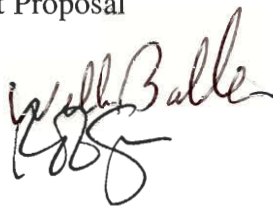Documenting the Blue and Green
Amenities of Worcester, Massachusetts

An Interactive Qualifying Project Proposal
Submitted to:

William Baller, Ph.D.
Robert Krueger, Ph.D.

27 February 2003

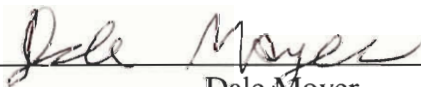In partial fulfillment of the requirements for the

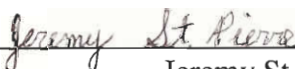Bachelor of Science Degree

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Abstract

Our project focused on raising awareness of the blue and green areas within the city of Worcester that offer recreational activities. We created a database that documents the characteristics of these sites. The database is easily expandable and designed to be useful to future projects with similar goals. This database was used to create a searchable website, a GIS layer, and a print-ready map that also lists activities offered at each site.

Acknowledgements

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Authorship Page

All sections of this report were written, in full, by Walter Dow, Matthew McDaniel, Dale Moyer, and Jeremy St. Pierre. The Literature Review and Bibliography include detailed information about our resources.

1   Introduction

Worcester has long been associated with textile and heavy manufacturing. In the late 1800's and early 1900's the city experienced a great deal of success during the industrial revolution, leading to extremely rapid growth in the population. Land that had formerly been used for farming was bought in order to build factories, and the city became crowded and dirty. As with many other cities around the world, urban regeneration has become a concern of the people living there.

After the Industrial Revolution, suburbanization slowly began. The working class prospered and began to move from the inner city to less congested local areas. This resulted in the development of previously undeveloped areas, further reducing green space in Worcester. Worcester transformed from an urbanized center into a true metropolis where the green spaces are few and far between.

The trend of suburbanization continued into the 20th century. By 1988, 88% of Worcester's land was developed (League of Women's Voters, 1988). Today Worcester has the second hottest real estate market in the country. If this trend persists, the open spaces will continue to disappear.

In an attempt to encourage environmentally responsible development of existing green space, WPI in collaboration with the director of the Broad Meadow Brook Wildlife Sanctuary has helped create a document that includes information on environmental sites and activities found in Worcester. The director of the Broad Meadow Brook Wildlife Sanctuary noted that a large volume of information is available, but no all-inclusive document exists. This project's goal was

to find these sites and organize them into a database (see summary in section 2.5), present the data to residents of and visitors to Worcester, and create a resource for others to use and expand upon. To accomplish these goals, we created a website, a GIS layer, and a print-ready map. The director hopes that these documents will help raise awareness of Worcester's environmental resources.

Working with the director of the Broad Meadow Brook Wildlife Sanctuary, Deborah Cary, we compiled a list of locations that offer activities involving the environment and developed a list of site characteristics that we later documented. We also created a database which we used to store these characteristics in an easily accessible format. The database was designed in a way such that it can be updated with minimal difficulty so that employees of the sanctuary can add information in the future. Once the information was compiled into the database we created a print-ready map detailing the information we recorded. We also created a dynamic website to present and maintain the database.

Our team looked into the history of Worcester along with its remaining environmental areas as part of our background research. We also studied database technologies for storing and presenting the information we gathered pertaining to Worcester's open spaces. From questions raised in our background and literature review we created the methodology we followed to complete our project goal: Documenting and presenting Worcester's blue and green amenities.

2   Literature Review

This literature review examines the formation of Worcester and the growth into the city that it is today. During this brief history we focus on the rapid growth of the city and how this led to the transformation of its natural resources, examining existing parks, lakes, and other blue and green areas found in the Worcester area and the recreational opportunities that these locations offer. We look at databases and Geographic Information Systems (GIS) technology to show how we determined how the data we gather should be stored. Finally, we analyze various models for delivering information about Worcester's blue and green amenities to our target audience: tourists, residents, and students.

2.1   Background of the City of Worcester

The history of Worcester has had a direct effect on the landscape that we see today. The city's growth has defined its development, leading to the consumption of blue and green areas. Over the course of Worcester's relatively short history, its inhabitants have failed to fully recognize the importance of the decreasing open space in the city. This section will explain the population's lack of awareness of the existence of blue and green amenities and the evolution of Worcester's landscape.

2.1.1   Settlement and Growth

The first attempt to charter Worcester as a city occurred in 1673, which was abandoned during King Phillip's War. A later attempt in 1713 ended similarly due to the threat posed by Indians. In 1848, after 135 years of township, Worcester was finally chartered as a city. (Southwick, 1998) Spanning 38.48 square miles, Worcester is the second largest city in Massachusetts and the third largest in New England (League of Women's Voters, 1988).

Worcester grew from 200 settlers in 1718 to 3000 in 1820 and its population continued to grow rapidly. Two factors that assisted the population growth were the construction of the Blackstone Canal and of the railroads. The Blackstone Canal was a man-made waterway constructed in 1828 that connected Worcester to Providence and the Narragansett Bay. This brought an abundance of business to Worcester. Seven years later the first railroads were laid in Worcester, marking the start of its Industrial Revolution (Southwick, 1998).

By 1840, Worcester's population reached 7500 people. The trains were a more effective form of transportation than the canal and the Blackstone became obsolete, occupying valuable space in the booming downtown area. To solve this problem, the city began to fill in the canal in 1840, a job which took nearly 100 years (Southwick, 1998). This reflected the population's general attitude that blue and green spaces were merely unexploited financial opportunities.

Due to increased business and a growing number of job opportunities in Worcester and the surrounding areas, Worcester County's population had grown to an astounding 346,958 by 1900,

a rapid growth for fifty years. Over the next 100 years suburbanization continued and the population doubled again. In 2000, it reached 750,963. This rapid growth led to the purchase of farm land in and around Worcester for development.

Worcester County, MA Population by Decades

Date	Population	Population Change	Annual % Change
1900	346,958	-	-
1910	399,657	52,699	1.4
1920	455,135	55,478	1.3
1930	491,242	36,107	0.8
1940	504,470	13,228	0.3
1950	546,401	41,931	0.8
1960	583,228	36,827	0.7
1970	637,969	54,741	0.9
1980	646,352	8,383	0.1
1990	709,705	63,353	0.9
2000	750,963	41,258	0.6

(http://www.census.gov/)

Population growth of Worcester County
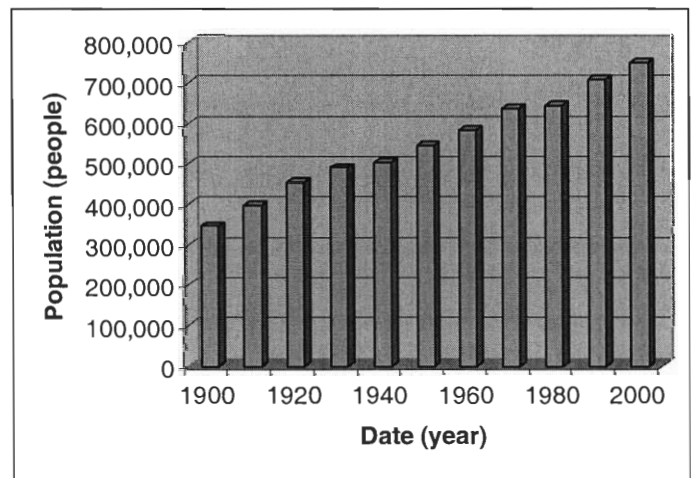
Rate of population change in Worcester County
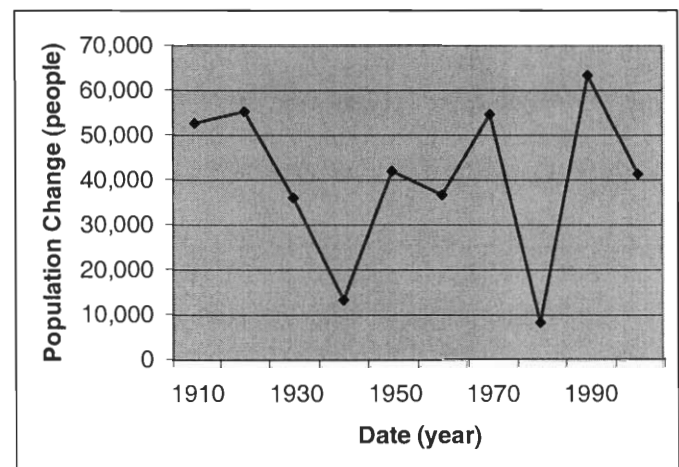
2.1.2 Urbanization

In 1848 the city was still dominated by farmland. Outside of the industrial center, 90% of the city was farmland. As the city grew it began to look more like a typical industrial city. A number of three to four-floor factories arose in the general downtown area. The vicinity quickly became populated and dirty (Southwick, 1998).

2.1.3 Recreational History

The cultural life of the city slowly grew once its immigrants began to prosper. In 1858, the Worcester Music Festival began, an annual event that still occurs today. Over the next fifty years, the recreational and cultural life of the city continued to grow. Businessman Horace H. Bigelow saw the opportunity for profit by providing social activities in Worcester. Lake Quinsigamond became the hot spot to cool off in Worcester between 1860 and the turn of the century. Activities that took place at the lake inspired many people to purchase lakefront property. Houses constructed around the lake became meeting places for social clubs (Perna, 1998). Bigelow saw great promise in the lake as a location for his dream amusement park.

In 1904, the construction of White City Amusement Park began. On June 18, 1905 its doors opened for the first time. Lake Quisigamond was used for rides at the park such as the Flume ride. Bigelow saw that people enjoyed the lake and he built his park to capitalize on this idea.

The park thrived and gave the people of Worcester, and visitors a place to enjoy the lake (Perna, 1998).

There hasn't been such a successful outdoor park or activity in Worcester since White City. A survey was conducted by the Massachusetts office of Travel and Tourism to investigate why present-day visitors come to Central Massachusetts. The data, last updated on December 27, 2001, showed that only 11.6% of trips made were for outdoor recreational activities (Mass. Office of Travel and Tourism handout, 2001).

2.1.4   Efforts to keep Worcester green

There was little focus on preserving the city's open space during the explosive growth of the Industrial Revolution. In 1966 50% of the city was undeveloped and by 1988 that number had shrunk to just 12% (League of Women's Voters, 1988).

The first noted attempt to preserve undeveloped land was made on March 20, 1854. The success and recognition enjoyed by Central Park in New York City inspired city officials to purchase the land that is now Elm Park. Its owners, Gov. Levi Lincoln and John Hammond, received $11,257.50 for what would be one of the first plots of land used solely for a public park in the United States (Herwitz, 2001).

Elm Park was the first of its kind in Worcester, but would certainly not be the last. The city saw the response it received from the 1854 purchase and bought many others including Institute Park,

Boynton Park, and Green Hill Park, the largest park in the city. A number of smaller parks have also been established throughout Worcester (Novick, N.D.).

Attempts to preserve Worcester's blue and green areas continue today. Environmental conservation organizations and nature activists work hard to protect the open spaces, but the lack of support and awareness allows the current trend of urbanization to continue. By documenting these areas our project will create a greater awareness of Worcester's natural amenities which will hopefully strengthen the support for environmentally responsible development.

2.2 Worcester's Recreational Environmental Resources

Worcester's history shows that it was not developed with the environment in mind. According to *Out-of-Doors*, a trail guide published by the Regional Environmental Council, "An account of the forests of Worcester from 1916 noted that 21% of the city was woodlands, 'far less than any other township in the county'... since 1916 the forest of Worcester has undoubtedly shrunk and become more fragmented" (Novick, N.D, p.10-11).

Despite this, Worcester is far from an urban wasteland barren of blue and green spaces. Worcester has many recreational environmental resources to offer both its inhabitants and visitors. In addition to privately owned land, hundreds of acres of undeveloped land in Worcester are protected by the Massachusetts Audubon Society and the Greater Worcester Land Trust (Cary, 1999, "Worcester: Some Green Facts", N.D.). Worcester also offers more than 1600 acres of recreational waterways (Ducsik & Cary, 2002, "Worcester: A Green City", N.D.).

Activities available in and around Worcester include bicycling, boating, camping, fishing, hiking, riding, off-road vehicular riding, swimming, and sites of historical interest (Massachusetts Department of Education, "Massachusetts Forests and Parks A Guide to Recreation", N.D.).

2.2.1   Blackstone River Valley

The Blackstone River Valley National Heritage Corridor is a protected region around the Blackstone River and a perfect example of Worcester's environmental resources; it contains many sites offering the activities mentioned, such as hiking, biking, and swimming. The river's headwaters are in Worcester and it continues through Massachusetts into Rhode Island. The Corridor is run by a combination of nonprofit organizations, local governments, state governments, and the National Park Service (National Park Service, "Blackstone River Valley", N.D.).

A map of trails and ponds in Worcester associated with the Blackstone River Valley National Heritage Corridor
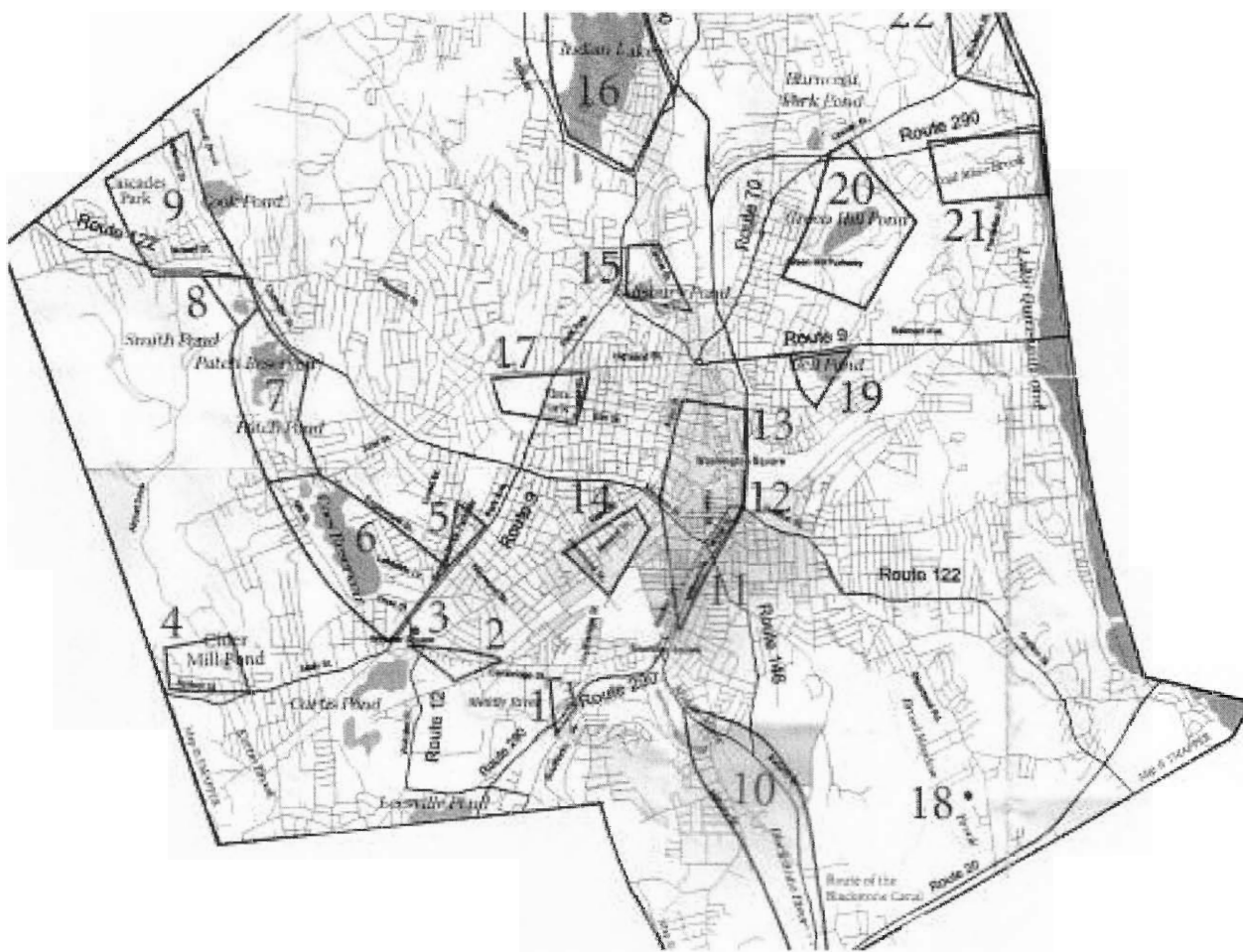
(Mass Audubon Society, "Worcester: Headwaters of the Blackstone", N.D.)

There are many lakes, ponds, brooks, reservoirs and parks that are open to visitors within the Corridor, many featuring sites of interest related to the Industrial Revolution in Worcester, which the Blackstone River and Canal played an important role in (Massachusetts Audubon Society, "Worcester: Headwaters of the Blackstone", N.D.). The map above, taken from a pamphlet detailing the sites within the Corridor, provides an excellent illustration of the quantity of sites within Worcester. Each numbered region is a trail, lake, pond, or point of historic interest. There

is also an off-road bikeway under construction along the river, which will provide yet another recreational opportunity for people to bike or hike along the river.

2.2.2   Broad Meadow Brook Wildlife Sanctuary

The Broad Meadow Brook Wildlife Sanctuary

B represents the Butterfly Trail.
C represents the Cardinal Trail.
E represents the Enchanted Forest Trail.
F represents the Frog Pond Trail.
H represents the Holdredge Trail.
L represents the Lady Slipper Trail.
M represents the Marsh Overlook Trail.
N represents North Link Trail.
S represents the Sprague Trail.
T represents the Troiano Brookside Trail.
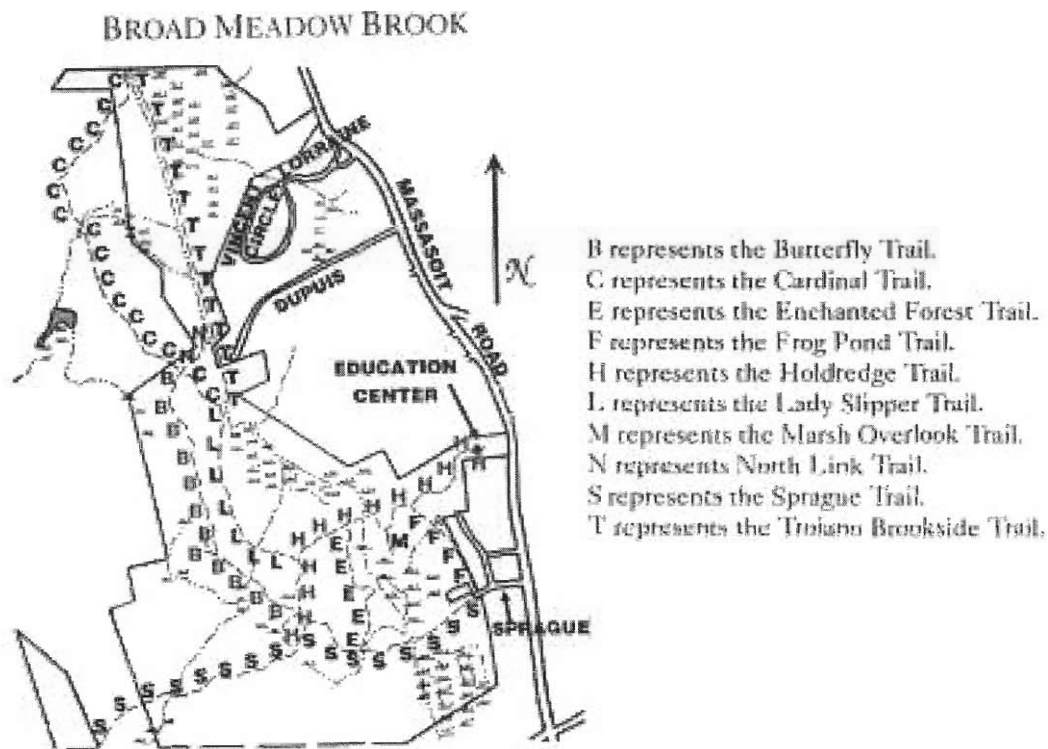
(Novick, N.D., p.36)

Another example of the green space Worcester offers its residents and visitors is the Broad Meadow Brook Wildlife Sanctuary. The Sanctuary was established by the Massachusetts Audubon Society in 1990. The approximately 400-acre region consists of land purchased by the Society, land owned by the New England Power Company, and land designated as a conservation area by the City of Worcester. An undeveloped wetlands area, the Sanctuary is a protected habitat for many species of plants and animals making it an interesting place for hiking

and exploration. The region consists of hills, forests, plains, and marshes and has trails running throughout.

2.2.3   Other Areas

Although the Blackstone River Valley National Heritage Corridor and the Broad Meadow Brook Wildlife Sanctuary are the two largest areas where people can enjoy Worcester's green nature, many smaller areas exist. Perkins Farm, the earliest recorded establishment in Worcester, offers 80 acres of woodland to explore (Worcester Conservation Commission, "Perkins Farm", N.D.). Another site of interest is the West Hill Dam, which was constructed in response to flooding caused by Hurricane Diane in 1955. The site of the dam now offers picnicking, swimming, and guided tours (US Army Corps of Engineers, N.D.).

Worcester has many blue and green amenities to offer its residents and visitors. As a brochure designed to lure tourists to Worcester states, "Acres of green space… Nature lovers will enjoy our miles of hiking trails, our expansive parks, and Broad Meadow Brook Wildlife Sanctuary, the largest urban sanctuary in New England" ("It's right here in Worcester", N.D.). In addition to providing a consistent, detailed source for information on large sites such as Broad Meadow Brook, we will bring attention to the smaller, less-known green sites of Worcester as well.

2.3   Tools for Data Organization and Presentation

As we have demonstrated, Worcester contains many blue and green amenities. The way we store the data we gather is important because it determines how easily the data can be accessed. It also determines how easily the data can be modified by others after we are done with it.

2.3.1   Database Systems

Databases are like filing cabinets, storing information in an organized fashion so that it can be retrieved for modification or presentation. However, unlike a filing cabinet, databases have the ability to relate information. This allows for a more "accurate model of data objects in the real world such as employees, customers, or orders" (Whitehorn, 2000, p.54). This section describes the basics of how databases work.

Each grouping of data, such as employees, or orders is stored in its own separate table in the database. Tables can be thought of as a two-dimensional grid where each column is a specific characteristic and each row is a member of the table. The columns are called "fields" and the rows are called "records." For example, in a table of employees, there could be fields labeled "Employee Number," "First Name," "Last Name," "Department," and "Position." Each record would correspond to a different employee with corresponding information stored in each field.

