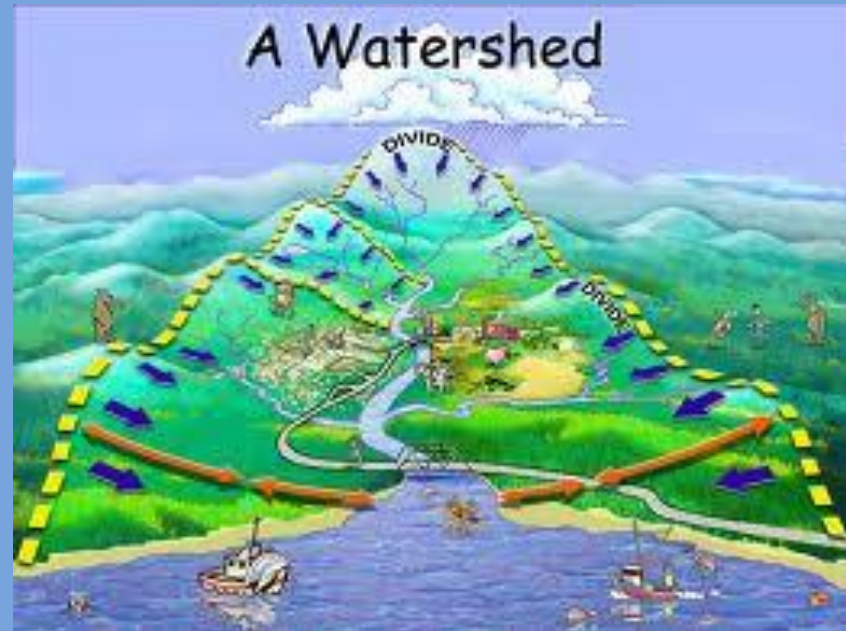


The North Dakota Watershed Boundary Dataset: A GIS Framework Layer



Ann Fritz
Environmental Scientist
North Dakota Department of Health
Division of Water Quality

- What is the WBD?
 - Acronyms and terminology
- How was it created?
 - what is the data structure?
- What can I do with the data?
- Examples
- Conclusions



What is it?

WBD = Watershed Boundary Dataset

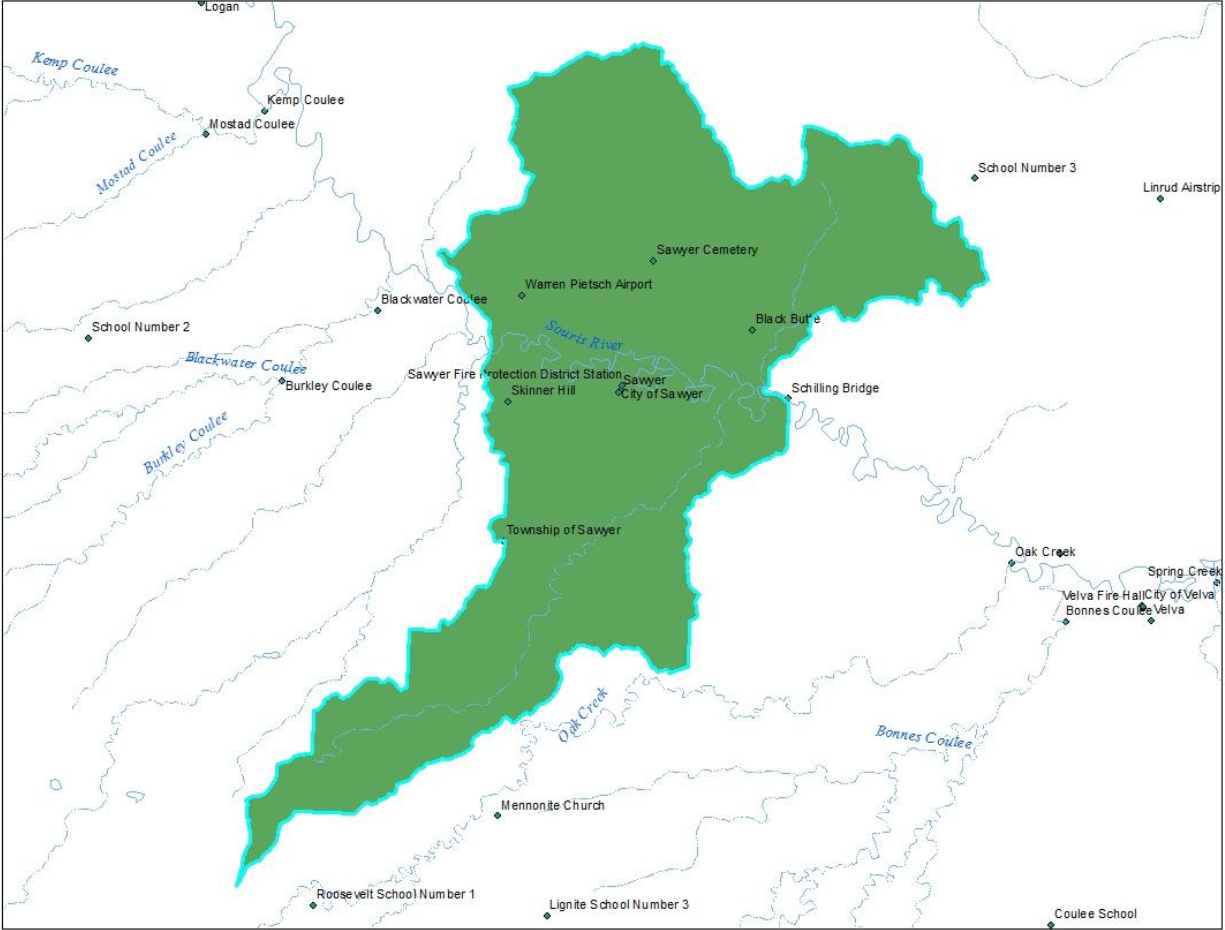
- A series of nested hierarchical drainage units encompassing all surface area in the nation.
- Each drainage unit is subdivided into uniform areas based on topography and hydrologic principles using Federal Standards.
- Baseline drainage area framework at 1:24,000 scale for the nation *in digital form*.
- Integral part of the NHD: National Hydrography Dataset
- Part of the U.S. Geological Survey *National Map*

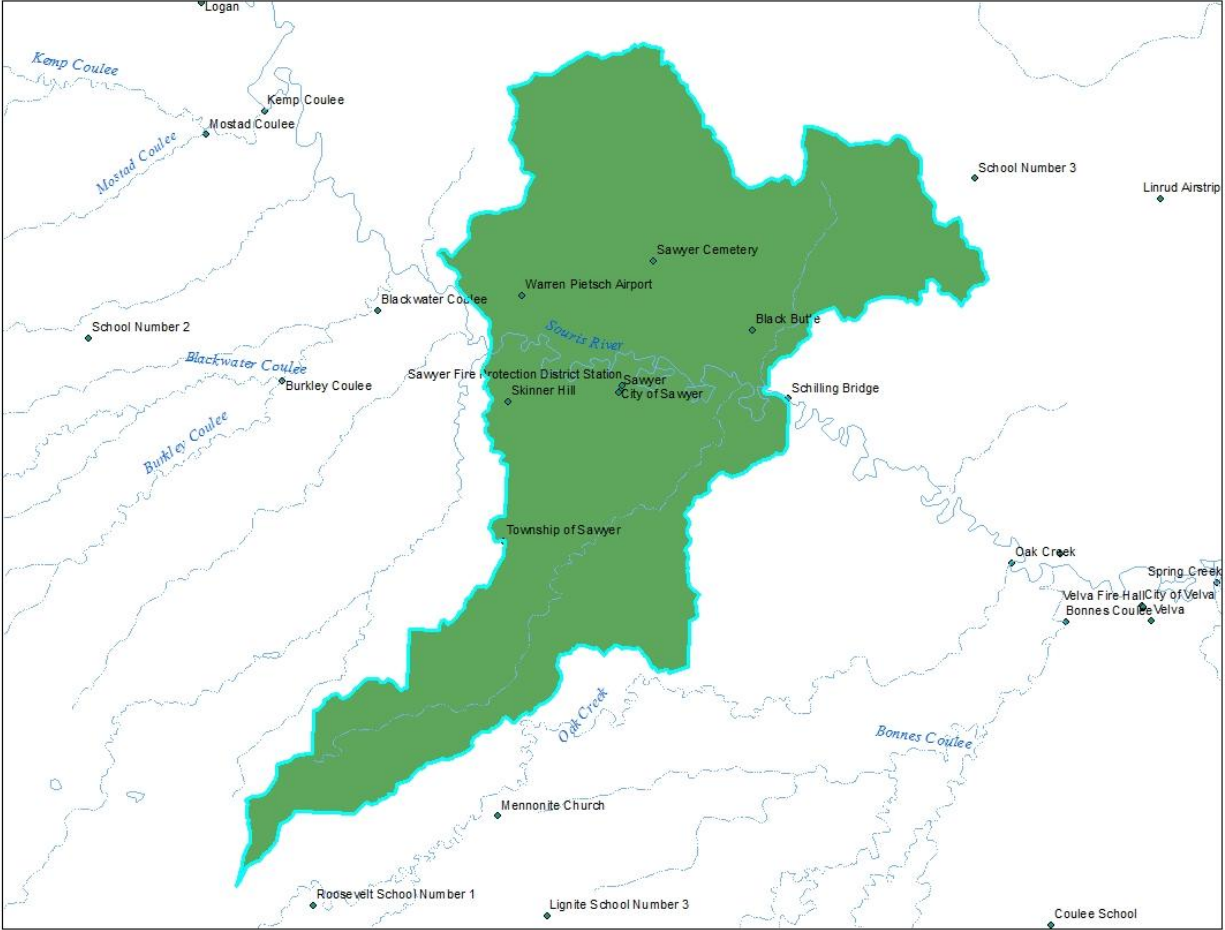
Hydrologic Unit Hierarchy

NAME	ALIAS	HYDROLOGIC UNIT CODE	CODE	AVERAGE SIZE	EXAMPLE
Region	1 st level	2-digit	09	177,560 mi ²	Souris-Red-Rainy
Subregion	2 nd level	4-digit	0901	16,800 mi ²	Souris River
Basin	3 rd level	6-digit	090100	10, 596 mi ²	Souris River
Subbasin	4 th level	8-digit	09010008	703 mi ²	Moose Mountain Creek-Souris River
Watershed	5 th level	10-digit	0901000811	63 to 391 mi ² (40,000 to 250,000 acres)	Oak Creek-Souris River
Subwatershed	6 th level	12-digit	090100081101	16 to 63 mi ² (10,000 to 40,000 acres)	City of Sawyer-Souris River
	7 th and 8 th	14 and 16 digit		< 16 mi ²	



Hydrologic Unit Hierarchy

NAME	HYDROLOGIC	EXAMPLE
Region		Missouri-Red-Rainy
Subregion		Souris River
Basin		Souris River
Subbasin		Moose Mountain Creek-Souris River
Watershed		Creek-Souris River
Subwatershed		Township of Sawyer-Souris River
	14 and 16 digit 8th	< 16 mi ²



