An Environmental Assessment of the Newark Road Prairie State Natural Area

Introduction

Newark Road Prairie is owned by Beloit College and was designated a State Natural Area in 1974 (Figure 1). It is a wet-mesic prairie remnant of the extensive prairie that covered Rock County in presettlement times. It is the largest known wet-mesic prairie in the county. A moisture gradient across the site results in differences in soils and vegetation composition. In the center is a sedge meadow that becomes drier on slight slopes to near mesic[1] conditions on the west. Stands of tall cord grass and blue-joint grass dominate the lower portions; big blue-stem, Indian grass, and switch grass dominate the higher ground. More than 100 species of prairie plants have been recorded from the site including cream wild indigo, rattlesnake-master, shooting-star, sneezeweed, prairie blazing-star, Michigan lily, compass plant, prairie dock, asters, goldenrods, and milkweeds.[2]

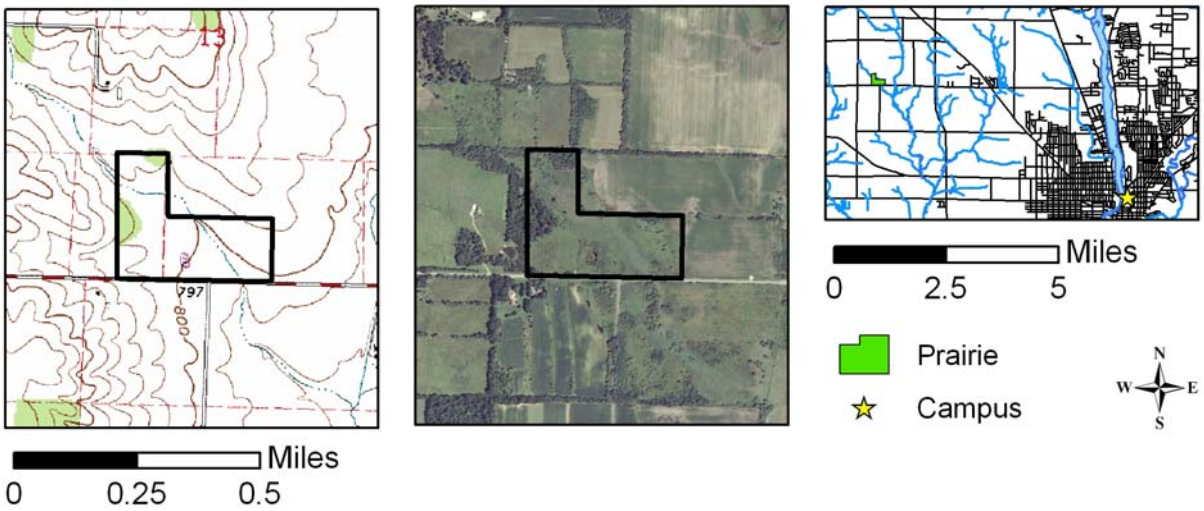


Figure 1. Location of Newark Road Prairie.

An understanding of the physical factors that contribute to the quality of this wet-mesic prairie is necessary for successful preservation and management. Over the next month, you will perform an environmental assessment of the prairie that includes collecting information on differences in topography and soils across the site, surface flow entering and leaving the site, and groundwater flow across the prairie. On the basis of this information and the land use conditions in the Raccoon Creek watershed, you will describe the current environmental conditions at the site and evaluate potential challenges or threats to the preservation and management of the prairie.

[1] Mesic means there is a moderate or well-balanced supply of moisture, as opposed to xeric (dry) or hydric (wet).
[2] State natural area description modified from http://dnr.wi.gov/ORG/LAND/ER/SNA/index.asp?SNA=113 .

This type of assessment is very typical of one that you might perform as an environmental geoscientist working for an environmental consulting company, a state natural resources agency, or a county land preservation department.

