

Activity Day 2: Mapping Field Data and Exploring Geo Careers

Purpose:

1. To introduce students to the concept of Geographic Information System (GIS);
2. to explore a geographic tool (ArcExplorer-Java Edition for Education) used for displaying spatial data;
3. to compare a great circle distance with a grid coordinate distance;
4. to plot point data collected from a Global Positioning System (GPS) unit;
5. to introduce students to potential careers in geography;
6. to guide students how to construct a resumé.

Description:

On Activity Day 2, students will be introduced to the concept of Geographic Information Systems (GIS) and geospatial technology. They will use ArcExplorer-Java Edition for Education (AEJEE), which is a stand-alone GIS data viewer, to explore different types of map projections; measure the distance between two points on the map; and create the map layout. Students will explore the satellite image of the Washington DC region and learn how to add GPS point data into a geographic information system. This activity will serve as an introduction to mapping and geospatial technology, and will help students gain a set of highly desirable skills for future employment.

Next, students will be introduced to career prospects and job opportunities in GIS. This includes a broad range of careers in GIS, from environmental science to urban planning to commercial businesses to defense, and beyond. The U.S. Department of Labor has identified geospatial technologies as one of the nation's current high growth industries. Career advisement materials have already been developed by professional societies; these materials will be supplemented with literature from local private companies. This session will encourage students to combine their passions or interests with GIS for a satisfying and successful career.

During the final segment of the day, TU faculty will assist students as they construct résumés, using Microsoft Word, from outlines with suggested types of background information, school/community activities, and work experiences that could be included. Students will each be given a memory stick to store their résumés for future use. With student permission, copies of the résumés will be kept by Mrs. Bello so that they will be easily retrievable during the students' senior year.

Staffing:

1. Thebpanya (lead); Morgan, Roberge, Cooper;
2. Bello, two FHHS teachers

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General Materials:

1. 30 student handouts
2. ArcExplorer-Java Edition for Education (AEJEE)
3. Microsoft Word
4. Memory sticks
5. Calculators
6. Breakfast
7. Lunch
8. Name tags & markers

General Schedule:

- 8:15 Meet Ms. Bello at FHHS; set up food
- 8:45 Breakfast; description of the day's activities; announcement of upcoming events
- 9:15 Walk to the lab
- 9:20 Introduce GIS to students; getting started with AEJEE
- 9:40 Lesson 1: Map projection and distance measurement
- 10:10 Lesson 2: Calculating a grid coordinate distance
- 10:20 Lesson 3: Adding GPS point data; create hot links
- 10:40 Calculating the Earth's circumference
- 10:50 Introduction to Geo careers
- 11:15 Stream Discharge
- 11:45 Lunch
- 12:15 Writing a resumé
- 1:00 End of day

Detailed Schedule & Activity Description:

Set Up: (Cooper, Thebpanya)

- Order Breakfast food
- Order Lunch food
- Meet Ms. Bello; get let into FHHS
- Set up breakfast foods

Breakfast:

- Place the information books out for students along with name tags
- Announcement of an upcoming event: October 16th - Living Classroom Boat Trip on the Chesapeake Bay (Cooper)
- Remind students to have their parents sign the public release form and the permission form for October 16th and turn them in to Ms. Bello (Cooper)
- Describe the day's activities (mapping spatial data, Geo careers, lunch & resumes) (Thebpanya)
- Eat with the students!

Introduction to GIS and AEJEE: (Thebpanya)

The use of computerized information is a growing part of everyday life. More and more people are plugging into geographic, social, economic, political, and environmental information to answer practical questions in their lives. A wide range of electronic tools were designed for acquiring, presenting, and interacting with information to help answer these questions. One of these is called a Geographic Information System (GIS). GIS is a system designed for storing, updating, analyzing, displaying, and manipulating spatial data—information about places on Earth. This system uses the power of the computer to answer geographic questions by arranging and displaying all kinds of data about places in a variety of ways such as via maps, charts, and tables. In this session, students will be introduced to the concept of GIS and geospatial technology. They will also learn how to use ArcExplorer-Java Edition for Education (AEJEE), which is a geographic software package, to explore different types of geospatial data.