Employees : Table				
Employee Number	First Name	Last Name	Department	Position
1231231	Bob	Smith	Sales	Associate
1231232	Jim	McDonough	Marketing	Specialist
1231232	Sarah	Jones	Sales	Manager

Record: 3 of 3

Each table must have its own primary key. A primary key is simply a field where every record's value is unique. In the employee table example, the primary key is the employee number. In this case, the employee number is assumed to be unique. Most database applications will not allow a user to enter two records with the same values in the primary key fields (Whitehorn, 2000, p.54).

The benefit of storing information in a database is the relationship that can be applied to realistically model the data as it exists in the real world (Whitehorn, 2000, p.54). For example, assume that an "Orders" table exists with the fields "Order Number," "Sold By," "Sold To," "Transaction Date," and "Payment Method." Also assume that a "Customers" table exists with the fields "Customer ID," "First Name," "Last Name," "Address," "City," "State," and "Zip Code."

Customers : Table						
Customer ID	First Name	Last Name	Address	City	State	Zip Code
4163215	Matthew	McDougal	154 Baptist Hill RD	Palmer	MA	01069
5123456	Gina	Carangero	41 Wachusett St	Worcester	MA	01609
8456123	Joe	McNeedles	2001 Gotham Ln	Ludlow	MA	01054

Record: 3 of 3

Oders : Table				
Oder Number	Sold By	Sold To	Transactoin Date	Payment Method
4891321	1231232	4163215	9/12/2002	Cash
5467891	1231231	5123456	10/4/2002	Credit
7897145	1231234	4163215	11/6/2002	Check

Record: 3 of 3

The "Order Number" field is the primary key that is a unique order number for the sale and the "Sold By" field is an employee number for the employee that made the sale, the "Sold To" field is the customer number who the sale was made with. The "Sold By" field relates the "Orders" table to the "Employees" table. The "Sold To" field relates the "Orders" table to the "Customers" table. These relationships tie the data together creating real-world information. The first record of the orders table represents "Sarah Jones, the sales manager sold something to Matthew McDougal on September 12, 2002. They paid Cash."

Relationships

Employees	Oders	Customers
Employee Numbe	**Oder Number**	**Customer ID**
First Name	Sold By	First Name
Last Name	Sold To	Last Name
Department	Transactoin Date	Address
Position	Payment Method	City
		State
		Zip Code
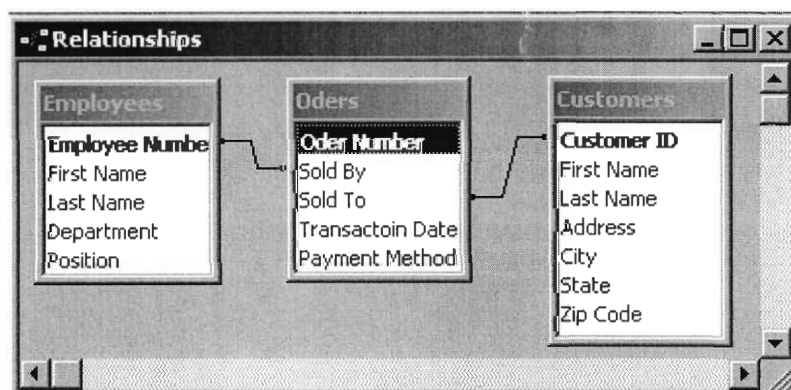
The necessity for a primary key in each table exists to avoid conflicts in relationships. If there were multiple employees with the same employee number, the "Sold By" field in the "Orders" table may correspond to multiple employees with that employee number, making it impossible to tell who made the sale.

Sometimes a primary key is easy to choose. For example, in a database of automobiles, the primary key could be the serial number on the engine. The serial numbers are unique enough to

use as a primary key. However, in the case of employees, where someone's name is certainly not distinct, nor the department or position, how can a primary key be defined? The simple solution is to give the employees an "Employee number." This is a common technique to create a distinction between objects (Whitehorn, 2000, p.54).

Once a database has its tables and relationships set up and contains some data, reports can be generated. Reports are a way of presenting data dynamically. For example, the sentence "Sarah Jones, the sales manager, sold something to Matthew McDougal on September 12, 2002. They paid Cash" could be created dynamically, such that all other orders would be created in the same fashion. Instead of saying "Sara" the report would say something like "Employees ! First Name." Using the existing relationships, every order record would reference one unique employee record and customer record. For example, the second order would generate "Bob Smith, the sales associate, sold something to Gina Corangero on October 4, 2002. They paid Cash." Hence, with the click of a button every "order-sentence" could be generated. This would be very useful for generating invoices or automated order-confirmation e-mails. These forms of dynamic output are called reports and are what makes databases so useful (Whitehorn, 2000, p.54).

We used databases to organize our information. Rather than using tables of employees or customers, our databases contain tables of blue and green amenity sites. Rather than employee names or order numbers, our database includes the following fields:

- ID
- MBL
- Primary Name
- Alternate Names
- System

- Acreage
- Major Public Access Point
- City
- State
- Alternate Access Point 1
- Alternate Access Point 2
- Alternate Access Point 3
- Alternate Access Point 4
- Classification
- Trails
- Name
- Address
- Phone
- E-Mail
- Website
- Activities Offered
- Office Hours
- Hours Of Operation
- Management
- Seasons of Operation
- Facilities / Attractions
- All Persons Accessibility
- Cost
- Images
- Flora
- Fauna
- History
- Personal Stories

The Map Block Lot (MBL) field refers to a specific plot of land. It was especially important to our project because the MBL is used to reference larger databases of locations which also contain MBLs. This type of data referencing is commonly referred to as Geographic Information Systems (GIS).

2.3.2   Geographic Information Systems (GIS) Technology

Geographic Information Systems (GIS) technology is a "computer system capable of assembling, storing, manipulating, and displaying geographically referenced information" (http://www.usgs.gov/research/gis/). Basically, it is a way of relating data based on location. GIS technology allows the relation of statistical information such as temperature to geographic information such as a city or a specific point in a city. Using GIS, it is possible to find the average rainfall at a college or the hottest city in the world for a particular time.

The associated statistical data such as rainfall or temperature is easily collectable and has been archived for years. The uniqueness of GIS is how it relates the information. The main requirement of a GIS system is that it has unique location (primary key). This location can come in a variety of forms. A simple location metric is zip code, which is acceptable for most GIS systems. A more specific system, such as one that finds the hottest point on earth would need a more specific location, such as a latitude/longitude/altitude. (http://www.usgs.gov/research/gis/) Integrating GIS data with multiple statistical information sources can create data that is far more powerful than the sum of its parts.
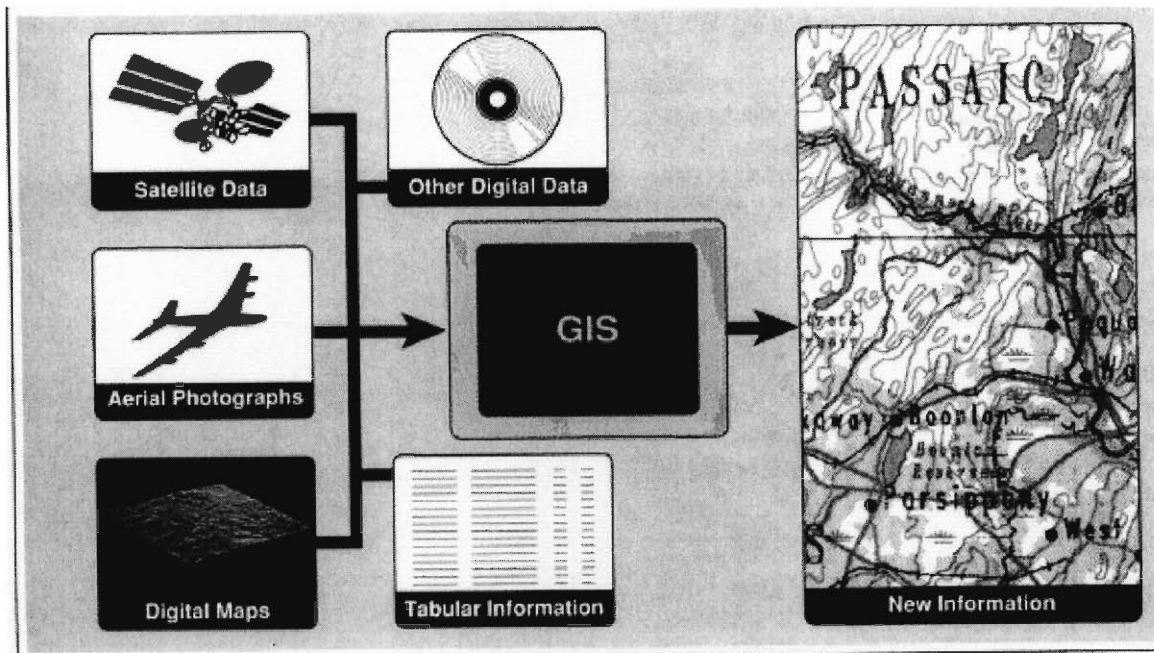
Figure 9. Data integration is the linking of information in different forms through a GIS.

Using GIS technology and Water Company billing information, it is possible to simulate the discharge of materials in the septic systems in a neighborhood upstream from a wetland. The bills show how much water is used at each address. The amount of water a customer uses will roughly predict the amount of material that will be discharged into the septic systems, so that areas of heavy septic discharge can be located using a GIS. (http://www.usgs.gov/research/gis/)

The most valuable aspect of storing GIS data is that it can be outputted in a very easy-to-understand, graphical, manner that shows detailed analysis over specific areas. Not only can this type of output aid the understanding of the person running the analysis, but it can also help other, less involved people to understand the results of the analysis. Due to the nature of GIS data, it can also be easily applied to create dynamic maps where various data can be physically shown on its respective location on a map (http://www.usgs.gov/research/gis/).

Our project uses GIS technology to store, organize, and present the data that we collected. Worcester, like most cities in the U.S., uses a Map Block Lot (MBL) format to partition its land into segments for each site. Most sites in our database have an MBL. The MBL relates each

site's information to the city's existing GIS data layers. By storing our information in this manner, we made it possible to present our data in a variety of visually appealing formats.

2.3.3   PHP scripting Language

To make our database more accessible, we developed a website to search and modify it. To display the contents of our database in a meaningful way on this site, we needed a scripting language that could access the database and dynamically create web pages based upon its contents. PHP is an appropriate scripting language for our project because it includes functions that allow easy access to mySQL databases. Our primary source of information on PHP was the PHP reference manual, which can be found on the PHP website, www.php.net.

PHP mixes web code, known as HTML, with special segments of PHP code that are interpreted by the web server to dynamically create a webpage based on input from users and our database every time the page is viewed. The browser viewing the page is only shown the webpage that the server generates, not the PHP code that generated the page. Our website will use PHP to modify and search our database, display lists of sites in an orderly fashion, and handle secure password authentication so that only authorized users can modify and expand the database.

A web-based system is a powerful model for presenting our data, but the information in our database can be presented in a variety of formats. Each presentation model has intrinsic benefits and limitations. We have evaluated each model for its positive and negative aspects.

2.4   Models

Thousands of sources of information on blue and green amenities currently exist, ranging in scope from specific locations to broad groups of sites. These models include formal atlases, tourist guides, newsletters, pamphlets, and websites. Each of these presentation forms has both desirable and undesirable qualities. The models we chose needed to allow us to incorporate numerous areas without appearing too cluttered or being too costly.

2.4.1   Atlases

Atlases are documents containing a collection of maps, often with graphical analysis. The information found in these can cover areas as large as continents or as small as cities. Within an atlas, you may find hundreds of maps detailing environmental areas, population densities, industrial regions, and many other valuable sources of information. Along with these maps, atlases usually contain graphical analysis of information provided, explaining what each separate map has to offer. Atlases may be published with a specific purpose in mind, or with a broader focus. They can detail information on medical findings, geography and landforms, marketing results, and environmental aspects. Environmental atlases are commonly "created with a goal of nature preservation, with a desire to enlighten the public with basic facts about the natural and human environments and what is happening to them" (Atlas of the Environment, p.9).

Atlases often include a plethora of information, which the reader has to sift through to find the sections that interest them. They may contain pages of facts, potentially making this task

tedious. Atlases most commonly cover large areas, with data spanning over the entire region rather than a specific place. Thus, if a person is looking at a map of Massachusetts, it will be difficult to determine what can be found in a small town. By creating an atlas of environmental activities within the Worcester area, we could provide specific information that may not be found in another source. With atlases, there is also an issue of cost; as the number of pages increases, the cost of publishing begins to climb. This cost is then passed on to the reader, who must have a strong desire for the information contained to pay the retail price. This leads to lower distribution numbers, as the atlases are not accessible to everyone.

For our project, we hoped to achieve a high level of distribution while minimizing cost. Thus, we needed to keep the publishing cost low. Although an atlas offers a large amount of space to present our data, it is also expensive to publish. However, atlases presented maps and other styles of detailing sites that could be used in our final product to present our information.

2.4.2   Tourist Guides

Tourist guides are available through most state tourist information centers or through travel guides. These often offer a large-scale map, with major attractions labeled, portraying a variety of locations and accommodations. Guides usually give a clearly labeled road map with attractions clearly labeled. Many major cities also have tourist centers that supply information on major tourist spots.

The Chicago Department of Environment and Chicago Park District has created a guide with a goal "to increase awareness, appreciation and stewardship of [their] valuable and diverse assets...Chicago's natural areas" (Chicago Department of Environment, N.D., p.1). This publication offers an abundance of information on events offered by the various citywide environmental organizations. The guide also includes a listing of many of these organizations, thus allowing the reader to seek more information if they find something of interest.

Tourist guides often contain generalized information. In attempting to cover as many attractions as possible, they may overlook smaller, less frequented areas. Information found on tourist guides may also be missing key aspects. Tourist guides often feature charts of activities offered at various sites they include, but the reader is left to their own judgment as to determine which site is best for their chosen activity. Thus, they may go to a park that offers biking, only to find that there is only a short trail, or even an unmarked, rough trail at the site. In trying to cover as many places as possible, tourist guides are often only successful in giving a broad overview of each place. In some cases, a tourist guide may be accompanied by a larger, more detailed, but more expensive handbook.

The *Nature Chicago* guide appears to be one of the better tourist guides available. However, their document does lack some qualities. This handbook offers information on many activities, but they include mainly wildlife related activities, such as bird watching, garden walking and informational classes on wildlife. The manual fails to look at recreational activities that exist in and around the city, which may also lead to an increase in environmental awareness, as some

citizens may not realize the opportunities that surround them (Chicago Department of Environment, N.D.).

After looking over tourist guides, we noted that charts featured on these documents offer an effective way of presenting activities offered, while using minimal space. We designed our documents in a way such that tourists and newcomers can easily find attractions, even if they are unfamiliar with the area.

2.4.3 Newsletters

Most environmental organizations publish weekly or monthly newsletters featuring nature-related activities. These documents offer an abundant list of options for those people interested in nature. Newsletters may also feature articles about environmental aspects, or announcements from the society or societies represented by the letter.

Although they offer a great deal of opportunities to the reader, most newsletters are still incomplete. A newsletter published by the Arcadia Wildlife Sanctuary lists 20+ environmental activities, but little information on the location of the activities. Our project also plans to branch off from specific activities offered by organizations, as we hope to increase the awareness of the multitude of opportunities that exist. This will involve featuring detailed information on sites, while newsletters are concerned more with specific classes and hikes than the variety of activities that may take place at a specific location. In order for the newsletter to be of value, the reader would need previous knowledge about the whereabouts of the site (Mass Audubon Society, Mass

Audubon Western Sanctuaries, 2002). This is because most newsletters are sent to members on a mailing list, who have more access to this knowledge from other sources. Because the organization's mailing list consists of already-aware individuals, the newsletter will only reach those people, excluding much of the target population.

A mass mailing of these documents could, potentially, reach most of our target audience, but the receivers might not bother to look into the information. The cost of such an endeavor would deprive funding from other activities sponsored by the organization, thus decreasing their ability to promote environmental awareness.

2.4.4 Pamphlets

Pamphlets come in a variety of shapes and sizes and may contain maps, articles, activities and even more valuable information. Pamphlets may be published as a resource for one particular location, a compilation of many related areas or a mix of these options. These brochures can be found at information centers and environmental agencies. Brochures are fairly cost effective, offering similar options as other models at a reduced cost.

However, pamphlets often lack a complete view of area activities, mainly focusing on one specific destination and not providing any information on other related opportunities. The quality of brochures often varies, depending on the cost to produce. Pamphlets for an individual site normally offer a high amount of detail on the location and activities offered. As more

destinations are added, the amount of detail supplied to the reader begins to diminish. Thus, the more locations contained within a brochure, the less information provided to the reader.

Although a pamphlet would have been too small to contain all of the data of our project, they provided further examples of how to present data such as ours.

2.4.5   Website

Websites are accessible through computers that have access to the internet. They vary widely in appearance and scope, and can offer both simple, summarized information and large quantities of detailed information by linking multiple pages.

The website model offers many advantages. Websites are easily accessible. Anyone, including individuals without a computer, can access a website through public libraries, which typically offer computers with free internet access. In addition, a website can make use of a search feature to cover a wide variety of information without overwhelming the user. Websites are also inexpensive to produce and display when compared with products. Usually, there is only a flat fee associated with hosting the site, where as a paper presentation model requires a fee for each reproduction. In addition, a website can be dynamically generated. If our database is updated, the website will automatically display the new information, with no additional cost. Paper products, in comparison, would require another printing to update, at an additional cost.

The primary disadvantage of a website would be the lack of visibility. A physical product can be placed somewhere with a high visibility, like an information center. To be seen by people who aren't actively searching for the site, a website must be linked to by another site or advertised. A second disadvantage is that the site cannot be viewed away from the computer unless a user has a portable computing device. If the user wishes to access the information away from their computer they would have to go through the hassle of printing the information they need and would be unable to take advantage of the dynamic, searchable nature of the site.

2.5   Summary

Worcester's history, despite the efforts of some individuals and organizations, has not been a green one. Few people think of outdoor recreation when they think of Worcester. However, Worcester has many blue and green spaces to entertain visitors. The background information in this section helped us prepare a detailed methodology to document and present these sites to Worcester's residents and visitors.

3   Methodology

The goal of this project is to document Worcester's blue and green amenities, present them to residents of and visitors to Worcester, and create a resource for others to use and expand upon. In the process of accomplishing this goal, we worked to accomplish the following tasks:

1.   Determine which sites to document

2.   Set up a database to store site information

3.   Collect data from each site and enter it into a database

4.   Display the data in a website, GIS layer, and print ready map

In this section we discuss the methods we used to complete these tasks. Data collection procedures include interview methodology and archival research. Archival information, such as existing nature guides, newsletters, pamphlets, and city records, helped us create our list of blue and green sites to focus on and determine how to present the information we gathered. By interviewing key persons, we gained a better understanding of what information was required for this project to be successful and learned efficient ways to store our information.

3.1   What sites do we examine, and what data must we gather from each site?

Our first task was to identify the sites to document. We completed this task by integrating interview and archival research methods to compile a valid, comprehensive list of sites. Our next objective was to decide which characteristics of each site to document.

3.1.1   Pre-Interview Archival Research

Prior to conducting our interviews we did background research to ensure that we had the necessary knowledge to ask pertinent questions. We also created a list of potential sites to document and created a list of site characteristics that we felt fully described the sites we were going to examine.

3.1.1.1.1   Interview Methodology

Face to face interviewing is one of the "oldest and most highly rewarded" methods for obtaining information. (Singleton, 1993, p.261) Interviews provide a "fuller, more complete response" when compared with other, less-personal methods such as questionnaires. (p.260) The dynamic nature of an interview helps avoid meaningless questions. Real-time responses allow the interviewer to request the interviewee to clarify confusing responses, eliminating the possibility of a misunderstood question. This provides concise and meaningful information.

In order to make efficient use of our resources, we interviewed experts in fields related to our studies. Because of their mutual concern for our project, our interview subjects were considered acquaintances, which allowed the interviews to be casual and informal. We ensured that our interviews were purposive to avoid wasting our interviewees' valuable time by following a semi-structured interview format, utilizing an agenda and avoiding tangents.

Our first interview was with the director of the Broad Meadow Brook Wildlife Sanctuary, Deborah Cary, an expert on the blue and green amenities in the Worcester area. She is a life-long environmental activist who has worked in this field for all of her professional career. We created a list of locations and asked her to verify this list by adding or removing any sites she felt necessary. We also received her input concerning the type of data we should record for each site.

Following this interview, we spoke with Colin Novick, the Program Coordinator of the Greater Worcester Land Trust. He works with information pertaining to Worcester's natural assets on a daily basis and has an extensive list of these sites. We spoke with him in a manner consistent with the interview with Deborah Cary.

To further strengthen the validity of our site list, we interviewed Commissioner Michael O'Brien and Deputy Commissioner Robert Antonelli of the Parks, Recreation, and Cemetery Department of Worcester. They are responsible for managing open spaces in Worcester, and provided a cumulative list of the green spaces managed by the department.

3.1.2 Archival Research Methodology

Archival records refer to existing recorded information (Singleton, 1993 p.108). Archival data can be more difficult to obtain than information from an interview but is usually more concrete and established than an interviewee's word. This information can be in the form of statistical records, public and private documents, and mass communications (Singleton, 1993, p.108).

Throughout the research process, we continually studied a variety of sources that list blue and green amenities in Worcester to make our list more comprehensive. We looked at the handbook "Out of Doors In Worcester," a recreation guide that documents the natural assets in the city. Another resource we used was "Biking & Hiking Worcester," a pamphlet created by the Worcester Regional Transit Authority. This guide has a map that lists hiking and biking opportunities in the city, as well as a map containing a variety of parks and playgrounds. We were able to obtain a listing of all the open spaces managed by the Parks, Recreation and Cemetery Department and the Greater Worcester Land Trust. The 1994 City of Worcester Open Space and Recreation plan supplied a listing of blue and green spaces. We also looked through existing site-specific pamphlets to ensure that no sites were missed.

The combination of our interview research and archival research allowed us to create a comprehensive list of the sites that we documented for this project. The use of multiple sources and methods strengthened the overall validity of this list.

3.2   Database Organization

To store information about each site we documented in an organized, accessible format, we created a database. This database, as described in the literature review, consists of tables with specific, geographically referenced information.

As stated in our Literature Review we made a list of site characteristics to record from each site we documented. These characteristics are the fields that make up our database tables. These fields are as follows:

- ID
- MBL
- Primary Name
- Alternate Names
- System
- Acreage
- Major Public Access Point
- City
- State
- Alternate Access Point 1
- Alternate Access Point 2
- Alternate Access Point 3
- Alternate Access Point 4
- Classification
- Trails
- Name
- Address
- Phone
- E-Mail
- Website
- Activities Offered
- Office Hours
- Hours Of Operation
- Management
- Seasons of Operation
- Facilities / Attractions
- All Persons Accessibility
- Cost
- Images
- Flora
- Fauna
- History
- Personal Stories

To ensure that this database will be useful to others we used standardized procedures for organizing our geographically referenced data. If the data was not organized properly, it would

be incompatible with GIS mapping software for presentation. If the relationships were not properly set up, it would be difficult to add new records or records of a new type. If our field names were not standard, others would have trouble importing our tables into their own databases. To avoid these situations we interviewed professionals that deal with this type of data on a daily basis to ensure that we used the appropriate methods.