Overall Procedure

Beginning with a field reconnaissance, we will spend five 2-hour class periods at the prairie. You will conduct fieldwork in a group with two or three other students. Once the fieldwork is complete, you will use it along with several other map resources to complete your assessment. **Each student is responsible for interpreting their own field data and writing their own environmental assessment**.

Data Sets

As part of the assessment, you will analyze several classes of environmental data. Detailed instructions on field and analysis methods will be provided in class. General descriptions of the data sets are provided below. The challenge in writing your environmental assessment will be in recognizing and explaining connections among the different types of environmental data.

Topography

Using a base map, you will delineate the basin, or watershed, for the stream that flows through Newark Road Prairie.

Stream flow

Using field measurements, you will calculate stream flow where the stream enters the prairie and where it leaves the prairie.

Soils

Using the field map of soils and well/staff gage locations **(see page 7)** and the soil texture flow chart on **page 8**, you will field check soils at three locations.

Groundwater flow

Using water level measurements and instrument elevations at seven monitoring wells and five staff gages **(see page 7)**, you will calculate hydraulic head and create a water table map for the southeastern portion of the prairie.

Land use

Using a land use map for the region **(see page 9)**, you will evaluate potential impacts to the prairie.

Data Collection

Your group will need to decide the order in which you collect your field data, being aware that the entire class is sharing field equipment – there is not enough field equipment for each group to have their own complete set. We will create a calendar on a dry erase board in the classroom so that you can post the dates that your group needs certain pieces of equipment. This way all groups will have a sense of equipment availability. Be aware that you may need to update your equipment needs each week based on field progress.

You will use a variety of equipment to collect your field data. Some of the equipment will be needed every time you visit the prairie. The timing of when your group needs the other pieces of equipment will depend on how you organize and prioritize your field tasks.

The following equipment is necessary every time you go into the field.

- A Trimble GeoXM and a stylus (one assigned to each group).
- A field map of soils and well/staff gage locations (each student has their own map, **see page 7**)

Table 1 lists the equipment that is needed for one or two visits, depending on your group's field agenda:

Table 1. Equipment list for Newark Road Prairie.

Equipment	Total Number Available
soil auger or probe	4
Munsell color chart	3
squirt bottle	lots
electronic water level meter	3
tape measure	6
meter stick	lots
velocity meter	2

All of your field data will be recorded in a GPS-enabled handheld PC (a Trimble GeoXM). The advantages of using a Trimble are that it "geo-tags" all of your data collection points. This allows you to see all of the locations in the field on a satellite image and later, to plot the locations on a map. Use of the handheld PC also allows you to see your own position as you walk through the prairie (you are the X). As you zoom into or out of the viewable area, think about the meaning of **scale** and what constitutes an **acceptable positional error** in your GPS coordinates.

The Trimble also allows for consistency in field notes. Using the same list of traits to describe, for example, soil moisture (dry, moist, saturated) allows you to standardize their meaning, thus making the traits more comparable among different locations. It can also be easy to get distracted in the field (at least for me, it is,…hmmm, did you see that bug?) and forget to record the same data at multiple field locations. Thinking about what it is you want to record *before* you go into the field and creating a data form on the Trimble ensures that you will collect all of the data that you need.

You will use the Trimbles to record stream flow measurements, soil descriptions, groundwater level measurements, and other relevant field notes. When you are finished collecting your field data, we will download them from the GeoXM and print them out.

Instructions on how to collect data will be provided in class, but in case you forget, the general procedure follows:

- Turn on the Trimble by pressing the green button once.
- Open ***TerraSync*** from the Start menu.

