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Modeling least-impact ATV trails in Berlin, NH with established fine-grained evaluation criteria (RSA 215-A: 43)

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MODELING LEAST-IMPACT ATV TRAILS IN BERLIN, NH WITH ESTABLISHED FINE-GRAINED EVALUATION CRITERIA (RSA 215-A: 43).

BY

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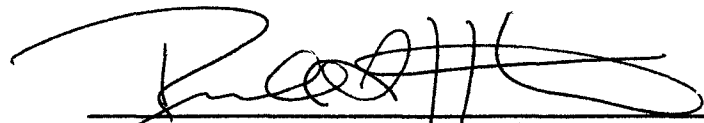

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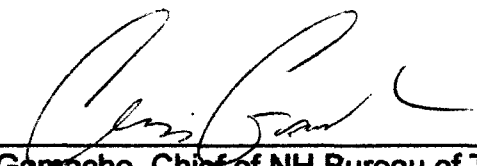

Chris Gamache, Chief of NH Bureau of Trails

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Date

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This thesis is dedicated to all my friends and family and especially Christina, who have supported me and all my endeavors through the years.

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ABSTRACT

MODELING LEAST-IMPACT ATV TRAILS IN BERLIN, NH WITH ESTABLISHED FINE-GRAINED EVALUATION CRITERIA (RSA 215-A: 43).

by

Shawn C. Herrick

University of New Hampshire, December, 2011

The evaluation of 7200 acres of land in Berlin, NH was conducted using the New Hampshire State Statues regarding fine-grained evaluation criteria for ATV trails (RSA 215-A: 43) to determine its viability as a multi-use trail park. A geographical information system (GIS) was used to facilitate the location of land, which is suited for trail construction. A comprehensive exploration of data led to the development of a geospatial database in which each criteria was given spatial value. Next, each of the 29 statutes regarding trail placement was analyzed and mapped to determine co-occurrence. Approximately, 1800 acres, or 25% of the total area of the proposed site is coincident with at least 1 statute prohibiting trail construction and of that, 20% is coincident with 2 or more statutes. The GIS proved to be a useful tool when interpreting laws involving spatial information in order to make responsible land use decisions.

CHAPTER I

INTRODUCTION

ATVs in New Hampshire

The first all-terrain vehicles (ATVs) in the United States were sold and manufactured in 1971 (Maine, 1989). By 1982 there were approximately 750,000 ATVs in use in the U.S. and by 1986 there were 2.5 million, most of which were used for recreational purposes (Maine, 1989).

Off-Highway Recreational Vehicle (**OHRV**) use including the use of All-Terrain Vehicles (**ATV**s) is one of the fastest-growing outdoor recreational activities in New Hampshire (NHOSP 2003). According to the Study Committee on ATVs and Trail-bikes (New Hampshire House of Representatives, 2001), in 1997 there were approximately 11,000 in-state and out-of-state registered ATV riders for New Hampshire. In 2003 there was a 100% increase or approximately 22,000 New Hampshire residents that owned OHRVs and approximately 4,500 out-of-state residents with OHRVs registered in New Hampshire (NHDRED 2003). According to estimates from the same aforementioned study committee, by 2008 the total number of in-state and out-of-state riders registered in NH will exceed 37,000; approximately a 40% increase in the number of registered riders in the state (NHDRED, 2003).

Currently, New Hampshire has 23 trail networks composed of over 776 miles of trails on which to accommodate existing OHRV enthusiasts.

Apprehension over the ability of the current trail network to accommodate the increase in ATVs is growing due to concerns that the current trail network seems to be unable to accommodate the current and future demand (NHDRED, 2003).

Concurrent with New Hampshire RSA 215, The NH Bureau of Trails was established within the Division of Parks and Recreation of the Department of Resource and Economic Development (DRED). The Bureau of Trails was charged with many responsibilities regarding OHRV's including but not limited to, administration of funds, land acquisition, and the planning, development and maintenance of the state trail system (NHRSA, 2007).

A Brief History of Berlin, NH and the Jericho Mountain State Park

In the 1820's Berlin's main industry transformed from agriculture to lumbering. The advancement of infrastructure and advent of saw mills continued to incite population growth into the 1900's. Despite labor union strikes and the depression the paper mill industry survived until May 2006 when the city's last paper mill closed. Berlin's population has also seen ups and downs with a sharp decline in population from 17,821 in 1960 to approximately 10,000 in 2005 (Census, 2006) and consequently a sharp decline in revenue has ensued. Berlin officials started to look at ways to bolster the local economy. Among other ideas, city officials looked at OHRV recreation, as an exciting opportunity for a much needed boost to the local economy.

In 2001, amidst growing interest for evaluating state lands for ATV use, the New Hampshire House of Representatives Subcommittee on ATVs and Trail-

bikes recommended that, "...DRED, through the Trails Bureau, within 90 days should select one site on public land which meets all environmental and other criteria for development of a new ATV trail system" (New Hampshire Division of Parks and Recreation, 2006). In 2002, HB1273 was passed requiring DRED to develop an ATV trails plan for the New Hampshire and in 2003 DRED completed the *Plan for Developing NH's Statewide Trail System for ATVs and Trail Bikes 2004-2008.* The two major recommendations were: 1) to consider new land acquisition, and 2) to consider developing an ATV park (New Hampshire Division of Parks and Recreation, 2006). This was a great opportunity for DRED officials to augment the state's OHRV trail system.

One of the first steps DRED took was to commission the development of a strategic plan which would evaluate the need for additional ORHV/ATV trails within the State, including current and future, supply and demand for trails. The task fell to Woodlot Alternatives of Topsham, ME. The results of the strategic plan affirmed the need to seek out new areas within the state to develop. Some of the main observations and recommendations are as follows (Horizon's, 2007):

1. In order to keep pace with the rise in OHRV sales and registrations, the State will need to develop nearly 350 miles of new trails over a five year period.

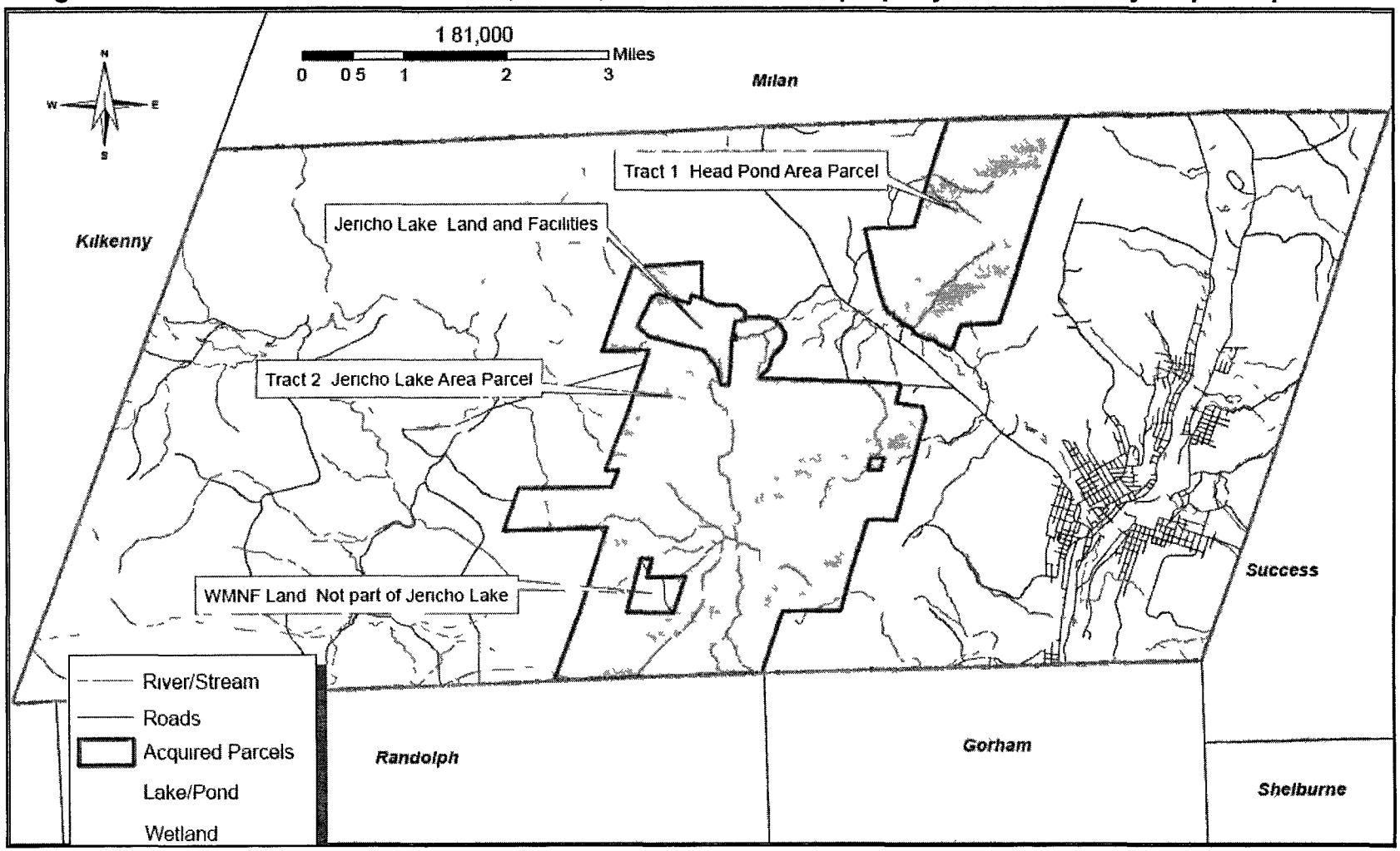
2. Given increased demand for OHRV trails and the sensitivity of private land owners to intensive use of their land, the report recommend that the State acquire, develop, and manage land for a comprehensive public riding area. The report recommended improved communication with private land owners as well as a high degree of rider education in order to optimize the opportunities for continued expansion of trails on private land.

3. The report recommended that once the State acquire the appropriate parcel(s) of land that a riding area master plan be undertaken to provide a comprehensive plan to develop a new public OHRV riding area.

In 2004, representatives from DRED and the City of Berlin, NH met to discuss the possibility of generating OHRV/ATV recreational opportunities in the Berlin area and foster their tourism industry. The park would encourage private investment and businesses, which in turn would provide more jobs and attract other business relocation to the area. These anticipated outcomes would help transition one of the influential industries of the area to tourism.

Subsequent to the meeting, several tracts of land were acquired by the State of New Hampshire they are as follows: First, Thomas R. Dillon and Scott A. Dillon, affiliates with T. R. Dillon Logging Inc. of Maine, approached Berlin officials and offered to sell two tracts of land (Figure 1) within the Township of Berlin totaling 7,200 acres to DRED on which to develop OHRV/ATV trails. The selling price for this land was $2,160,000 and was to be paid out over the next 5 years. During the 5 year payment period, the Dillon's would retain their right to harvest legal and marketable timber on the two tracts of land (NH Division of Parks and Recreation, 2005) and hold gravel rights in perpetuity. In addition, the Dillon's offered to gift to the state a 6.6 mile by 30ft wide recreational trail easement also within the Township of Berlin. This easement abutted the two tracts of land offered to the state.

Figure 1. Jericho Mountain State Park, Berlin, NH: Jericho Lake property and two newly acquired parcels.



Second, excited at the prospect of a state-managed recreational trails site and camping area within the City of Berlin, the City agreed to gift to the State, the land and facilities close to Jericho Lake. This included 293 acres of land around Jericho Lake as well as another 10 acre parcel of land in proximity to Jericho Lake.

After gaining approval from the State of New Hampshire's Governor and Council to acquire the land, DRED now had over 7,500 acres of undeveloped land and was eager to coordinate the development of an OHRV/ATV park to serve as the gateway to outdoor recreation in New Hampshire's North Country. One additional step that the City of Berlin took was to designate the Route 110 corridor abutting the Dillon property as a Jericho Gateway Zone (The City of Berlin, NH, 2007). This was done to promote recreational, residential, and compatible commercial development near the newly designated State OHRV/ATV park.

In 2006, the contract for developing a master plan for an ORHV/ATV riding area was awarded to Horizons Engineering, PLLC, of Littleton, NH. Horizons Engineering collaborated with Mr. Ted Burns, a trail master of the North Country ATV club in Stratford, NH (Horizons, 2007). The main principles for the master plan are as follows (Horizons, 2007):

1. The overall goal is to provide an all-inclusive, user-friendly facility that will attract OHRV enthusiasts from within New Hampshire as well as from out of State.

2. Although the park is primarily planned as an ATV park, trails and facilities will be designed for many different users, motorized and non-motorized, as well as individuals and

families, leisure and aggressive riders, and day and overnight visitors.

3. High quality overnight camping facilities will provide an opportunity for visitors to extend their stay in the area while exposing them to the natural beauty of the Jericho Lake site.

4. Partnerships with local, state and federal agencies as well as private entities will be established to ensure that future planning and development efforts will be dedicated to preserving the natural resources in the park for future generations.

5. The park will become the hub of North Country OHRV activity. As such, it will have widespread economic benefits to the local and regional economies.

In the United States, the environmental impact and effects of OHRVs has been a controversial issue for many years (Webb and Wilshire, 1983). Recently, ATV use in New Hampshire has gained priority among recreational management concerns. In order to alleviate environmental concerns and to ensure proper OHRV trail delineation and compliance with current New Hampshire State Laws regarding OHRV vehicles and trails, an assessment of the Revised Statutes Annotated (RSA), Section 215-A: 43 was needed. Section 215-A: 43 is a set of statutes pertaining to the evaluation process for trail placement and construction (APPENDIX A). These statutes can be broken down into three parts: 1) Seven statutes dealing with local ordinances, deed restrictions and overall compatibility with other land uses, 2) Eighteen statutes dealing with environmental and wildlife habitat issues, and 3) Four statutes dealing with safety issues and enforcement.

Using GIS

In order to spatially represent the dynamic relationship between landscape characteristics and the statutes governing trail placement, this study utilized a Geographic Information System (GIS). The GIS was used to gather, store, and analyze available spatial data. It was also used to quantify the New Hampshire State Statues, such that they can be represented spatially to help decision makers and stakeholders determine best placement of OHRV/ATV trails. In order to construct a spatial model for acceptable OHRV/ATV trail sites, one of the most fundamental concepts in Geography was utilized—Overlay Analysis (DeMers, 2005).

An overlay analysis, in general terms, is conducted when the co-occurrences of significant features is of importance. The spatial representations of each statute were overlain onto a base map to delineate acceptable areas for OHRV trails. Resulting maps of potential trail sites were generated to assist decision makers in the trail placement process. Additionally, GIS overlays of protected and prohibited areas provide land managers with a means to identify and prioritize areas to be protected.

Goals and Objectives

The overall goal of this study was to evaluate the 7,500 acre parcel of land, acquired by the State of New Hampshire for the use as a multi-use, outdoor recreational trail facility. The specific objectives of this study were to: 1) identify any lack of spatial data resources related to current RSA statutes, 2) identify

areas within the proposed Jericho State Park site that can be used for OHRV/ATV trails, and 3) report findings to the New Hampshire Department of Resource and Economic Development for use in their decision-making process.

CHAPTER II

LITERATURE REVIEW

In order to delineate trail sites for an ATV Park using GIS, it is necessary to acquire an understanding of Federal, State, and local factors influencing laws and regulations. It is also necessary to identify appropriate GIS spatial analysis techniques. First, there is a brief discussion about the numerous terms related to the definition of an ATV. Second, environmental impacts caused by ATVs are briefly discussed. Third, policies and laws affecting ATV trail placement are investigated. Last, the different stages of spatial data acquisition, creation and analysis are reviewed.

Defining ATVs

One complication associated with ATV research is the lack of clarity in defining an ATV and similar concepts. There are many definitions and terms used when referencing the types of vehicles used for off-road purposes. The definition of an off-road vehicle (ORV) according to the federal government is (New Hampshire House, 2001):

> ...any motorized vehicle designed for or capable of cross-country travel on or immediately over land, water, sand, snow, ice, marsh, swampland, or other natural terrain; except that such term excludes (A) any registered motorboat, (B) any fire, military, emergency or law enforcement vehicle when used for emergency purposes, and any combat or combat support vehicle when used for national defense purposes, and (C) any vehicle whose use is expressly authorized by

> the respective agency head under a permit, lease, license, or contract...

This definition covers a broad range of recreational vehicles as well as recreational vehicles modified for off-road use such as dune buggies and off-road trucks. Possibly due to the vagueness of this definition, most states include their own definition(s) associated with ATVs.

According to New Hampshire State Law RSA 215-A: 1-VI:

> ... [an] off highway recreational vehicle (OHRV) means any mechanically propelled vehicle used for pleasure or recreational purposes running on rubber tires, tracks, or cushion of air and dependent on the ground or surface for travel, or other unimproved terrain whether covered by ice or snow or not, where the operator sits in or on the vehicle... [and] OHRVs shall not include snowmobiles...

This classification includes all ATVs which are defined by state law as being:

> ...any motor-driven vehicle which is designed or adapted for travel over surfaces other than maintained roads with one or more tires designed to hold not more than 10 pounds per square inch of air pressure, having capacity for passengers or other payloads, not to exceed 1,000 pounds net vehicle weight, and not to exceed 50 inches in width" (NHRSA, 2007).

In contrast to New Hampshire statute, some authors include snowmobiles in their definitions. *Sheridan* (1979) used the term Off Road Vehicle (ORV) and it included motorized vehicles used for recreational purposes and suggested that his definition include various types of motorcycles, four-wheel drive vehicles like jeeps and pickups, snowmobiles and ATVs. *Nicholes* (1979) decided to differentiate between off-highway vehicles (OHV) and off-road vehicles (ORV) by stating that off-road vehicles use an "unobstructed pattern"

when operating while off-highway vehicles are confined to " lineal corridors" such as trails and dirt roads.

