Variable Width Riparian Areas Mapping: A Robust GIS Approach

Wednesday November 19th , 3.00pm-5.00pm EDT.

Association of State Wetland Managers

Wetlands Mapping Consortium Webinars

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Outlines

- Introduction.
- Riparian definitions.
- Previous approaches vs. New approach.
- Model inputs and demonstration of the tool.
- Data preparation.
- How the model works.
- Sample results.
- Model parameters.
- Updates.
- Questions.

Introduction

- Riparian areas are dynamic, transitional ecosystems between aquatic and terrestrial ecosystems with well defined vegetation and soil characteristics.
- Riparian areas have vegetation communities along stream banks often delineate riparian boundaries however geology, soil chemistry, hydrologic changes and animal habitats also need to be considered (Niaman an McClain 2005).
- A riparian zone is “Land inclusive of hydrophytes and/or with soil that is saturated by ground water for at least part of the growing season within the rooting depth of potential native vegetation”. This definition includes wetlands as defined by Cowardin et al. (1979) and adjacent lands that have a moderate or well balanced supply of moisture (Mitsch and Gosselink, 1993).

Riparian Definition

- Riparius, the original Latin term for riparian areas means " of or belonging to the bank of a river" Naiman et al. (1997).
- More than 35 terminologies for riparian areas Fischer et al. (2001).
- Verry et al.(2004) summarized 100 years of definitions and concepts published in literature.

Riparian Definition

- "… a three-dimensional space of interaction that includes terrestrial and aquatic ecosystems that extend down into the groundwater, up above the canopy, outward across the floodplain, up the near-slopes that drain to the water, laterally into the terrestrial ecosystem, and along the water course at a variable width"

(Verry and others 2004)

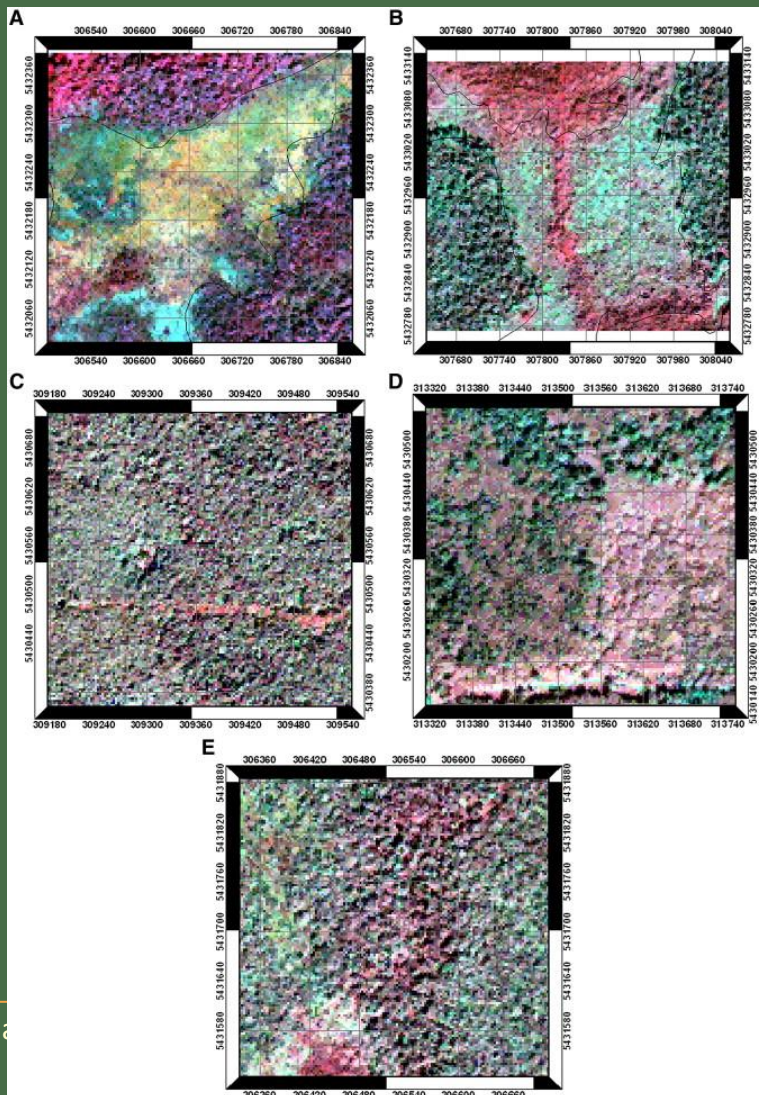
Previous Approaches

- Palik and Others (2000) showed that fixed width buffer riparian delineation approach is inadequate. Fixed width buffers do not naturally imitate natural riparian corridors since they have no functional relationship to naturally varying watercourse.
- Suggested buffer width guidelines from the Minnesota Forest Resources Council were evaluated by Skally and Sagor (2001) in a single-case pilot study. Their report described the difficulty in using the designated guidelines of fixed width buffers because many watercourse variables, such as site condition and water body type, need to be incorporated into the delineation process. Their research also concluded that the riparian ecotone boundary was, on average, 2.5 times farther from the stream than the suggested fixed width buffer.

Previous Approaches

Previous Approaches

- Two primary factors that all riparian areas are dependent on: the watercourse and its associated floodplain.
- Remote Sensing approach.
  - ✓ expensive to acquire data.
  - ✓ needs remote sensing expertise.
  - ✓ Limited coverage.
  - ✓ Site specific.
  - ✓ Share and compare data is very hard.



From Johansen et al. 2007

Our Approach

- A new simple practical mapping approach utilizing available open source geospatial data and the geospatial capabilities of python language under ArcGIS Desktop.
- The model accounts for river/stream watercourse and its associated floodplain.
- Optional data inputs provides extended riparian mapping and attributes such as riparian wetlands, riparian soil type, and riparian land cover classes.
- The model is independent of landform.
- The model is an ArcGIS toolbox with a simple interface that can be easily added, shared, and used by a non GIS expert.
- The model results can be easily shred and results can be replicated.

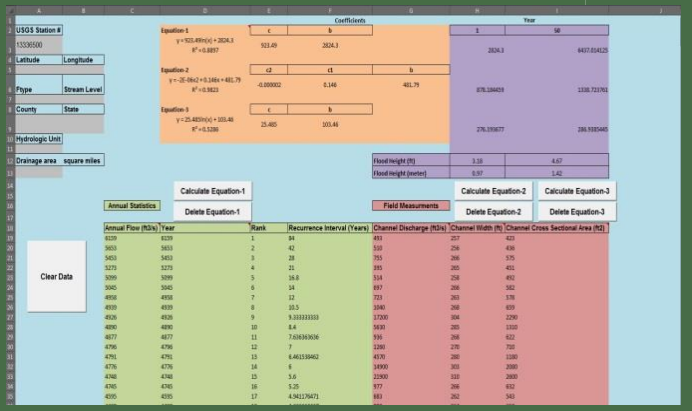
Model Inputs

- Open source geospatial data.
- Available by federal agencies with known methodologies and known accuracies.
- The data continuously maintained and updated with a wall to wall coverage such as National Hydrography Dataset, National elevation Dataset, National Wetlands Inventory, SURRGO, National Land Cover Database, and Cropland Data Layer.

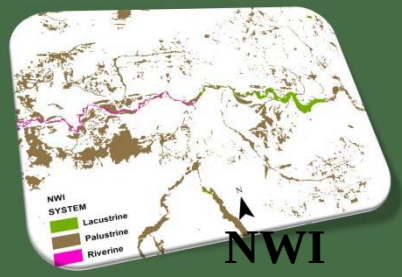
Input Data	Sources
Streams, Lakes, and Watersheds	USGS National Hydrology Dataset (NHD) http://nhd.usgs.gov/
50 year Flood Height	Calculated utilizing Masson (2007)
Wetlands	National Wetlands Inventory (NWI) http://www.fws.gov/wetlands/Data/Data-Download.html
Soil	Natural Resources Conservation Service (NRCS) http://soildatamart.nrcs.usda.gov/ or http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm
Elevation	National elevation Dataset http://ned.usgs.gov/ GIS Data Depot http://data.geocomm.com/
Land Cover	National Land Cover Database http://www.mrlc.gov/ Corp land Data Layer http://www.nass.usda.gov/research/Cropland/SARS1a.htm

*Also most of the data mentioned above can be downloaded at http://datagateway.nrcs.usda.gov/

Streams



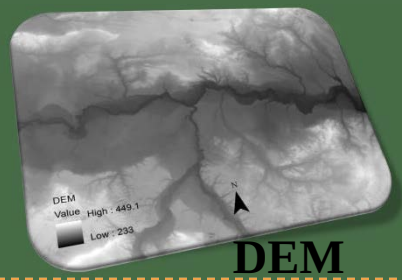
50 YFH



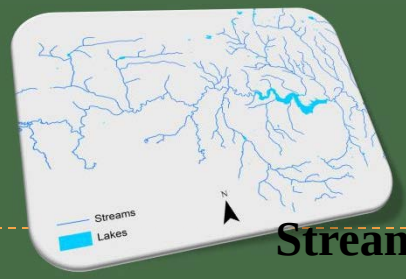
NWI

Soils

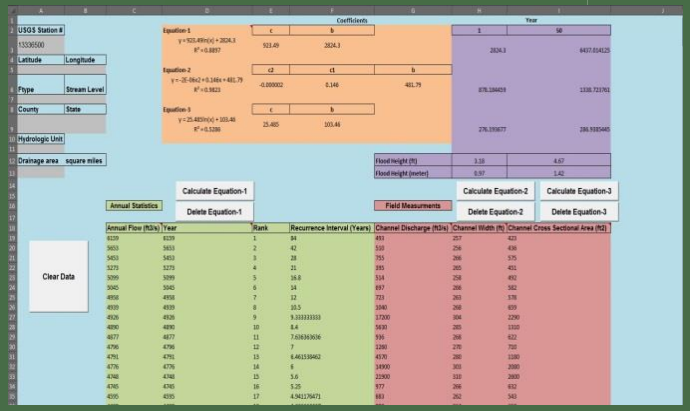
NLCD



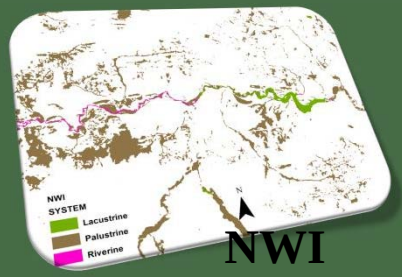
DEM



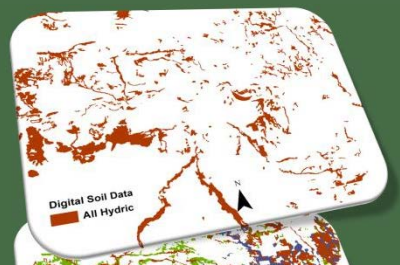
Streams

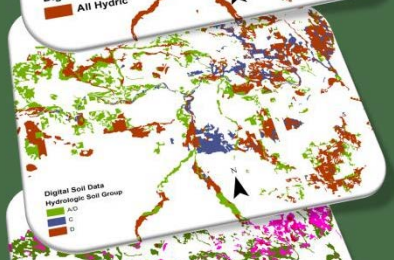


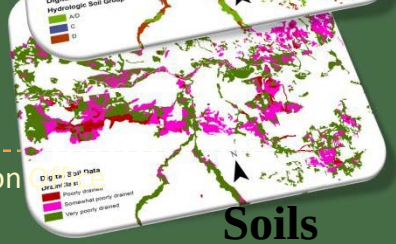
50 YFH



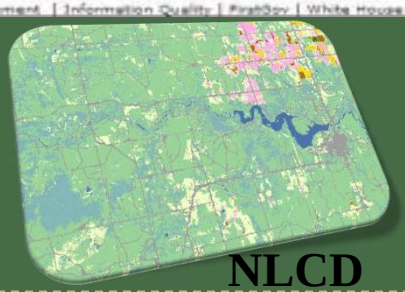
NWI



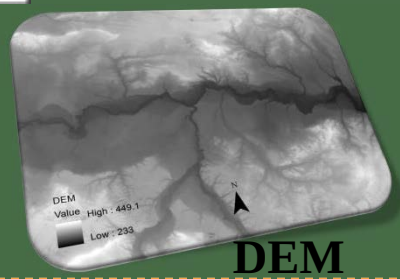




Soils



NLCD



DEM


Riparian Buffer Delineation Model V2.3
Streams Layer
Sreams Criteria
Lakes Layer
Lakes Buffer (Meters), Ilhardt and Others (2000)
30.48
Watershed Layer
Length of Transects Vector (Meters)
DEM Dataset
50 Years Flood Height (Meters)
Use Majority Filter (optional)
NWI Layer (optional)
National Wetlands Inventory Criteria (optional)
Digital Soil Data - Hydric Soil Rating (optional)
Hydric Soil Rating Selection Criteria (optional)
Digital Soil Data - Drainage Class (optional)
Drainage Class Selection Criteria (optional)
Digital Soil Data - Hydrologic Soil Group (optional)
Hydrologic Soil Group Selection Criteria (optional)
Classified Raster Layer (NLCD or CDL Raster Layer) (optional)
OK
Cancel
Environments...
<< Hide Help
Tool Help
Riparian Buffer Delineation Model V2.3
Riparian zones are dynamic, transitional ecosystems between aquatic and terrestrial ecosystems with well-defined vegetation and soil characteristics. By hydrologically defining a riparian ecotone to occur at the 50-year flood height and incorporating digital elevation data, this model utilizes the spatial modeling capabilities of ArcMap GIS to map riparian zones accurately and efficiently. The approach offers advantages over other previously used methods by better characterizing the watercourse and its associated floodplain. The Riparian Buffer Delineation Model (RBDM) utilizes spatial data readily available from Federal and State agencies and geospatial clearinghouses. It is a scale free model.
The model is copyrighted by MICHIGAN TECHNOLOGICAL UNIVERSITY. If problems are encountered when running the model, contact Sinan Abood(saabood@mtu.edu) or Ann Maclean(amaclean@mtu.edu) for technical support. There is a sample dataset available upon request.
Forest Resources & Environmental Science
MichiganTech
Create the Future
ArcToolbox
ArcToolbox
3D Analyst Too
Analysis Tools
Cartography T
Conversion To
Data Interopera
Data Managem
Editing Tools
Geocoding To
Geostatistical A
Hillshade Tools
Hillshade Tools
Linear Referenc
Multidimensio
Network Analy
Parcel Fabric T
Riparian Buffer
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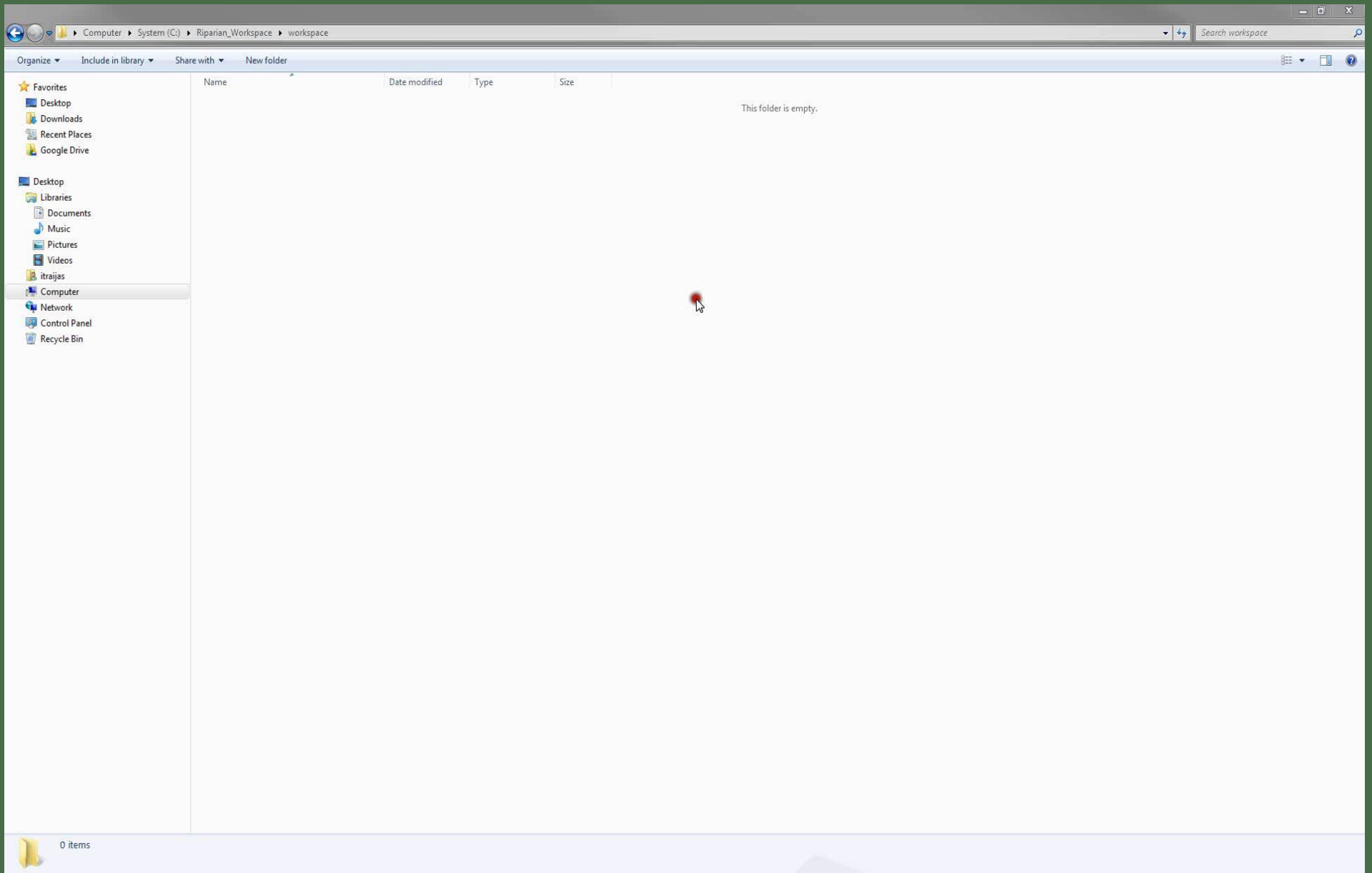
Schematics To
Server Tools
Spatial Analyst
Spatial Statistic
Tracking Analy