- In ***TerraSync***, select **Data** from the ***TerraSync*** main menu (upper left drop down box).
- Choose **New File** (if it is the first time that you are collecting data – we will do this as a class) or **Existing File** (if you are adding to a file) from the drop down box below the ***TerraSync*** main menu.
- For an **Existing File**, the list of files stored on the Trimble will appear. Select yours and press **Open** (button on the right). Confirm the antenna height by pressing **Yes**.
- Choose **Collect Features** from the drop down box below the ***TerraSync*** main menu.
- Choose the appropriate **Feature Name** (Well, Soils, Stream flow, Notes).
- When you are ready to mark the location, select **Create** (button on the right).
- Fill out the form with all of the feature's information.
- Press **OK** to save the feature (otherwise press **Cancel** if you want to move to a different location without saving).
- After creating (or cancelling) you return to the **Collect** screen. To go back to the map, select **Map** from the ***TerraSync*** main menu.
- When you are done, exit ***TerraSync*** by pressing the X in the upper right corner.
- Turn off the Trimble by pressing the green button once.

Data Analysis

You will need to analyze the different classes of environmental data for use in your overall environmental assessment. Some of the data sets require specific calculations, which are explained below. Once calculations are complete, try to identify how the different data sets are interrelated. For example, how do your stream flow results relate to your groundwater flow results? How do the soils results relate to topography?

Topography

Using the base map provided, delineate the basin, or watershed, for the stream that flows through Newark Road Prairie. I recommend using pencil so that you can erase, if necessary. **This map should be included in your final report (see page 10).**

Stream flow

Using your field measurements, plot the points where you measured stream flow on the map on **page 11**. Then, calculate stream flow where the stream enters the prairie and where it leaves the prairie. Find the discharge for each section by multiplying its cross-sectional area by the stream velocity (V_{stream}). Express your discharge results in m^3/s.

$$\textbf{Discharge for each section} = \mathbf{V_{stream}} \times \textbf{Area}$$

Soils

Compare your soils descriptions to the descriptions provided by the Soil Conservation Service**.** A copy of the **Soil Survey of Rock County, Wisconsin** can be

found on our Moodle site. You should also plot the points where you collected soil samples on the map on **page 11**. Use different symbols from those you used for the stream flow measurements. Create a legend on the map that identifies all of the symbols. **This map should be included in your final report.**

Groundwater flow

Using the water level measurements that you collected in the field and the instrument elevations at the seven monitoring wells and four staff gages, calculate the hydraulic head at each measurement point. **Table 2** shows elevations for each well and staff gage. **Create a summary table for your report** that lists the well or staff gage name, the measured water level, the elevation of the well or staff gage, and the hydraulic head. The summary table should be created in a word processor or spreadsheet. It should be neat and it should include an informative title. You can use the tables in this handout as examples of well-constructed tables. Do not forget to include units, where necessary.

Table 2. Well and staff gage elevations.

Well or Staff Gage Name	**Elevation** (feet, above local datum)
MW1	100.88
MW2	102.37
MW3	100.03
MW4	103.74
MW5	99.52
MW6	99.67
MW7	100.11
A	101.76
B	100.74
BM	100.00
C	99.09
D	98.62

Create a water table map for the southeastern portion of the prairie using your hydraulic head measurements and the base map provided **(see page 12)**. First, plot the positions of the wells and staff gages using the UTM coordinates that you recorded in the field. Use different symbols for the wells and for the staff gages. Write down the hydraulic head value next to the position of each well or staff gage, and then contour the hydraulic head measurements. Be sure to consider the position of the stream as you create the water table map. Include a complete legend. **This map should be included in your final report.**

Land use

Use the land use map for the region to evaluate potential impacts to the prairie. You will need to consider not only the different types of land uses in the region, but also what your field results tell you about whether or not the prairie is vulnerable to human activities associated with these land uses.