Research literature pertaining to ATVs, ORVs, OHVs, and OHRVs are not divided accordingly. The term an author will choose depends on the state in which the study takes place as well as the overall focus of the project. This further complicates research because studies cannot be directly compared due to definition discrepancies. For example, studies related to soil impacts will differ in their results depending on whether or not snowmobiles are included and soil erosion studies differ if four-wheel drive trucks are included in the study. However, impacts on wildlife, forest vegetation, and air and water quality generally produce similar results. ATVs will be specified where the literature allows, otherwise the term ORV which include ATVs will be used.

Environmental Impacts from ATVs

Every type of ecosystem in the United States has been adversely affected by ORVs—sand dunes on Cape Cod; pine and Cyprus stands in Florida; Montana prairie grasslands; alpine meadows in Colorado; Alaskan tundra (Sheridan, 1979). Although the focus of this study is not on impacts related to ATVs it is important to understand these impacts due to their influence on current laws which govern where and how ATVs can be operated. The literature related to ATV impacts is generally divided into 3 categories: 1) air and water quality, 2) soil and vegetation, and 3) wildlife and habitat fragmentation.

Air and Water Quality

In general, research focused on the effects of ATVs on air quality is lacking. Additionally, literature on air quality was not focused on ATVs but either the more general term ORV or more specific, snowmobiles. Therefore, the discussion that follows largely relates to ORVs. It is important to note that ORVs is the more general term and does include ATVs.

Kockelman (1983) pointed out that the two main impacts on air quality are, "fugitive dust" and "gaseous exhaust". Dust is initially generated when ORVs traverse an area that has exposed soil surfaces and can be later regenerated by wind gusts over those same surfaces. ATVs erode exposed surfaces, loosening and reworking dirt causing erosion. The dust can negatively affect photosynthesis, transpiration, respiration and can cause the absorption of toxins into vegetation (Farmer, 1991; Angold, 1997; Farmer, 1991). The U. S. Environmental Protection Agency (EPA), Office of Mobile Sources describes the major constituents of exhaust as being hydrocarbons (HC), nitrogen oxides (NOx), carbon monoxide (CO), and carbon dioxide (CO_2). The EPA also recognizes particulate matter, including dust and soot as major pollutants (EPA, 1996).

Two-cycle and four-cycle engines contribute to increasing photochemical smog by emitting hydrocarbons and nitrogen oxides (Kockelman, 1983). ATVs equipped with two-cycle (sometimes called two-stroke) engines can release up to 30% of their fuel unburned into the air (Karasin, 2003). According to a report done by the California Air Resources Board in 2001, a two-cycle engine

operating for one hour can produce more smog constituents as the average car in one year. Furthermore, ORVs equipped with four-cycle engines emit approximately 7 times the level of carbon monoxide as most new cars (Wildland Center for Preventing Roads, 2001).

Recently, the EPA, in working with ATV manufacturers, was able to finalize new national ATV emission standards leading to more strict exhaust emission and evaporative emission standards for 2006 models and later (40 C. F. R., 2005). The EPA estimates that these stricter standards will reduce HC emissions by 67% and CO emissions by 28% (EPA, 2003). Additionally, improvements will be made to materials and barrier treatments, which help reduce evaporative emissions (EPA, 2003). However, there are still countless ATVs used for recreational purposes in NH were manufactured prior to 2005 and not have to meet these standards. Currently, New Hampshire State Law does not have emission standards, but relies on national emission standards.

The quantity and quality of surface and ground waters are adversely affected by the ORVs which traverse the landscape. The same chemical pollutants and particulate matter which affect air quality can also affect water quality; particulate matter enters water either through the settling of dust or direct disturbance from wheels and tires and chemical pollutants such as gasoline and lubricant leakage (Kockelman, 1983). ORVs can also cause the spread of invasive and exotic species as well as negatively affecting several types of aquatic ecosystems (Mullins et al., 2005). As will be discussed later, ORVs cause

soil compaction, erosion and loss of vegetation which all contribute to the decline of available surface and ground water, primarily through runoff (Karasin, 2003).

Soil and Vegetation

In addition to the negative effects of air pollution on vegetation there is an abundance of literature that discuss additional vegetation impacts as well as soil impacts associated with ORVs: erosion and compaction.

Vegetation loss due to ORV trampling increases wind and water erosion on landscape surfaces. This in turn results in increased decomposition of organic matter in the soil, a weakening of soil stability, and the formation of an inorganic surface crust (The Wilderness Center, 2006). Surface runoff is increased over these inorganic crusts and infiltration is decreased, which creates and environment that hinders plant growth and survival (Dregne, 1983). ORV tracks over these surfaces form rills, channels, and gullies which redirect and change water flow patterns and severely increases soil erosion (Heede, 1983). The accelerated erosion of soils makes protection of sensitive areas such as wetlands a priority in proper recreational land management.

Compaction is caused by the intensive use of ORVs. It is a long-lasting effect of ORV use and also leads to less infiltration of water, increased runoff, and erosion (Webb, 1983). It has also been known to cause decreased plant growth in some environments (Lathrop and Rowlands, 1983; Lathrop, 1983). Adams et al. showed that soil, even with the slightest degree of compaction, had an accelerated drying rate compared to soil that was not compacted. This faster

drying rate caused higher soil strengths which inhibited and sometimes prevented root growth and regeneration (Adams et al., 1982). The effects are certain, however the degree of compaction vary depending on the soil type.

Wildlife and Habitat Fragmentation

The effects of ORV use on wildlife have not been well documented in eastern habitats; most of the research has been done in the western part of the United States and has focused on snowmobiles. However, existing literature does show that ORVs have both direct and indirect impacts on wildlife.

Indirect impacts relate to issues discussed in previous sections; poor air quality and soil erosion and compaction lead to vegetation decline and in some cases remove vegetation completely. The vegetation loss or habitat loss can cause wildlife mortality or decline in several ways: loss of shelter and food sources are the most serious consequences. The removal of vegetation can also result in habitat fragmentation.

Habitat Fragmentation is defined by *Franklin et al.* (2002) as, "...the discontinuity, resulting from a given set of mechanisms in the spatial distribution of resources and conditions present in an area at a given scale that affects occupancy, reproduction, or survival in a particular species." In general, it is the breaking up of large contiguous blocks of habitat into smaller blocks of habitat usually from some anthropogenic disturbance, i.e. roads, deforestation, housing developments, etc... This fragmentation can alter wildlife habitat and behavior in several ways: altered habitat or new vegetation patterns along roadsides;

avoidance of roads which limits species home-range; introduction of non-native plants; and increased sedimentation in stream habitat are just some of the negative impacts associated with habitat fragmentation (Wilderness, 2006; Larkin, 1996; Bagley, 1998). Studies have shown that ORV trails have the same effects as roads, but that due to the high density of trails in a smaller area, they actually can have greater impacts to wildlife (Gaines, 2003; Gilbert, 2003).

Direct impacts refer to the direct mortality by an ATV, that is, when an animal is hit or run over. *Bury and Luckenback* (1983) showed that several species of lizards and rodents in the Algodones Dunes of California were at risk of being run over and their underground burrows crushed by ORVs. The authors arrived at the same results in a 2002 study of the impacts of ORVs to the desert tortoise (*Gopherus agassizii*) in the Mojave Desert. Brown and McLachlan (2002) noted that the nests, eggs, and hatchlings of shorebirds were also being destroyed by ORVs. Other studies show that animals tended to migrate or rather, be frightened away from their shelter and feeding areas due to ATVs (Haiganoush et al., 2006;; Kockelman, 1983).

Policies and Law

As shown thus far, the negative environmental impacts of ATVs is widely acknowledged and recognized. These impacts have been recognized by the Federal government for nearly 40 years. Several crucial Executive Orders have laid the foundation for the protection of the natural environment and initiated awareness and research on impacts to the environment. State legislation

regarding ORV use and impacts vary widely from states with no policies to states with extensive policies. It was important to this study to become familiar with both federal and state laws regarding ATVs/OHRVs.

Federal Laws

The federal government's first real awareness of ORV use and impacts came in 1968 when the California Bureau of Land Management published a report which documented considerable damage done by ORVs to the desert environment (California, 1968). This initiated other studies and brought together the stakeholders (i.e. environmentalists, land owners, etc...) involved in this new problem. By 1971, the Secretary of the Interior created a special task force, whose main objective was to study the ORV problem, which had grown considerably since 1968 (Off-Road, 1979). It didn't take long for the ORV task force to conclude that there was a great need for extensive federal policy related to the use of ORVs on public land.

On February 8th, 1972, Executive Order 11644 regarding the use of ORVs on public lands was signed by President Richard Nixon (Off-Road, 1979). The purpose of this executive order was to establish policies and procedures that would direct the use of off-road vehicles on public lands to ensure the protection of resources and those using the resources (EO11644). The potential for negative impacts on natural resources by ORVs was widely recognized and needed to be addressed. The executive order stated that trail placement should avoid damage to soil, vegetation, wildlife and wildlife habitat, and that it should

not cause problems with existing land uses. Later, in 1977, President Jimmy Carter amended Executive Order 11644 under Executive Order 11989 to add Section 9: Special Protection of Public Lands. This section called for the immediate closure of trails if there was damage done to, "...soil, vegetation, wildlife, wildlife habitat or cultural or historic resources of particular areas or trails of the public lands..."

In 1979, the Council on Environmental Quality recognized the use ORVs as being one of the most serious land use problems of that time (Sheridan, 1979). Production and sales of ORVs were on the rise and it was obvious that the use of ORVs as a major public recreation activity was here to stay.

State Law

New Hampshire State Law RSA 12-1 called for the Establishment of the Department of Resource and Economic Development (DRED). Currently, there are four divisions within DRED: (1) The Division of Economic Development, (2) The Division of Forests & Lands, (3) The Division of Parks and Recreation, and (4) The Division of Travel & Tourism Development. The NH Bureau of Trails is the management component within the Division of Parks and Recreation, which is responsible for all motorized and non-motorized trails within the state.

In Chapter 215, the New Hampshire general court determined that it was in the "public interest to balance the demand for ATV and trail bike trails on state lands" with other management objectives such as other non-motorized trails, management goals for the state lands and protection of wildlife and areas of

ecological importance (RSA215). One of the duties of the Bureau of Trails is to provide a statewide trails system. This statewide trail system plan shall include planning, development, and maintenance of the trails (RSA 215-A: 3). Furthermore, specific evaluation criteria was established in regards to the placement of ATV trails; RSA215-A: 43. These evaluation criteria are the main focus of this study.

Defining Geographical Informational Systems (GIS)

There is not one universally accepted definition of a GIS rather; there are many definitions of a geographical information system (GIS). Most definitions describe its components and capabilities similarly. The U. S. Fish and Wildlife Service defines GIS as " an organized collection of computer hardware, software, geographic data, and personnel designed to efficiently capture, store, update, manipulate, analyze, and display all forms of geographically referenced information. The Environmental Systems Research Institute (ESRI), a world leader in the development of GIS software, defines a GIS as "an integrated collection of computer software and data used to view and manage information about geographic places, analyze spatial relationships, and model spatial processes. A GIS provides a framework for gathering and organizing spatial data and related information so that it can be displayed and analyzed." The utility of a GIS lies in its ability to link coordinates on a map, in this case a digital map, with coordinates in the field. Most GIS utilize a database structure known as a relational database structure. In a relational database, data are assigned to

certain rows and columns whereby a column of data represents a single attribute for the entire dataset (DEMERS, 2005).There are many types of analysis a GIS can perform including but not limited to buffering, overlaying, 3-dimensional representation, network analysis, viewscape analysis, and various statistical analyses. The possibilities for incorporating GIS into scientific research are seemingly limitless.

GIS and ATV trails

Literature on the use of GIS spatial analysis techniques and ATV trail planning or placement is largely non-existent. Several studies exist which explore the use of GIS in suitability analyses for recreational trail placement, but these studies focus on non-motorized trail placement such hiking, biking, and horse-back riding trails or they focus on the development of a rating system based on 'user expectations' in order to enhance the users experience (Starr, 1999). Spatial analysis and GIS are commonly used in land use and site selection studies related to road planning and construction (Collins, 2001). GIS spatial analysis techniques are also used frequently in the assessment of impacts from off-road vehicles including ATVs (Andrews, 1980; Baldwin, 1973; Sheridan, 1979). Inherently, GIS tools are optimal for analyzing numerous, complex spatial datasets as well as quantifying non-spatial data.

CHAPTER III

METHODOLOGY

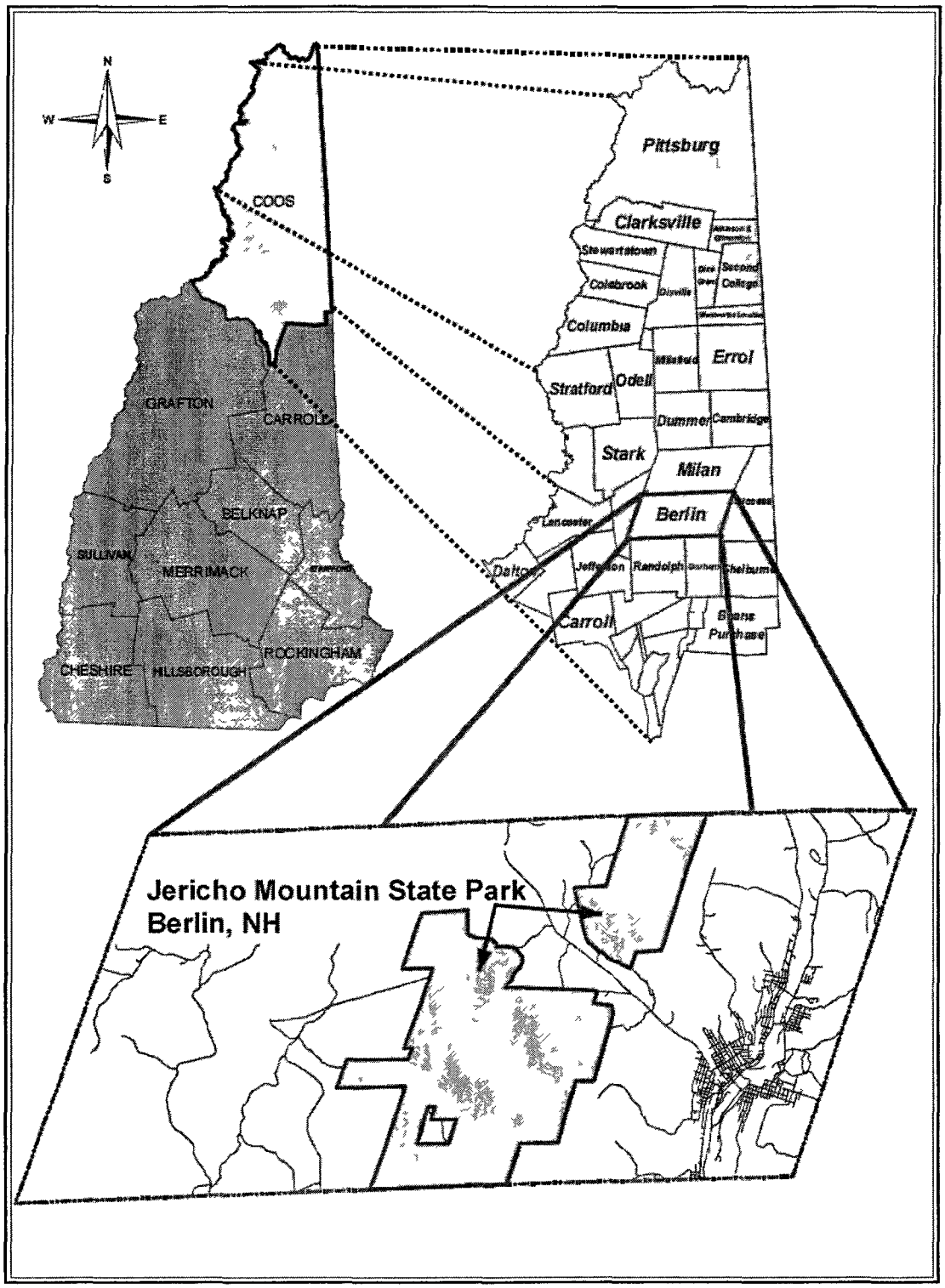
Study Area

The site for the proposed ATV park is within Berlin, NH, located in the central part of Coos County (Figure 2). Berlin is the only city in Coos County. The city is located on the Androscoggin River and the south-western boundary encompasses part of the White Mountain National Forest.

The site for the proposed ATV park originates at the former 293 acre Jericho Lake Park which is accessed via Rt. 110 in Berlin. Additionally, the State of New Hampshire in cooperation with the City of Berlin purchased one 7200 acre parcel of land in two tracts from Thomas R. Dillon and Scott A. Dillon. The final site (which will henceforth be referred to as the Jericho State Park) totals approximately 7500 acres of land.

Based on the Coos County Soil Survey the majority of the land within the Jericho State Park is described as sandy loam, very stony, and has a multitude of bedrock outcrops. The soil structure, according to the Highly Erodible Lands (HEL) classification, is described as potentially high to highly erodible (USDA, NRCS, Soil Survey, 2006). It is also moderately drained to somewhat excessively –drained according to natural drainage classification (USDA, 2006). The two tracts of land vary greatly in their associated land cover classifications.

Figure 2. Location of Jericho Mountain State Park



The first tract of land, referred to as the Head Pond Area, is approximately 1675 acres in size and is situated east of Head Pond, west of Cates Hill, north of Rt. 110 and south of the Milan town boundary, to which it abuts. The New Hampshire Land Cover Classification of 2001 (Complex Systems, 2002) shows the Head Pond area as being approximately 90% forested, the majority of which is coniferous tree species. However, the 2006 aerial photos from the National Agriculture Imagery Program (NAIP) show the area to be extensively logged. Much of this logging activity has been recent and will continue for the next four years according to the aforementioned logging rights currently retained by the previous owners. The elevation range spans from 1060 feet near the banks of Jericho Brook, the Dead River, and Head Pond, to 1640 feet at the northeast boundary. Compared to its surroundings, this area is somewhat flat with gradual elevation change. Several intermittent streams flow into Head Pond and the Dead River, however no permanent surface water is present.