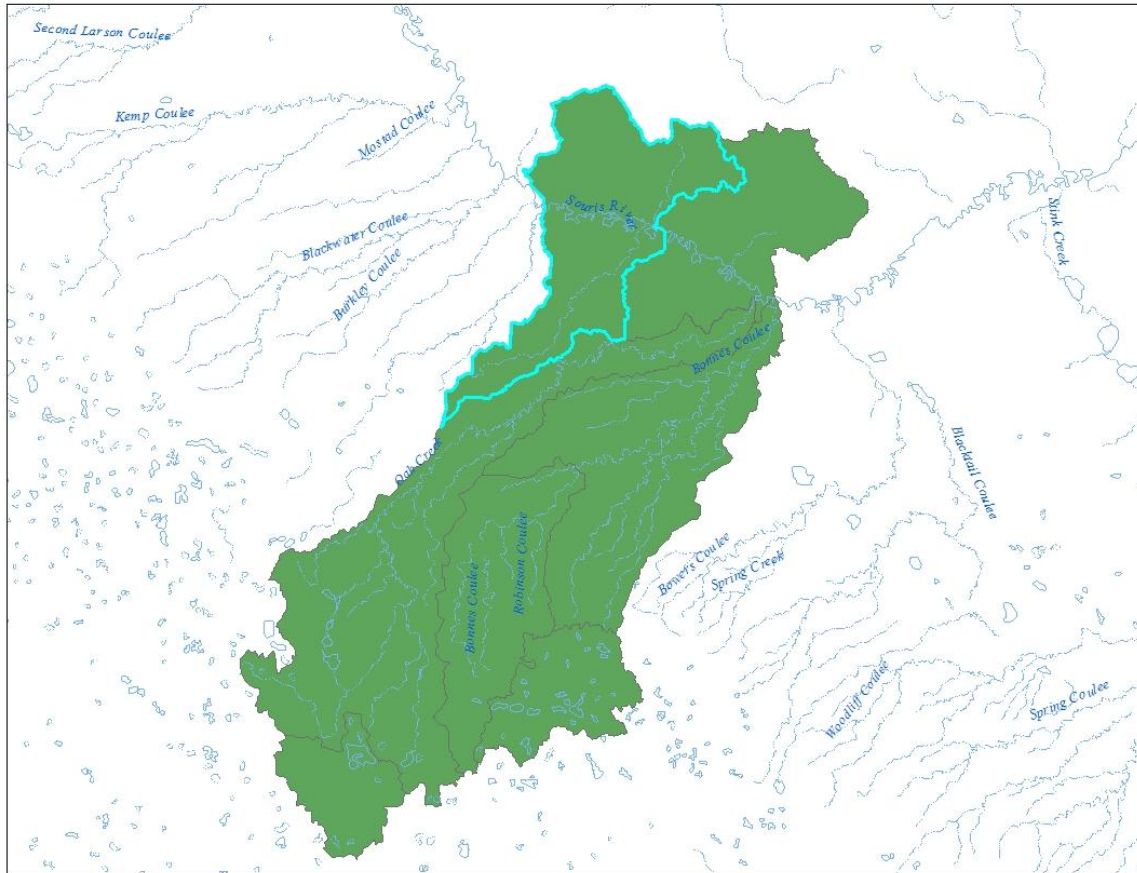
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	7 th and 8 th	14 and 16 digit		< 16 mi ²	



Hydrologic Unit Hierarchy

NAME	ALIAS	HYDROLOGIC UNIT CODE	CODE	AVERAGE SIZE	EXAMPLE
Region					Souris-Red-Rainy
Subregion					Souris River
Basin					Souris River
Subbasin					Moose Mountain Creek-Souris River
Watershed					Dak Creek-Souris River
Subwatershed					City of Sawyer-Souris River
	7 th and 8 th	14 and 16 digit		< 16 mi ²	



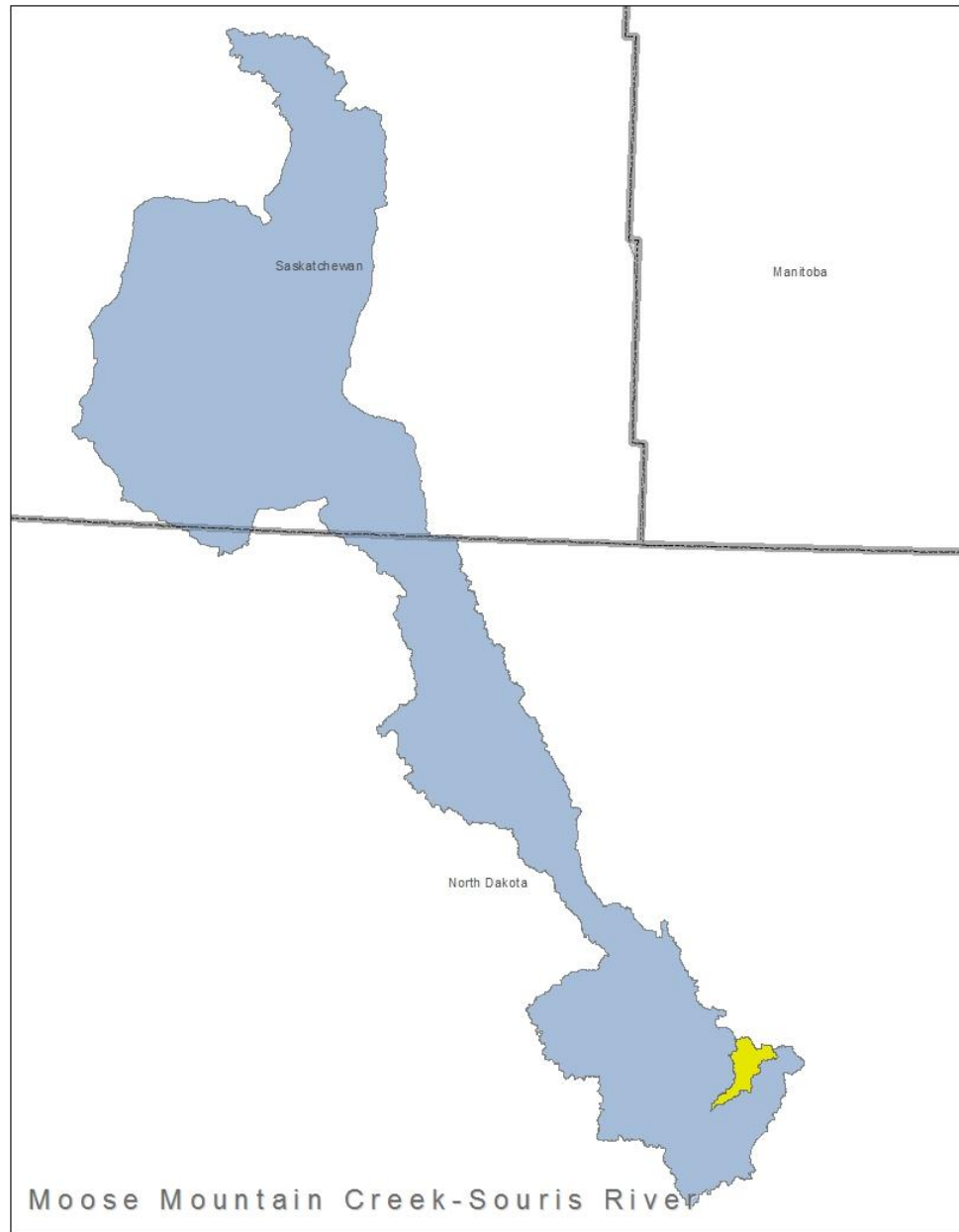
Hydrologic Unit Hierarchy

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	7 th and 8 th	14 and 16 digit		< 16 mi ²	



Hydrology

NAME	AL
Region	1 st
Subregion	2 nd
Basin	3 rd
Subbasin	4th
Watershed	5 th
Subwatershed	6 th
	7 th
	8



EXAMPLE
Souris-Red-Rainy
Souris River
Souris River
Moose Mountain Creek-Souris River
Oak Creek-Souris River
City of Sawyer-Souris River

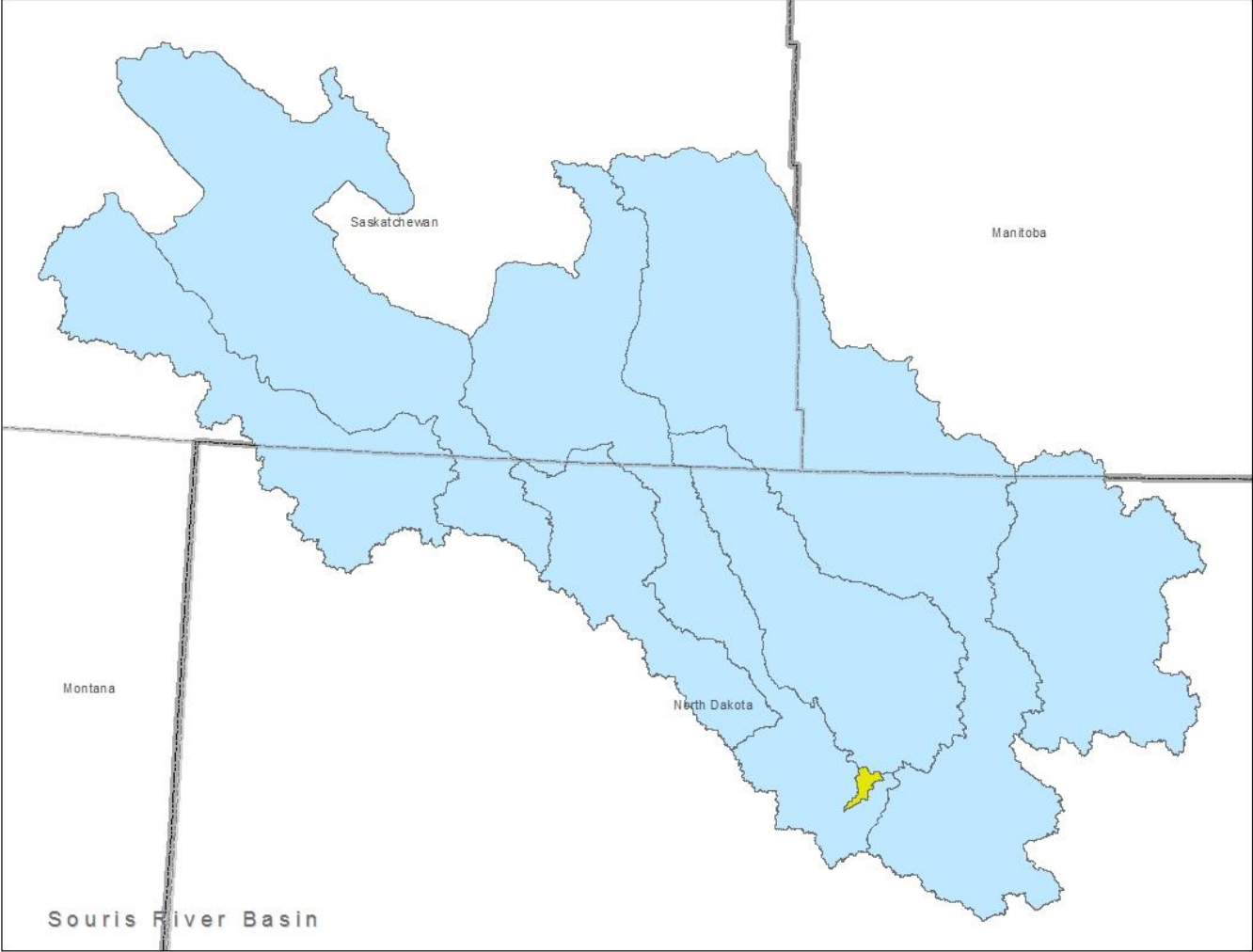


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Subwatershed	6 th level	12-digit	090100081101	16 to 63 mi ² (10,000 to 40,000 acres)	City of Sawyer-Souris River
	7 th and 8 th	14 and 16 digit		< 16 mi ²	