3.2.1 Interviews

Ruth Gentile, the GIS Coordinator of the city of Worcester, was a valuable resource for this section because she commonly works with geographically referenced databases. We interviewed her in a manner consistent with previous interviews. We asked questions pertaining to methods for data storage and organization relating to GIS. The information she provided proved vital in linking our database to GIS data layers.

Our interview with Ruth also provided contact information for Paul Samara, the GIS coordinator for the CMRPC (Central Massachusetts Regional Planning Commission). We interviewed him on the same subject. This interview confirmed that the information we received on GIS data-linking methods was complete and accurate.

3.3   Data Collection Procedure

Once the database was set up we began to gather data. Both archival sources and interviews were important sources of information for this process.

3.3.1 Archival Research

In order to gather the site-specific information we needed, we made use of archives and literature about the various sites were documenting, including city and state records and pamphlets provided by sites. We used many of the same resources that were used to create our site list, including "Out Of Doors," "Biking and Hiking in Worcester," and "Headwaters of the Blackstone Canal."

Along with the sources we uncovered during our interview, we also used additional sources acquired from our interviewees. Deborah Cary gave us "City of Worcester Open Space Recreation Guide." This document lists many of the smaller sites in Worcester, such as playgrounds and fields along with the activities that are offered there. Colin Novick provided a similar source called, "What's Left," which lists and details all of the unprotected open spaces in Worcester. Another important source, also given to us by Colin Novick, was Worcester's GIS layers. We used these layers to locate MBLs, along with ownership and acreage of various sites.

These archival records provided a majority of our data, but were unable to provide a complete set of data for most of the sites. To continue the data collection we performed interviews with people who are familiar with the information we were missing

3.3.2 Interviews

We conducted casual interviews to obtain specific information that could not be obtained through archival research or observation. Once again, we talked to the director of the Broad Meadow Brook Wildlife Sanctuary, who has extensive familiarity with the sites we were trying to document. She was able to fill in many blank fields that we could not fill through archival research.

Our interview with the Commissioner of the Park, Recreation, and Cemetery Dept. of Worcester also helped us fill in empty fields in our database. In addition to site characteristics, the Parks, Recreation, and Cemetery Department had a large collection of images from various sites around the city. These images were used on our website to provide a multimedia supplement to the information from our database.

Any unrecorded fields in the database after archival and interview research were left empty. Not all fields applied to all sites; some sites simply lacked specific data such as facilities or activities.

3.4 Presentation

After the data collection and entry, we needed to present the information. To do this we researched the different features that GIS technology offers. We carried out this research by studying archival information on GIS usage and mapping and interviewing persons familiar with

presenting GIS data. We also researched methods for developing a dynamic website to present our data to a wide audience. Lastly, we determined what technical resources were available to support a web-based product.

3.4.1   Archival Research for GIS Standards

Before our interviews on GIS presentation we searched for archives containing information about presentation of geographically referenced information. We looked through the help file for ArcGIS 3.2a as well as an introductory document called "Introduction to GIS using ArcGIS" from the Univerity of Durham's Information Technology Service (http://www.dur.ac.uk/ITS/Help_and_Info/Documents/Guides/ 37GIS.pdf). This information provided a broad background for our interviews and an un-biased opinion of useful GIS presentation methods.

3.4.2   Interviews for GIS Data Presentation

Our interview with the city's GIS coordinator, Ruth Gentile, helped us better understand GIS and how it could be used to visually represent our database. Ruth handles the city's GIS layers and helped us integrate our database with the city's GIS data layers.

The interview with the Program Coordinator of the Greater Worcester Land Trust helped us familiarize ourselves with the capabilities of GIS map presentation software. He manages geographically referenced information on a daily basis.

3.4.3 Web Resources

In order to present our information in an easily accessible, easily searchable format, we decided to create a dynamic website that would allow users to search our database and update it as the information we gathered becomes outdated. We chose a website because the production cost is minimal and it would allow users to quickly access the information they needed. It would also be available to anyone with internet access at no additional cost.

In order to design a dynamic website that would interface with most web-servers, we needed to evaluate what types of database formats, dynamic scripting languages, and platforms were available to us. We interviewed Alex Hanks, the webmaster from the *Worcester Telegram and Gazette,* to find out what type of web environment they use for their "On the Common" website. We also interviewed the Information Technology Manager of the Massachusetts Audubon Society, Louise Grinrod, to find out what platform they use. Lastly, we interviewed Josh Brandt, WPI's UNIX administrator, to evaluate the database and dynamic web environment used at WPI.

3.5   Summary

The completion of the tasks described in this section provided enough information to create our database, GIS layer, map, and website. Our database and website also provide an opportunity for others to extend our project to a greater geographic region or encapsulate our database's tables into a larger database. The finished database, GIS layer, map, and website will undoubtedly be a useful tool to Worcester's occupants and visitors.

4   Results and Data Analysis

Following our methodology, we successfully fulfilled the goals we established at the beginning of the project.   In this section, we discuss and analyze the results of this process.

4.1   Creating the Site List and Site Characteristics

In order to create a valid and comprehensive list of sites and site characteristics, we followed the interview and archival research schedule documented in the methodology.

4.1.1   Preliminary Archival Research Results

Prior to our interviews regarding the site list, we conducted preliminary research in order to create a foundation for our list of sites. Using documents mentioned in our methodology, we listed all sites that we had archival sources for. We also created a list of data points that we felt were needed to fully document each site. Once we had developed a working list, we performed interviews to locate more sites and ensure that our list of site characteristics was comprehensive.

4.1.2   Interview Results

Our interview with Deborah Cary, the director of the Broad Meadow Brook Wildlife Sanctuary, nearly doubled our list of sites. We agreed that our project should be limited to the City of Worcester boundaries, to ensure that the project could be completed in one term. She reviewed

both our list of sites and site characteristics, making changes that she deemed necessary. Deborah provided more archival records to ensure that no sites were overlooked.

The interview conducted with the Program Coordinator of the Greater Worcester Land Trust, Colin Novick, provided a list of sites managed by his organization along with "What's Left?," a report created by the City Manager's Office of Planning and Community Development. This document provided a listing of all unprotected open space in Worcester. He reviewed our list of site characteristics and assured us that our list was comprehensive. He also provided useful information on ArcView, the GIS mapping software we used for this project.

Commissioner Michael O'Brien and Deputy Commissioner Robert Antonelli of the Parks, Recreation, and Cemetery Department provided a list of all sites under their management. This list added to our collection of sites, including additional playgrounds and beaches and validated many of the sites we already listed.

4.1.3 Post-Interview Archival Research

While conducting the interviews, we accumulated several archival records to research. These documents helped to expand and complete our list of sites to 91 sites, including many small areas such as fields and playgrounds. Once we exhausted these resources we were confident that our list was comprehensive.

4.2 Database Organization

Once our list of sites and site characteristics was complete, we began to research database design methods that would be compatible with other GIS databases. Our primary source of advice and information on designing our databases came from our interviews. We interviewed professionals that supplied the advice and technical details that would allow us to create our database in a way such that it would be compatible with GIS standards and could be easily used by others.

4.2.1 Interview Results

We asked the GIS coordinator for the City of Worcester, Ruth Gentile, what GIS software they used and which database platform would integrate best with the city's existing GIS layers. She explained that the city uses the ArcGIS suite, more specifically ArcView 8.2, but ArcView 3.2a is also acceptable. She told us that ArcView integrates with "dbf" files that can easily be created by Microsoft Access and that Access was probably our best choice for data organization because its user interface would decrease our development time.

We also asked Ruth what specific fields our database would require to integrate with the ArcGIS software. She explained that the city's databases use a Map Block Lot field called "MBL" that describes a specific plot of land within the city of Worcester. The MBL field should be recorded in the format 'MMM-BB-LLL' where the M's are map segments, the B's are city block's, and the L's are lot numbers. By putting an MBL field in our database we made it compatible with the city's GIS database tables.

We asked the same set of questions to Paul Samara, the GIS coordinator of the Central Mass Regional Planning Commission, for comparison. He confirmed that the best way to ensure that our database would be compatible with most GIS databases would be to have an MBL field. He felt that Microsoft Access would be an excellent platform for our database because it has the option to export to multiple database formats, including the "dbf files" that are used for the ArcGIS system.

Based on the advice given by the GIS coordinator for the Central Mass Regional Planning Commission and the advice given to us by the GIS coordinator for the city of Worcester, we decided to create a database in Microsoft Access. Access' user interface drastically reduced our development time. We created the database called "amenities" and added a table called "sites." The fields for the "sites" table were all the site characteristics that we decided upon from the previous section with the addition of the MBL field.

Once the database design was complete, we were ready for data entry. Access has a feature to easily convert a database table into a user-friendly form. With this feature, we created a user friendly form that we used to enter data as we gathered it.

4.3   Data Collection

Once we completed our lists of sites and site characteristics and the database had been developed, we began data collection. The process was similar to the methods used to create the list of sites, including preliminary archival research, interviews, and archival research of sources obtained from these interviews.

4.3.1   Archival Research Results

Archival research allowed us to fill in portions of the database. After we had exhausted our archival sources, we found that they were not nearly comprehensive enough to fill every field in the database. We were able to find basic information on the majority of the sites, but few documents contained all of the desired data. We realized that interviews would be crucial to locating the majority of the data we lacked.

4.3.2   Interview Results

Our interview with the Program Coordinator of the Greater Worcester Land Trust gave us a number of sources to work with including: the city's unprotected open space report "What's Left," a database with information pertinent to our project called CCurrent, and additional GIS layers.

The city's GIS manager provided the city's open space GIS layer which contained map block lot listings and addresses of open spaces in Worcester.

The interview with the Commissioner and Deputy Commissioner of the Parks, Recreation, and Cemetery Department provided a list of the parks in the city. This document listed activities that each park has to offer. The deputy commissioner provided contact information for organizations that manage specific properties in the city. He also provided contacts for individuals at the city's Assessor's Office that would assist us in finding site addresses. While at the office, we accessed the Parks Department's archives to gather information on site history and collect images of various parks.

Upon completion of these interviews, we printed a report for the Director of the Broad Meadow Brook Wildlife Sanctuary. This report featured the current information in our database, with spaces for her to fill in any additional information she could provide.

4.3.3   Post Interview Archival Research Results

Upon completion of our interview research, we studied any archives that were given to us, or that we found, during the interview period. These documents included the GIS layers given to us by the program coordinator of the Greater Worcester Land Trust, the open space layer given to us by the city of Worcester's GIS manager, and the reports returned to us by the Director of the Broad Meadow Brook Wildlife Sanctuary. These sources helped us fill many of the blank spots in our database.

Because of the time constraints on this project, it was impossible to completely fill the database. Once we exhausted the sources collected during the interview period, we decided that the data research and entry process was complete. We are confident that the database design will allow future users to easily enter new sites. They could also enter information that is missing from the sites we have documented. Once the data was collected and entered into the database, we focused on methods of presenting our data. Our goal during this process was to present our data to as many people in our target audience as possible.

4.4   Presentation

Once our database was filled with site data, we designed methods for data presentation. To reach our target audience, residents of and visitors to Worcester, we needed to make our data accessible and easy to use. Based on evaluations of various data presentation models, we decided to create three deliverables:

1.)   A GIS layer that displays Worcester's blue and green amenities

2.)   A print-ready map that highlights each site and displays the activities offered at each

3.)   A dynamic website that allows users to search and maintain a database of site characteristics

4.4.1   GIS Layer

The GIS Layer was the simplest presentation format to create because we designed our database around it. As described in section 4.2.1 the city of Worcester's GIS Manager explained that we needed to have an MBL field in our database in order to make it GIS compliant. The GIS layer is created by joining our database with existing layers' MBL fields. This creates a GIS layer that is referenced by the MBL field and displays all of the data from our database for each particular site. The benefit of the GIS layer is that it allows city officials to easily incorporate our database into the library of existing GIS layers, making our project more useful to the city.

4.4.2   Print-Ready Map

The second presentation model that we created was a print-ready map. This map details the city of Worcester with the major sites labeled. It also shows a table that lists the activities found at each site. In this table, each row corresponds to one site and also has checkmark in each cell that corresponds to an activity offered.

ID	Site Name	Baseball	Basketball	Bird watching	Boating	Canoeing	Cycling	Fishing	Football	Golf	Handball	Hiking
1	Apricot Street Playground											
2	Bailey Prouty Playground	X										
3	Ballard Woods											X
4	Banis Street Playground											
5	Beaver Brook											
6	Beaver Brook Park and Playground	X	X						X			
7	Bell Hill Park											
8	Bell Pond											

Sample table, see Appendix J for full table and map

The benefit of this presentation model is that it allows the majority of our target audience to view it. The GIS layer and website require that the person trying to access them has a computer and internet access. The map helps reach the portion of our target audience that may not have internet access. Unfortunately, this model has disadvantages. It requires a budget to cover the design and printing costs that are required to create a marketable document. Another problem is that a paper document becomes obsolete when the database is updated. If the database is updated, another document would have to be printed and distributed to update the document.

4.4.3 Dynamic Website

The most common problem among the presentation models we considered was the ability to effectively display enough information in one place without making it difficult to locate specific information. Another problem was that the production cost of a document that would comprehensively display all of the information we collected would be high, due to the quantity of information and number of copies we would need to print. Lastly, we considered the amount of time it would take the reader to find specific information about multiple sites.

Our other presentation deliverables offer an overview of what is available in Worcester, but lack the ability to quickly find cross-referenced information among all sites, one of the most useful benefits of storing information in a database. For example, we wanted to make it easy for someone to find information on locations where you can play basketball and then go for a hike to cool off. We also wanted to overcome the common problems mentioned among the other deliverables.

We decided to develop a dynamic website that would allow users to quickly search our table of site information. As mentioned in section 3.4.3 we interviewed Alex Hanks, the webmaster for the Worcester Telegram and Gazette, to determine their web platform. They use a Windows system with very limited space that lacks the ability do anything dynamic, such as a database search on the web. Because of this, their server capabilities did not meet our needs.

We also interviewed Louise Grinrod, the Information Technology manager for the Massachusetts Audubon Society, on the same subjects. She explained that they use a UNIX system with PHP and mySQL for database interfacing, which would be ideal for our website. However, the Massachusetts Audubon Society didn't have funds budgeted to host our site.

WPI's UNIX administrator, Josh Brandt, informed us that WPI supports mySQL and PHP, which would serve our needs for database and dynamic webpage support. WPI also has a 45MBps connection to the Internet as of August 2002 (http://www.wpi.edu/Admin/Netops/MRTG/), faster than any of the other hosts we considered. The only disadvantage of hosting on the WPI servers is that it may not be hosted indefinitely. However, due to time constraints, we ultimately decided to end our search for hosts and use the WPI servers, the hosting option most readily available to us.

We created a WPI UNIX account for the site called "atlas" and developed the website using it. The site can be accessed publicly at "http://www.wpi.edu/~atlas". The website can provide users with a list of all of the sites in the database and allows users to search for sites with specific

characteristics, such as sites that offer basketball and hiking. All of the information stored in the database, including name, MBLs, activities, facilities, and access points, can be found at the site. The page also provides additional information in the form of images, maps, and driving directions.

In addition to the basic features described above, the website has a section that allows administrative users to update the database with new sites, modify existing information, and remove sites that become outdated or developed. This portion of the website can only be accessed by users with specific usernames and passwords. The rest of the site is available to all users. Non-administrative users are not required to enter any login information.

The website offers a more user-friendly interface than the database, and is more accessible than the maps, as most users will be able to access it from their own homes. It also offers a search feature, saving users the time and effort needed to manually search through data that they are not interested in. The only downside of this model is that some members of our target audience do not have internet access. However, most public libraries provide free internet use for members.

4.5 Summary

The results found in this section were obtained by following the agenda described in our methodology. We achieved the goals set at the beginning of the project, successfully creating the database, GIS layer, website, and map. The database and can serve as powerful tools for

anyone working on a project relating to the sites we have covered, and the website and map will be useful to anyone looking for recreational blue and green sites within Worcester.

5   Conclusion

Using the knowledge we gained during our literature review and following the methodology described in chapter 3, we have created a database documenting Worcester's blue and green amenities, a GIS layer that can be easily integrated with the city's GIS data, a website to make this information publicly accessible in a user-friendly format, and a print-ready map showing the locations and activities of these sites within Worcester.

5.1   Database and GIS Layer

The database created during this project contains information on the majority of Worcester's blue and green sites, using the list of 90 sites we created during our literature review and the information we gathered on these sites while executing our methodology. It is intended to serve as a resource for anyone wishing to research or advertise such sites within Worcester, and is used to generate our website.

To reduce the chance of our database being forgotten or not maintained in the future, we have created an access database that can be merged with the city's GIS layers through their GIS software, ArcView and ArcMap. This allows the local government to easily make use of our information. If our SQL database is updated in the future, the Access database will become out-of-date. To work around this, we've provided a script that will alter our mySQL database to make it in a format that is merge-able with the city's GIS data (see Appendix H). This script consists of breaking down any records with multiple MBLs into multiple, otherwise identical

records with differing MBLs, one per MBL within the site. From here they can either export the database to DBF format using a third party application or, if they have a recent version of ArcGIS such as 8.2, open it directly.

5.2   Website

During this project we also created a website to accomplish two purposes: to make the information within the database we created more readily accessible and to provide a simple method to maintain and expand the site information within the database.

5.2.1   Design and Functionality

The website offers two primary services: accessing the database of sites and modifying the database. The former, available to anyone visiting the site, takes the form of site listing and searching functions. The latter, which requires a password to access, is possible through create, modify, and delete site functions.

The listing function of the website accesses all of the sites stored and provides all of the data on the sites, alphabetically ordered by sites, in a list on a single page. The site data also contains links to images of the site, stored locally, and maps and driving directions provided through the MapQuest site.

The search function allows the users to specify a list of desired attributes, such as site name, activities offered, or site MBL, and produces a list as the sites that fit the criteria identical in form to the list produced by the listing feature, but only showing sites that fit the search criteria. There is a basic and an advanced search, to offer both ease of use and the ability to search a wide range of attributes, and the option to extend the search results to include sites that fit any one of the criteria instead of all of them.

The create function generates a form with an input box for each field in the database. The user fills in the fields they have information for and then submits the form, which adds the site to the database. The modify function is similar, but pre-fills out the form with the current known attributes. The delete function brings a list of all sites and allows the user to check off a set of sites to delete and then press a button to delete the selected sites.

5.2.2 The Future of the Site

Visitors to our website can use it to find blue and green amenities in their area. Besides simply providing this service, the site is also intended to help raise awareness of the undeveloped sites by getting people to visit them and appreciate what Worcester has to offer. Ultimately, raising appreciation thus may help strengthen effort to sustain and preserve such locations.

Both the Worcester Parks Department and the Massachusetts Audubon Society have expressed an interest in linking to our site, which would increase the site's online visibility and lead people

to view the site. As of the completion of this paper, we had e-mailed both organizations and were in the process of arranging for the links to be set up.

As of the end of our project, our site is hosted on the Worcester Polytechnic Institute servers. We attempted to get hosting with Mass Audubon and other Worcester-activity related sites but were unsuccessful. Although currently the site remains up, it would be best if some organization more directly interested in the site's content were to host it to ensure that it remains up in the future. To make this possible, we have written detailed server migration instructions explaining how to move the site to another server.

5.3   Map

Using our GIS software, ArcView 3.2a, and the city GIS layers we obtained from our interviews, we created a map of Worcester's blue and green sites. This map is supplemented by a list of activities at each site using the information stored in our database. The map and activities listing were put together in a print-ready format so that a non-electronic product, advertising the sites we researched, could be easily produced. This could be printed and distributed to raise awareness of the sites. The combination of the map, the GIS layer, and the website will hopefully encourage more environmentally conscious development of Worcester's blue and green amenities.

5.4   Future Projects

Having completed our project, there are two suggestions we would make for future projects to further support our project's goals. One possible project would be further data collection to more thoroughly document the sites in our database or add more sites to expand the scope beyond the city of Worcester. This would make the database more comprehensive and the website of greater utility. A second project would be to develop a professional atlas from our data. This would create another presentation media to better market our data to the residents of and visitors to Worcester.

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Appendix A   List Of Sites

Apricot Street Playground
Bailey Prouty Playground
Ballard Woods
Banis Street Playground
Beaver Brook
Beaver Brook Park and Playground
Bell Hill Park
Bell Pond
Bennett Field
Blithewood Ave. Playground
Boynton Park
Broad Meadow Brook Wildlife Sanctuary
Burncoat Park
Burncoat Street Playground
Carter Road Conservation Area
Cascades Parklands
Cider Mill Pond
City Hall Common
Coal Mine Brook Park (Future)
Coes Pond
Coes Pond Beach
Columbus Park
Cook's Pond
Cookson Field
Cristoforo Columbo Park
Crompton Park
Crow Hill Conservation Area
Curtis Pond
Dallas Touraine Conservation Area
Dawson Road Conservation Area
Dodge Park
East Side Trail
EcoTarium
Elm Park
Fairmont Park
Farber Field
God's Acre Conservation Area
Grant Square Playground
Great Brook Valley Playground
Green Hill Park
Green Hill Pond
Greenwood Park
Hadwen Park
Harrington Field
Harry Sherry Field
Holland Rink Playground

Holmes Field
Indian Lake
Indian Lake Beach
Institute Park
Kendrick Field Playground
Kettle Brook
Kettle Brook North Conservation Area
Lake Park
Lake Quinsigamond
Lakeview Playground
Laurel Street Playground
Lindburg/ Bovenzi Conservation Area
Logan Field
Middle River
Middle River Park
Midstate Trail
Miscoe Estates Conservation Area
Morgan Landing
Mulcahy Field
Newton Hill
Nick's Woods
Oakland Heights Playground
Oread Castle Park
Parson's Cider Mill Conservation Area
Patch Pond
Patch Reservoir
Patches Pond Conservation Area
Perkins Farm
Providence Street Playground
Quinsigamond State Park
Ramshorn Island
Regatta Point State Park
Rockwood Field
Rosewood Estates Conservation Area
Salisbury Park
Salisbury Pond
Shale Street Playground
Sherer Trail Conservation Area
Shore Park
Tacoma Street Playground
Ty Cobb Field
University Park
Vernon Hill Park
West Side Trail System
Wetherell Park

Appendix B   List of Site Characteristics

- ID
- MBL
- Primary Name
- Alternate Names
- System
- Acreage
- Major Public Access Point
- City
- State
- Alternate Access Point 1
- Alternate Access Point 2
- Alternate Access Point 3
- Alternate Access Point 4
- Classification
- Trails
- Name
- Address
- Phone
- E-Mail
- Website
- Activities Offered
- Office Hours
- Hours Of Operation
- Management
- Seasons of Operation
- Facilities / Attractions
- All Persons Accessibility
- Cost
- Images
- Flora
- Fauna
- History
- Personal Stories

Appendix C   Interview Summaries

C.1   Deborah Cary, Director of the Broad Meadow Brook Wildlife Sanctuary

During our interview with Deborah Cary, the director of the Broad Meadow Brook Wildlife Sanctuary, we discussed her expectations for the project and received clarification on some aspects of the data we were collecting.