Final Report

Your final report should be a well-written assessment of the current environmental conditions at Newark Road Prairie and the potential challenges or threats to its preservation and management. Include the following sections with headings to distinguish each section:

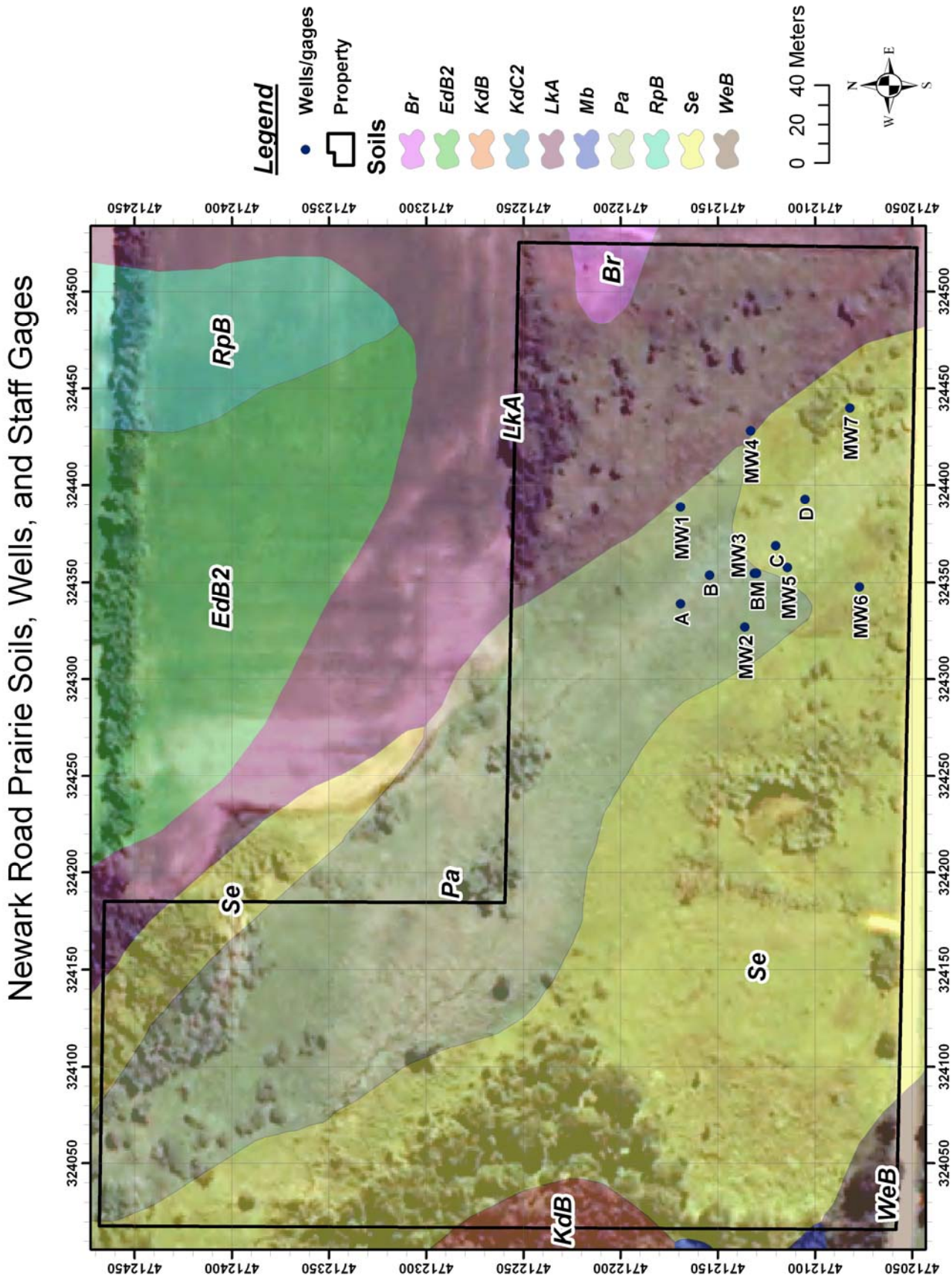
Introduction: This section should include your overall purpose and a broad description of your study area. This might include (but is not limited to) things like the prairie's location, size, and current use.

Current conditions: In this section, you should fully describe the results of your fieldwork. Draw from readings and class discussions to complement the physcial data you collected in the field. You might also reflect on how different data sets make sense (or don't make sense) in relation to each other. Make sure you refer to all of the tables and figures (maps) that you include in the report. Tables and figures should have concise titles. They should be numbered consecutively as you refer to them in the text.

