



GIS Career Awareness Learning Module # 2 Version 4.1 April 30, 2009

How Can GIS Help Us? - GIS Applications in Various Fields

- **Estimated Time:** 2.5 hours
- **Learning Goal:** This module will introduce various GIS applications and illustrate their usefulness in different specialty areas such as traffic and street view (Google map and Traffic 511), wild fire web mapping service, criminal justice (crime mapping and tracking), business and marketing (real estate sales and pricing), and environmental science/ecology (environmental monitoring & management).
- **Platforms:** PC, Mac, or UNIX.
- **Software Tools Required:** Web browser with high-speed Internet access.
- **Allied to California Content standards:** GIS Learning module #1 can be allied to the following California Content standards:
 - **History-Social Science Content Standards**
11.8.6 Discuss the diverse environmental regions of North America, their relationship to local economies, and the origins and prospects of environmental problems in those regions.
 - **Science Content Standards**
9. b (Earth Science) Students know the principal natural hazards in different California regions and the geologic basis of those hazards.
9.d Students know how to analyze published geologic hazard maps of California and know how to use the map's information to identify evidence of geologic events of the past and predict geologic changes in the future.
2. 1 (Investigation and Experimentation) Analyze situations and solve problems that require combining and applying concepts from more than one area of science.
 - **English-Language Arts Content Standards**
1.1 (Writing) Establish a controlling impression or coherent thesis that conveys a clear and distinctive perspective on the subject and maintain a consistent tone and focus throughout the piece of writing.

Note: This Web-based GIS learning module was developed with support from a National Science Foundation – Advanced Technological Education Program Research Grant (NSF-ATE DUE # 0401990): “A Scalable Skills Certification Program in Geographic Information Systems (GIS).”
(<http://geoinfo.sdsu.edu/hightech>)

ANSWER ALL QUESTIONS ON THE SEPARATE ANSWER SHEET

Section 1 – Traffic Map and Street view

Part I – Google Street view of San Diego State University

To finish this part, you may need to install the Adobe Flash Player Version 9 or newer edition before use. You should spend no more than 10 minutes on this section.

As one of most popular web maps, Google map has created a function called “Street view”. Street view combines photos and 3D functionality, and enables the users to have a real view of the place they search. Please pay attention, you could view and navigate within street-level imagery only in certain locations (most of the time, they are major roads in big cities).

- Please navigate to <http://www.maps.google.com>.
- Type “San Diego State University” in the top of the page. The webpage will update as shown below (See Figure 2-1).

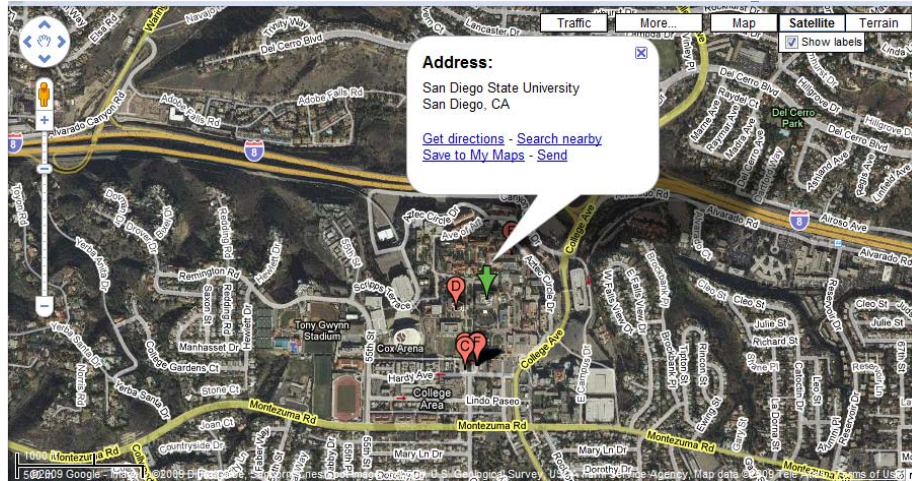


Figure 2-1: Google Map of San Diego State University

- Click on the person on the top left part of the screen directly above the plus indicating the “zoom in” feature. Now drag him to one of the streets near San Diego State University. You will notice that as you drag the person, the streets will become highlighted by a blue frame and a green circle outline will appear directly below.
- Drag the symbol, the green circle outline, to where you would like to view the street and release your mouse. The “Street View” will now be displayed for the location that you dropped your symbol. (See Figure 2-2).