Hydrologic Unit Hierarchy

NAME	HYDROLOGIC	EXAMPLE
Region		Red-Rainy
Subregion		Souris River
Basin		Souris River
Subbasin		Moose Main Creek- Souris River
Watershed		Moose-Creek-Souris River
Subwatershed		Moose-Creek-Sawyer- Souris River

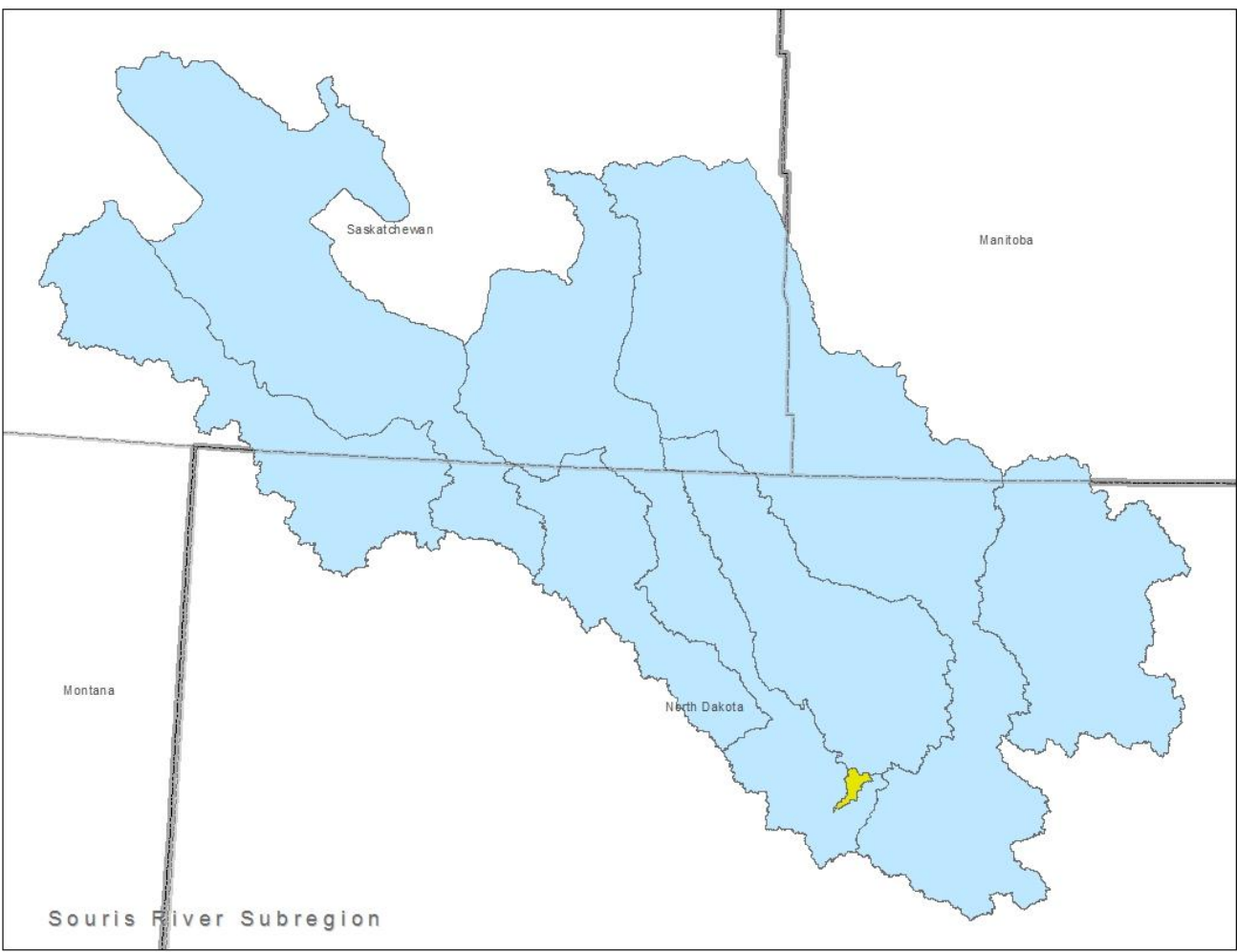


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Hydrologic Unit Hierarchy

NAME					EXAMPLE
Region					Missouri-Red-Rainy
Subregion	Souris River				Souris River
Basin	Souris River				Souris River
Subbasin	Moose Mountain Creek-Souris River				Moose Mountain Creek-Souris River
Watershed	Creek-Souris River				Creek-Souris River
Subwatershed	Port of Sawyer-Souris River				Port of Sawyer-Souris River
	7 th and 8 th	14 and 16 digit		< 16 mi ²	

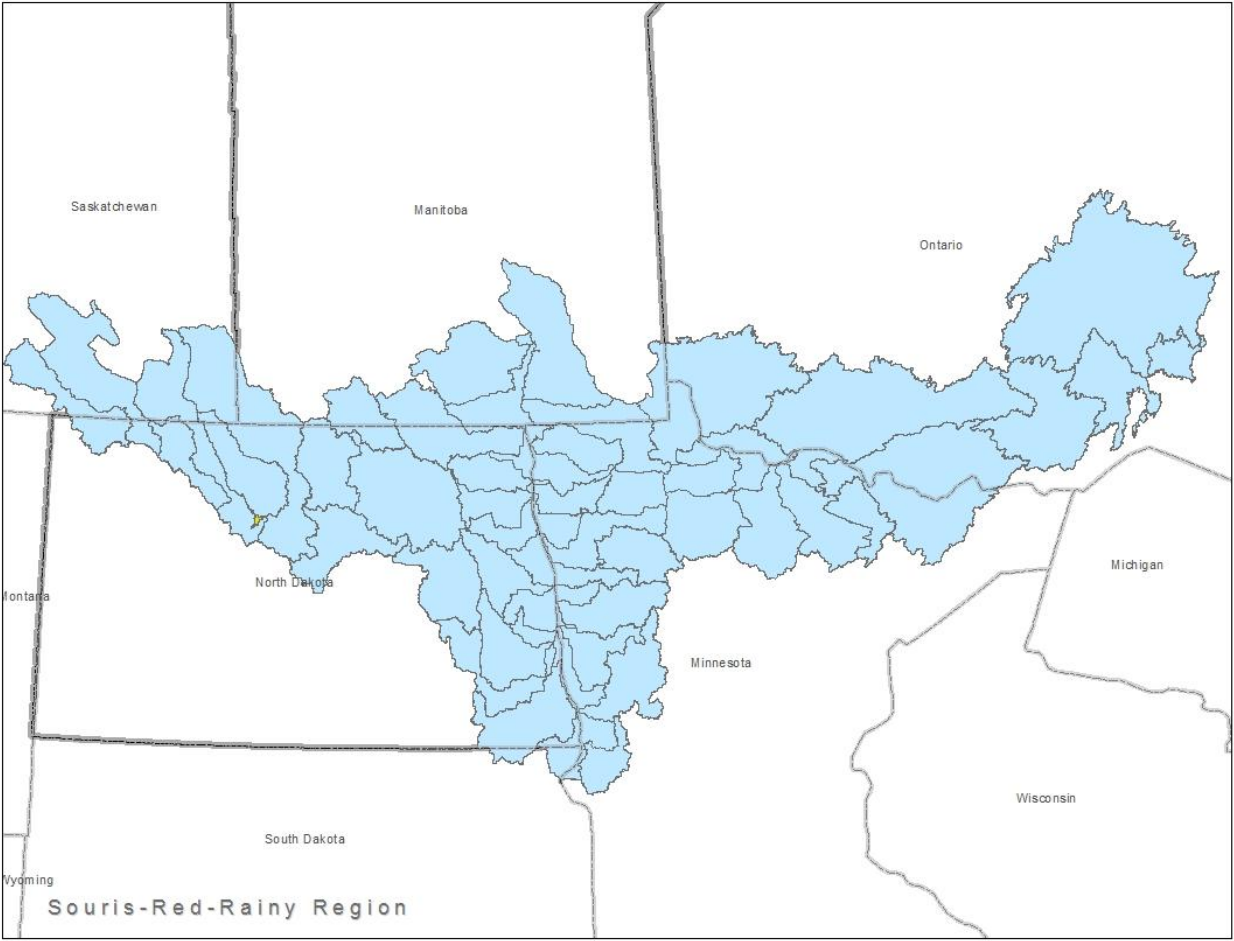


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Hydrologic Unit Hierarchy

NAME	HYDROLOGIC			EXAMPLE
Region				Souris-Red-Rainy
Subregion				Souris River
Basin				Souris River
Subbasin				Moose Mountain Creek- Souris River
Watershed				Moose Creek-Souris River
Subwatershed				County of Sawyer- Souris River
	8th	14 and 16 digit	< 16 mi ²	



HOW was it created?

Standards, Certification & Updates

Federal Standards and Procedures for the National Watershed Boundary Dataset (WBD), By the U.S. Geological Survey and U.S. Department of Agriculture, Natural Resource Conservation Service

Chapter 3 of Section A, Federal Standards, Book 11, Collection and Delineation of Spatial Data.

Techniques and Methods 11-A3; Third Edition, 2012

WHO created the WBD?

- North Dakota Cooperators (signed MOU)

- ND Dept. of Health
- ND State Water Commission
- ND Geological Survey
- U.S. Forest Service - Dakota Prairie Grasslands
- U.S. Geological Survey
- U.S. Dept. of Agriculture - Natural Resource Conservation Service

Additional technical or financial support provided by U.S. Bureau of Reclamation, ND GISTC Data Acquisition Funds, EPA Consolidated Funding Grant, and EPA National Environmental Information Exchange Network grants.