Lesson 1: Map projection, Scale, and Distance Measurement: (Thebpanya)

The 3-D Earth is transformed to a 2-D flat surface by use of a geometric form, such as a plane, cylinder, or cone, or it may be derived mathematically (Figure 1). There are nearly an infinite number of possible projections that can be produced, but they generally fall into one of four projection families: azimuthal (planar), cylindrical, conic, and mathematical. Each family has their own characteristic grid and potential applications.

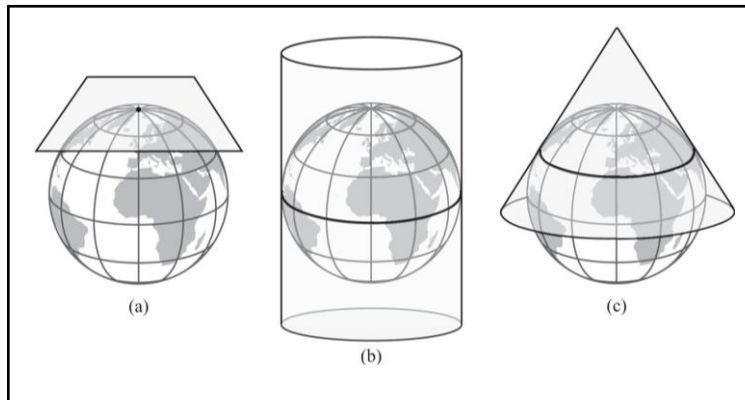


Figure 1. The plane (a), cylinder (b), and cone (c) are all geometrically developable projection surfaces.

The projection process involves map distortion. It is impossible to render the spherical surface of the reference globe as a flat map without distortions. There are four projection properties (area, shape, distance, and direction) that can be maintained (but not all at the same time) that help define what kind of distortion takes place. Specific projections can be selected by asking questions about the map purpose, allowable distortion, and area of the world that is being mapped. In this lesson, students will use AEJEE to explore different types of map projections and then visually examine the distortion patterns. Although there are thousands of named projections currently supported by most GIS and mapping software, knowledge of a fairly small number of projections and projected coordinate systems can fulfill a variety of mapping needs.

Lesson 2: Calculating a Grid Coordinate Distances: (Thebpanya/Cooper)

Lesson 2 will introduce students to the concept of a great circle distance and a grid coordinate distance. A great circle distance is the shortest distance between two surface points on Earth. A grid coordinate distance is measured on a two-dimensional coordinate system in which x - and y -axes intersect at 90 degrees, and the interval along each axis is linear.

Students will use the “Measure” tool in AEJEE to measure and compare the great circle to grid coordinate distances between two points on the map. Next, they will select two cities on the world map, read the x - and y - coordinates of those two cities, and use a calculator to calculate a grid coordinate distance.

Lesson 3: Adding GPS Point Data and Creating Hot Links: (Thebpanya)

In this lesson, students will explore a satellite image of the Washington DC region. Then, they will add the GPS point data for some interesting sites, such as the Washington Monument, the White House, and the Capitol, into a geographic information system. Next, they will use the “Hot Link” button in AEJEE to link those GPS points to other objects, such as websites, images, or documents.

Calculating the Earth’s Circumference: (Cooper)

Students will use the GPS data collected on Activity Day 1 to calculate the circumference of the Earth.

Geo Careers: (Morgan)

The U.S. Department of Labor has identified geospatial (GIS) technologies as one of the nation’s current high growth industries. One of the TU faculty members will introduce students to career prospects and job opportunities in GIS. This includes a broad range of careers in GIS, from environmental science to urban planning to commercial businesses to defense, and beyond.

Stream Discharge: (Roberge)

Students will examine the stream velocity data that they collected on Day 1, and use it to calculate the discharge of the Lower Beaverdam Creek. They will then compare this stream discharge to other nearby rivers.

Lunch: One of the faculty members will leave the group a few minutes early and set up the lunch materials.

Resumés: (Cooper)

Students will use the information from their resumé worksheets, completed on Activity Day 1, to construct resumés in Microsoft Word. One faculty member will guide students how to write and reformat the resumé. Students will each be given a memory stick to store their resumés for future use.

Lesson 1:

Map projection and distance measurement

One of the biggest challenges facing a cartographer (mapmaker) is that of representing a spherical surface on a flat piece of paper or computer screen. Showing a three-dimensional object in a two-dimensional space would involve distortion of **distance**, **area**, **shape**, or **direction**, or some combination thereof.

