Creating a Value-Added Wetlands Layer: Enhancing the Utility of Wetland Mapping in Montana

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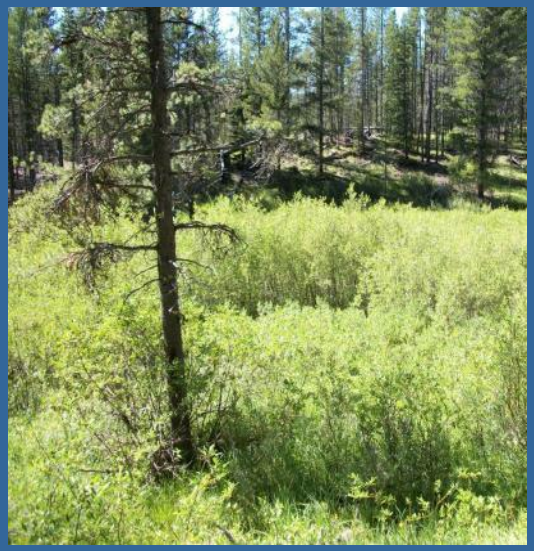
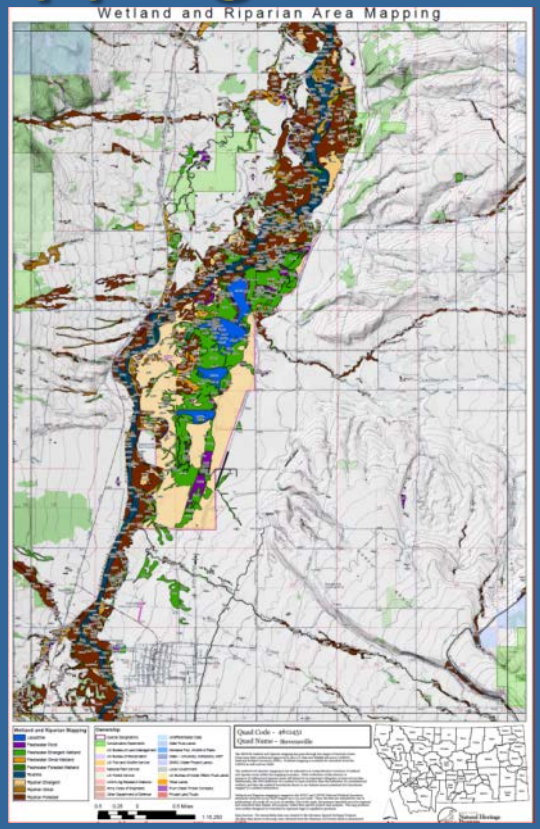
The University of Montana

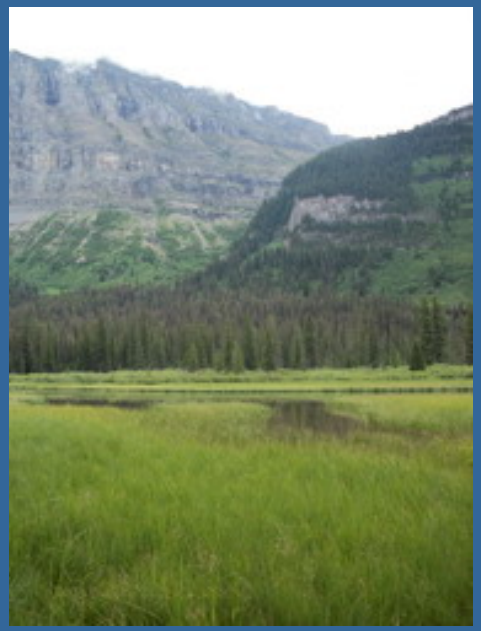
Wetlands & Riparian Mapping



Wetland and riparian digital mapping are a data layer in the Montana Spatial Data Infrastructure.

Goal: create statewide digital wetland and riparian mapping.





Wetland and Riparian Classification Standards

FWS/OBS-79/31
DECEMBER 1979
Reprinted 1992

Classification of Wetlands and Deepwater Habitats of the United States

U.S. Department of the Interior
Fish and Wildlife Service

U.S. Fish & Wildlife Service

A System for Mapping Riparian Areas In The Western United States

U.S. Fish and Wildlife Service
Division of Habitat and Resource Conservation
Branch of Resource and Mapping Support
Arlington, VA 22203

November 2009

Riparian definition:

Plant communities contiguous to and affected by surface and subsurface hydrologic features of rivers, streams, lakes, or drainage ways. Riparian areas are usually transitional between wetland and upland.

- Different vegetative species than adjacent areas
- The same species but exhibiting more vigorous or robust growth forms.

Riparian Mapping

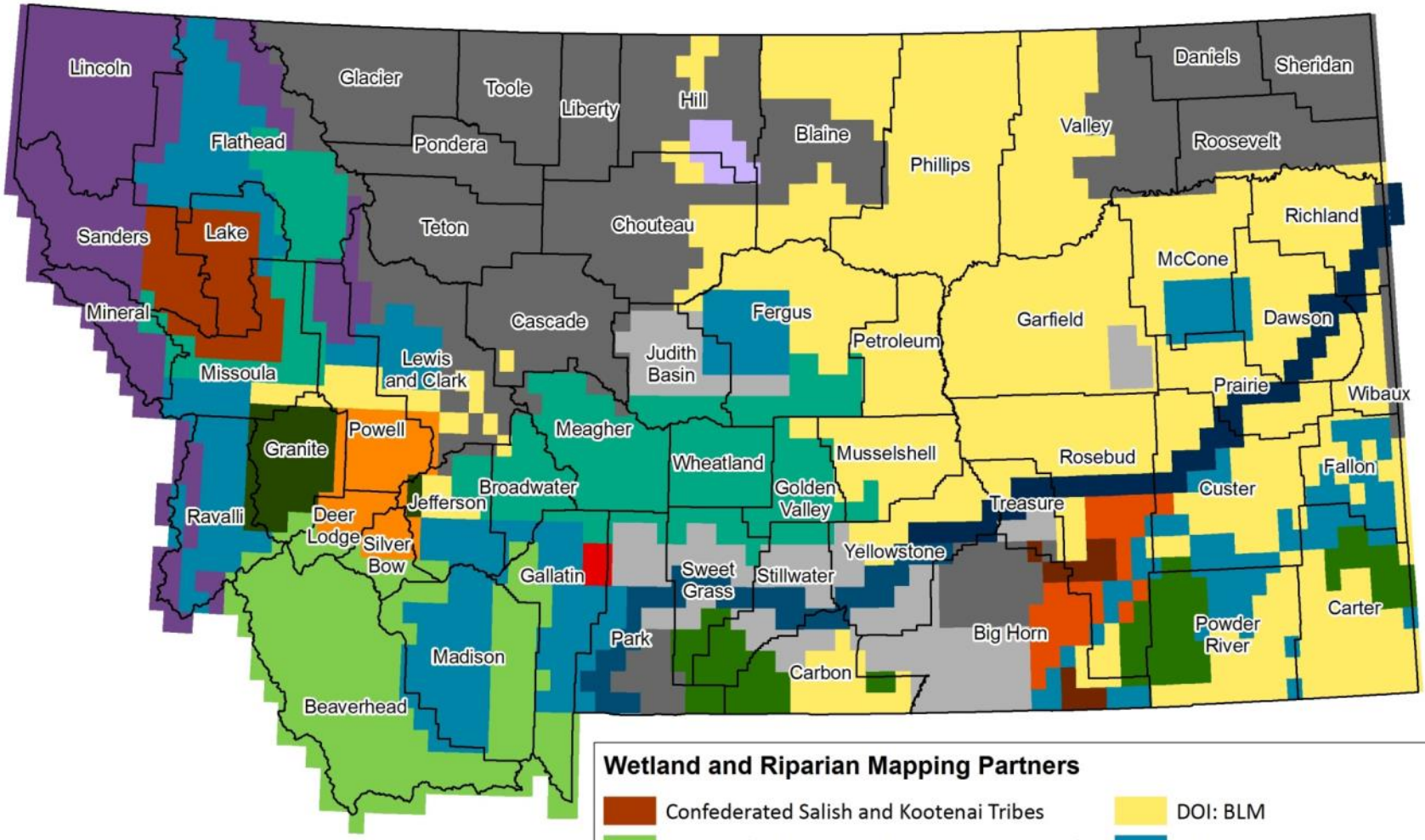
- Woody riparian areas associated with lotic systems are the predominant features

- Emergent cover is also mapped if imagery allows for identification of these features

Wetland and Riparian Mapping Center

- Started in 2006 with funding from an EPA Wetland Program Development Grant
- Seven full-time photo interpreters
- Have access to necessary infrastructure and software
- Funding comes from many partners

Wetland and Riparian Mapping Project Partners



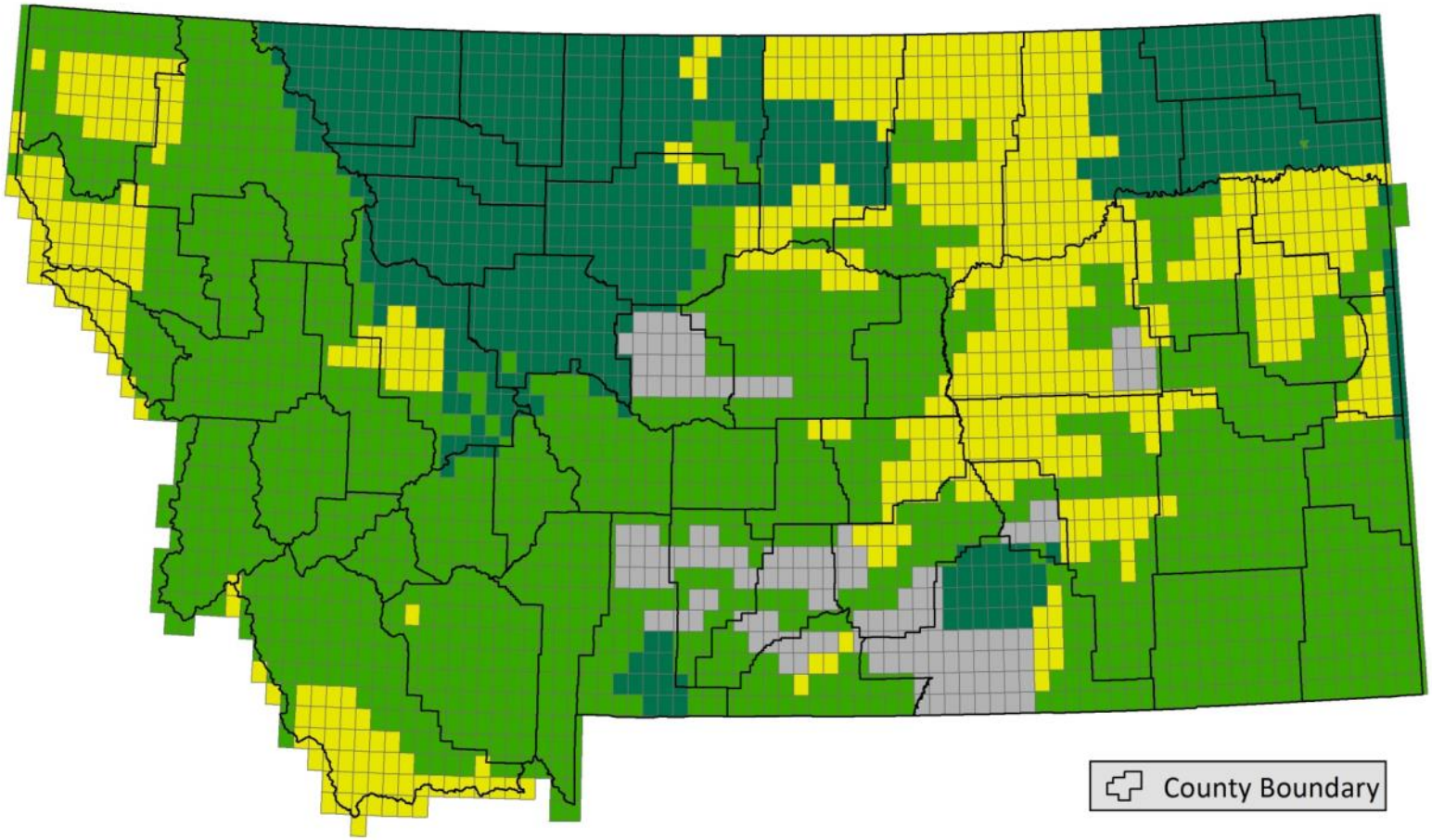
Wetland and Riparian Mapping Partners

- Confederated Salish and Kootenai Tribes
- SWMT - (MT DEQ, PPL, MLIA, USFS Region1)
- MT DOJ: Natural Resource Damage Program
- MT DEQ Mines
- US Army Corps of Engineers
- MLIA/Yellowstone River ConservationDistrict
- Chippewa Cree Tribe
- MT Land Information Act
- DOI: BLM
- US EPA
- USFS - Custer National Forest
- Great Northern LCC
- MT DEQ
- Northern Cheyenne Tribe
- US Forest Service - Region 1

- Mapped from 1980s Imagery (USFWS)
- No Mapping Available

Last Updated: November 19, 2013

Wetland and Riparian Mapping Status by USGS Topographic Quad



Wetland and Riparian Mapping Status

- Mapping completed by and available from MTNHP
- Mapping in progress by MTNHP
- Historic NWI Mapping completed by USFWS
- No Wetland and Riparian Mapping Available

Last Updated: December 3, 2013

Accessing Wetland and Riparian Mapping

Download Geodatabase from Montana Geographic Information
ftp://ftp.gis.mt.gov/WetlandsFramework/

Geographic Information

Providing Montana a sense of place

MSL Home | MSDI | Data | Geography | Web Changes

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Montana Wetland and Riparian Framework ★ MSDI

Download Data

Data Provider	Montana Natural Heritage Program (MTNHP)
Date	02/01/2013
Content Type	Downloadable Data

Description | Usage | Status | Contact | Distribution | Metadata

Abstract

The Montana Wetland and Riparian Framework represents the extent, type, and approximate location of wetlands, riparian areas, and deepwater habitats in Montana. These data delineate the areal extent of wetlands and deepwater habitats as defined by Cowardin et al. (1979) and riparian areas as defined by the U.S. Fish and Wildlife Service (2009). The Montana Wetland and Riparian Framework consists of features that were manually digitized at a scale of 1:4,500 or 1:5,000 from orthorectified digital color-infrared aerial imagery collected during the summers of 2005, 2006, 2009, and 2011 by the National Agricultural Imagery Program (NAIP). These data are intended for use in