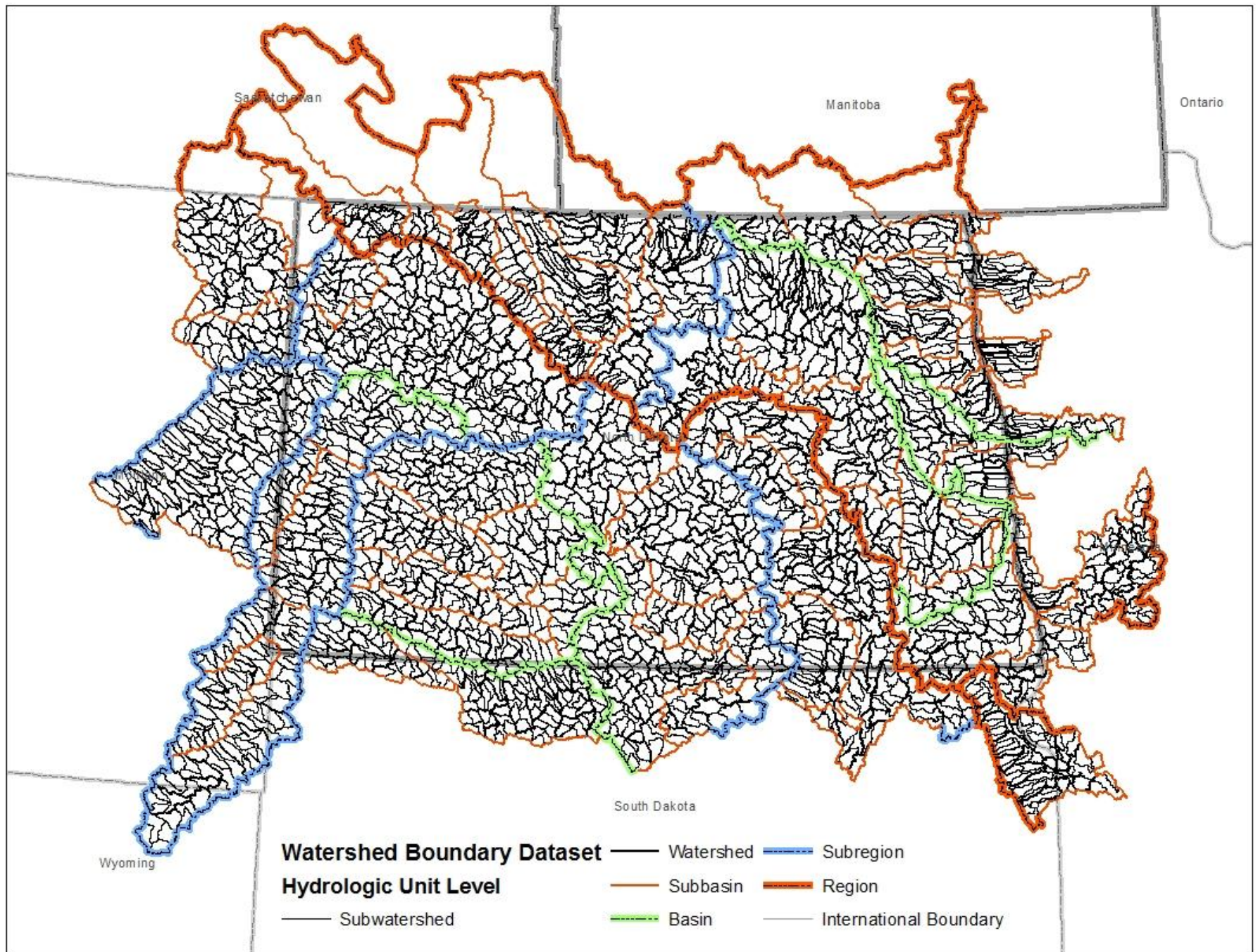
- International Cooperators

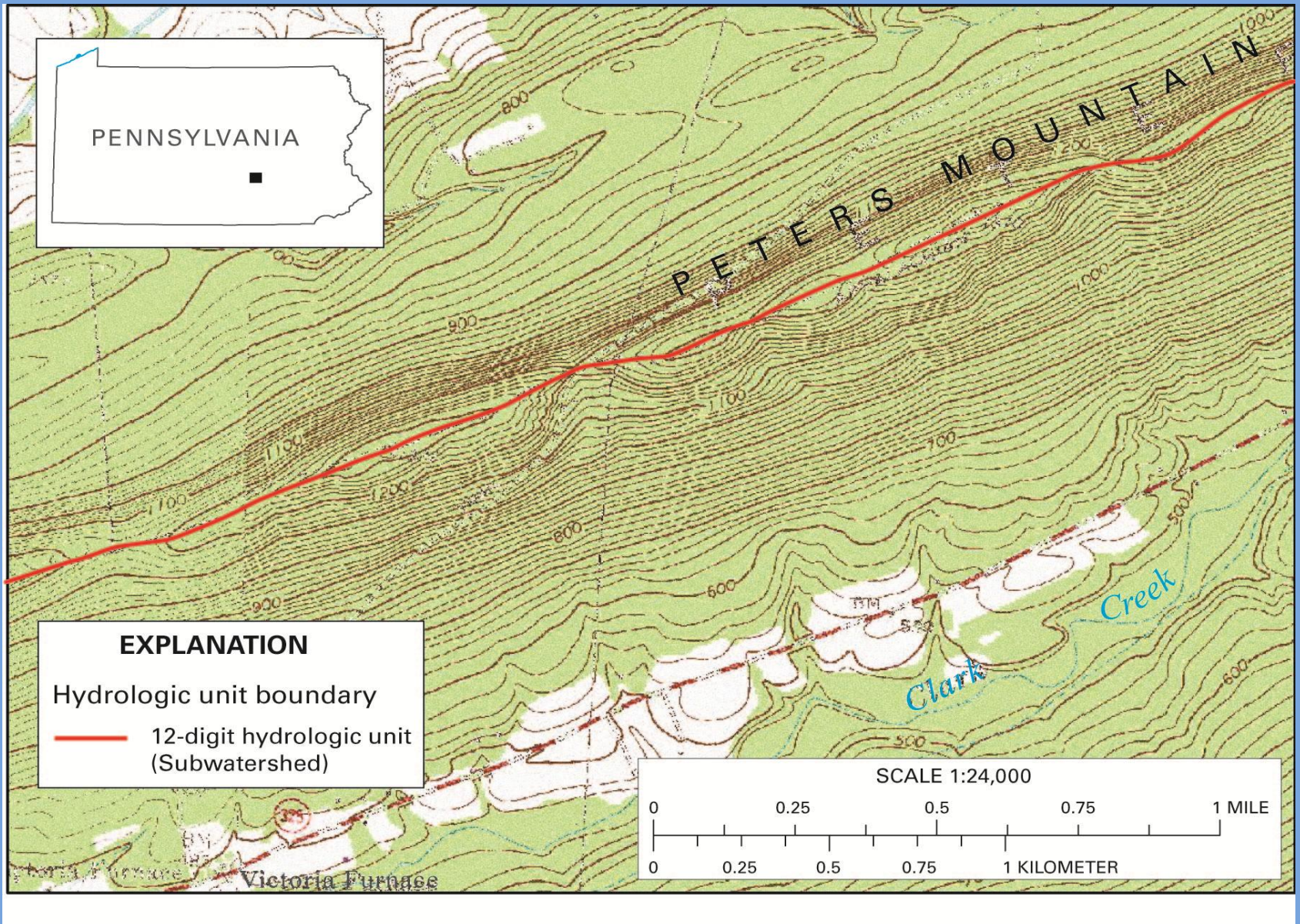
- Manitoba Water Stewardship
- Saskatchewan Water Stewardship
- Canadian Agri-Environment Services Branch - PFRA

- Regional Cooperators

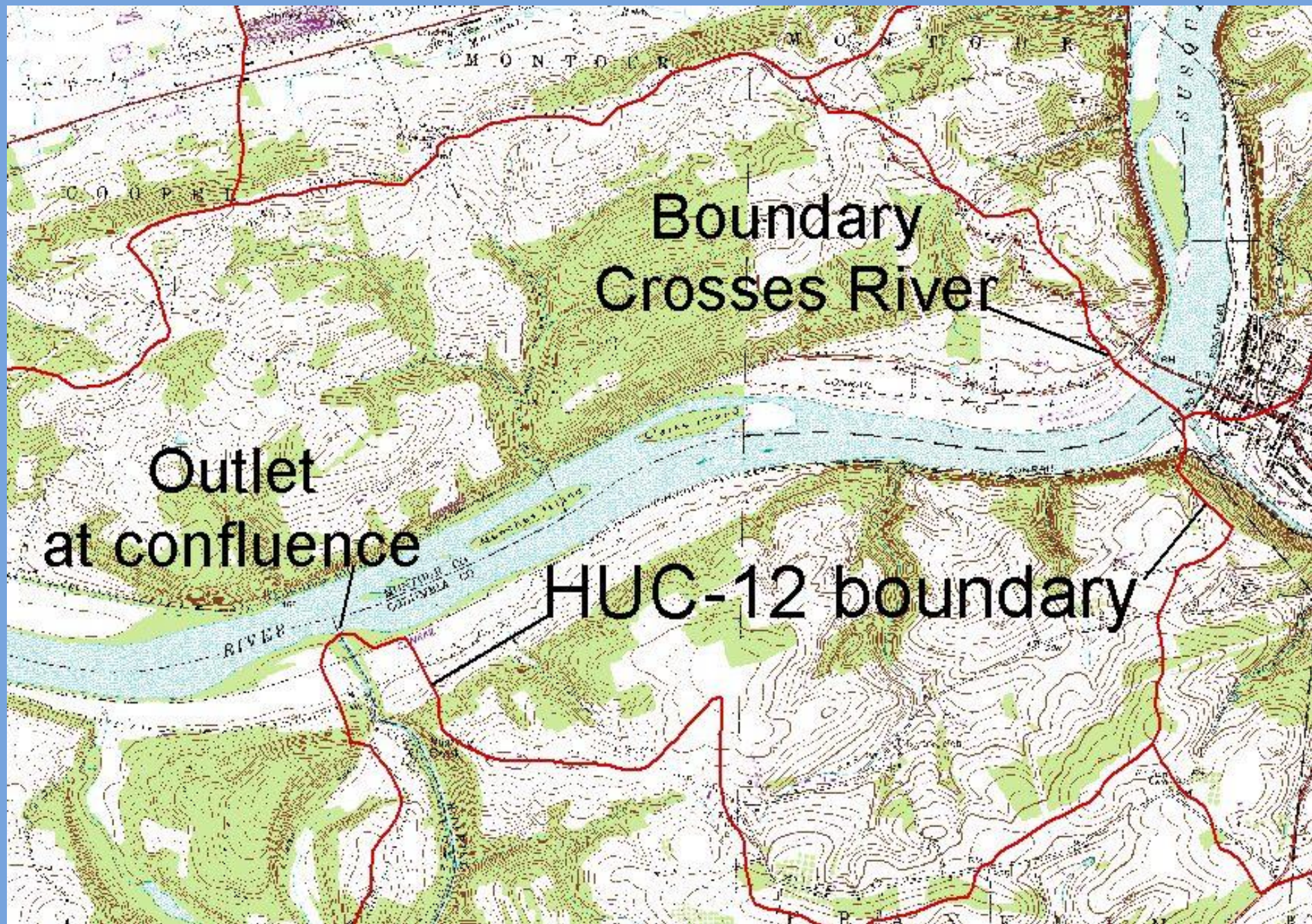
- Minnesota Department of Natural Resources
- U.S. Geological Survey – MN Water Science Center
- U.S. Geological Survey – SD Water Science Center
- U.S. Forest Service - Dakota Prairie Grasslands
- U.S. Dept. of Agriculture - Natural Resource Conservation Service (MT, ND, SD state offices)