Map Projection is the transformation process that projects a spherical globe, along with land masses, bodies of water, and other features onto flat surface.

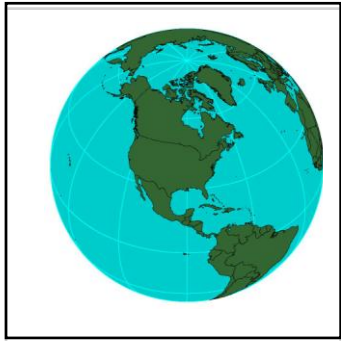
In this lesson, you will explore the following world projections in order:

- Orthographic
- Robinson
- Sinusoidal
- Peters
- Mercator
- Bonne

1. Which projection do you like best? Why?

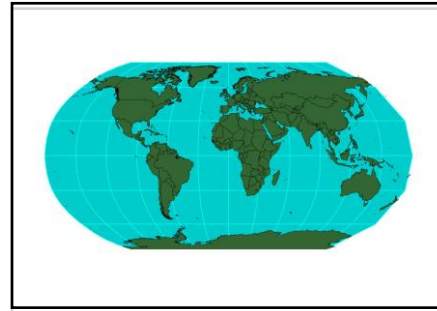
2. Choose the world projection you like best and create an attractive map layout. You can print out your map or export it as an image file. (See Demo)

(a) Orthographic



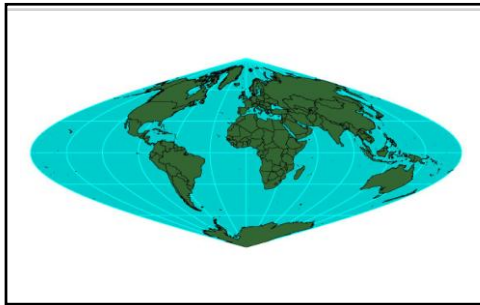
Used for perspective views of the Earth. Areas and shapes are distorted by perspective.

(b) Robinson



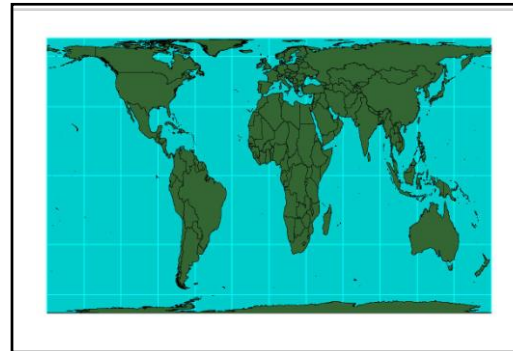
A compromised map projection to make the world “look right”.

(c) Sinusoidal



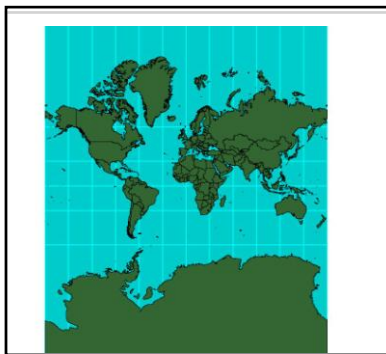
Used frequently in Atlases to show distribution.

(d) Peter



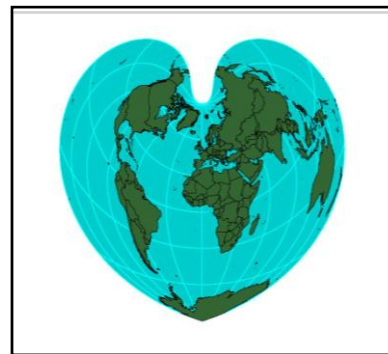
A rectangular equal area projection emphasizing low latitude.

(e) Mercator



Used for navigation or maps of equatorial regions. Any straight line on map is a line of constant direction.

(f) Bonne



Simple conic equal area projection, useful for mapping continent-size areas of the Earth; should not be used for areas of considerable east-west direction.

Lesson 2: Calculating a grid coordinate distances

A **great circle** is formed by passing a plane through the center of the sphere. This plane forms a perfect circle where it intersects with the sphere's surface (Figure 2). Certain qualities about the circle are worth knowing:

1. The plane forming the great circle bisects the spherical surface.
2. Great circles always bisect other great circles.
3. An arc segment of the great circle is the shortest distance between two points on the spherical surface.

