



Five Themes of Geography: Human-Environment Relationships Climate, Hazards, and Minor League Baseball Stadium Orientation

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Purpose: This exercise applies concepts associated with physical and environmental geography with a number of cities that are home to Minor League Baseball teams in North America. As a result of completing this exercise, students will be more familiar with how environmental conditions influence the weather and associated hazards in certain Minor League cities as well as learn why stadium designers orient ballparks in certain directions.

Supplies: To complete this exercise, students will need a pen or pencil, a red, blue, and green colored pencil, a geometry compass, and a calculator

Data: Primary data for this exercise was obtained from Minor League Baseball Online, Baseball Reference Online, and the websites of individual Minor League Baseball franchises. Data analysis required to design this exercise was completed by the author.

Part A: Case Study: Climate Patterns among Three Pairs of Minor League Baseball Cities

Weather (daily atmospheric conditions) and climate (long-term atmospheric trends) play a significant role in Minor League Baseball because all 160 teams play outdoors. Players, team personnel, and fans must prepare for the weather on game days. Although the season is played in late spring and summer and the weather is generally warm throughout North America, a great degree of variability in temperature and precipitation exists among cities hosting Minor League teams. In this portion of the exercise, you will examine how the primary influences in climate (latitude, topography, elevation, proximity to large bodies of water, prevailing winds, air masses, and atmospheric pressure) create distinctly different environments for teams that play a few hundred miles apart.

1. Use the climate data provided below to produce climographs for three pairs of Minor League Baseball cities (Figure 1). Use a red pencil to draw a vertical line graph for average daily high temperatures by month, a blue pencil to draw a vertical line graph for average daily low temperatures by month, and a green pencil to draw a vertical bar graph for average monthly precipitation.

