created from the data downloaded from the Ground-Water Information Center (GWIC) at the Montana Bureau of Mines and Geology. First a depth to water table map was developed using all wells (depths range from 0 to 1000 feet). The second map layer includes only areas where groundwater is at a depth of 8 feet or less during peak flows and high water runoff. This better depicts the depth of the water table during peak flows.

Process for determining depth to water table using all wells

1. Downloaded County Well Index data from the NRIS database in December 2007. Interpolation based on 2007 Flathead County well data developed by Ground-Water Information Center (GWIC) at the Montana Bureau of Mines and Geology and shallow groundwater points along river corridors. Wells with a Static Water Level (SWL) value with negative or 0 values (including artesian wells) were eliminated from the analysis due to the uncertainty of the SWL value (n=170).
2. Wells with overlapping coordinates were eliminated. The spatial location of these wells were assumed to be incorrect due to lack of reliable coordinate information (n= 4055).
3. All remaining wells were filtered for location so that at least 2 wells had to be within 500 m (1640.415 ft) of each other or within 1,500 m (4921.245 ft) in valley location (n = 9329).
4. A depth to water table map was then interpolated using the TOPOGRID command in Arc/INFO v9.2.

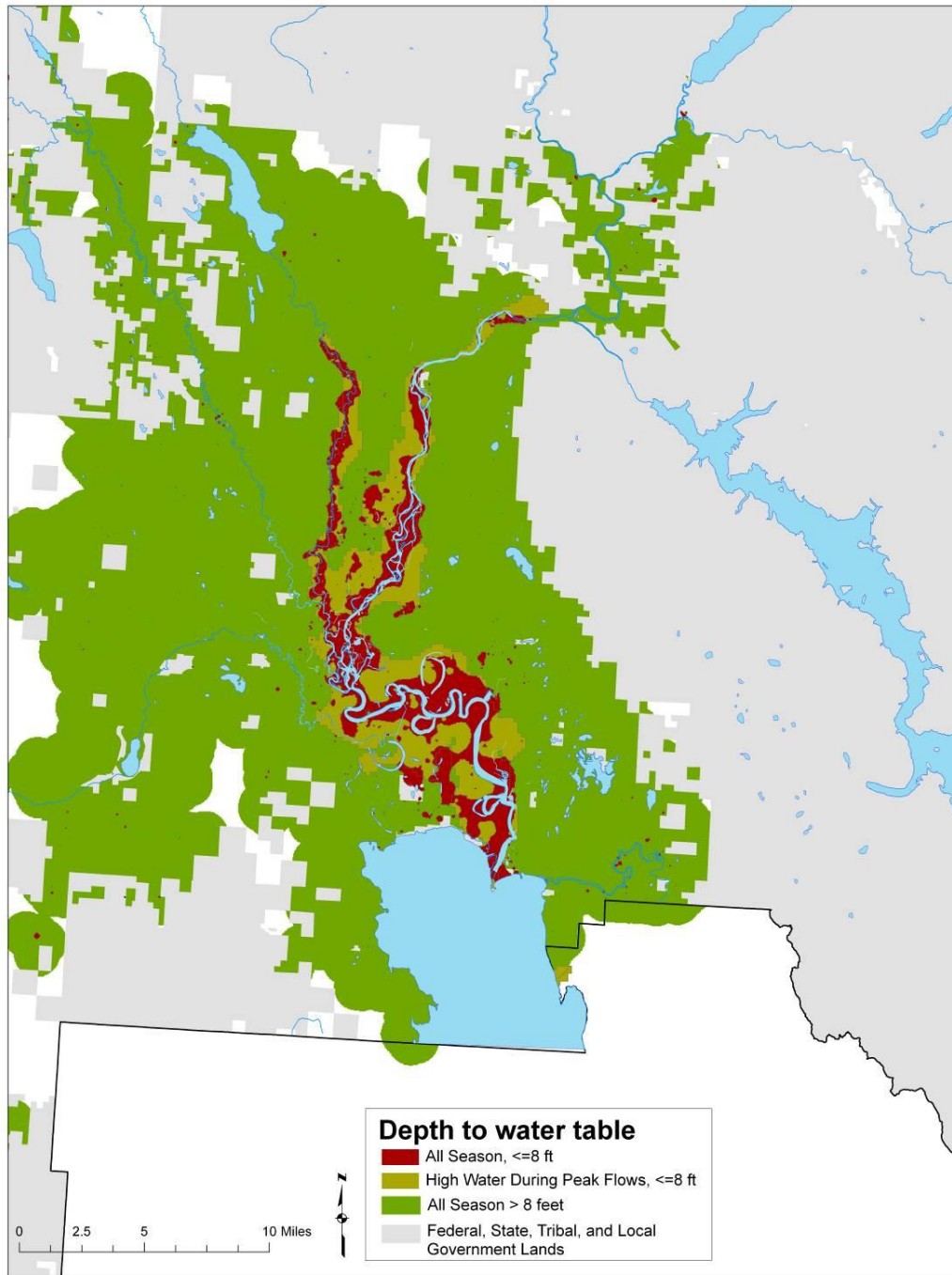
Process for determining depth to water table using wells established during high runoff periods