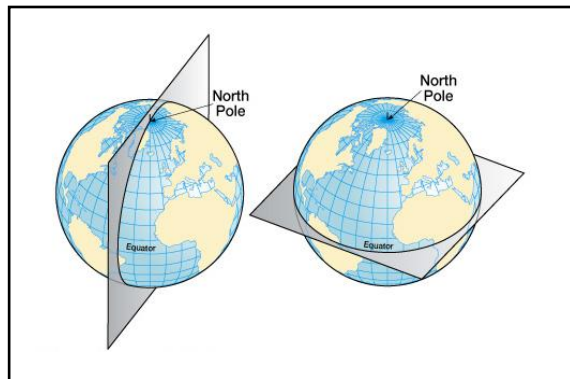


Figure 2. Any plane that divides Earth into equal halves will intersect the globe along a great circle; the great circle is a full circumference of the globe.

A **great circle distance** is the shortest distance between two points on the surface of the Earth. On the Earth, to travel along a meridian (north-south) is to go the shortest distance. Traveling along a parallel (east-west) is *not* the shortest distance! Following the path of the equator, however, is an efficient way of travel.

A **grid coordinate distance** is measured on a two-dimensional coordinate system in which x - and y - axes intersect at 90 degrees, and the interval along each axis is linear.

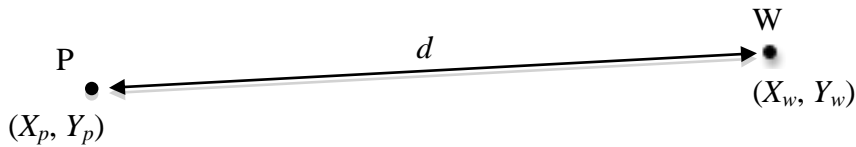
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Select two cities on the world map and record the x-coordinate (longitude) and y-coordinate (latitude) in the table below:

	Latitude (decimal degrees)	Longitude (decimal degrees)
City 1:		
City 2:		

How to calculate a grid coordinate distance

Distance between two points, P (X_p, Y_p) and W (X_w, Y_w)

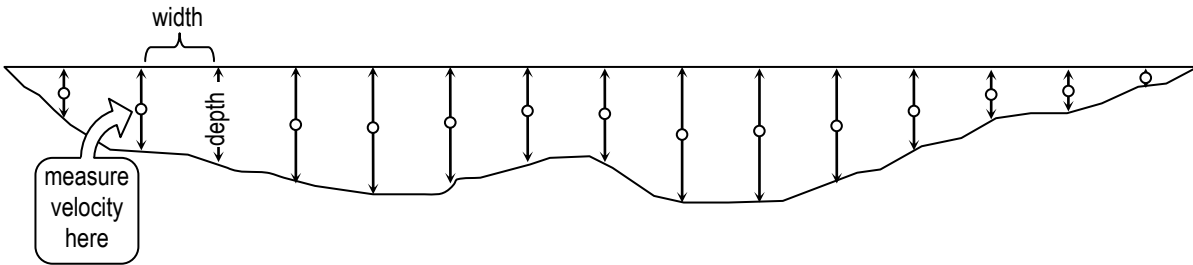


Equations:

$$d = \sqrt{(X_p - X_w)^2 + (Y_p - Y_w)^2}$$

The distance between _____ and _____ is _____ miles.
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Measuring Stream Discharge



Discharge of a stream segment = Velocity × Area of segment

This means
“the sum of”