Deborah Cary's primary expectation was that we create a resource that others could use to create presentations that would raise awareness of Worcester's blue and green spaces. She emphasized that making our project accessible and easy to work with was important. In addition, she wanted the data presented to be pertinent and of practical use to the populace of Worcester, helping them find places to go in Worcester as opposed to providing information only of academic interest. She agreed with our decision to limit the scope of our project to Worcester due to time constraints, but suggested that she create a list of a few sites outside of the city limits that could also be included such as the nearby Wachusett Mountain, which offers skiing. Later in the project, after this interview, she decided against doing this.

When discussing our data, Deborah helped us clear up our terminology. One example was helping us remove non-official terms such as "conservatory" with more official labels like "conservation area." We also discussed land management, and learned that while many areas are conserved, not all of them are actively managed and some do not have public access points and may be less accessible and safe. As mentioned above, Deborah wants our project to be useful for

others for finding sites to visit. In this section of our interview, she emphasized the importance of providing driving directions and public access points.

During this interview we obtained the additional contact information for the Program Coordinator of the Greater Worcester Land Trust, Colin Novick, to improve our ability to contact him and schedule a meeting.

C.2   Ruth Gentile, City of Worcester GIS Coordinator

Our interview with Ruth Gentile was brief and strictly focused on the technical details of creating a GIS layer from our database. Ruth explained that we should include a field called "MBL" to ensure that our database would be compatible with the city of Worcester's existing GIS layers. MBL refers to a "Map Block Lot" system of organizing the cities lots. Ruth explained that most cities in the United States reference their plots of land via MBL.

Ruth also explained the process of creating a GIS layer (shapefile) from our database tables. She walked us through joining our table of sites with the city's parcels layer to create a new layer of amenities.

C.3   Paul Samara, Central Mass. Regional Planning Commission GIS Specialist

The interview with Paul Samara was conducted to verify that the methods provided by Ruth Gentile were valid. Paul gave the exact same instructions that Ruth did. He mentioned that other,

smaller cities outside of Worcester do not necessarily have a GIS system, nor do they reference their lots with an MBL system. He also added that because of these problems, it would be practically impossible to include sites from these types of smaller cities in a GIS layer. This was another reason for limiting our geographic scope to the city of Worcester.

C.4 Colin Novick, Program Coordinator for the Great Worcester Land Trust

During our interview with the Program Coordinator of the Greater Worcester Land Trust, Colin Novick, we received a list of sites managed by the Greater Worcester Land Trust, received information on using ArcView, and were given a tutorial on how GIS layers work.

We asked Colin for assistance with site data from Greater Worcester Land Trust sites. He provided a list of GWLT-run sites and directed us to a guide entitled "What's Left," which contains information on non-protected, undeveloped land in Worcester. He also told us what seasons and times GWLT-managed sites are open.

Colin gave us a tutorial in using ArcView, showing us how to use it and discussing compatibility issues between 3.2a (the version we had) and 8.2 (the version he and the city use). He provided a recent copy of the city's GIS data layers which contained some of the information our database lacked.

Colin explained that some sites may have multiple MBLs, which was contrary to our expectation, and that we needed to list all of the MBLs associated with a site. In addition, he told

us that lakes and other waterways will not correspond well with MBL numbers. Finally, he suggested that we design our product so that it can easily be exported to a standard GIS database that ArcView could load so that anyone at City Hall could make use of our database. This would reduce the chance of our project being forgotten or orphaned as time passes.

C.5 Michael O'Brien, Commissioner of Parks, Recreation, and Cemetery Dept. and Robert Antonelli, Deputy Commissioner of Parks, Recreation, and Cemetery Dept.

Our interview with the Commissioner of the Parks Department, Michael O'Brien, opened with him introducing his deputy Robert Antonelli, who served as our main contact with the Parks Department. Robert Antonelli gave us a list of sites run by the Department, which also included the activities offered and acreage of each site. Later, we went over the list and gained additional information such as which had restrooms and their hours of operation.

During this interview we also discussed our list of data points, which was found to be fairly comprehensive, and scheduled a second meeting to gather images of the sites from their records. In this second meeting we did that.

C.6   Alex Hanks, Worcester Telegram & Gazette Webmaster

In an attempt to find a permanent host for our website, we interviewed Alex Hanks. Alex explained that the *Worcester Telegram & Gazette* uses a third party software package to create their website. This package includes their hosting fee, but the size of the web space is not sufficient to host our project. It also lacks the PHP and mySQL functionality that is necessary to host our website.

C.7   Louise Grinrod, Massachusetts Audubon Society Technology Manager

In a second attempt to find a host for our website, we interviewed Louise Grinrod. She explained that the Massachusetts Audubon Society website was maintained by an IT company called "Iguana" from Cambridge, MA. Their website did support the features we needed (mySQL and PHP), but they did not have the budget to purchase additional web space for our project.

C.8   Josh Brandt, WPI UNIX Administrator

In another attempt to find a permanent host for our website, we interviewed Josh Brandt. He explained that WPI has enough web space available to host our site. The web servers at WPI also support PHP and have access to a dedicated mySQL server, mysql.wpi.edu. He helped us create a new UNIX account for the project called "atlas." This account has a "public_html" directory that is publicly accessible to the entire internet. The WPI web servers also support FTP, telnet, and SSH for updating purposes.

Appendix D   Website Documentation

D.1   Subsystem Decomposition
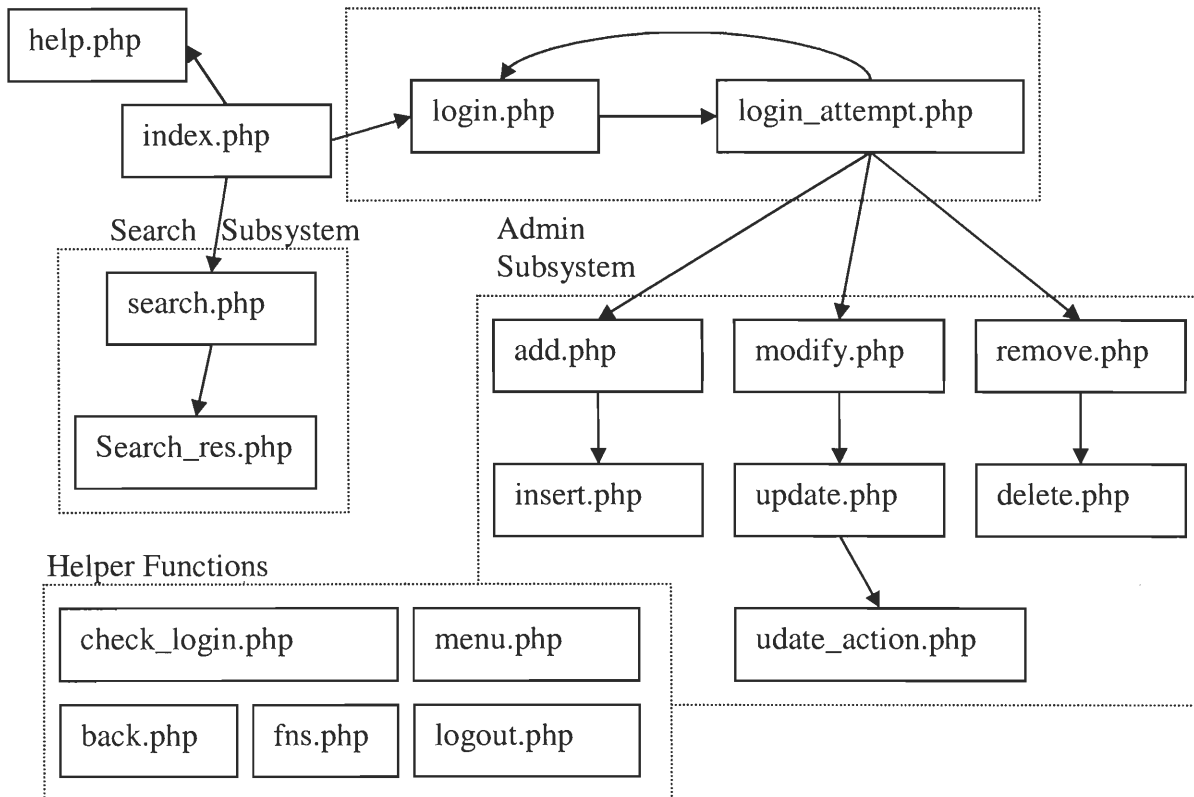
D.2 index.php
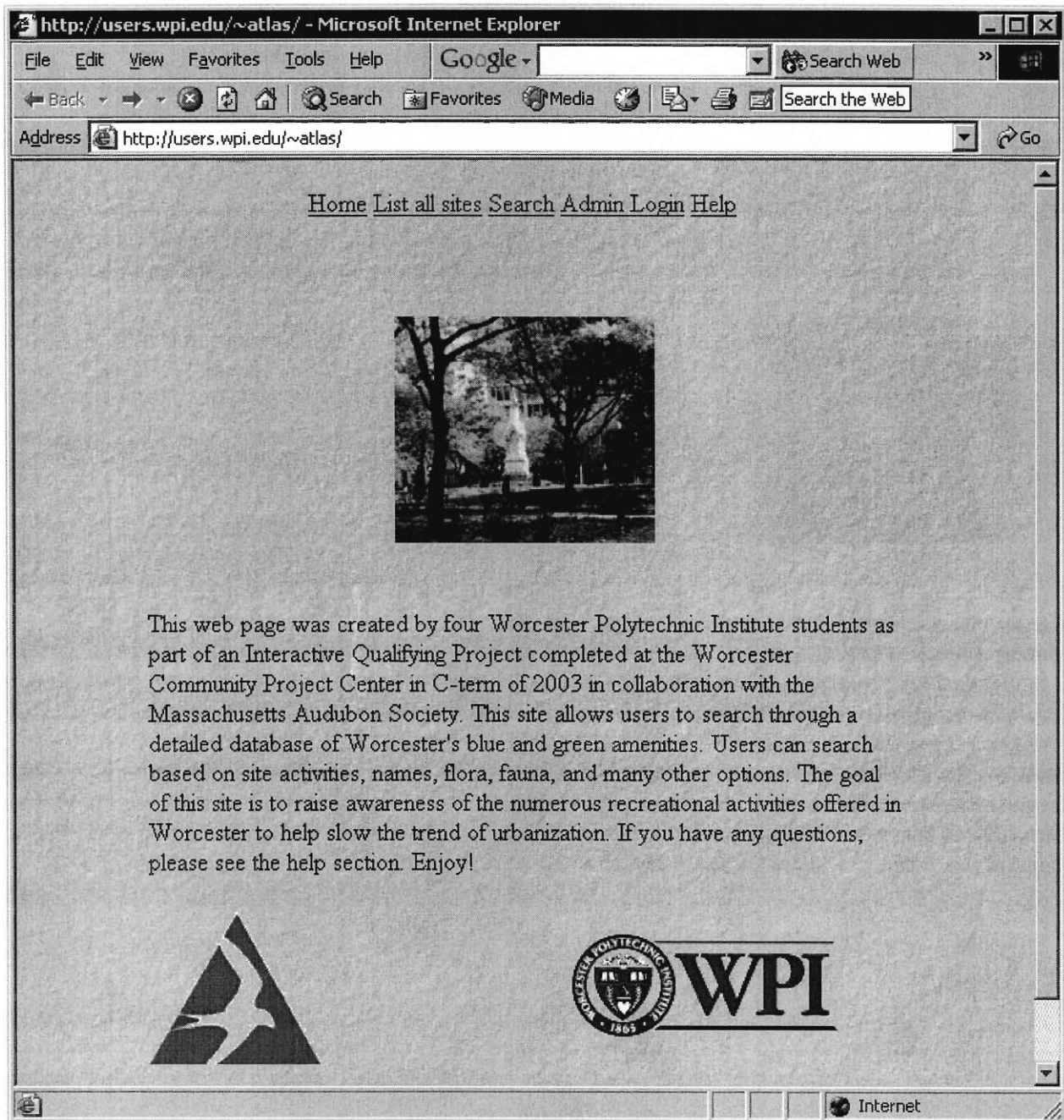
D.2.1 Source Code

```php
<?php
        session_start();
        include("fns.php");
?>
<html><body background="<?php include("back.php") ?>">
<?php include("menu.php") ?>
<table width="100%" height="100%" border="0">
<tr><td width="10%"><td>
```

```
<td align="center" valign="center" cellpadding=10">
<table width="100%" border="0">
<tr><td width="100%" colspan="3" align="center"><?php echo get_random_pic() ?></td></tr>
<tr>
<td colspan="2">
<br><br>
This web page was created by four Worcester Polytechnic Institute students as part of an
Interactive Qualifying Project
completed at the Worcester Community Project Center in C-term of 2003 in collaboration with the
Massachusetts Audubon
Society. This site allows users to search through a detailed database of Worcester's blue and
green amenities. Users can
search based on site activities, names, flora, fauna, and many other options. The goal of this
site is to raise
awareness of the numerous recreational activities offered in Worcester to help slow the trend of
urbanization. If you
have any questions, please see the help section. Enjoy!
<br><br>
</td> </tr> <tr>
<td align="left"><img src="img/mas_logo.gif" alt="Mass. Audubon Society"></td>
<td align="right"><img src="img/wpi_logo.png" alt="WPI"</td>
</tr>
</table>
<td width="10%"><td>
</td></tr></table>
</body>
</html>
```

D.2.2 Purpose

This page is the "Home Page" for the website. It displays the site's purpose and the logos of our sponsors. It also displays a random image from a folder of images used for this page.

D.3   search.php

D.3.1   Source Code

```php
<?php session_start() ?>
<html>
<head>

<?php // ensure that there's at least one search criteria provided ?>
<script language="javascript">
        function validForm(passForm) {
                x=0;
                for(i=0;i<passForm.elements.length;i++){
                        if(passForm.elements[i].value!=""){
                                x++;
                        }
                }
                if(x<=1){
                        alert("Please enter at least 1 search criteria");
                        return(false);
                }
        }
</script>
</head>

<body background="<?php include("back.php") ?>">
<?php
    include("menu.php");
    include("fns.php");
    $qs_include = $HTTP_SERVER_VARS['QUERY_STRING'];
    $var_arr = array();

//  break down the query string into variables in an array
    $arr = split("&",$qs_include);
```

```php
    foreach ($arr as $value)
    {
        $arr_temp = split("=",$value);
        $var = decode($arr_temp[0]);
        $val = decode($arr_temp[1]);
        if($val && $var != "submit")
        {
            $var_arr[$var] = $val;
        }
    }
?>
<form name="query" method="get" action="search_res.php" onsubmit="return validForm(this)">
<h3>Search Sites</h3>
        <table border="0">
<?php
// check if this is an advanced search
        if(array_key_exists("Adv", $var_arr) && $var_arr["Adv"] == "Y")
        {
            $advanced = TRUE;
        } else
        {
            $advanced = FALSE;
        }
// connect to the search info database
        $db = mysql_connect("mysql.wpi.edu","mattmcd","jxzLnt")or die("ERROR:" . mysql_error());
        mysql_select_db("amenities",$db)or die("ERROR:" . mysql_error());
        $result = mysql_query("SELECT * FROM site_search")or die("ERROR:" . mysql_error());
// generate the search form from the database
        while($row = mysql_fetch_array($result, MYSQL_ASSOC))
        {
            if($advanced || $row["Advanced"] == 0)
            {
                $field_name = $row["Search_Name"];
                printf("<tr><td>%s</td>", $field_name);
                if($row["Search_Type"] != 2)
                {
                    printf("<td><input type=text name='%s'></td></tr>",$field_name);
                } else
                {
                    printf("<td>NOT IMPLEMENTED</td></tr>");
                }
            }
        }

?>
        </table>
        <input type="submit" name="submit" value="submit">
</form>

<?php
//  Display a link to toggle advanced search on and off
if($advanced){
    printf("<br> <br> <a href=\"?Adv=N\">Basic Search</a><br>");
} else{
    printf("<br> <br> <a href=\"?Adv=Y\">Advanced Search</a><br>");
} ?>
</body></html>
```

D.3.2 Purpose

This page allows the user to search the database for sites that meet user-specified criteria. A link on this page can toggle advanced search mode on and off, which offers more search fields than basic search. This page takes the criteria the user enters into the forms and passes them to search_res.php which produces the search results.

D.4   search_res.php
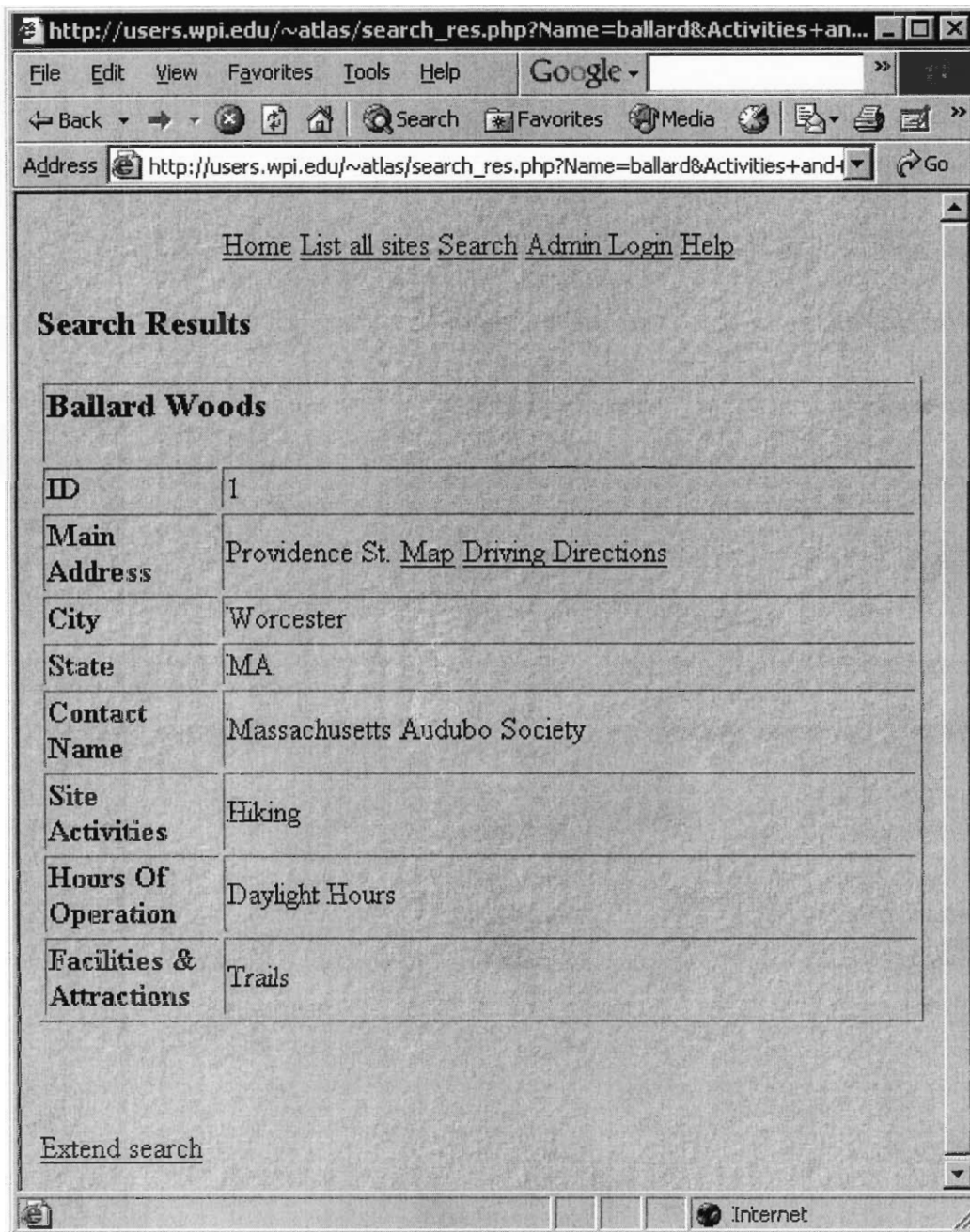
D.4.1 Source Code

```
<?php    session_start() ?>
<html><body background="<?php include("back.php") ?>">
<?php
    include("fns.php");
    include("menu.php");
```

```
    $qs_initial = $HTTP_SERVER_VARS['QUERY_STRING'];
    $search_vars = array();

// break the query string into an array of variables
    $arr = split("&",$qs_initial);
    foreach ($arr as $value)
    {
        $arr_temp = split("=",$value);
        $var = decode($arr_temp[0]);
        $val = decode($arr_temp[1]);
        if($val && $var != "submit")
        {
            $search_vars[$var] = $val;
        }
    }

// check if this is an extended search
    if(array_key_exists("Extend", $search_vars) && $search_vars["Extend"] == "Y")
    {
        $extend = TRUE;

    } else
    {
        $extend = FALSE;
    }

// connect to the search info database
    $db = mysql_connect("mysql.wpi.edu","mattmcd","jxzLnt")or die("ERROR:" . mysql_error());
    mysql_select_db("amenities",$db)or die("ERROR:" . mysql_error());
    $result = mysql_query("SELECT * FROM site_search")or die("ERROR:" . mysql_error());

/* Construct an SQL command string */
    $SQL = "SELECT * FROM sites WHERE ";
    $crit = 0;
    /* for each possible search variable, check if there's a criteria for
    it and update the string */
    while($row = mysql_fetch_array($result, MYSQL_ASSOC))
    {
        if(array_key_exists($row["Search_Name"], $search_vars))
        {
            $search_fields = split(",",$row["Search_Fields"]);
            $fields_count = count($search_fields);
            $search_crit = $search_vars[$row["Search_Name"]];
            $tok = strtok($search_crit," \n\t");
            while($tok)
            {
                if($crit > 0)
                {
// the extended search ORs rather than ANDs the search criteria
                    if($extend)
                    {
                        $SQL = $SQL . " OR ";
                    } else
                    {
                        $SQL = $SQL . " AND ";
                    }
                }
                if($fields_count > 1)
                {
                    $SQL = $SQL . " ( ";
                }
                for($i = 0; $i < $fields_count; $i++)
                {
                    if($i > 0)
                    {
                        $SQL = $SQL . " OR ";
                    }
                    if($row["Search_Type"] == 1)
                    {
                        $SQL = $SQL . $search_fields[$i] . " = '" . $tok . "' ";
                    } else
```

```
                     {
                          $SQL = $SQL . $search_fields[$i] . " LIKE '%" . $tok . "%'";
                     }
                 }
                 $tok = strtok(" \n\t");
                 $crit = $crit + 1;
                 if($fields_count > 1)
                 {
                     $SQL = $SQL . " ) ";
                 }
             }
         }
     }

//  Sort the results alphabetically
     $SQL .= "ORDER BY Primary_Name";
     if($crit == 0)
     {
         printf("No search criteria recieved.<br>");
     } else
     {
         if(array_key_exists("ALL", $search_vars) && $search_vars["ALL"] == "Y")
         {
             $result = mysql_query("SELECT * from sites") or die("ERROR:" . mysql_error());
         } else
         {
             $result = mysql_query($SQL)or die("ERROR:" . mysql_error());
         }
         $first_record = 1;
         $name = "Primary_Name";
         if($myrow = mysql_fetch_array($result))
         {
             echo "Results :<br><br>";
             $first_record=0;
             $num_of_fields = mysql_num_fields($result);
             do
             {

// Display the results
                 printf("<table border=1 width='100%s'><tr><td colspan=2 width='20%s'>","%","%");
                 printf("<h3>%s</h3></td></tr>",$myrow[$name]);
                 for($x=0;$x<$num_of_fields;$x++)
                 {
                     $field_name = mysql_field_name($result,$x);
                     if($myrow[$x] && $field_name != $name)
                     {
                       if(strpos($field_name,"Public_Access_Point")){
                             $map = get_map($myrow[$x],$myrow["Major_Public_Access_City"],
                                 $myrow["Major_Public_Access_State"]);
                             $dir =
get_directions($myrow[$x],$myrow["Major_Public_Access_City"],
                                 $myrow["Major_Public_Access_State"]);
                             printf("<tr><td
width='20%s'><b>%s</b></td>","%",get_alias($field_name));
                             printf("<td>%s %s %s</td></tr>\n",$myrow[$x],$map,$dir);
                       }
                       elseif($field_name=="Contact_E_Mail"){
                             printf("<tr><td
width='20%s'><b>%s</b></td>","%",get_alias($field_name));
                             printf("<td><a
href='mailto:%s'>%s</a></td></tr>\n",$myrow[$x],$myrow[$x]);
                       }
                       elseif($field_name=="Contact_Website"){
                             printf("<tr><td
width='20%s'><b>%s</b></td>","%",get_alias($field_name));
                             printf("<td><a
href='http://%s'>%s</a></td></tr>\n",$myrow[$x],$myrow[$x]);
                       }
                       else{
                             printf("<tr><td
width='20%s'><b>%s</b></td>","%",get_alias($field_name));
```

```
                        printf("<td>%s</td></tr>\n",$myrow[$x]);
                }
            }
        }
        $tmpDir = "img/" . $myrow["ID"];
        if ($dir = @opendir($tmpDir)) {
            printf("<tr><td width='20%s'><b>Images</b></td>\n<td>","%");
            while (($file = readdir($dir)) !== false) {
                if($file!="." && $file!=".."){
                    echo "<a href='$tmpDir/$file'>$file</a>  ";
                }
            }
            closedir($dir);
        }
         echo "</td></tr>\n";

         echo "</table><br>\n";
    } while ($myrow = mysql_fetch_array($result));
}
// If first record still = 1 then, there must not be any records!
    if($first_record)
    {
        echo "Sorry, but your search returned 0 results.<br>\n";
    }
    }

//  display an "extend results" link if this search wasn't extended
    if(!$extend && $crit > 0)
    {
        $new_vars = "?" . $HTTP_SERVER_VARS['QUERY_STRING'] . "&Extend=Y";
        printf("<br> <br> <a href=\"$new_vars\">Extend search</a><br>");
    }
?>
</body></html>
```