The second tract of land, referred to as the Jericho Lake Area, is approximately 5525 acres in size and is situated in central Berlin, encompassing Jericho Lake on its northern border, and abutting the Randolph town boundary to its south The White Mountain National Forest to its west and southwest. The New Hampshire Land Cover Classification of 2001 shows the Jericho Lake area as being nearly 95% forested and dominated by deciduous tree species. The 2006 aerial photos from NAIP show minor logging activity currently in this area, though extensive logging similar to the Head Pond Area is anticipated. The

elevations range spans from 1240 feet in the northern part of this tract, heading east of Jericho Lake, to 3140 feet in the southwest corner of the parcel. The extreme gradient change in this area follows the northern limit of the Crescent Mountain Range and is ¾ of a mile northwest of Black Crescent Mountain. This area is adjacent to the current boundary of the White Mountain National Forest. Numerous tributaries of Jericho Brook cover this area in a dendritic pattern and flow north towards Jericho Lake in the northwest corner of the Jericho Lake Area.

In addition to a few existing trails and access roads, there exist numerous logging roads which can be integrated into the trail system design and more will be constructed to accommodate current logging activity.

Database Development

Database Tools

Software developed by the Environmental Systems Research Institute, Inc, (ESRI) was employed for GIS database development and analysis. ESRI is the world's leading producer of GIS software. ArcGIS is a collection of software products necessary for a comprehensive GIS. The Desktop GIS is the preferred platform used by GIS professionals and researchers. The two software applications used for this study are ArcMap version 9.2/9.3 and ArcCatalog. ArcMap version 9.2/9.3 is the primary application used for analysis and map creation. ArcCatalog is a shared application used to store and organize GIS data for access by ArcMap (GIS, 2006).

Data Gaps

During exploration and examination of existing spatial data to be used in this study, it was discovered that several important data layers did not exist for the study site. Issues related to fund development and apportionment, and data development contributed to these gaps in available data. Spatial data that were developed for other parts of the state, but were incomplete for Coos County included: land use data and surficial geology data. Although these datasets are not directly referenced in the evaluation criteria, they would have been very effective in the basemap creation and site description. Additionally, data layers that have not been created due to the lack of funds and/or field investigations include: Ordinary High Water Mark data, specific location data for rare plants and exemplary natural communities, cultural and historic resource data, eagle, osprey and other raptor nests or nest trees, eagle winter roosting areas, wetlands containing heron rookeries, and areas representing unique geology. Upon examination into potential data development methods for filling these data gaps, it was determined that to develop these datasets would be outside the scope of this study and thus the results would be unreliable with respect to these parameters.

Spatial Data Overview

In order to validate the usage of existing datasets for trail delineation, a brief description of each dataset and its relevance pertaining to each of the fine-criteria statutes is necessary. Unless otherwise specified, all data used in this

study are in the same coordinate system. The 3-dimensional model or datum inherent in all the digital spatial data is the North American Datum, developed in 1983 (NAD83). The 2-dimensional representation used was the State Plane Coordinate System (SPCS) and the specific zone used was New Hampshire. The unit of measurement for all data was feet. The scale at which the datum was created is 1:24000. Most data layers used in this study were acquired from the New Hampshire Geographically Referenced Analysis and Information Transfer System (NH GRANIT). NH GRANIT is a cooperative project between the University of New Hampshire (UNH) and the New Hampshire Office of Energy and Planning. NH GRANIT is housed within the UNH Institute for the Study of Earth, Oceans, and Space (NH GRANIT, 2007). Specific information about data layer properties and processes discussed here can be found in the data layer's metadata, located on the NH GRANIT website (http://www.granit.unh.edu, NH GRANIT, 2007).

Spatial Data layers used in basemap development

The basemap created for this study serves as the spatial reference for this study and registers all other data layers used, to the site location. It will include background reference data and will be combined with thematic data related to this study.

Political Boundaries for New Hampshire. The political boundary data layer for New Hampshire (PBNH) was created by the Complex System Research Center (CSRC) at the University of New Hampshire, from the USGS DLGs. The

spatial data represents corporate boundaries at several levels, including the town level, mapped at the standard 7.5-minute USGS quadrangle. This data layer was intended to be used for development of municipal, regional, or statewide base maps. This data layer meets current National Map Accuracy Standards. The National Map Accuracy Standards define accuracy standards for all published maps, including accuracy testing methods. This data layer will be used to reference other spatial data to the boundaries of Berlin, NH; the city in which the study site is located.

New Hampshire Landcover Assessment—2001. The landcover assessment data layer for 2001 is the most recent and detailed landcover data layer for New Hampshire. It was created by CSRC from Landsat Thematic Mapper imagery taken in 1990 and 1999. The final data layer can be represented using 23-class or 7-class landcover classification system. These data were found to be 82.2% accurate at the 23-class level and 95.9% accurate at the 7-class level. This data layer was used to quantify landcover within the study site prior to the aforementioned logging activity of the prior landowners.

Proposed ATV Park Site Boundary. The proposed ATV park site boundary data layer was acquired from the New Hampshire Department of Resources and Economic Development. This data layer is a digital representation of the site boundaries for the land purchased by the State of New Hampshire from the prior land owners, Thomas R. Dillon and Scott A. Dillon. This data layer was used as the boundaries, within which all quantification of landscape characteristics for this study will occur.

In addition to the above mentioned data layers, the National Wetlands Inventory data layer, the Department of Transportation Roads data layer, Recent Trail & Access Road data layers and the New Hampshire Hydrography data layer were all used in basemap development and in the analysis and are described in the subsequent section.

Spatial Data layers used in GIS analysis

Prior to analysis, data layers that extended outside the City of Berlin's were clipped to the city's corporate limits. This was done because data outside city limits were not relevant to this study. Additionally, many of the data layers consisted of large data files which, if processed in their entirety would slow computer processing time.

Berlin Zoning Ordinance. The Berlin Zoning Ordinance was adopted in 1999 and amended in 2000 and 2005. The amendment in 2005 added the Jericho Gateway Zone, which included permitted uses related to outdoor recreation and OHRV use. Digital representation of this zoning ordinance was acquired from the City of Berlin's Planning Department. These data included zoning codes for each delineated zoning polygon within the city boundaries. Zone descriptions included in the Berlin Zoning Ordinance document (The City of Berlin, NH Zoning, 2007) were appended to this dataset for accurate labeling of zones. Although no metadata exists for these data, data integrity and accuracy are assumed satisfactory for this study due to its usage by the city in their

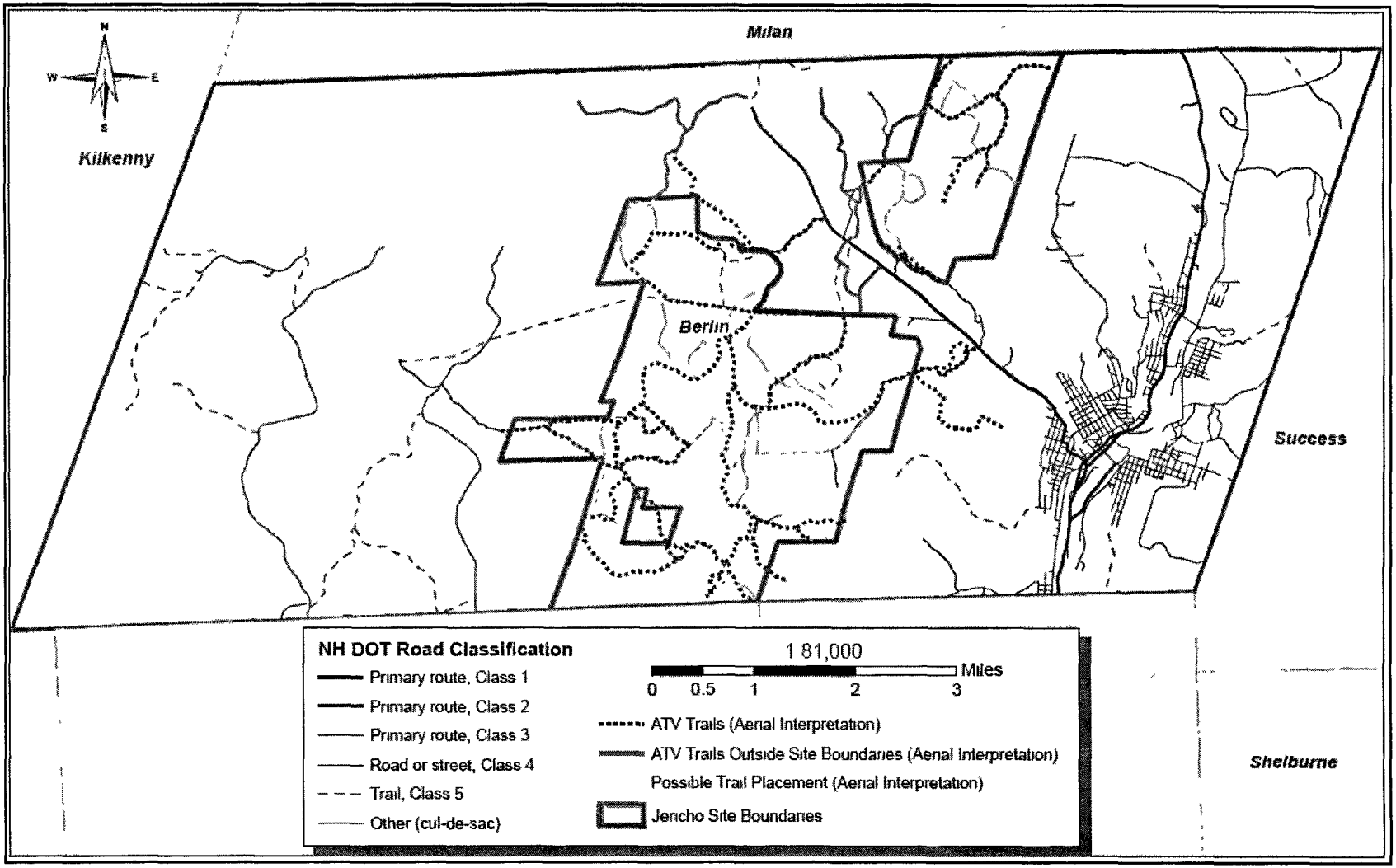
planning processes. The usage of this data layer pertained to the fine-criteria RSA 215-A: 43 II (d).

Department of Transportation Roads. The roads data layer was originally created from the United States Geological Survey's topographic quadrangles. The data layers are frequently updated and maintained by the New Hampshire Department of Transportation (NH DOT). The initial roads data layer was acquired from NH GRANIT. The most recent update to this data layer was acquired directly from the NH DOT and appended to the initial roads data layer. This data layer has numerous attributes relevant to this study and covers the entire state. This data layer meets current National Map Accuracy Standard (USGS, 1999). The National Map Accuracy Standards define accuracy standards for all published maps, including accuracy testing methods (NH GRANIT, 2007).The usage of these data pertained to the fine-criteria RSA 215-A: 43 II (j).

Trail & Access Roads. The trail and access road data layer (Figure 3) was developed for this study. Several sources were used to create and verify current trails and access roads: 1998 Digital Orthophoto Quadrangles, Aerial Photos from the National Agriculture Imagery Program (2003, 2004, and 2006), and 2006 Aerial photos provided by the prior landowners. The aerial photos provided by the prior landowner are intended to be used as a visual reference because information regarding photo capturing and processing is unknown. The usage of the data layer pertained to the fine-criteria RSA 215-A: 43 II (j).

Wellhead Protection Areas. Wellhead protection is crucial in protecting groundwater drinking supplies from contamination. The wellhead protection area

Figure. 3. Location of Existing Trails and Access Roads



(WHPA) is both, the surface and subsurface area that encompasses a public water supply well (NH DES Water, 2007). These data were acquired through the One-Stop Data Retrieval Site on the New Hampshire Department of Environmental Service (NH DES) website. In order to address security concerns of the U.S. Department of Homeland Security, NH DES has designated this as sensitive data and has prohibited its redistribution. Due to this, wellhead protection area data used in this study were not delineated directly, but were aggregated with other datasets prior to visual representation. Furthermore, metadata records for this data layer will not be made available. However, data standards are consistent with other data layers and the data creation processes sufficiently adhere to RSA 485: 48 on wellhead protection. The usage of this data layer pertained to the fine-criteria RSA 215-A: 43 II (l).

Earthen/Earthfill Dams, Dikes, and Spillways. The Earthen or Earthfill dam is the most common dam found in New Hampshire (NH DES Dam, 2007). According to the NH DES Bureau of Dams' definition, an Earthen or Earthfill dam is, "...a dam in which more than 50 percent of the volume consists of soil." In order to address security concerns of the U.S. Department of Homeland Security, NH DES has designated this as a sensitive data layer and has prohibited its redistribution. Also, metadata records for this data layer will not be made available. Data standards for this data layer is consistent with other data layers. Engineering plans were also acquired for the dam at the eastern border of Jericho Lake, as well as the dike at the western boarder of the lake and its auxiliary spillway. These plans will be necessary in order to quantify the area of

the dam and development of accurate buffers around the dam. Again, these plans will not be available through this study. The usage of this data layer pertained to the fine-criteria RSA 215-A: 43 II (m).

Soil Survey Geographic (SSURGO) database for Coos County, New Hampshire. The soils data layer originates from data collected by the U.S. Department of Agriculture, Natural Resources Conservation Service (Figure 4). The digital data layer was developed by the National Cooperative Soil Survey. This spatial data layer displays an inventory of soil units throughout the state. Due to the multitude of attributes associated with these data, a separate document entitled NHSoilMaster accompanies the data layer and contains most of the attribute data. This document can be linked to the spatial data for use of those attributes in other applications. The basemap on which the soil units were compiled adhere to National Map Accuracy Standards, however, inaccuracies of the actual soil units are compounded by landscape characteristics such as slope and problems arising from edge-matching (NH GRANIT, 2007). The usage of this data layer pertained to the fine-criteria RSA 215-A: 43 II (n).

National Wetlands Inventory. The National Wetland Inventory (NWI) is a data layer that contains the classification and location of wetlands and non-wetlands as delineated by the U.S. Fish & Wildlife Service (Figure 5). These data are accompanied by a document entitled NWImapcode (NH GRANIT, 2007), which contains a dendrogram explaining its coding methodology. Although this document can not be directly linked to the spatial data, minimal time was spent inputting data necessary for code definition. Spatial accuracy information was not

included in the metadata record. This data layer was used in conjunction with other data layers for interpretation of fine-criteria RSA 215-A: 43 II (o) and (p).