Potential threats: In this section, draw conclusions as to how the prairie might be vulnerable in the future to physical processes and/or human activities. Support your conclusions using your field data, other background data (e.g., land use), or information from readings and class discussions.

Format: Your typed, double-spaced report should include no less than four full pages of text and no more than five pages of text. Use 12-point, Times or Times New Roman font. Margins should be 1" or 1.25". Include an appropriate title, and staple all tables and figures to the end of the report.

Due Date: Tuesday, November 2nd


Newark Road Prairie Soils, Wells, and Staff Gages
Legend
Wells/gages
Property
Soils
Br
EdB2
KdB
KdC2
LkA
Mb
Pa
RpB
Se
WeB
0 20 40 Meters
N
E
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MW1
MW2
MW3
MW4
MW5
MW6
MW7
A
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BM
C
D
Br
LkA
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Pa
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324050
324100
324150
324200
324250
324300
324350
324400
324450
324500
4712050
4712100
4712150
4712200
4712250
4712300
4712350
4712400
4712450

SOIL TEXTURE BY FEEL

Making a Ribbon

Is the soil saturated or nearly saturated and does it appear to be high in organic matter?

Yes → Gently rub wet soil between forefinger and thumb. After the second rub, does the soil feel greasy?

Yes → **Muck**

No

No → Place an egg size volume of soil in your palm. Add water dropwise and knead the soil to break down all aggregates. Soil is at the proper consistency when plastic and moldable, like moist putty.

Add dry soil to soak up water

Yes

Yes

Does soil remain in a ball when squeezed?

No → Is the soil too dry?

No → Is the soil too wet?

No → **Sand**

Yes

Place a ball of soil between thumb and forefinger, gently push the soil with the thumb, squeezing it upward into a ribbon. Form a ribbon of uniform thickness and width. Allow the ribbon to emerge and extend over the forefinger, breaking from its own weight.

Does the soil form a ribbon?

No → **Loamy Sand**

Yes

Does soil make a weak ribbon less than 1 inch long before breaking?

No → Does soil make a ribbon 1 inch long before breaking?

No → Does soil make a strong ribbon two inches or longer before breaking?

Yes

Yes

Yes

Excessively wet a small pinch of soil in palm and rub with fore finger.

Yes → Does soil feel very gritty?

Yes → **Sandy Loam**

No → Does soil feel very smooth?

Yes → **Silt Loam**

No → Neither gritty nor smooth?

Yes → **Loam**

Yes → Does soil feel very gritty?

Yes → **Sandy Clay Loam**

No → Does soil feel very smooth?

Yes → **Silty Clay Loam**

No → Neither gritty nor smooth?

Yes → **Clay Loam**

Yes → Does soil feel very gritty?

Yes → **Sandy Clay**

No → Does soil feel very smooth?