D.4.2 Purpose

This page displays the result of a search. By default, it searches the database for sites that meet all of the search criteria. A link at the bottom of the page can extend these search results by looking for sites that meet any of the criteria. The search results script is also used for the listing function, which calls a search that displays all records.

D.5   login.php
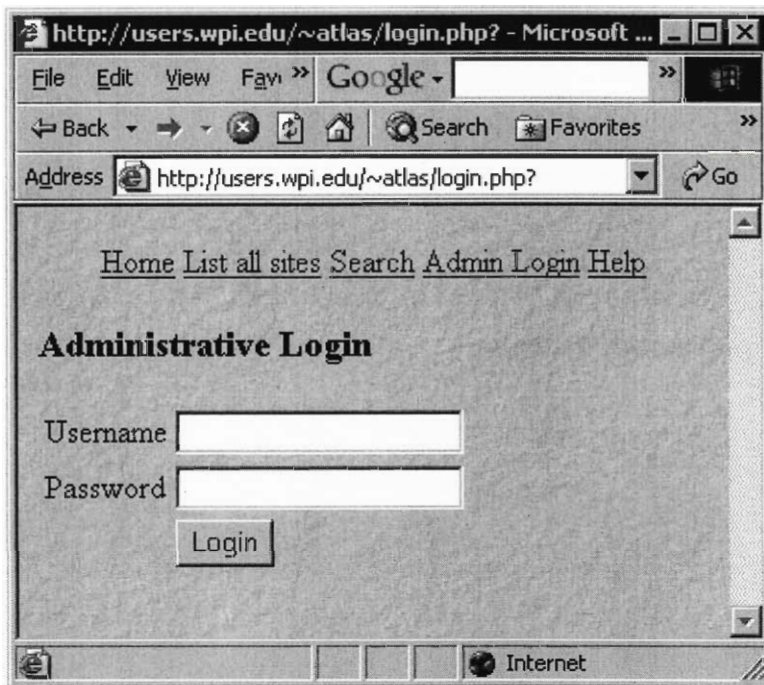
D.5.1 Source Code

```
<html><body background="<?php include("back.php") ?>">
<?php
        if(!$att){
                include("menu.php");
        }
?>
<form action="login_attempt.php" method="post">
        <input type=hidden name=url value=<?php echo "$url" ?>>
        <table border=0>
        <tr>
                <td>Username</td>
                <td><input type=text name=username maxlength=12 value=<?php echo "$username"; ?>
></td>
        </tr>
        <tr>
                <td>Password</td>
                <td><input type=password name=password maxlength=12></td>
        </tr>
        <tr>
                <td></td><td><input type=submit value=Login></td>
        </tr>
</form>
</body></html>
```

D.5.2 Purpose

This page allows users to attempt to log into the administrative portion of the website. They enter a username and password. When a user clicks the "Login" button, they are directed to "login_attempt.php" to verify the username/password combination.

D.6   login_attempt.php

D.6.1   Source Code

```php
<?php
        session_start();
        // Set flag variable to keep attemp.php from displaying menu.php
        $att = 1;

        // Connect to the Database and Get record corresponding to entered username
        $db = mysql_connect("mysql.wpi.edu","mattmcd","jxzLnt") or die("ERROR: " .
        mysql_error());
        mysql_select_db("amenities",$db) or die("ERROR: " . mysql_error());
        $SQL = "SELECT * FROM users WHERE username = '" . $username . "'";
        $result = mysql_query($SQL,$db) or die("ERROR: " . mysql_error());

        // If username is found, get the password
        if(mysql_num_rows($result)!=0){
                $pass = mysql_result($result,0,"password");

                // If correct password, re-direct to previous location
                if($pass==$password){
                        $_SESSION['logged'] = 1;
                        Header ("HTTP 302 Redirect");
                        Header ("Location: " . $url);
                        exit;
                }

                // If incorrect password, re-display menu and login page
                else{
                        include("menu.php");
                        echo "<br><b><font color=red>Invalid password,     please try
                        again</font></b><br>\n";
                        include("login.php");
```

```
                }
        }

        // If username is not found, show error message, display menu and login page
        else{
                $username="";
                include("menu.php");
                echo "<br><b><font color=red>Username not found, please try
                again</font></b><br>\n";
                include("login.php");
        }
?>
</body></html>
```

Purpose

This page validates users that attempt to log into the administrative portion of the website. If the user provides a valid username/password combination they will be re-directed to the home page with a new administrative menu system. If the username/password combination provided is invalid they will receive an appropriate error message.

D.7   add.php

D.7.1 Source Code

```php
<?php
        //Verify that user has admin priveledges
        include("check_login.php");
        include("fns.php");      // use helper functions
        include("menu.php");     // display menu
?>
<html>
<head>
<script language="javascript">
        function validForm(passForm) {
                x=0;
                for(i=0;i<passForm.elements.length;i++){
                        if(passForm.elements[i].value!=""){
                                x++;
                        }
                }
```

```
                    if(x<=1){
                            alert("Please enter at least 1 value");
                            return(false);
                    }
            }
    </script>
    </head>
    <body background="<?php include("back.php") ?>">
    <form name="query" method="get" action="insert.php" onsubmit="return validForm(this)">
    <h3>Add a new site</h3>
            <table border="0">
    <?php
            // Connect to Database
            $db = mysql_connect("mysql.wpi.edu","mattmcd","jxzLnt") or die("ERROR: " .
    mysql_error());
            mysql_select_db("amenities",$db) or die("ERROR: " . mysql_error());
            $result = mysql_query("SELECT * FROM sites") or die("ERROR: " . mysql_error());

            // Get # of fields
            $num_of_fields = mysql_num_fields($result) or die("ERROR: " . mysql_error());

            // Loop through fields
            for($x=1;$x<$num_of_fields;$x++){
                    $field_name = mysql_field_name($result,$x);
                    printf("<tr><td>%s</td>",get_alias($field_name));

                    // If it's a long field, show text area
                    if(mysql_field_type($result, $x)=="blob"){
                            printf("<td><textarea name=%s rows=5 cols=70></textarea>",$field_name);
                    }
                    // If not, show regular text box
                    else{
                            printf("<td><input type=text size=90 name=%s></td></tr>",$field_name);
                    }
            }
    ?>
            </table>
            <input type="submit" name="submit" value="submit">
    </form>
    </body></html>
```

D.7.2 Purpose

This page allows administrative users to add a new site into the database. They can enter the site characteristics into the respective fields and click on the "submit" button at the bottom to submit the record to the database.

D.8 insert.php
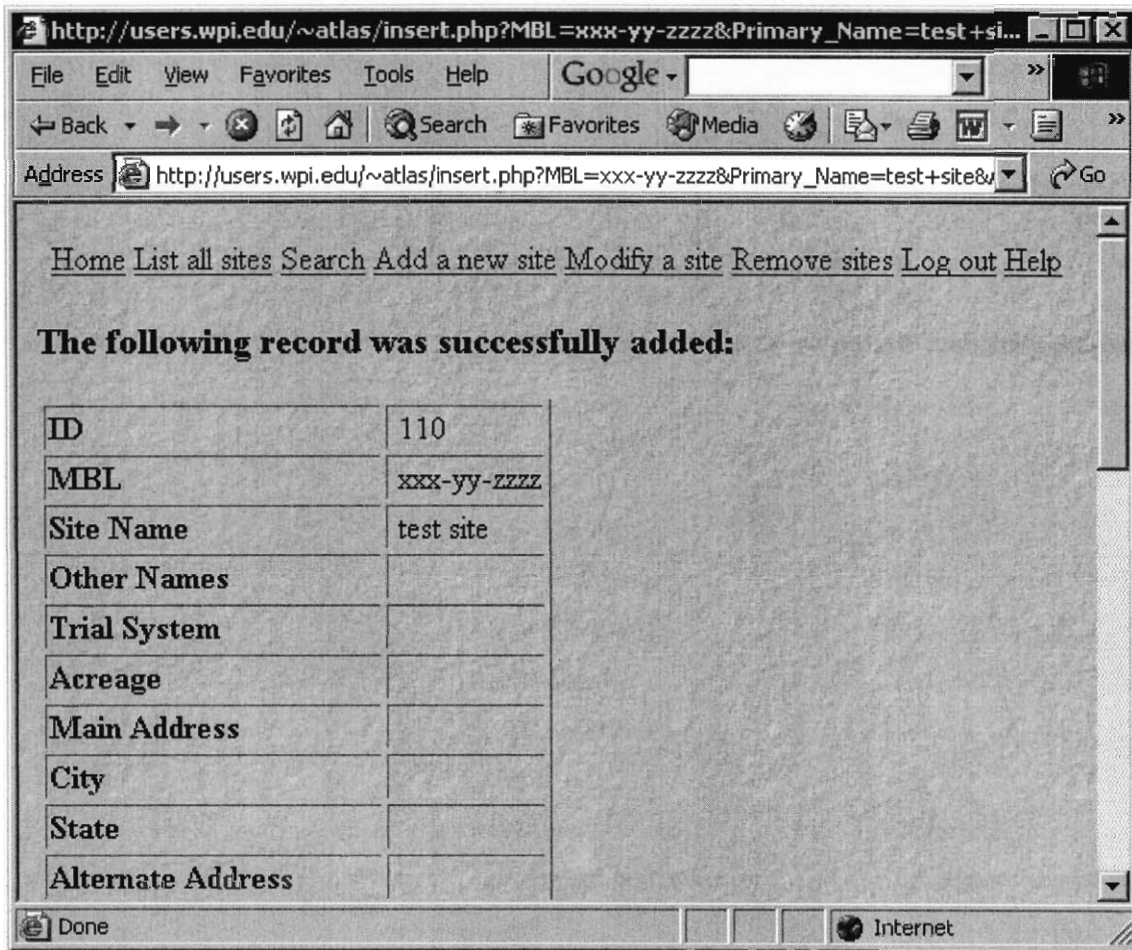
D.8.1 Source Code

```php
<?php
        //Check that user has admin. priveledges
        include("check_login.php")
?>
<html><body background="<?php include("back.php") ?>">
<?php
        // Get helper functions and display menu
        include("fns.php");
        include("menu.php");

        // Get next available ID
        // Find highest one...
        $ID = 0;
        $db = mysql_connect("mysql.wpi.edu","mattmcd","jxzLnt") or die("ERROR: " .
        mysql_error());
        mysql_select_db("amenities",$db) or die("ERROR: " . mysql_error());
        $result = mysql_query("SELECT ID FROM sites",$db) or die("ERROR: " . mysql_error());
        for($x=0;$x<mysql_num_rows($result);$x++){
                if(mysql_result($result,$x,"ID")>$ID){
                        $ID =mysql_result($result,$x,"ID");
                }
        }
        // And add 1 to it
        $ID++;
```

```php
        // Get Query String values
        $qs_initial = $HTTP_SERVER_VARS['QUERY_STRING'];
        $arr = split("&",$qs_initial);
        $x=0;
        $fields = "(ID, ";
        $vals = "(" . $ID . ", ";
        foreach ($arr as $value) {
                $arr_temp = split("=",$value);
                $var = $arr_temp[0];
                $val = decode($arr_temp[1]);
                $x++;
                if($val && $var != "submit"){
                        $fields = $fields . $var . ", ";
                        $vals   = $vals   . "'" . $val . "', ";
                }
        }
        $fields = substr($fields,0,strlen($fields)-2) . ")";
        $vals   = substr($vals,0,strlen($vals)-2)    . ")";

        // Create SQL INSERT statement and run it
        $SQL = "INSERT INTO sites " . $fields . " VALUES " . $vals;
        mysql_query($SQL,$db) or die("ERROR: " . mysql_error());
        echo "<h3>The following record was successfully added:</h3>\n";
        output_record($ID);
?>
</body></html>
```

D.8.2 Purpose

This page updates the database with the values entered from "add.php". It also displays the record using a helper function "output_record()" from "fns.php".

D.9　modify.php
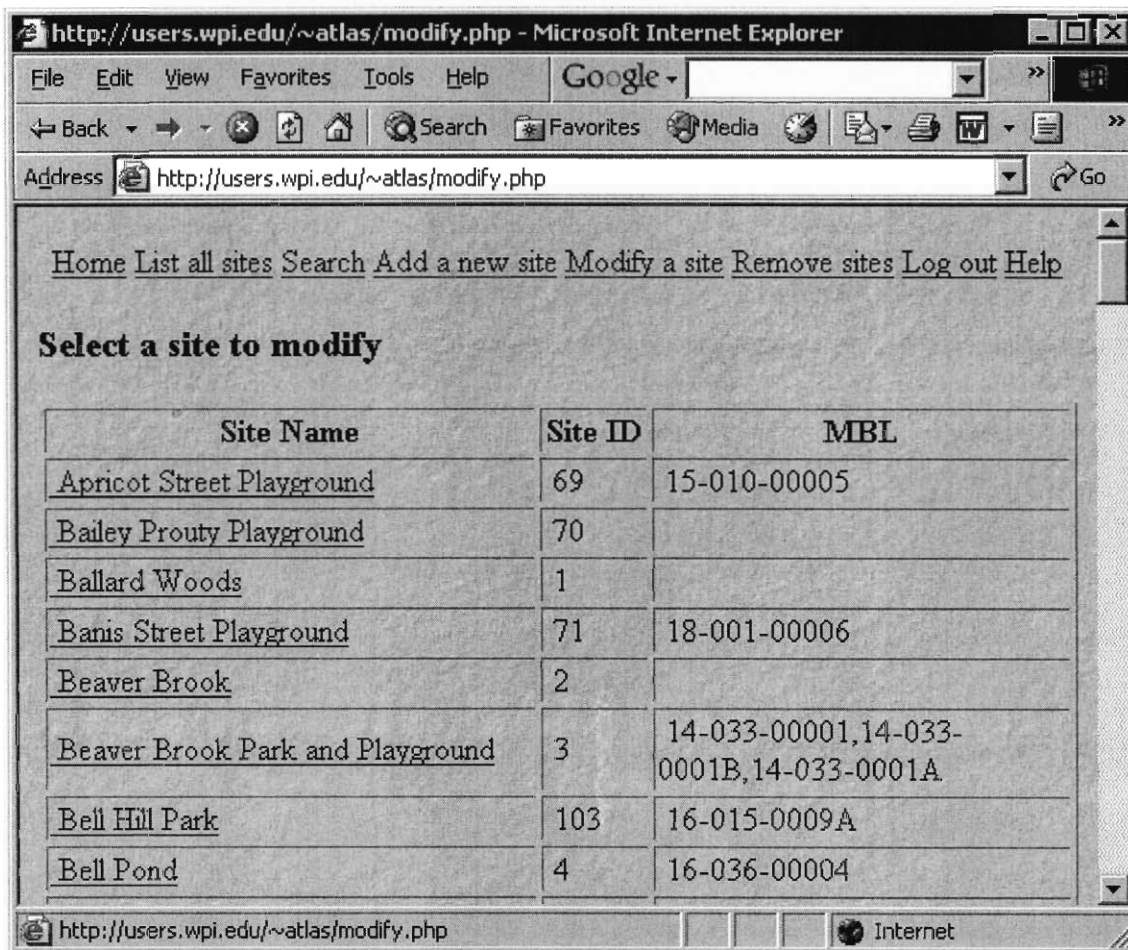
D.9.1　Source Code

```php
<?php include("check_login.php") ?>
<html>
<body background="<?php include("back.php") ?>">
<?php include("menu.php") ?>
<h3> Select a site to modify:</h3>
<table border="1">
<tr><th>Site Name</th><th>MBL</th><th>Site ID</th></tr>
<?php

// connect to DB and get ALL sites
$db = mysql_connect("mysql.wpi.edu","mattmcd","jxzLnt") or die("ERROR: " . mysql_error());
mysql_select_db("amenities",$db) or die("ERROR: " . mysql_error());
$result = mysql_query("SELECT * FROM sites ORDER BY Primary_Name") or die("ERROR: " .
mysql_error());
$num_of_rows = mysql_num_rows($result) or die("ERROR: " . mysql_error());

// show every site as a hyperlink to modify
for($i=0;$i<$num_of_rows;$i++) {
        printf("<tr><td><a href='update.php?ID=%s'>",mysql_result($result,$i,"ID"));
        printf(" %s</a></td>\n",mysql_result($result,$i,"Primary_Name"));
        printf("<td> %s</td>\n",mysql_result($result,$i,"MBL"));
        printf("<td> %s</td></tr>\n",mysql_result($result,$i,"ID"));
}
?>
```

```
</table>
<body>
</html>
```

D.9.2 Purpose

This page allows administrative users to select a site to modify.