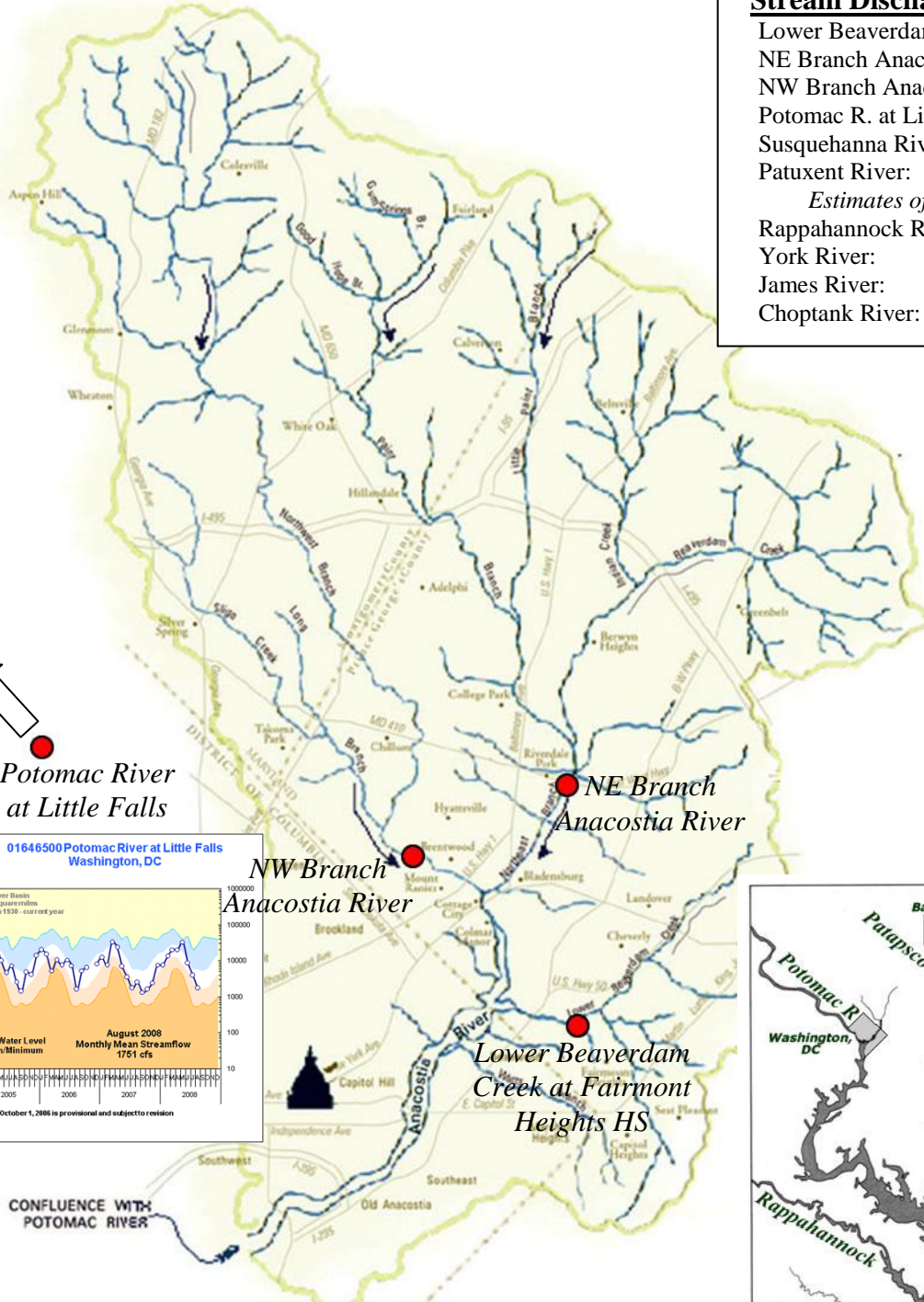
$$\text{Total Discharge} = \sum_{i=0,1\dots n} \text{Width}_i \times \text{Depth}_i \times \text{Velocity}_i$$

<i>i</i>	depth (cm)	width (cm)	velocity (cm/s)	discharge (cm ³ /s)	comments
0	3 cm	50	3	450	Chidi, DJ, Marcus, & Dejuan's group
1	11	50	9	4,950	
2	14	50	12	8,400	
3	17	50	16	13,600	
4	15	50	20	15,000	
5	12	50	15	9,000	
6	12	50	6	3,600	
7	11	50	5	2,750	
8	7	50	2	700	
9	.1	50	1	50	
Sum of all segments:				58,500 cm ³ /s = 0.0585 m ³ /s	1 m ³ = 100cm x 100cm x 100cm = 1,000,000cm ³

<i>i</i>	depth (cm)	width (cm)	velocity (cm/s)	discharge (cm ³ /s)	comments
0	5.5 cm	50	2	550	“Group 1”
1	11.5	50	7	4,025	
2	12	50	8	4,800	
3	15	50	13	9,750	
4	12	50	17	10,200	
5	12	50	16	9,600	
6	11	50	10	5,500	
7	11	50	3	1,650	
8	4.5	50	2	450	
9	1	50	1	50	
Sum of all segments:				46,575 cm ³ /s = 0.0466 m ³ /s	1 m ³ = 100cm x 100cm x 100cm = 1,000,000cm ³

Stream Discharge on 9/20/2008

Lower Beaverdam Creek:	0.05 m ³ /s
NE Branch Anacostia R.:	0.48 m ³ /s
NW Branch Anacostia R.:	0.51 m ³ /s
Potomac R. at Little Falls:	51.53 m ³ /s
Susquehanna River:	114.09 m ³ /s
Patuxent River:	9.03 m ³ /s
<i>Estimates of stream discharge</i>	
Rappahannock River:	7 m ³ /s
York River:	6 m ³ /s
James River:	28 m ³ /s
Choptank River:	3 m ³ /s



Potomac River at Little Falls

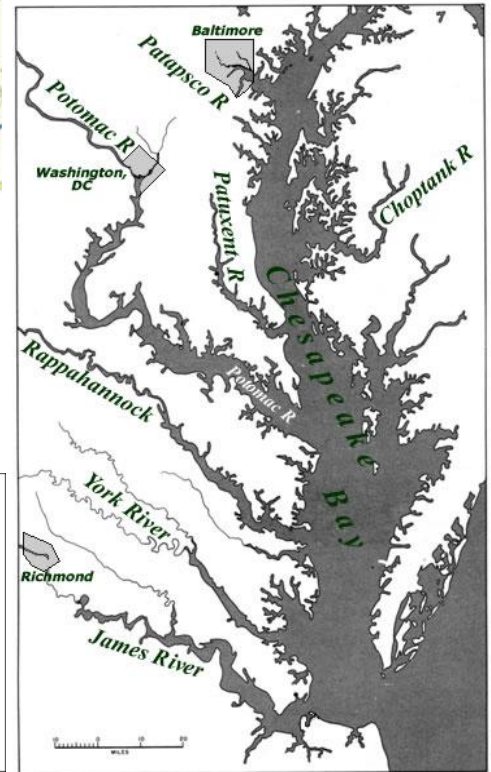
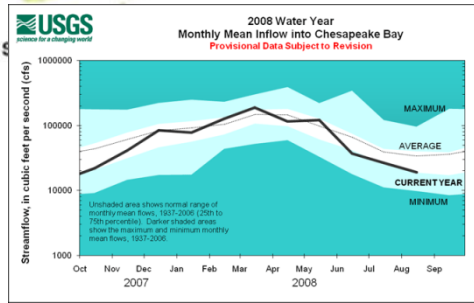
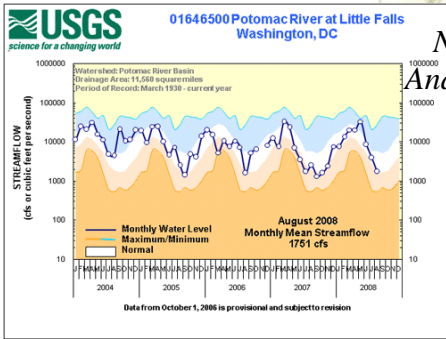
NE Branch Anacostia River

NW Branch Anacostia River

Lower Beaverdam Creek at Fairmont Heights HS

CONFLUENCE WITH POTOMAC RIVER

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OBJECTIVE: To obtain a scholarship in graphic arts.

EDUCATION: Fairmont Heights High School Capitol Heights, MD
Expected Graduation Date June 2011
Grade Point Average 3.4

SCHOLASTIC AWARDS: National Honor Society 2008-2009
Honor Roll 2007-2009
Perfect Attendance Award 2007-2008

ACTIVITIES: Geomatics Academy 2008-2009
Outdoor Track 2007-2009
• Captain 2008-2009
Females Achieving Monumental Excellence 2008-2009

EXPERIENCE: Forever 21, salesperson 2008-present
• Assisted customers in fashion selection
• Operated cash registers
• Stocked new merchandise

VOLUNTEER WORK: Habitat for Humanity Summer 2007
Camp Sunshine, counselor Summer 2008
• Organized craft activities for 9 year-olds
• Responsible for cabin of 6 girls for overnight trip

REFERENCES: Paul Frank, teacher
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