Demo


Computer ▸ System (C:) ▸ Riparian_Workspace ▸ workspace
Search workspace
Organize
Include in library
Share with
New folder
Favorites
Desktop
Downloads
Recent Places
Google Drive
Desktop
Libraries
Documents
Music
Pictures
Videos
itraijas
Computer
Network
Control Panel
Recycle Bin
Name
Date modified
Type
Size
This folder is empty.
0 items

Data Preparation

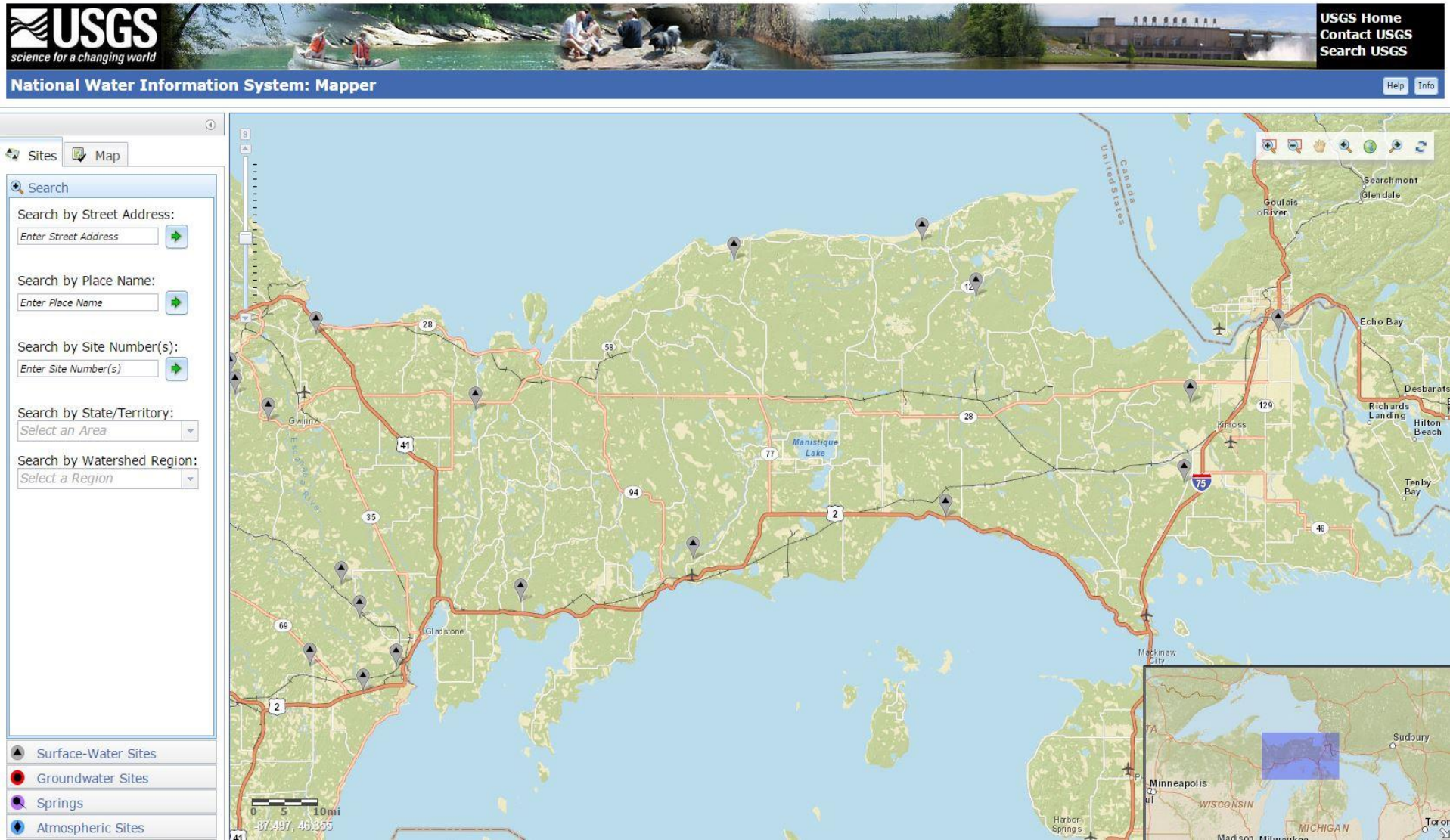
- Hydrological estimation
- Streams positional inaccuracies.
- Soils data.
- Prepare the model file geodatabase.

Data Preparation-Hydrological Estimation

- The 50-year floodplain is the optimal hydrologic descriptor of riparian ecotone along moving watercourse as determined by Ilhardt et al. (2000).
- This flood recurrence was selected because in most cases the 50-year flood height intersects the first terrace or other upward sloping surface and supports the same microclimate and geomorphology as the stream channel.
- We calculate the 50-year flood height using a methodology developed by Mason (2007).

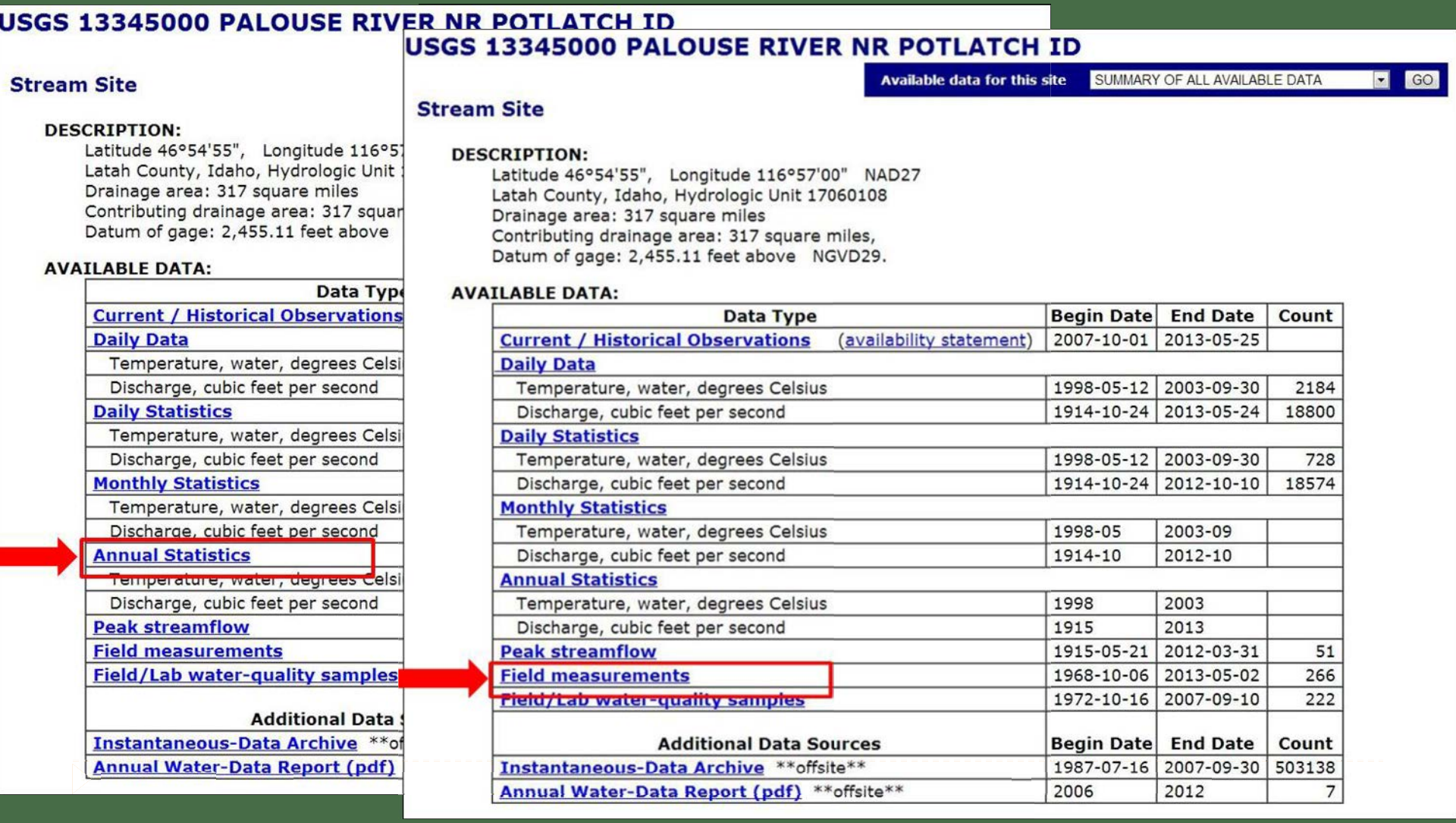
Data Preparation-Hydrological Estimation

- Downloading water data from USGS gauges at USGS water data website http://maps.waterdata.usgs.gov/mapper/index.html



Data Preparation-Hydrological Estimation

- Click on the gauging station of interest and a new page will open with the station information including its gauge number.



USGS 13345000 PALOUSE RIVER NR POTLATCH ID

Stream Site

DESCRIPTION:
Latitude 46°54'55", Longitude 116°57
Latah County, Idaho, Hydrologic Unit
Drainage area: 317 square miles
Contributing drainage area: 317 squar
Datum of gage: 2,455.11 feet above

AVAILABLE DATA:

Data Type
Current / Historical Observations
Daily Data
Temperature, water, degrees Celsi
Discharge, cubic feet per second
Daily Statistics
Temperature, water, degrees Celsi
Discharge, cubic feet per second
Monthly Statistics
Temperature, water, degrees Celsi
Discharge, cubic feet per second
Annual Statistics
Temperature, water, degrees Celsi
Discharge, cubic feet per second
Peak streamflow
Field measurements
Field/Lab water-quality samples
Additional Data
Instantaneous-Data Archive **of
Annual Water-Data Report (pdf)

USGS 13345000 PALOUSE RIVER NR POTLATCH ID

Available data for this site: SUMMARY OF ALL AVAILABLE DATA — GO

Stream Site

DESCRIPTION:
Latitude 46°54'55", Longitude 116°57'00" NAD27
Latah County, Idaho, Hydrologic Unit 17060108
Drainage area: 317 square miles
Contributing drainage area: 317 square miles,
Datum of gage: 2,455.11 feet above NGVD29.

AVAILABLE DATA:

Data Type	Begin Date	End Date	Count
Current / Historical Observations (availability statement)	2007-10-01	2013-05-25	
Daily Data			
Temperature, water, degrees Celsius	1998-05-12	2003-09-30	2184
Discharge, cubic feet per second	1914-10-24	2013-05-24	18800
Daily Statistics			
Temperature, water, degrees Celsius	1998-05-12	2003-09-30	728
Discharge, cubic feet per second	1914-10-24	2012-10-10	18574
Monthly Statistics			
Temperature, water, degrees Celsius	1998-05	2003-09	
Discharge, cubic feet per second	1914-10	2012-10	
Annual Statistics			
Temperature, water, degrees Celsius	1998	2003	
Discharge, cubic feet per second	1915	2013	
Peak streamflow	1915-05-21	2012-03-31	51
Field measurements	1968-10-06	2013-05-02	266
Field/Lab water-quality samples	1972-10-16	2007-09-10	222

Additional Data Sources	Begin Date	End Date	Count
Instantaneous-Data Archive **offsite**	1987-07-16	2007-09-30	503138
Annual Water-Data Report (pdf) **offsite**	2006	2012	7

Data Preparation-Hydrological Estimation

- Calculate the 50-year flood height using the Hydrologic Estimation.xlsm file developed according to Mason (2007) and Bedient $ Huber (2002).

	A	B	C	D	E	F	G	H	I
1						Coefficients		Year	
2	USGS Station #			Equation-1	c	b		1	50
3	13336500			y = 923.49ln(x) + 2824.3 R² = 0.8897	923.49	2824.3		2824.3	6437.014125
4	Latitude	Longitude							
5				Equation-2	c2	c1	b		
6	Ftype	Stream Level		y = -2E-06x2 + 0.146x + 481.79 R² = 0.9823	-0.000002	0.146	481.79	878.184459	1338.723761
7									
8	County	State		Equation-3	c	b			
9				y = 25.485ln(x) + 103.46 R² = 0.5286	25.485	103.46		276.193677	286.9385445
10	Hydrologic Unit								
11									
12	Drainage area	square miles							
13									

Calculate Equation-1 | Calculate Equation-2 | Calculate Equation-3

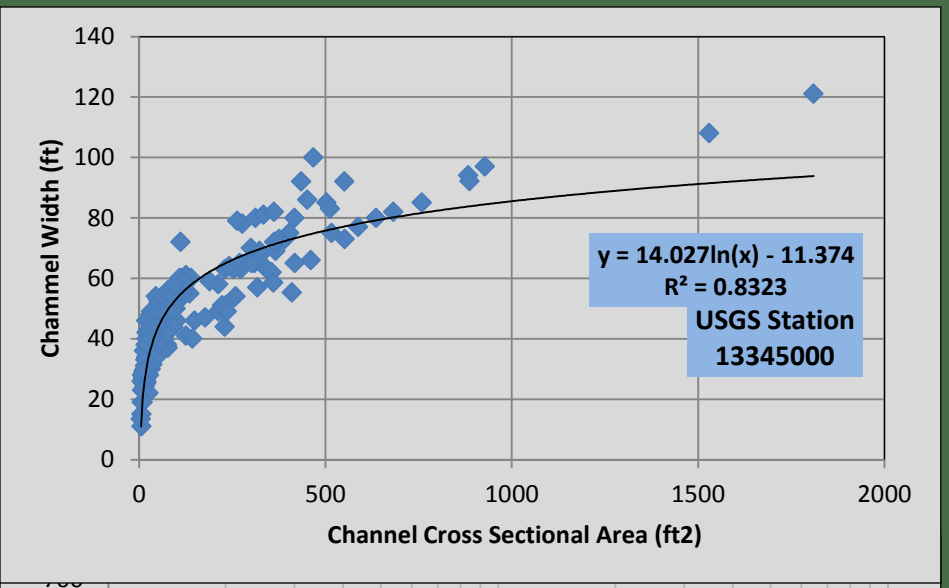
Annual Statistics | Delete Equation-1 | Field Measurments | Delete Equation-2 | Delete Equation-3