D.10   update.php
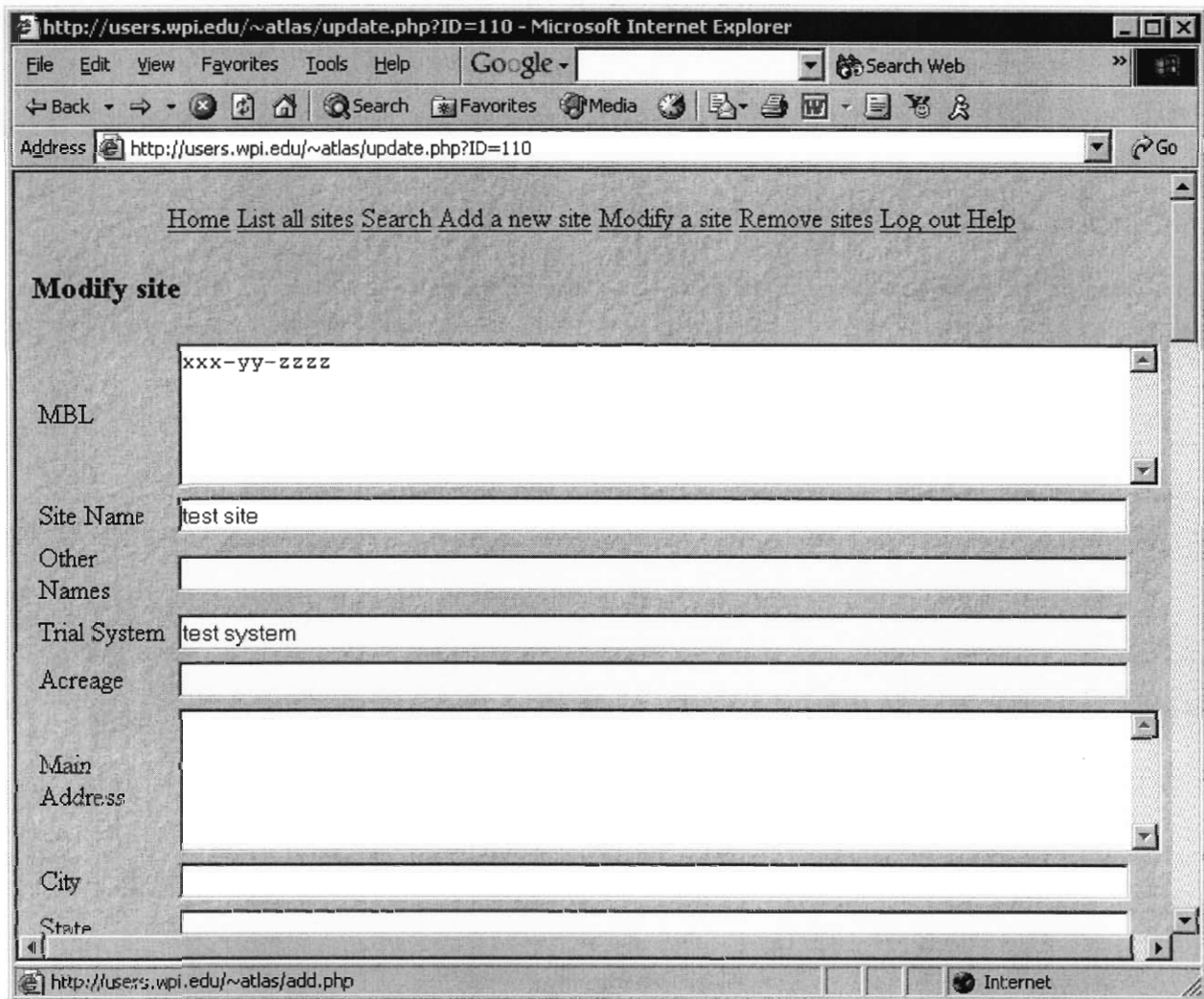
D.10.1 Source Code

```php
<?php
        // Make sure user has admin. priveledges
        include("check_login.php");
        include("fns.php");
?>
<html><body background="<?php include("back.php") ?>">
<?php include("menu.php") ?>
<form name="myForm" action="update_action.php">
<table border="0">
<input type="submit" value="Update Record">
<?php
        // Pass along ID
        echo "<input type=hidden name=ID value=$ID>\n";

        // Get Query String
        $qs_initial = $HTTP_SERVER_VARS['QUERY_STRING'];
        $arr = split("=",$qs_initial);
        $ID = $arr[1];

        // Get Data for record wishing to be modified
```
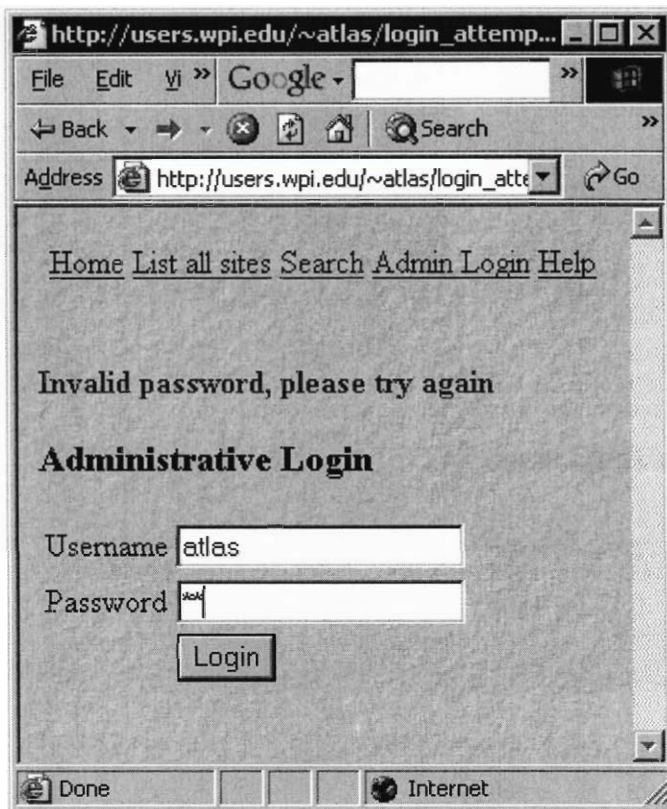
```
        $db = mysql_connect("mysql.wpi.edu","mattmcd","jxzLnt") or die("ERROR: " .
mysql_error());
        mysql_select_db("amenities",$db) or die("ERROR: " . mysql_error());
        $result = mysql_query("SELECT * FROM sites WHERE ID='".$ID."'") or die("ERROR: " .
mysql_error());
        $num_of_fields = mysql_num_fields($result) or die("ERROR: " . mysql_error());

        // Show current values for record to be modified
        for($x=1;$x<$num_of_fields;$x++){
                $field_name = mysql_field_name($result,$x);
                $value = htmlspecialchars(mysql_result($result,0,$field_name),ENT_QUOTES );
                printf("<tr><td>%s</td>",get_alias($field_name));
                if(mysql_field_type($result, $x)=="blob"){
                        printf("<td><textarea name=%s rows=5
cols=70>%s</textarea>",$field_name,$value);
                }
                else{
                        printf("<td><input type=text size=90 name=%s
value='%s'></td></tr>",$field_name,$value);
                }
        }
?>
</form>
</table>
</body></html>
```

D.10.2 Purpose

This page allows administrative users modify a site from the database. They can enter the site characteristics into the respective fields and click on the "submit" button at the bottom to submit the record to the database.

D.11 update_action.php
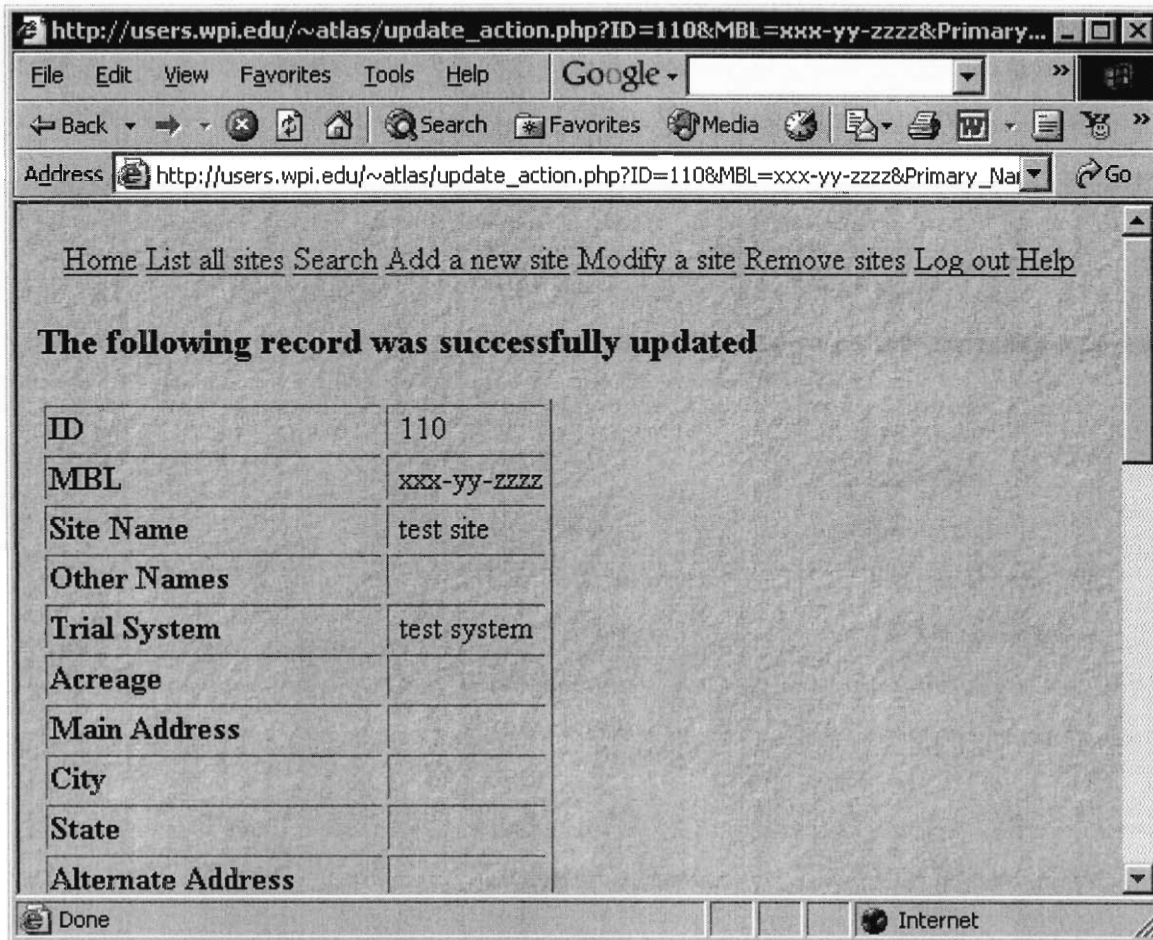
D.11.1 Source Code

```php
<?php include("check_login.php") ?>
<html><body background="<?php include("back.php") ?>">
<?php
        include("menu.php");
        include("fns.php");
        // Get ID
        $db = mysql_connect("mysql.wpi.edu","mattmcd","jxzLnt") or die("ERROR: " .
        mysql_error());
        mysql_select_db("amenities",$db) or die("ERROR: " . mysql_error());
        $result = mysql_query("SELECT ID FROM sites",$db) or die("ERROR: " . mysql_error());

        // Build SQL statement from Querystring values (passed form previous page)
        $SQL = "UPDATE sites SET ";
        $qs_initial = $HTTP_SERVER_VARS['QUERY_STRING'];
        $arr = split("&",$qs_initial);
        foreach ($arr as $value) {
                $arr_temp = split("=",$value);
                $var = $arr_temp[0];
                $val = decode($arr_temp[1]);
                if($val){
                        $SQL .= $var . " = '" . $val . "', ";
                }
        }
        $SQL = substr($SQL,0,strlen($SQL)-2);
        $SQL .= " WHERE ID = '" . $ID . "'";
```

```
        // Execute SQL INSERT statement
        mysql_query($SQL,$db) or die("<br>ERROR: " . mysql_error());
        echo "<h3>The following record was successfully updated</h3>\n";
        output_record($ID);
?>
</body></html>
```

D.11.2 Purpose

This page updates the database with the values entered from "modify.php". It also displays the record using a helper function "output_record()" from "fns.php".

D.12 remove.php
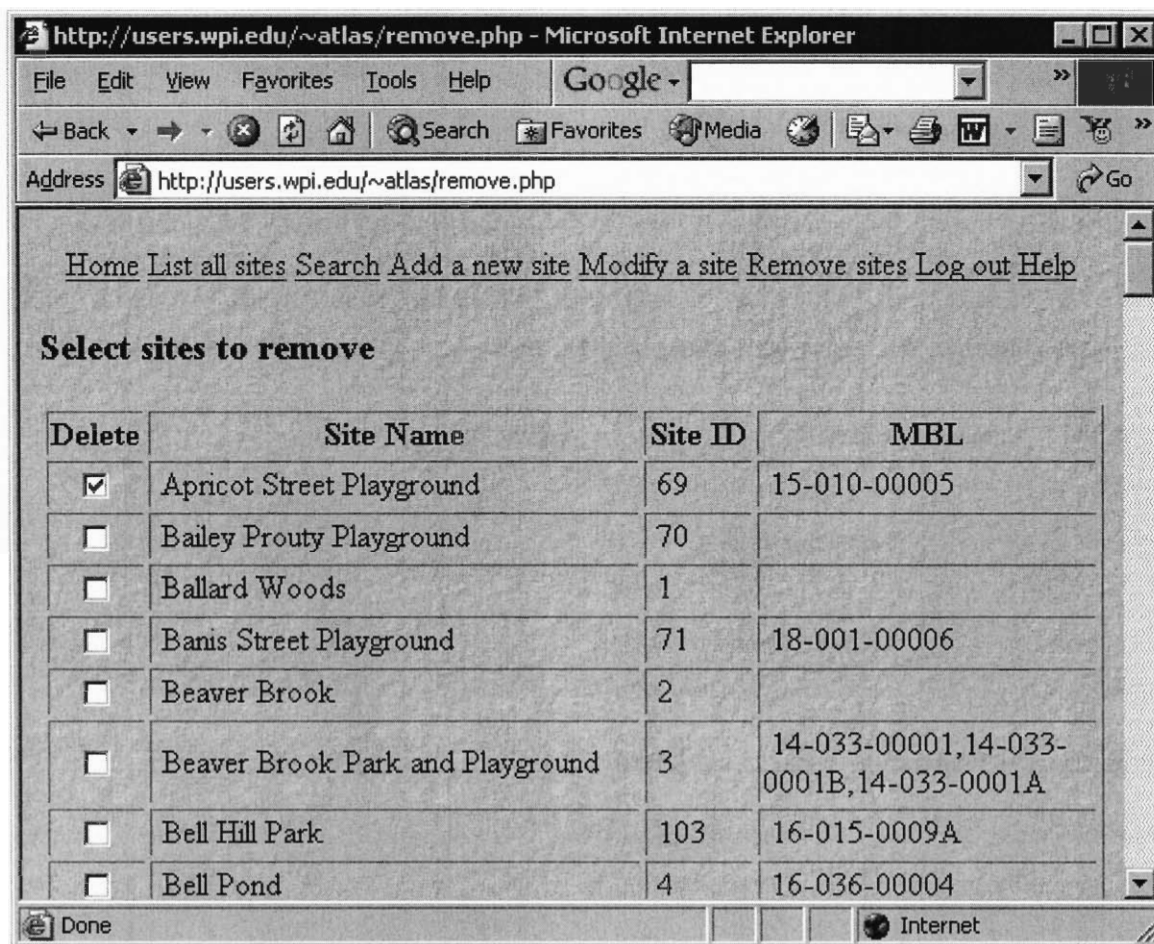
D.12.2 Source Code

```php
<?php include("check_login.php") ?>
<html>
<body background="<?php include("back.php") ?>">
<?php include("menu.php") ?>
<h3> Select sites to remove</h3>
<form name="myForm" action="delete.php">
<table border="1">
<tr><th>Delete</th><th>Site Name</th><th>MBL</th><th>ID</th>
<?php
// Connect to Database and display all existing records
// with checkboxes to check off records to delete
$db = mysql_connect("mysql.wpi.edu","mattmcd","jxzLnt") or die("ERROR: " . mysql_error());
mysql_select_db("amenities",$db) or die("ERROR: " . mysql_error());
$result = mysql_query("SELECT * FROM sites ORDER BY Primary_Name") or die("ERROR: " .
mysql_error());
$num_of_rows = mysql_num_rows($result) or die("ERROR: " . mysql_error());
for($i=0;$i<$num_of_rows;$i++) {
        printf("<tr><td><input type=checkbox name='%s'</td>\n",mysql_result($result,$i,"ID"));
        printf("<td> %s</td>\n",mysql_result($result,$i,"Primary_Name"));
        printf("<td> %s</td>\n",mysql_result($result,$i,"MBL"));
        printf("<td> %s</td></tr>\n",mysql_result($result,$i,"ID"));
}
?>
<input type=submit><br><br>
</table>
```

```
<body>
</html>
```

D.12.2 Purpose

This page allows administrative users to select one or more sites to remove from the database.

D.13   delete.php

D.13.1 Source Code

```php
<?php include("check_login.php") ?>
<html>
<body background="<?php include("back.php") ?>">
<?php
        include("menu.php");

        // Build SQL statement from Query String with ID's of
        // records to delete, and then delete them
        $SQL = "DELETE FROM sites WHERE ID = ";
        $qs_initial = $HTTP_SERVER_VARS['QUERY_STRING'];
        $arr = split("&",$qs_initial);
        for($x=0;$x<count($arr);$x++){
                $pair = split("=",$arr[$x]);
                $tmp_SQL = $SQL . $pair[0];
                $db = mysql_connect("mysql.wpi.edu","mattmcd","jxzLnt") or die("ERROR: " .
mysql_error());
                mysql_select_db("amenities",$db) or die("ERROR: " . mysql_error());
                mysql_query($tmp_SQL,$db) or die("ERROR: " . mysql_error());
        }
        echo "<h3>The record(s) were successfully removed</h3>\n";
?>
</body>
</html>
```

D.13.2 Purpose

This removes the records from the database specified from "remove.php".

D.14   back.php

D.14.1 Source Code

```php
<?php
        // This just returns the background img
        // used for all pages.
        echo "img/sand_grn.jpg";
?>
```

D.14.2 Purpose

This page returns the location of the image file for the background of each page. By putting it in one place, we only need to change it once to have it change the entire site.

D.15 menu.php

D.15.1 Source Code

```
table width="100%">
<tr><td width="100%" align="center">
<a href="search_res.php?Name=x&ALL=Y&Extend=Y&submit=submit">List all sites</a>
<a href="search.php">Search</a>
<?php

        // if users is logged in (admin) show admin options
        if($_SESSION['logged']){
                echo "<a href='add.php'>Add a new site</a>\n";
                echo "<a href='modify.php'>Modify a site</a>\n";
                echo "<a href='remove.php'>Remove a site</a>\n";
        }

        // otherwise, display login URL
        else {
                echo "<a href='login.php?'>Admin Login</a>\n";
        }
?>
</td></tr></table>
<br>
```

D.15.2 Purpose

This page displays the navigational menu. It shows administrative options if the user is logged in. We keep the menu in one file, rather than on each page for consistency.

D.16   check_login.php

D.16.1 Source Code

```php
<?php
        session_start();
        // If user is not logged in, re-direct out,
        // effectively disabling access to pages with
        // this page included
        if($_SESSION['logged']!= 1){
                Header ("HTTP 302 Redirect");
                $urlArr = split("/",getenv("REQUEST_URI"));
                $url = $urlArr[2];
                Header ("Location: login.php?url=".$url);
                exit;
        }
?>
```

D.16.2 Purpose

This script checks if the user has logged into the administrative system. If they have not, it re-directs them to the login page. This is meant to be included at the beginning every administrative page to keep regular users from modifying the database.

D.17   logout.php

D.17.1 Source Code

```php
<?php
        session_start();
        $_SESSION['logged'] = 0;
        Header ("HTTP 302 Redirect");
        Header ("Location: " . $url);
?>
```

D.17.2 Purpose

This script logs administrative users out of the database by changing the login session variable.

D.18   help.php

```
http://users.wpi.edu/~atlas/help.php - Microsoft Internet Explorer    _ □ ×
 File   Edit   View   Favorites   Tools   Help    Google ▾ [            ] ▾ 🔍Search Web   »
 ← Back  ▾  →  ▾  ⊗  🔄  🏠   🔍Search  📑Favorites  🎞Media  🕹  🔖▾ 🖨 🖃 📄 🎟 👤
 Address  🔗 http://users.wpi.edu/~atlas/help.php                    ▾  🔗Go
```

Home List all sites Search Admin Login Help

Online Help

List all sites
Click on list all sites, in the menu above, to receive all of the site data from this webpage listed alphabetically.

Search
Click on search, in the menu above, to receive a form to search for sites. By clicking on the Advanced Search link at the bottom of the search form, you can receive more criteria. Fill out the forms, and click "Submit" to receive a list of sites that meet all of your criteria.

If you do not find enough sites that meet your citeria, click on the "Extend Search" link to receive a list of all the sites that meet any of your criteria, instead of all of them.

Login
If you are not logged in as an administrator, you can use the login menu option to receive administrative access if you have an account and password. Fill in the form provided and click the Login button to submit you username and password.

```
🔗                                              🌐 Internet
```

D.18.1 Source Code

```php
<?php
        session_start();
        include("fns.php");
?>
<html><body background="<?php include("back.php") ?>">
<?php include("menu.php") ?>
<h3>Online Help</h3>

<br><br>
<b>List all sites</b><br>
Click on list all sites, in the menu above, to receive all of the site
data from this webpage listed alphabetically.
<br><br>

<br><br>
<b>Search</b><br>
Click on search, in the menu above, to receive a form to search for sites.
By clicking on the Advanced Search link at the bottom of the search form,
you can receive more criteria.  Fill out the forms, and click "Submit" to
receive a list of sites that meet all of your criteria.
<br><br>
If you do not find enough sites that meet your criteria, click on the
"Extend Search" link to receive a list of all the sites that meet any of
your criteria, instead of all of them.
<br><br>

<br><br>
<b>Login</b><br>
  If you are not logged in as an administrator, you can use the login menu
option to receive administrative access if you have an account and
password. Fill in the form provided and click the Login button to submit
you username and password.
<br><br>

<br><br>
<h4><u>Administrative Functions</u></h4>
All of the functions listed below will show on the menu only if you are
logged in as an administrator.  See "Login" above for instructions on how
to login.

<br><br>
<b>Add a new site</b><br>
   To add a new site, click on the add a new site link, fill out the form
provided, and click submit.  This will add your site to the database.
<br><br>

<br><br>
<b>Modify a site</b><br>
   To add an existing site, click on the modify a site link, fill out
the
form provided, and click the link for the site you wish to modify.  Change
the forms provided as needed, and click Update Record to update the site
info.
<br><br>

<br><br>
<b>Remove Sites</b><br>
   To remove sites, click on the remove sites link.  Click on the check
box of each site you wish to remove, then click the Remove button to
delete those sites.
<br><br>

<br><br>
<b>Logout</b><br>
   The Logout link will log you our as an administrator.  Alternately,
closing the browser will also work.
<br><br>
```

```
</body>
</html>
```

D.18.2 Purpose

Help.php serves to document all of the functions of our website. It explains the purpose and use of each feature of the site.