1. Downloaded Flathead River Q at Columbia Falls from USGS (1922-present).
2. Used the filtered well data from NRIS (n=13256). Good drill date records begin around 1963.
3. Imported tables into Access and built queries to extract the wells that were installed during the annual peak discharge, defined here as the time when the hydrograph is between peak discharge and peak -1 standard deviation (n=271).
4. An interpolated depth to water table map during high runoff was created based on the SWL using the above methods.
5. The final raster image was limited to the Flathead River valley and Whitefish River valley due to the known fluctuation of water table within this area.

In areas where the MBMG wells data is limited, this map may not show all shallow groundwater areas. Independent studies on private property have shown the depth to water table to be shallow in areas not included in this map, including in some areas on the north shore of Flathead Lake.

Accuracy of map

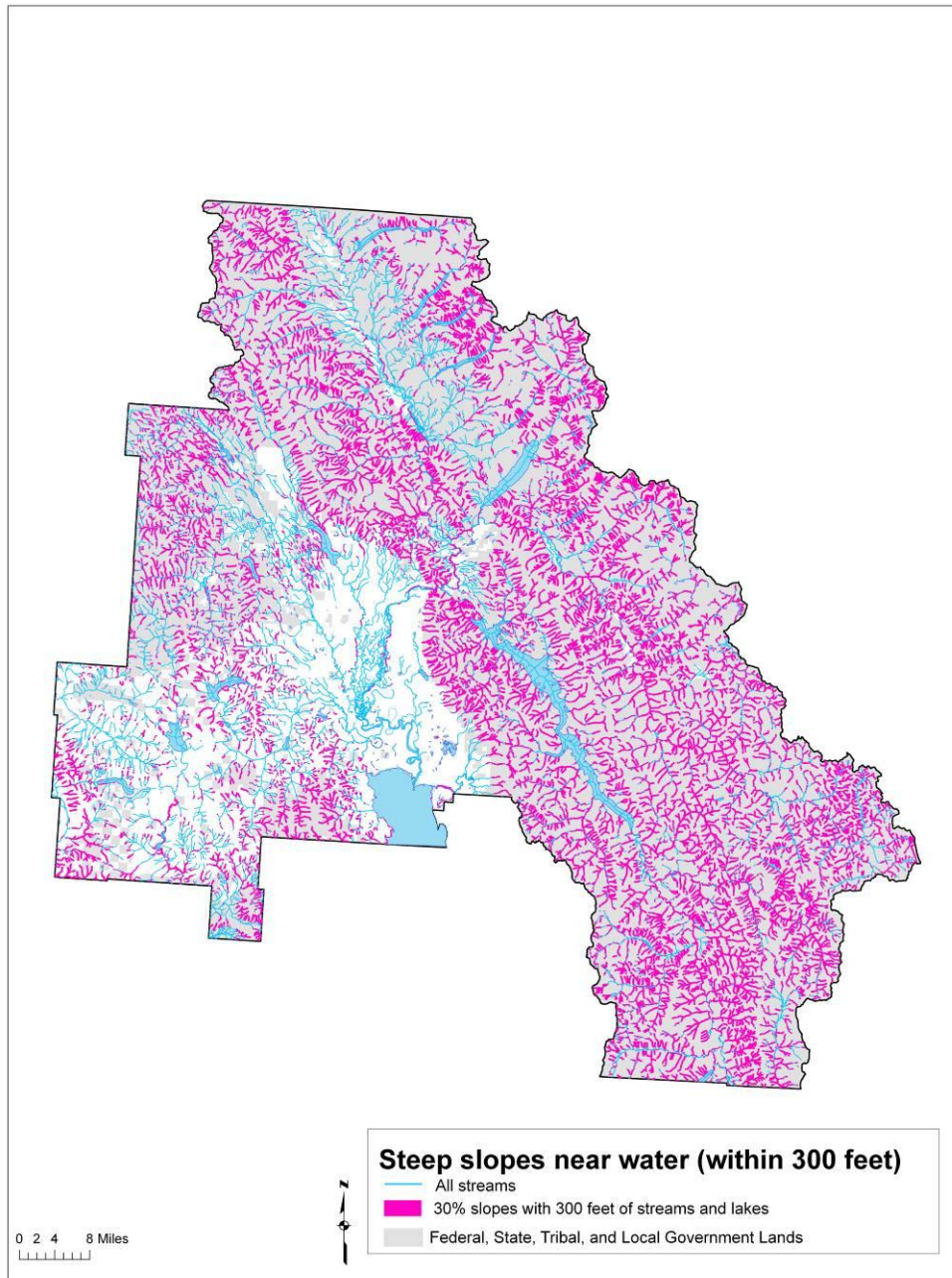
After interpolation of the depth to water table was completed, an assessment was performed to evaluate the accuracy of the map. The accuracy assessment was conducted by comparing actual well static water level depths to the current designation on the map. For all wells used in the interpolation process 83% were correctly classified, while 97% of shallow wells (< 8 feet) were correctly classified. We concluded that the assessment of shallow groundwater areas is highly accurate.



Steep Slopes

A 10 meter (32.8 ft) Digital Elevation Model (DEM) was acquired from the U.S. Geological Survey's National Elevation Dataset (NED). Slope was derived from the DEM. All slopes greater than 30% within 300 feet of a stream or lake were highlighted as areas of concern. The 10 m DEM is the best available elevation dataset currently available for Flathead County.