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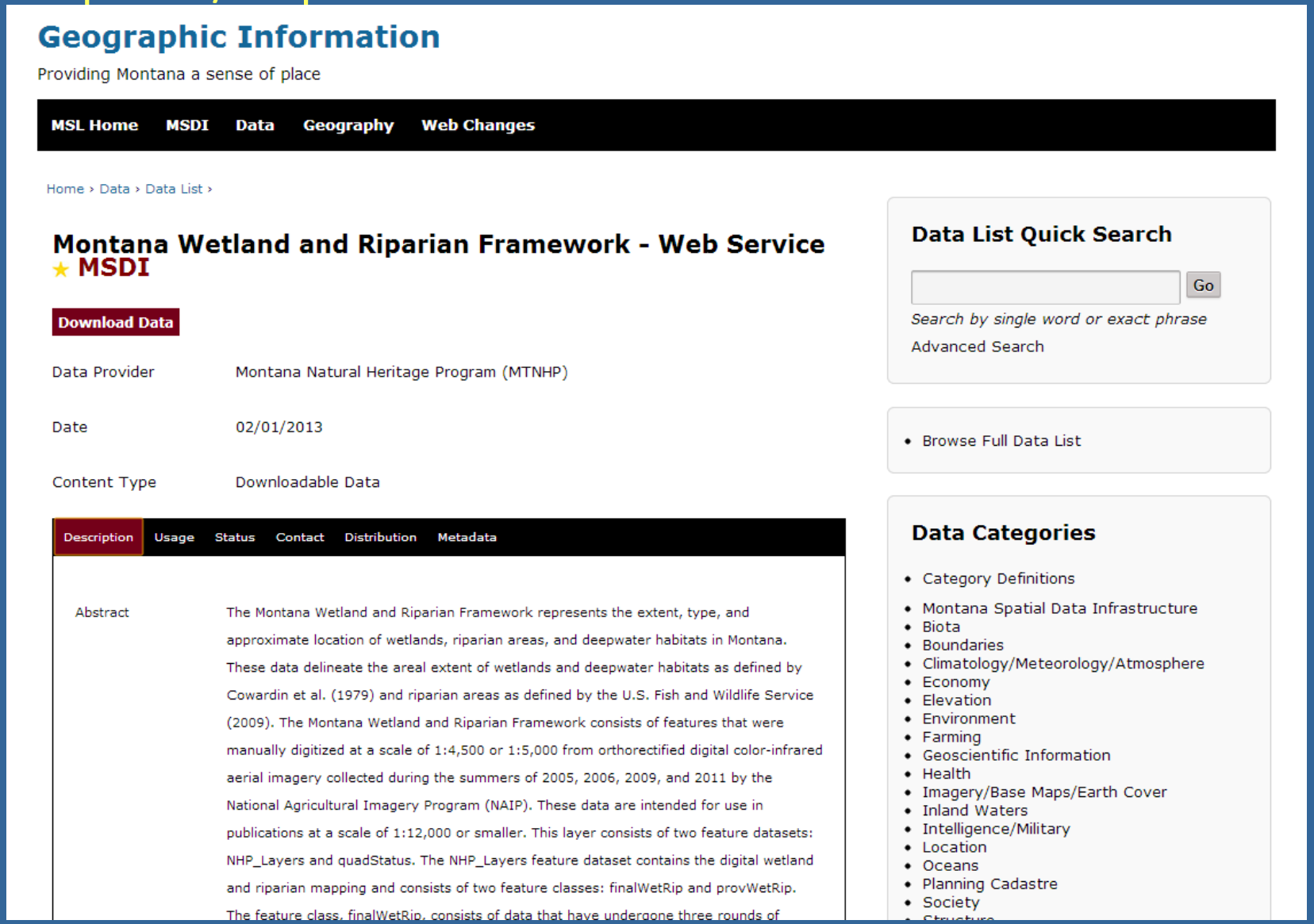
- Category Definitions
- Montana Spatial Data Infrastructure
- Biota
- Boundaries
- Climatology/Meteorology/Atmosphere
- Economy
- Elevation
- Environment
- Farming
- Geoscientific Information
- Health

Accessing Wetland and Riparian Mapping

http://gisservice.mt.gov/ArcGIS/rest/services/MSDI_Framework/WetlandsRiparian/MapServer



Geographic Information

Providing Montana a sense of place

MSL Home | MSDI | Data | Geography | Web Changes

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Montana Wetland and Riparian Framework - Web Service ★ MSDI

Download Data

Data Provider: Montana Natural Heritage Program (MTNHP)

Date: 02/01/2013

Content Type: Downloadable Data

Description | Usage | Status | Contact | Distribution | Metadata

Abstract: The Montana Wetland and Riparian Framework represents the extent, type, and approximate location of wetlands, riparian areas, and deepwater habitats in Montana. These data delineate the areal extent of wetlands and deepwater habitats as defined by Cowardin et al. (1979) and riparian areas as defined by the U.S. Fish and Wildlife Service (2009). The Montana Wetland and Riparian Framework consists of features that were manually digitized at a scale of 1:4,500 or 1:5,000 from orthorectified digital color-infrared aerial imagery collected during the summers of 2005, 2006, 2009, and 2011 by the National Agricultural Imagery Program (NAIP). These data are intended for use in publications at a scale of 1:12,000 or smaller. This layer consists of two feature datasets: NHP_Layers and quadStatus. The NHP_Layers feature dataset contains the digital wetland and riparian mapping and consists of two feature classes: finalWetRip and provWetRip. The feature class, finalWetRip, consists of data that have undergone three rounds of

Data List Quick Search

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Search by single word or exact phrase

Advanced Search

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Data Categories

- Category Definitions
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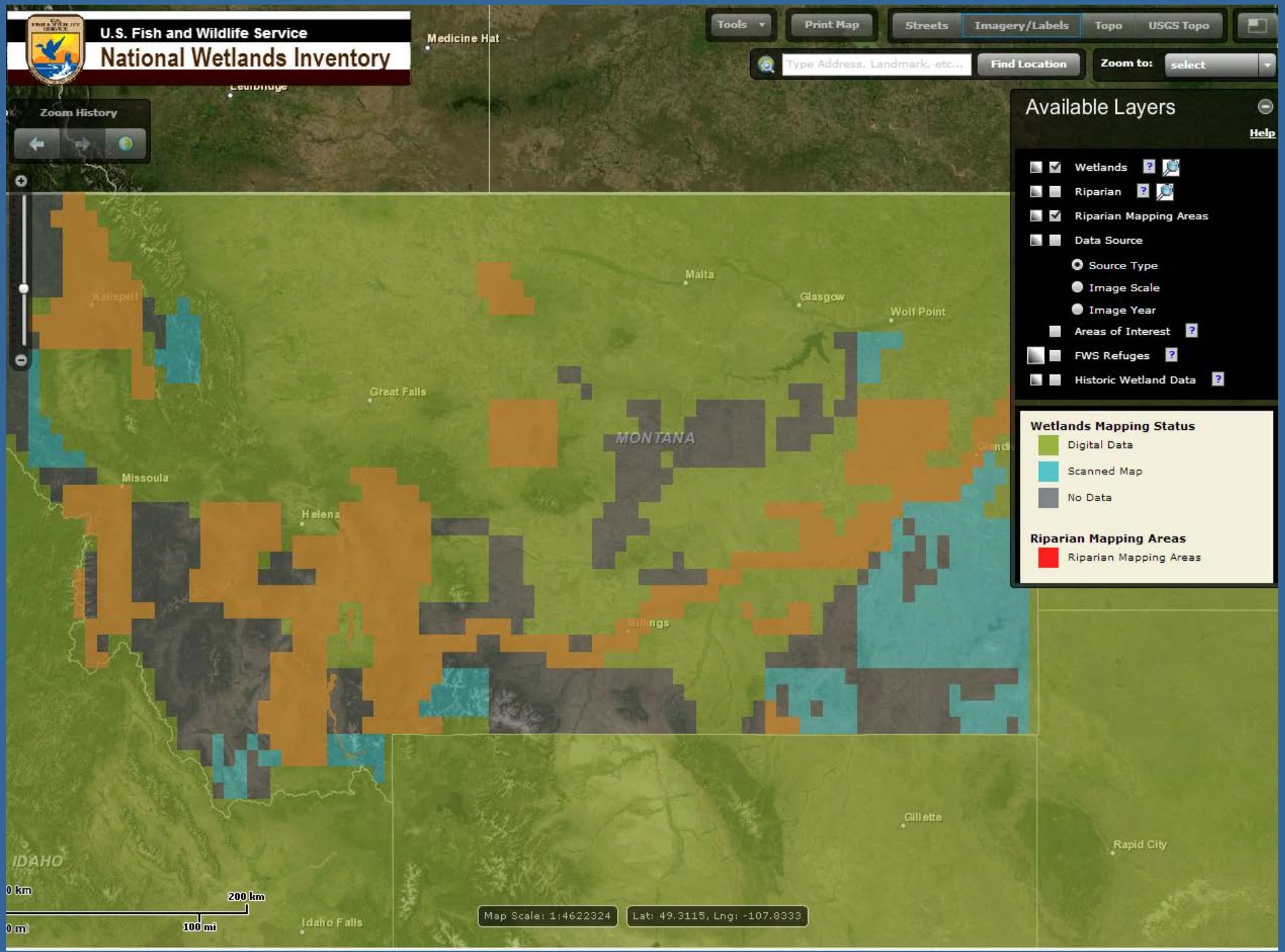
- Farming
- Geoscientific Information
- Health
- Imagery/Base Maps/Earth Cover
- Inland Waters
- Intelligence/Military
- Location
- Oceans
- Planning Cadastre
- Society


U.S. Fish and Wildlife Service
National Wetlands Inventory
Tools
Print Map
Streets
Imagery/Labels
Topo
USGS Topo
Type Address, Landmark, etc...
Find Location
Zoom to:
select
Zoom History
Available Layers
Help
Wetlands
Riparian
Riparian Mapping Areas
Data Source
Source Type
Image Scale
Image Year
Areas of Interest
FWS Refuges
Historic Wetland Data
Wetlands Mapping Status
Digital Data
Scanned Map
No Data
Riparian Mapping Areas
Riparian Mapping Areas
Medicine Hat
Malta
Glasgow
Wolf Point
Kalispell
Great Falls
MONTANA
Missoula
Helena
Billings
Gillette
Rapid City
IDAHO
Idaho Falls
200 km
100 mi
Map Scale: 1:4622324
Lat: 49.3115, Lng: -107.8333

Uses of Wetland and Riparian Mapping in Montana

- Complete picture of wetland and riparian resources in Montana
- Evaluate wetland losses/gains
- Preliminary site assessment for the presence of wetlands
- Facility and transportation/corridor siting
- Conservation incentive programs
- Conservation area planning
- NAWCA grants
- Tribal wetland protection ordinances
- Restoration planning
- Fisheries protection
- Floodplain management
- Water quality protection
- Watershed restoration
- Plant and wildlife survey stratification

Enhancing Wetlands Data

- Cowardin classification identifies wetland type based largely on vegetation (biotic)
- Useful to have information on abiotic properties of wetlands
- Enhance the utility of wetlands data by adding HGM descriptors

LLWW: Landscape Position, Landform, Water Flow Path, Waterbody type

- Set of descriptors developed by Ralph Tiner with USFWS for the eastern U.S.
- Based on geomorphic setting, water source, and hydrodynamics
- Links wetland type with wetland function (biotic/abiotic)
- Predict potential wetland function

LLWW Descriptors

Landscape Position (L):

- Lentic (LE) – lake shores
- Lotic (LO) – river/stream shores and floodplains
- Terrene (TE) – surrounded by upland

Landform (L):

- Basin (BA) – depression
- Floodplain (FP) – subject to river/stream overflow
- Slope (SL) – occurs on a slope or has groundwater inputs
- Flat (FL) – occurs on relatively flat landform and has precipitation as primary input

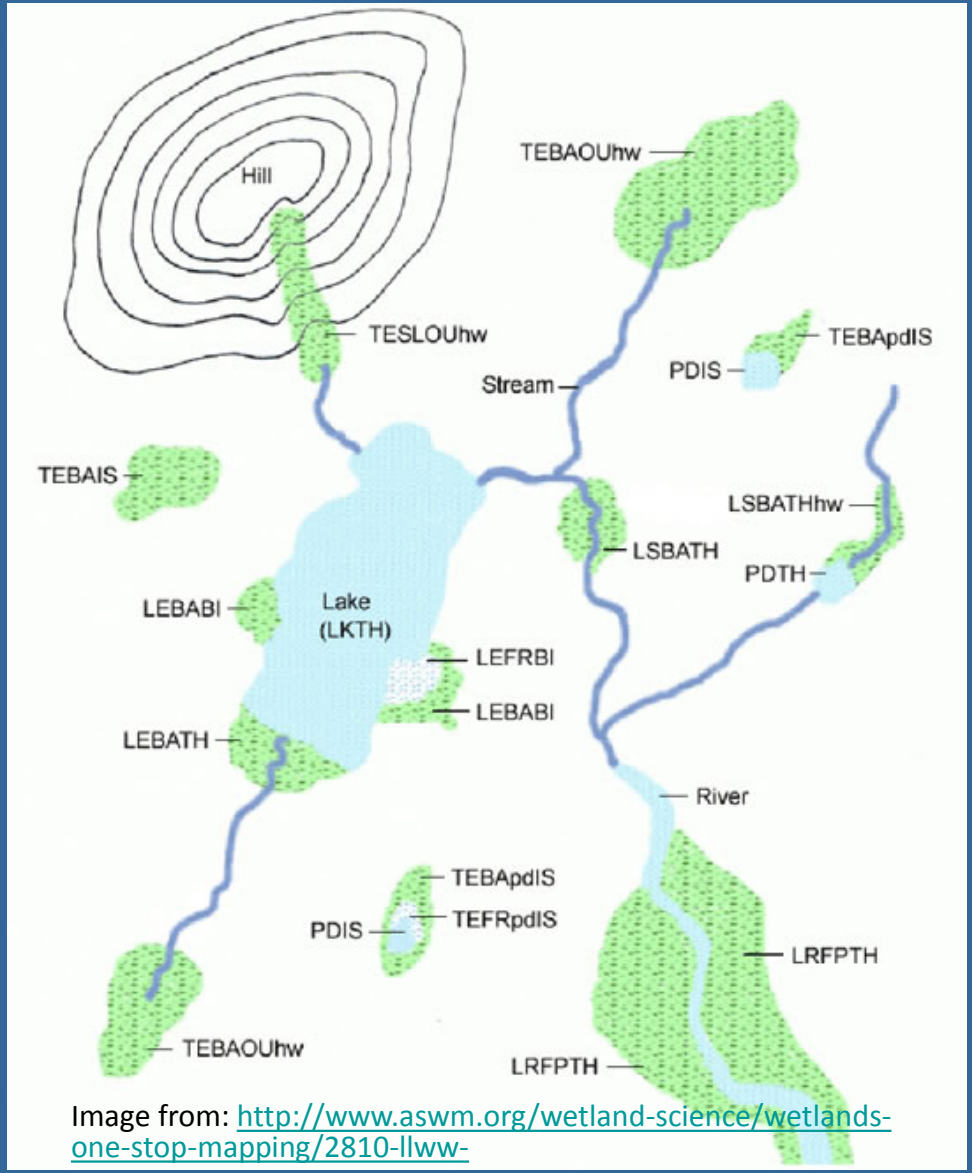


Image from: http://www.aswm.org/wetland-science/wetlands-one-stop-mapping/2810-llww-

LLWW Descriptors

Water Flow Path (W):

- Inflow (IN)
- Outflow (OU)
- Throughflow (TH)
- Bidirectional (BI)
- Isolated (IS)

Waterbody Type (W):

- Lake (LK)
- Pond (PD)
- River (RV)
- Stream (ST)

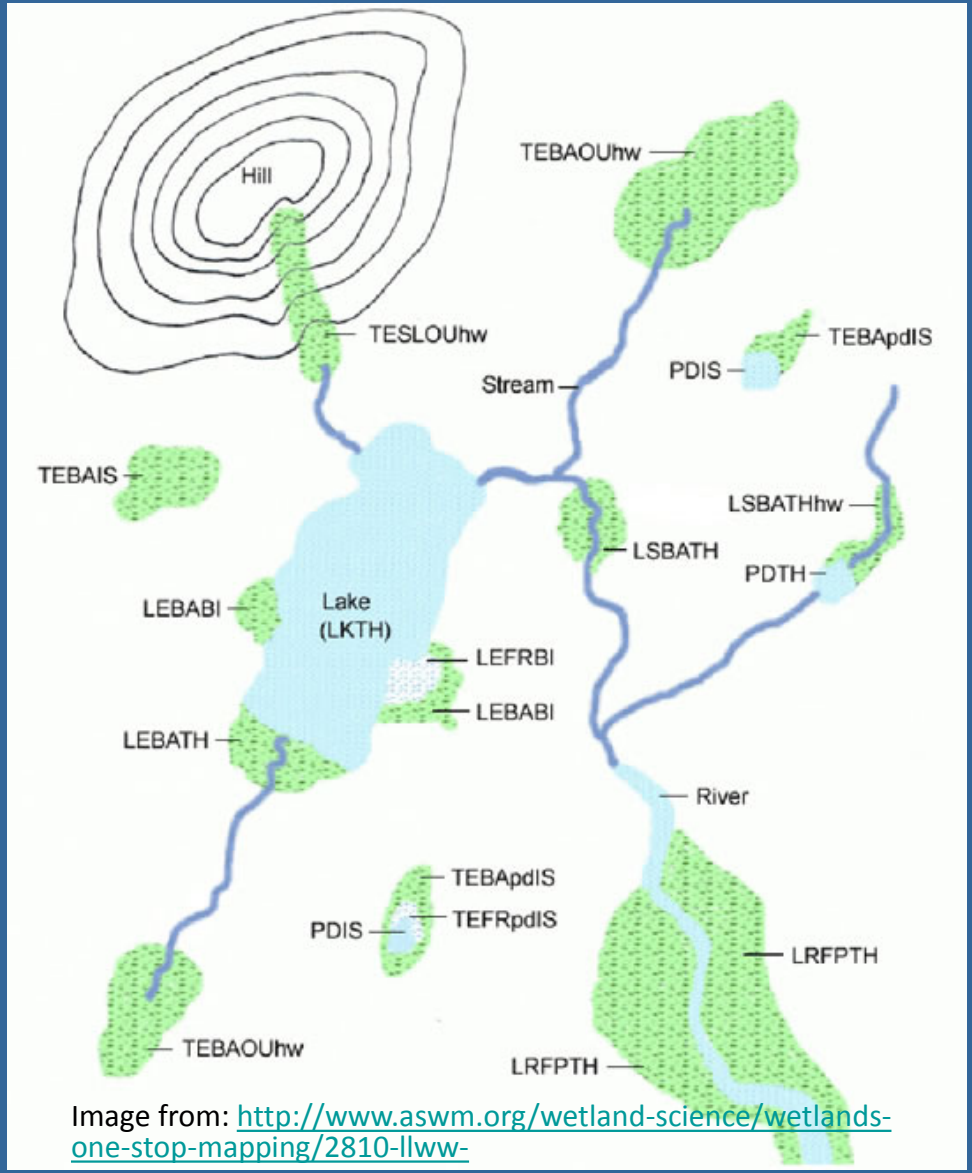
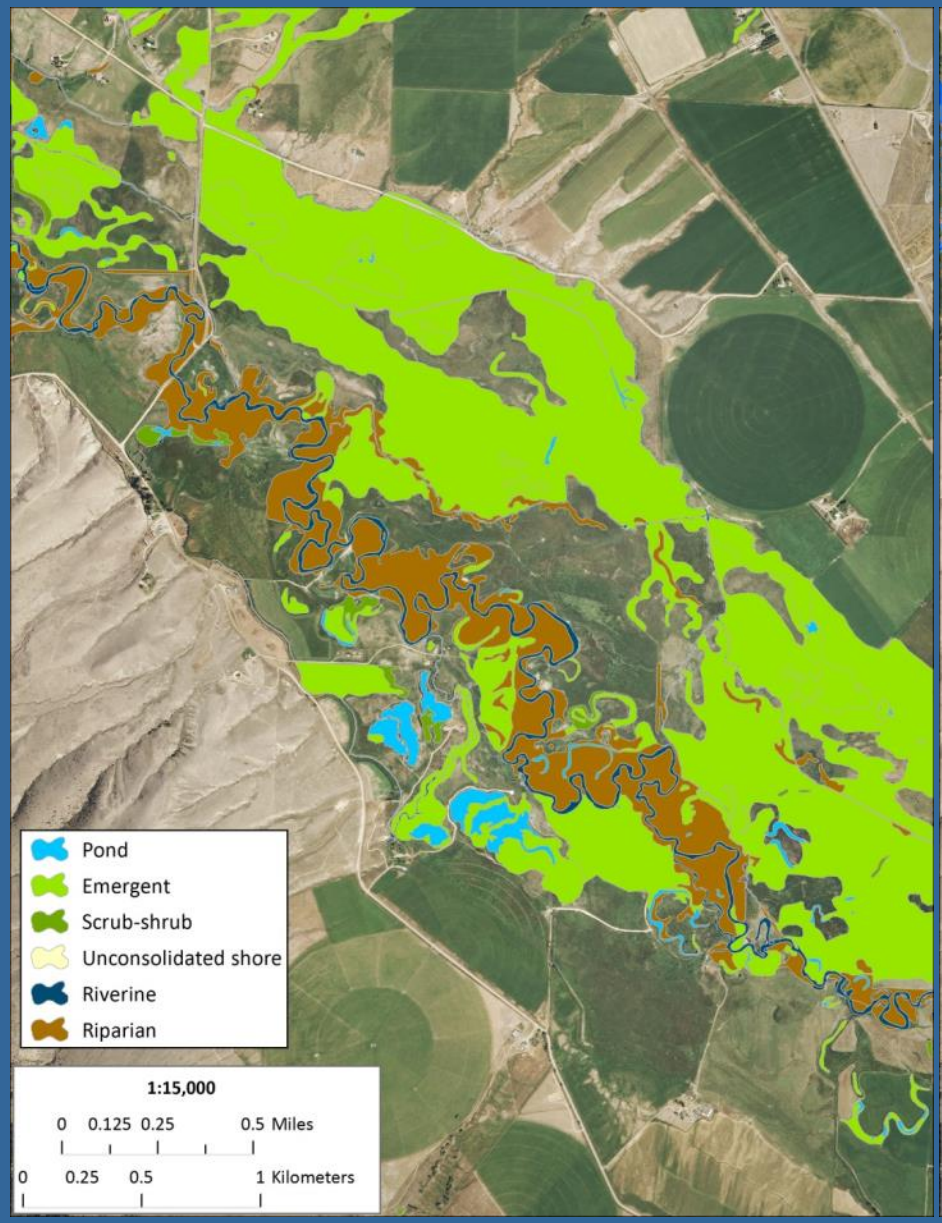
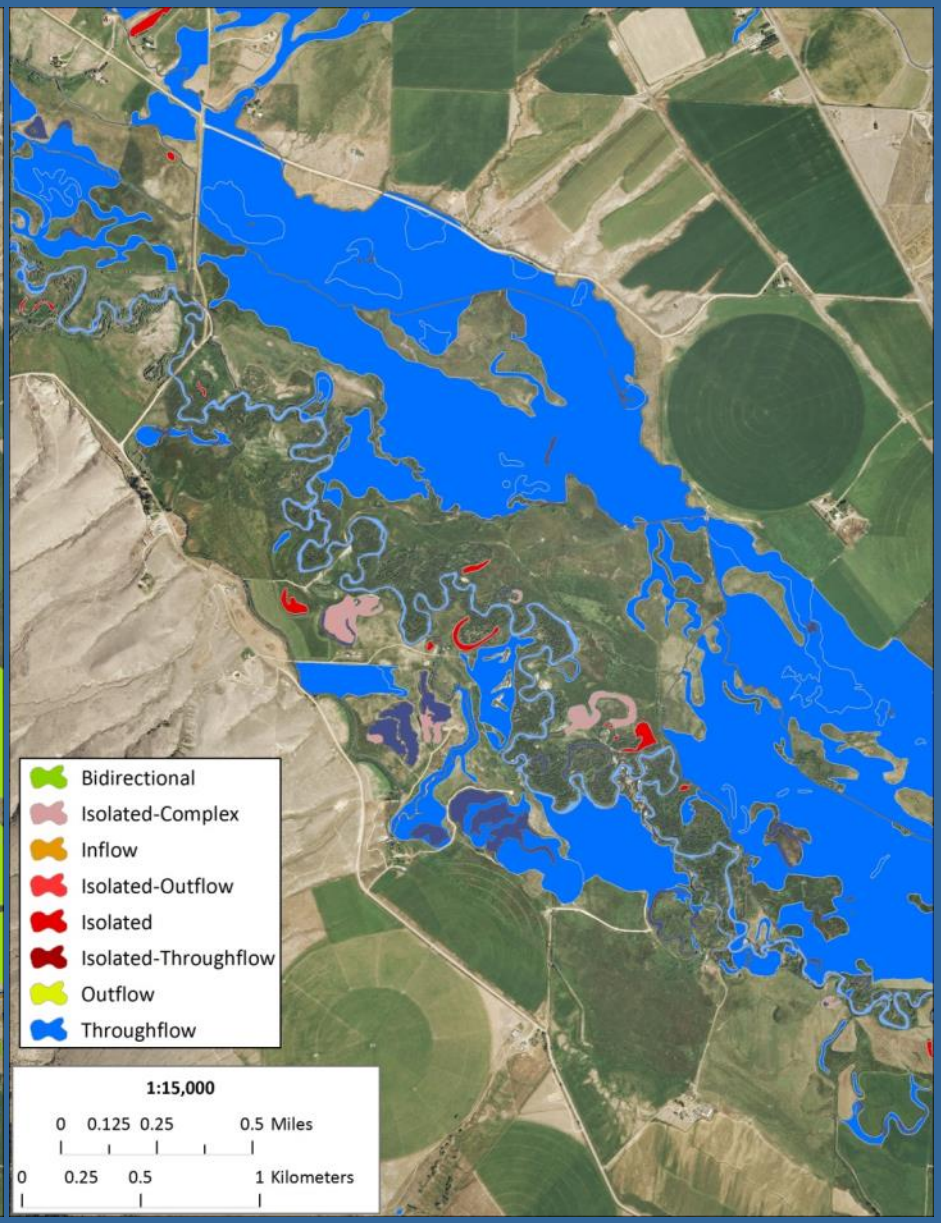


Image from: http://www.aswm.org/wetland-science/wetlands-one-stop-mapping/2810-llww-

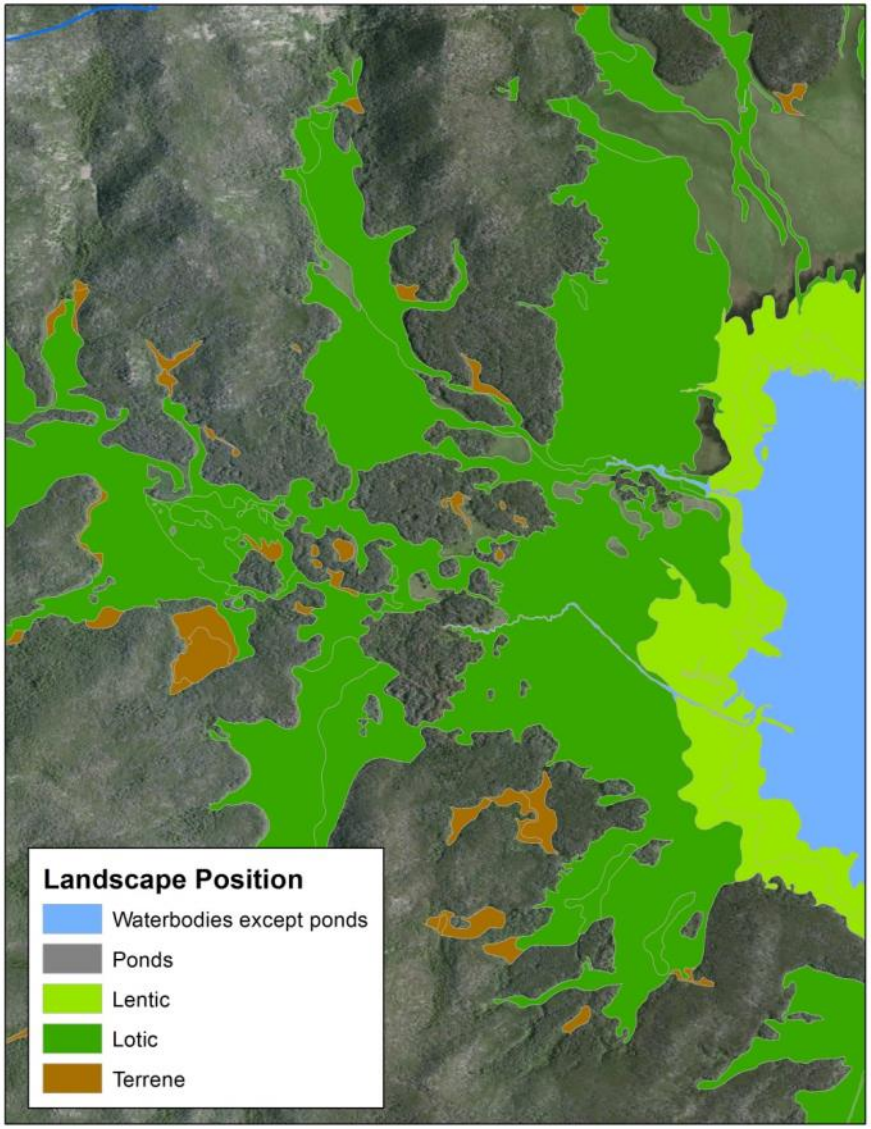
Cowardin Class

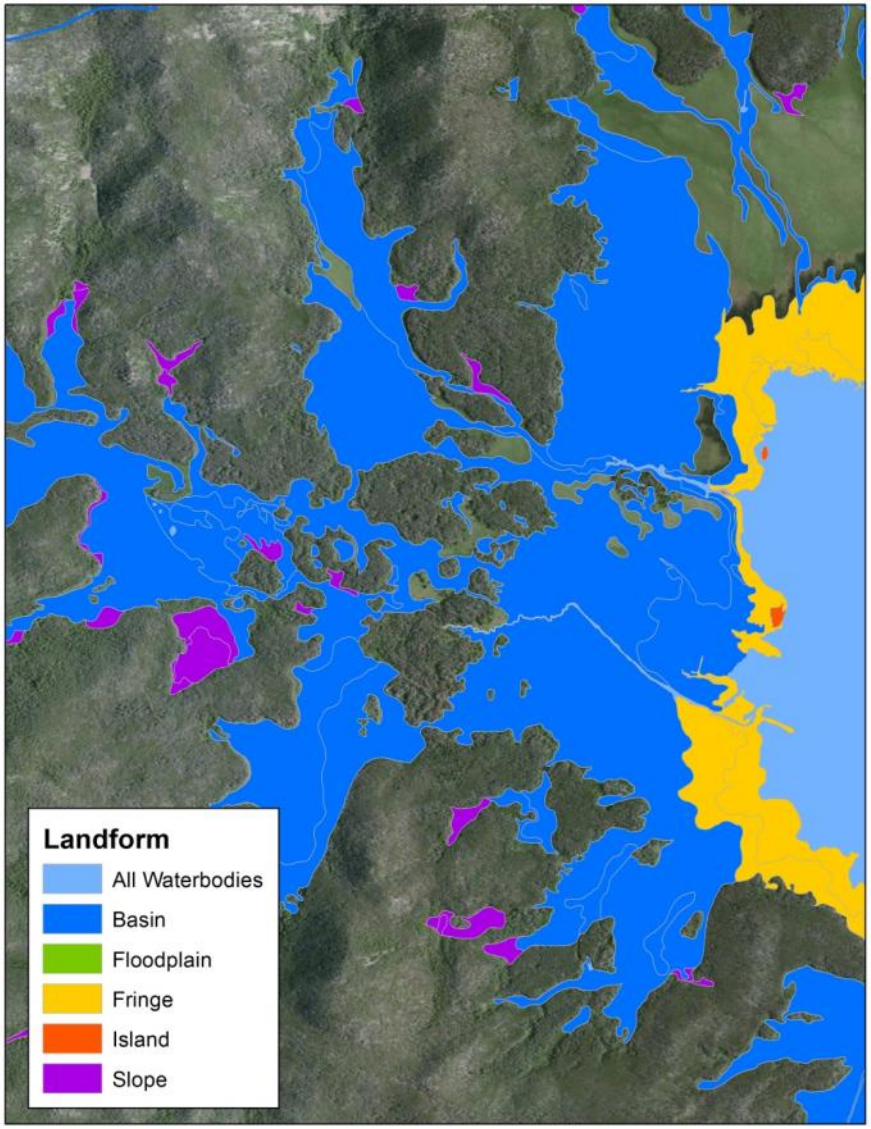


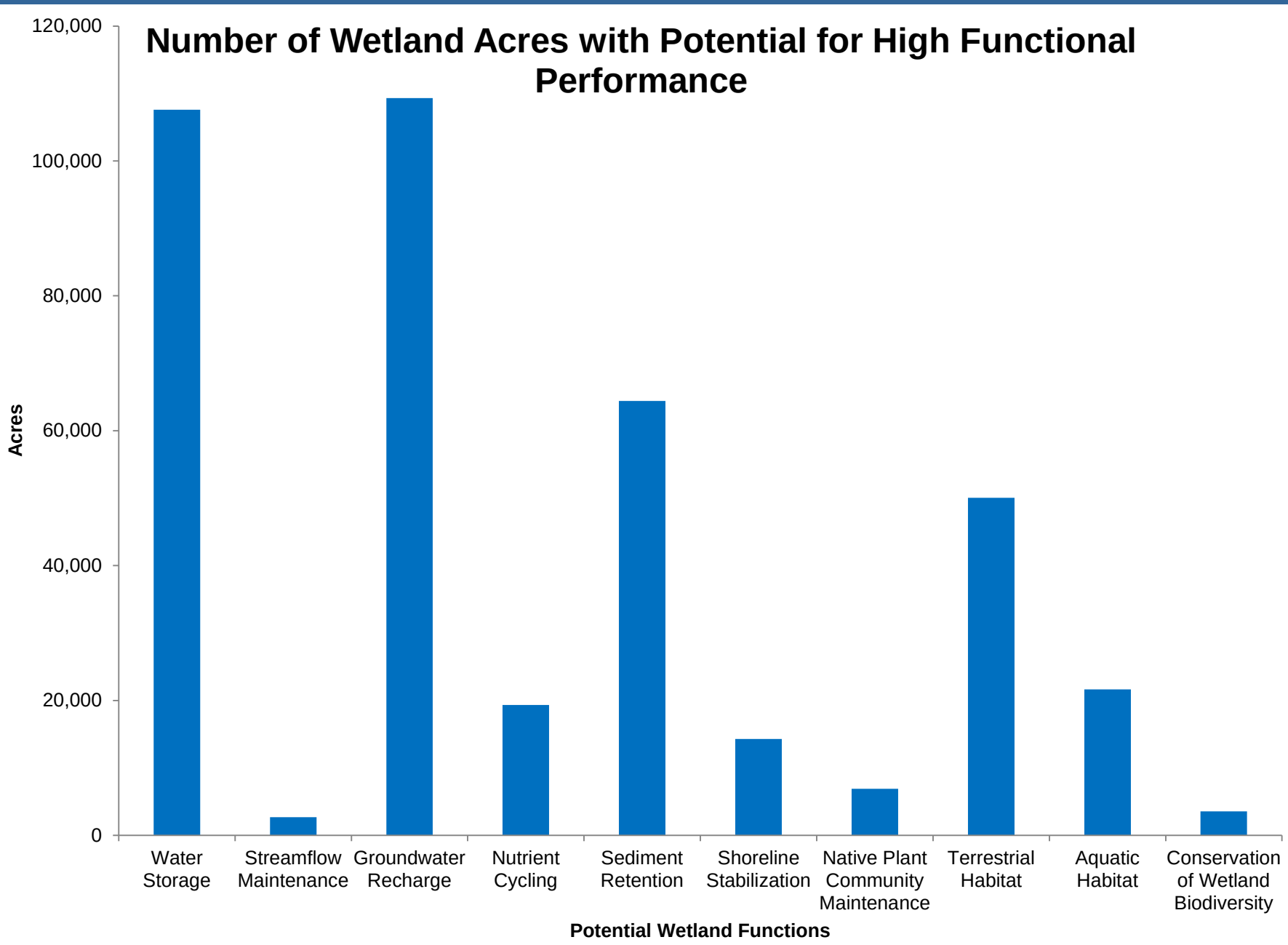
Water Flow Path



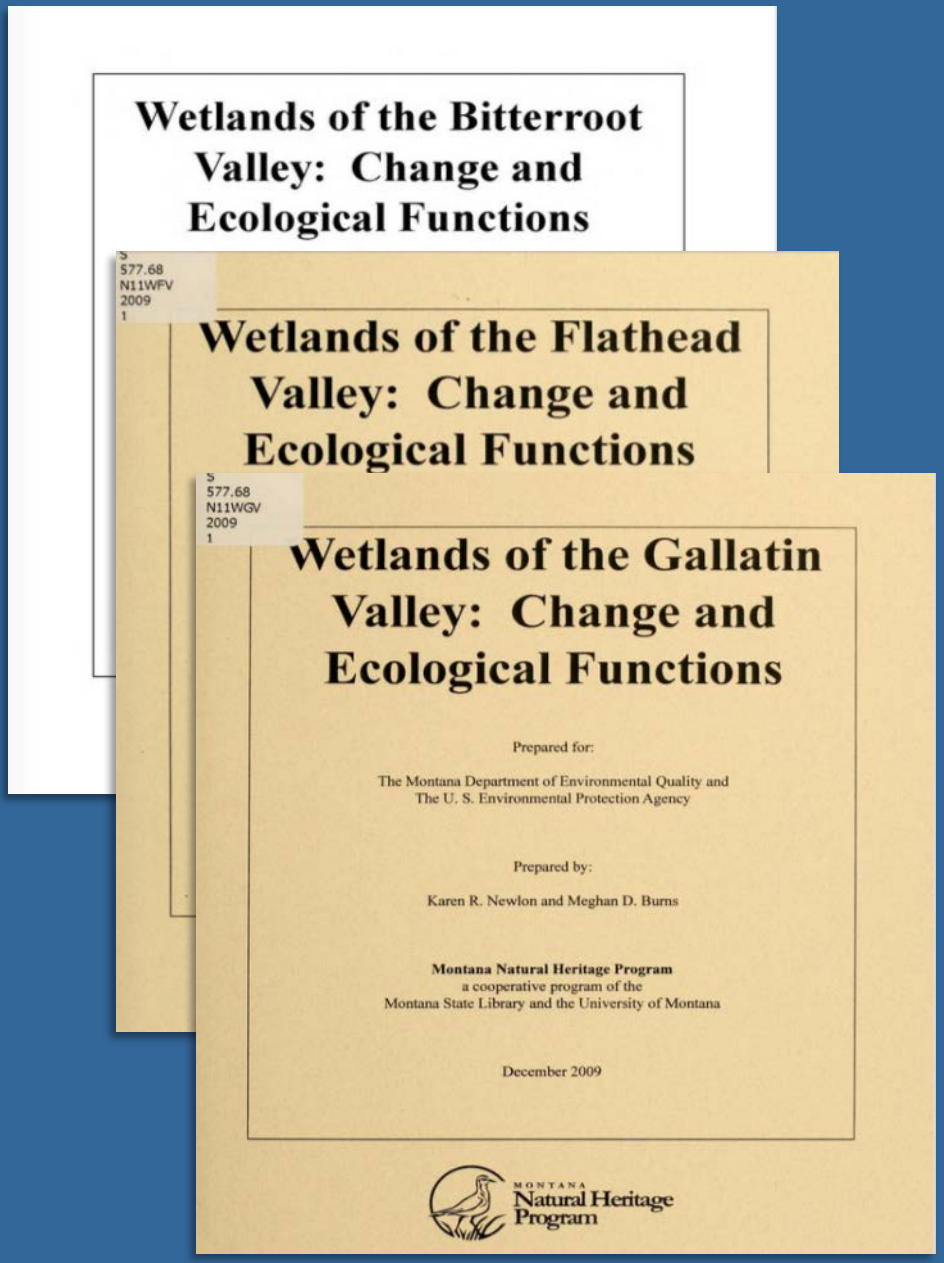
Locate Wetlands with Significance for Particular Functions






Number of Wetland Acres with Potential for High Functional Performance
120,000
100,000
80,000
60,000
40,000
20,000
0
Acres
Water Storage
Streamflow Maintenance
Groundwater Recharge
Nutrient Cycling
Sediment Retention
Shoreline Stabilization
Native Plant Community Maintenance
Terrestrial Habitat
Aquatic Habitat
Conservation of Wetland Biodiversity
Potential Wetland Functions

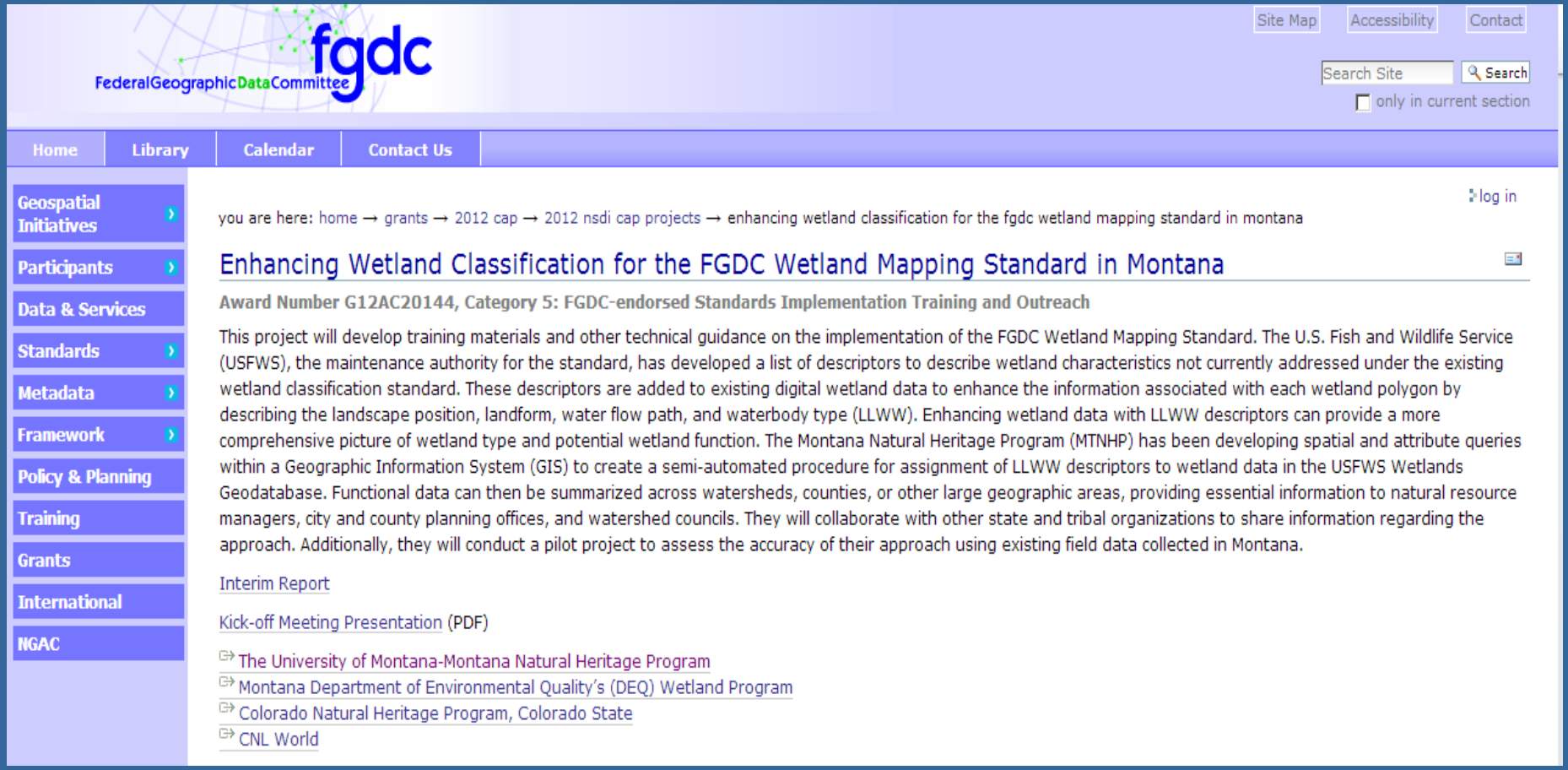
LLWW in Montana



- predict changes in wetland function in rapidly developing watersheds
- required manual photointerpretation
- not feasible over large areas
- needed to adapt original classification to Montana
- needed to automate the process

LLWW in Montana

- received 2012 NSDI-CAP grant from the FGDC
- develop geoprocessing procedures
- develop training materials
- reviewed by project partners and technical advisors



LLWW in Montana

- ideally fully automate assignment of descriptors
- tradeoff between accuracy and efficiency
- fully automated approach: overall accuracy ranged from 60% in Oklahoma to 81% in Oregon
- certain wetland types can be assigned more accurately than others
- MTNHP developed semi-automated procedures

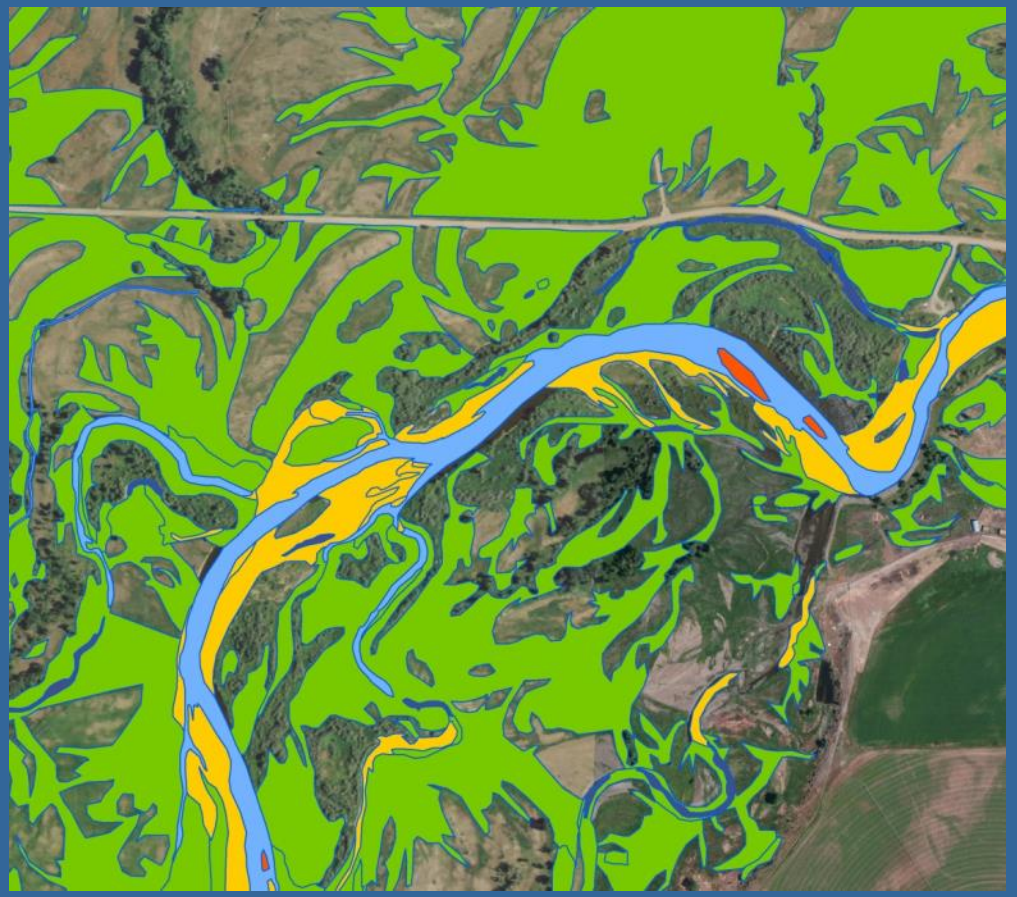
Limitations

- accuracy of source data (i.e., wetland mapping)
- accuracy of ancillary data layers used to assign LLWW descriptors
- individual wetland polygon may encompass more than one LLWW type
- level of subjectivity

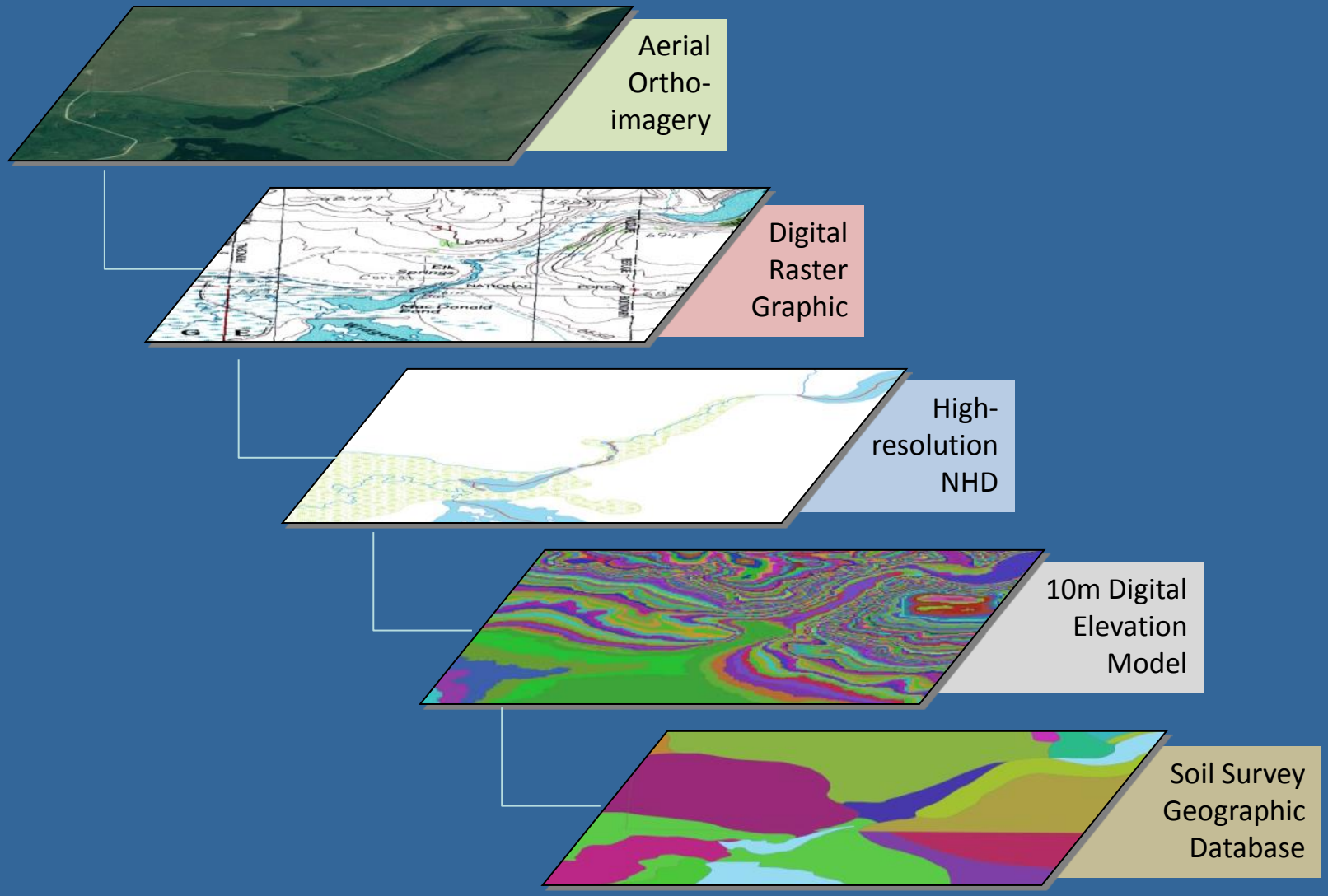
LLWW Descriptors: Challenges

Combines:

- wetland ecology
- wetland hydrology
- GIS

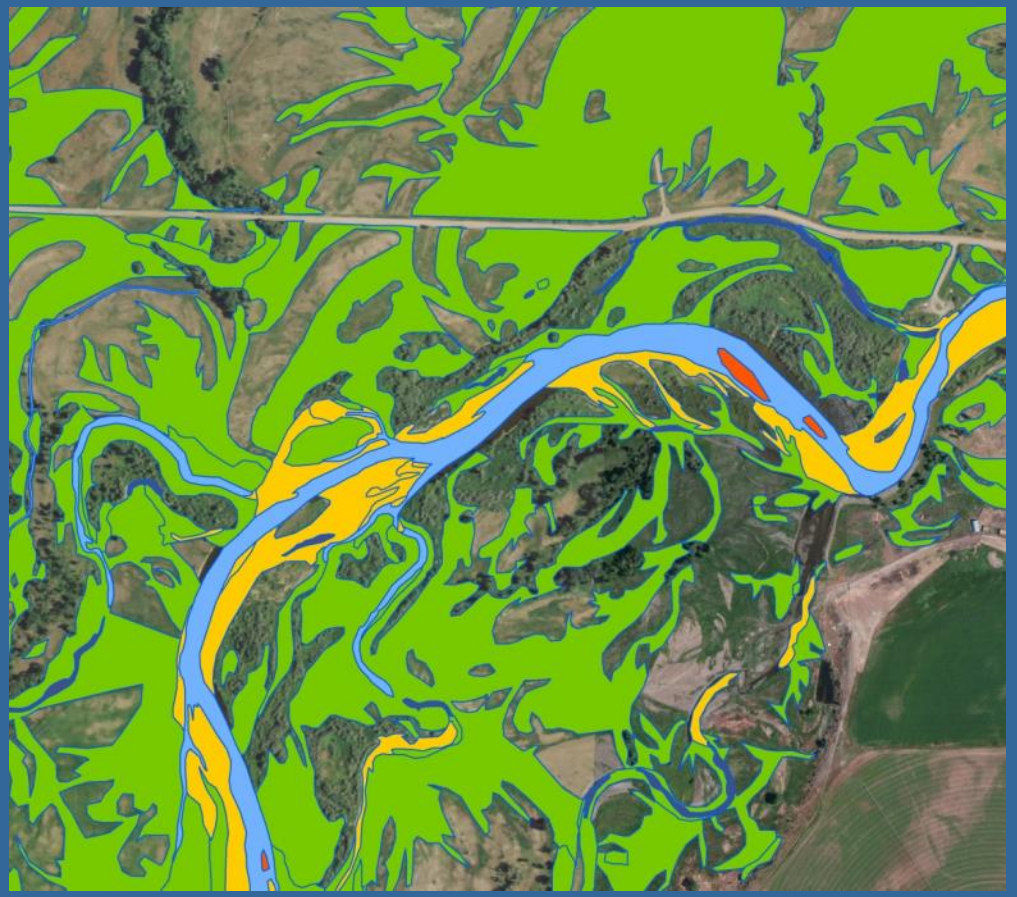


LLWW Descriptors: Ancillary Data Layers



LLWW Descriptors: Challenges

- does the order in which descriptors are assigned matter?
- which polygons can be assigned in a fully automated way?



LLWW Descriptors: Example Select Queries

River (RV):

- Select by Attributes: Create a new selection: "ATTRIBUTE" LIKE 'R2UB%' OR "ATTRIBUTE" LIKE 'R2AB%'.
- Populate Waterbody field with “RV”.
- Select by Attributes: Create a new selection: “ATTRIBUTE” LIKE ‘R%UB%’ OR “ATTRIBUTE” LIKE ‘R%AB%’ AND “ATTRIBUTE” NOT LIKE ‘R%x’.
- Select by Location: select from the currently selected features from Target layer: check wetland layer.
- Source layer: NHDArea attribute = StreamRiver.
- Spatial selection method: Target layer(s) features intersect the Source layer feature (NHDArea).
- Populate Waterbody field with “RV”.

LLWW Training Materials

- fact sheet

Creating a Value-Added Wetlands Layer: Enhancing the Utility of Wetland Mapping in Montana

The MTNHP creates digital wetland mapping using the Cowardin classification system of the National Wetlands Inventory (NWI). This wetland classification can be enhanced by incorporating descriptors to characterize hydrogeomorphic features that can be used to characterize potential wetland function. These descriptors are added to each wetland polygon to describe the landscape position, landform, water flow path, and waterbody type (LLWW) associated with each wetland. The addition of these descriptors can provide a more comprehensive picture of wetland type and potential wetland function.

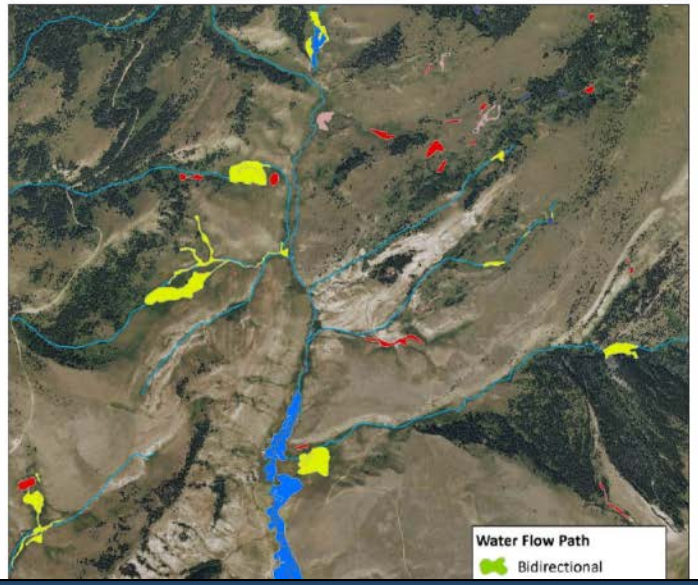
Since the early 2000s, the NWI has been enhancing wetland data by adding LLWW descriptors to enhance the information in the existing wetland classification standard by providing information on potential wetland function.

LLWW descriptors describe:

- ***landscape position*** (relation of a wetland to an adjacent waterbody)
- ***landform*** (the physical shape of the wetland)
- ***water flow path*** (the direction water flows into and out of the wetland)
- ***waterbody type*** (lake, river, stream, or pond).

These enhanced wetland data can then be used to conduct landscape analyses of wetland function, assist in the development of conservation strategies, and increase

Wetlands of the Ruby River Watershed, Madison County, Montana Classified by Water Flow Path



LLWW Training Materials

- fact sheet
- dichotomous key to LLWW descriptors

Creating a Value-Added Wetlands Layer: Enhancing the Utility of Wetland Mapping in Montana

KEY TO LLWW (LANDSCAPE POSITION, LANDFORM, WATER FLOW PATH, AND WATERBODY TYPE) DESCRIPTORS

Montana Natural Heritage Program, October 2013 (*modified from Tiner 2011*)

Key A-1: Key to Wetland Landscape Position Descriptors

1. Wetland is completely surrounded by upland (non-hydric soils) ..... **Terrene**
Go to Key B-1 for Landform Classification

1. Wetland is connected to a waterbody or other wetland **2**

2. Wetland is located in or along a lake or reservoir (permanent waterbody where standing water is typically deeper than 6.6 feet *or* larger than 20 acres), including streamside wetlands in a lake basin ..... **Lentic**
..... Go to Landscape Position Modifier for Lentic Wetlands below
Go to Key B-1 for Landform Classification

Note: Lentic wetlands consist of all wetlands in a lake basin (i.e., the depression containing the lake), including lakeside wetlands intersected by streams emptying into the lake. The upstream limit of lentic wetlands is defined by the upstream influence of the lake, which is usually approximated by the limits of the lake basin.

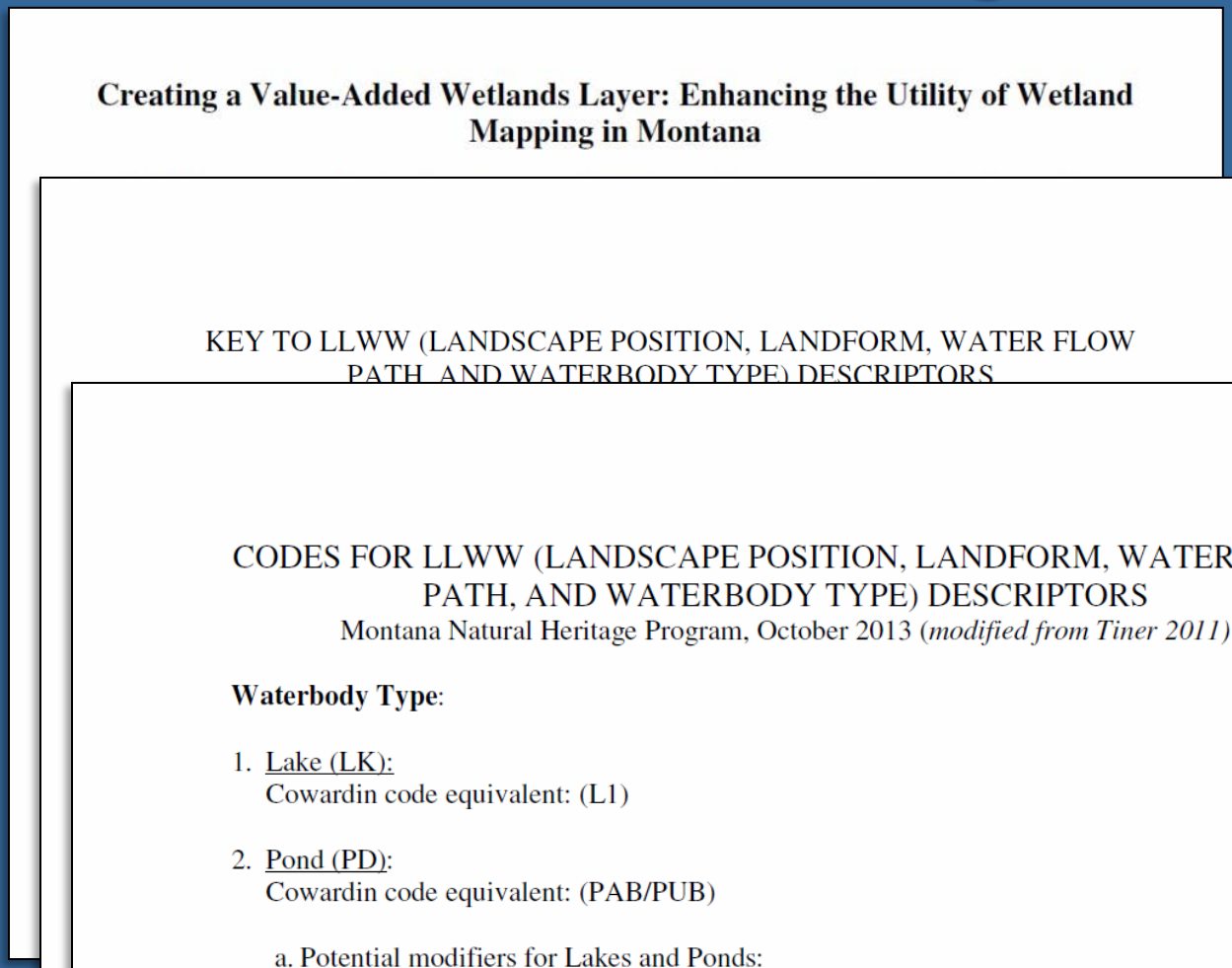
2. Wetland does not occur along a lake or reservoir **3**

3. Wetland is located in a river or stream (including in-stream ponds), within its banks, or on its floodplain **4**

3. Wetland is not located in a river or stream or on its floodplain OR wetland is located along a stream but is NOT subject to frequent overflows. Instead, the wetland is maintained by groundwater inputs ..... **Terrene**
Go to Key B-1 for Landform Classification

LLWW Training Materials

- fact sheet
- dichotomous key to LLWW descriptors
- list of LLWW codes



Creating a Value-Added Wetlands Layer: Enhancing the Utility of Wetland Mapping in Montana

KEY TO LLWW (LANDSCAPE POSITION, LANDFORM, WATER FLOW PATH, AND WATERBODY TYPE) DESCRIPTORS

CODES FOR LLWW (LANDSCAPE POSITION, LANDFORM, WATER FLOW PATH, AND WATERBODY TYPE) DESCRIPTORS

Montana Natural Heritage Program, October 2013 (*modified from Tiner 2011*)

Waterbody Type:

1. Lake (LK):
   Cowardin code equivalent: (L1)

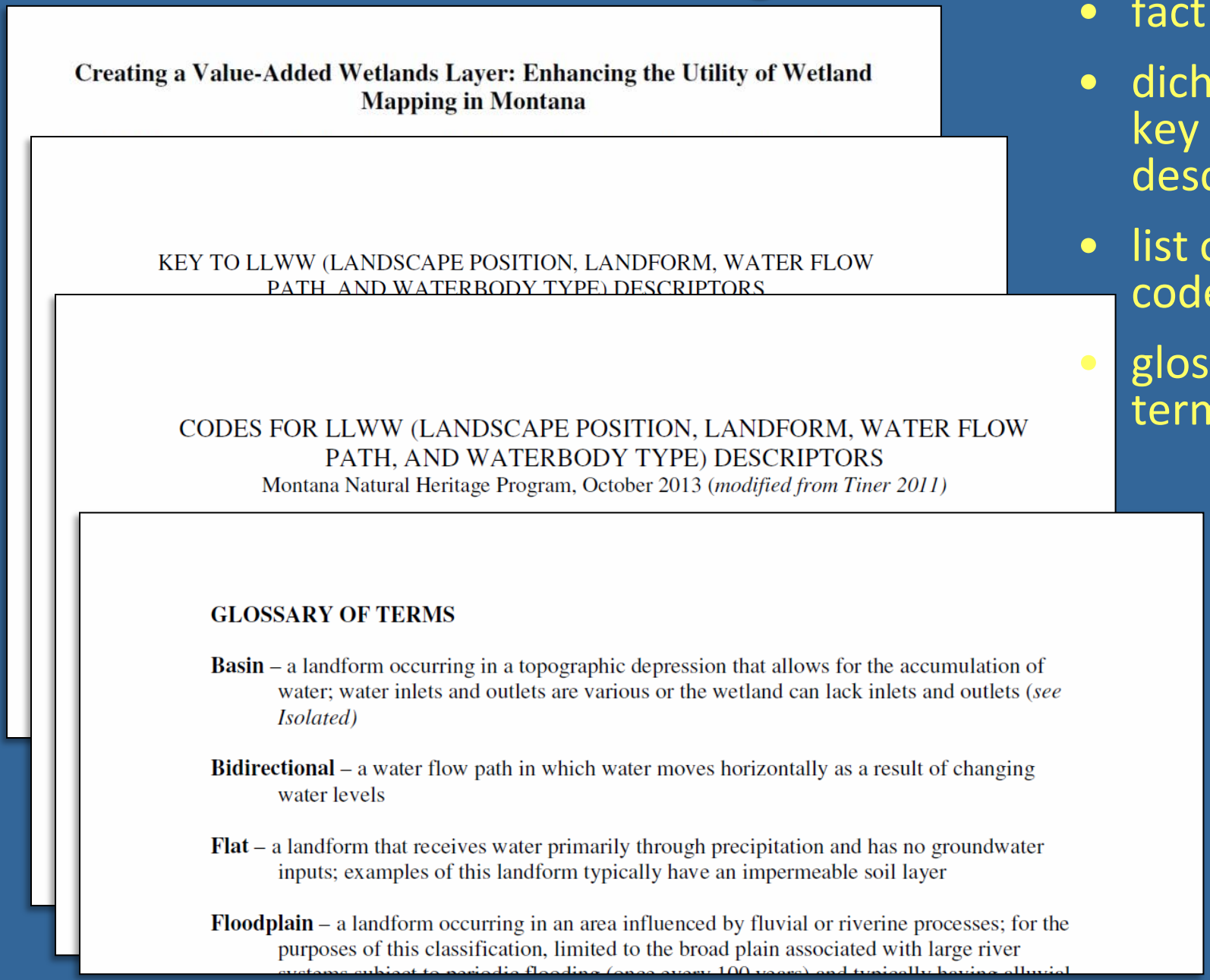
2. Pond (PD):
   Cowardin code equivalent: (PAB/PUB)

   a. Potential modifiers for Lakes and Ponds:
      Natural Lake (1)
      Dammed River Valley (2)
      Other Dammed Lake (3)
      Excavated (4)

   b. Potential Water Flow Paths for Lakes and Ponds:
      Inflow (IN)
      Outflow (OU)

LLWW Training Materials

- fact sheet
- dichotomous key to LLWW descriptors
- list of LLWW codes
- glossary of terms



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KEY TO LLWW (LANDSCAPE POSITION, LANDFORM, WATER FLOW PATH, AND WATERBODY TYPE) DESCRIPTORS

CODES FOR LLWW (LANDSCAPE POSITION, LANDFORM, WATER FLOW PATH, AND WATERBODY TYPE) DESCRIPTORS

Montana Natural Heritage Program, October 2013 (*modified from Tiner 2011*)

GLOSSARY OF TERMS

Basin – a landform occurring in a topographic depression that allows for the accumulation of water; water inlets and outlets are various or the wetland can lack inlets and outlets (*see Isolated*)

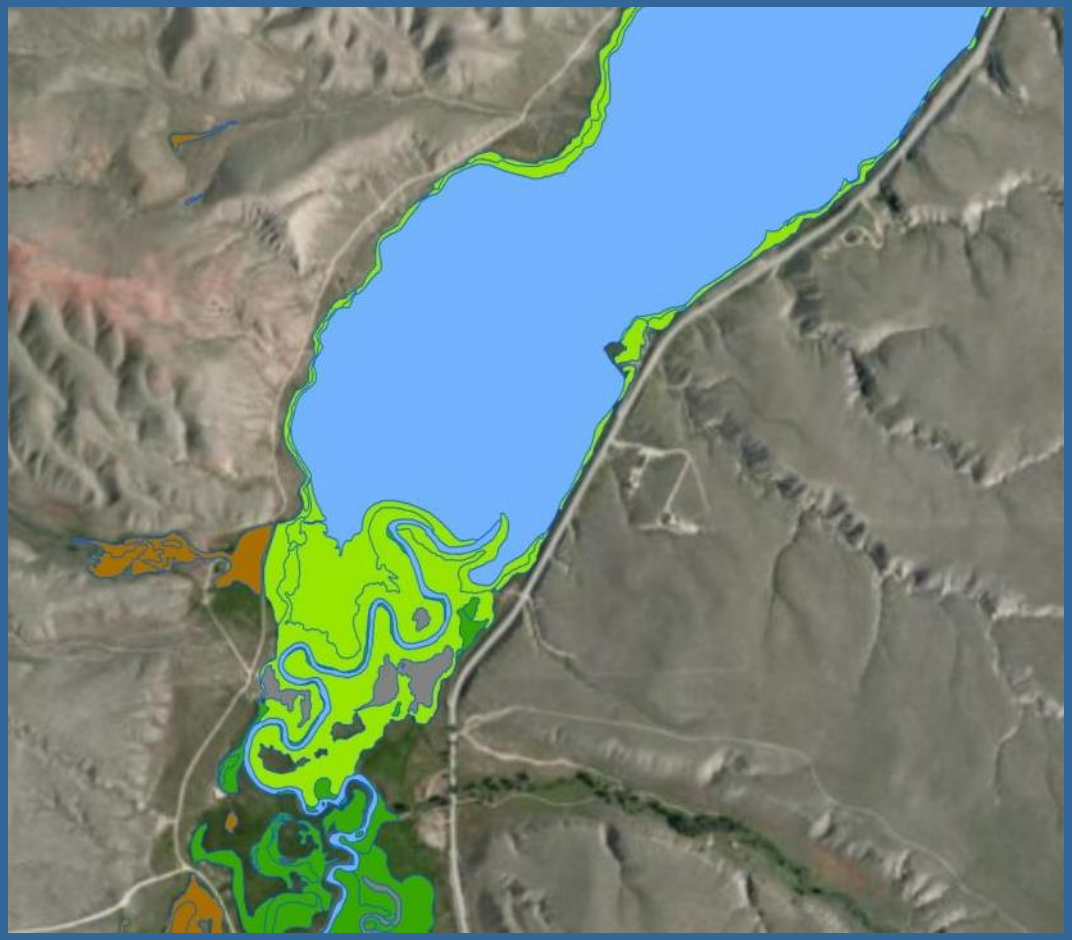
Bidirectional – a water flow path in which water moves horizontally as a result of changing water levels

Flat – a landform that receives water primarily through precipitation and has no groundwater inputs; examples of this landform typically have an impermeable soil layer

Floodplain – a landform occurring in an area influenced by fluvial or riverine processes; for the purposes of this classification, limited to the broad plain associated with large river

LLWW Descriptors: Next Steps

- **Accuracy assessment**
- Develop a tool
- Refine ancillary data layers

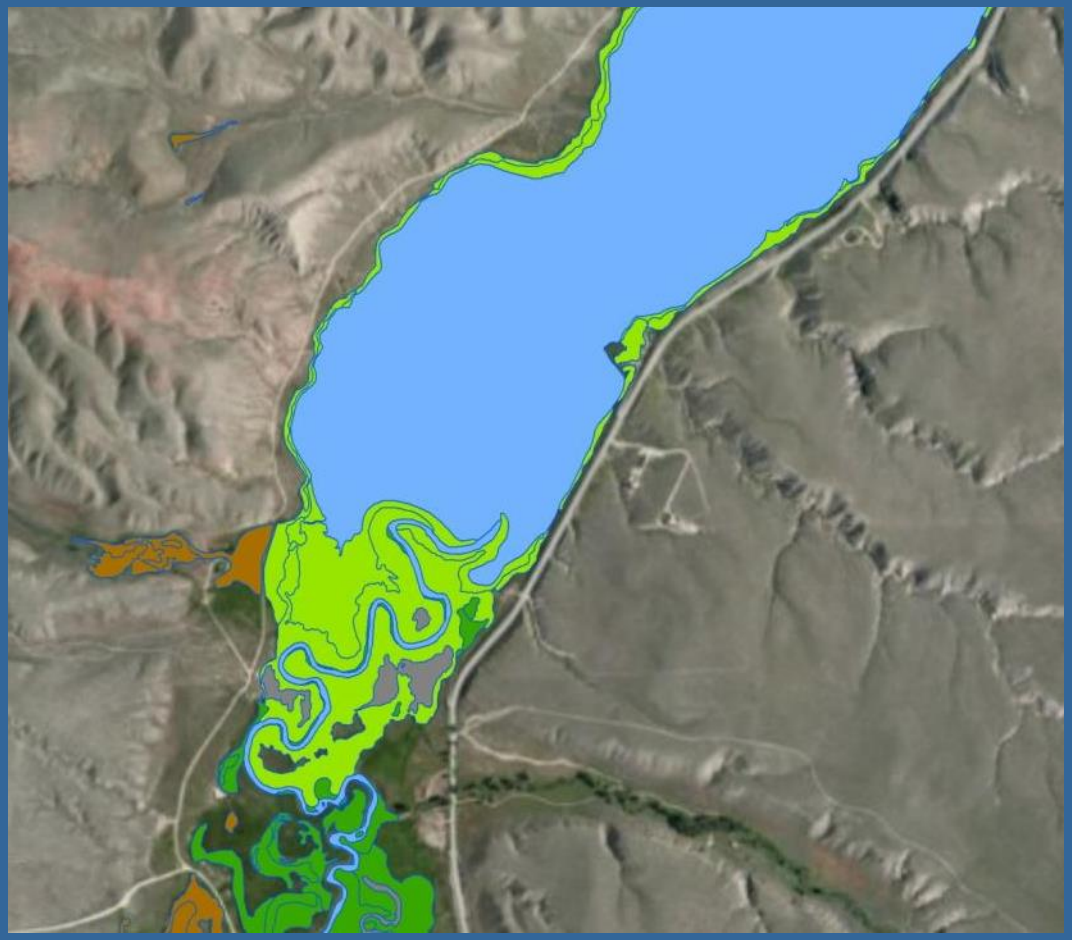


LLWW Descriptors: Challenges - Accuracy

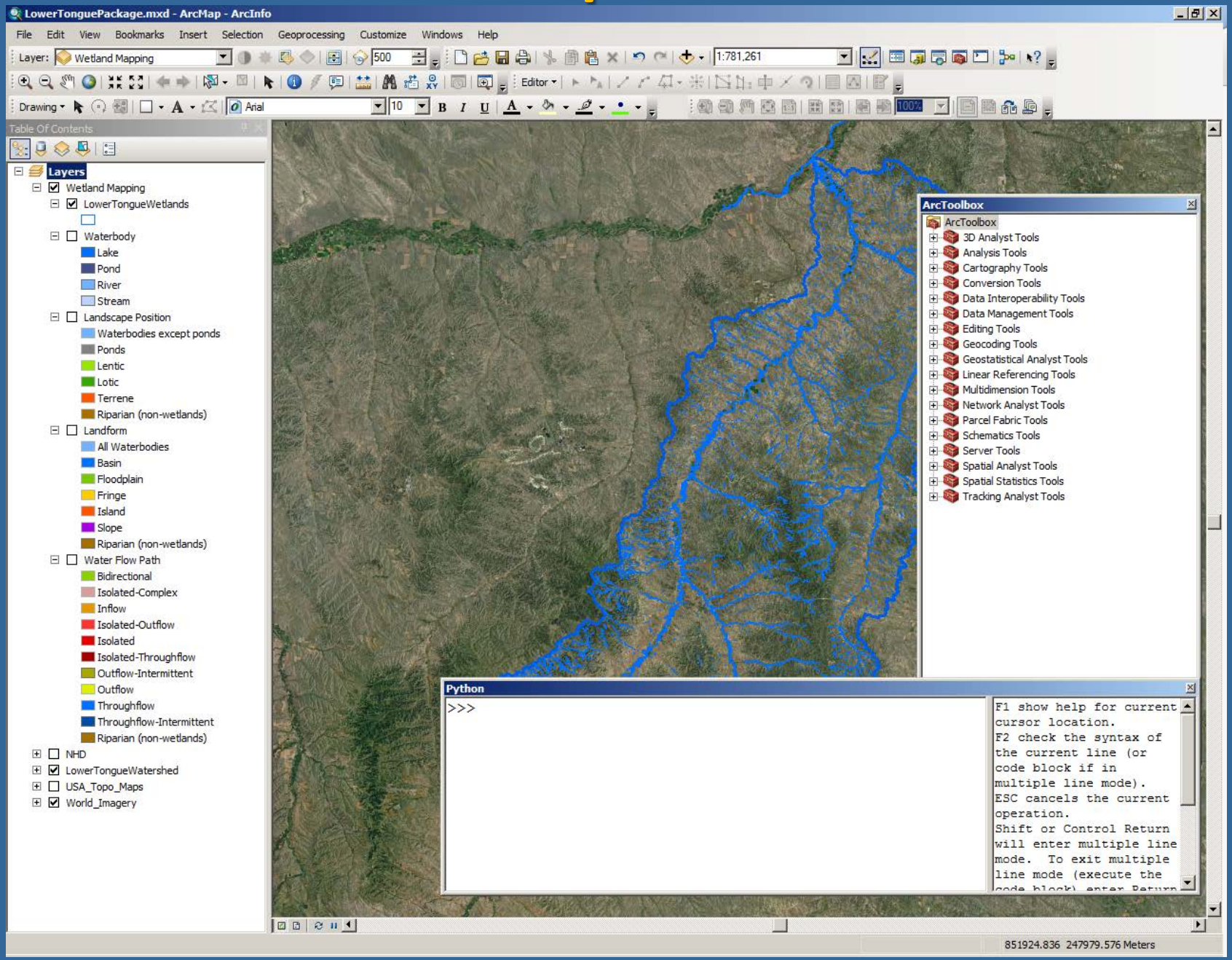
LLWW Descriptors: Challenges

LLWW Descriptors: Next Steps

- Accuracy assessment
- **Develop a tool**
- Refine ancillary data layers

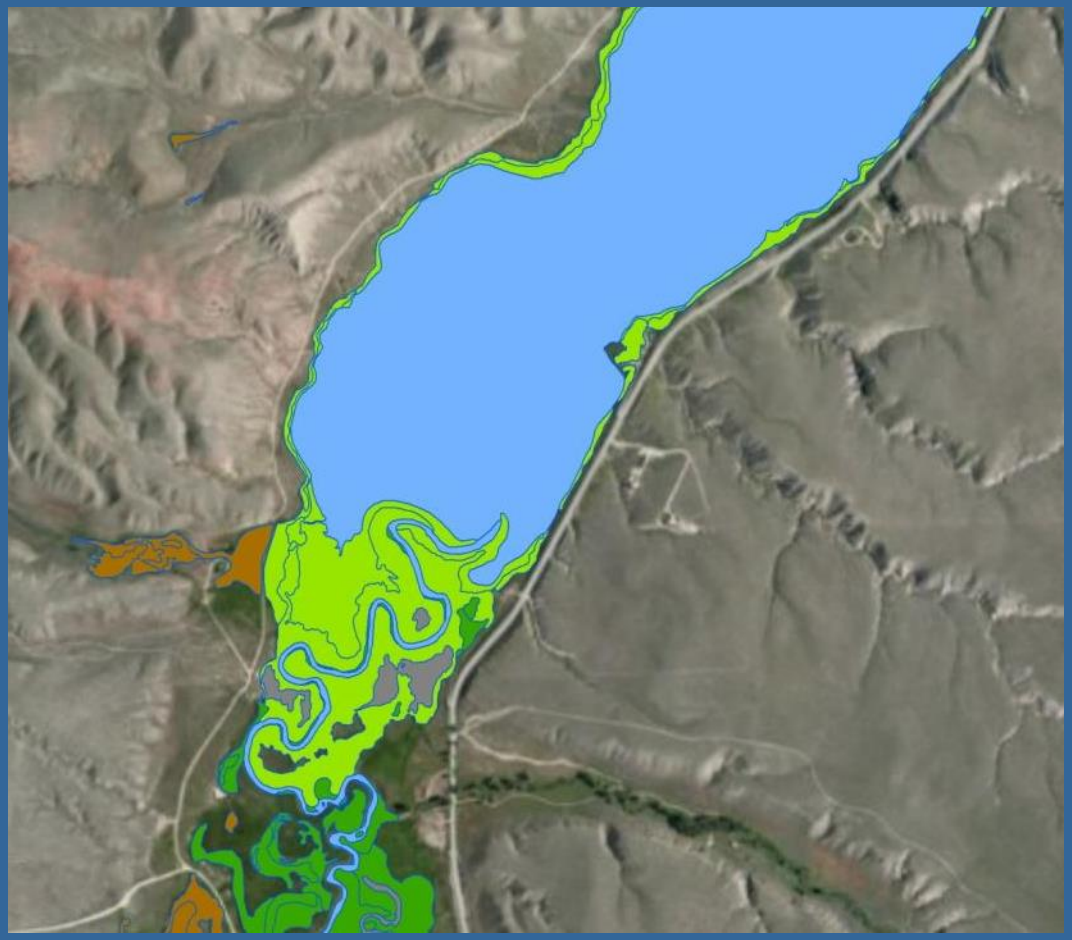


Develop Toolbox

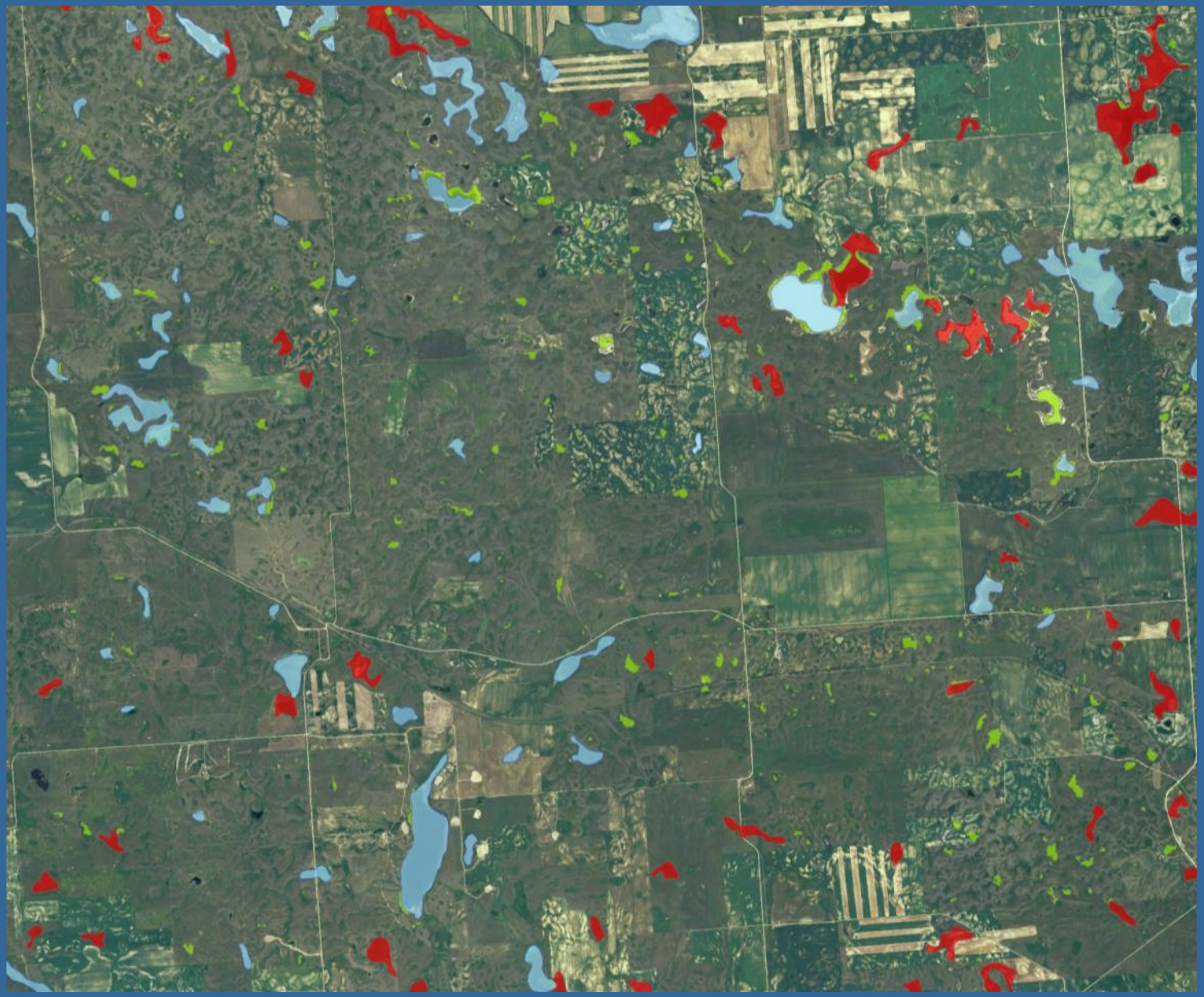


LLWW Descriptors: Next Steps

- Accuracy assessment
- Develop a tool
- **Refine ancillary data layers**

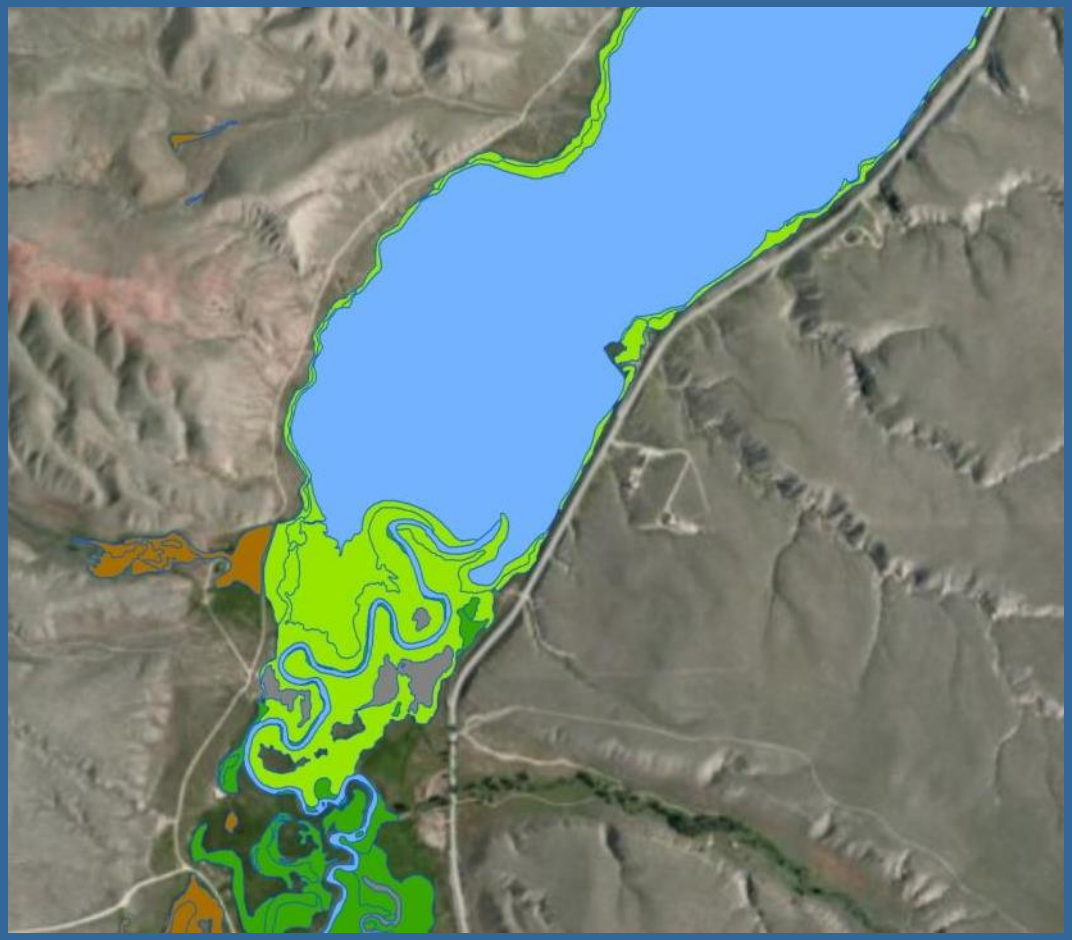


Potentially Wet Soils

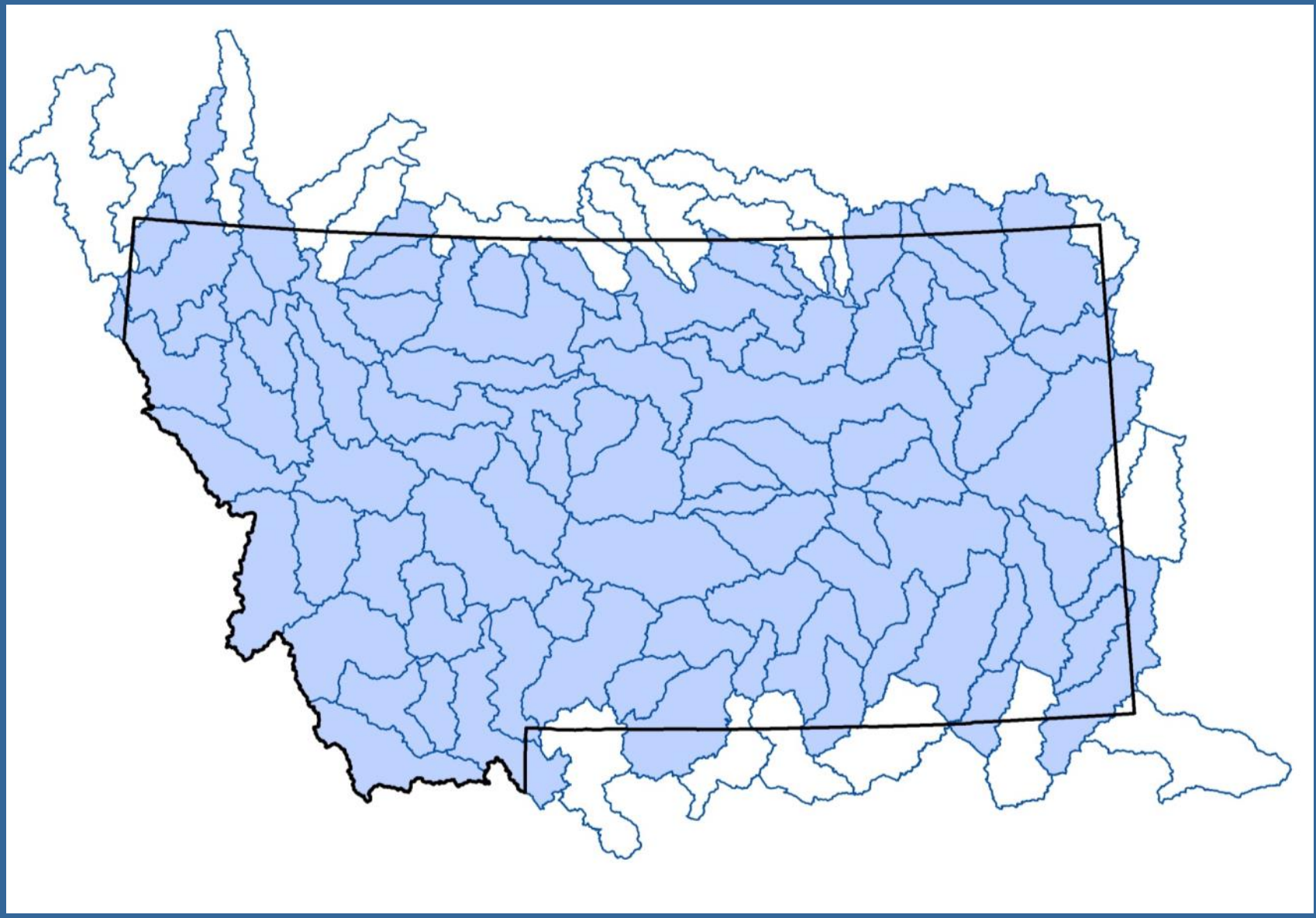


LLWW Descriptors: Next Steps

- **Develop work plan for incorporating LLWW descriptors into existing wetland mapping**
- Develop a functional correlation matrix for Rocky Mountain wetlands



8-Digit HUCs



LLWW Descriptors: Next Steps

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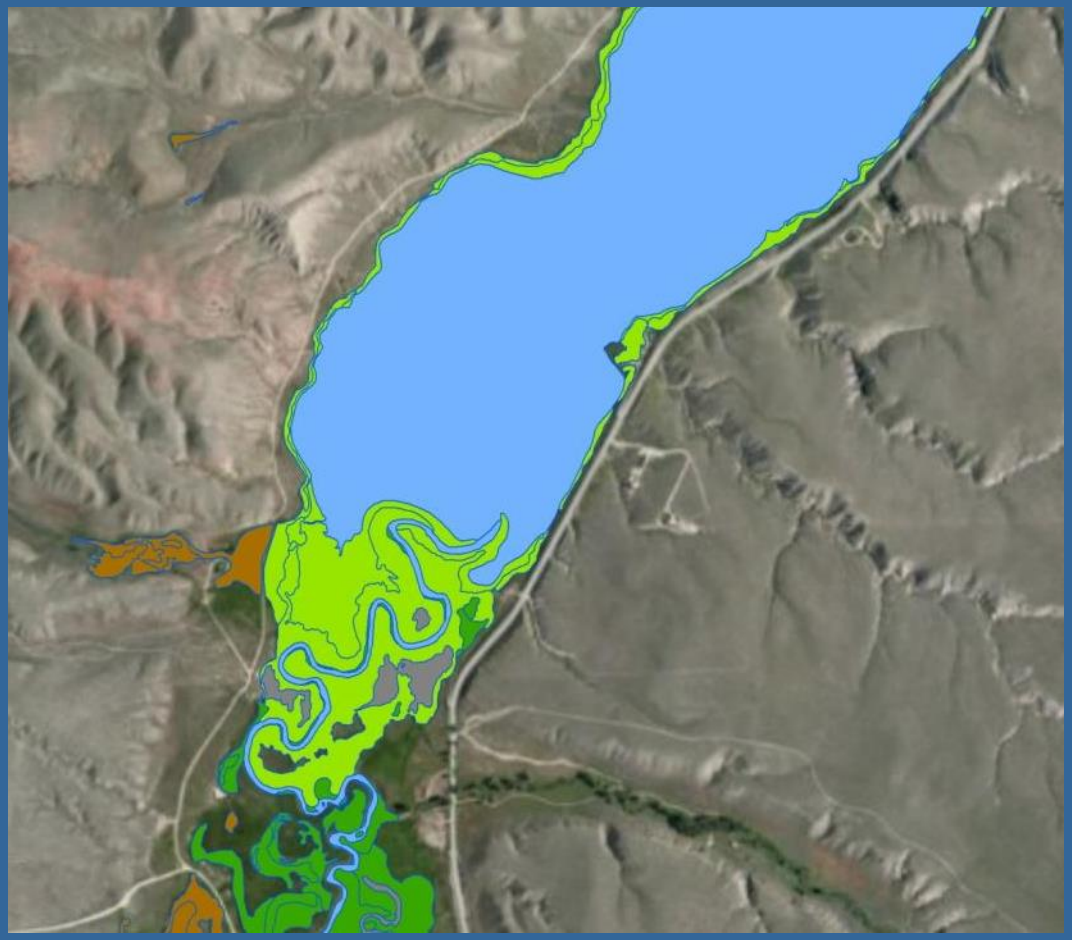

Develop Correlation Matrix for Montana

Correlating Enhanced National Wetlands Inventory Data
with Wetland Functions for Watershed Assessments:
A Rationale for Northeastern U.S. Wetlands

Ralph W. Tiner
Regional Wetland Coordinator
U.S. Fish & Wildlife Service
Northeast Region
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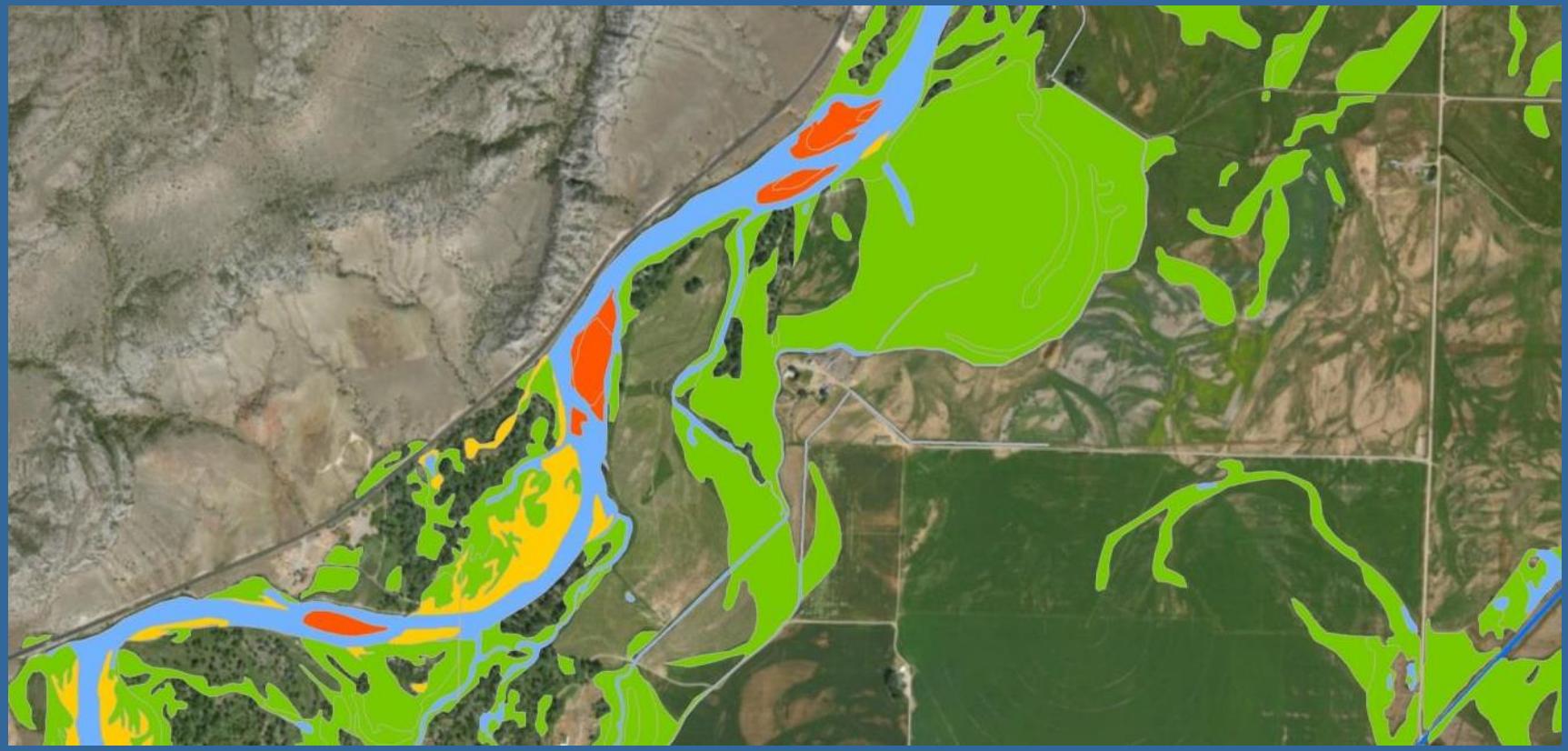
Hadley, MA 01035

Useful Links

- http://mtnhp.org/wetlands/
- http://mtnhp.org/nwi/
- ftp://ftp.gis.mt.gov/WetlandsFramework/
- http://gisservice.mt.gov/ArcGIS/rest/services/MSDI_Framework/WetlandsRiparian/MapServer

Acknowledgments

- NSDI-CAP grant
- Ralph Tiner – U.S. Fish and Wildlife Service
- Colorado Natural Heritage Program: Joanna Lemly, Gabrielle Smith, Jeremy Sueltenfuss
- Dennis Lichtenberg – CNL World
- Steve Carpenedo - Montana DEQ



Questions?

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