D.19   fns.php

D.19.1 Source Code

```php
<?php
function decode ($arg_1) {
        // Convert HTML special characters to what they should be
        $val = $arg_1;
        $val = preg_replace("/\+/"," ",$val);
        preg_match_all("/%(..)/e",$val,$arr_mch);
        for($i=0;$i<count($arr_mch[0]);$i++){
                        $srch = $arr_mch[0][$i];
                        $repl = chr(hexdec(substr($arr_mch[0][$i],1,strlen($arr_mch[0][$i]))));
                        $val=str_replace($srch,$repl,$val);
        }
        $val = str_replace("'","\'",$val);
        $val = str_replace(")","\)",$val);
        $val = str_replace("(","\(",$val);
        $val = str_replace("%","\%",$val);
        return($val);
}

function get_map($adr,$city,$state){
        // Create MAPQUEST map URL for given address
        $url = "<a href='http://www.mapquest.com/maps/map.adp?country=US";
        $url.= "&address=" . $adr;
        $url.= "&city=" . $city;
        $url.= "&state=" . $state;
        $url.= "&homesubmit=Get+Map'>Map</a>";
        return($url);
}

function get_directions($adr,$city,$state){
        // Create MAPQUEST directions URL for given address
        $url = "<a href='http://www.mapquest.com/directions/main.adp?src=maps";
        $url.= "&2a=" . $adr;
        $url.= "&2c=" . $city;
        $url.= "&2s=" . $state;
        $url.= "&2y=US'>Driving Directions</a>";
        return($url);
}

function get_alias($str){
        // Lookup alias for given string
        $SQL = "SELECT * FROM alias WHERE name ='" . $str . "'";
        $db    =    mysql_connect("mysql.wpi.edu","mattmcd","jxzLnt")    or    die("ERROR:    "   .
        mysql_error());
        mysql_select_db("amenities",$db) or die("ERROR: " . mysql_error());
        $result = mysql_query($SQL,$db) or die("ERROR: " . mysql_error());

        // if there's an alias, use it!
        if(mysql_num_rows($result)){
                $row = mysql_fetch_array($result);
                $str = $row["alias"];
        }

        // replace "_" with " "
        $str = str_replace("_"," ",$str);
        return($str);
}
```

```
function output_record($ID){
        // simply out put a record in a table format
        $db    =    mysql_connect("mysql.wpi.edu","mattmcd","jxzLnt")    or    die("ERROR:    "    .
        mysql_error());
        mysql_select_db("amenities",$db) or die("ERROR: " . mysql_error());
        $SQL = "SELECT * FROM sites WHERE ID='".$ID."'";
        $result = mysql_query($SQL,$db) or die("ERROR: " . mysql_error());
        echo "<table border=1>\n";
        $num_of_fields = mysql_num_fields($result);
        while($row = mysql_fetch_array($result, MYSQL_ASSOC)){
                for($x=0;$x<$num_of_fields;$x++){
                        $field_name = mysql_field_name($result,$x);
                        $val = $row[$field_name];
                        echo "<tr><td><b>" . get_alias($field_name) . "</b></td>";
                        echo "<td> " . $val . "</td></tr>\n";
                }
        }
        echo "</table>\n";
}

function get_random_pic(){
        // find a random picture form the 'img/random' dir.
        $x=0;
        $tmpDir = "img/random";
        if ($dir = @opendir($tmpDir)) {
                while (($file = readdir($dir)) !== false) {
                        if($file!="." && $file!=".."){
                                $pics[$x] = $file;
                                $x++;
                        }
                }
                closedir($dir);
        }
        // return a URL to the Image
        $rand = rand(0,$x-1);
        $imgUrl = "<img src='" . $tmpDir . "/" . $pics[$rand]. "' alt='" . $pics[$rand] . "'>";
        return($imgUrl);
}
?>
```

D.19.2 Purpose

This script is a global group of helper functions. HTML converts special characters when passing them over forms (i.e. '&' = '%amp%'). The decode function decodes them back to their original characters. The get_map and get_directions functions will return a URL for mapquest maps and directions to the address specified in the arguments. The get_alias function queries a database table of aliases for fields names. This way the field names are transparent to the user (i.e. Instead of seeing "Primary_Name" they see "Site Name". The output_record function displays a record in table form. The get_random_pic function returns the url of a random image selected from a directory of images.

Appendix E   Web Migration Instructions

The atlas website can be migrated to another web server by carefully following these steps:

1.) Ensure that the destination web server has PHP 4 or greater installed or install it.

2.) Ensure that the destination web server has mySQL 3.23 or greater is installed or install it.

3.) Create a mySQL database called "amenities" on the destination server.

4.) FTP to the server the site is hosted on. (If the site has not been previously migrated, it will be on ccc.wpi.edu and you may need to acquire the password for the account "atlas" from WPI).

5.) Copy all files from "public_html" to a desired location on the destination web server, being careful to maintain the exact same directory structure.

6.) Verify that all files have permissions set such that they're "web-readable". You may need to type "chmod a+rx <foldername>" if you're running a UNIX-based system or right-click the folder in a Windows NT Environment and set properties of "read" for "all".

7.) Telnet or SSH to the server the site is hosted on. Type "mysqldump --opt -hmysql.wpi.edu -uatlas_user -pI3eKNp amenities > amenities.sql" to export the database to a file.

8.) Copy this ".sql" file to the destination server.

9.) Log into the destination web server and type "mysql –h<hn> –u<un> -p<pw> amenities < amenities.sql" where <hn> is the mySQL server, <un> is a valid username for the mySQL database on the destination server, and <pw> is a corresponding password. This will import the database.

Appendix F   GIS Layer Creation Instructions

The following steps describe how to create a GIS layer with ArcView GIS 3.2a that uses the amenities database for its source data.

1.)   Open the "amenities.mdb" file in Microsoft Access 2002(XP)

2.)   Right-click the "GIS" table and click "Export"

3.)   Save the file as "sites.dbf" and make sure "dBase 5(*.dbf)" is selected from the "Save as type".

4.)   Start ArcView GIS 3.2a with a new view.

5.)   Click on the view window and then click on the "add theme" button (next to the save button).

6.)   Select the parcels.shp file (you can get this from the city of Worcester. One office with this file is Neighborhood Services).

7.)   Click the parcels.shp in the left column of the view window and then click "Theme" and then "table".

8.)   Now, from the main window, click on the "Tables" icon. (you should see "Attributes of Parcels.shp"). Click "Add" and select the "sites.dbf" file you created in step 3.

9.)   Highlight the MBL fields from both tables ("Attributes of Parcels.shp" and "sites.dbf") and click on "Join" button from the toolbar (to the left of the "sigma"/ "sum" button)

10.)   Now the "Attributes of Parcels.shp" table should have all of the fields from the "sites.dbf" file included. Highlight the "ID" fields and click the "sort ascending" button from the toolbar.

11.)   Hold the shift key and highlight all records with a valid "ID" field.

12.)   Verify that the Parcels.shp is selected and click "Theme" then "Convert to Shapefile".

13.)   Save the file and you're done. The shapefile is your layer.

These instructions are for use with the Access database created during this project. The GIS layer was created from our database as it was at the end of our project. If the mySQL web database is modified, the Access database will be inconsistent with the mySQL web database. In this case, the mySQL database could be imported into the Access database using some third party software. If this is done, the user may need to modify the resulting field names because earlier formats, such as DBF, do not support long field names. Alternately, more recent versions of ArcView or ArcMap, such as 8.2, are capable of reading mySQL databases directly. Unfortunately, we were unable to obtain a copy of ArcGIS later then 3.2a, so we cannot provide any more specific instructions on how to do this. However, we have provided a script that will convert our mySQL database into a format that allows it to be merged with GIS layers (see Appendix H).

Appendix G   VB Database Conversion Script Documentation

As mentioned earlier, we needed to use a Microsoft Access database to interface with the Arc GIS software. We also needed to use a mySQL database to interface with the UNIX web system. In an effort to keep the two databases consistent and simplify some typical database tasks, a series of scripts were written. These scripts were written in Microsoft Visual BASIC 6.0. They use all of the standard libraries as well as the Microsoft ActiveX Data Objects 2.5 Library.


```
MS-Acess > mySQL Conversion                                          _ □ ×

[ Convert Access to mySQL ]  [ Make All City/State Worcester ]  [ Populate Activities ]  [ Create GIS Table ]  [ List all sites ]  [ List Data Points ]

INSERT INTO Activities ([Site ID],[Site Name]) VALUES ('1','Ballard Woods')

INSERT INTO Activities ([Site ID],[Site Name]) VALUES ('2','Beaver Brook')

INSERT INTO Activities ([Site ID],[Site Name],[Baseball],[Basketball],[Football],[Little League Baseball],[Roller Hockey],[Softball],[Swimming]) VALUES ('3','Be

INSERT INTO Activities ([Site ID],[Site Name]) VALUES ('4','Bell Pond')

INSERT INTO Activities ([Site ID],[Site Name]) VALUES ('5','Coal Mine Brook Park (Future)')

INSERT INTO Activities ([Site ID],[Site Name],[Hiking],[Picnicking],[Softball]) VALUES ('7','Boynton Park',true,true,true)

INSERT INTO Activities ([Site ID],[Site Name],[Birdwatching],[Hiking],[Snowshoeing]) VALUES ('8','Broad Meadow Brook Wildlife Sanctuary',true,true,true)

INSERT INTO Activities ([Site ID],[Site Name],[Hiking],[Nature Walking]) VALUES ('9','Cascades Park',true,true)

INSERT INTO Activities ([Site ID],[Site Name]) VALUES ('10','Cider Mill Pond')

INSERT INTO Activities ([Site ID],[Site Name]) VALUES ('11','Coes Pond')

INSERT INTO Activities ([Site ID],[Site Name],[Baseball],[Basketball],[Football],[Hiking],[Little League Baseball],[Softball],[Swimming],[Tennis]) VALUES ('13','

INSERT INTO Activities ([Site ID],[Site Name],[Cross-Country Skiing],[Cycling],[Nature Walking]) VALUES ('14','Crow Hill Conservation Area',true,true,true)

INSERT INTO Activities ([Site ID],[Site Name],[Canoeing],[Fishing],[Nature Walking],[Skating]) VALUES ('15','Curtis Pond',true,true,true,true)

INSERT INTO Activities ([Site ID],[Site Name]) VALUES ('16','Dawson Road Conservation Area')

INSERT INTO Activities ([Site ID],[Site Name]) VALUES ('17','East Side Trail')

INSERT INTO Activities ([Site ID],[Site Name],[Nature Walking]) VALUES ('18','EcoTarium',true)

INSERT INTO Activities ([Site ID],[Site Name],[Basketball],[Nature Walking],[Picnicking],[Roller Hockey],[Skating],[Tennis]) VALUES ('19','Elm Park',true,true

INSERT INTO Activities ([Site ID],[Site Name]) VALUES ('20','God\s Acre Conservation Area')

INSERT INTO Activities ([Site ID],[Site Name],[Baseball],[Golf],[Handball],[Little League Baseball],[Picnicking],[Skating],[Sledding],[Swimming],[Tennis],[Volle
```

G.1   Convert Access to mySQL

This script was written to copy the Access database data into the mySQL database. It requires that an ODBC file DSN be setup for the Access database and that a myODBC DSN be setup for the mySQL database. It also requires that the mySQL database and Access database both have tables named "sites" with the exact number of fields. The script performs a one to one conversion, so all the fields must also be in the same order. So, in simpler terms, the two databases must be built exactly the same. The script will copy values from each field in the Access database into the corresponding field in the mySQL database.

G.1.1 Source Code

```
Private Sub Command1_Click()
    Dim srcCon As New ADODB.Connection
    Dim srcRs As New ADODB.Recordset
    Dim targetCon As New ADODB.Connection
    Dim targetRs As New ADODB.Recordset
    Dim x, y As Integer
    Dim strSQL, strFields, strValues As String

    'Setup the connections
    srcCon.ConnectionString = "fileDSN=amenities.dsn"
    targetCon.ConnectionString  =  "driver={MySQL};   server=localhost;   uid=atlas;pwd=1234;
        database=amenities"
    srcCon.Open
    targetCon.Open
    targetCon.Execute ("DELETE FROM sites")
    targetRs.ActiveConnection = targetCon
    targetRs.CursorLocation = adUseClient
    targetRs.LockType = adLockReadOnly
    targetRs.CursorType = adOpenStatic
    targetRs.Open "Select * FROM sites"
    srcRs.ActiveConnection = srcCon
    srcRs.CursorLocation = adUseClient
    srcRs.LockType = adLockReadOnly
    srcRs.CursorType = adOpenStatic
    srcRs.Open "Select * FROM sites"

    'Loop through all records from Access DB
    For y = 0 To srcRs.RecordCount - 1
        strFields = ""
        strValues = ""
        'Loop through each field
        For x = 0 To srcRs.Fields.Count - 1
            'add the name and value of the record to a string
            strValues = strValues & "'" & fixQuote(srcRs.Fields(x).Value) & "'"
            strFields = strFields & targetRs.Fields(x).Name
            'If it's not the last fields, add a comma
            If x < srcRs.Fields.Count - 1 Then
                strFields = strFields & ", "
                strValues = strValues & ", "
            End If
        Next x

        'Create the SQL statement and execute it
        strSQL = "INSERT into SITES (" & strFields & ") VALUES (" & strValues & ");"
        Text1.Text = Text1.Text & strSQL & vbNewLine & vbNewLine & vbNewLine
        targetCon.Execute (strSQL)
        srcRs.MoveNext
    Next y

    'Cleanup
    Set srcRs = Nothing
    Set srcCon = Nothing
    Set targetRs = Nothing
    Set targetCon = Nothing
End Sub
```

G.2 Make All City/State Worcester
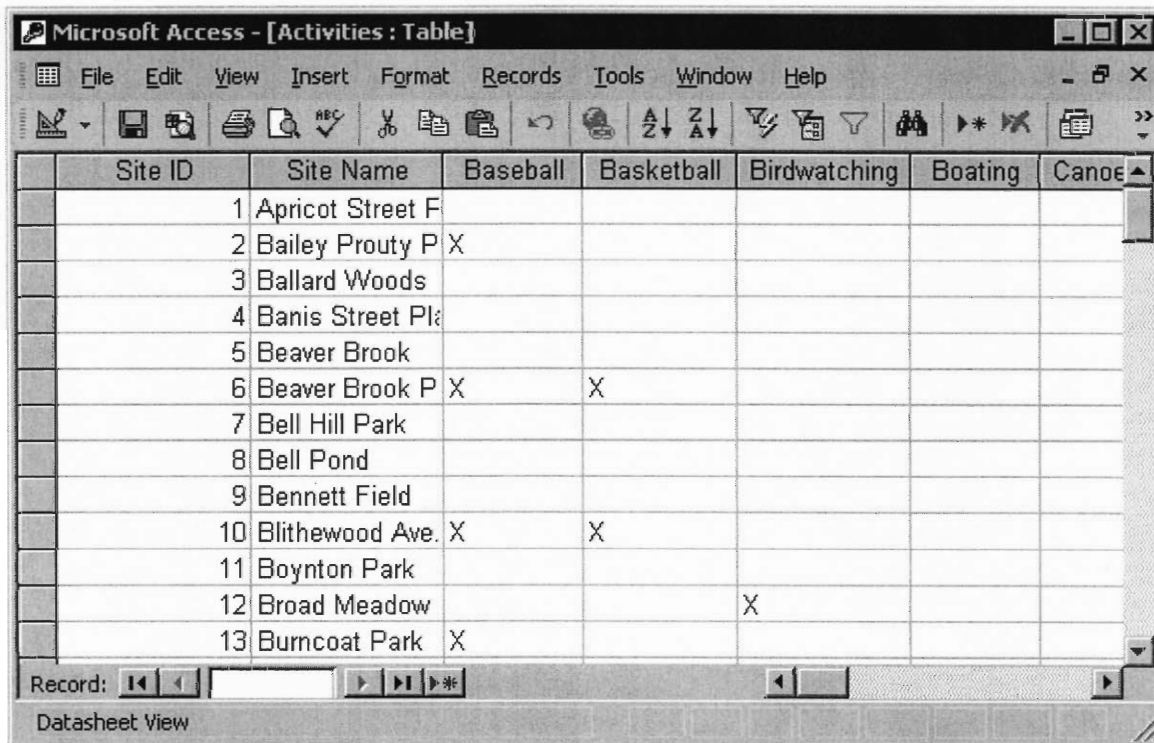
This script was written to populate all of the "City" and "State" fields with "Worcester" and "MA" because every site in our database is located in Worcester, MA. The MapQuest functions for the website read the city and state fields and a misspelling would produce undesired effects. This script saves the time of entering the data and also ensures that all City/State fields are consistent.

G.2.1 Source Code

```
Private Sub Command2_Click()
    Dim srcCon As New ADODB.Connection
    Dim srcRs As New ADODB.Recordset
    Dim x, y As Integer
    Dim strSQL, strFields, strValues As String

    'Setup the connection
    srcCon.ConnectionString = "fileDSN=amenities.dsn"
    srcCon.Open
    srcRs.ActiveConnection = srcCon
    srcRs.CursorLocation = adUseClient
    srcRs.LockType = adLockReadOnly
    srcRs.CursorType = adOpenStatic
    srcRs.Open "Select * FROM sites"

    'Loop through all site records from Access DB
    For y = 0 To srcRs.RecordCount - 1
        'Set each city and state value to Worcester
        strSQL = "UPDATE sites Set City = 'Worcester',State = 'MA' WHERE ID =" &srcRs("ID")& ";"
        Text1.Text = Text1.Text & strSQL & vbNewLine & vbNewLine & vbNewLine
        srcCon.Execute (strSQL)
        srcRs.MoveNext
    Next y

    'Cleanup
    Set srcRs = Nothing
    Set srcCon = Nothing
End Sub
```
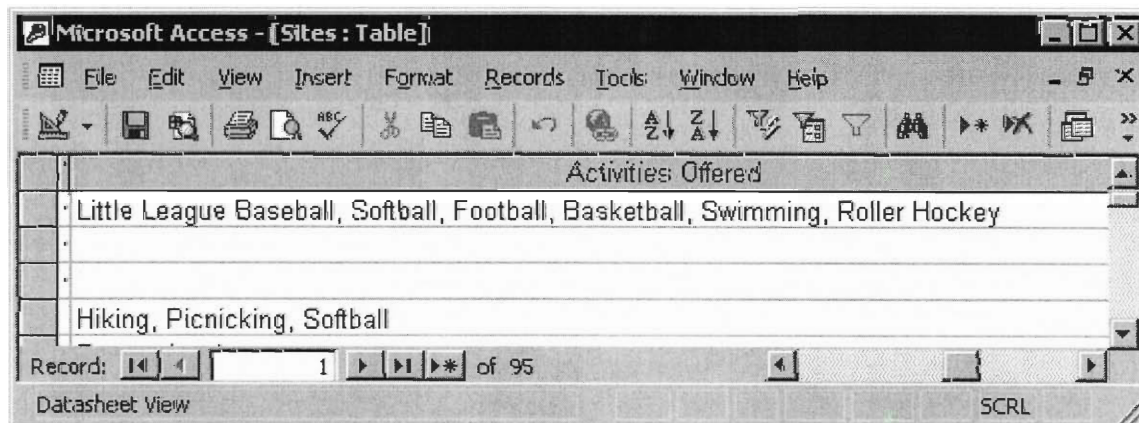
G.3   Populate Activities

A table called "Activities" was created in the Access database for our print-ready map. The table consists of a grid of sites and activities (shown below).

This script was written to automatically populate the cells in this table with "X" based on the data given in each sites "Activities Offered" field from the "sites" table.

G.3.1 Source Code

```
Private Sub Command3_Click()
    Dim Con As New ADODB.Connection
    Dim rs As New ADODB.Recordset
    Dim actRs As New ADODB.Recordset
    Dim x, y As Integer
    Dim strFields, strValues, strSQL As String
    Text1.Text = "" 'Clear output box

    'Set up Connections
    Con.ConnectionString = "fileDSN=amenities.dsn"
    Con.Open
    rs.ActiveConnection = Con
    rs.CursorLocation = adUseClient
    rs.LockType = adLockReadOnly
    rs.CursorType = adOpenStatic
    rs.Open "Select * FROM Sites"
    actRs.ActiveConnection = Con
    actRs.CursorLocation = adUseClient
    actRs.LockType = adLockReadOnly
    actRs.CursorType = adOpenStatic
    actRs.Open "Select * FROM Activities"
    'Clear out any old data for activities
    Con.Execute ("Delete * FROM Activities")

    'Loop through site records
    For x = 0 To rs.RecordCount - 1
        strFields = "[Site ID],[Site Name],"
        strValues = "'" & rs("ID") & "','" & KillQuotes(rs("Primary Name")) & "',"
        'Loop through fields in Activities DB
        For y = 0 To actRs.Fields.Count - 1
            'If the field name is in the activities field of the Sites table,
            'check it off!
            If srchStr(actRs.Fields(y).Name, rs("Activities Offered")) Then
                strFields = strFields & "[" & actRs.Fields(y).Name & "],"
                strValues = strValues & "'X',"
            End If
        Next y
        'remove the last comma
        strFields = Mid(strFields, 1, Len(strFields) - 1)
        strValues = Mid(strValues, 1, Len(strValues) - 1)
        strSQL = "INSERT INTO Activities (" & strFields & ") VALUES (" & strValues & ")"
        Con.Execute (strSQL)
        Text1.Text = Text1.Text & strSQL & vbNewLine & vbNewLine
        rs.MoveNext
    Next x
End Sub
```

G.4   Create GIS Table

We used the ArcView GIS 3.2a software package to create the GIS layer for this project. As mentioned in Appendix F, to create the layer the GIS table needs to be joined to the city's "parcels" layer table via the MBL field. However, the MBL field in the "sites" table handles sites with multiple MBLs by separating them with commas to maintain a simple one to one database relationship. When joining the sites table with the parcels table, sites with multiple MBLs do not match because the entire string of MBLs from the "sites" table is compared with one MBL from the city's "parcels" layer. To fix this problem, this script was written. It copies all the records from the "sites" table into a new "GIS" table. This "GIS" table is identical to the "sites" table except that it does not have a primary key. When sites with multiple MBLs are copied into the "GIS" table, a separate record is created for each MBL. The resulting "GIS" table may have multiple records for each site, breaking the one-to-one relationship of the "sites" table, hence the reason for eliminating the primary key "ID". This new "GIS" table matches perfectly to the city's "parcels" layer table, allowing us to create the GIS layer.

G.4.1 Source Code

```
Private Sub Command4_Click()
    Dim Con As New ADODB.Connection
    Dim rs As New ADODB.Recordset
    Dim actRs As New ADODB.Recordset
    Dim x, y, z, index As Integer
    Dim arrMBL() As String
    Dim strFields, strValues, strSQL As String
    'Clear output box
    Text1.Text = ""

    'Setup connection to Access DB
    Con.ConnectionString = "fileDSN=amenities.dsn"
    Con.Open
    rs.ActiveConnection = Con
    rs.CursorLocation = adUseClient
    rs.LockType = adLockReadOnly
    rs.CursorType = adOpenStatic
    rs.Open "Select * FROM Sites"
    'Kill any existing data in the GIS table (we'll update it with this fn)
    Con.Execute ("Delete * FROM GIS")

    'Loop through all records in Sites table
    For x = 0 To rs.RecordCount - 1
        'If there are multiple MBLs , do some stuff =)
        If srchStr(",", rs("MBL")) Then
            'Split the MBLs into an array of each one
            arrMBL = Split(rs("MBL"), ",")
            For y = 0 To UBound(arrMBL) 'Loop through each MBL
                'Create a new record for each MBL variation
                strSQL = "INSERT INTO GIS VALUES ("
                'Copy all fields' values (duplicate the record)
                For z = 0 To rs.Fields.Count - 1
                    'If it's the MBL, get the current MBL from the array, not RS!
                    If rs.Fields(z).Name = "MBL" Then
                        strSQL = strSQL & "'" & arrMBL(y) & "',"
                    Else
                        strSQL = strSQL & "'" & KillQuotes(rs(z).Value) & "',"
                    End If
                Next
                strSQL = Mid(strSQL, 1, Len(strSQL) - 1) & ")"
                Con.Execute (strSQL)
                Text1.Text = Text1.Text & strSQL & vbNewLine & vbNewLine
            Next y
        Else ' If not a multiple MBL, copy it to GIS table
            strSQL = "INSERT INTO GIS VALUES ("
            'Copy all fields' values (duplicate the record)
            For z = 0 To rs.Fields.Count - 1
                strSQL = strSQL & "'" & KillQuotes(rs(z).Value) & "',"
            Next
            strSQL = Mid(strSQL, 1, Len(strSQL) - 1) & ")"
            Con.Execute (strSQL)
            Text1.Text = Text1.Text & strSQL & vbNewLine & vbNewLine
        End If
        rs.MoveNext
    Next x
End Sub
```

G.5   List All Sites

This script lists all of the site names from the "sites" table.