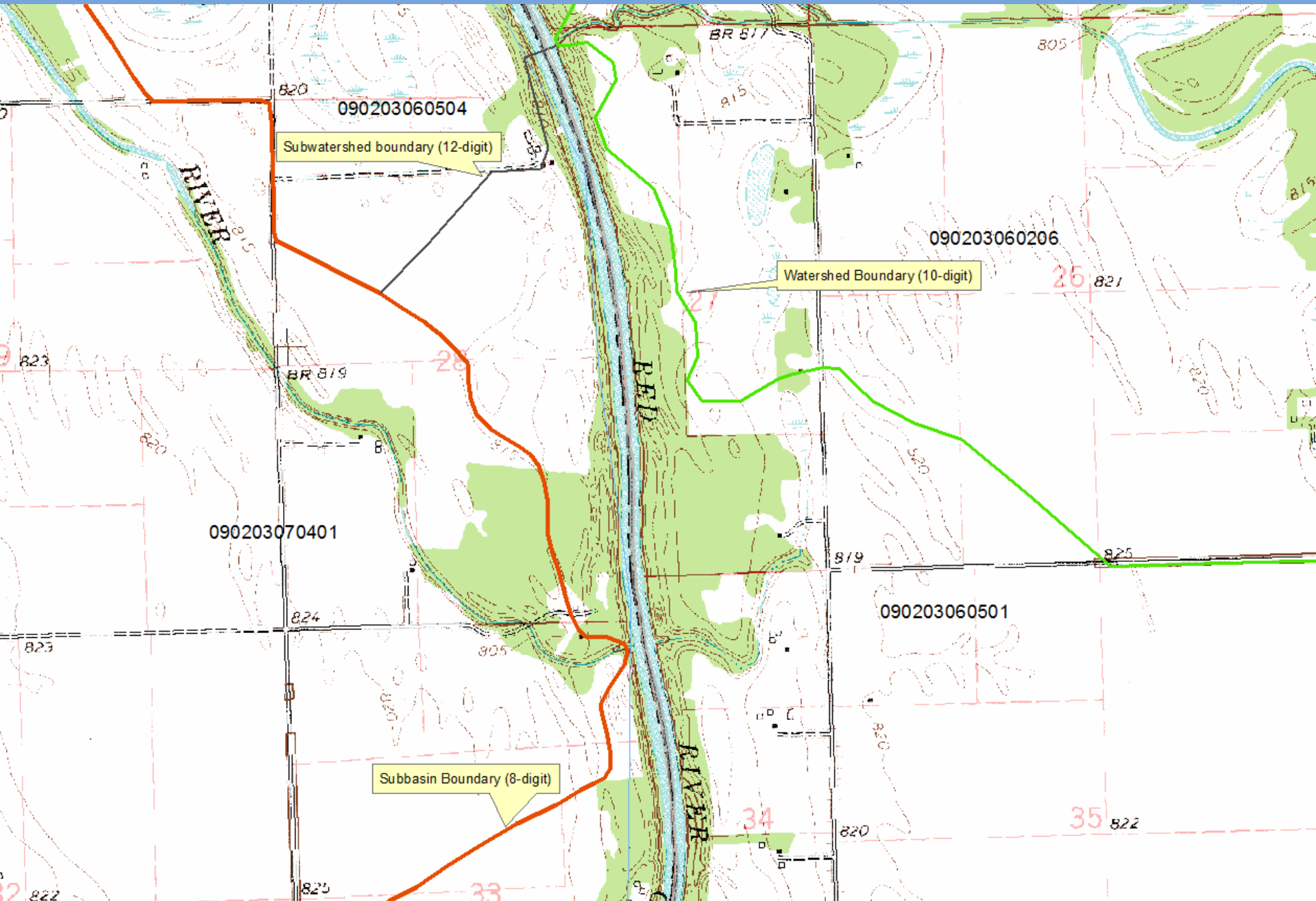
Followed Federal Standards for delineation, 1:24K map accuracy standards



Boundary
Crosses River

Outlet
at confluence

HUC-12 boundary



090203060504

Subwatershed boundary (12-digit)

090203060206

Watershed Boundary (10-digit)

090203070401

090203060501

Subbasin Boundary (8-digit)

Polygon Attribute Fields

Field Name	Definition	example
HUC_X	Numeric identifier for each level (2,4,6,8,10, and 12) of hydrologic units	
HUC_X_NAME	Name assigned to each level (2,4,6,8,10, and 12) of hydrologic units	
HU_X_TYPE	Geomorphic and other considerations used to develop the hydrologic unit.	S, C, F, M, W, I
HU_X_MOD	Two-character, uppercase abbreviation(s) for either (1) the type of modification to natural overland flow that alters the location of the boundary or (2) the special conditions GF-ground-water flow, GL-glacier, IF-ice field, OF-overbank flow, KA-karst, NC-noncontributing area, and IT-interbasin transfer that may exist in the unit.	AW, DM, LE, MA, NM, UA, RC*, WD*
NContrib_Acres	Area that does not flow toward the outlet of a hydrologic unit.	
HU_X_DS	Downstream unit; new data model will have FROM_HUC and TO_HUC	
STATES	States that the unit is located.	MT,ND,CAN
META_ID	identification of metadata, state postal code followed by numeric designation	ND10

Line Attribute Fields

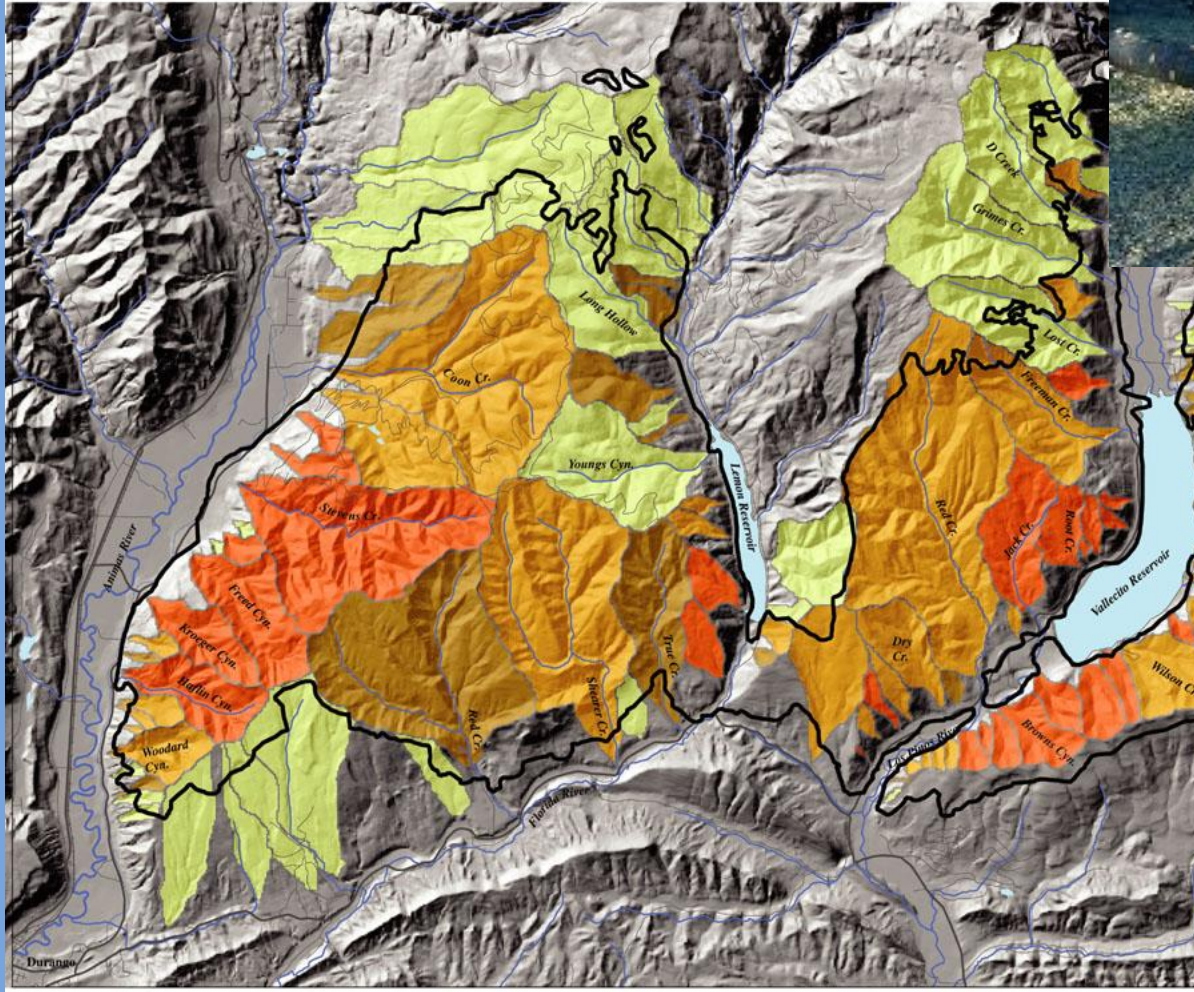
Field Name	Definition	example
HU_LEVEL	Numeric identifier for each level of hydrologic units	1,2, 3, 4, 5, 6, 7, 8
LINESOURCE	Code for the base data used for delineation of hydrologic unit boundaries which indicates if the line was created using digital raster graphics, imagery, LiDAR or some other data source.	DRG24,NAIP2010
HU_MOD	Two character abbreviation used to track special conditions applied to a specific boundary line segment. If more than one modification is used, they are listed in order of importance.	TF, AW, UA, DM
META_ID	identification of metadata, state postal code followed by numeric designation	ND10

WHAT can I do with the WBD?

Three Primary Functions Supported by the WBD

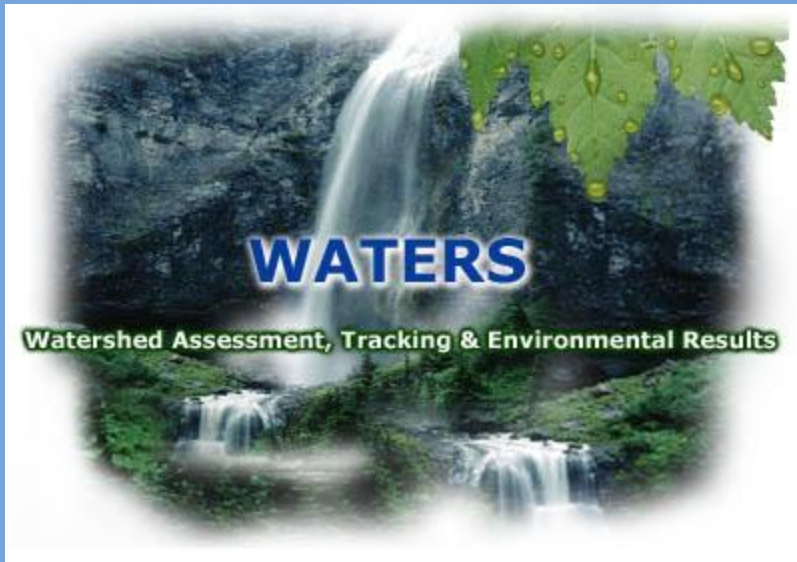
- **Water Accounting:** Assignment of a detailed, unambiguous address to any point or area in the United States small enough to be relevant to local, state and national programs and water resource initiatives
- **Depict the flow of water through the landscape:** The network connectivity of each nested level is identified within the structure of the WBD. This allows easy identification of all upstream and downstream drainage units at multiple spatial scales
- **The aggregation of Basin characteristics:** Both vertical and horizontal integration with other component datasets. The WBD will easily integrate and be interoperable with other national and local datasets

post-wildfire landslide analysis



define conditions for fire-related debris flow occurrence and develop a basin-scale model for debris flow probability.

WBD and NHD are backbone of...



WATERS (Watershed Assessment, Tracking & Environmental Results) unites water quality information that was previously available only from several independent and unconnected databases.

EPA gathers water quality information to address public concerns such as: How healthy is my watershed?