Figure 2-2: the street view of Google Map

- Double click the white arrow in the photo; you will see the street view is changing. And as you move within the street view, the cutout in the bottom right updates your position. Now try panning, rotating and zooming.

Please view the webpage <http://local.google.com/support/bin/topic.py?topic=11640> and answer the following questions on the separate answer sheet:

A-1: Is the Google Map Street View imagery real-time?

A-2: Where does Street View imagery come from? When were these pictures taken? Does Google accept photo submissions from individuals?

A-3: Can you see people in the street view imagery? Does Street View violate the privacy of people if they were in the imagery?

A-4: Please key in your home or school address. Is street view available in this area? Is the imagery the same as you see now?

Part II – Traffic Map of Traffic 511

Traffic 511 is a free phone and Web service that consolidates the San Diego region's transportation information into a one-stop resource. 511 provides up-to-the minute information on traffic conditions, incidents and driving times, schedule, and route and fare information for San Diego public transportation services, carpool and vanpool referrals, bicycling information, and more. Traffic 511 is available 24 hours a day, 7 days a week. Now, let's try some applications of the Live Traffic Map. You should spend no more than 5 minutes completing this part.

- Navigate to <http://www.511sd.com>, and click on the picture “Real Time Traffic Conditions.” A new Web page will pop up which displays the current traffic conditions for San Diego (See Figure 2-3).
- Try to drag the red pane in the top of the web page or click the colored road in the map. Explore the map tools.



Figure 2-3: The Website of Traffic 511

Read the map legend, try to understand the function of this live traffic map. Pay attention, the color of the road shows the traffic congestion information according to the legend in the bottom of the left side of the web page.

Please answer the following questions on the separate answer sheet:

A-5: *How often does the traffic map update? Is this automatic?*

A-6: *How do the different colors congestion levels indicate in the Traffic Congestion layer? (Hint: the speed)*

A-7: *Does the map provide all the freeway traffic information in San Diego?*

A-8: *Click the tool button “Driving time”; first, choose any place you are interested in as a starting point. Once the dots have turned magenta, select your destination (see Figure 2-4). Click on the link for “click for more details on trip” to record the following information: the distance; estimated time; traffic congestion (Hint: the color of the highway); and max, min, and average speed limit for each highway.*

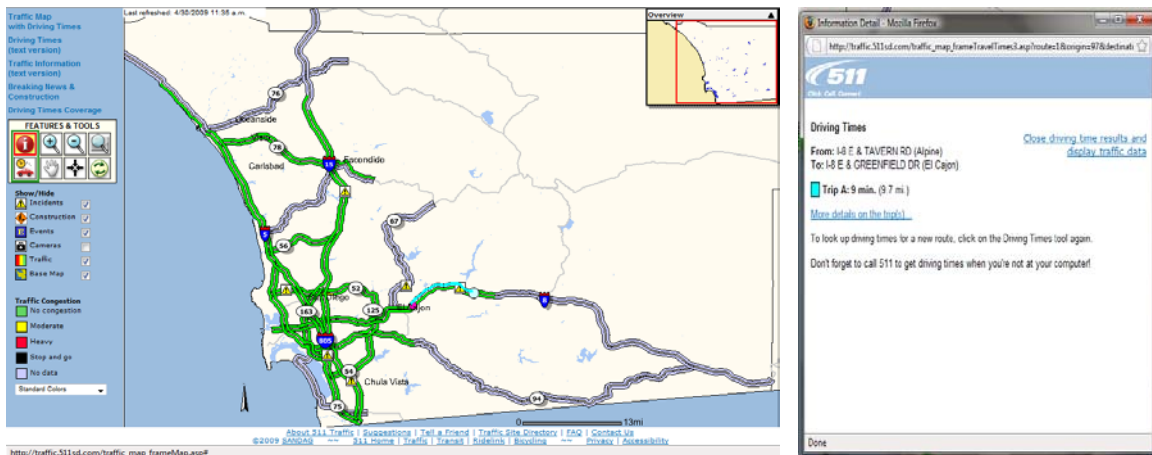


Figure 2-4: Tool “Driving Time” of Traffic 511 Route & Associated Popup

Section 2 – Web Mapping Services for Wildfires

The San Diego 2007 wildfires killed nine people and destroyed hundreds of homes. Wildfires are one of the major natural disasters that occur in California. In the process of salvation and reconstruction, GIS can provide updated wildfire spatial information that facilitates communications and resource relocation plans. Now we’ll see how GIS helps in this wildfire by scanning a website (Figure 2-5).