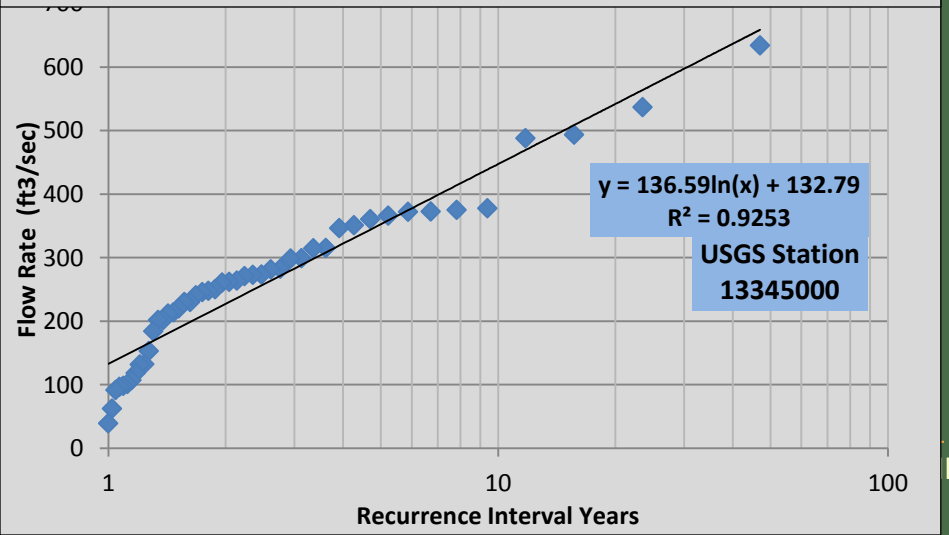
Clear Data

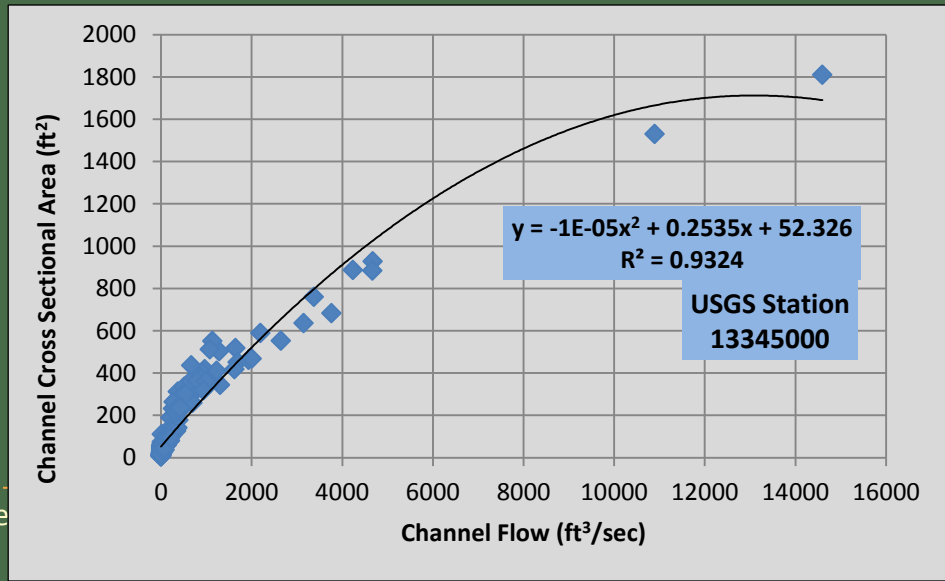
18	Annual Flow (ft3/s)	Year	Rank	Recurrence Interval (Years)	Channel Discharge (ft3/s)	Channel Width (ft)	Channel Cross Sectional Area (ft2)
19	6159	6159	1	84	493	257	423
20	5653	5653	2	42	510	256	436
21	5453	5453	3	28	755	266	575
22	5273	5273	4	21	395	265	451
23	5099	5099	5	16.8	514	258	492
24	5045	5045	6	14	697	266	582
25	4958	4958	7	12	723	263	578
26	4939	4939	8	10.5	1040	268	659
27	4926	4926	9	9.333333333	17200	304	2290
28	4890	4890	10	8.4	5630	285	1310
29	4877	4877	11	7.636363636	936	268	622
30	4796	4796	12	7	1260	270	710
31	4791	4791	13	6.461538462	4570	280	1180
32	4776	4776	14	6	14900	303	2080
33	4748	4748	15	5.6	21900	310	2600
34	4745	4745	16	5.25	977	266	632
35	4595	4595	17	4.941176471	683	262	543

Data Preparation-Hydrological Estimation

- Calculate the 50-year flood height using the Hydrologic Estimation.xlsm file developed according to Mason (2007) and Bedient $ Huber (2002).







Data Preparation-Hydrological Estimation

- Calculate the 50-year flood height using the Hydrologic Estimation.xlsm file developed according to Mason (2007) and Bedient $ Huber (2002).

USGS Station #	
13336500	
Latitude	Longitude
Ftype	Stream Level
County	State
Hydrologic Unit	
Drainage area	square miles

		Coefficients			Year 1	Year 50
Equation-1	y = 923.49ln(x) + 2824.3, R² = 0.8897	c = 923.49	b = 2824.3		2824.3	6437.014125
Equation-2	y = -2E-06x2 + 0.146x + 481.79, R² = 0.9823	c2 = -0.000002	c1 = 0.146	b = 481.79	878.184459	1338.723761
Equation-3	y = 25.485ln(x) + 103.46, R² = 0.5286	c = 25.485	b = 103.46		276.193677	286.9385445
Flood Height (ft)					3.18	4.67
Flood Height (meter)					0.97	1.42

Calculate Equation-1 | Delete Equation-1 | Calculate Equation-2 | Delete Equation-2 | Calculate Equation-3 | Delete Equation-3

Annual Statistics | Field Measurments

Clear Data

Annual Flow (ft3/s)	Year	Rank	Recurrence Interval (Years)	Channel Discharge (ft3/s)	Channel Width (ft)	Channel Cross Sectional Area (ft2)
6159	6159	1	84	493	257	423
5653	5653	2	42	510	256	436
5453	5453	3	28	755	266	575
5273	5273	4	21	395	265	451
5099	5099	5	16.8	514	258	492
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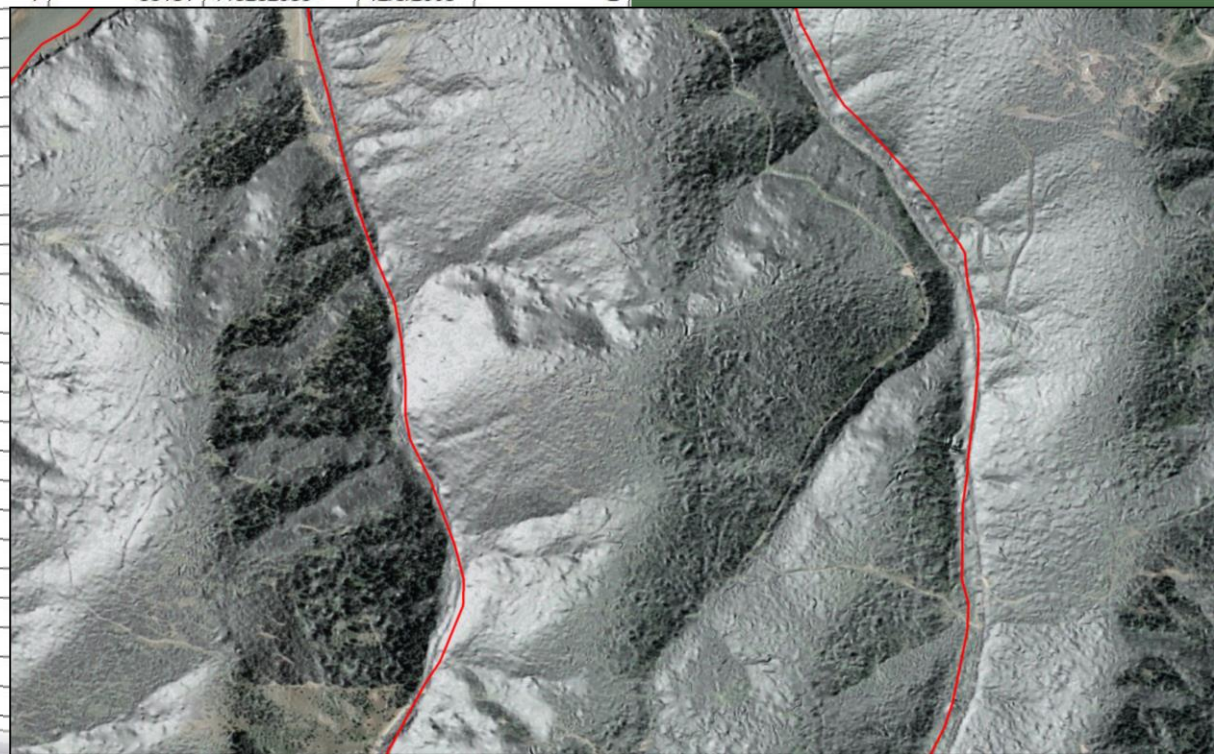
4748	4748	15	5.6	21900	310	2600
4745	4745	16	5.25	977	266	632
4595	4595	17	4.941176471	683	262	543

Data Preparation-NHD

- Streams attribute table should have “StreamLevel” field.
- Correct NHD streams locations. NHD reported a 40ft positional inaccuracies.

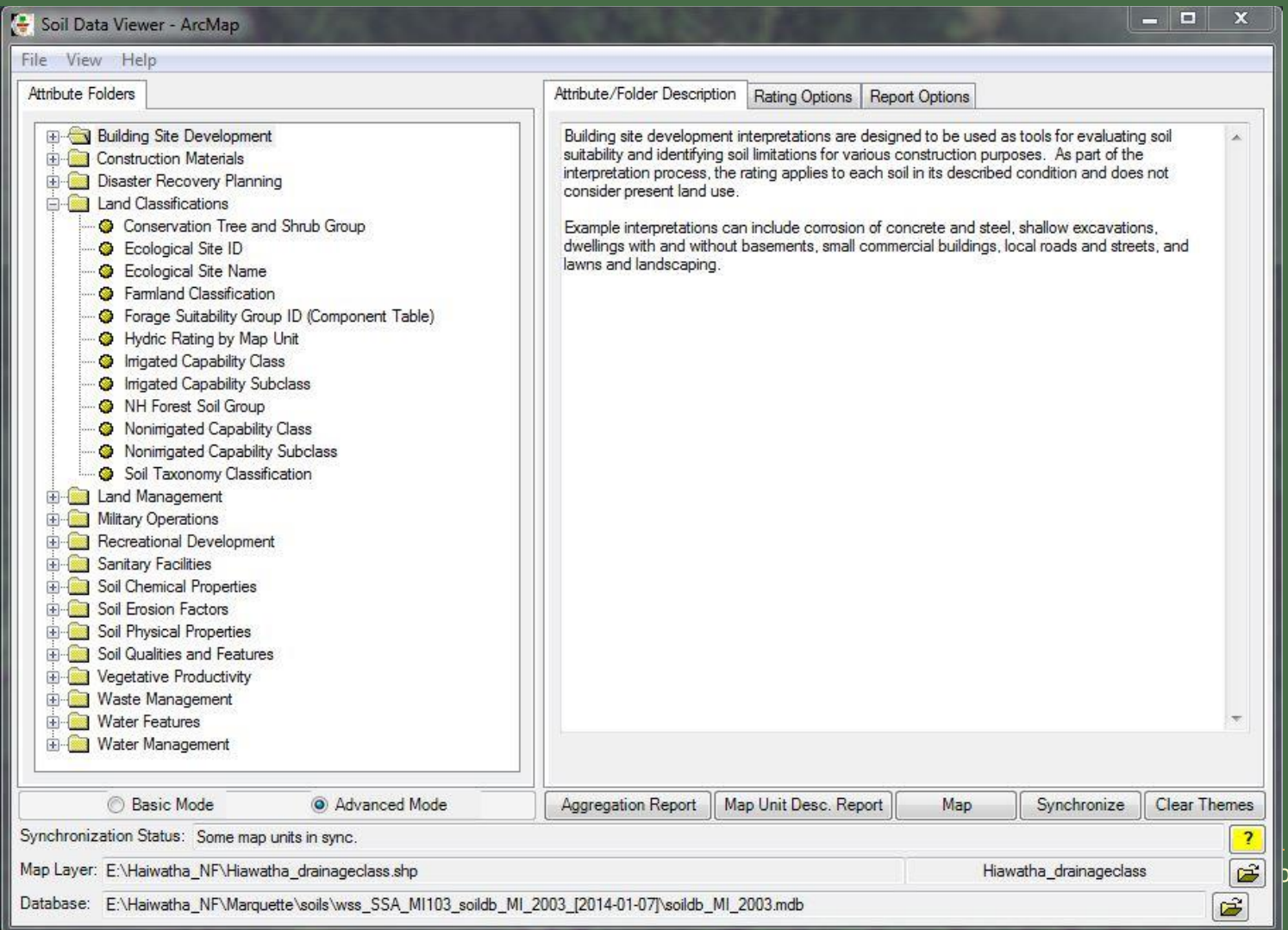
Hiawatha_streams

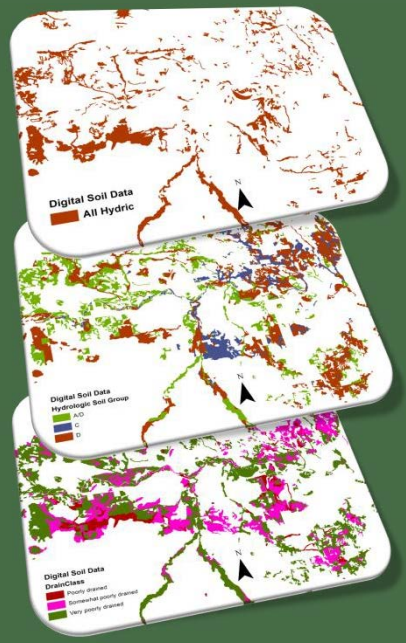
	FlowDir	WBArea_Per	FType	FCode	Shape_Leng	Enabled	OBJECTID_2	Permanent1	FDate_1	StreamLeve
▶	1		460	46006	0.00029	1	36806	109937528	11/5/2003	3
	1		460	46006	0.000475	1	67538	92127672	7/31/2003	3
	1		460	46006	0.006732	1	54939	113232463	12/8/2003	4
	1		334	33400	0.00187	1	37499	109938954	11/5/2003	5
	1	92131168	558	55800	0.000379	1	67792	92128202	7/31/2003	5
	1		460	46003	0.003295	1	69079	92136352	7/31/2003	4
	1		460	46006	0.003889	1	114605	44350814	7/2/2002	5
	1		460	46006	0.004366	1	38071	109940106	11/5/2003	2
	1		460	46006	0.003688	1	55181	113232959	12/8/2003	2
	1		460	46006	0.000638					
	1		460	46003	0.001022					
	1		334	33400	0.008685					
	1		460	46006	0.003935					
	1	44365692	558	55800	0.003913					
	1		460	46003	0.005498					
	1		460	46006	0.007511					
	1		460	46006	0.002015					
	1	113236761	558	55800	0.000171					
	1		460	46006	0.000133					
	1		460	46006	0.000651					
	1		460	46003	0.002185					
	1		460	46006	0.007792					
	1		460	46006	0.000116					
	1	44364286	558	55800	0.009928					
	1		460	46003	0.006173					
	1		460	46003	0.00205					
	1		460	46003	0.001022					
	1		460	46003	0.003168					
	1		460	46006	0.000149					
	1	113236447	558	55800	0.000323					
	1		460	46006	0.001103					
	1	109945792	558	55800	0.004355					
	1		334	33400	0.000054					



Data Preparation-Soils

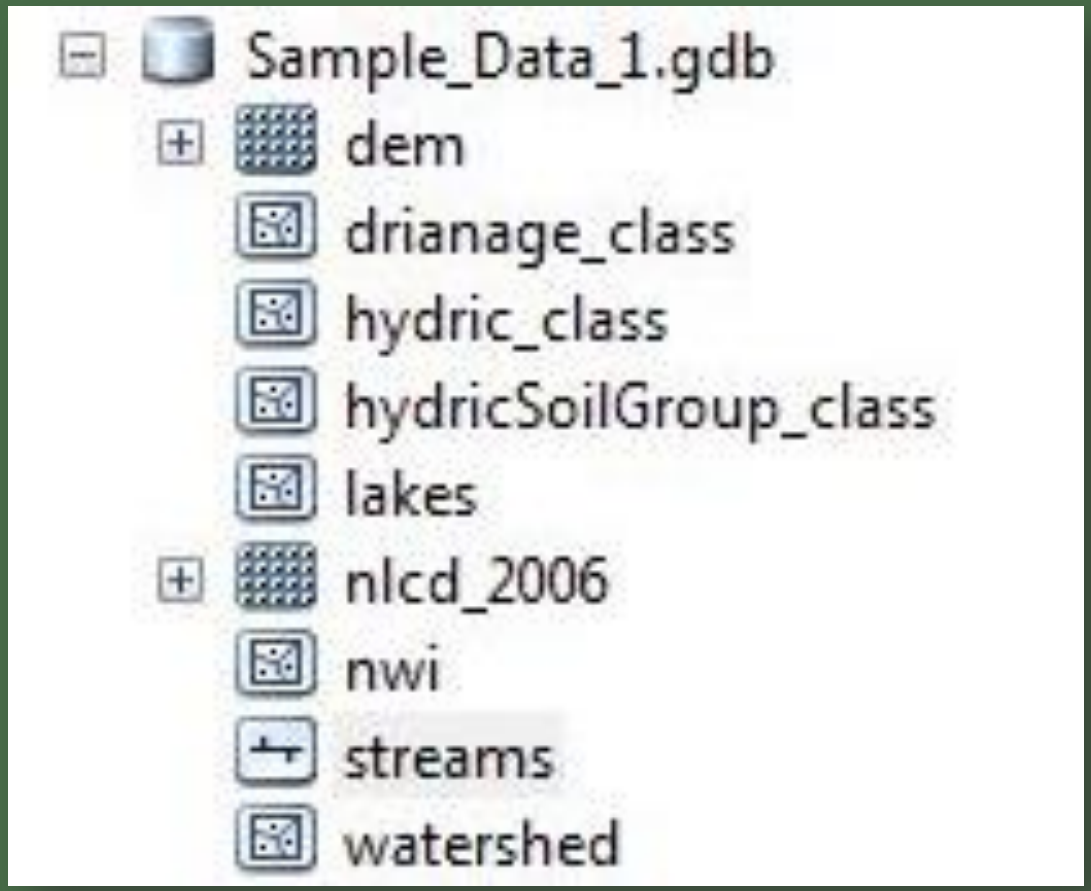
- Prepare soil layers using Soil Data Viewer extension for ArcGIS Desktop. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/survey/geo/?cid=nrcs142p2_053614