Pair 1: Tacoma and Spokane,
Washington

Pair 2: Burlington, Vermont and
Portland, Maine

Pair 3: Colorado Springs,
Colorado and Tulsa, Oklahoma

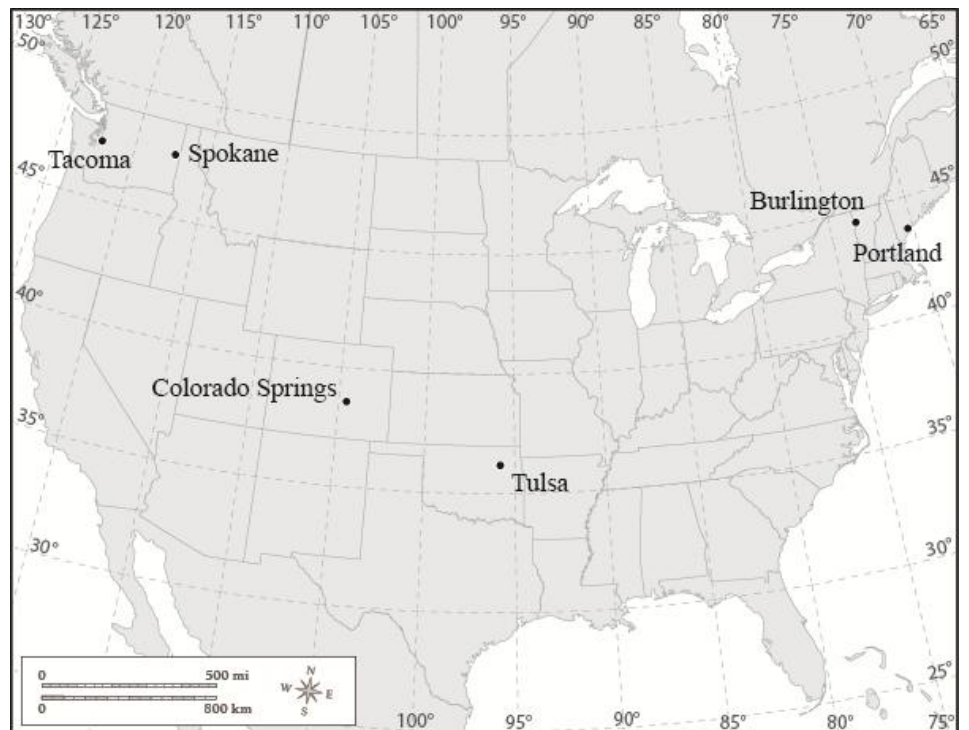
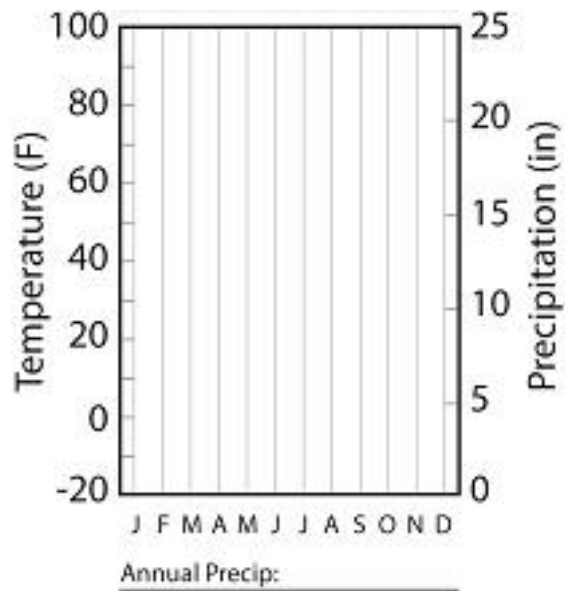
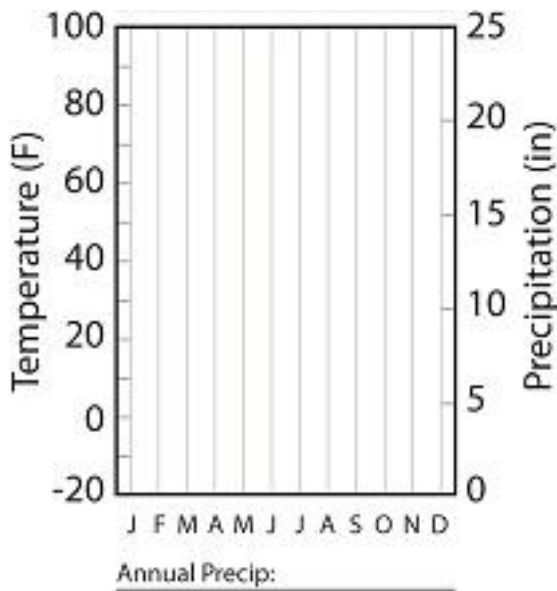


Figure 1: Case Study Cities

Tacoma, Washington	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ave/Tot
Average High Temp (F)	45.8	49.5	53.2	58.2	64.4	69.6	75.3	75.6	70.2	59.7	50.5	45.5	59.8
Average Low Temp (F)	35.9	37.2	39.1	42.1	47.2	51.7	55.3	55.7	51.9	45.7	39.9	35.9	44.8
Average Precipitation (in)	5.13	4.18	3.75	2.59	1.78	1.49	0.79	1.02	1.63	3.19	5.9	5.62	37.07

Spokane, Washington	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ave/Tot
Average High Temp (F)	32.8	39.3	48.6	57.5	66.2	73.9	82.5	82.6	72.5	58.5	41.1	32.8	57.4
Average Low Temp (F)	21.7	25.7	30.4	35.5	42.6	49.2	54.6	54.5	45.9	35.8	28.7	21.6	37.2
Average Precipitation (in)	1.82	1.51	1.53	1.28	1.6	1.18	0.76	0.68	0.76	1.06	2.24	2.25	16.67



- _____ Which city is warmer during the baseball season (April-August)?
- _____ In which city is rain more likely during the baseball season?
- _____ During which season (spring, summer, autumn, winter) do these cities receive most of their precipitation?
- _____ Which city experiences higher diurnal (daytime to nighttime) change in temperature during the baseball season?