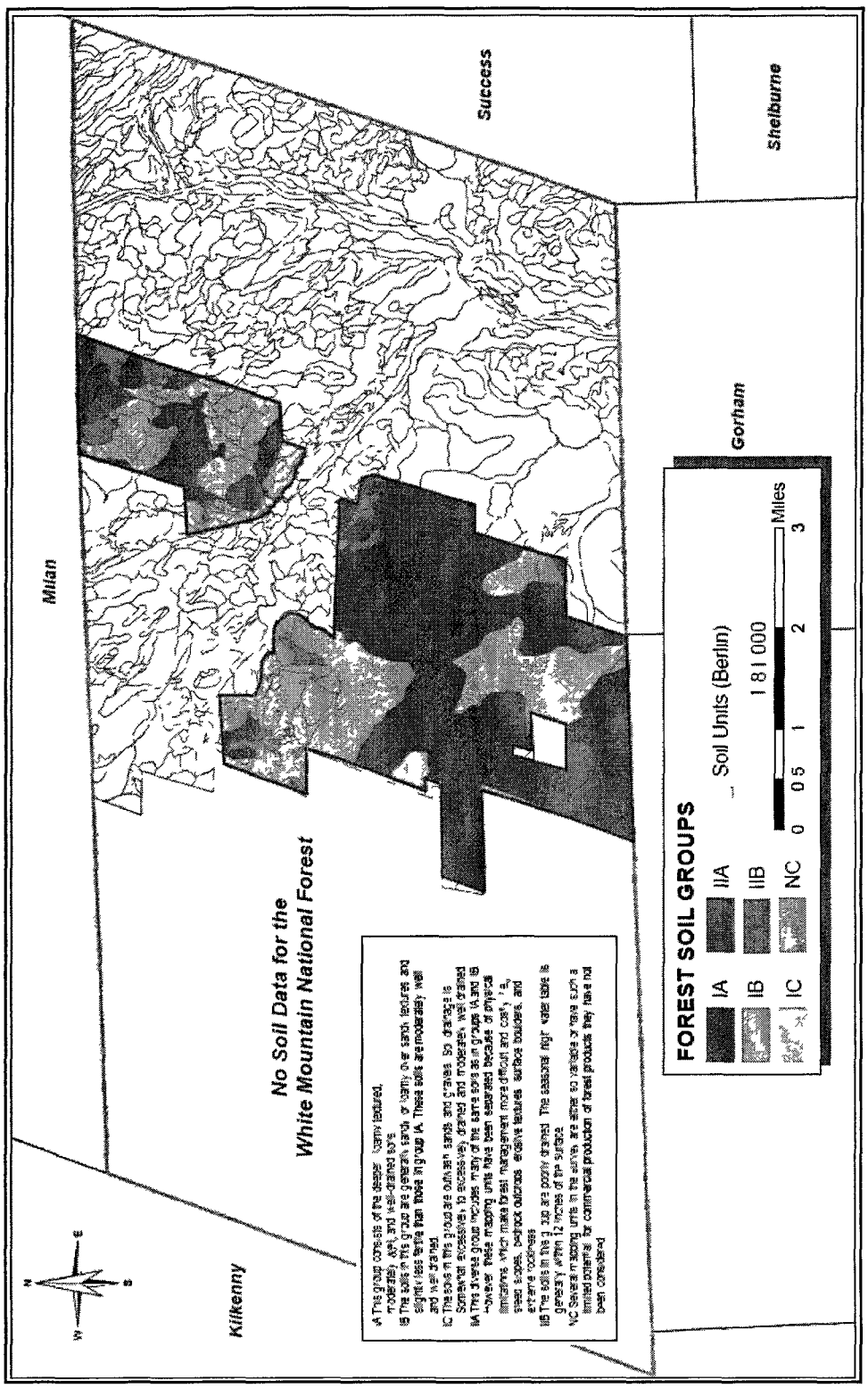
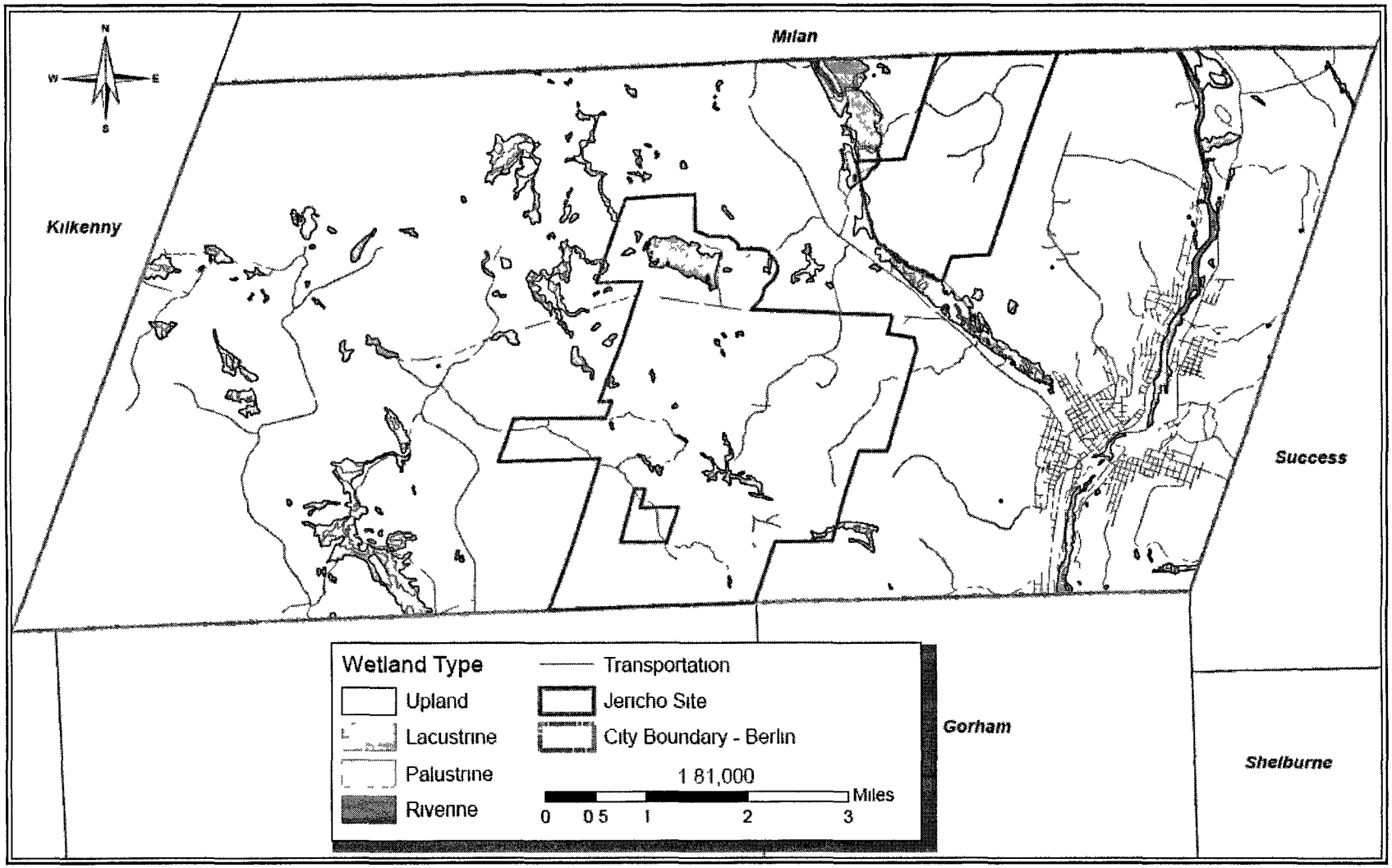


Figure 4. New Hampshire Soil Survey: Forest Soils.

Figure 5. National Wetlands Inventory: Wetland Types.



New Hampshire Hydrography Dataset. The New Hampshire Hydrography Dataset (NHHD) was created by the Complex Systems Research Center (CSRC) at the University of New Hampshire (Figure 6). It is an extracted subset of the National Hydrography Dataset (NHD), which is housed and maintained by the USGS. This data layer includes the entire state's water drainage system; including rivers, and streams. This data layer is accompanied by four supplemental documents (NH GRANIT, 2007): 1) NHHD_Quickstart_01040001 — a reference document for the use and viewing of NHHD, 2) NHHD_Tasks_ 01040001— a reference document of using the data layer with ArcGIS, 3) NHHD_Concepts_and_ Contents_01040001— a detailed description of the datum within the NHHD data layer, and 4) NHHD_Geodatabase_01040001— a diagram showing all the tables and attribute information in the geodatabase model. Methods for testing spatial accuracy of this data layer is included and explained in detail in the metadata records (NH GRANIT, 2007). This data layer was used in conjunction with other data layers for interpretation of fine-criteria RSA 215-A: 43 II (o) and (p).

Digital Elevation Model. The Digital Elevation Model (DEM) is a terrain elevation data set in digital raster format and thus uses a series of columns and rows in its array of elevation data (Figure 7). Several DEMs were used to cover the entire study site, as each DEM is provided as a standard USGS 7.5-minute file. These data layers were created by CSRC and are intended to be used in the creation of contour, slope,

Figure 6. New Hampshire Hydrography Dataset: Hydrography Types.

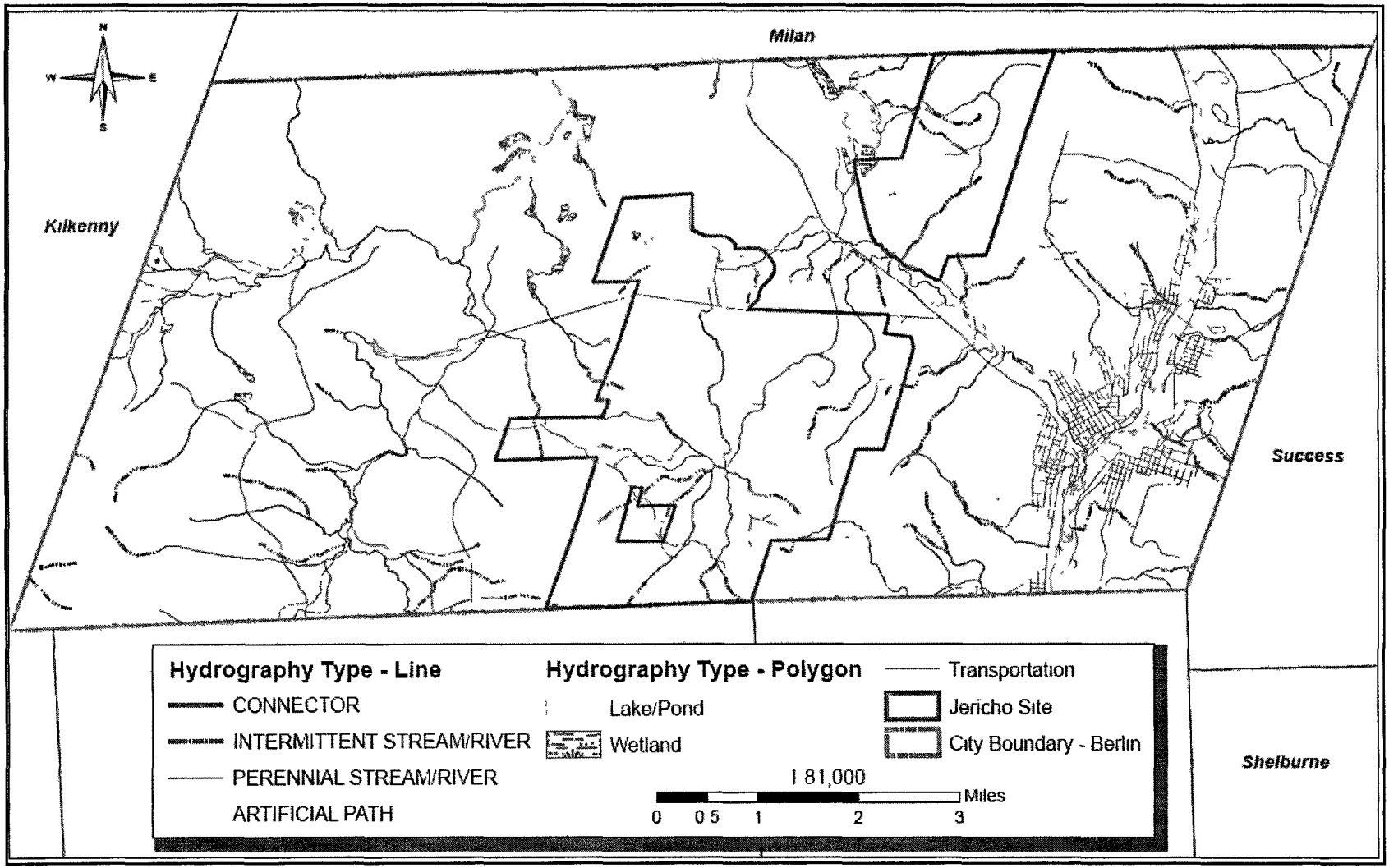
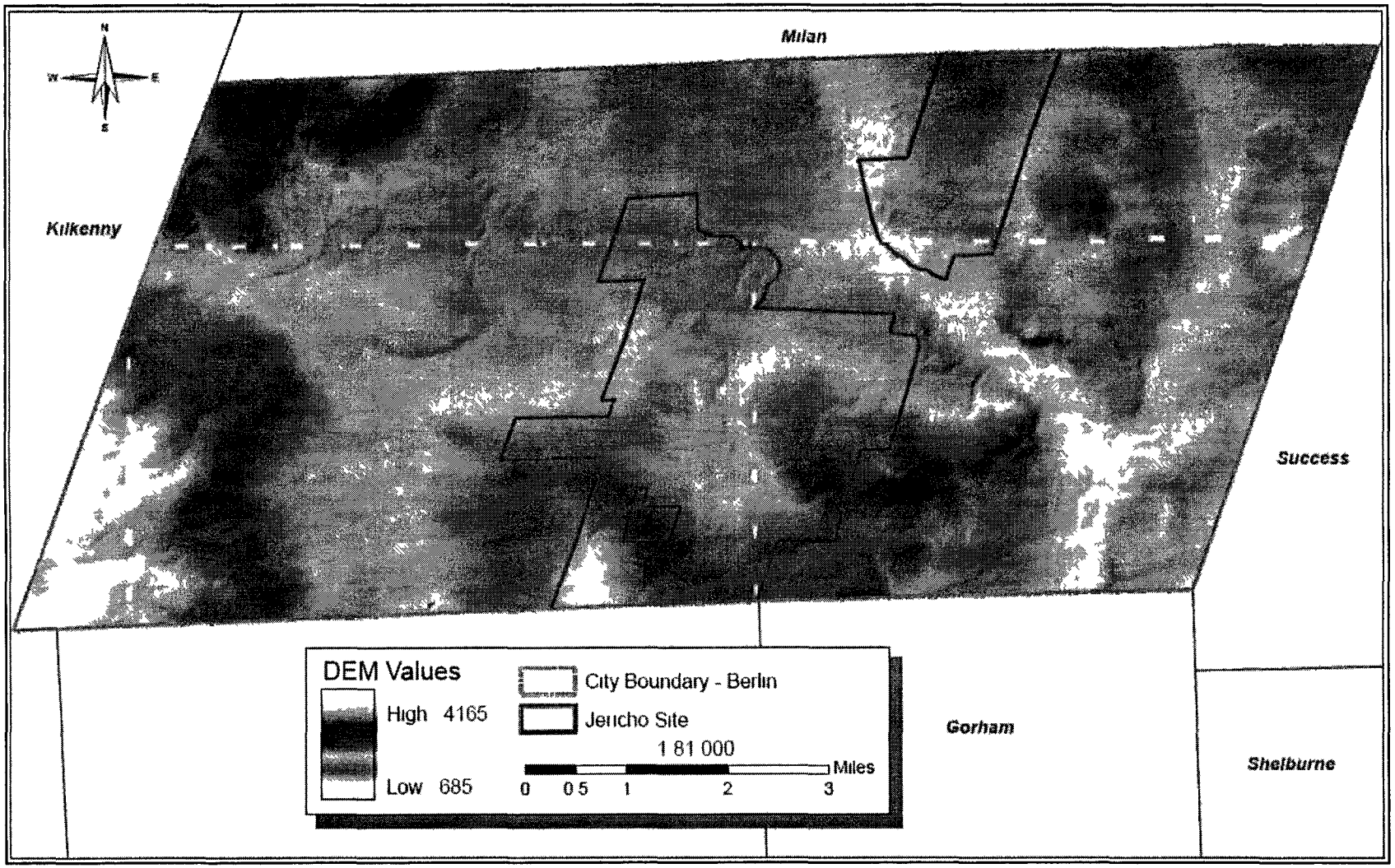


Figure 7. Digital Elevation Model: DEM Mosaic.



and hillshade data layers, through the use of sophisticated GIS software. Methods for testing spatial accuracy of this data layer is included and explained in detail in the metadata records (NH GRANIT, 2007). The usage of this data layer pertained to fine-criteria *RSA 215-A: 43 II (r).*

New Hampshire Natural Heritage Bureau. The Natural Heritage Bureau (NHB) provides data which describes and inventories New Hampshire's biodiversity. The bureau acts under the Native Plant Protection Act of 1987 (RSA 217-A) and works in cooperation with NH Fish & Game in maintaining critical information related to rare wildlife (NHB, 2007). The biodiversity information is comprised of natural communities, rare plant species, and rare animal species.

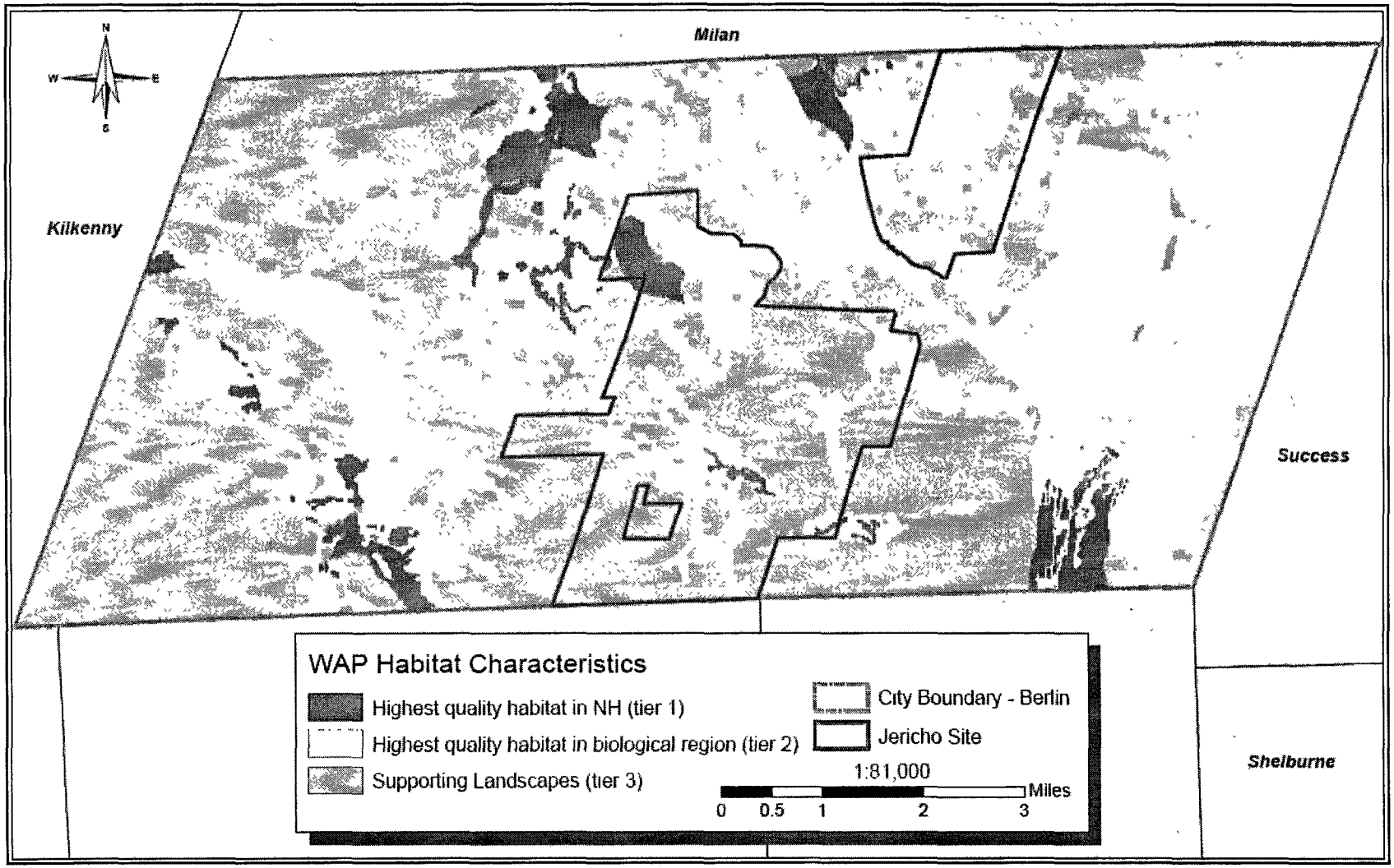
Natural communities, as defined by the NHB, are, "...assemblages of plants and animals that recur in predictable patterns across the landscape under similar physical conditions." Included in the Natural Communities data are several types of wetlands and forests. The exemplary criteria include communities of a rare type or an exceptional common type (NHB, 2007).