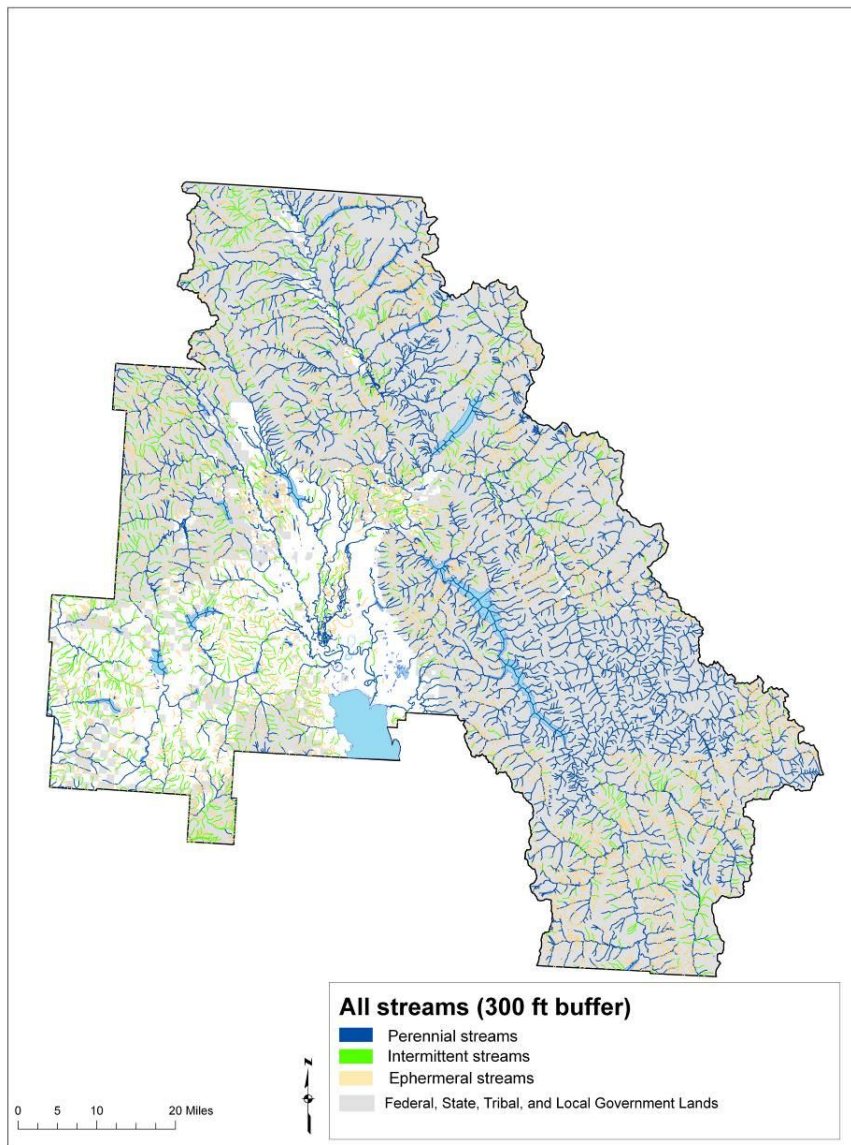
See <http://giscoordination.mt.gov/elevation/msdi.asp> for additional information



Streams and Stream Buffers

The designation of perennial, intermittent, and ephemeral streams were derived from the “Geographically Isolated Wetlands and Intermittent/Ephemeral Streams in Montana: Extent, Distribution, and Function” project completed by the Montana Natural Heritage Program. Using the low (1:100, 000) and high resolution (1:24,000) National Hydrologic Datasets (NHD) a statewide coverage was developed to identify the extent of perennial, intermittent, and ephemeral streams (Vance, L. 2009). See http://mtnhp.org/Reports/Isolated_Wetlands.pdf for additional information.

A 300-foot buffer was applied to all streams to highlight their associated riparian area. We used the recommended 300-foot (91.44 m) buffer distance provided by the Montana Governor’s Riparian Task Force.



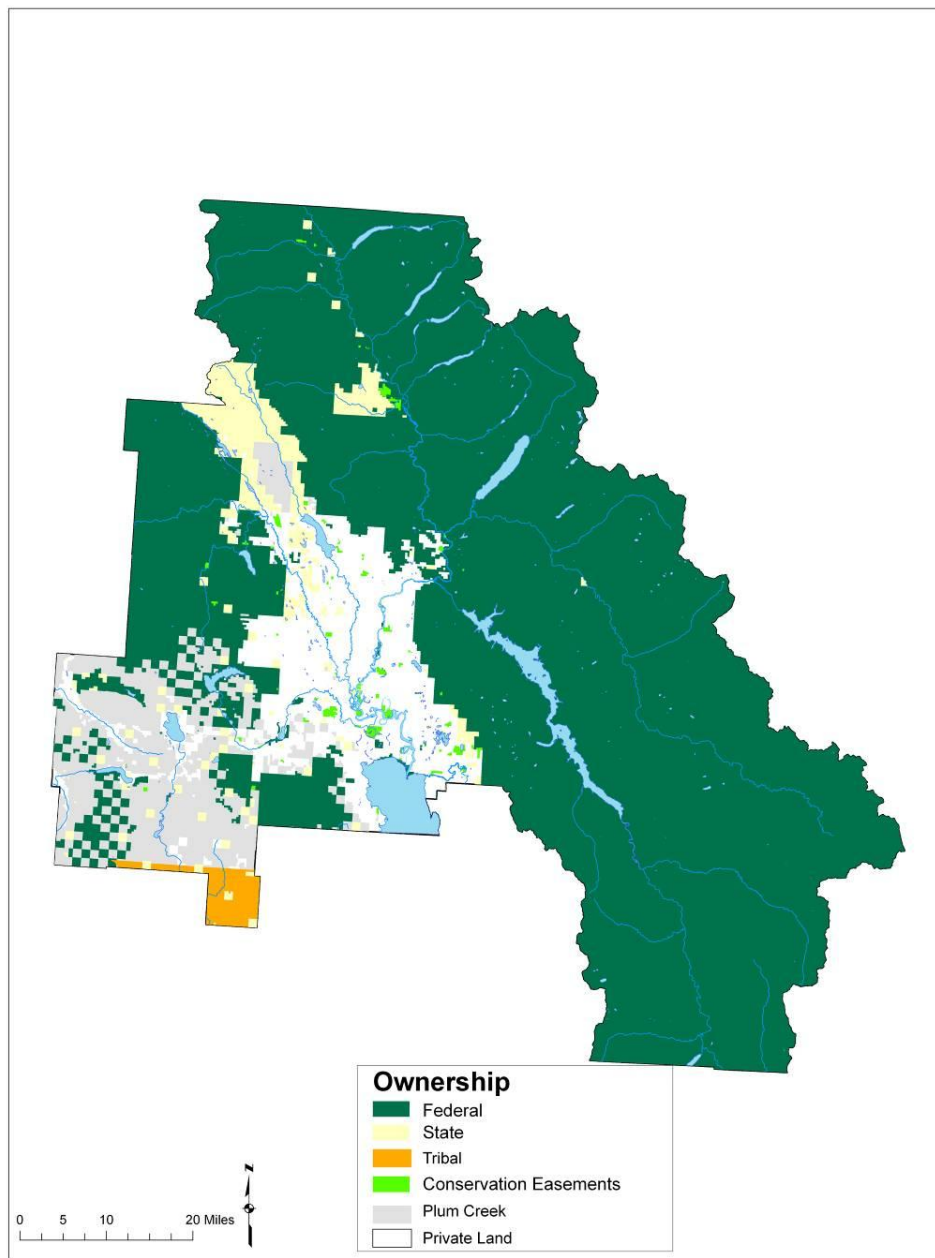
Ownership

The Land Ownership layer is part of the Montana Stewardship Database. This layer shows all the lands in Montana that are managed by public agencies, private lands that are within government designated areas such as national forests, and private lands that are under conservation easements and conservation leases. See