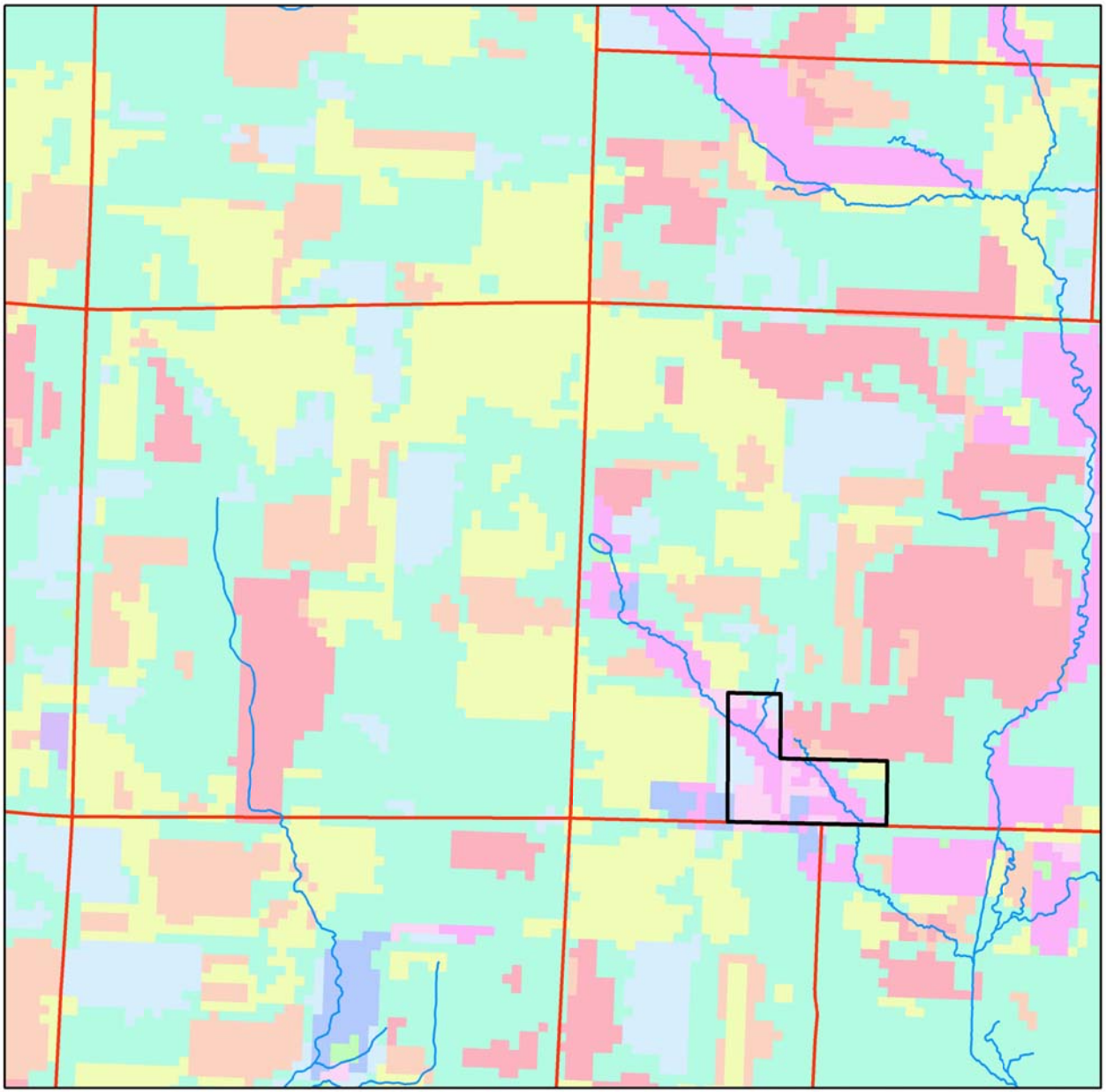
Yes → **Silty Clay**

No → Neither gritty nor smooth?

Yes → **Clay**

Modified from S.J. Thien. 1979. *A flow diagram for teaching texture by feel analysis.* Journal of Agronomic Education. 8:54-55.

Land use near Newark Road Prairie



Legend

Property

Streams

Roads

Land use

- Corn
- Emergent / Wet Meadow
- Forage Crops
- Forested Wetland
- Grassland
- Lowland Shrub
- Broad-Leaved Deciduous
- Open Water
- Other Row Crop
- Red Pine

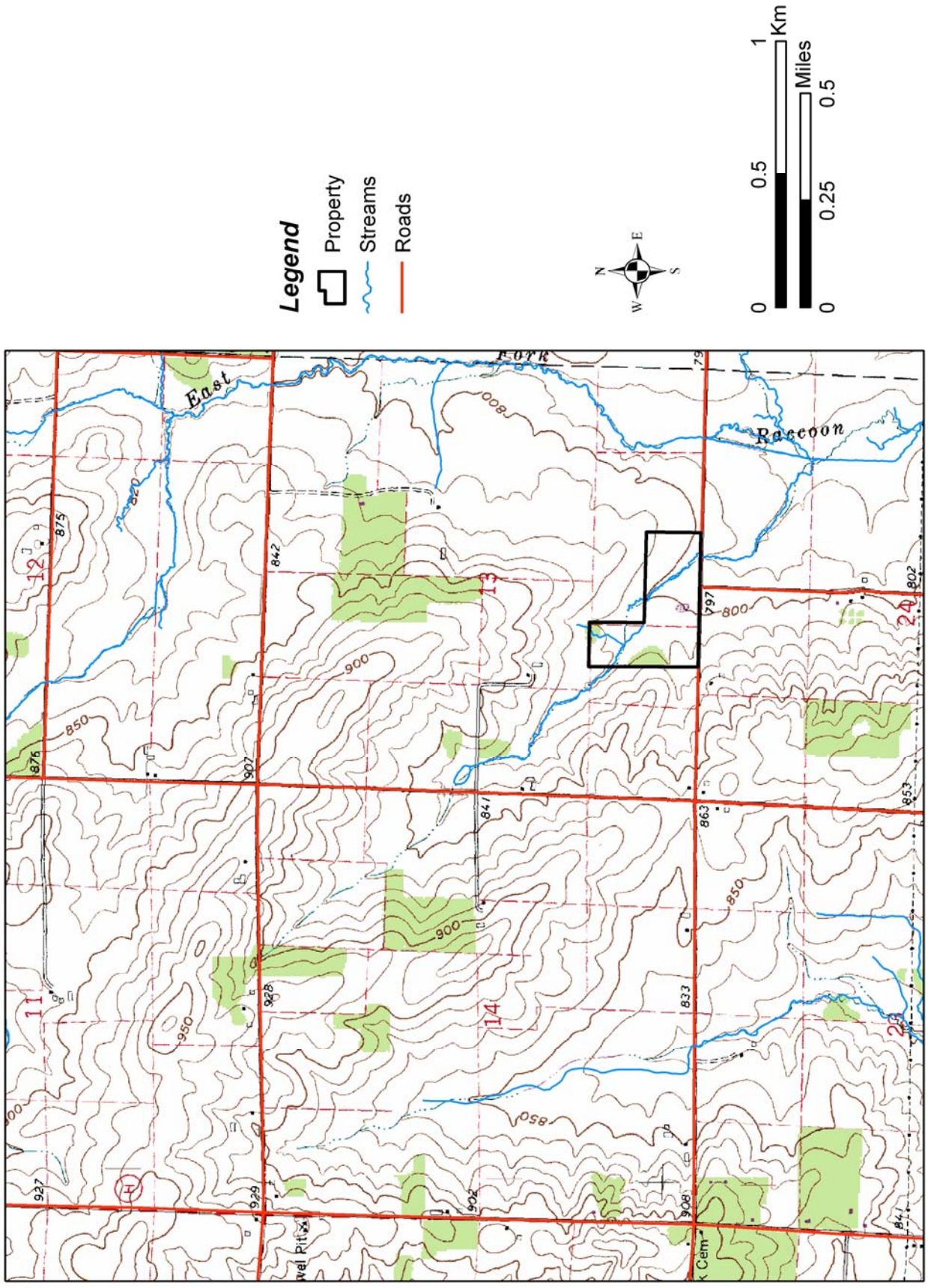
N
W E
S

0 0.5 1 Km

0 0.25 0.5 Miles

Source: WISCLAND landcover data, WDNR.

GEOL110


Legend
Property
Streams
Roads
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0
0.5
1
Km
0
0.25
0.5
Miles
East
Fork
Raccoon
11
12
13
14
24
25
800
850
900
950


Legend
Property
0 20 40 Meters
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4712250
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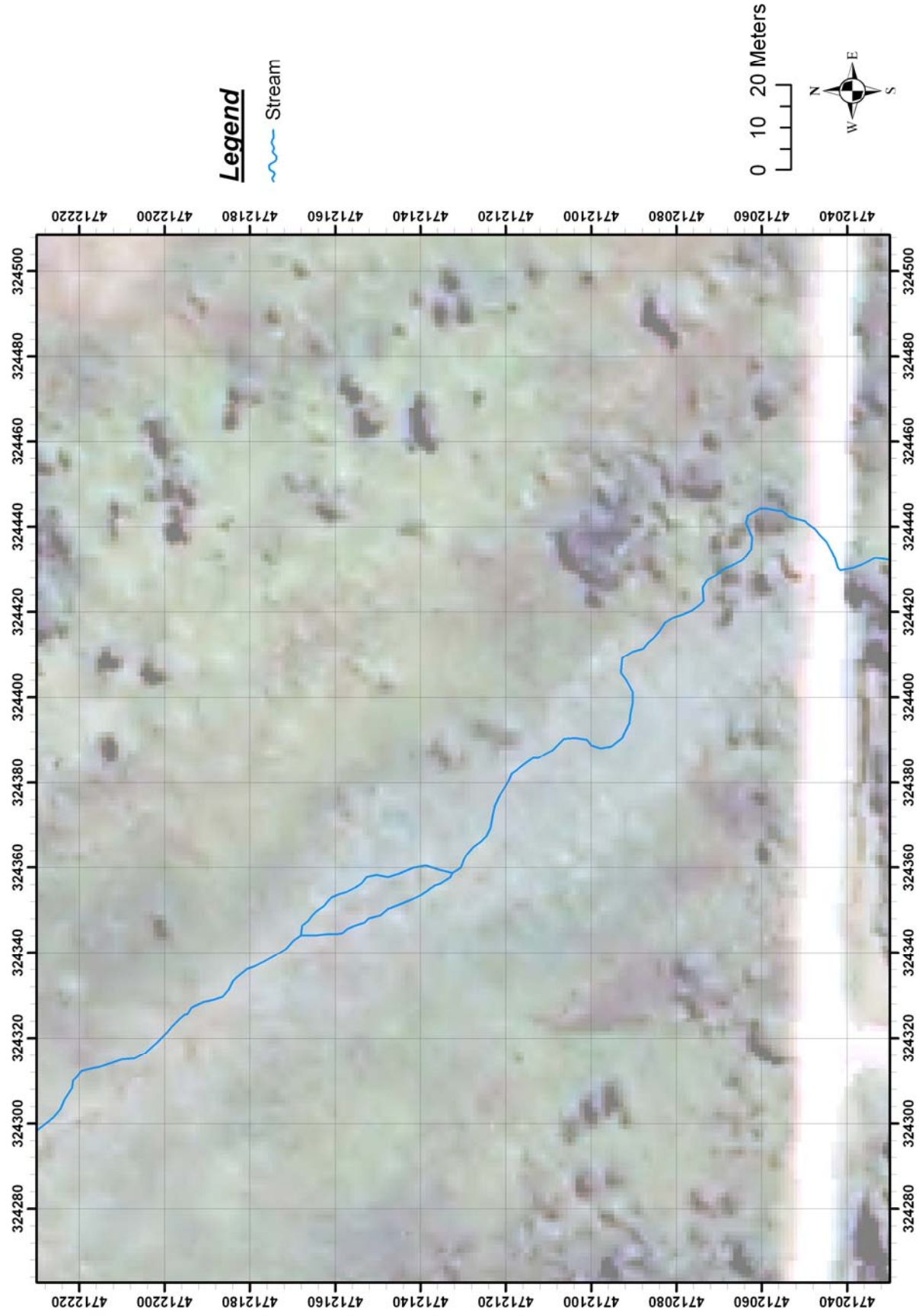
Legend
Stream
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