Can I drink the water?

Can I eat the fish?

Is it safe to swim in the water?

USGS StreamStats - Mozilla Firefox

streamstatsags.cr.usgs.gov/mn_ss/default.aspx?stabbr=mn&dt=1330112323507

USGS Minnesota StreamStats

Zoom To 1:351,966

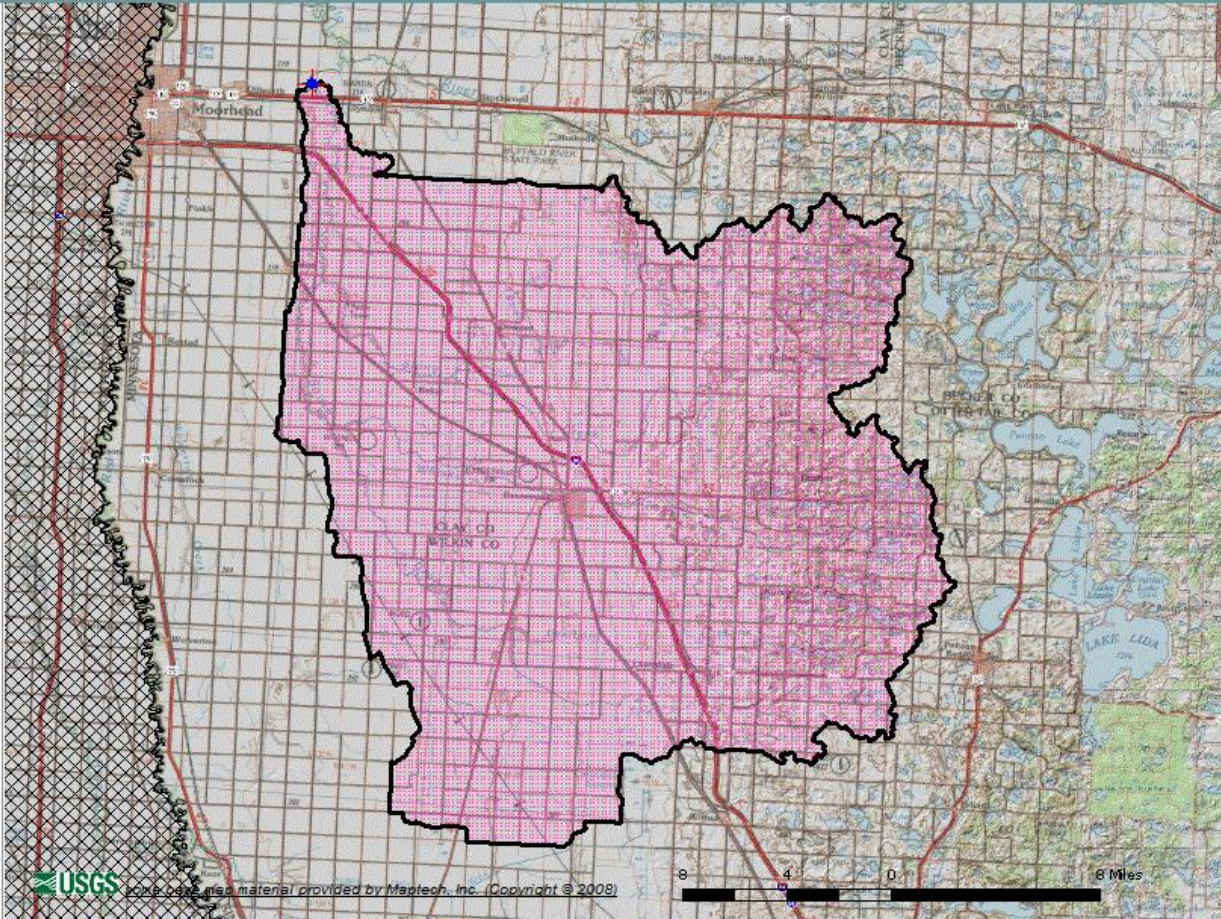
Results

Map Contents

- MN@mn_ss
 - GlobalWatershedPoint
 - Slp1085Point
 - LongestFlowPath3D
 - GlobalWatershed
 - Stream Gages
 - Stream Grid

Navigation

Overview



USGS

Accessibility FOIA Privacy Policies and Notices

U.S. Department of the Interior | U.S. Geological Survey

URL: http://streamstatsags.cr.usgs.gov/mn_ss/default.aspx

Page Contact Information: StreamStats Help

Page Last Modified: 02/24/2012 13:38:44

Streamstats Status News

USA.gov

TAKE PRIDE IN AMERICA

Interactive mapping of drainage area to a point

SPARROW Modeling of the Red, Souris and Assiniboine - Summary

The problem:

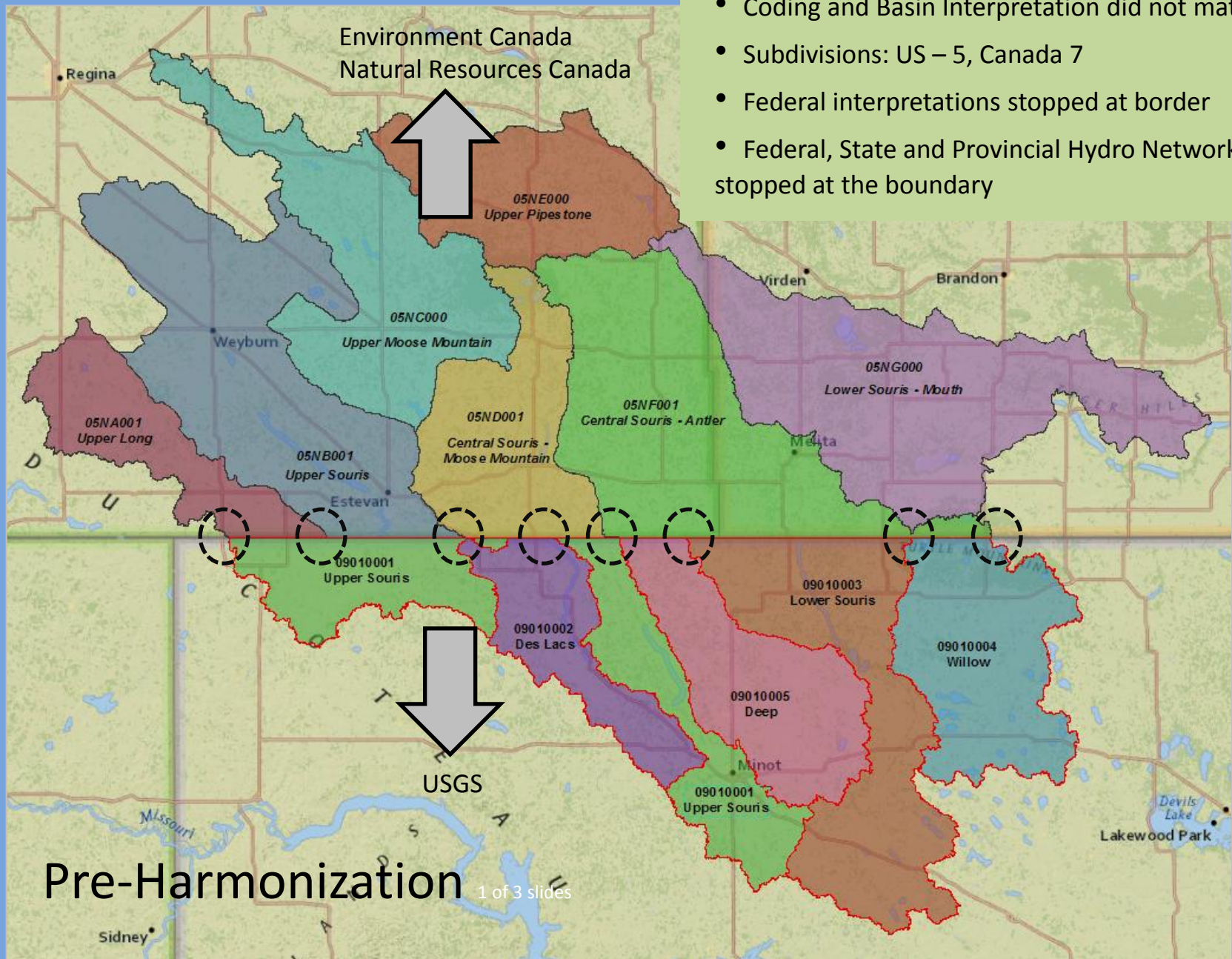
- Water quality (nutrients) a persistent problem in the Red-Assiniboine basin and L. Winnipeg
- Questions as to nutrient loads across the borders and total loads to L. Winnipeg, mitigation strategies etc.
- IJC – relatively new movement into WQ modeling (compared to Hydraulic, etc.)

The project:

- International Watersheds Initiative (IWI) – bi-national integrated approach to investigating water quality issues in Red-Assiniboine basin.
- Pilot system to demonstrate utility of the USGS SPARROW Water Quality Model in bi-national and Canadian context
- Build on IWI hydrographic and geospatial harmonization project and associated expertise
- Project ongoing – overview of model and progress thus far