http://nris.mt.gov/nsdi/nris/stew_owners.html,

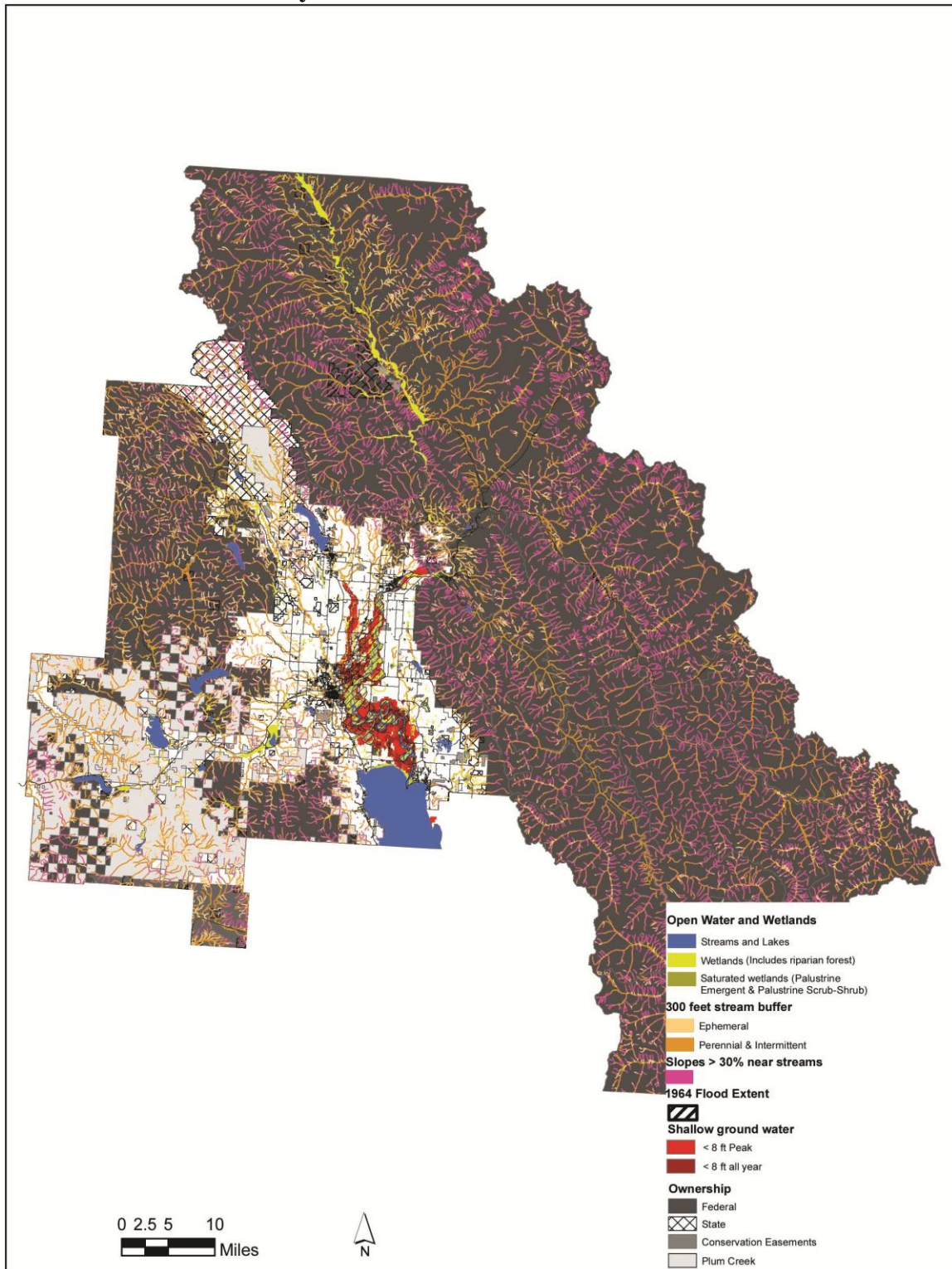
http://nris.mt.gov/nsdi/nris/stew_management.html, and

http://nris.mt.gov/nsdi/nris/stew_easements.html for additional information.