G.5.1 Source Code

```
Private Sub Command5_Click()
    Dim Con As New ADODB.Connection
    Dim rs As New ADODB.Recordset
    Dim x As Integer
    'Setup connection to Access DB
    Con.ConnectionString = "fileDSN=amenities.dsn"
    Con.Open
    rs.ActiveConnection = Con
    rs.CursorLocation = adUseClient
    rs.LockType = adLockReadOnly
    rs.CursorType = adOpenStatic
    rs.Open "Select * FROM Sites ORDER BY [Primary Name]"
    'Clear output box
    Text1.Text = ""
    'Loop through all records and output the name
    For x = 0 To rs.RecordCount - 1
        Text1.Text = Text1.Text & rs("Primary Name") & vbNewLine
        rs.MoveNext
    Next x
End Sub
```

G.6   List Data Points

This script lists all of the field names (site characteristics / data points) from the "sites" table.

G.6.1 Source Code

```
Private Sub Command6_Click()
    Dim Con As New ADODB.Connection
    Dim rs As New ADODB.Recordset
    Dim x As Integer
    'Setup connection to Access DB
    Con.ConnectionString = "fileDSN=amenities.dsn"
    Con.Open
    rs.ActiveConnection = Con
    rs.CursorLocation = adUseClient
    rs.LockType = adLockReadOnly
    rs.CursorType = adOpenStatic
    rs.Open "Select * FROM Sites"
    'Clear output box
    Text1.Text = ""
    'Loop through all fields and output each one's name
    'THis lists all of the things we measure about each site
    For x = 0 To rs.Fields.Count - 1
        Text1.Text = Text1.Text & rs.Fields(x).Name & vbNewLine
        rs.MoveNext
    Next x
End Sub
```

G.7   Helper Functions

These functions are used by the main scripts. They were separated for the possibility that they could be re-used.

The fixQuote function converts single quotes to " \' " to be compatible with mySQL statements (the un-slashed single quotes will break mySQL database commands).

The srchStr function checks if one series of characters is found in a larger series and does not consider the difference between lower and upper-case characters. For example, srchStr("mA","matt") would return "true", but srchStr("mtt","matt") would return "false".

The KillQuotes function converts single quotes to slashes (' → /). The single quotes break Microsoft Access SQL statements and are converted to slashes.

G.7.1 Source Code

```
Function fixQuote(incoming)
    'This function converts ' -> \' becuase a ' will mess up
    'SQL statements
    Dim x As Integer
    Dim strFixed, strSrc As String
    'Check for NULL to avoid VB problems with comparing NULLs
    If IsNull(incoming) Then
        strSrc = ""
    Else
        strSrc = incoming
    End If
    strFixed = ""
    'Add characters on to string, if a ' then make it a \
    For x = 1 To Len(strSrc)
        If Mid(strSrc, x, 1) = "'" Then
            strFixed = strFixed & "\'"
        Else
            strFixed = strFixed & Mid(strSrc, x, 1)
        End If
    Next x
    fixQuote = strFixed 'return string
End Function
```

```
Function srchStr(Needle, HayStack) As Boolean
    'This function does a case-insensitive substring search
    'and returns true if needle is found in haystack, false if not
    Dim x, str1, str2
    'Check for NULLs
    If IsNull(Needle) Or IsNull(HayStack) Then
        srchStr = False
        Exit Function
    End If
    'Loop through each character of the haystack string
    For x = 1 To Len(HayStack) - Len(Needle) + 1
        'Get a string the size of the needle
        str1 = LCase(Mid(HayStack, x, Len(Needle)))
        str2 = LCase(Needle)
        'and then compare it to the needle to see if it matches
        If str1 = str2 Then
            srchStr = True
            Exit Function
        End If
    Next x
    srchStr = False
End Function


Function KillQuotes(strIn) As String
    'Replace a ' -> \
    'check for NULL 1st
    If IsNull(strIn) Then
        KillQuotes = ""
    Else
        KillQuotes = Replace(strIn, "'", "\")
    End If
End Function
```

Appendix H   UNIX mySQL PHP GIS Database Conversion Script Documentation

As mentioned in Appendix F, the latest version of ArcGIS supports importing mySQL tables. To ensure that our mySQL database will be consistent with the methods for importing the GIS table from the Access database, we have created a PHP script to populate a mySQL GIS table. The relationship between the sites table and the GIS table in the mySQL database is consistent with the Access database (see G.4). This script serves the same purpose as the VB Script described in section G.4, but it runs on UNIX with mySQL rather than on Windows with MS Access. The script file is stored on the web server with the rest of our PHP pages and can be run via the web at "www.wpi.edu/~atlas/populate_GIS_table.php."

H.1   Source Code

```
<html><body><table border="1" width="100%">
<?php
        $db = mysql_connect("mysql.wpi.edu","mattmcd","jxzLnt") or die("ERROR: " .
        mysql_error());
        mysql_select_db("amenities",$db) or die("ERROR: " . mysql_error());
        // Clear old data from GIS table
        $SQL = "DELETE FROM gis";
        echo "<tr><td>".$SQL."</td></tr>";
        $result = mysql_query($SQL,$db) or die("ERROR: " . mysql_error());
        // Get SIte records
        $SQL = "SELECT * FROM sites";
        echo "<tr><td>".$SQL."</td></tr>";
        $result = mysql_query($SQL,$db) or die("ERROR: " . mysql_error());
        $num_of_fields = mysql_num_fields($result);
        while($row = mysql_fetch_array($result, MYSQL_ASSOC)){
                if(strchr($row["MBL"],",")){
                        $arrMBL = split(",",$row["MBL"]);
                        for($y=0;$y<count($arrMBL);$y++){
                                $SQL = "INSERT INTO gis VALUES (";
                                $num_of_fields = mysql_num_fields($result);
                                for($x=0;$x<$num_of_fields;$x++){
                                        if(mysql_field_name($result,$x)=="MBL"){
                                                $SQL = $SQL . "'" .
                                                str_replace("'","\'",$row["MBL"]) . "',";
                                        }
                                        else {
                                                $field_name = mysql_field_name($result,$x);
                                                $val = str_replace("'","\'",$row[$field_name]);
                                                $SQL = $SQL . "'" . $val . "',";
                                        }
                                }
                                $SQL = substr($SQL,0,strlen($SQL)-1) . ")";
                                echo "<tr><td>".$SQL."</td></tr>";
                                mysql_query($SQL,$db) or die("ERROR: " . mysql_error());
                        }
                }
```

```
        else{
                $SQL = "INSERT INTO gis VALUES (";
                $num_of_fields = mysql_num_fields($result);
                for($x=0;$x<$num_of_fields;$x++){
                        $field_name = mysql_field_name($result,$x);
                        $val = str_replace("'","\'",$row[$field_name]);
                        $SQL = $SQL . "'" . $val . "',";
                }
                $SQL = substr($SQL,0,strlen($SQL)-1) . ")";
                echo "<tr><td>".$SQL."</td></tr>";
                mysql_query($SQL,$db) or die("ERROR: " . mysql_error());
        }
    }
?> </table></body></html>
```

Appendix I   Website Manual

Basic Functions

The Main Menu
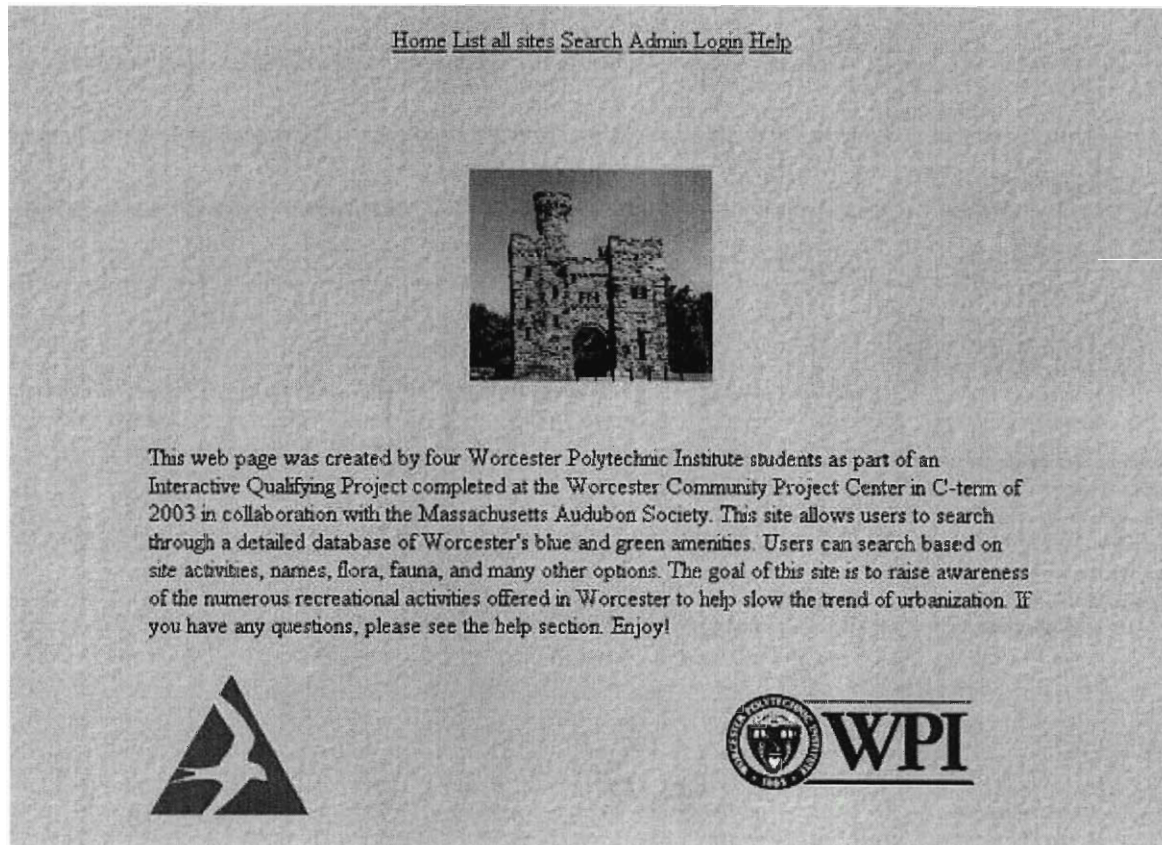
The Main Menu
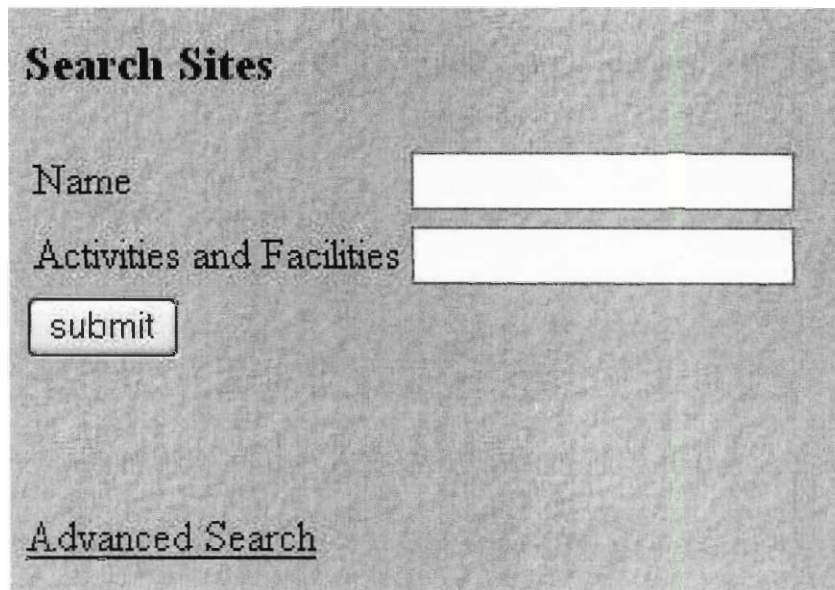
This is the main screen of the website. The menu atop this page appears atop every page and offers navigational links to access the various features of the site.

List/Search

From the menu, select "List all sites" or "Search" to access information about individual sites. "List all sites" will bring you to a page with all of the information stored in the site's database. "Search" will bring you to a page that looks like this:

The Search Menu

Fill in either the name of the site or the activities you are looking for and hit "submit" to search for sites that fit those criteria. If you wish to search for additional criteria, click on "Advanced Search" to get the advanced search menu.

Home List all sites Search Admin Login Help

Search Sites

Name
Activities and Facilities
Managed by
Access Address
ID Number
MBL
System
Classification
Trail Name
Contact Information
History
Flora
Fauna
Access Address

submit

The Advanced Search

After either search form is submitted, you will receive a page containing all of the sites that fit the criteria. The aforementioned "List all sites" function also brings you to a similar page. You can look over sites on this page, and click on any links provided to get additional information such as a map, driving directions, or images of the site.

Search Results	
Ballard Woods	
ID	1
Main Address	Providence St. Map Driving Directions
City	Worcester
State	MA
Contact Name	Massachusetts Audubo Society
Site Activities	Hiking
Hours Of Operation	Daylight Hours
Facilities & Attractions	Trails
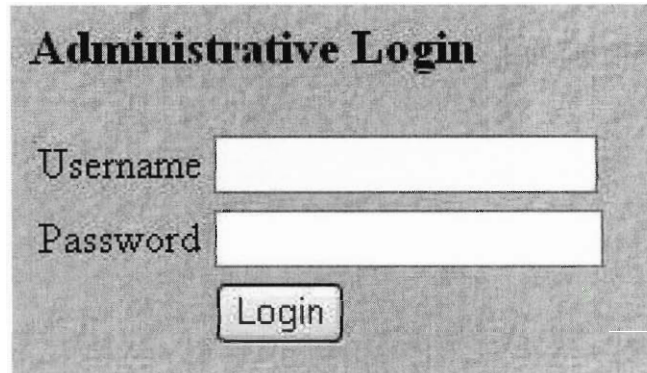
Extend search

The Search Results

If you specified multiple criteria and do not find the site you are looking for, you can click on "Extend search" from the results page. This will return sites that meet any of your criteria, instead of the default results which only show sites that meet all of your criteria.

Administrative Functions

To access the administrative functions, you must first login as an administrator; click on the "Admin login" link from the menu and enter your username and password.

The Administrative Login

Once logged in, additional options will be accessible from the menu, as shown below.

Home List all sites Search Add a new site Modify a site Remove sites Log out Help
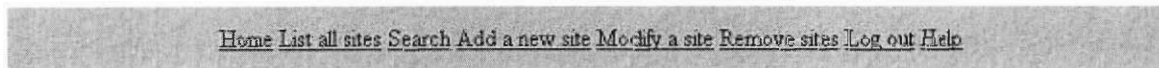
The Administrator's Menu

You will remain logged in as an administrator until you close the browser window or click on the "Log out" link in the menu.

Adding Sites

To add a site, you must be logged in as an administrator (see "Administrative Functions"). Select "Add a new site" from the menu. That will bring you to a form such as this one:

The Add a site page

Fill out the form provided with your site information, and then click on the "submit" button at the bottom of the form. Your site will be added to the database and will now show up on the page.

Modifying Sites

To modify site data, you must be logged in as an administrator (see "Administrative Functions"). Select "Modify a site" from the menu. This will bring you form such as this one:

Select a site to modify

Site Name	Site ID	MBL
Apricot Street Playground	69	15-010-00005
Bailey Prouty Playground	70	
Ballard Woods	1	
Banis Street Playground	71	18-001-00006
Beaver Brook	2	
Beaver Brook Park and Playground	3	14-033-00001,14-033-0001B,14-033-0001A
Bell Hill Park	103	16-015-0009A
Bell Pond	4	16-036-00004
Bennett Field	72	15-002-00001
Blithewood Ave. Playground	73	34-030-00034
Boynton Park	7	

The select site to modify menu

Locate the site you wish to alter the information for, and click on the link provided. That will bring you to the modify site form.

The Modify site form

Alter the information in this form as needed, and then click the submission button at the bottom to update the site's data.

Removing Sites

To remove sites from the database, you must be logged in as an administrator (see "Administrative Functions"). Select "Remove sites" from the menu. This will bring you form such as this one:

Select sites to remove

Delete	Site Name	Site ID	MBL
☐	Apricot Street Playground	69	15-010-00005
☐	Bailey Prouty Playground	70	
☐	Ballard Woods	1	
☐	Banis Street Playground	71	18-001-00006
☐	Beaver Brook	2	
☐	Beaver Brook Park and Playground	3	14-033-00001,14-033-0001B,14-033-0001A
☐	Bell Hill Park	103	16-015-0009A

The remove sites form

Click on the check boxes of all the sites you wish to remove from the database, and then click on the "remove" button at the bottom of the form. All of the checked-off sites will be deleted.

Advanced Administrative Functions

The functions listed below are not accessed through the website, but instead require access to the server the website is hosted on. Adding images will require knowledge of some UNIX file transfer protocol such as FTP or scp, and altering administrative accounts will require basic familiarity with mySQL.

Adding and Removing Images

To add images to a site, go to the "public_html/img" directory on the server. Locate a directory named after the ID of the site the image is for; if no such directory exists, make one. The site's ID can be found by performing a search for the site through the webpage if it is not known. Put the image inside of that folder. For example, assuming you have a site with an ID of 1, you would put images for that site in the folder "public_html/img/1".

To delete an image, locate the image's folder in the same way. For example, if a site has an ID of 1, the image will be within "public_html/img/1". Locate the image you wish to remove and delete the file. If there are no images in a site folder, the folder should be deleted.

Adding and Removing Administrative Accounts

Modification to the list of administrative users can only be done through the database. To do so, telnet or SSH to the machine that is currently hosting the database.

Specify the amenities database by typing "`USE amenities;`".

To add a new user, type "`INSERT INTO users VALUES ('<un>','<pwd>');`" where <un> is the username to add and <pwd> is the corresponding password.

To change a password type "`UPDATE users SET password = '<pwd>' WHERE username = '<un>';`" where <un> is the username to add and <pwd> is the corresponding password.

To remove a user account type "`DELETE FROM users WHERE username = '<un>';`"

Appendix J   Print-Ready Map and Table

ID	Site Name	Baseball	Basketball	Birdwatching	Boating	Canoeing	Cross-Country Skiing	Cycling	Fishing	Football	Golf	Handball	Hiking	Kayaking	Little League Baseball	Nature Walking	Picnicking	Roller Hockey	Sailing	Shuffleboard	Skating	Sledding	Snowshoeing	Soccer	Softball	Swimming	Tennis	Volleyball
1	Apricot Street Playground																X											
2	Bailey Prouty Playground	X													X													
3	Ballard Woods												X															
4	Banis Street Playground																											
5	Beaver Brook																											
6	Beaver Brook Park and Playground	X	X							X					X			X							X	X		
7	Bell Hill Park																				X					X		
8	Bell Pond																									X		
9	Bennett Field																								X			
10	Blithewood Ave. Playground	X	X												X													
11	Boynton Park												X			X	X								X			
12	Broad Meadow Brook Wildlife Sanctuary			X									X										X					
13	Burncoat Park	X													X						X							
14	Burncoat Street Playground		X																								X	
15	Carter Road Conservation Area																											
16	Cascades Parklands												X			X	X											
17	Cider Mill Pond																											
18	City Hall Common																											
19	Coal Mine Brook Park (Future)																											
20	Coes Pond																											
21	Coes Pond Beach																									X		X
22	Columbus Park																									X		
23	Cook's Pond																											
24	Cookson Field																											
25	Cristoforo Columbo Park	X	X							X			X		X										X	X	X	
26	Crompton Park	X	X							X															X	X	X	
27	Crow Hill Conservation Area						X	X								X												
28	Curtis Pond					X			X							X					X							
29	Dallas Touraine Conservation Area																											
30	Dawson Road Conservation Area																							X				
31	Dodge Park																X											
32	East Side Trail												X			X												
33	EcoTarium															X												
34	Elm Park		X													X	X	X			X						X	
35	Fairmont Park		X																	X								
36	Farber Field																							X				
37	God's Acre Conservation Area																											
38	Grant Square Playground		X																									
39	Great Brook Valley Playground																								X	X		
40	Green Hill Park	X									X	X	X				X				X	X			X		X	X
41	Green Hill Pond																											
42	Greenwood Park	X	X										X				X								X		X	X
43	Hadwen Park	X	X										X								X		X					
44	Harrington Field	X	X												X													
45	Harry Sherry Field	X	X									X			X											X		
46	Holland Rink Playground	X	X												X													

ID	Site Name	Baseball	Basketball	Birdwatching	Boating	Canoeing	Cross-Country Skiing	Cycling	Fishing	Football	Golf	Handball	Hiking	Kayaking	Little League Baseball	Nature Walking	Picnicking	Roller Hockey	Sailing	Shuffleboard	Skating	Sledding	Snowshoeing	Soccer	Softball	Swimming	Tennis	Volleyball
47	Holmes Field	X																X								X		
48	Indian Lake																											
49	Indian Lake Beach																									X		
50	Institute Park																										X	
51	Kendrick Field Playground	X	X												X										X	X		
52	Kettle Brook																											
53	Kettle Brook North Conservation Area						X	X								X	X											
54	Lake Park	X	X						X																X	X	X	
55	Lake Quinsigamond				X				X																	X		
56	Lakeview Playground																											
57	Laurel Street Playground																											
58	Lindburg/ Bovenzi Conservation Area																											
59	Logan Field	X	X										X			X									X			
60	Middle River																											
61	Middle River Park																											
62	Midstate Trail																											
63	Miscoe Estates Conservation Area																											
64	Morgan Landing																										X	
65	Mulcahy Field	X	X												X													
66	Newton Hill	X	X							X			X														X	
67	Nick's Woods																											
68	Oakland Heights Playground																											
69	Oread Castle Park		X									X															X	
70	Parson's Cider Mill Conservation Area				X			X								X	X									X		
71	Patch Pond																											
72	Patch Reservoir																											
73	Patches Pond Conservation Area																											
74	Perkins Farm			X									X															
75	Providence Street Playground																							X				
76	Quinsigamond State Park				X				X					X					X							X		
77	Ramshorn Island																											
78	Regatta Point State Park								X								X		X							X		
79	Rockwood Field	X													X									X	X			
80	Rosewood Estates Conservation Area																											
81	Salisbury Park																											
82	Salisbury Pond																											
83	Shale Street Playground																											
84	Sherer Trail Conservation Area																											
85	Shore Park																		X							X		
86	Tacoma Street Playground		X																							X		
87	Ty Cobb Field	X													X													
88	University Park		X																			X				X		
89	Vernon Hill Park	X	X												X										X		X	
90	West Side Trail System																											
91	Wetherell Park	X													X													