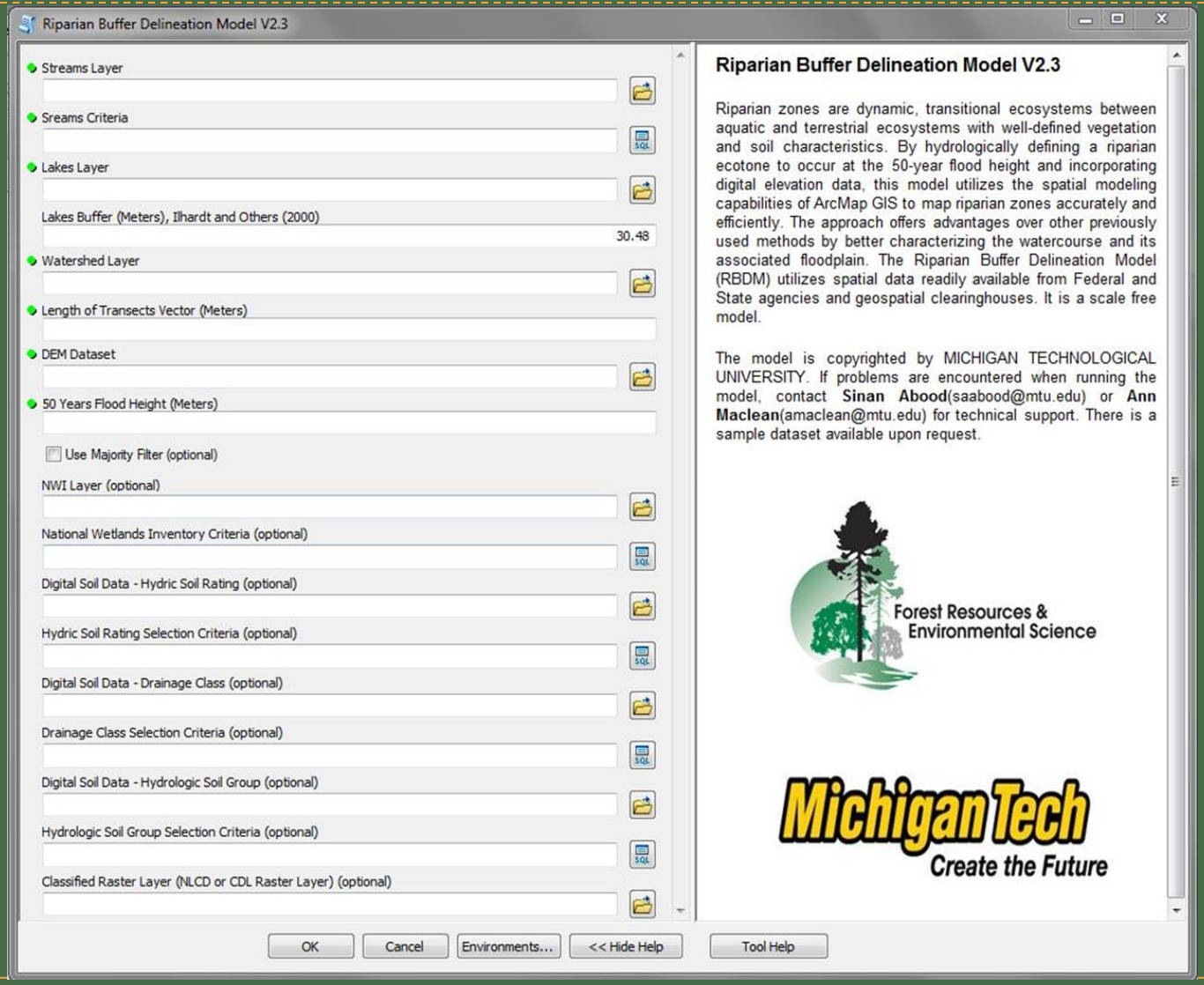


Data Preparation-Model File Geodatabase

- Create a file geodatabase and import all the required layers. The model workspace should look like below:



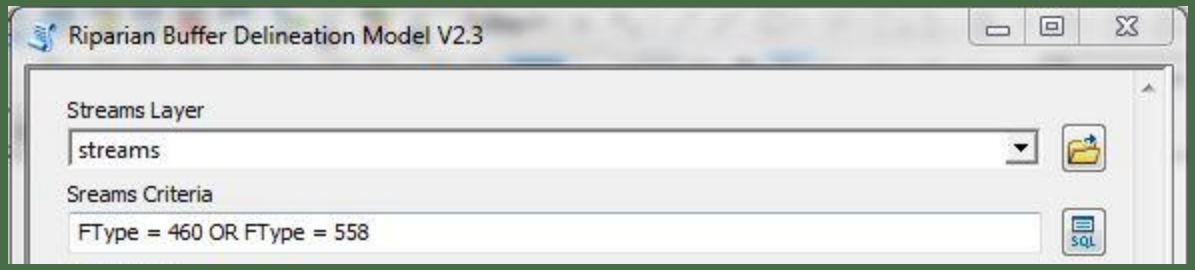
How the model works



How the model works

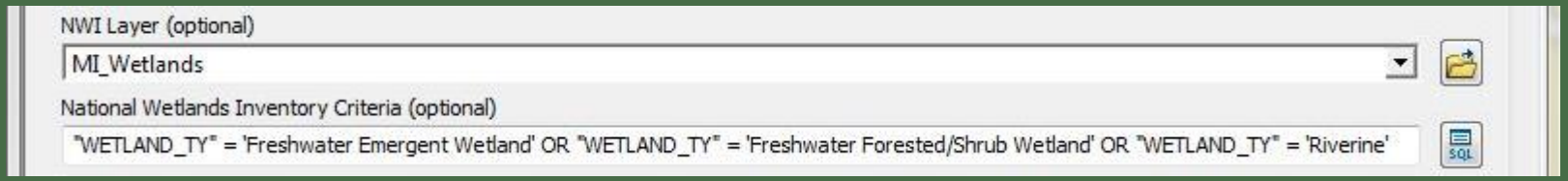
- The model uses 3 sets of queries.

1



- 334 = Connector.
- 336 = Canal Ditch.
- 460 = Stream River (46003 Intermittent, 46006 Perennial, 46007 Ephemeral).
- 558 = Artificial path

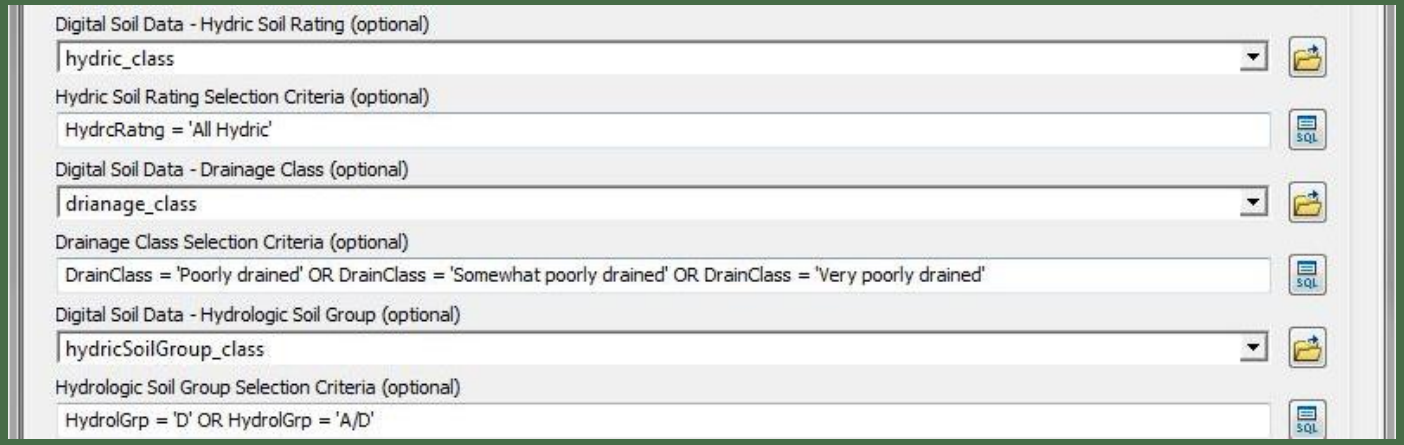
2



How the model works

- The model uses 3 sets of queries.

3



Verry et al. 2004
Palik et al. 2004

- The new Hydric layer query column is "SdvOutpu_1" instead of "HydrcRating".
- The new Drainage Class layer query column is "SdvOutpu_1" instead of "DrainClass".
- The new Hydrologic Soil Group layer query column is "SdvOutpu_1" instead of "HydrolGrp".

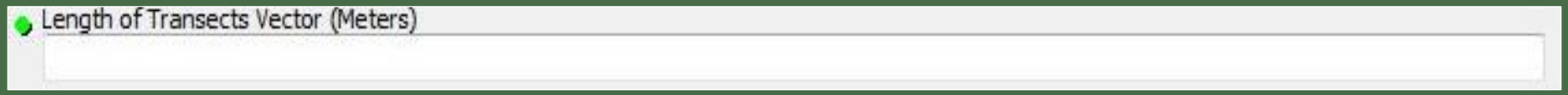
How the model works

- Full soil query definition.

Soil Attribute	Definition
Hydric Rating by Map Unit	"All Hydric" Hydric soils are defined by the National Technical Committee for Hydric Soils (NTCHS) as soils that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part (Federal Register, 1994).
Drainage Class	"Poorly Drained (P)" Soils may have a saturated zone, a layer of low haydraulic conductivity, or seepage. Depth to water table is less than 1 foot.
	"Very Poorly Drained (VP)" Soils are wet to the surface most of the time. Depth to wate table is less than 1 foot, or is ponded.
	"Somewhat Poorly Drained (SP)" Soils commonly have a layer with low hydraulic conductivity, wet state high in profile. Depth to water table is 1 to 3 ft.
Hydrologic Soil Group	"Group C" Soils having a slow infiltration rate when thoroughly wet. Soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission
	"Group D" Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a clay pan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.
	"A/D", "B/D", and "C/D" Drained/undrained hydrology class of soils that can be drained and are classified

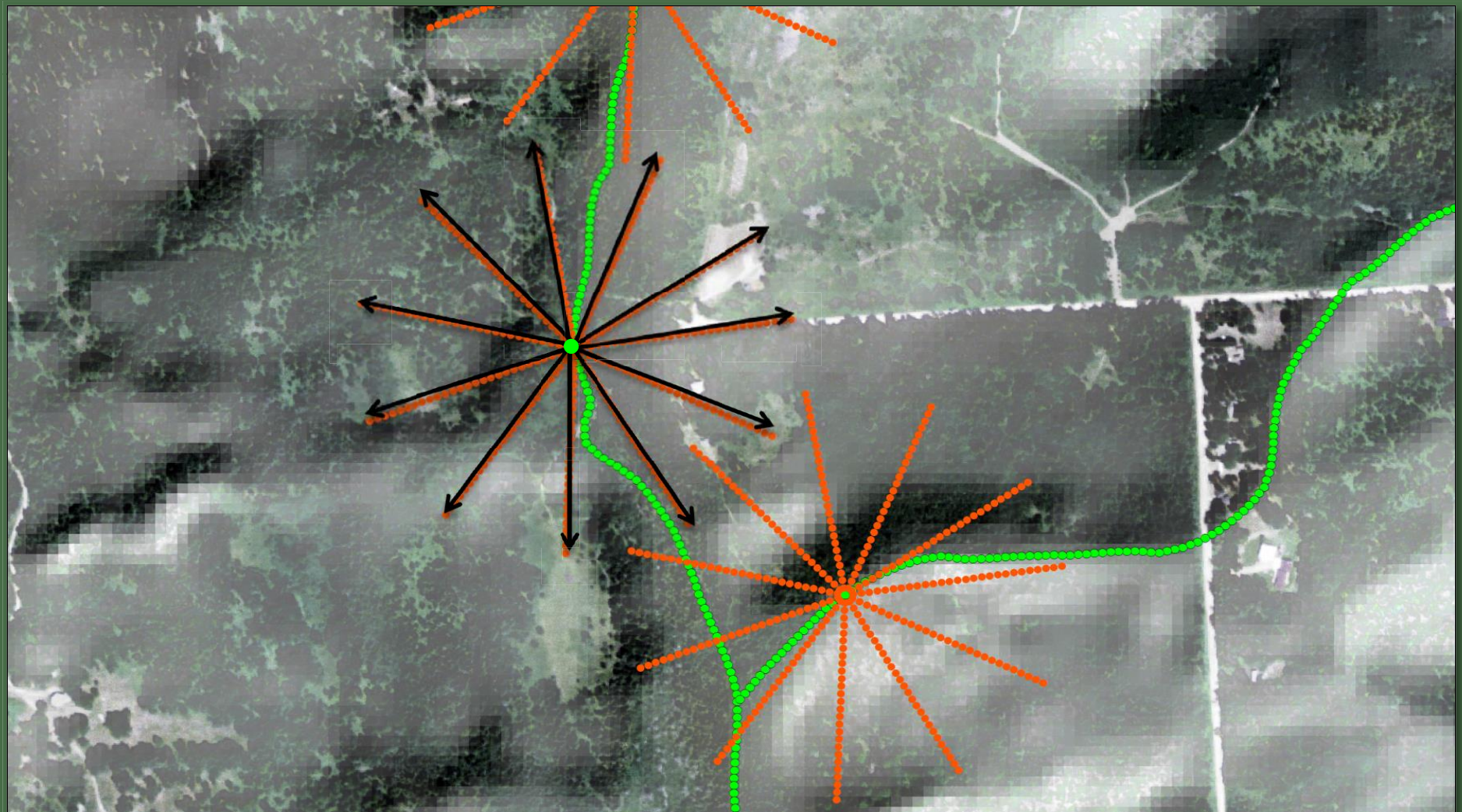
How the model works

- The model introduces a new sampling technique.
- The sampling distance is defined by the user for a maximum distance of 3000 meter from the stream.

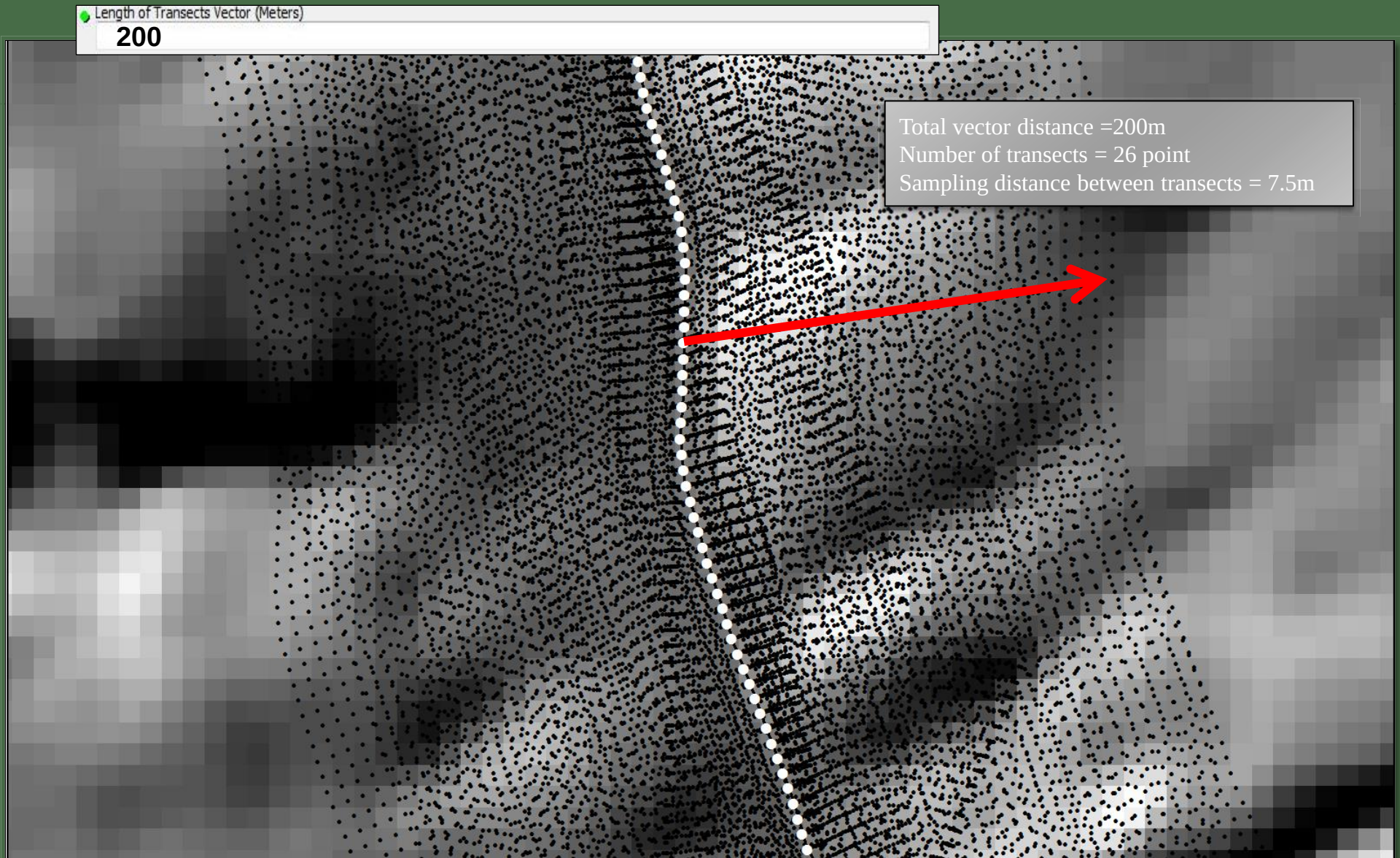


How the model works

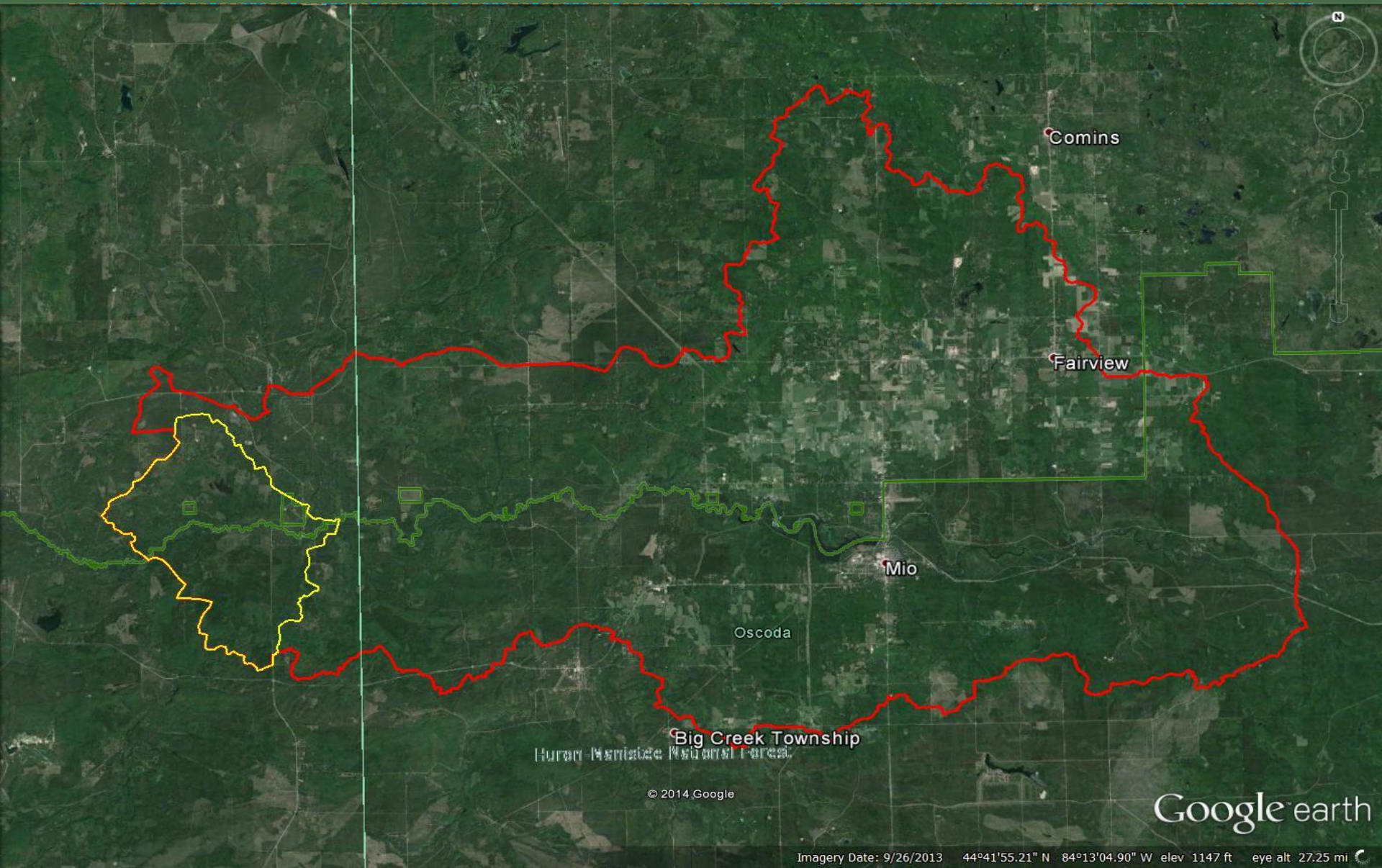
- The model produces sample points (green) along stream segments every 75% of the DEM spatial resolution.
- At each sample point a special function generates transects in 11 vectors.



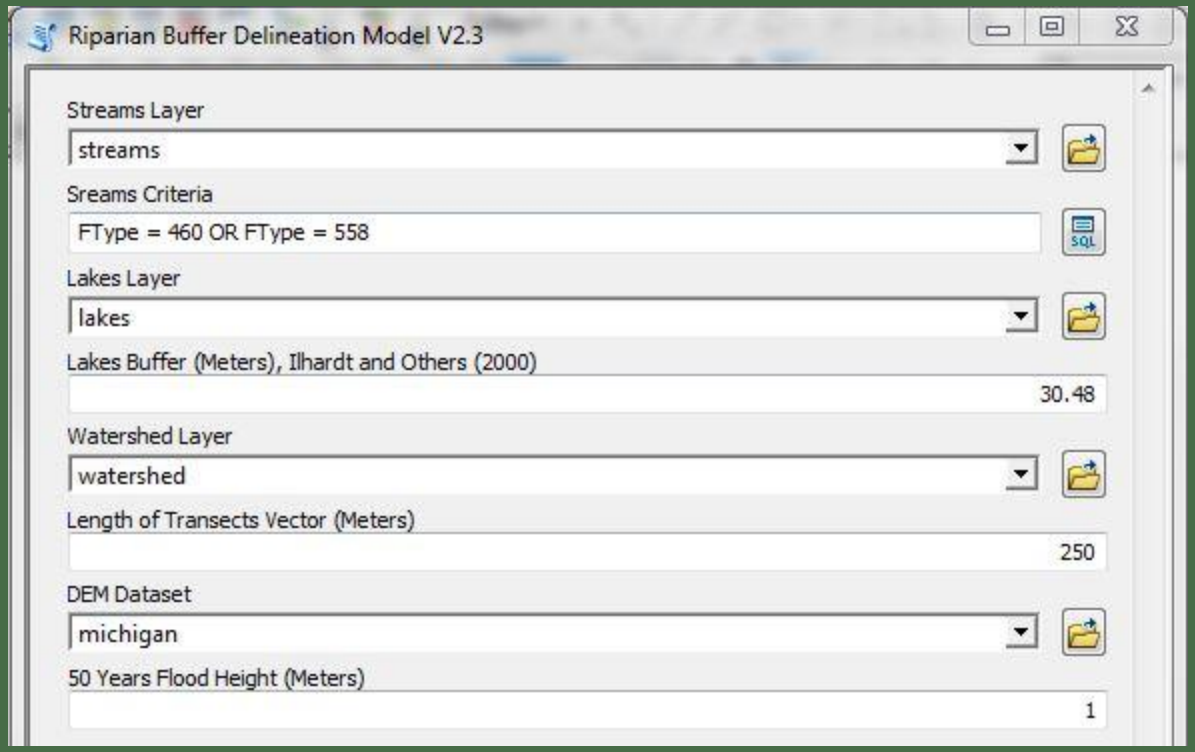
Point Cloud


Length of Transects Vector (Meters)
200
Total vector distance =200m
Number of transects = 26 point
Sampling distance between transects = 7.5m

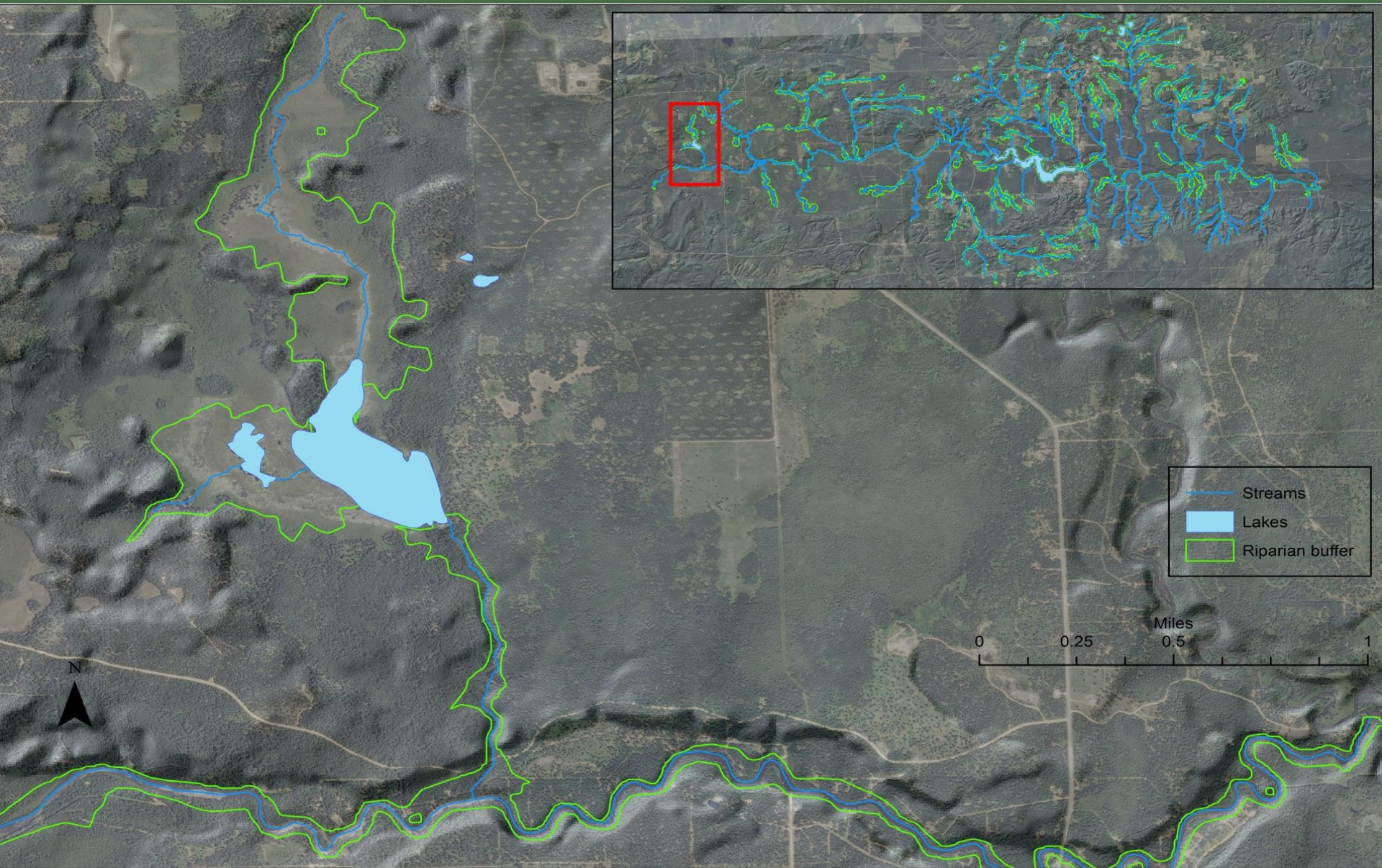
Study Area


Comins
Fairview
Mio
Oscoda
Big Creek Township
Huron-Manistee National Forest
© 2014 Google
Google earth
Imagery Date: 9/26/2013 44°41'55.21" N 84°13'04.90" W elev 1147 ft eye alt 27.25 mi

Approach - 1


Riparian Buffer Delineation Model V2.3
Streams Layer
streams
Sreams Criteria
FType = 460 OR FType = 558
SQL
Lakes Layer
lakes
Lakes Buffer (Meters), Ilhardt and Others (2000)
30.48
Watershed Layer
watershed
Length of Transects Vector (Meters)
250
DEM Dataset
michigan
50 Years Flood Height (Meters)
1

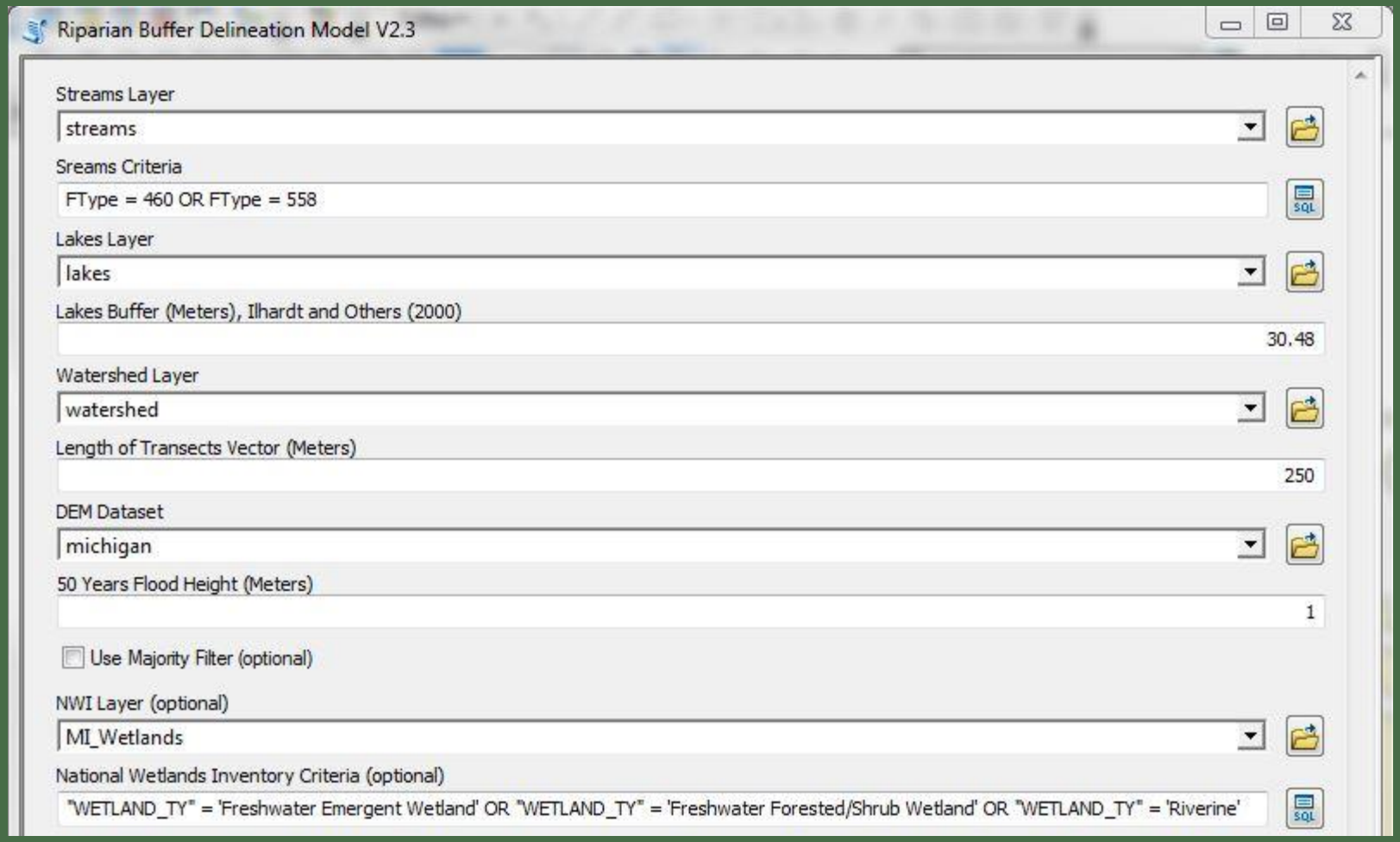
Approach - 1



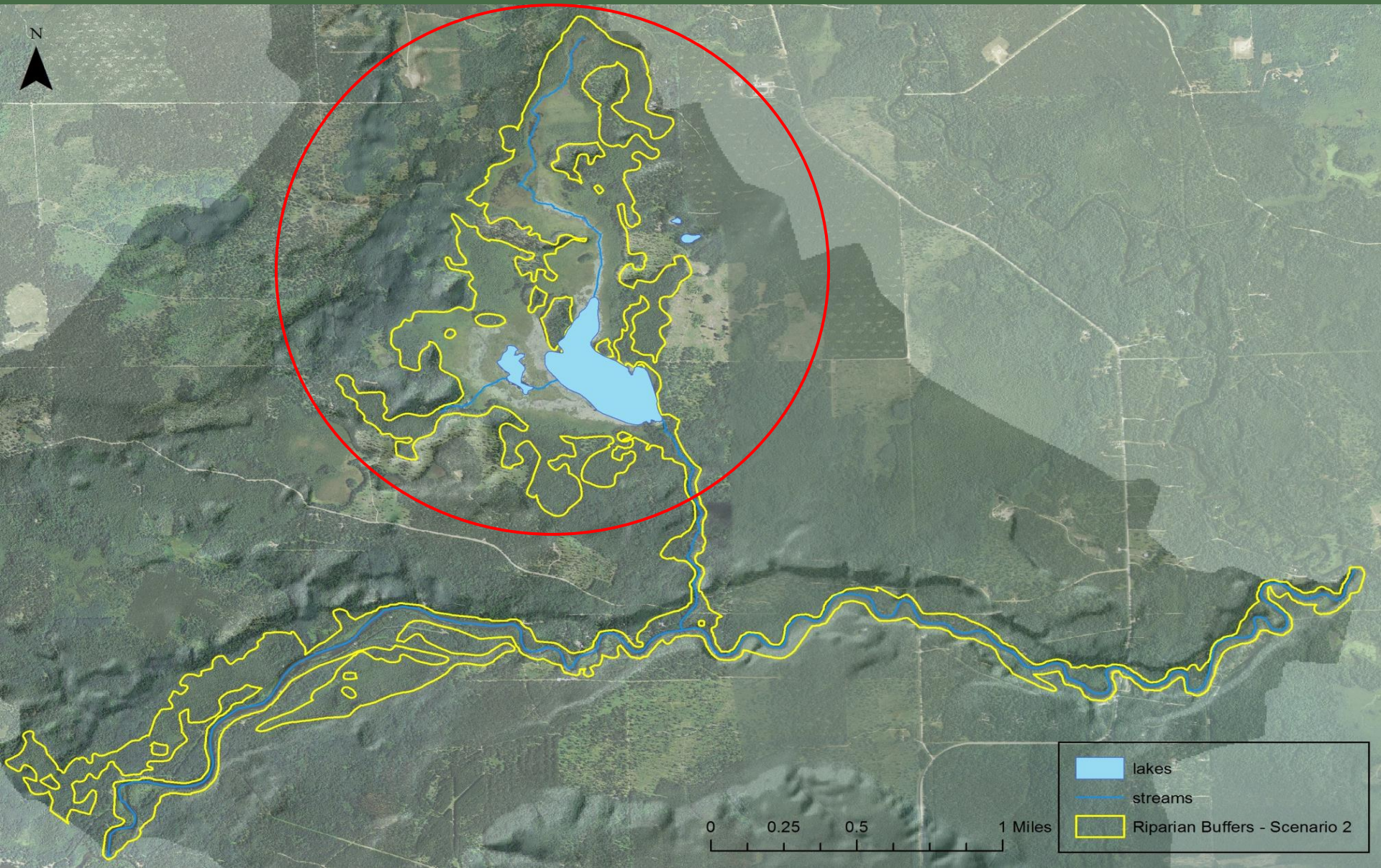
Approach - 1


N
1992
Imagery Date: 9/26/2013 44°41'25.34" N 84°25'53.01" W elev 1073 ft eye alt 13391 ft
Google earth

Approach - 2


Riparian Buffer Delineation Model V2.3
Streams Layer
streams
Sreams Criteria
FType = 460 OR FType = 558
Lakes Layer
lakes
Lakes Buffer (Meters), Ilhardt and Others (2000)
30.48
Watershed Layer
watershed
Length of Transects Vector (Meters)
250
DEM Dataset
michigan
50 Years Flood Height (Meters)
1
Use Majority Filter (optional)
NWI Layer (optional)
MI_Wetlands
National Wetlands Inventory Criteria (optional)
"WETLAND_TY" = 'Freshwater Emergent Wetland' OR "WETLAND_TY" = 'Freshwater Forested/Shrub Wetland' OR "WETLAND_TY" = 'Riverine'

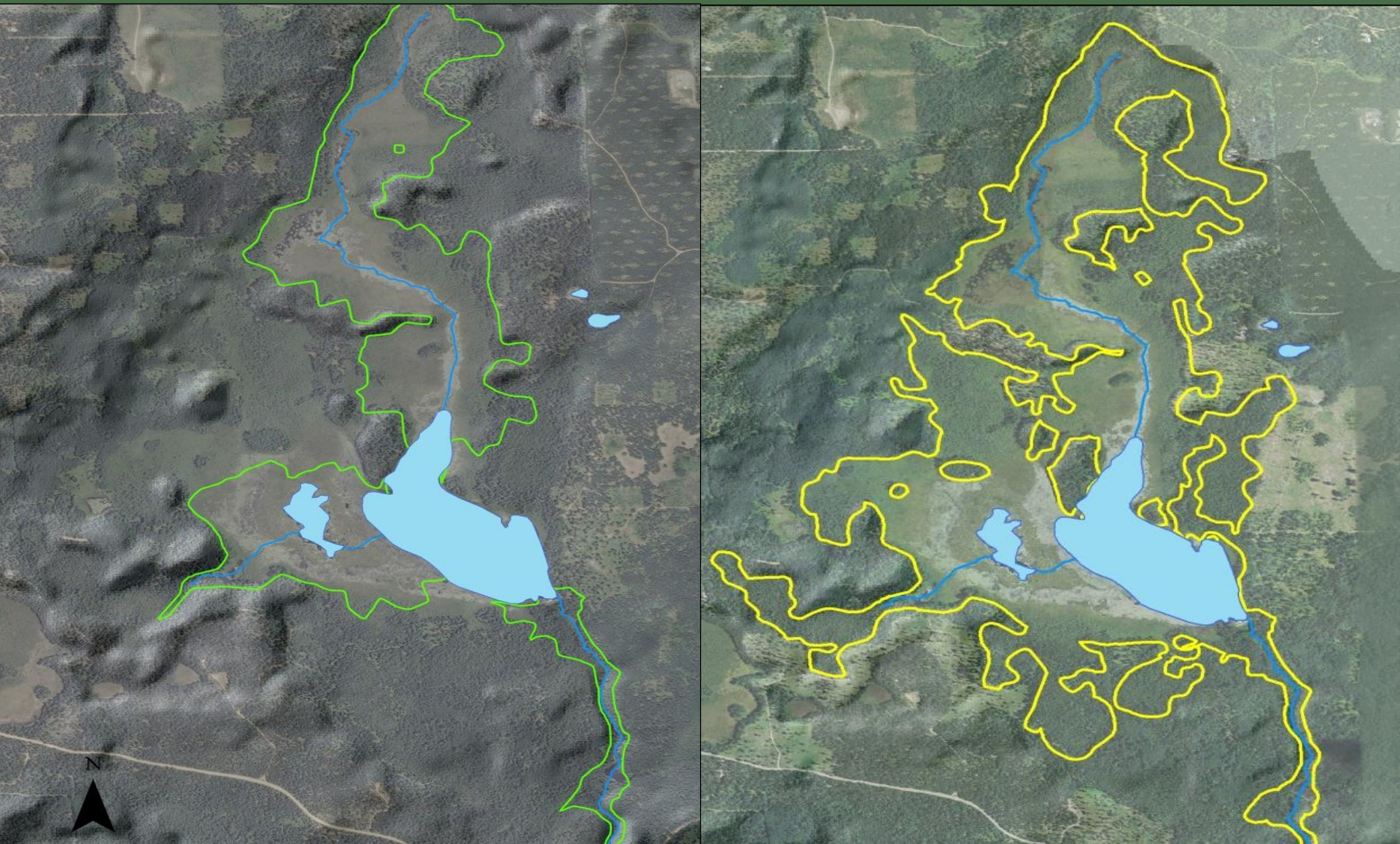
Approach - 2



Approach - 2

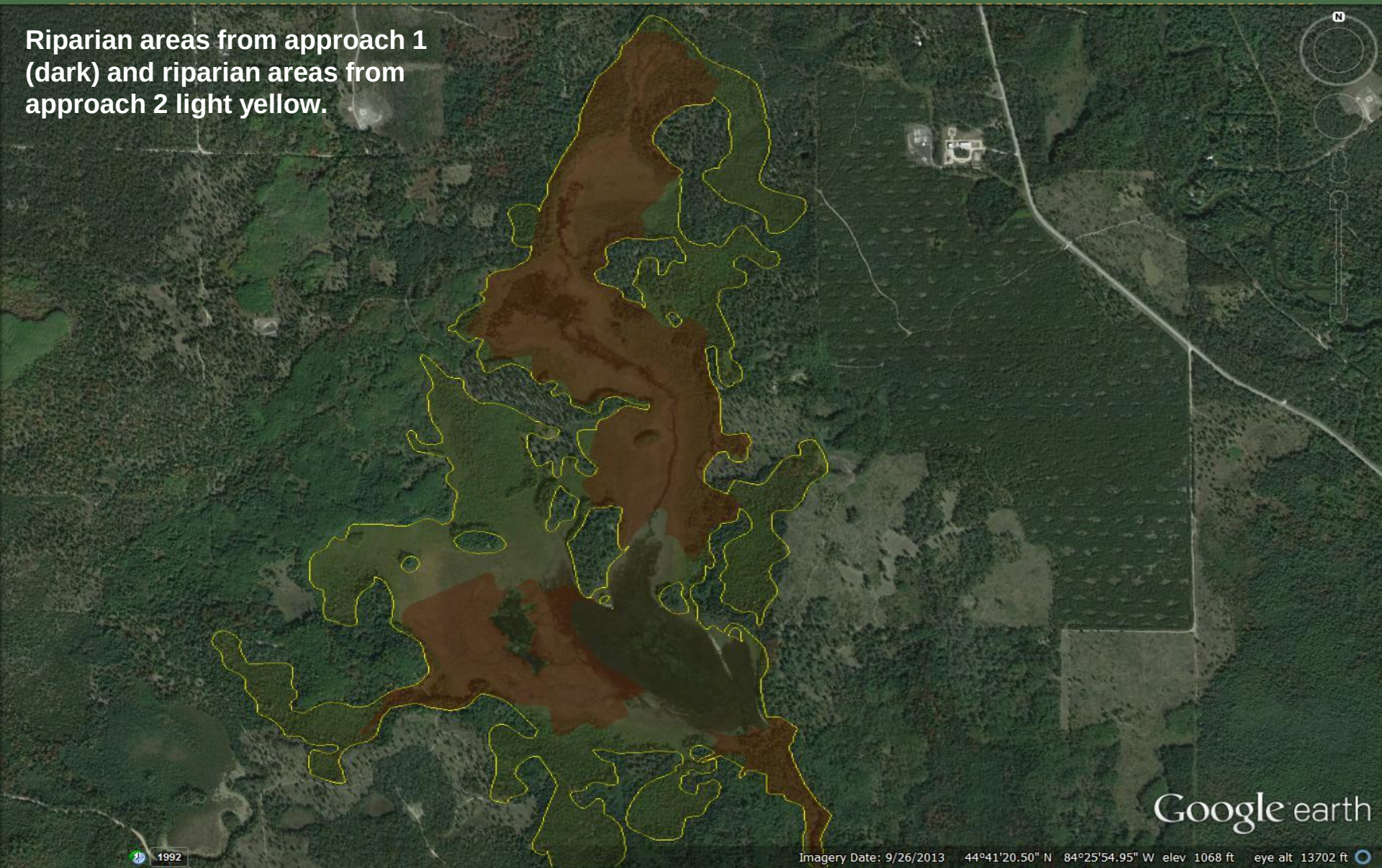

N
Google earth
1992
Imagery Date: 9/26/2013 44°41'25.34" N 84°25'53.01" W elev 1073 ft eye alt 13391 ft

Approach 1 vs. 2

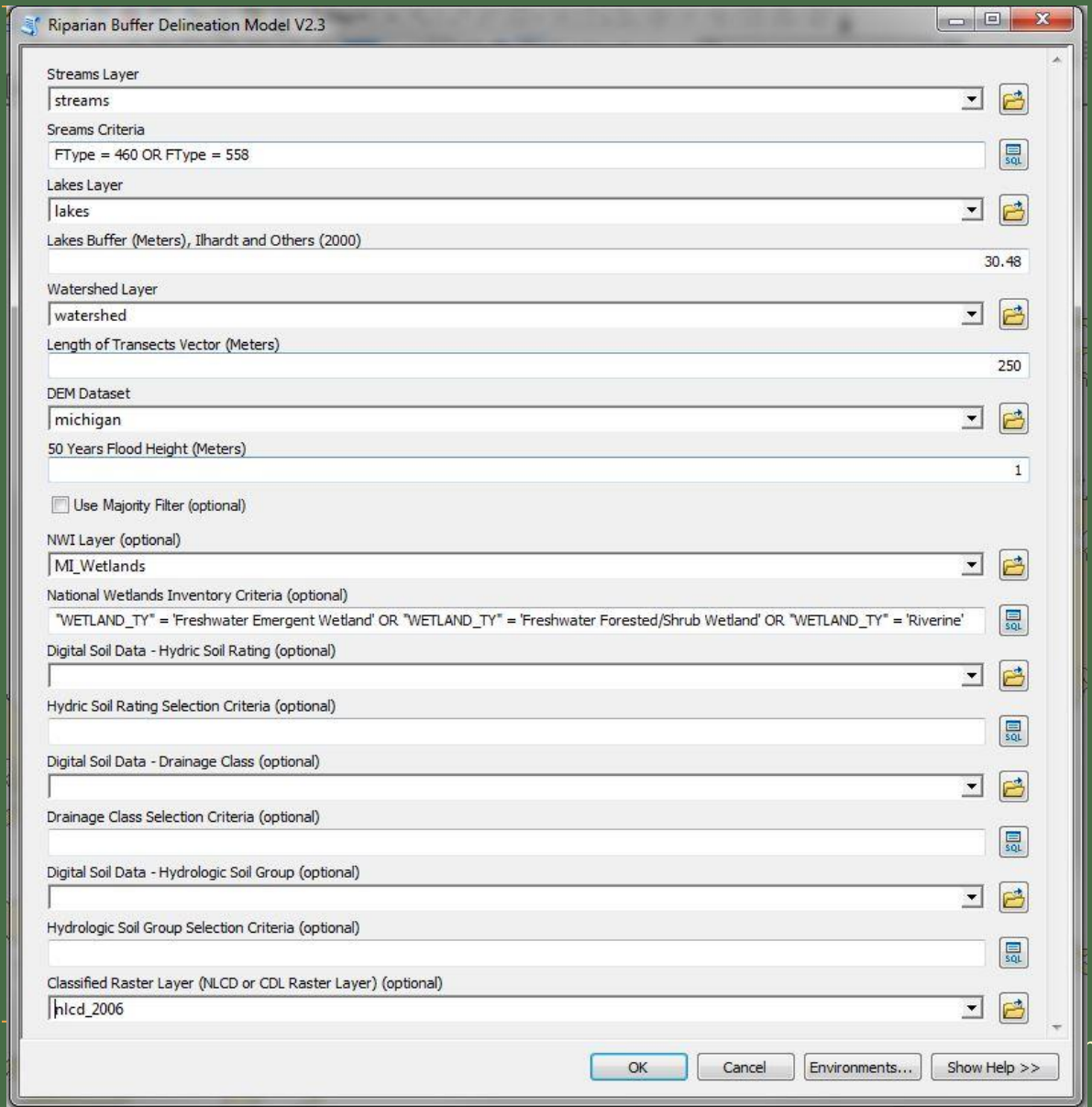


Approach 1 vs. 2

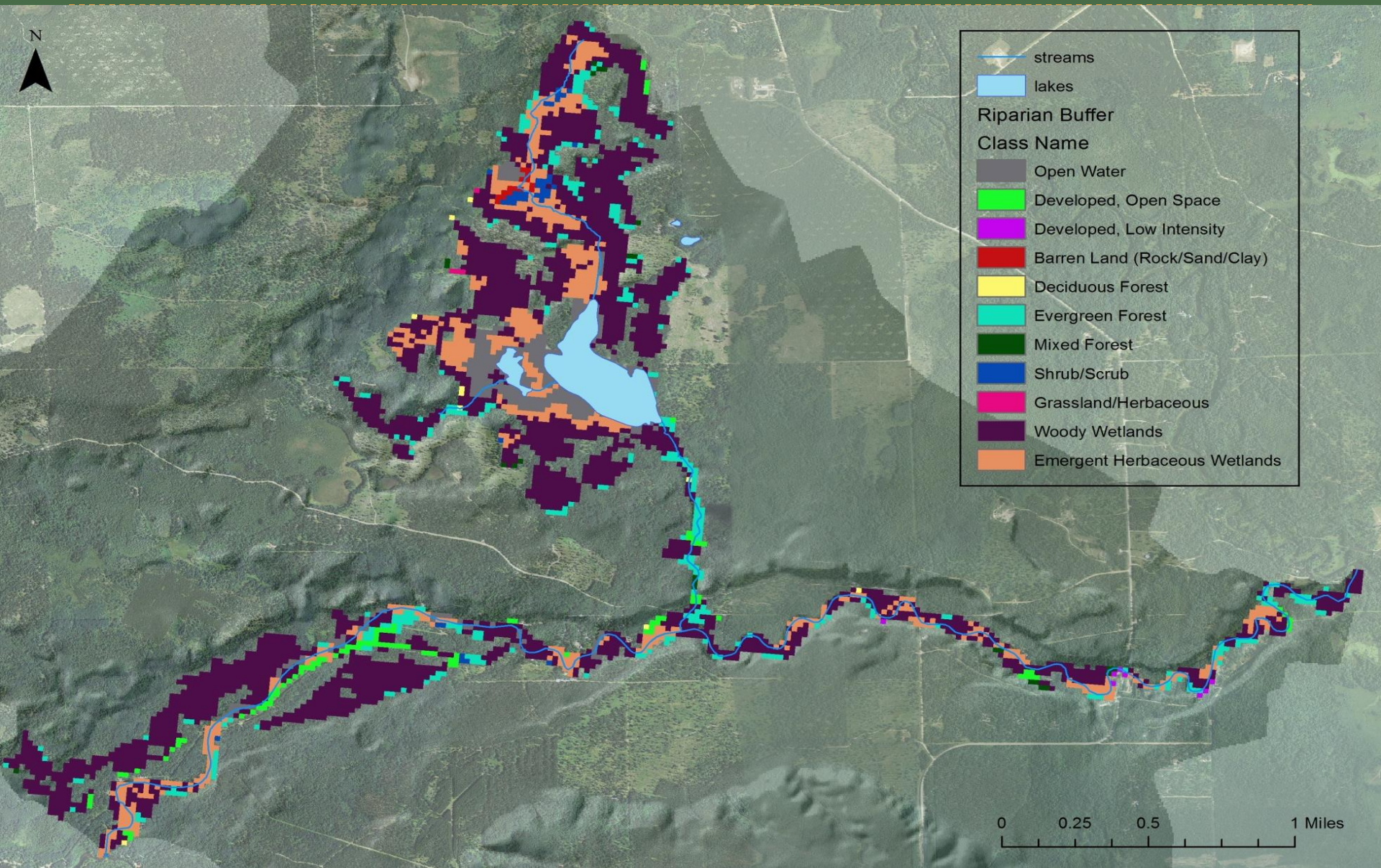
Riparian areas from approach 1 (dark) and riparian areas from approach 2 light yellow.



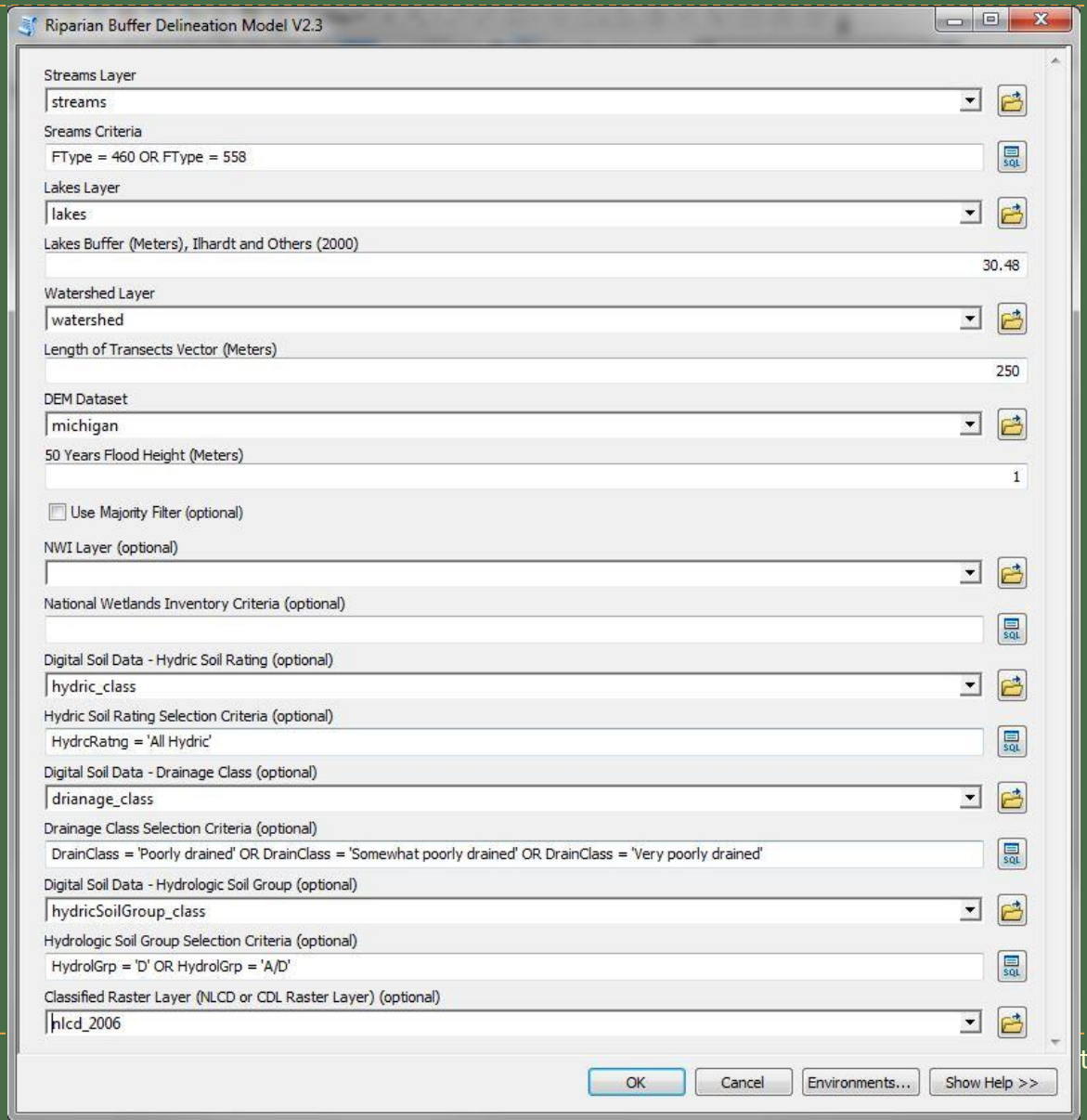
Approach - 3


Riparian Buffer Delineation Model V2.3
Streams Layer
streams
Sreams Criteria
FType = 460 OR FType = 558
Lakes Layer
lakes
Lakes Buffer (Meters), Ilhardt and Others (2000)
30.48
Watershed Layer
watershed
Length of Transects Vector (Meters)
250
DEM Dataset
michigan
50 Years Flood Height (Meters)
1
Use Majority Filter (optional)
NWI Layer (optional)
MI_Wetlands
National Wetlands Inventory Criteria (optional)
"WETLAND_TY" = 'Freshwater Emergent Wetland' OR "WETLAND_TY" = 'Freshwater Forested/Shrub Wetland' OR "WETLAND_TY" = 'Riverine'
Digital Soil Data - Hydric Soil Rating (optional)
Hydric Soil Rating Selection Criteria (optional)
Digital Soil Data - Drainage Class (optional)
Drainage Class Selection Criteria (optional)
Digital Soil Data - Hydrologic Soil Group (optional)
Hydrologic Soil Group Selection Criteria (optional)
Classified Raster Layer (NLCD or CDL Raster Layer) (optional)
nlcd_2006
OK
Cancel
Environments...
Show Help >>

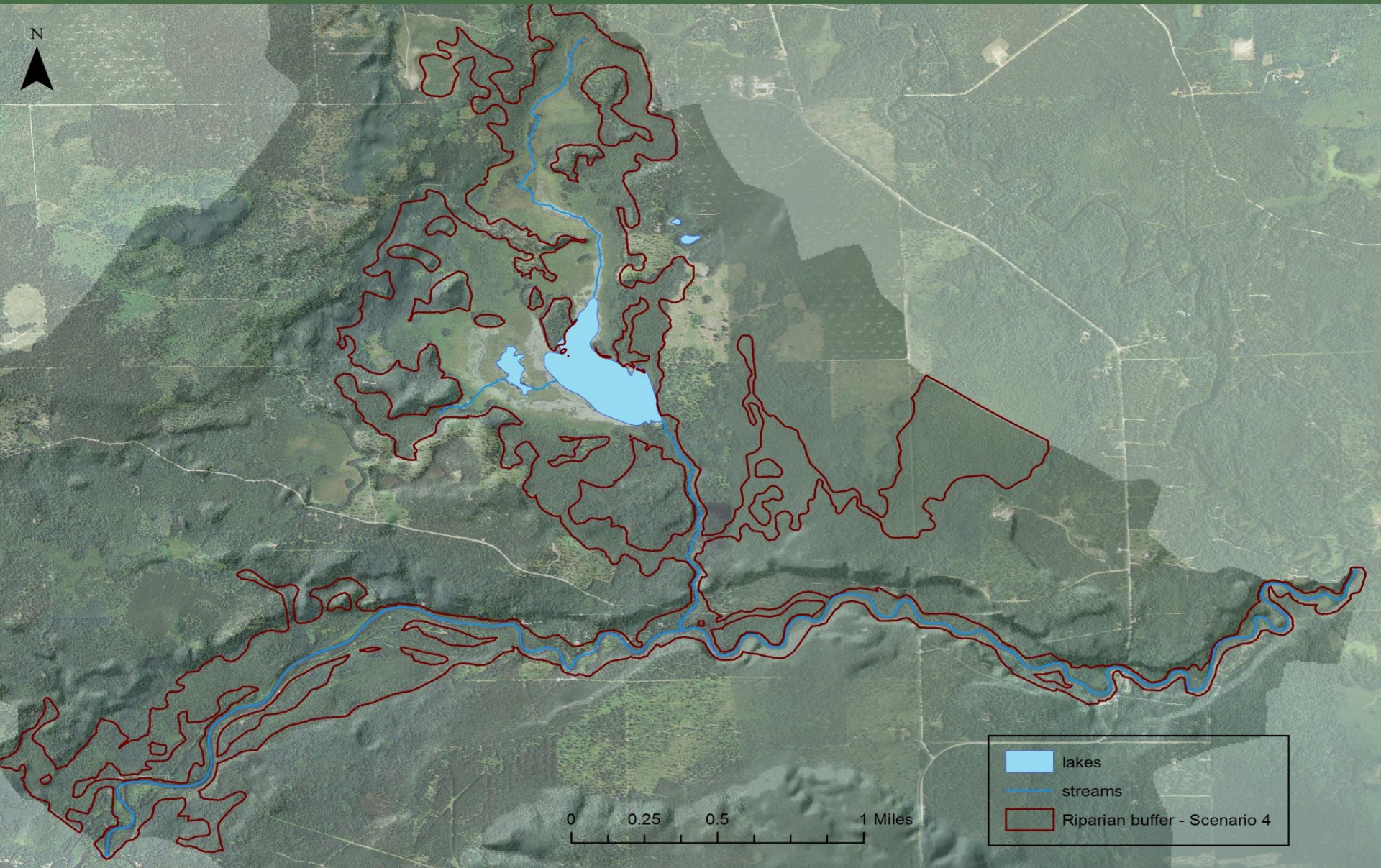
Approach - 3


N
streams
lakes
Riparian Buffer
Class Name
Open Water
Developed, Open Space
Developed, Low Intensity
Barren Land (Rock/Sand/Clay)
Deciduous Forest
Evergreen Forest
Mixed Forest
Shrub/Scrub
Grassland/Herbaceous
Woody Wetlands
Emergent Herbaceous Wetlands
0
0.25
0.5
1 Miles

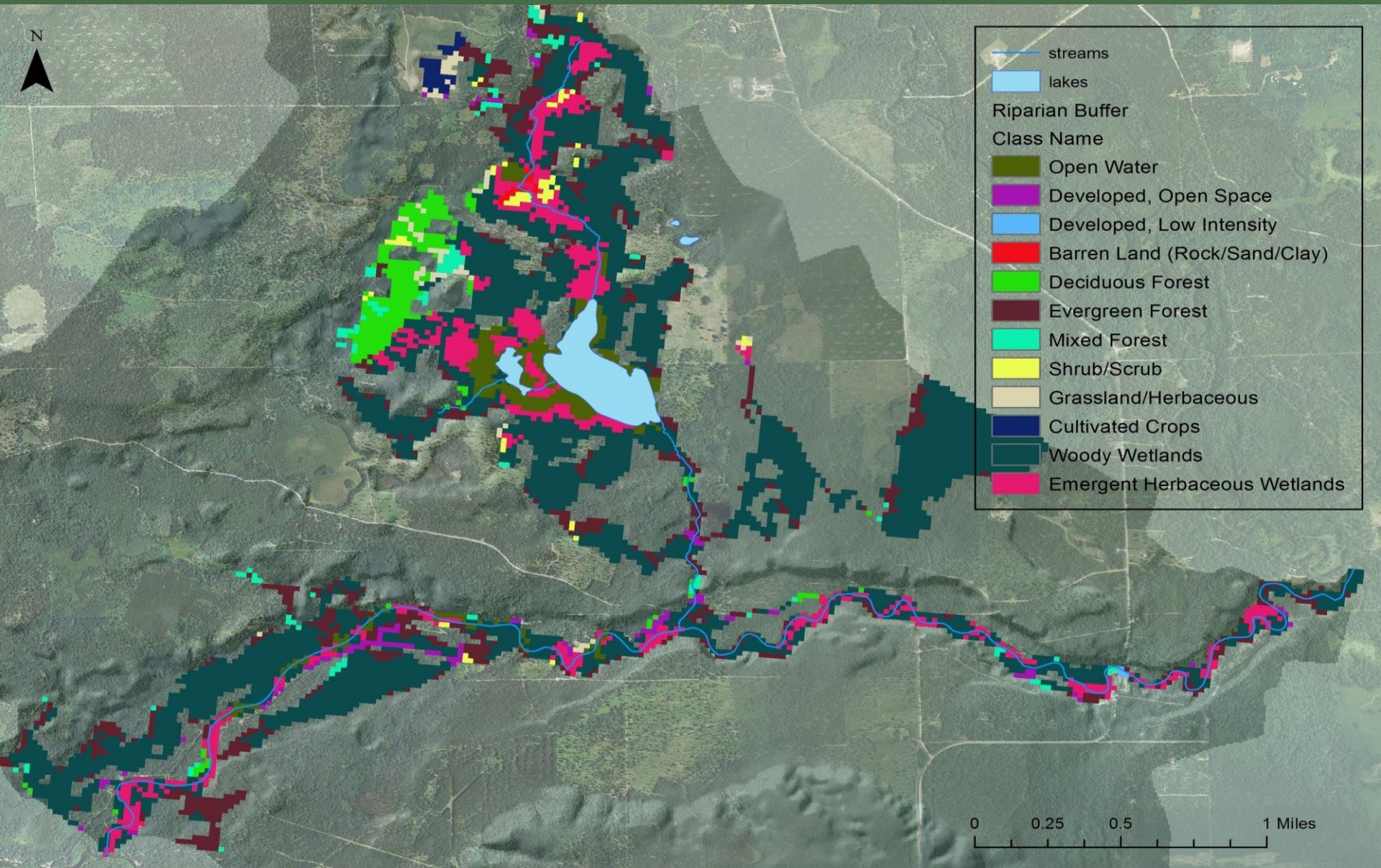
Approach - 4


Riparian Buffer Delineation Model V2.3
Streams Layer
streams
Sreams Criteria
FType = 460 OR FType = 558
Lakes Layer
lakes
Lakes Buffer (Meters), Ilhardt and Others (2000)
30.48
Watershed Layer
watershed
Length of Transects Vector (Meters)
250
DEM Dataset
michigan
50 Years Flood Height (Meters)
1
Use Majority Filter (optional)
NWI Layer (optional)
National Wetlands Inventory Criteria (optional)
Digital Soil Data - Hydric Soil Rating (optional)
hydric_class
Hydric Soil Rating Selection Criteria (optional)
HydrcRatng = 'All Hydric'
Digital Soil Data - Drainage Class (optional)
drianage_class
Drainage Class Selection Criteria (optional)
DrainClass = 'Poorly drained' OR DrainClass = 'Somewhat poorly drained' OR DrainClass = 'Very poorly drained'
Digital Soil Data - Hydrologic Soil Group (optional)
hydricSoilGroup_class
Hydrologic Soil Group Selection Criteria (optional)
HydrolGrp = 'D' OR HydrolGrp = 'A/D'
Classified Raster Layer (NLCD or CDL Raster Layer) (optional)
nlcd_2006
OK
Cancel
Environments...
Show Help >>