Navigate to the website <http://map.sdsu.edu/>. This website is maintained and updated by the San Diego GIS force group, a volunteer group of SDSU faculty and students. You should spend no more than 40 minutes completing this section.

MAP.SDSU.EDU
Department of Geography San Diego State University

Web Mapping Services for San Diego 2007 Wildfires

(Any media or persons are welcome to reproduce or redistribute these maps and information by acknowledging the map sources and the [Department of Geography](#), San Diego State University.)

This website is maintained and updated by the San Diego GIS force group, a volunteer group of SDSU faculty and students. (Disclaimer: Since all GIS layers in these mapping services are derived from external sources, SDSU and the Department of Geography will do our best to provide useful information. However, we can not guarantee the accuracy of these data from external sources).

If you have any questions or suggestions regarding this website, please contact Dr. Ming-Hsiang Tsou, mtsou@mail.sdsu.edu at the Department of Geography, San Diego State University or gisforce@geography.sdsu.edu.

[Link to 2008 Volunteer Hazard Mapping Corps \(VHMC\) Workshop Documents](#)

Figure 2-5: The Web Mapping Services for San Diego 2007 Wildfires

Task-1: Aftermath and Damage Assessment

Step 1: Aerial Photo analysis for damaged areas and buildings:

- Click the link “<http://map.sdsu.edu/aerial-photos.htm#Download>” and click on Collection B.
- Scroll down and click on the “[pict_28102007221604.jpg](#)” image (this should be the first picture in Collection B).
- Scroll down further to “[pano_img_0198_georef.jpg](#)” and “[pano_img_0907_georef.jpg](#)”, these are geo-referenced images meaning that several images have been put together to form a more complete image.

Please answer the flowing questions on the separate answer sheet:

B-1: Why do you see shadows in “[pict_28102007221604.jpg](#)” image?

B-2: When comparing the “[pan_img_0198_georef.jpg](#)” and “[pano_img_0907_georef.jpg](#)” images, why do you see a “fog” over certain parts of the images?

Step 2: High Resolution Satellite Images:

- Within the maps.sdsu.edu website, click the link “[High Resolutions Satellite Images from FORMOSAT-2](#)”.
- Examine carefully the 3rd image from the left in the first set of images; it should look like the one below. (Hint: Click on it to make the image larger) These are high resolution satellite images taken from FORMOSAT-2 taken on October 26, 2007 (See Figure 2-6).

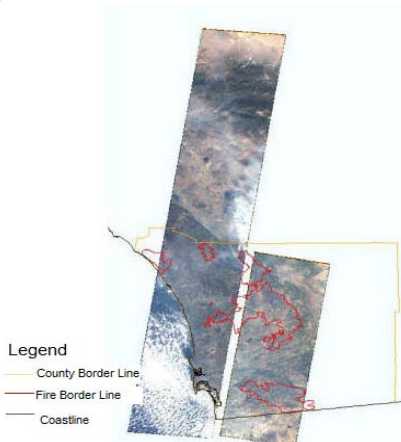


Figure 2-6: Image of “Oct. 26, 2007, FORMOSAT-2”

B-3: Which part in the image shows the areas destroyed by the wildfire?
(Hint: see the legend)

B-4: There are two white areas in this image. What is the difference between these two areas? (Hint: consider the reflection of light upon water and the shooting angle of satellite images)

Step 3: NASA EO-1 and IKONOS Satellite Images

- Go back to the maps.sdsu.edu homepage and click the link “[NASA EO-1 and IKONOS Satellite Images \(preview image\)](#)”. Scroll down and study the images carefully to answer the following questions.