To further the protection of these natural communities, including rare plants and animals, the NHB prohibits redistribution of precise locations. Therefore, locations of known rare plants and animals will not be identified on any maps resulting from this study. Spatial accuracy information was not included in the acquisition of these data. However, species locations were calculated from field investigations and spatial accuracy was assumed to be satisfactory for this study. The usage of this data layer pertained to fine-criteria *RSA 215-A: 43 II (t), (u), (x), and (y).*

New Hampshire Wildlife Action Plan. The New Hampshire Wildlife Action Plan (WAP) is the most comprehensive assessment of wildlife to date (NHF&G, 2006) (Figure 8). It combines data on critical habitats, species of concern, and developed tools for use in land management decisions in the state. The report was developed by the New Hampshire Fish & Game Department and their conservation partners. Some of the conservation partners include New Hampshire Audubon, North East Ecological Services, the New Hampshire Chapter of the Nature Conservancy, the U.S. Fish and Wildlife Service, the University of New Hampshire, and many others (NHF&G, 2007).

To further demonstrate the importance of this report the NH Fish & Game Department created several tools to illustrate data compiled in the report, as well as aiding in its implementation. These tools include several maps and their associated data layers used in map creation. These data layers quantify characteristics associated with wildlife habitat land cover, ranked habitat by ecological condition, and conservation focus areas as determined by co-occurrence of ranked habitat. Methods for testing spatial accuracy of these data layers are included and explained in detail in the metadata records (NH GRANIT, 2007). The usage of these data layers pertains to fine-criteria *RSA 215-A: 43 II (s), (t), (u), (x), and (y).*

Figure 8. New Hampshire Wildlife Action Plan: Habitat Characteristics.



Evaluation Process

The Bureau and other state agencies, including the Department of Transportation (DOT), Department of Environmental Services (DES), and the New Hampshire Fish and Game Department (NHFG) are required to collaborate on the development of the wheeled OHRV trails system on public and private lands (NHRSA, 2007). In general, certain guidelines must be met for proper trail development. These guidelines state the following:

1. The property has been evaluated by the Bureau with cooperation from the other state agencies that are custodians of the property using the Coarse/Fine evaluation process.

2. A memorandum must exist between the Bureau and the other state agencies that are custodians of the property, which outlines the part each shall take in maintenance, monitoring, and law enforcement of the trails.

3. A written agreement must exist between the Bureau and a locally-formed ATV club outlining the club's responsibilities regarding the trail system.

4. A management plan for the use of ATVs on the property.

Site evaluation for new trails is facilitated through a two tiered process: 1) Coarse, and 2) Fine criteria evaluation statutes (RSA215-A: 42 & RSA215-A: 43).

Coarse-Criteria Evaluation

In order to legally develop trails the property first had to undergo a two-step evaluation process referred to as the Coarse/Fine evaluation process

(RSA215-A: 42). The first step or Coarse-criteria evaluation process has six requirements:

1) There are no restrictions, deed or otherwise, that would prohibit the use of ATVs on the property

2) Less than 90% of the property consists of natural communities, habitat associated with federal or state listed threatened or endangered species, type IIB Forested Wetlands

3) There must be at least 700 acres or contiguous land

4) Trail corridor links can only connect existing trails or those soon to be in existence

5) ATV and trail bike use does not conflict with the purpose for which the property was acquired

6) The use of ATVs and trail bikes is not prohibited by an existing management plan for the property.

The project site has undergone evaluation using the coarse-criteria by the NH Bureau of Trails and will not be repeated in this study. The site passed the coarse-criteria (Horizons, 2007).

Fine-Criteria Evaluation: Non-Spatial, Fine-Grained Criteria

The Fine-criteria evaluation process is made up of 29 statutes. It was determined that 12 fine-criteria had no spatial component to represent and would be addressed in the discussion section of this report. Those 12 fine-criteria are as follows (APPENDIX A): *RSA215-A: 43 II (a), (b), (c), (e), (f), (h), (i), (p), (z), (aa), (bb), and (cc).*

Fine-Criteria Evaluation: Spatial, Fine-Grained Criteria

Base map data layers. Prior to performing any analysis certain base map features were compiled and incorporated into the GIS database. The corporate boundary for the City of Berlin was extracted from the New Hampshire Political Boundaries data layer. The city boundary serves as an extended project site in order to preserve awareness of adjacent landscape characteristics. The tract boundary data layer of the Dillon property was acquired from the New Hampshire Department of Resources & Economic Development. The Jericho Lake State Park boundary was appended to the Dillon property boundary forming the ATV Park boundary. Additionally, the ATV Park boundary was spatially adjusted in order to properly align to the adjacent White Mountain National Forest (WMNF) boundary. The WMNF boundary, acquired from the U.S. Department of Agriculture Forest Service, was the primary data layer used in conflation. The resultant multipart polygon consisting of both the Jericho Lake parcel and the Head Pond parcel were then converted to individual polygons to aid the quantification of specific characteristics for each parcel. Finally, several USGS topographic quadrangles were used to explore existing features within the ATV Park Site. The proposed ATV Park site will hereafter be referred to as the Jericho State Park.

In order to expedite computer processing time data used in the following method descriptions were first clipped to both the city boundaries and the site boundaries and spatial attributes were recalculated to reflect the corresponding area.

The following are a list of the statutes and associated analysis methods used in database development (*RSA 215-A: 43 II*):

(d) The bureau has given due consideration to local planning and zoning ordinances.

The zoning data layer for the City of Berlin did not require further data preparation prior to overlay analysis. Statistics for the data layer was quantified and summated (Figure 9).

(g) The proposal is reasonably compatible with existing uses.

The New Hampshire Conservation Lands and zoning data layers were compared and contrasted to the site boundaries (Figure 10). Additionally, any conservation land parcel(s) within the site boundaries were examined as to understand any easements placed on the parcel(s).

(j) The proposed trail layout incorporates existing motorized travel corridors whenever possible.

Data layers showing motorized travel corridors were created by interpreting aerial photos and then on-screen digitizing the motorized travel corridors. The Digital Orthophoto Quadrangles (DOQ) for 1998, the National Aerial Inventory Project (NAIP) photos for 2003, 2004, and 2006, and aerial photos privately flown for the previous owners in April of 2006 were examined to identify any motorized travel corridors. The travel corridors were then digitized

Figure 9. Zoning Ordinance: City of Berlin, NH.

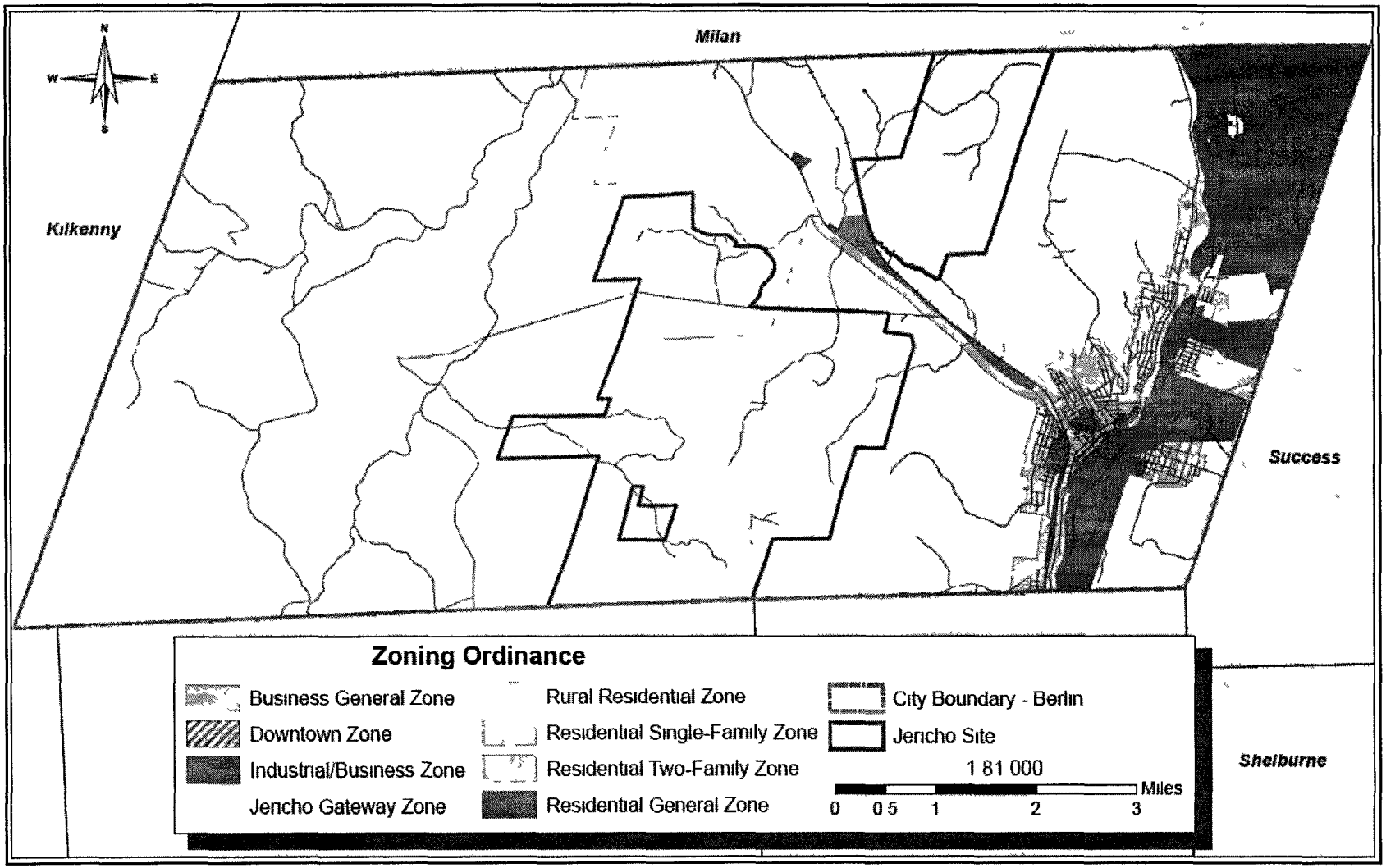
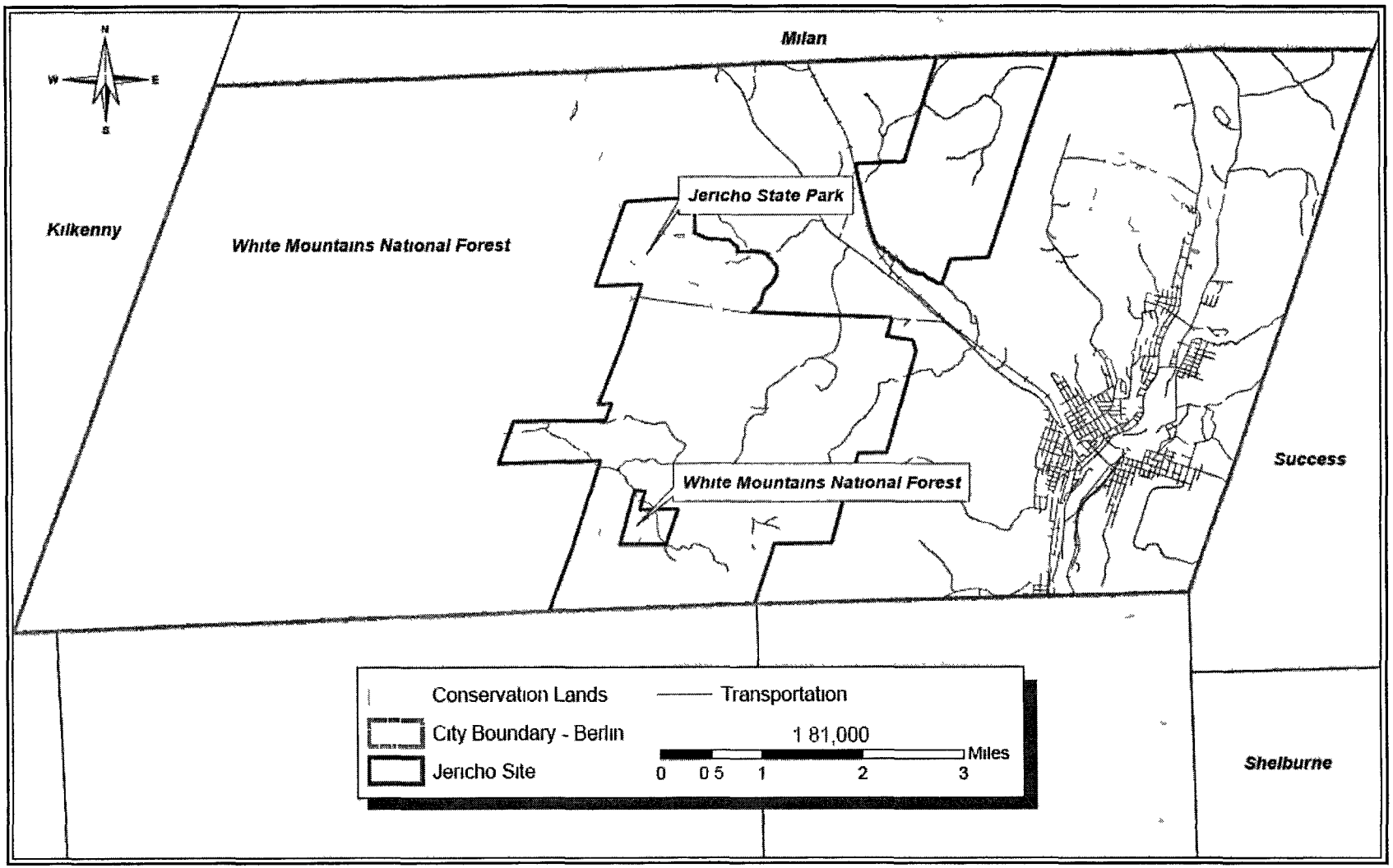


Figure 10. New Hampshire Conservation Lands.

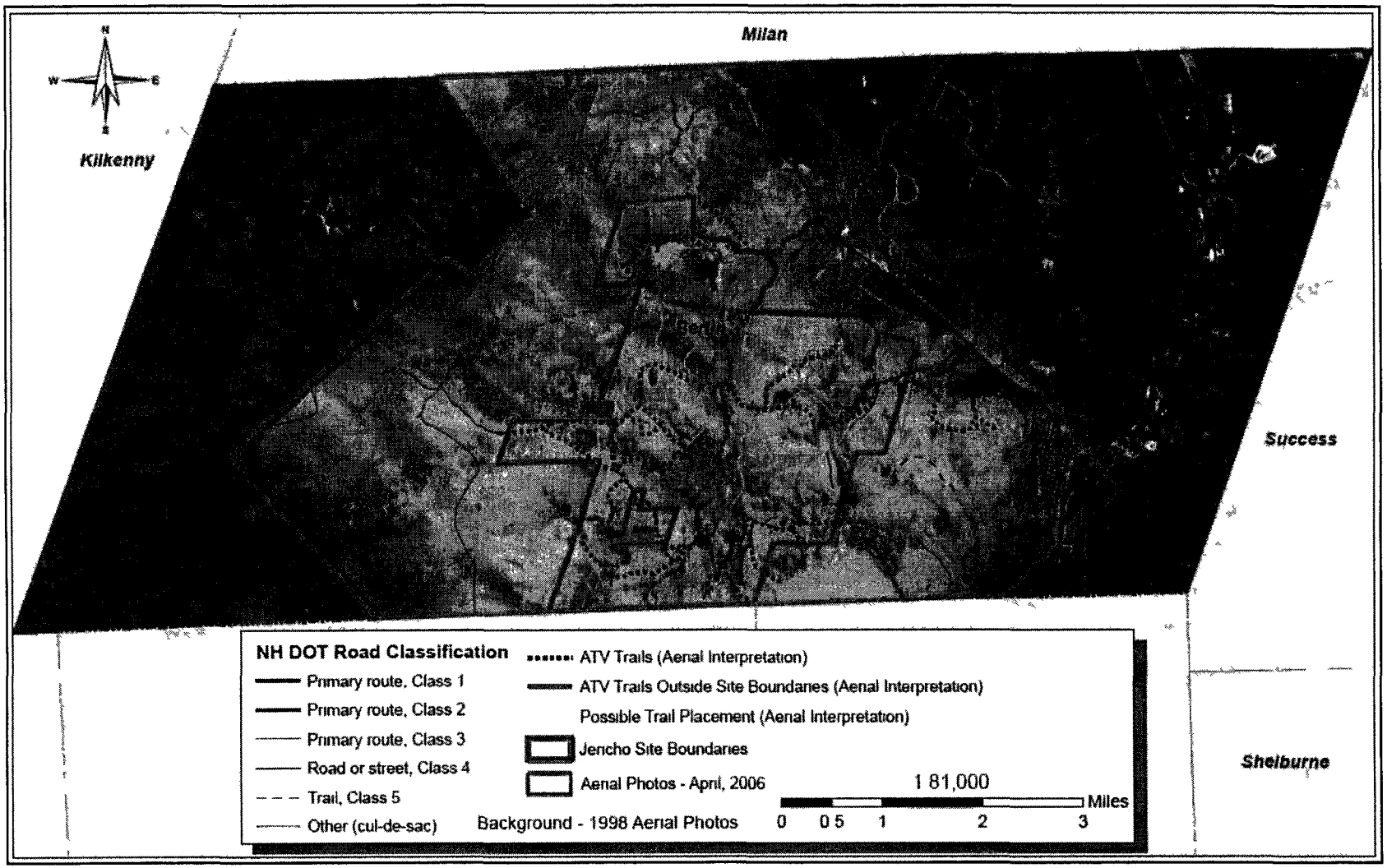


from the 1998 DOQs and NAIP aerial photos at a scale equivalent to the raster resolution for each photo; raster resolutions were 1:3780, 1:3780, 1:7387, and 1:7409 respectively. The aerial photos from April, 2006 were georegistered to the site boundaries. The newly created data layer was then compared to a set of GPS coordinates collected in the field to ensure accuracy. The digitized travel corridors were then appended to existing NHDOT recognized roads data layer within the site boundaries creating the final existing travel corridors data layer (Figure 11). The spatial attributes were then recalculated in ArcGIS using the Calculate Geometry tool.

(l) The proposed trail does not pass through a wellhead protection area as determined by the department of environmental services under RSA 485: 48, II.

A wellhead protection area (WHPA) as defined by the NHDES, is, "...the surface and subsurface area surrounding a public water supply well from which water and contaminants are likely to reach the well" (NHDES: Water, 2007). An inquiry into WHPA was submitted to the New Hampshire Department of Environmental Services (NHDES) for the project site. NHDES supplied a data layer showing one WHPA in proximity to the site; however no WHPAs were found to be within the project site. In the interest of Homeland Security, the NHDES has prohibited these data from being published in any form. Therefore, these data will not be displayed on any maps created for this project.

Figure 11. Existing Travel Corridors.



(m) The proposed trail is not located on earthen dams, dikes, and spillways.

According to the NHDES, an earthen dam or embankment dam relies on the fill material characteristics for support and stability (NHDES: Dam Bureau, 2007). A dike is another type of embankment used to confine or control water. A spillway acts as an overflow area for dammed water. Initial base map examination showed that the only earthen dams, dikes, and spillways within the site boundaries are those abutting Jericho Lake. Engineering plans were georeferenced using four control points for each of the three sheets. The boundaries for each feature were then digitized on-screen. Spatial attributes for each feature were then recalculated. A new field for acreage was added and calculated. In the interest of Homeland Security, the NHDES has prohibited these data from being published in any form. Therefore, those data will not be displayed on any maps created for this project.

(n) The proposed trail avoids areas having soil types classified as important forest soil group IIA or IIB as defined and mapped by the Natural Resources Conservation Service, unless there is an existing soil condition or surface roadway that can be used to reduce adverse environmental impacts.

The USDA has defined Important Forest Soil Group IIA and IIB as follows:

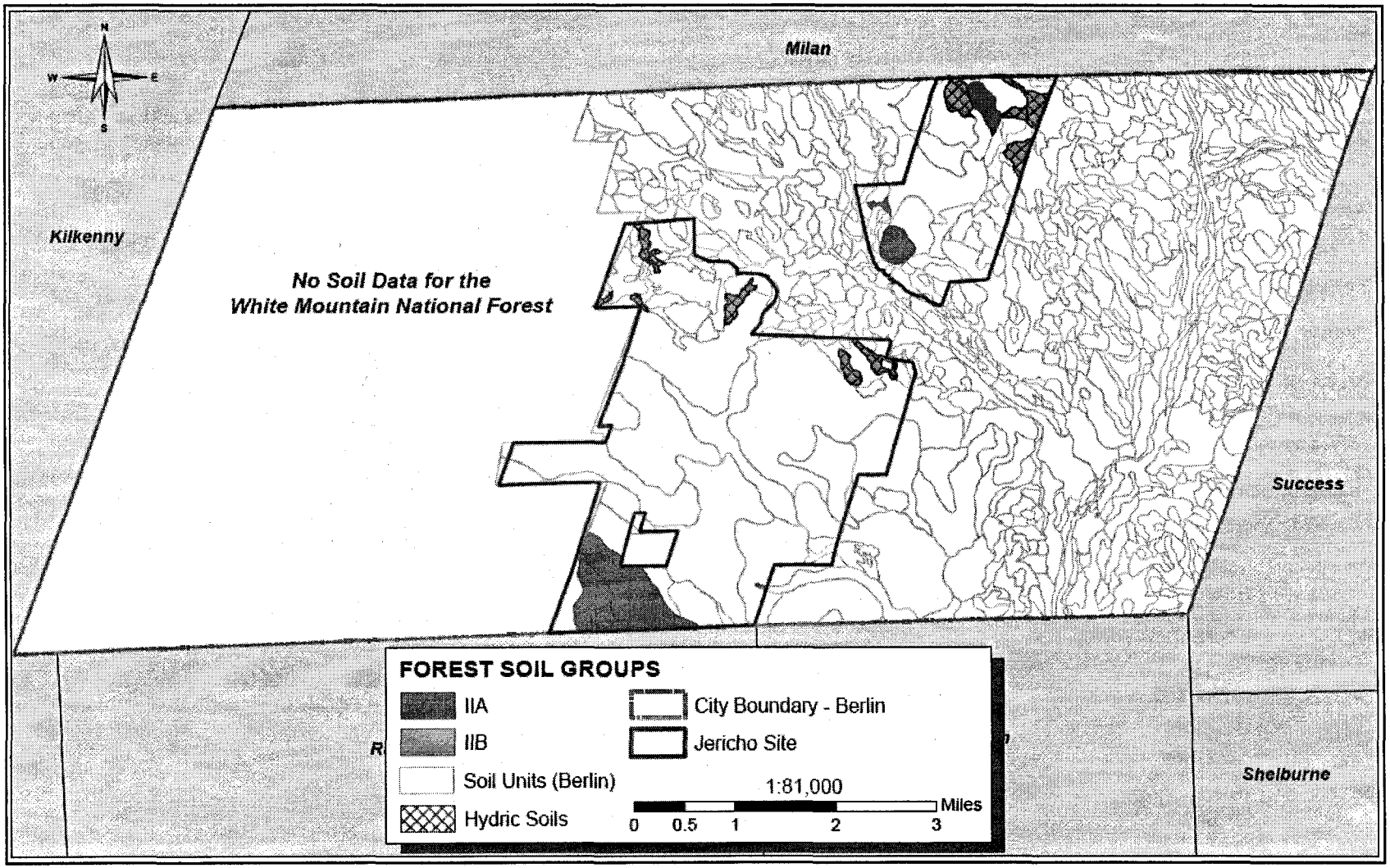
> IIA—This diverse group includes many of the same soils as in groups IA and IB. However, these map units have been separated because of physical limitations which make forest management more difficult and costly, i.e., steep slopes, bedrock outcrops, erosive textures, surface boulders, and extreme rockiness. Usually productivity of these soils is not greatly affected by their physical limitations. However,

management activities such as tree planting, thinning, and harvesting are more difficult and more costly. Due to the diverse nature of this group, it is not possible to generalize about successional trends or to identify special management opportunities.

IIB—The soils in this group are poorly drained. The seasonal high water table is generally within 12 inches of the surface. Productivity of these poorly drained soils is generally less than soils in other groups. Successional trends are toward climax stands of shade tolerant softwoods, i.e., spruce and balsam fir. Balsam fir is a persistent component in stands in northern New Hampshire. Due to abundant natural reproduction in northern New Hampshire, these soils are generally desirable for production of spruce and balsam fir, especially pulpwood. However, due to poor soil drainage, forest management is somewhat limited. Severe wind-throw hazard limits partial cutting, frost action threatens survival of planted seedlings, and harvesting is generally restricted to periods when the ground is frozen.

Soil feature attributes were queried using structured query language (SQL) for type IIA and IIB Forest Soils. These features were extracted and exported to a new data layer and the spatial attributes were recalculated. A new field for acreage was added and calculated. Hydric soils were also queried using SQL. These features were extracted and exported to a separate data layer and spatial attributes were recalculated. Hydric soils were extracted because of their reference as an important wetland indicator in the 1987 Army Corps of Engineers Wetland Delineation Manual and under the 1989 Federal Manual for Identifying and Delineating Jurisdictional Wetlands (NHDES Wetlands, 2007). These data were used for display only as areas that need further consideration and were not used to delineate ATV trails in this project (Figure 12). Both of these features were then Clipped to the site boundaries and spatial attributes recalculated. Site examination using available data revealed no known soil conditions or surface roadways that could be used to reduce adverse environmental impacts.

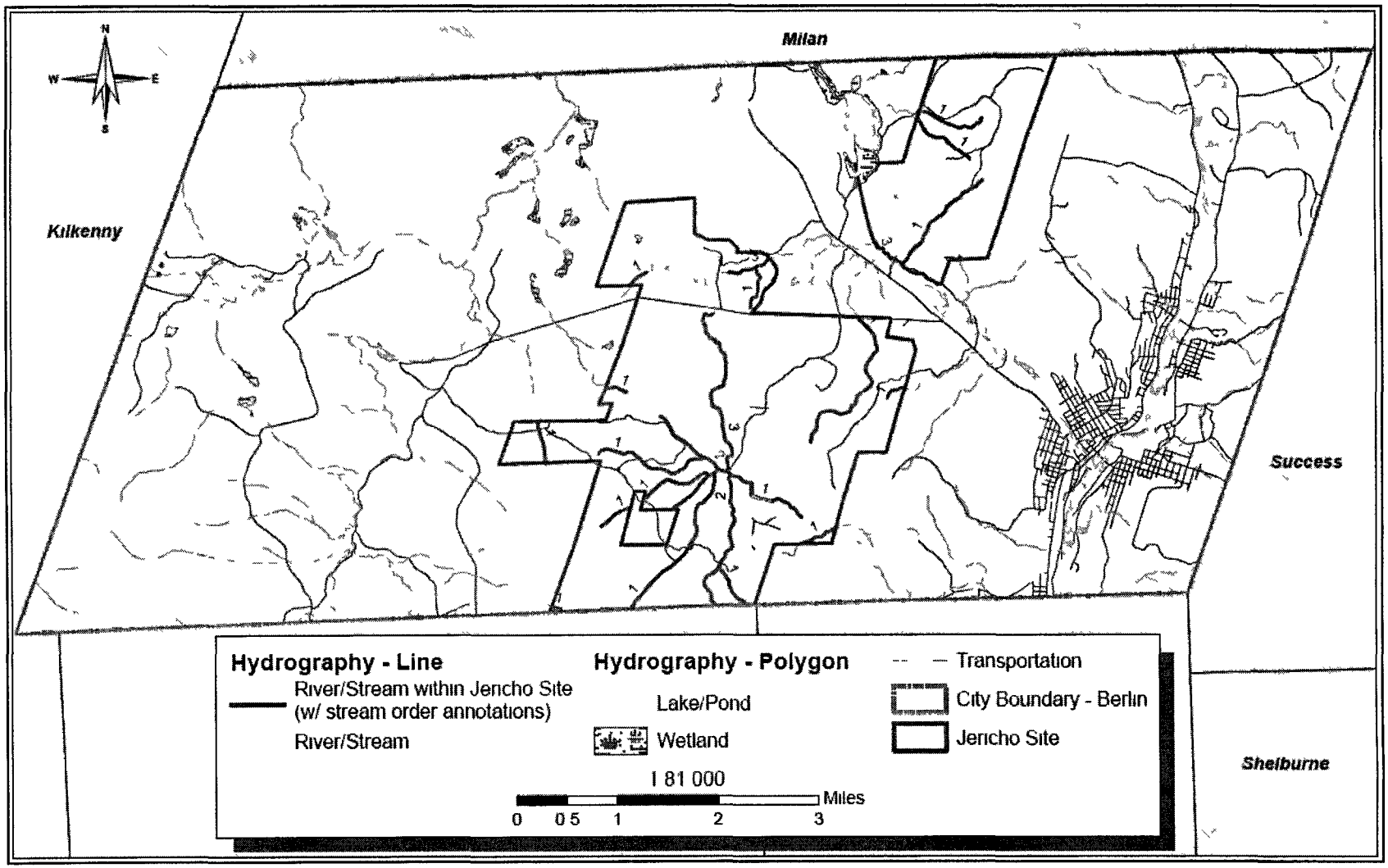
Figure 12. New Hampshire Soil Survey: Hydric and Forest Soil Types.



(o) The proposed trail is not within 100 feet of the ordinary high water mark of first and second order streams, 330 feet of third order streams, and 600 feet of fourth order and higher streams, except for the purposes of stream crossing.

The Ordinary High Water mark as defined by NHDES is, "...the line on the shore, running parallel to the main stem of the river, established by the fluctuations of water. It is indicated by physical characteristics such as a clear, natural line impressed on the immediate bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas". Due to the ever-changing nature of ordinary high water marks and their complex boundary indicators, the NHD delineated stream boundaries were used in lieu of OHWM data. The NHD data were queried using SQL for 1st and 2nd order streams. There features were exported into a new data layer. A second query was performed to identify and eliminate artificial paths. Artificial paths mark the flow of water through areal water bodies to create a fully connected stream network. These features are removed to eliminate redundancy in data processing; they are managed in RSA 215-A: 43 II (q). The resulting features were then buffered at 100 feet. Similar steps were followed for 3rd order streams and 4th or higher order streams using 330ft and 600ft buffers respectively. The final data layers for each group of streams were then merged into one data layer. These data were then clipped to the site boundaries and spatial attributes were recalculated (Figure 13). A new field for acreage was added to each data layer and calculated.

Figure 13. New Hampshire Hydrography Dataset: Stream Orders and High Water.



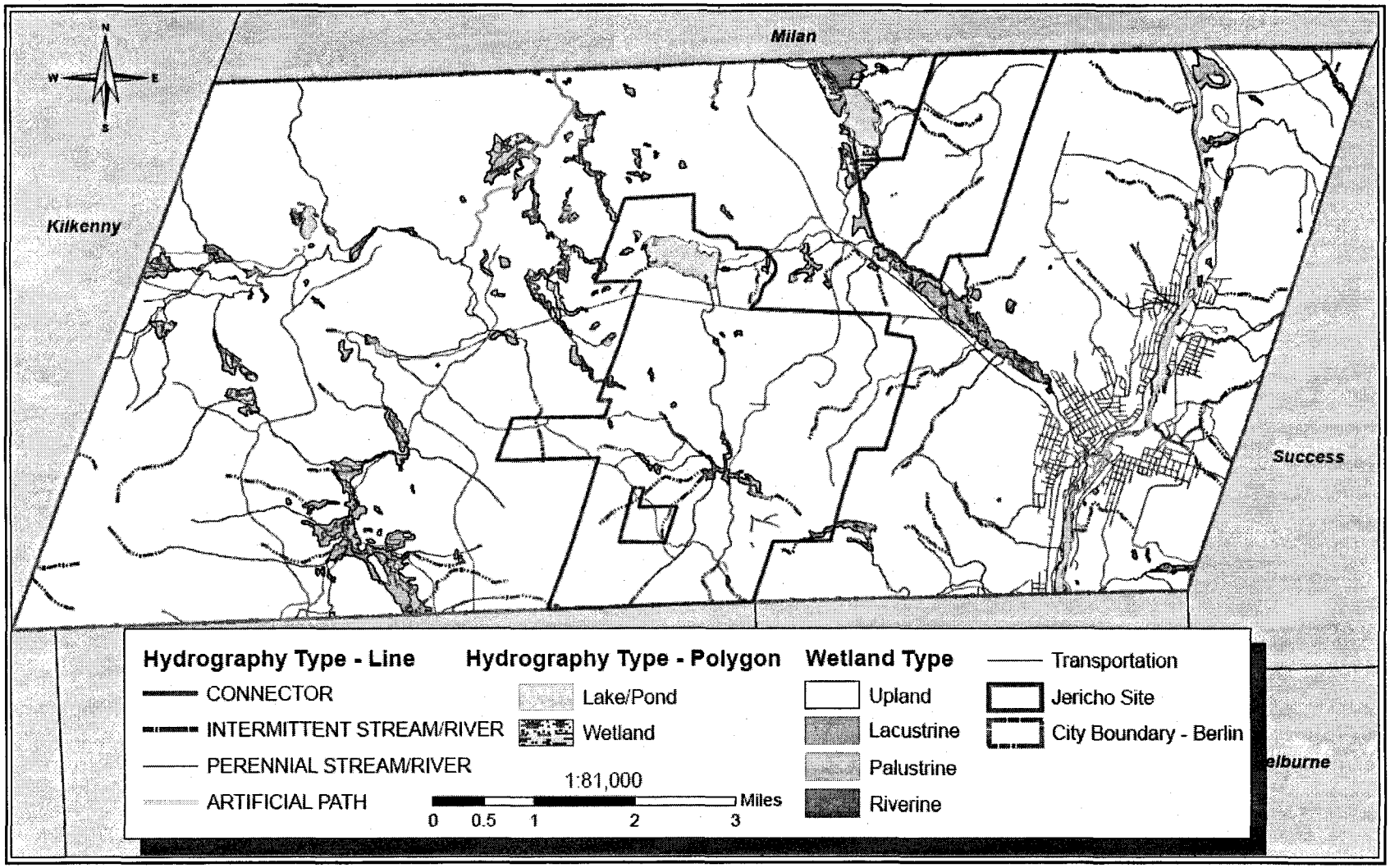
(q) The proposed trail is not within 200 feet of any water body, forested or non-forested wetland, or vernal pool.

There are several data layers available which have features relevant to this criterion (Figure 14). The NWI data layer was used as the primary data layer in conflation with the Upper Androscoggin River and Upper Connecticut River Water Bodies data layers. All features were examined using the NAIP 2006 aerial photos as reference to locate non-coincident features. Non-coincident features from the Water Bodies data layer were then appended to the NWI data layer. A final inspection of the NAIP 2006 aerial photos was conducted to locate any features that were missing from either data layers. No new features were identified during this process. Wetland and water body features were then buffered at 200 feet. These data were then clipped to the site boundaries and spatial attributes were recalculated. A new field for acreage was added to the data layer and calculated.

(r) The proposed trail avoids elevations over 2700 feet.

In order to properly model elevation for the site, 5 DEMs were mosaiced together; these DEMs were: 1) Berlin, 2) Pliny Range East, 3) Pliny Range West, 4) Milan, and 5) West Milan. In areas where cells overlapped mean values were calculated. At this point the mosaiced DEMs were clipped to Berlin and site boundaries to expedite processing. Next, a surface analysis was conducted in

Figure 14. National Wetlands Inventory: Hydrography and Wetland Types.



which 20 foot contour lines were interpolated based on the 30 meter raster resolution (Figure 15). Additionally, elevation benchmarks as denoted on 1:24000 USGS Topographic quadrangles were used as control points in contour generation. Contour intervals were then converted to polygons and recoded to represent areas under 2700 feet and areas greater than or equal to 2700 feet. These polygons were then queried using SQL to extract areas greater than or equal to 2700 feet. Selected polygons were then merged together and interval boundaries dissolved. Spatial attributes were then recalculated including a new field showing acreage.

Statutes with no known data. Despite many extensive and exhaustive searches, no known datum was identified pertaining to the following statutes:

(s) The proposed trail avoids important wildlife habitat features for species of concern

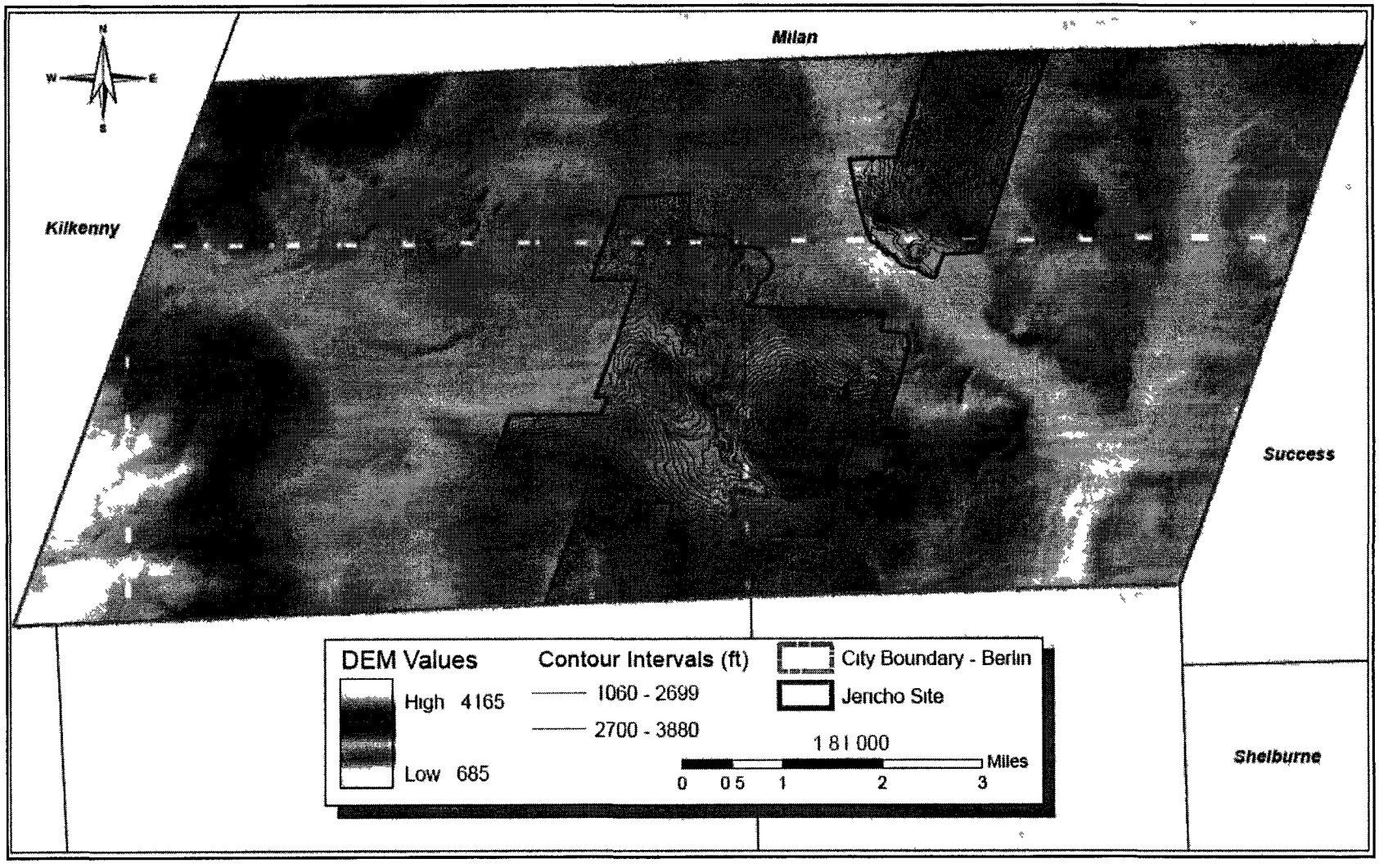
(t) The proposed trail avoids known locations of federally and state listed endangered or threatened species, or their habitat, as specified on a site-specific basis by the fish and game department

(u) The proposed trail avoids known locations of rare plants and exemplary natural communities, as specified on a site-specific basis by the natural heritage inventory

(x) The proposed trail is not within 330 feet of known raptor nest trees, or within 650 feet of trees with eagle or osprey nests

(y) The proposed trail is more than 650 feet from eagle winter roosting areas and 330 feet from the edge of wetlands containing heron rookeries.

Figure 15. Digital Elevation Model (DEM) & Hypsography.



In the absence of known data related to the above statutes the New Hampshire Wildlife Action Plan (WAP) was considered. The WAP was funded and mandated by the federal government with the purpose of providing decision-makers with better tools and data that would help to restore and maintain critical habitats and populations of the state's species of conservation and management concern (New Hampshire State Fish & Game, 2006 and 2007). The New Hampshire Wildlife Action Plan data layer was examined in detail using GIS tools and included an exploration of the procedures and limitations of these data noted in the metadata (New Hampshire Fish & Game, 2006 and 2007).

(v) The proposed trail avoids alteration or disturbance of unique geologic features, formations, and designated state geologic waysides, as specified on a site-specific basis by the state geologist. (w) The proposed trail avoids alteration, disturbance, and adverse impacts to cultural and historic resources.

Data for the two statutes above had not been developed to date and therefore could not be processed. These statures will be addressed *in situ* during development.

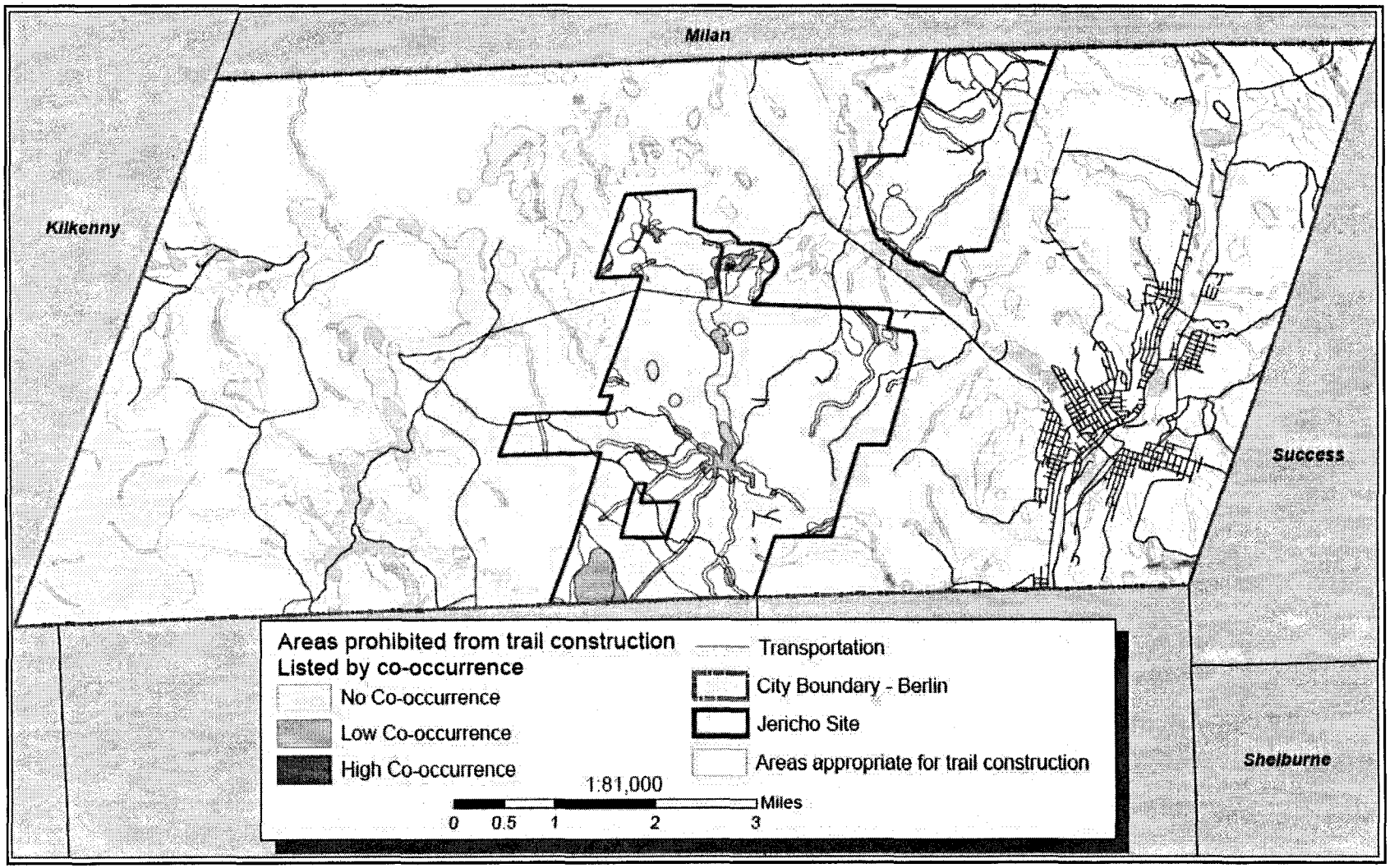
(k) The proposed trail layout minimizes further fragmentation of blocks of forestland by locating trails on areas with existing development whenever possible.

The above statute was not included due to the fact that all logging rights were retained by the former owners of the Jericho State Park, as part of the selling agreement. Furthermore, minimizing fragmentation on the site due to forestry practices is not the responsibility of the State of New Hampshire.

Areas Prohibited from Trail Construction. A final co-occurrence map depicting areas prohibited from trail construction was created using the results of all fine-grained evaluation criteria (Figure 16). Data layers showing areas on which trails cannot be built were combined using a geometric intersection tool, which combines all features, into 4 classes: 1) Areas appropriate for trail construction, 2) "No Co-occurrence", which are areas that are prohibited from trail construction, but do not have co-occurrence with other prohibitive characteristics, 3) "Low Co-occurrence" which are areas that are prohibited from trail construction and have co-occurrence with one other prohibitive characteristic, and 4) "High Co-occurrence" which are areas that are prohibited from trail construction and have co-occurrence with at least 2 other prohibitive characteristics.

New fields were added to the data layer; each field added represented a data layer used. Each feature was then populated with a value for the statute used in the corresponding field. That is, if a feature represented a stream buffer, then it was populated with a '1' in that field. If the feature was not representing a stream buffer, it received a value of '0'. The values for each feature were then tallied and entered into a new field named 'Sum". A field was then added in which acreage was calculated for each feature. Finally, the new data layer was symbolized according to the 'Sum' field and aforementioned classifications.

Figure 16. Co-occurrence Model based on Evaluation Criteria: Areas Prohibited from Trail Construction.



Chapter IV

RESULTS

GIS Analysis

Project Site

The initial exploration of the basemap data layers revealed the City of Berlin's corporate limit encompassed 39805.7 acres of land. The Jericho State Park boundary encompasses 7479.8 acres according to the data layer acquired from DRED. The Jericho State Park area includes a parcel of land acquired by the state known as the Dillon property as well as the area of Jericho Lake Park. The expectation is that this area will be donated to the state for incorporation into the ATV park development (Letter, 2005; Jericho, 2007). There was a 23.2 acre discrepancy between the site data layer and the documented total size in the Coos County Registry of Deeds records of 7503 acres (CCRD1161-0975, 519-0115, 39-0177).

FGC (d): the bureau has given due consideration to local planning and zoning ordinances

The results of examining the zoning ordinance for the City of Berlin (Table 1) showed that the city is approximately 75% residential, 15% Jericho Gateway, and about 8% industrial/business. The Jericho State Park is made up

Table 1 *Zoning Distribution for the City of Berlin, NH.*

ZONE CODE	ZONE DESCRIPTION	ACRES	%
RR	Rural Residential	28664.39	72.06
JG	Jericho Gateway	5981.14	15.04
IB	Industrial / Business	2761.71	6.94
RS	Residential Single-Family	1199.08	3.01
RG	Residential General	534.06	1.34
BG	Business General	416.74	1.05
RT	Residential Two-Family	186.07	0.47
DT	Downtown	35.68	0.09

Total Acerage= 39778.86

of 2 zones—approximately 63% Rural Residential Zone and 37% Jericho Gateway Zone (Table 2).

Table 2 Zoning Distribution for Jericho State Park.

ZONE CODE	ZONE DESCRIPTION	ACRES	%
RR	Rural Residential	4692.14	62.83
JG	Jericho Gateway	2776.40	37.17

Total Acerage= 7468.54

FGC (g): The proposal is reasonably compatible with existing uses.

The attributes associated with the conservation easements found within or abutting the Jericho State Park, originate from the GRANIT Conservation Lands Registry database. The Jericho State Park parcel completely contains one parcel of land and abuts another parcel; both are part of the White Mountain National Forest (WMNF) and are both listed under the same Tract ID. A third

parcel of land, known as Jericho Lake Park is also contained within the Jericho State Park boundary and is owned by the City of Berlin. All new and existing records in the Conservation Lands Registry database are accompanied by a list of characteristics about that parcel (Table 3). Most fields must be completed; however, an answer of "unknown" is an acceptable entry. The primary protection type for all conservation parcels is "fee ownership" which means that the organization owns the parcel and controls the development rights to the land. The Jericho Lake Park parcel is protected by the City of Berlin while the WMNF tracts are protected federally by the US Department of Agriculture, Forest Service. Discrepancies in reported and calculated sizes were quite large; the WMNF tracts are calculated to be 7100.1 acres larger than reported; the Jericho Lake Park tract is calculated to be 150.1 acres larger than reported. The WMNF tract's area as reported in the conservation lands associated data file is incorrect as the tract within the site area was not differentiated from the main tract which encompasses the entire WMNF. The WMNF size according to the spatial attributes of the conservation lands data layer is 99.5 acres, approximately 19 acres smaller than the Jericho State Park boundary.

Table 3 Summary of Attributes: Conservation Lands parcels found within or abutting the Jericho State Park.

Description	Abbreviation	#1	#2
Tract ID	TID	047-001 -	038-002 -
Parcel Name	NAME	White Mountain National Forest	Jericho Lake Park
Primary Protection Type	PPTYPE*	FO	FO
Term of Protection	PPTERMTYPE	Unknown	Unknown
Primary Protection Agency	PPAGENCY	22000	7020
Type of Primary Protection Agency	PPAGENTYPE*	2	1
Reported size of tract, in acres	RSIZE	720500	135
Calculated size of tract, in acres	CSIZE	727623.1	285.1
Protection Level	LEVEL*	1	1
Management Status	MSTATUS*	2	3

***PPTYPE**: FO=Fee Ownership
***PPAGENTYPE**: 2=Federal Agency, 1=Town/County
***LEVEL**: 1=Permanent conservation land. Land protected from development through conservation easement, restriction, or outright ownership by an organization or agency whose mission includes protecting land in perpetuity; more than 50% of area will remain undeveloped, 2=Unofficial conservation land. Owned by an agency or organization whose mission is not conservation, but whose intent is to keep the land for conservation, passive recreation, or educational purposes. Not permanently protected.
***MSTATUS**: 2=A tract totally protected from conversion of natural land cover and with a management plan in operation to maintain a primarily natural state, but where uses (e.g. vehicular traffic, hunting, etc.) and/or suppression of natural processes may degrade the quality of existing natural communities, 3=A tract protected from conversion of natural cover for more than 50% of area, but subject to extractive uses such as timber harvest or mining.

The Jericho State Park is 93% forested; less than 1% is dedicated to residential, commercial, industrial, and transportation uses combined (Table 4).

Table 4 Summary of Attributes: 2001 New Hampshire Land Cover.

GRIDCODE	DEFINITION	ACRES	%
110	Residential, commercial, or industrial	5.86	0.22
140	Transportaion	1.34	0.05
211	Row crops	2.01	0.07
412	Beech/oak	556.39	20.51
414	Paper birch/aspen	614.73	22.66
419	Other hardwoods	469.82	17.32
421	White/red pine	159.90	5.90
422	Spruce/fir	179.81	6.63
423	Hemlock	75.45	2.78
430	Mixed forest	467.68	17.24
500	Open water	1.52	0.06
610	Forested wetlands	15.17	0.56
620	Non-forested wetlands	67.69	2.50
710	Disturbed	3.00	0.11
790	Cleared/other open	92.03	3.39

FGC (j): The proposed trail layout incorporates existing motorized travel corridors whenever possible

The aerial photos from April, 2006 were georegistered using 4 control points and had a resulting root mean square error (RMS) of 11 feet. The photos had no known spatial or technical information associated with them. Digitized lines were compared to GPS coordinates. The lines were considered acceptable if they fell within 15 meters of the GPS coordinate. This was the positional accuracy root mean square error of the GPS unit without Wide Area Augmentation System (WAAS) correction.

Fifty-seven GPS points were collected on existing trails for ground reference. The GPS coordinates were collected using a Garmin E-Trex GPS device, while surveying the Jericho State Park on a Kawasaki Mule. Positional accuracy was improved by taking multiple (in some cases more than 5) GPS points for the same location and averaging them together. The results of the proximity analysis showed that 90% of the GPS points were within 15 meters of the digitized lines. The digitizing process exhibited 41.9 miles of various discernable travel corridors within the Jericho State Park and another 15.4 miles of travel corridors within close proximity of the site.

FGC (l): The proposed trail does not pass through a wellhead protection area as determined by the department of environmental services under RSA 485:48, II.

Results of the inquiry submitted to the New Hampshire Department of Environmental Services regarding wellhead protection areas showed that there were no wellhead protection areas within the site. However, the closest wellhead protection area was within the city limits, approximately 2 miles from the site.

FGC (m): The proposed trail is not located on earthen dams, dikes, and spillways.

The digitized representations of the dam/spillway and dike had a root mean square (RMS) error of 1.7ft and 3ft respectively. The dam and spillway are 13.1 acres in size and the dike is 2.1 acres in size.

FGC (n): The proposed trail avoids areas having soil types classified as important forest soil group IIA or IIB as defined and mapped by the Natural Resources Conservation Service, unless there is an existing soil condition or surface roadway that can be used to reduce adverse environmental impacts.

Soil characteristics for forest soil group IIA and IIB were summarized in Table 5. Forest soils from group IIA and IIB encompassed 810.31 acres or approximately 11% of the site. In general these soils were very stony or contained outcrops. Soils from group IIA made up 4.5% of the total area and were composed of soils classified as potentially highly erodible to highly erodible soils. These soils are non-Hydric, ranging from well-drained to somewhat excessively drained soils. Soils from forest soil group IIB made up 6.4% of the total area and were composed of soils classified as poorly drained to very poorly drained and therefore classified as Hydric soils. Soils, classified as Forest Soil Group IIB were found to be 100% Hydric. The majority of the soils were classified as potentially highly erodible with 2 soil types labeled not highly erodible. In general these soils were all considered very stony.

Table 5 Summary of Attributes: 2002 NH Soil Survey for Coos County, NH.

FOREST SOIL GROUP	ACRES	%	HYDRIC
IA	3683.06	49.2	N
IB	1260.35	16.9	N
IC	540.08	7.2	N
IIA	330.71	4.4	N
IIB	479.60	6.4	Y
NC	1184.77	15.8	N/A

FGC (o): The proposed trail is not within 100 feet of the ordinary high water mark of first and second order streams, 330 feet of third order streams, and 600 feet of fourth order and higher streams, except for purposes of stream crossing.

The stream characteristics of streams found within the Jericho State Park are summarized in table (Table 6). The total length of all streams within the site was 18.4 miles. The summary of stream characteristics did not reflect the sections of streams that were coincident with open water or wetland.

Table 6 Summary of Stream Characteristics within Jericho State Park.

NAME	MILES	STREAM ORDER
Not listed	12.66	1, 2
Dead River	0.15*	3
Jericho Brook	5.04**	1, 2, 3
North Branch Upper Ammonoosuc River	0.14	1
Tinker Brook	0.39	1
	TOTAL= 18.38	

* Due to boundary discrepencies between the Jericho site boundary and adjacent Dead River, it was assumed that the two were coincident and the total length given.

** Due to boundary discrepencies between the Jericho site boundary and adjacent Jericho Brook, it was assumed that the two were coincident and the total length given.

There was 13.6 miles of 1st order streams, 1.3 miles of 2nd order streams, and 3.4 miles of 3rd order streams (Table 7). The summary of stream characteristics did not reflect the sections of streams that were coincident with open water or wetland.

Table 7 Summary of Stream Order Characteristics within Jericho State Park.

STREAM ORDER	MILES
1	13.60
2	1.34
3	3.44*

* Due to boundary discrepencies between the Jericho site boundary and adjacent 3rd order stream(s), it was assumed that the two were coincident and the total length given.

As shown in Table 8, streams of the 1st and 2nd order, buffered for 100ft resulted in 370.34 acres of land. Streams of the 3rd order, buffered at 330ft resulted in 317.59 acres of land. There were no 4th order streams or higher within the project site. The sum of all stream buffers is 687.93 acres.

Table 8 Summary of Stream Buffer Measurements.

STREAM ORDER	STREAM BUFFER DISTANCE (ft)	AREA (ac)
1 & 2	100	370.34
3	330	317.59
4+	600	0
	TOTAL=	687.93

FGC (q): The proposed trail is not within 200 feet of any water body, forested or non-forested wetland or vernal pool.

There were 4 waterbodies identified, 3 of them were unnamed and the other was Jericho Lake (Table 9). The geoprocessing of wetlands within the site resulted in 53 different wetland polygons (Table 10). There were no vernal pools

Table 9 Summary of Waterbody Characteristics.

TYPE	NAME	ACREAGE
Lake/Pond	unknown	0.18
Lake/Pond	unknown	0.15
Lake/Pond	unknown	2.53
Lake/Pond	Jericho Lake	126.54
	TOTAL=	129.40

Table 10 Summary of Wetland Characteristics.

SYSTEM	CLASS	SUBCLASS	ACREAGE
palustrine	emergent	persistent	10.26
palustrine	forested	broad-leaved deciduous	27.58
palustrine	forested	dead	4.14
palustrine	forested	needle-leaved evergreen	19.6
palustrine	scrub-shrub	broad-leaved deciduous	44.25
palustrine	unconsolidated bottom	n/a	130.7
		TOTAL=	236.53

identified during this study. The total acreage of waterbodies and wetlands is approximately 369.9 acres. The resulting 200 foot buffer area is 604.9 acres, including the area for waterbodies and wetlands.

FGC (r): The proposed trail avoids elevations over 2700 feet.

The area of elevation over 2700 feet is approximately 1.8% of the entire site. The highest peak within the site is the lower peak of Black Crescent Mountain and is approximately 3142 feet in elevation. There was 134.4 acres of land with an elevation of 2700 feet or higher (Table 11).

Table 11 Summary of Elevation Characteristics.

ELEVATION (ft)	ACRES
3100-3160	52.2
3000-3100	38.3
2900-3000	24.1
2800-2900	16.3
2700-2800	3.5

TOTAL= 134.4

FGC (s): The proposed trail avoids important wildlife habitat features for species of concern, FGC (t): The proposed trail avoids known locations of federally and state listed endangered or threatened species, or their habitat, as specified on a site-specific basis by the fish and game department, FGC (u): The proposed trail avoids known locations of rare plants and exemplary natural communities, as specified on a site-specific basis by the natural heritage inventory; FGC (x): The proposed trail is not within 330 feet of known raptor nest trees, or within 650 feet of trees with eagle or osprey nests; FGC (y): The proposed trail is more than 650 feet from eagle winter roosting areas and 330 feet from the edge of wetlands containing heron rookeries.

An inquiry into the New Hampshire Natural Heritage Bureau revealed one area of known Loon habitat within the site boundary. Table 12 summarizes the land area within the Jericho State Park, quantified by the Wildlife Action Plan (WAP) of 2006. Areas associated with open waterbodies were excluded from the WAP statistics. Northern Hardwood Conifer Forests and Lowland Spruce-Fir Forests made up 96.7%, peatland, marsh and scrub wetland, and high elevation Spruce-Fir forests made up 2.6%, and open water made up 0.8% of habitat within the site boundaries. Table 13 summarizes how the habitat type within the project site ranks with all habitat type within the project site.

Table 12 Summary of Wildlife Action Plan Characteristics.

HABITAT TYPE	ACREAGE	PERCENTAGE (%)
Peatland	12.82	0.2
Northern Hardwood Conifer Forests	3827.81	51.2
Marsh and Scrub Wetlands	81.02	1.1
Lowland Spruce-Fir Forests	3404.67	45.5
High Elevation Spruce-Fir Forests	94.75	1.3
Open Water	58.81	0.8

TOTAL= 7479.88

Table 13 Summary of WAP Scoring.

Habitat Rank	Habitat Value	ACERAGE	%
1	Highest Ranked Habitat in NH	226.09	3
2	Highest Ranked Habitat in the Biological Region.	3075.26	41

FGC (m), (n), (o), (q), and (r): Total buffered area and co-occurrence results

There were 5 criteria which comprised areas that must be excluded from trail creation. The total areas for each of those are summarized in Table 14. However, the resultant data layers for each criterion have coincident areas. The total area, not including multiple coincidental areas, is 1835.22 acres.

Table 14 Summary of Acreage for Fine-Grained Criteria.

FINE-GRAINED CRITERIA	ACERAGE
FGC (m)	15.19
FGC (n)	813.52
FGC (o)	613.47
FGC (q)	604.93
FGC (r)	134.34

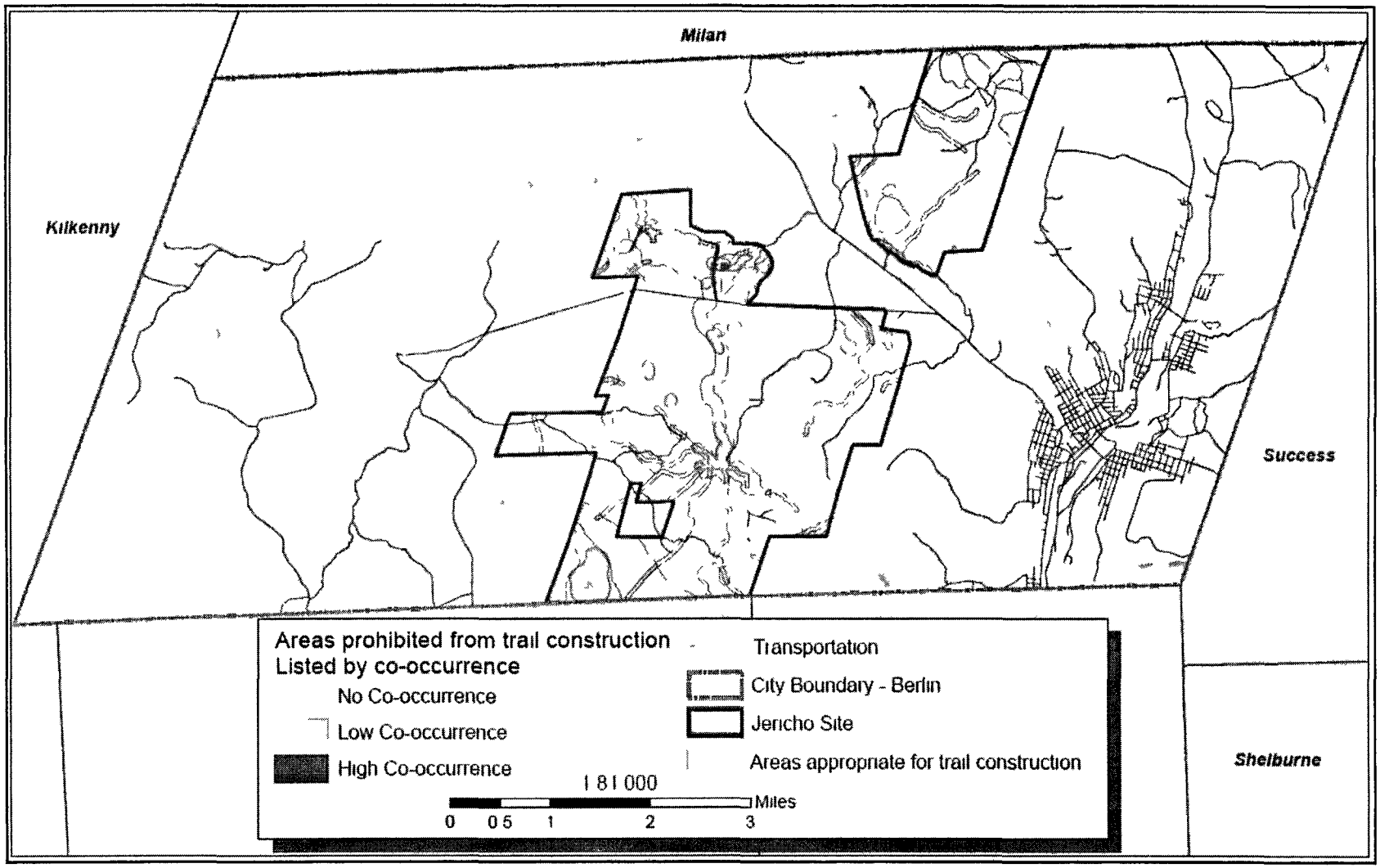
Final Co-Occurrence Map of Project Site

A co-occurrence map was created using the coincident areas (Figure 17). Priority 1 areas were low priority areas in which polygons were not coincident with other polygons or "no co-occurrence". As shown in Table 15, the total acreage for Priority 1 areas was 1494.91 acres. Priority 2 areas were polygons with 1 other coincident polygon or "low co-occurrence". The total acreage for Priority 2 areas was 334.42 acres. Priority 3 areas were high priority areas in which polygons were coincident with at least 2 other polygons or "high co-occurrence". The total acreage for Priority 3 areas was 5.9 acres.

Table 15 Summary of Co-occurrence Attributes.

PRIORITY	ACERAGE
1	1494.91
2	334.42
3	5.90
TOTAL=	1835.22

Figure 17. Final Co-occurrence Map.



CHAPTER V

DISCUSSION

This project examined the feasibility of developing a multiuse trail park on 7500 acres of state owned land in Berlin, NH. Prior to this evaluation, the extent of a trail network and placement of trails on the Jericho site was largely unknown.

The study was done by developing a GIS database that compiled existing spatial datasets, as well as deciphering the fine-grained criteria from RSA215-A: 43 II, and then converting them into spatial data. The area within the project site was evaluated using the RSA215-A: 43 evaluation criteria to determine trail placement in hopes that low impact trail construction could be maximized on the site to accommodate a wide breadth of users and uses.

The evaluation of the site revealed that the majority of the fine-grained criteria were evaluated and found not to be in conflict with trail construction; however, was clear that, based on the results of this study, there were some real concerns that needed to be addressed in order for this multiuse trail park to be constructed. Issues related to zoning, forest soils, wetlands, elevation, existing manmade features, and wildlife habitat, as well as some smaller infractions, needed to be remediated, before the park could be constructed. As will be discussed in a subsequent section, the aforementioned issues are currently not preventing construction of trails within Jericho Mountain State Park.

Non-spatial fine-grained criteria

There were 12 fine-grained criteria under RSA215-A: 43 II that had to be met for this portion of the evaluation to pass. Those criteria are as follows: FGC (a), (b), (c), (e), (f), (h), (i), (p), (z), (aa), (bb), and (cc). A brief discussion of each follows:

FGC (a): The new trail is supported by an organized ATV or trail bike club recognized by the bureau.

This criteria requires an ATV organization that is recognized by the NH Bureau of Trails, support any new trails. There were many ATV enthusiasts and ATV clubs that supported the creation of the Jericho Mountain State Part, but in August of 2006, the Androscoggin Valley ATV Club was officially recognized as the host club for the park (Horizons, 2007), by the NH Bureau of Trails. As host club for the park, the Androscoggin ATV Club was formally charged with the following rights and responsibilities (2007):

- To work cooperatively with the State in providing and maintaining an environmentally-sound, safe, functional, attractive, and user-friendly OHRV trail system.
- Exclusive rights to operate, manage, maintain and use, and to uphold the public right to use the trails, all in cooperation and coordination with the State.
- The trails will be open for OHRV seasonal use during the period May 23rd, or after continuous snow cover has melted, subject to closure as described in the Agreement. The trails are open to public use for non-motorized uses and are not limited to exclusive use by The Club.
- The Club shall work cooperatively with the State to mitigate the impact of the trails on natural resources and other uses of the property.

- The Club shall assist the State in maintenance of the trails and may apply for Grant-in-Aid funds for projects. The Club shall use best management practices as described in *Best Management Practices for Erosion Control during Trail Maintenance and Construction.*
- The Club shall monitor trail use in cooperation and consultation with the State and communicate with users of the trails to promote public safety and ensure that ecological conditions are not substantially diminished by OHRV use.
- The Club will submit to the State an annual Trial Maintenance Work Plan.
- The Club will conduct an OHRV User Education program as prescribed by the State, known as the *Volunteer Trail Patrol Program.*
- Prior to designated use of the trails, the state shall mark the trails in accordance with the *Trail Signing Handbook; Guidelines for Signing Wheeled OHRV Trails.*

In response to the creation of the Jericho Mountain State Park, the Androscoggin ATV Club's membership increased from 50 to approximately 250 members, and is currently still growing (Androscoggin, 2009). The quick increase in membership suggests an eagerness and excitement shared by a growing number of ATV enthusiasts.

At this point it is relatively unknown as to whether or not the club is actually satisfying its responsibilities. However, monitoring reports from the club have been sent to the NH Bureau of Trails. There are no regular updates or list of accomplished goals on any website, for either the Androscoggin ATV Club (http://www.avatvclub.org/ Home_Page.php) or the NH Bureau of Trails (http://www.nhstateparks.org/explore/state-parks/jericho-mountain-state-park.aspx). Information from these reports would be helpful and should be posted for the general public to view. There is much news however, on events at the park including riding events, special events such as mud racing, the construction

of new facilities, etc... The State is actively promoting awareness of the park to attract new riders.

FGC (b): ATVs or trail bikes operated on the trail will comply with maximum decibel limit[s] established by law.

According to NH RSA 215-A:12 on Manufacturing Specification Requirements, paragraph IV, "No person shall operate in this state a trail bike or all terrain vehicle which produces a sound level in excess of 96 decibels on the A scale, when measured in accordance with the provisions of the Society of Automotive Engineers Recommended Practice". