ES341 Introduction to Georeferencing, Map Layers and Spatial Associations

One of the basic principles of GIS is the notion of map layers (thematic layers of information; points, lines or polygons) that are georegistered in a common coordinate space. Georeferencing allows layers to be placed in a unified geographic coordinate system, so that map elements (e.g. bedrock geology polygons) and related attribute information (e.g. rock type, lithology, age) are properly aligned and overlie one another in spatial context. Georeferencing and thematic layers provide a power framework to conduct spatial analyses within and between coverages; useful for such activities as city planning, zoning, hazards mitigation, etc.

This exercise provides a hands-on introduction to georerencing, projected 2-D coordinate systems and layered map themes. Attached are four analog map-layer transparacencies for the Monmouth-Independence area (attached handouts). The four layers include (1) Monmouth-WOU Roads, (2) WOU Buildings, (3) Monmouth Geology, and (4) Monmouth Flood Hazard Zonation. The following is the key for the geology and flood polygon identifiers:

Geology Code

ID	Explanation
Qtlb	Quaternary Alluvium (bottomlands)
Qtm	Quaternary Alluvium (middle terrace)
Qth	Quaternary Alluvium (high terrace)
Ts	Eocene Spencer Formation

Flood Hazards Code

ID	Explanation
NO	Not in flood plain
FL	Part of zone AE – Floodway (active annually)
A	100 year flood
AE	100 year flood with elevation determined
X	500 year flood

The projected map referencing system for all four layers is Oregon State Plane North in feet **(NOTE: THE TRANSPARENCIES HAVE SCALE LISTED UNITS IN "METERS", THIS IS A TYPO, THE BAR SCALE IS IN FEET)**. The neatline box is set at the same dimensions and scale in each of the four map layers. Examine the maps / transparencies, complete the following tasks.

1. Determine the fractional scale of the Monmouth map layers. Show all of your math work.

2. The upper left corner of the neat box is located at the following State Plane Coordinate

Easting: 7,488,836 ft Northing: 449,324 ft

a. Using map scale, engineers scale and ruler, determine the following state plane coordinates for the other 3 corners of the neat box. Show all of your math work.

	Easting (ft)	Northing (ft)
Upper Right (NE) Corner	_____	_____
Lower Right (SE) Corner	_____	_____
Lower Left (SW) Corner	_____	_____

b. Calculate the total area of the map coverage, as defined by the bounding rectangular neatline, in square feet. Show all of your math work.

c. Calculate the total area of the map coverage, as defined by the bounding rectangular neatline, in square kilometers. Show all of your math work.

d. Calculate the total area of the map coverage, as defined by the bounding rectangular neatline, in hectares. Show all of your math work.

3. Overlay and align (georegister) the Monmouth Roads layer (transparency) on top of the WOU Buildings layer (transparency). Using the red transparency marker, draw a rectangular box on the Roads layer that circumscribes the footprint distribution of the WOU Buildings layer below. Label the box you've drawn "WOU Boundary".

   a. Calculate the area of the rectangular box / building footprint you've drawn in square feet. Show all math work and conversions.

   b. Calculate the area of the rectangular box / WOU boundary polygon you've drawn in square kilometers. Show all math work and conversions.

   c. Calculate the area of the rectangular box / WOU boundary polygon in hectares. Show all math work and conversions.

4. Overlay and align (georegister) the WOU buildings layer on top of the Monmouth Roads layer. Using your mental geography of Monmouth and the Monmouth 7.5-min quad, identify Main Street and Monmouth Ave. on the Roads Layer. Now using the blue transparency marker, trace/draw both streets onto the WOU Buildings layer, from end to end as shown on the map extent.

5. Identify, outline and label the Natural Science Building on the WOU layer (transparency). Identify, outline and label the "New PE" Building on the north side of the stadium.

    a. Measure the center-to-center distance between the Natural Science Building and New PE in feet.

    b. Measure the center-to-center distance between the two buildings in kilometers, show all of your math work.

6. Overlay and align (georegister) the Monmouth-WOU Geology layer on top of the Monmouth Flood Zones layer (transparency). Outline all of the "no flood zones" polygons (map unit "NO") on the geology overlay using a blue marker pen.

7. Overlay and align (georegister) the Monmouth-WOU Geology layer on top of the Monmouth Flood Zones layer (transparency). Group the FL (floodway), A-AE (100 yr floodplain), and X (500 yr floodplain) hazards units, and outline them with the red marker pen on the geology overlay.

8. Overlay and align (georegister) the Flood Hazard layer on top of the WOU Buildings layer. On the flood hazard overlay, use a compass and ruler to draw a circle 2000 feet in diameter, with center located in the middle of the Natural sciences building.

9. Answer the following questions:
    a. Which geologic map units are associated with flood hazards in the Monmouth area? Explain your answer in terms of geologic map associations with flood hazards.

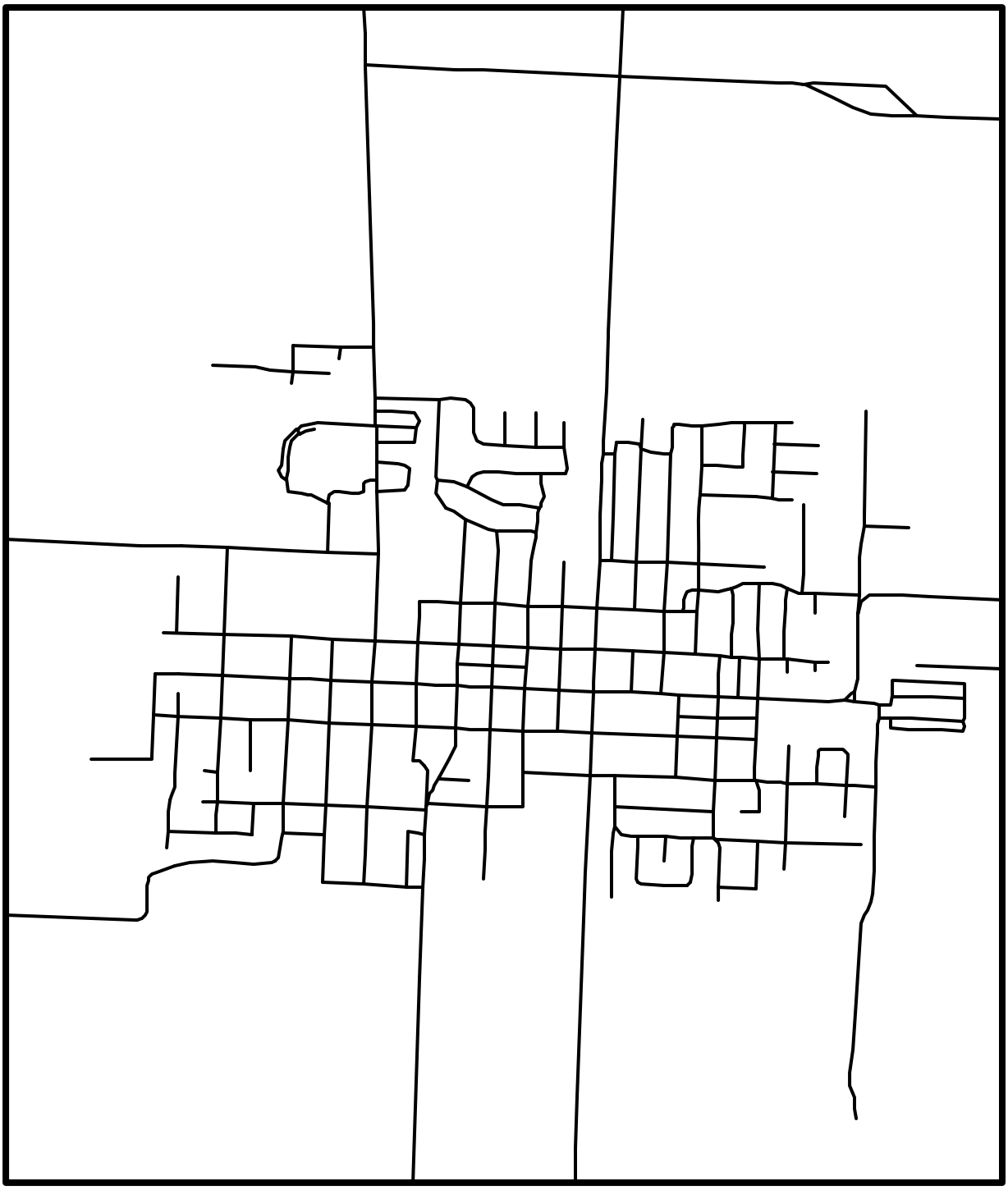
    b. Which geologic map units are associated with unit "NO" no flood hazards in the Monmouth area? Explain your answer, what geologic reasons are associated with an "NO" hazard designation.

    c. What is the probability of the Natural Sciences building being flooded by the Willamette River in the next 100 years? In the next 500 years? Explain your answer and line of reasoning.

10. Using the Monmouth Geology layer and your calculated map area from 2b above, determine the percentage of the map area covered by Quaternary Alluvium (Qtlb+Qtm+Qth) vs. Eocene Spencer Formation (Ts)
    a. Total Map Area _____ sq. ft _____ % of Total
    b. Total Qa Area _____ sq. ft _____% of Total
    c. Total Ts Area _____ sq. ft _____ % of Total

11. Given your calculated areas and percentages in 10 above, hypothesize as to the potential for the occurrence of alluvial water-bearing aquifers in the WOU-Monmouth area. Explain your answer and line of reasoning.

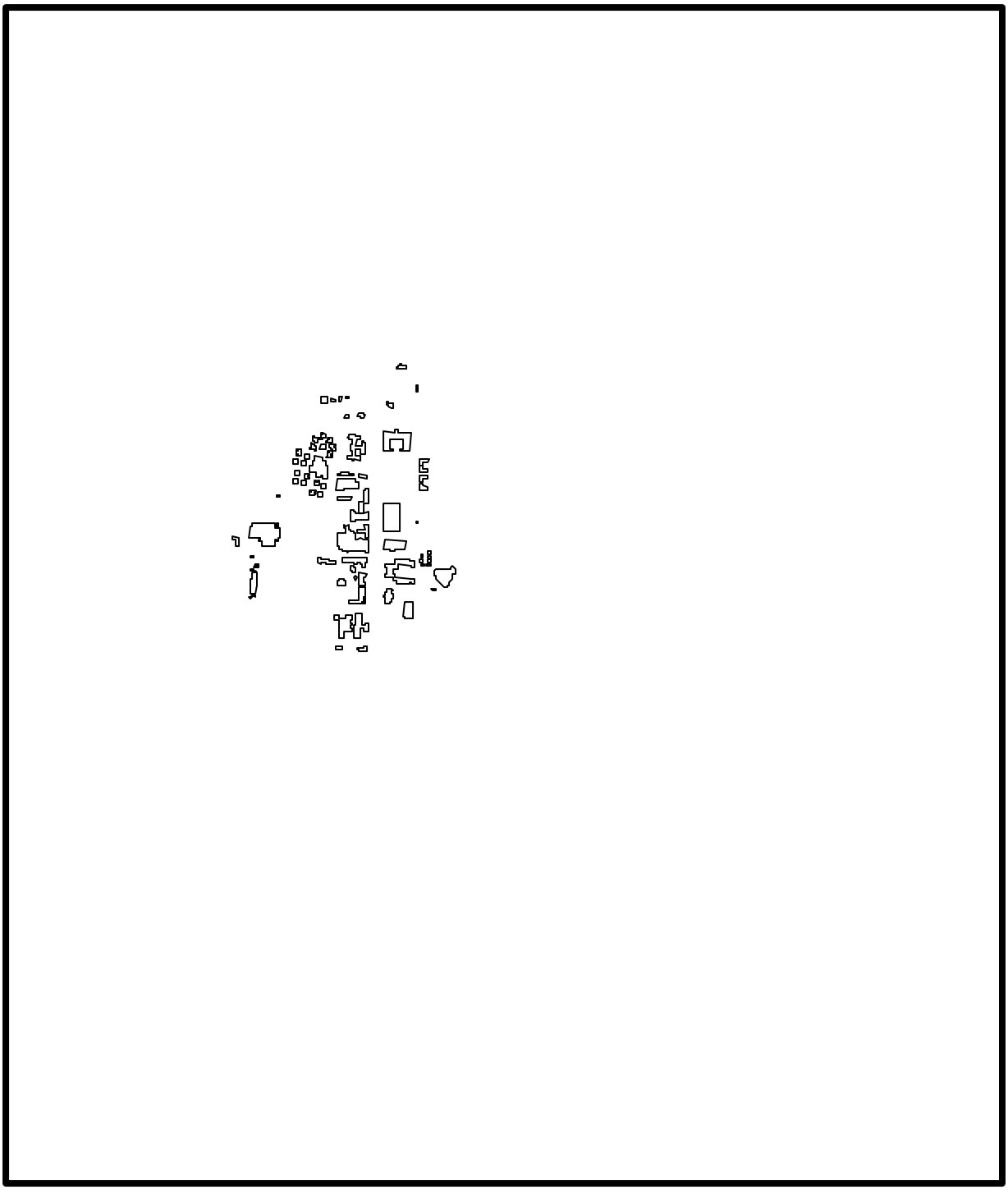
Monmouth-WOU Roads



N

1000 0 1000 2000 Feet (corrected)

WOU Bldgs



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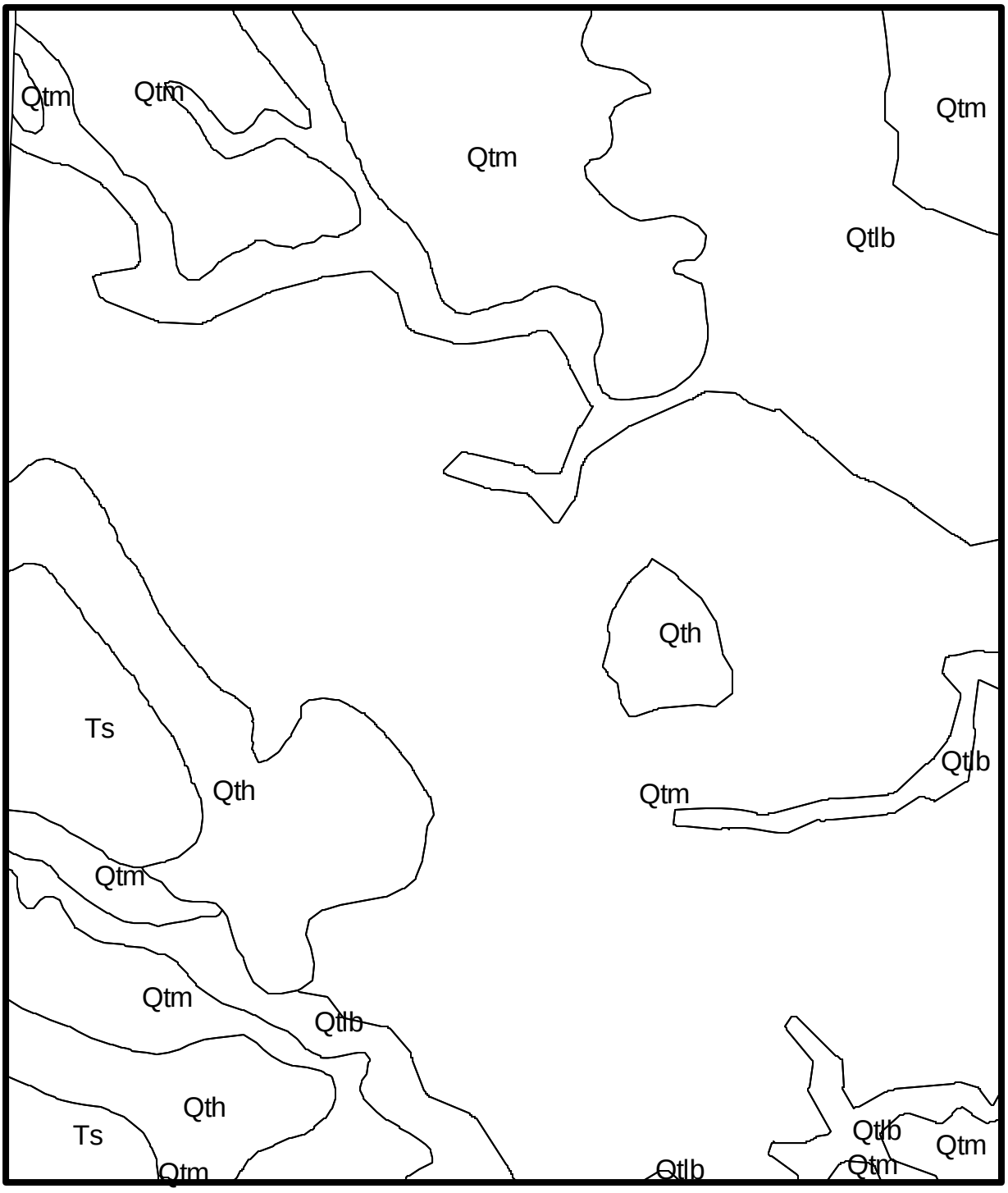
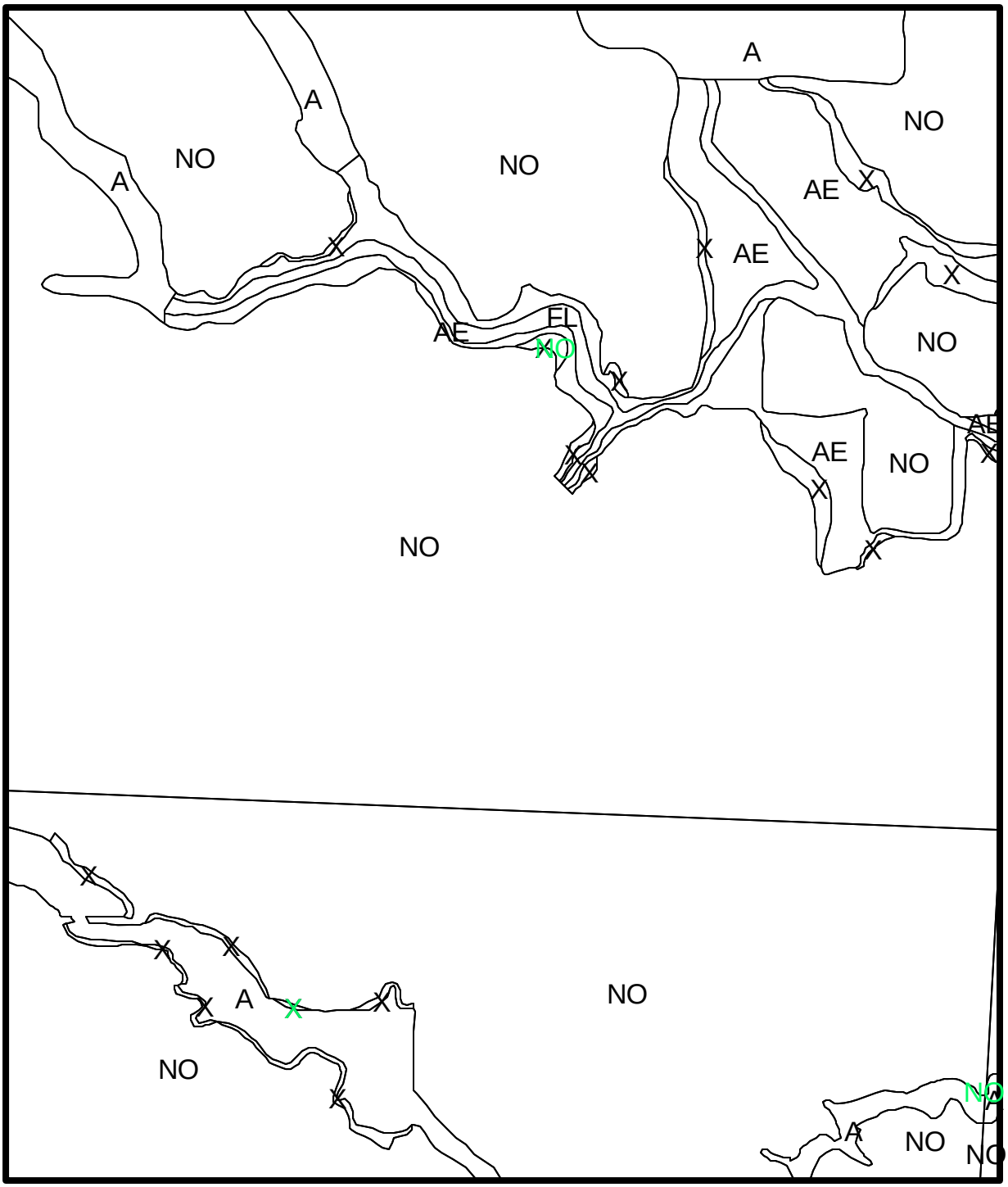
Monmouth-WOU Geology



Monmouth Flood Zones



1000 0 1000 2000 Feet (corrected)

N