Describe how each of the following climatic influences plays a role in each city's climate:

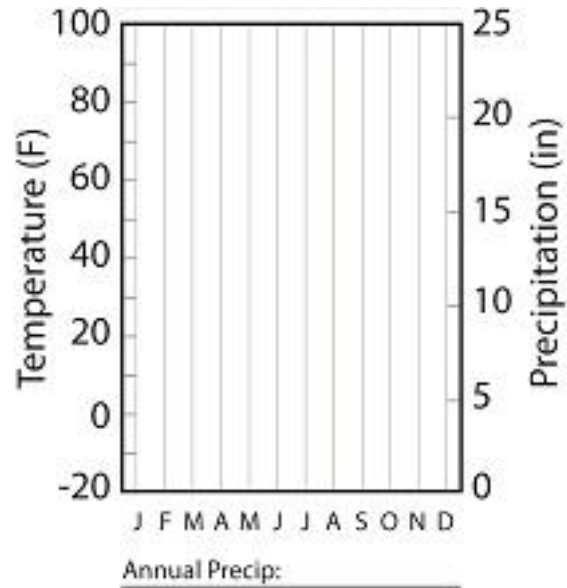
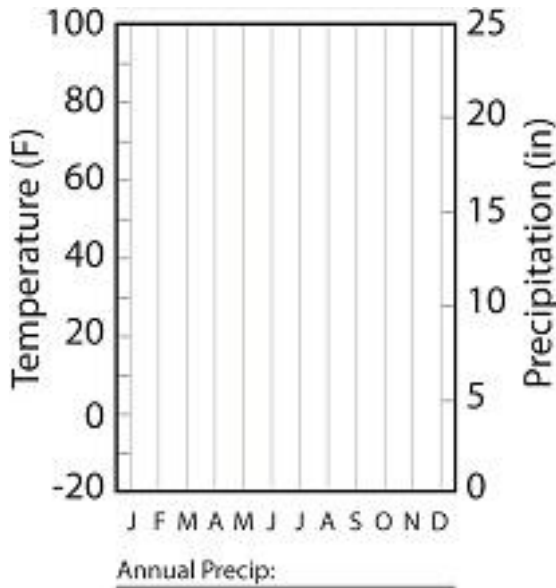
Proximity to large bodies of water: _____

Prevailing winds: _____

Topography: _____

Burlington, Vermont	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ave/Tot
Average High Temp (F)	26.7	29	39.6	53.3	67.8	76.5	81.4	78.4	68.9	56.4	44	32.3	54.5
Average Low Temp (F)	9.3	10.9	21.8	33.6	45.2	54.7	59.8	58.1	49.9	38.9	30.3	17.3	35.8
Average Precipitation (in)	2.22	1.67	2.32	2.88	3.32	3.43	3.97	4.01	3.83	3.12	3.06	2.22	36.05

Portland, Maine	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ave/Tot
Average High Temp (F)	30.9	34.1	42.2	52.8	63.3	72.8	78.8	77.3	68.9	57.9	47.1	36.4	55.2
Average Low Temp (F)	12.5	15.6	25.2	34.7	44.2	52.9	58.6	57.2	48.5	37.4	29.5	18.7	36.3
Average Precipitation (in)	4.09	3.14	4.14	4.26	3.82	3.28	3.32	3.05	3.37	4.4	4.72	4.24	45.83



- _____ Which city is warmer during the baseball season (April-August)?
- _____ Does one city receive more precipitation during the baseball season than the other?
- _____ ; _____ During which season (spring, summer, autumn, winter) do these cities receive most of their precipitation? (list Burlington first, then Portland)
- _____ Which city experiences higher diurnal (daytime to nighttime) change in temperature during the baseball season?