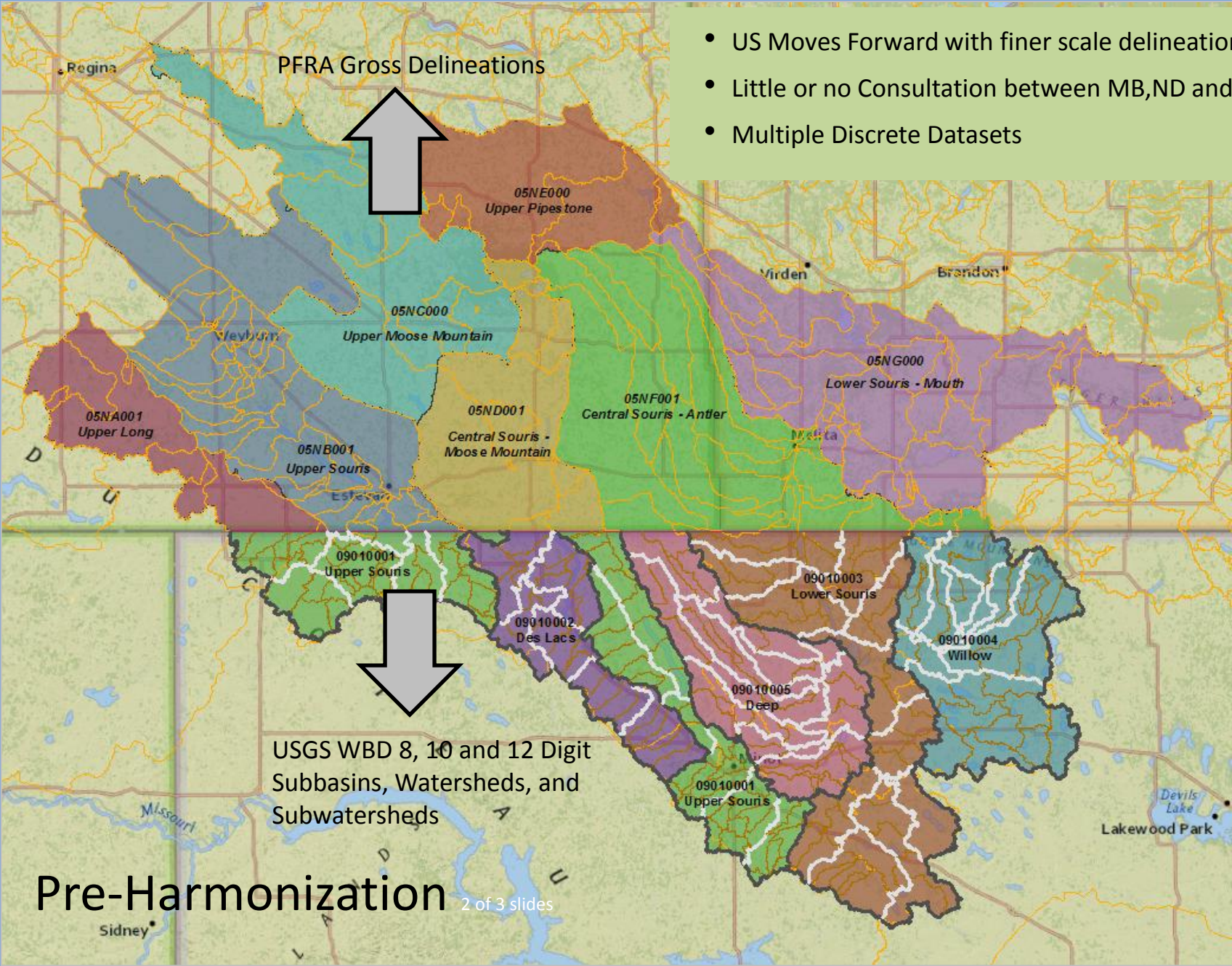


SPARROW models can be used to explain spatial patterns in monitored stream-water quality in relation to human activities and natural processes as defined by detailed geospatial information. Previous SPARROW applications have identified the sources and transport of nutrients in the Mississippi River basin, Chesapeake Bay watershed, and other major drainages of the United States.



- Coding and Basin Interpretation did not match
- Subdivisions: US – 5, Canada 7
- Federal interpretations stopped at border
- Federal, State and Provincial Hydro Networks stopped at the boundary

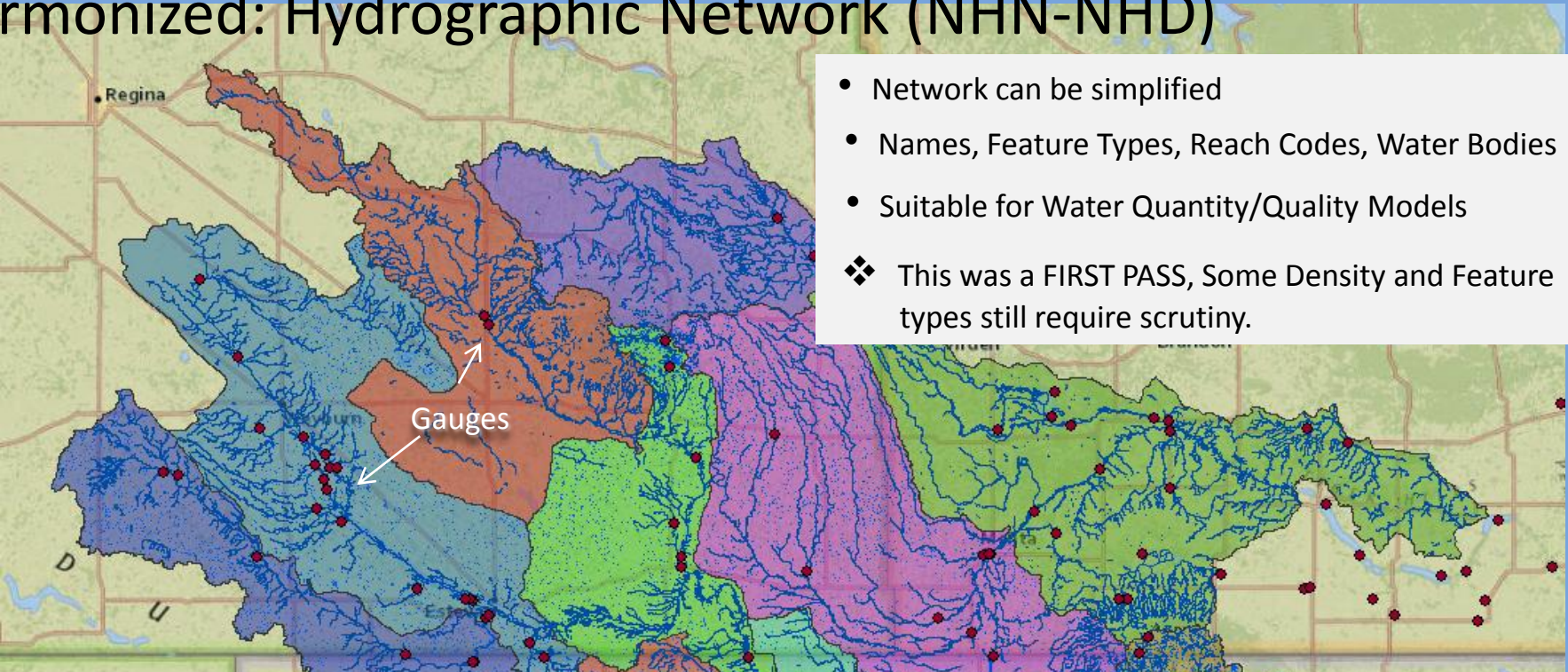
- US Moves Forward with finer scale delineations
- Little or no Consultation between MB,ND and SK
- Multiple Discrete Datasets



Pre-Harmonization 2 of 3 slides

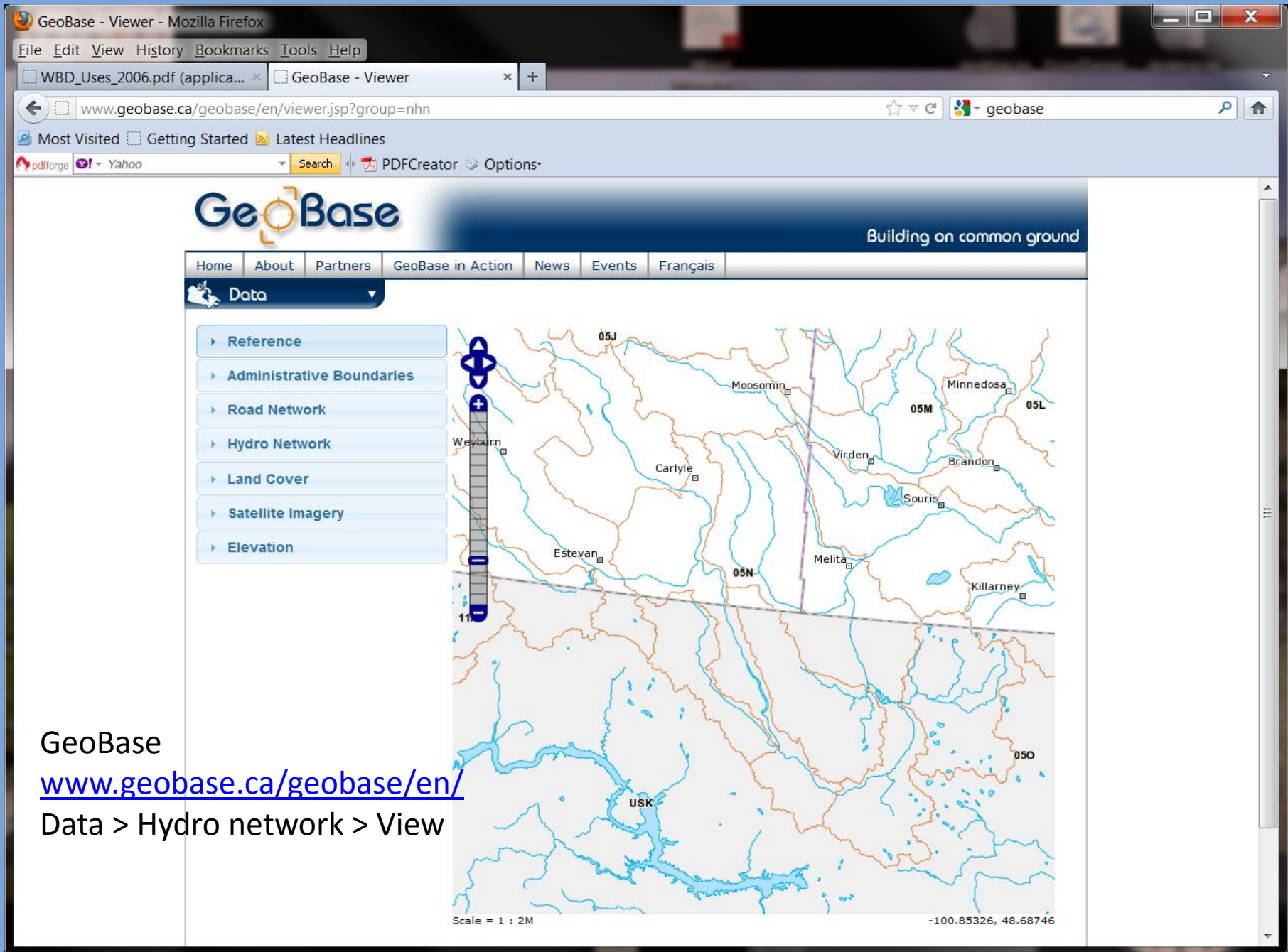
Harmonized: Hydrographic Network (NHN-NHD)

- Network can be simplified
- Names, Feature Types, Reach Codes, Water Bodies
- Suitable for Water Quantity/Quality Models
- ❖ This was a FIRST PASS, Some Density and Feature types still require scrutiny.



OBJECTID*	Shape*	ComID	Permanant Identifier	EDate	Resolution	GRS_ID	GRS_Name	LengthKM	ReachCode	FlowDir	WBAID
1	Point	17390471	4736606-8591-4740-4161-78318893862	8/20/2011 11:59:53 AM	high	00778125	Saint Mary River	2.824	0904000100910	W/NoDigtz	
2	Point	169148503	91997000C-4238-4988-2022-270C3F970007	8/20/2011 1:30:31 PM	high	-1	Pothole Creek	1.769	09040001010704	W/NoDigtz	-Halt
3	Point	169148464	02642620-1-4088-4137-4726-85C108642002	8/20/2011 1:43:39 PM	high	-1	St. Mary River	6.275	09040001014952	W/NoDigtz	-Halt
4	Point	13623321	13623321	8/20/2011 2:43:34 PM	high	00778125	Saint Mary River	2.143	09040001009056	W/NoDigtz	
5	Point	169148462	803664AC-FA0A-4E42-80C6-F264767999E1	8/20/2011 1:29:49 PM	high	-1	Pothole Creek	1.236	09040001010291	W/NoDigtz	-Halt
6	Point	169150198	02C748E3-CFFC-4825-8941-0741737F1E2	8/20/2011 4:00:50 PM	high	-1	St. Mary River	6.828	09040001010231	W/NoDigtz	-Halt
7	Point	169151691	80C52364-F0F3-408A-84D1-414207F3E088	8/20/2011 1:45:57 PM	high	-1	St. Mary River	5.584	09040001012927	W/NoDigtz	-Halt
8	Point	169149622	02C73002-80D7-44F3-850A-022641F8F6A1	8/20/2011 1:42:19 PM	high	-1	Pothole Creek	4.427	09040001010153	W/NoDigtz	-Halt
9	Point	169149384	89805455-2B10-4048-9489-F288465405A1	8/20/2011 4:07:24 PM	high	-1	Rolph Creek	6.022	09040001019772	W/NoDigtz	-Halt
10	Point	169148171	95428461-8C37-4138-82E4-53188B8EAD7F	8/20/2011 1:00:22 PM	high	-1	St. Mary River	1.014	09040001010331	W/NoDigtz	-Halt
11	Point	169152102	02C7379D-0966-487F-841C-0A4038884A48	8/20/2011 1:41:24 PM	high	-1	St. Mary River	3.175	09040001013902	W/NoDigtz	-Halt
12	Point	169147738	84AEC18A-EDF6-4436-8C9E-809C1861058C8	8/20/2011 1:38:28 PM	high	-1	St. Mary River	6.212	09040001010844	W/NoDigtz	-Halt
13	Point	169148140	0A8A7560-086C-436D-8C01-A1804D088022	8/20/2011 1:42:40 PM	high	00778125	Rolph Creek	6.951	09040001013726	W/NoDigtz	-Halt
14	Point	13623479	13623479	8/20/2011 1:26:09 PM	high	00778125	Saint Mary River	8.442	09040001009794	W/NoDigtz	
15	Point	13623286	13623286	8/20/2011 1:27:35 PM	high	00778125	Saint Mary River	2.896	09040001009959	W/NoDigtz	-Halt
16	Point	169151161	10151044-FA3A-4C11-8E18-1C8880C10788	8/20/2011 1:28:44 PM	high	-1	Pothole Creek	6.296	09040001010290	W/NoDigtz	-Halt
17	Point	169148062	834C0391-0D07-4997-4D54-048448430161	8/20/2011 1:45:15 PM	high	-1	Pothole Creek	6.095	09040001011054	W/NoDigtz	-Halt
18	Point	169150009	0249C1A4-1839-44E6-8888-0D8A12FCC7D	8/20/2011 1:46:15 PM	high	-1	Rolph Creek	1.954	09040001011093	W/NoDigtz	-Halt
19	Point	13623411	13623411	8/20/2011 1:31:19 PM	high	00778125	Saint Mary River	6.391	09040001010739	W/NoDigtz	
20	Point	13623486	13623486	8/20/2011 1:24:45 PM	high	00778125	Saint Mary Canal	5.578	09040001009107	W/NoDigtz	
21	Point	169148370	8036980D-9428-48E4-8D3A-5D04C4820C9F	8/20/2011 1:30:30 PM	high	-1	Rolph Creek	2.64	09040001012739	W/NoDigtz	-Halt
22	Point	169148622	094C203A-F957-4EE1-8E28-10E29C001713	8/20/2011 1:51:42 PM	high	-1	St. Mary River	6.162	09040001014492	W/NoDigtz	-Halt
23	Point	169147774	71FEAF66-618A-44AA-ASCC-8E93808E4A88	8/20/2011 1:31:53 PM	high	-1	St. Mary River	6.308	09040001011668	W/NoDigtz	-Halt
24	Point	169151550	9F388863-2905-4AEB-8196-37818883F222	8/20/2011 1:21:40 PM	high	00778125	Saint Mary River	6.122	09040001012003	W/NoDigtz	-Halt
25	Point	13623410	13623410	8/20/2011 1:25:16 PM	high	00778125	Saint Mary River	8.465	09040001009602	W/NoDigtz	
26	Point	169147490	84A9F315-C8B8-4CDE-888E-4E4AC0588144	8/20/2011 1:35:10 PM	high	-1	Lee Creek	6.48	09040001014084	W/NoDigtz	-Halt
27	Point	169151762	02C72048-02CA-4951-88E6-00968F022108	8/20/2011 1:19:00 PM	high	-1	Lee Creek	3.062	09040001011840	W/NoDigtz	-Halt
28	Point	169148478	8E44E43F-20F4-49A3-461A-42818888866A	8/20/2011 1:30:10 PM	high	-1	St. Mary River	6.189	09040001011018	W/NoDigtz	-Halt
29	Point	13623268	13623268	8/20/2011 1:28:50 PM	high	00778125	Willow Cr	5.91	09040001009719	W/NoDigtz	-Halt
30	Point	169147770	04193149-F2F1-4E4E-AF3A-778289520860	8/20/2011 1:37:24 PM	high	-1	St. Mary River	6.177	09040001011714	W/NoDigtz	-Halt
31	Point	13623314	13623314	8/20/2011 1:29:00 PM	high	00778125	Saint Mary River	6.318	09040001009794	W/NoDigtz	
32	Point	169152158	04A4A03F-8AFC-4C1A-1A1E-821804070E9A	8/20/2011 1:15:15 PM	high	-1	St. Mary River	2.285	09040001011444	W/NoDigtz	-Halt
33	Point	169148205	041107FE-0E4F-431F-9178-87A052852368	8/20/2011 1:45:20 PM	high	-1	Pothole Creek	6.272	09040001014505	W/NoDigtz	-Halt
34	Point	13623287	13623287	8/20/2011 1:24:48 PM	high	00778125	Saint Mary River	6.561	09040001009162	W/NoDigtz	
35	Point	169147770	02E1120F-2968-47AE-8E49-F852E4177C11	8/20/2011 1:16:31 PM	high	-1	St. Mary River	6.004	09040001011558	W/NoDigtz	-Halt
36	Point	169149102	81A2023F-37FA-40E4-8EE6-818E1C98C480	8/20/2011 1:36:03 PM	high	-1	Pothole Creek	6.205	09040001011684	W/NoDigtz	-Halt
37	Point	169150559	02C408F8-3E0B-47E8-AF02-4E10710FC260	8/20/2011 1:32:07 PM	high	-1	St. Mary River	6.52	09040001012363	W/NoDigtz	-Halt
38	Point	169151113	81A4881B-2372-4297-8E38-B0C19FC08A1	8/20/2011 1:29:10 PM	high	-1	Rolph Creek	1.171	09040001010277	W/NoDigtz	-Halt
39	Point	169147646	00C332E1-8A32-4E16-8345-47AC02060E4A	8/20/2011 1:45:30 PM	high	-1	Pothole Creek	4.428	09040001011069	W/NoDigtz	-Halt
40	Point	169150027	02F810AF-21CB-4AEB-B0C1-0747027F9911	8/20/2011 4:06:32 PM	high	-1	Rolph Creek	6.221	09040001011570	W/NoDigtz	-Halt

First Pass Network Harmonization: Network connected within a 200 KM buffer- Networks are topographically identical- attributes will differ according to which Data set is used.



GeoBase

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Data > Hydro network > View

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GeoBase

Building on common ground

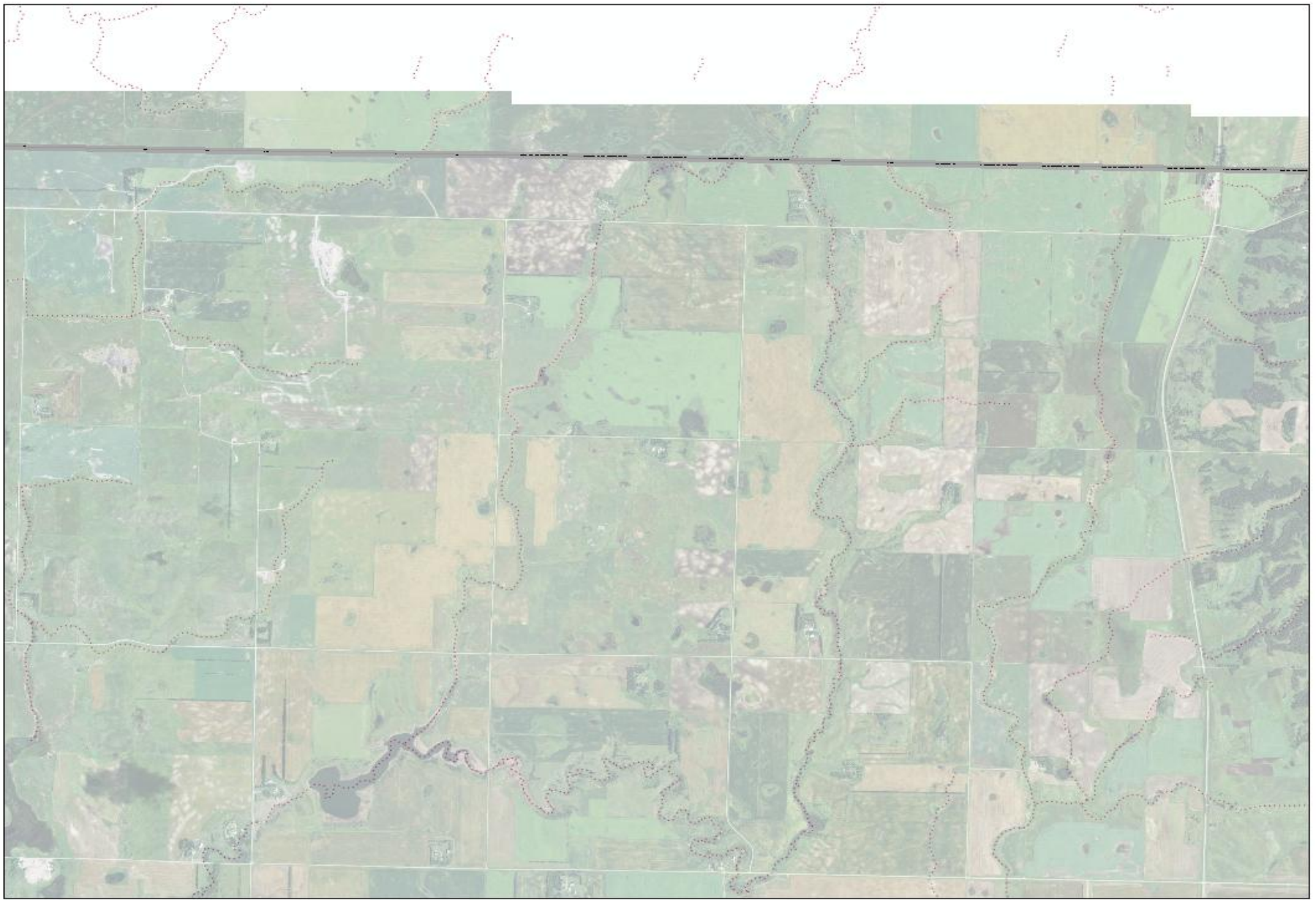
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Data

- Reference
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 - Hydrographic Names
- Analysis Tools**
 - Upstream
 - Downstream
 - Result
 - Clear all results
- Land Cover
- Satellite Imagery
- Elevation

Scale = 1 : 406K

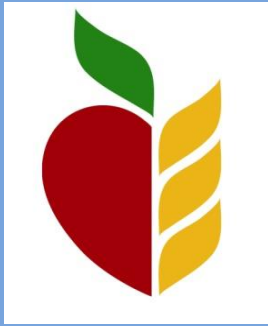
-102.55180, 48.75638



add GeoBase Hydro Network to ArcGIS map document using WMS (Web Mapping Service)

- 💧 WBD is surface area drainage for the nation.
- 💧 WBD provides framework data for the federal and state agencies that deal with natural resources.
- 💧 WBD was consistently created across the nation using Federal Standards.

💧 *We're all on the same page*



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