Approach - 4



Approach - 4

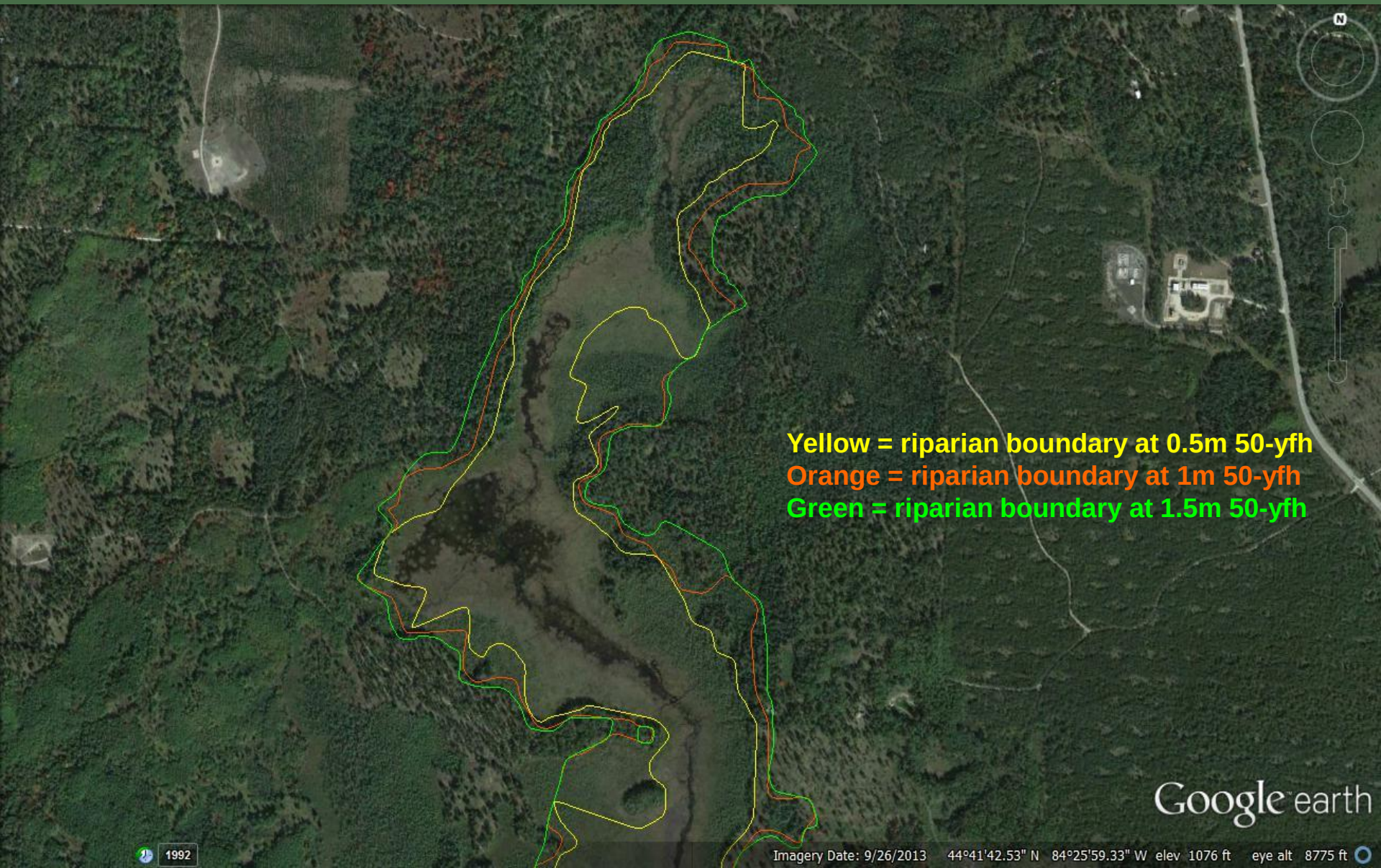

N
streams
lakes
Riparian Buffer
Class Name
Open Water
Developed, Open Space
Developed, Low Intensity
Barren Land (Rock/Sand/Clay)
Deciduous Forest
Evergreen Forest
Mixed Forest
Shrub/Scrub
Grassland/Herbaceous
Cultivated Crops
Woody Wetlands
Emergent Herbaceous Wetlands
0
0.25
0.5
1 Miles

Approach 2 vs. 4

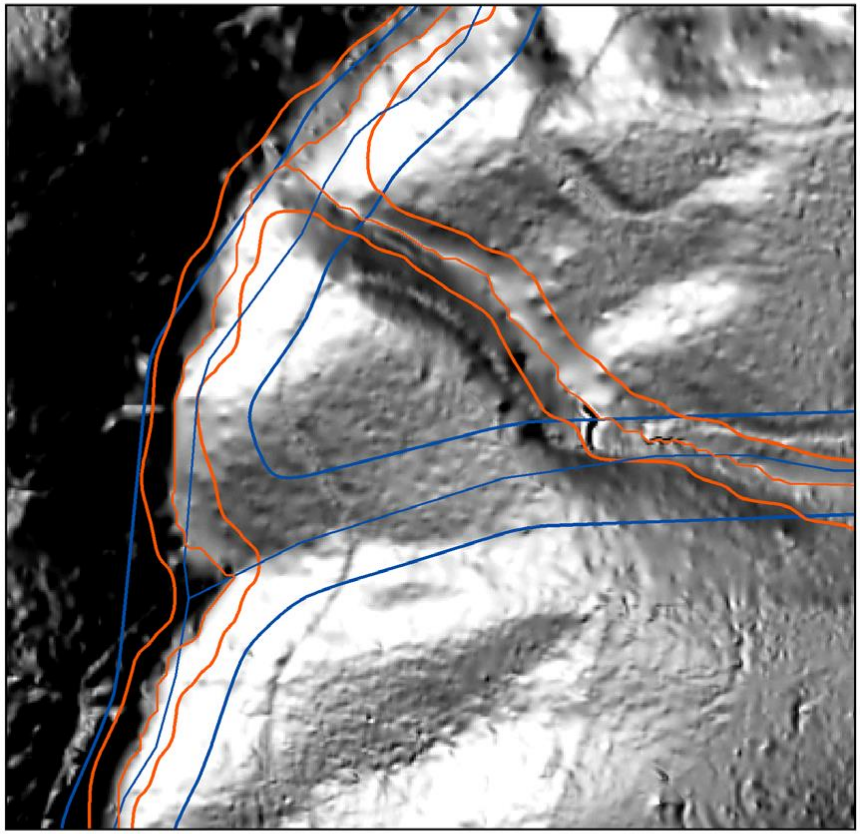
Model Parameters

- 50-year flood height.
- Streams positional inaccuracies.
- DEM spatial resolution.

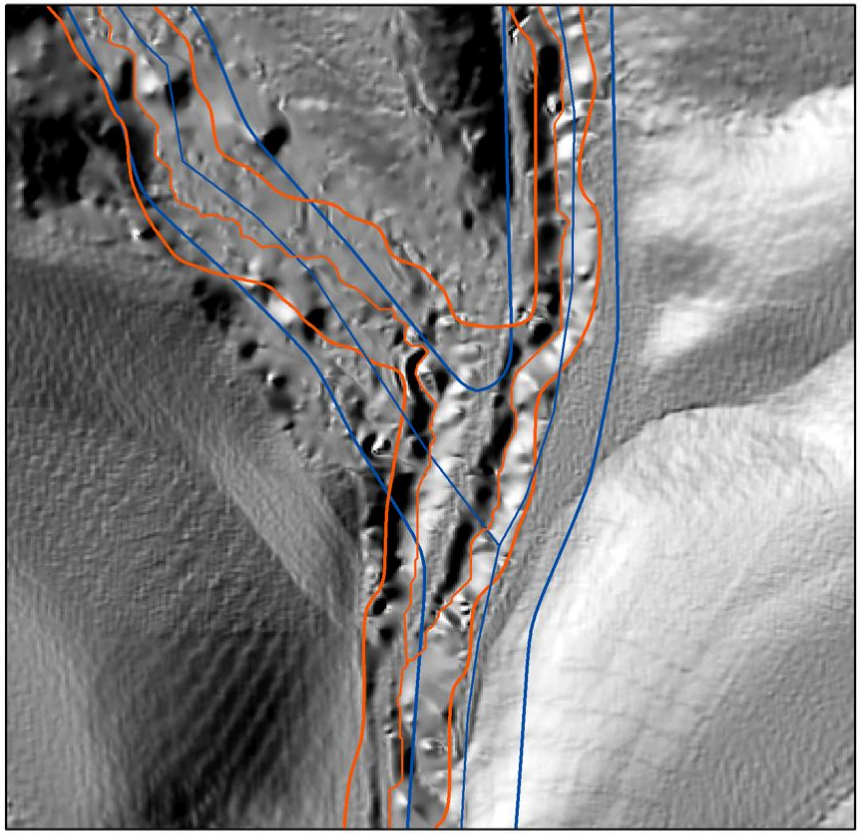
Model Parameters – 50-year height



Model Parameters – Streams positional inaccuracies



Watershed 6



Watershed 9

N

Delineated Streams
NHD Streams
Riparian Ecotones Utilizing Delineated Streams
Riparian Ecotones Utilizing NHD Streams

0 250 500 1,000 Feet

Model Parameters – DEM spatial resolution

Table 4.5 Total delineated riparian ecotones area utilizing the average 50-year flood height and different DEM pixel resolutions.

	1m DEM	3m DEM	5m DEM	10m DEM
Overall riparian ecotones, Acres	6,176.75	7,328.13	7,549.99	8,366.84
% of watershed area	7.65	9.07	9.35	10.36

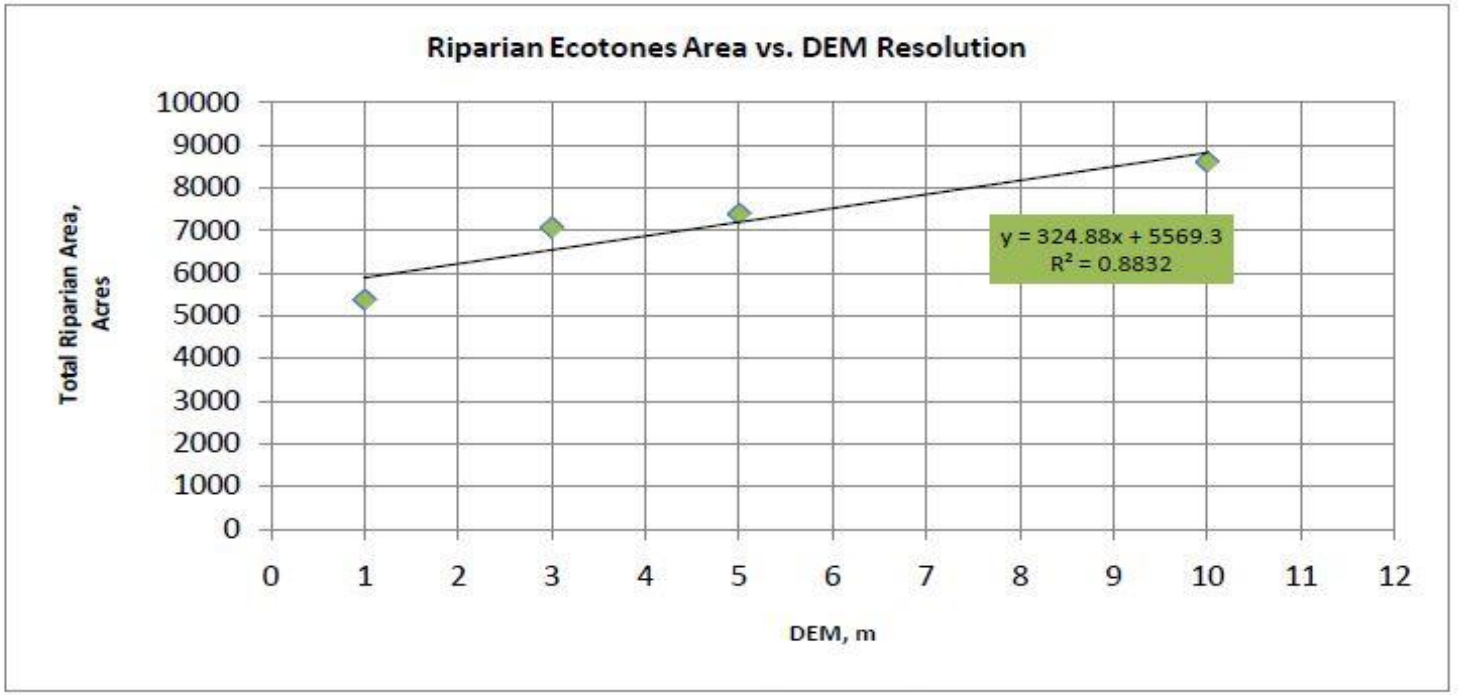
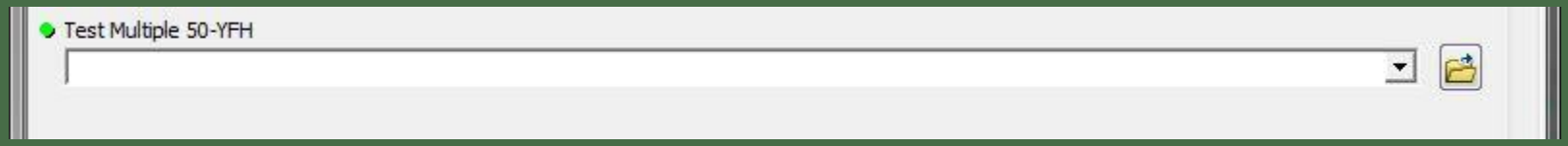


Figure 4.7 Riparian area vs. DEM spatial resolution utilizing the average 50-year flood height and the NHD stream network.

From Abood 2011

Future Updates

- RBDM version 3.0
- A new tool to import input data into multiple file geodatabase.
- Multiple 50-year flood height.
- Add more functionalities such as REPORT generation.



Table

FloodHeight

OBJECTID *	StreamOrder	YFLH
1	1	0.3
2	2	0.5
3	3	1
4	4	1.5

Table

mutliplefloodheight

OBJECTID *	FType	Order_	_YFH__meter_
2	558	2	0.3
3	558	3	0.75
4	558	4	1.5
5	460	2	0.3
6	460	3	0.75
7	460	4	1.5

To download the Model

- http://www.sfi.mtu.edu/muses/GIS_Riparian.htm

RENEWABLE ENERGY FROM FOREST RESOURCES:
An Investigation of the Complex Interrelated Issues Associated with Generating Automotive Fuels From Lignocellulosic Biomass

MUSES

Michigan Technological University

Sustainable Futures Institute
1400 Townsend Drive
Houghton, Michigan 49931
Phone: 906.487.3612
Fax: 906.487.2943
e-mail: sfi@mtu.edu

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Geographic Information Systems: Riparian Model

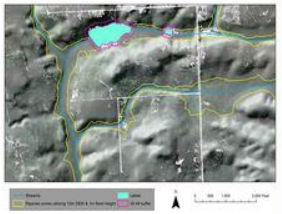
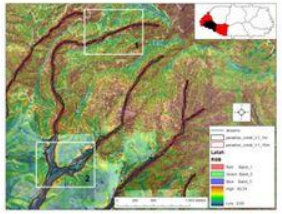


Figure of working Riparian Model, from Abood et al 2012 manuscript. (available after submitting information and clicking through to next page)



Working GIS image exploring the RIPARIAN MODEL.

Faculty: Ann Maclean , PhD;
Professor, Geographic Information Systems/Remote Sensing;
School of Forest Resources and Environmental Science

Graduate Students: Sinan Abood
Department of Civil and Environmental Engineering
Anthony Landon
School of Forest Resources and Environmental Science

Riparian ecotones are unique, diverse networks of vegetation and soils in close proximity to streams, rivers and lakes. Previous approaches to riparian boundary delineation utilized fixed width buffers, but using a fixed width riparian buffer only takes the watercourse into consideration. It does not consider the surrounding landscape. By hydrologically defining a riparian ecotone to occur at the 50-year flood height and incorporating digital elevation data, the spatial modeling capabilities of ArcMap GIS are utilized to map riparian zones accurately. This approach better characterizes the watercourse and its associated floodplain. Riparian zones delineated using 10 versus 30 meter DEMs and stream course information from the National Hydrography Dataset differ significantly. Within our study areas, 30 meter DEMs are not adequate to map elevation changes for accurate riparian area delineation. The result is a robust GIS based model in an ArcMap Toolbox format to delineate a variable-width riparian boundary.

Obtain a copy of the Riparian GIS Model

Please provide contact information in the request form below. After filling in the information, you will be redirected to the Riparian Model download webpage.

First Name: MI Last Name:

E-mail Address:

Enter questions or comments here:

Submit Form

Acknowledgment

- Many thanks for Professor Dr. Ann Maclean.
- School of Forest Resources and Environmental Science at Michigan Technological University.
- National Science Foundation.

References

- *Abood, S. A., Maclean, A., Mason, L., 2012(a), Modeling Riparian Zones Utilizing DEMs and Flood Height Data, Photogrammetric Engineering & Remote Sensing (PE&RS), 78(3):259-269.
- Abood, S. A., Maclean, A., 2012(b), Modeling and classifying riparian ecotones via GIS utilizing geophysical and vegetative inputs, proceedings of the 2012 AWRA Summer Specialty Conference-Riparian Ecosystems IV, 27-29 June, Denver, Colorado (American Water Resources Association, Middleburg, Virginia), unpaginated CD-ROM.
- Abood, S.A., 2011. Modeling and Classifying Variable Width Riparian Zones Utilizing Digital Elevation Models, Flood Height Data, Digital Soil Data and National Wetlands Inventory: A New Approach for Riparian Zone Delineation, Ph.D. Dissertation, Michigan Technological University, Houghton, Michigan, 111 p.
- Ilhardt, B.L., E.S. Verry, and B.J. Palik, 2000. Defining riparian areas, Riparian Management in Forests of the Continental Eastern United States, (E.S. Verry, J.W. Hornbeck, and C.A.Dolloff, editors). Lewis Publishers, New York, pp. 23–42.
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- Palik, B. J., Tang, S.M. and Chavez, Q. 2004. Estimating riparian area extent and land use in the Midwest, General Technical Report NC-248, U.S. Department of Agriculture, Forest Service, North Central Research Station, St. Paul, MN, pp. 28.
- Verry, E.S., C.A. Dolloff, and M.E. Manning. 2004. Riparian ecotone: a functional definition and delineation for resource assessment. Water, Air, and Soil Pollution: Focus 4:67-94.

***2nd place recipient of the 2013 ESRI Award for Best Scientific Paper in Geographic Information Systems, American Society of Photogrammetry & Remote Sensing (ASPRS) 2013 Annual Conference.**

Questions

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Spatial Analyst-ORISE Research Fellow

USDA Forest Service

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sinanayadabood@fs.fed.us

saabood@gmail.com