B-5: Refer to the first images on this page. Use the direction of smoke dispersal shown on these images to try and predict the direction the wildfire will spread. (Hint: think of wind direction)

Task-2: Evacuation Map Updates and GIS Maps.

This web page includes major government websites (county and city) and GIS maps related to evacuation, traffic updates, power outages and related information.

- Click the link “[Evacuation Map Updates and GIS Maps.](#)”, which will direct you to the new page of “Evacuation Mapping Updates”.
- Click the link “[10-29-07 Updated Countywide Fire Map Perimeter.](#)” to open the PDF map. Please answer the following questions on the separate answer sheet.

B-6: How many shelters can you find on the image?

B-7: We can see that the shelter in Peirce (Olive) Middle School is close to the burned area; why do you think the government set a shelter so near the burned area?

- Scroll down to “Printable PDF maps” and click the first image “[Harris](#)”. Please answer the following questions on the separate answer sheet. (See Figure 2-7)

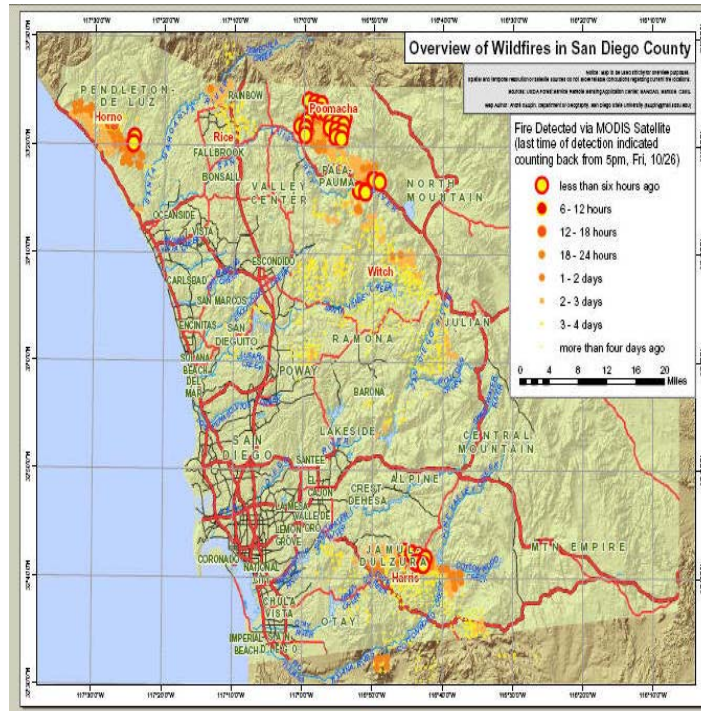


Figure 2-7: The Image of “Harris”

***B-8:** According to this map, if you are the chief of San Diego fire department, how would you distribute the resources and manpower to put out the wildfire? Which part should be the most important areas on Oct. 26?*

Task-3: 3D Visualization and Animation Maps.

- Click the link of “[3D Visualization and Animation Maps.](#)” and turn to a new page.
- Scroll down to see the image of “KMZ file for JPL Wind Direction Map Animation” and “NASA JPL Wind Direction Map Animation.” Answer the following question on the separate answer sheet (See Figure 2-8).

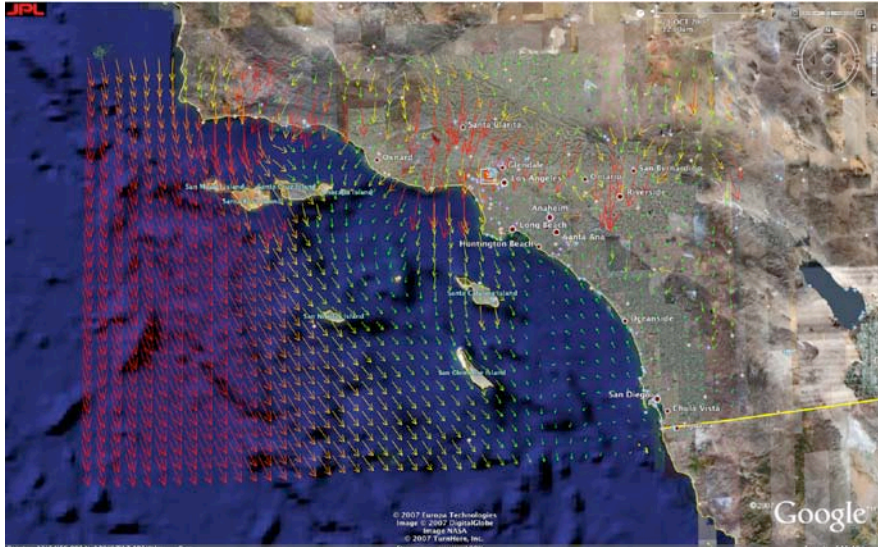


Figure 2-8: Wind Direction Map

B-9: *What do you think the meanings of the colors of the arrows shown in the wind direction map?*

Task-4: Satellite Images Overlay and Remote Sensing.

The following page collects all relevant satellite images and overlays them with GIS layers (streets, highways, rivers).

- Click the link” [Satellite Images Overlay and Remote Sensing.](#)” And turn to the new page.
- See the Animation of NASA MODIS satellite images updated on Oct. 21-29, 2007 carefully. Please answer the following question on the separate answer sheet.

B-10: *Describe the change in wind direction from Oct. 21 to 29. (Hint: Make sure to watch the entire animation)*

- Now, scroll down and take a look at the three MODIS satellite images collected on Oct. 22, 2007 and answer the following question on the separate answer sheet.

B-11: *Compare the original satellite images (without any high way or roads) with the GIS enhanced images (with high ways). Which kind of image is more useful? Why?*

Section 3 – Criminal Justice - Crime Mapping and Tracking

Part I – City of San Diego Crime Map

The third GIS application example can be used to study and visualize reported criminal incidents and the locations where they occurred. This is an example of a “Crime Map.” A Web-based mapping tool was developed for the Automated Regional Justice Information System (ARJIS) in San Diego, a computer network utilized by 50 local, state and federal agencies in the San Diego region. Please follow the steps below. You should spend no more than 10 minutes on this section.

- Navigate to <http://www.arjis.org> and then click “**Crime Maps**”. A new Web page will pop up (*If you are using Microsoft Internet Explorer as your Web browser and you receive a message indicating that the pop-up was blocked, hold down the <Control> key and click on the **Crime Maps** link to bypass the Pop-Up Blocker.*)
- On the Crime Maps Disclaimer page, click on the button “**Accept**” to continue.
- On the next page, click on the button “**Go to Mapping**”, the Regional Crime Maps Web interface should appear.
- Under **Jurisdiction**, click on “**San Diego**”.
- A column named **San Diego** will appear; choose “**Address**”.
- In the third column, enter your home or high school street address if you live in San Diego; if not, type “**5500 Campanile Dr.**”
- Click on “**Verify Address**”. If **multiple addresses** appear, choose any one that is closest to your actual address.
- Choose “**1 mile**” from the pull-down menu under “**Radius for shaded area around selected location.**” This is known as a “buffer area” and will display all of the incidents within a one-mile radius.
- Click “**Next**” at the top of the browser window.



Figure 2-9: San Diego County Regional Crime Map Interface

- Under **Incident Types**, choose all types of **Crimes** by checking off all of the criminal incident types under the **Crimes** folder.
- Click the button “**Next**” toward the center-top of the browser window.



Figure 2-10: Selecting Incident Types

- Look up the incidents that have been stored in the system by selecting a range of dates, days of the week, and time range. For now, don't change it. It is automatically set for the last month. Click “**next**”.
- A map should appear around the address you selected. There may or may not be any incidents recorded around the location for the given time period. Incidents are denoted by icons on the map.
- In the Example Crime Map image below this paragraph, you can see several icons including green plus signs (vandalism), yellow dots (theft), and blue triangles (residential burglary).
- Use the Zoom Out and Zoom In controls to change the map areas displayed. If you can't see any incidents, you may need to change the address or the time range. After changing any of the settings, you can redisplay the map by selecting the Map button in the lower-left corner.

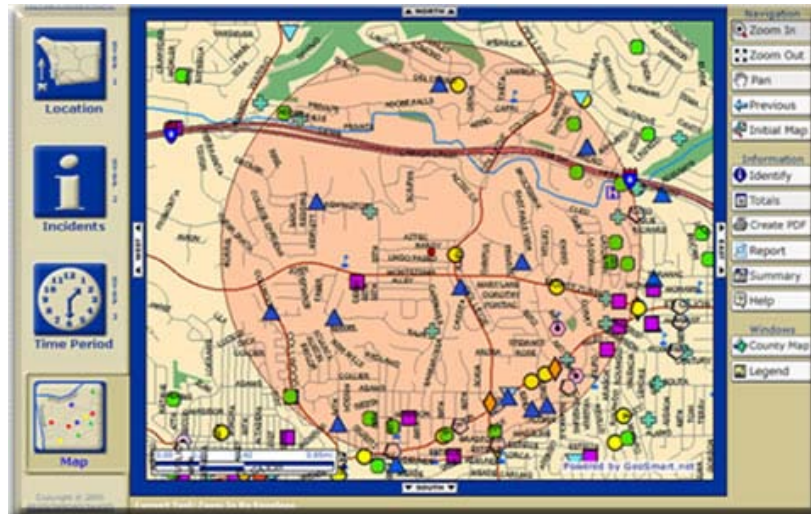


Figure 2-11: Example Generated Crime Map

- Select the Identify button on the right side, and click on any incident icon to get more information.



Figure 2-12: Identifying a Specific Incident

- Change the Location, Incidents, and Time Period by clicking on the buttons on the left side. After that, click on the Map button to redisplay your map. This system covers all areas in San Diego County. You can look up any street address, city and zip code within San Diego County.

Part- II. Please answer the following questions on the separate answer sheet. You should spend no more than 10 minutes completing this part.

C-1: Based on the Crimes that you mapped, what types of incidents are most frequent around the area you selected?

Go to the Incidents menu by selecting the Incidents button (the big “i” button on the left of the map). Now unselect all of the Crime types and now select all of the Traffic-related incident types. After doing so, redisplay your map by clicking on the Map button on the bottom-left of the browser window.

C-2: Based on the new information that is displayed, what types of Traffic-related incidents are most common on your redisplayed map?

Go back to the Incidents menu by selecting the Incidents button (the big “i” button on the left of the map). Now unselect all of the Traffic-related incident types and now select all of the Arrests and Citation incident types. After doing so, redisplay your map by clicking on the Map button on the bottom-left of the browser window.

C-3: Based on the new information that is displayed, what types of Arrests and Citation incidents are most common on your redisplayed map?

Section 4 – Business and Marketing - Real Estate Sales and Pricing

Part I. – Real Estate Housing Costs with Zillow.com

This example will introduce GIS applications in private industry, business, and commerce. Many companies have been utilizing GIS to promote business and increase profit. They do this by conducting market analysis, and making new store and distribution center site-selection studies. GIS can combine information about the cost of land, the cost of local taxes, the local laws and regulations (zoning), the distance to the sales locations (or retail outlets), and the types of customers within the local area (demographic analysis). Using all of this information and more, decision makers can make better business management choices.

The following example introduces a unique GIS application in the Real Estate business specialty area. This application estimates home values based on recent sales in the area of equivalent homes. You should spend no more than 5 minutes completing this part.

- Please navigate to <http://www.zillow.com>.
- Type in the street address of a house. It is also okay to just type the street name without the address number. Then, type the city and either the state or zip code and press GO.
For Example:
Type in “Catalina Blvd” and “San Diego, CA” in the text field.
- A map should appear. You can navigate by changing the direction and zooming in/out once it is displayed. You can change the level of detail. Try several different views to see which one you prefer. Make sure the estimated home prices are visible. Note that home prices are displayed in 100,000’s. For example \$400K means \$400,000. (See Figure 2-13)

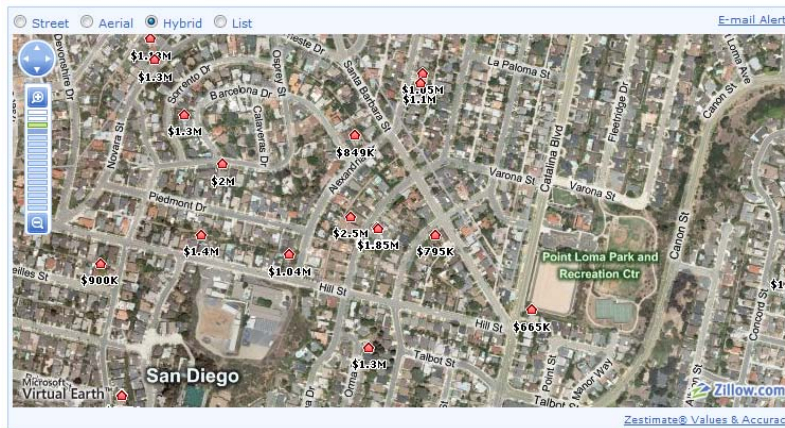


Figure 2-13: Address Input Example

Part II– Please answer the following questions on the separate answer sheet. You should spend no more than 10 minutes doing this part.

After selecting an area, click on a home and determine its estimated value.

D-1: What is the street name of your selected home?

D-2: What is the estimated value of your selected home?

D-3: What is the estimated value of the neighboring property to the east of your selected home? (Hint: You may have to zoom in fully to see neighboring house prices.)

D-4: What is the estimated value of the neighboring property to the west of your selected home?

D-5: Is there any difference in the estimated values between the three properties (original selected home, one to the east, and one to the west)?

Again, click on the first home which you selected to get a pop-up window with more information. In addition to estimated value, the address, the number of bedrooms, the number of bath rooms, and the square footage of the house may be displayed. Get more information for the two neighboring houses as well.

D-6: Is the property that you selected larger or smaller than the other two neighboring houses and does this difference seem to affect the housing costs?

D-7: If you wanted to buy a home in San Diego, how could you use this Website to help you to select the house?

D-8: If you wanted to sell a home in San Diego, how could you use this Website to help you to select the house?

Section 5 – Environmental Science/Ecology - Environmental Monitoring & Management

Part I – San Diego Watershed Common Ground Website

This section will introduce GIS applications in environmental science and ecology with specific examples for environmental monitoring and management tasks. Many federal agencies, such as the U. S. Geological Survey (USGS) and the Environmental Protection Agency (EPA), and local governments have been using GIS to manage their watersheds, water supplies, wildlife, wetlands. The following example will introduce a research project developed through the collaboration of the SDSU Geography Department, the City of San Diego, a private environmental consulting company, and San Diego Coastkeeper (a non-profit environmental advocacy group).

- Navigate to <http://www.sdbay.sdsu.edu>. Click on the link “**Journey through a Watershed Video**”.
- Watch the **4-minute** multimedia video (You will need to have a multimedia video player on your computer). Please answer the following questions after watching the video. You should spend no more than 9 minutes doing this part.



Figure 2-14: San Diego Bay Watersheds: Common Ground Home Page

E-1: Where did the pollutants come from?

E-2: Where did the pollutants end up?

E-3: What can you do to help keep San Diego Bay clean?

- Close the video player window and switch back to the home page (<http://www.sdbay.sdsu.edu>).
- Select the quick link “What is GIS?” on the right side and spend five minutes reading the Webpage content.
- Now select the **Maps** pull-down menu at the top, then select **Interactive**.
- A disclaimer page will appear. Scroll down to the bottom and click on the **Agree** button.
- A new map window should have popped up. On the right side of the window, you will see a list of layers which organize water quality data around the San Diego region. Click and place a check mark in the square “check box” next to the **Pueblo Watershed** in the Layers list to display it in the map.
- Also, select the circular “radio button” of the same layer---the **Pueblo Watershed**. This will allow you to explore the Pueblo Watershed data interactively on the map.

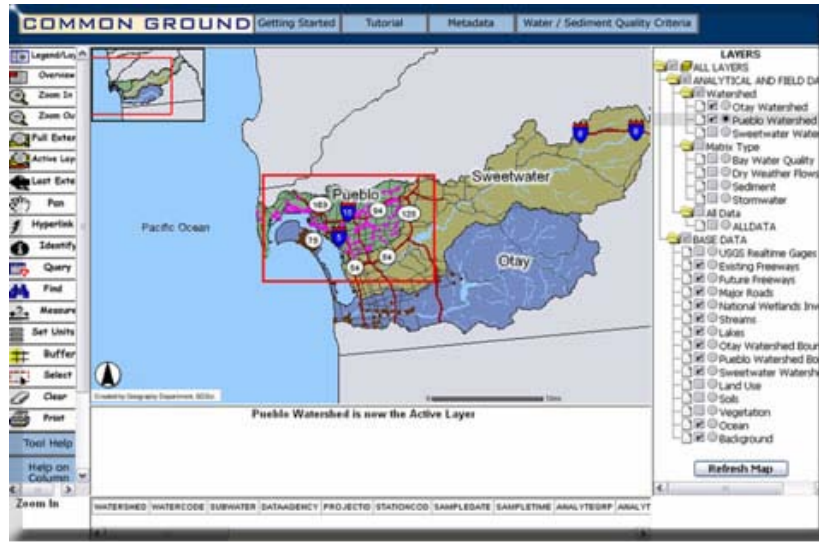


Figure 2-15: Zooming In to Water Quality Monitoring Sites

- On the left side of the map, click the “Zoom In”. Next click and drag a rectangular box around the area with the pink water quality monitoring sites (See above).



Figure 2-16: Zoomed In to Water Quality Monitoring Sites

- After you have successfully zoomed in (See above), click on the Identify tool located on the left side.
- Now, select one of the Pink water quality monitoring points on the map. If successful, the system will check the database of the water quality monitoring station located at your selected site and display the information in a table below the map. Briefly examine the data and feel free to check the data at other water quality monitoring sites (the pink dots).



Figure 2-17: Displaying Water Quality Monitoring Data

Part II– Please answer the following questions on the separate answer sheet. You should spend no more than 6 minutes completing this part.

E-4: The word “Analyte” describes the substance that is being analyzed. In this application, the analytes are the substances measured in water. In your database query result of water quality data, what is the first ANALYTE listed?

E-5: For this analyte, what is its corresponding RESULT value and UNIT?

E-6: What do the RESULT value and UNIT represent?

E-7: How can you use this system to monitor the water quality in your neighborhood?

Section 6 – Additional GIS Web Applications

The next step is to visit only *ONE* GIS application website from the following table or some other place and provide a short summary of the Website’s purpose and its major GIS/Mapping functions. You should spend no more 15 minutes doing this part.

Website	Description
http://geoinfo.sdsu.edu/campusmap/	San Diego State University Campus Map
http://maps.google.com/	Google Maps
http://www.mapquest.com/	MapQuest

F-1: Please write down your selected Website on the separate answer sheet:

F-2: Please write down a short summary (100 words) of your selected Website's purpose and its major GIS/Mapping functions on the separate answer sheet:

Section 7 – Written Assignment

Now that you have seen five GIS applications examples in five different fields, we would like you to answer some questions with the idea that you will be putting them all together in a 250-word paragraph (approximately one double-spaced typed page) by including the following information. You should spend no more than 25 minutes doing this part.

G-1: In your paragraph, please highlight five different applications of GIS. Can you think of ONE additional new application area that was not mentioned in this learning exercise? Please mention it if you can think of one.

G-2: In your paragraph, please discuss which application you liked best and WHY? Do you think that this GIS application can help people? If so, how?

G-3: In your paragraph, please tell us if it was easy or difficult to access the Web GIS maps using your Web browser. Why was this so?

Student Survey

This learning module was developed specifically for you---the students---in order to expose you to GIS and related geospatial technologies.

GIS and related geospatial technologies, similar to what you worked with in this learning module, are major components of one of the most important new industries for career growth. Businesses, organizations, and governments are increasingly seeking skilled talent in this industry.

Now, to benefit other students and the authors of this learning module, you are required to finish this Student Survey and please send it back to the San Diego State University NSF-ATE team. We would greatly appreciate your input. Please take time to answer these questions as openly and honestly as possible. **They will not affect your grade or score.** You can provide your feedback to your teacher/educator along with the learning module answers on the separate answer sheet.

Thank you for helping us improves our modules!

S-5: What did you like best about this learning module two? Why?

S-6: What did you like least about this learning module two? Why?

S-7: Was there anything that was really hard to understand or difficult to complete in this module two? What was **it**? Why?

S-8: Is there anything in this learning module two that we can add, exclude, or change to make it better? What is it? Why?