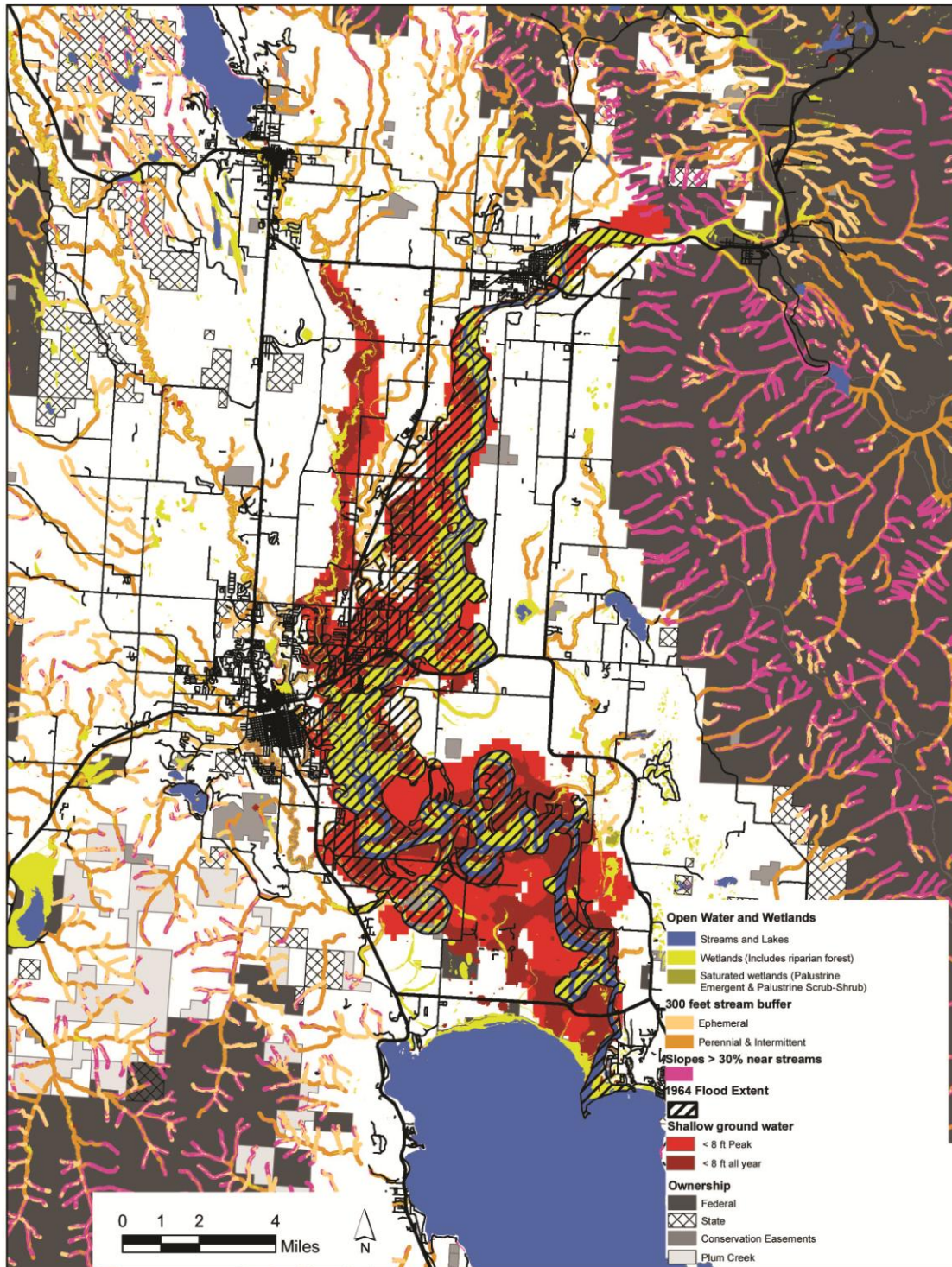


Critical Water Resources Map

A. Flathead County



B. Flathead Valley Subset



Potential Errors in the Analysis

- Errors Inherent in Source Data
- Digitizing Errors
- Interpolation Errors
- Misclassification of NWI and River Corridor Shallow Groundwater