Describe how each of the following climatic influences plays a role in each city's climate:

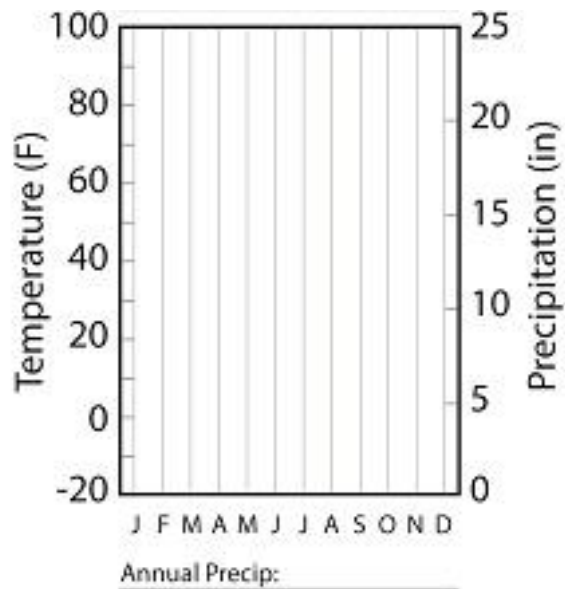
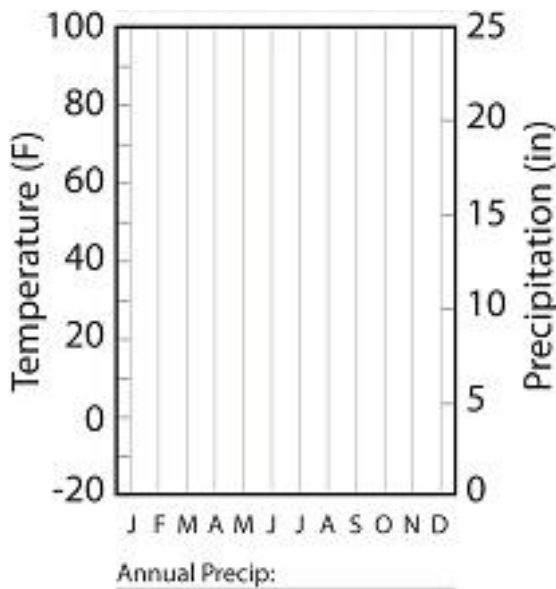
Proximity to large bodies of water: _____

Prevailing winds: _____

Topography: _____

Colorado Springs, Colorado	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ave/Tot
Average High Temp (F)	41.7	45.4	51.6	59.2	68.4	79.2	84.4	81.6	74.1	63.4	49.8	42.4	61.8
Average Low Temp (F)	14.5	18	23.9	31.4	40.7	49.5	54.8	53.6	45.4	34.3	22.6	15.6	33.7
Average Precipitation (in)	0.28	0.35	1.06	1.62	2.39	2.34	2.85	3.48	1.23	0.86	0.52	0.42	17.4

Tulsa, Oklahoma	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ave/Tot
Average High Temp (F)	46.5	52.9	62.4	72.1	79.6	88	93.8	93.2	84.1	74	60	49.6	71.4
Average Low Temp (F)	26.3	31.1	40.3	49.5	59	67.9	73.1	71.2	62.9	51.1	39.3	29.8	50.1
Average Precipitation (in)	1.6	1.95	3.57	3.95	6.11	4.72	2.96	2.85	4.76	4.05	3.47	2.43	42.42



- _____ Which city is warmer during the baseball season (April-August)?
- _____ Which city receives more precipitation during the baseball season?
- _____ During which season (spring, summer, autumn, winter) do these cities receive most of their precipitation?
- _____ Which city experiences higher diurnal (daytime to nighttime) change in temperature during the baseball season?

Describe how each of the following climatic influences plays a role in each city's climate:

Elevation: _____

Prevailing winds: _____

Topography: _____

Part B: Minor League Baseball Stadium Orientation

One of the most important factors in choosing the location of a baseball stadium is its planned orientation (the direction it will be facing). In this exercise, you will use data collected from 30 Triple-A stadiums to graph their orientations on a blank compass rose included below.

1. Determining Azimuth

Determining the azimuth, or the number of degrees from true north (0°), can be done with a compass in the field, with a geometry compass and a traditional map, or with recently introduced technologies such as Google Earth. Use a geometry compass to determine the azimuth for Fifth Third Ballpark, home of the Single-A West Michigan (Grand Rapids) Whitecaps (image to the right).



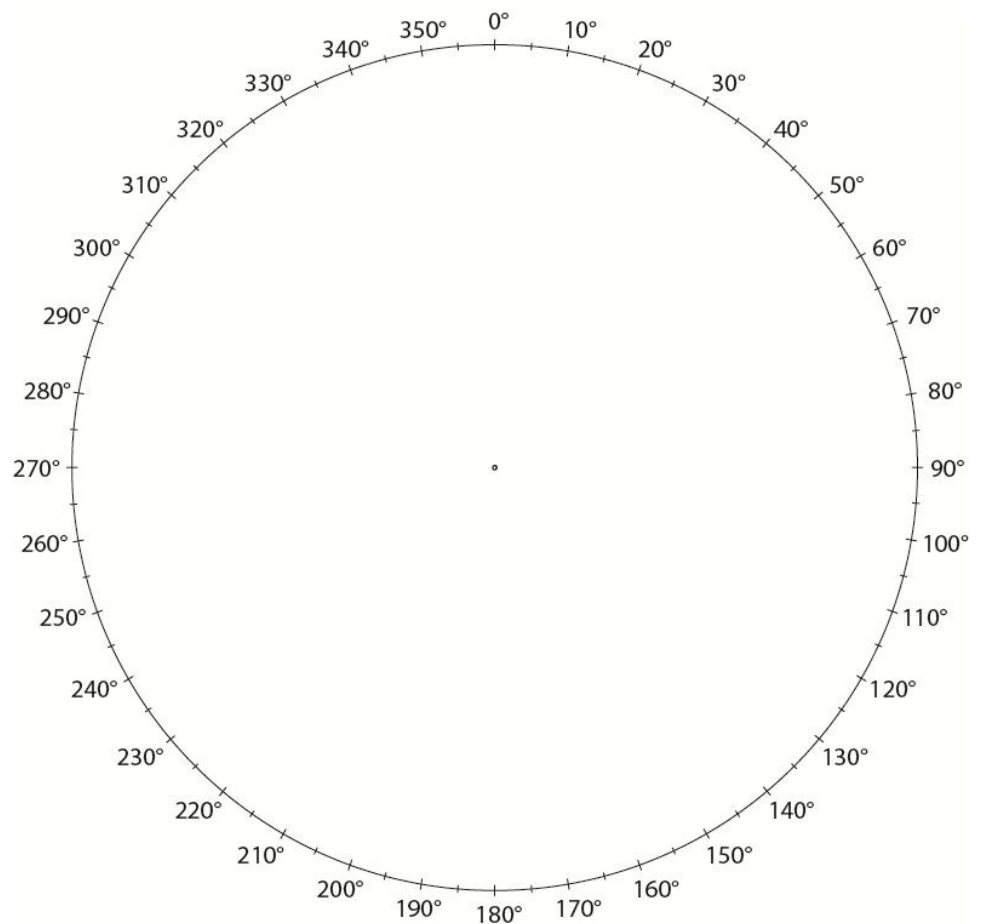
_____ $^\circ$ Ballpark orientation (in degrees)

_____ Ballpark orientation (general direction)

2. Graphing Azimuth Data

Use a geometry compass to draw the azimuth data for Triple-A baseball stadiums on the blank compass rose.

Triple-A Team	Azimuth (degrees)
New Orleans	56
Round Rock	44
Tucson	44
Gwinnett	117
Charlotte	52
Memphis	69
Albuquerque	45
Oklahoma City	55
Las Vegas	45
Durham	73
Fresno	100
Norfolk	138
Nashville	147
Louisville	14
Sacramento	45
Colorado Springs	144
Reno	30
Indianapolis	55
Columbus	133
Lehigh Valley (Allentown)	49
Salt Lake City	135
Omaha	45
Scranton/Wilkes-Barre	45
Iowa (Des Moines)	35
Toledo	86
Pawtucket	344
Buffalo	158
Syracuse	0
Rochester	69
Tacoma	31



Describe the general pattern of Triple-A ballpark orientations, including the range of azimuths, the directions stadiums face and do not face, and common azimuths.

What is the mean orientation of Triple-A ballparks? (use a calculator) _____

Which azimuth reading among Triple-A ballparks is most frequent? _____

Why are ballparks oriented in the manner that they are? Which environmental factors are stadium designers considering? Hint: imagine you are a pitcher, batter, or outfielder.

Based on what you have learned in regards to baseball stadiums, do you think that stadium designers consider the same environmental factors when determining the orientation of football or soccer stadiums? Why or why not?

3. Case Study: The Bakersfield, California Blaze

With a west-northwest orientation of 296° , Sam Lynn Baseball Park in Bakersfield, California is a Minor League Baseball rarity. This stadium is the home of the Advanced Single-A Bakersfield Blaze, a team that ranked 147th out of 160 teams in attendance during the 2010 season with 932 people per game.

Bakersfield, California	Apr	May	Jun	Jul	Aug	Ave/Tot
Average High Temp (F)	75.7	83.8	91.6	96.9	95.4	88.7
Average Low Temp (F)	49.6	56.8	63.7	69.2	68.4	61.5
Average Precipitation (in)	0.45	0.24	0.12	0	0.08	0.89



Sam Lynn Baseball Park

Based on the data provided above, formulate an explanation for the team's poor attendance.

Part C: Natural Hazards and Minor League Baseball: The Quad City River Bandits' "Field of Streams"

Natural hazards such as tornadoes, hurricanes, earthquakes, and thunderstorms affect all Minor League Baseball teams to some degree. The Quad Cities River Bandits of Davenport, Iowa face a hazard most teams do not – flooding. If abundant, spring rain showers and snow melt in the Upper Mississippi River Valley can threaten play at Modern Woodman Park, located on the banks of the Mississippi River. The infamous flood of 1993 forced the team to abandon the stadium and play a significant number of their home games elsewhere in the city (Figure 2). Instead of relocating this historic ballpark, the city has invested millions of dollars into the ballpark to make it flood proof!



Figure 2. Aerial view of Davenport, Iowa in the spring of 1993 (Source: Augustana College Archives).

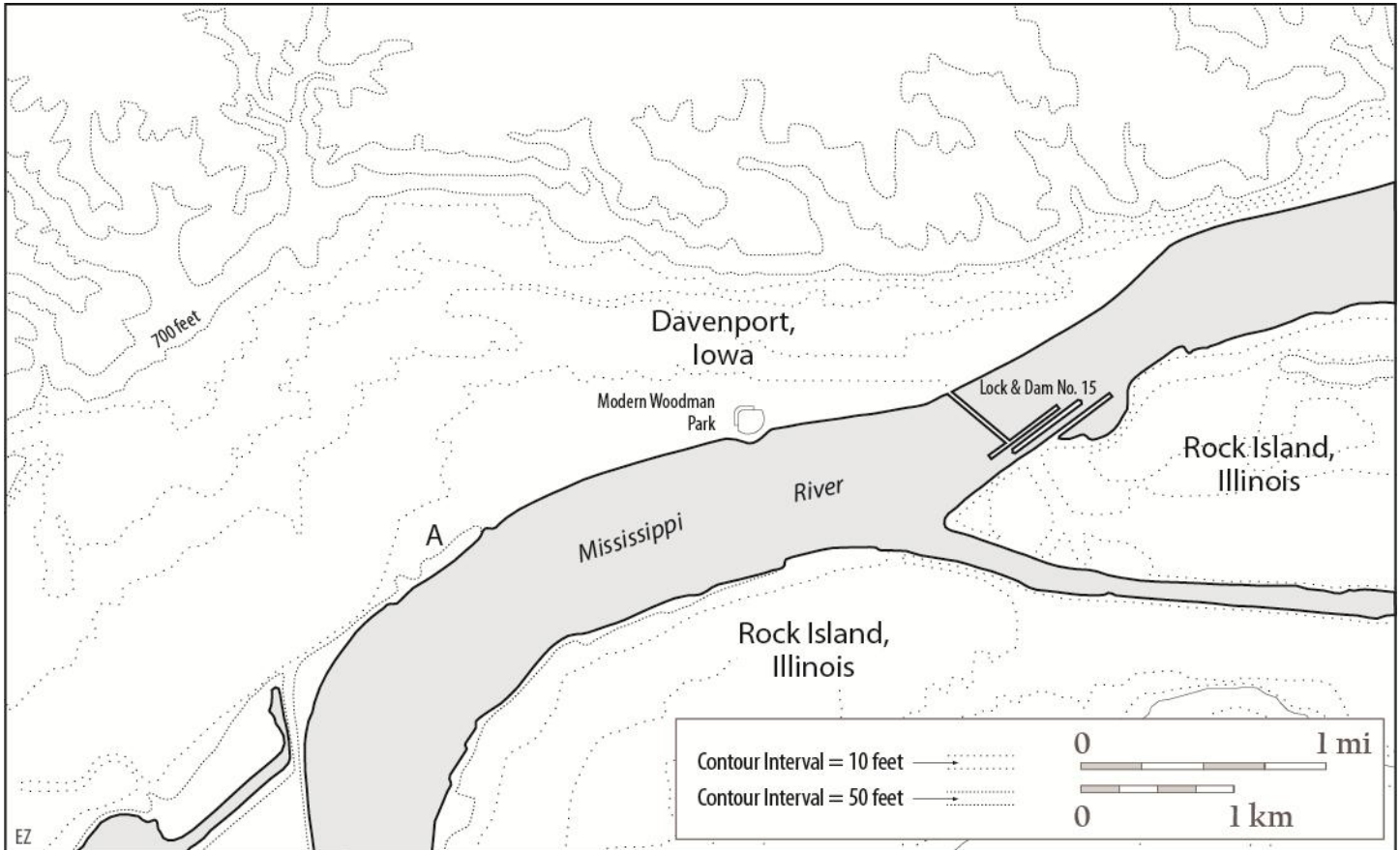
The final phase of the flood proofing project was completed just in time to be tested in the spring of 2011. Aluminum panels were installed around the concourse of the stadium to prevent rising waters from entering, and although a scaffold walkway had to be installed from dry land for access, games were actually played while floodwaters surrounded the ballpark (Figure 3). The decision by the City of Davenport use of earthen berms and aluminum panels for the prevention of flooding in Modern Woodmen Park is one example of how humans use technology to mediate the impacts of natural hazards.



Figure 3. Aerial view of Modern Woodman Park in the spring of 2011 (Source: Quad Cities Dispatch).

Unlike the city of Rock Island, Illinois across the river, the city of Davenport has chosen to maintain a physical and psychological connection to their waterfront by limiting the presence of permanent flood barriers. In fact, it is the largest city between St. Paul, Minnesota and St. Louis, Missouri without a levee. Therefore, when the Mississippi River floods, the residents of Rock Island can rest behind their levees while the City of Davenport asks for volunteers to build temporary levees.

The generalized map below emphasizes the location of the River Bandits’ stadium in relation to the Mississippi River and the local topography. Lines on the map are called isolines, and they display areas of equal elevation. The Army Corps of Engineers maintains the elevation of water above Lock and Dam Number 15 at 561 feet above sea level. Below it, the controlled elevation of the river is 545 feet above sea level. Examine the map and answer the questions below.



_____ What is the elevation of the isoline labeled “A”?

_____ The location of Modern Woodman Park falls between which range of elevations?

The record flood stage for Davenport was set in 1993. In the spring of this year, the section of river below Lock and Dam Number 15 peaked at an elevation of 22.6 feet above normal river elevation. Use a blue colored pencil to draw in the approximate level of the flood waters in Davenport had the city not constructed temporary levees to mitigate damage. Since 1993, the City of Davenport has condemned and cleared many buildings lying below 660 feet. Considering this area of the city is only susceptible to flooding during a small portion of the year, propose some creative ways the city could use this land.
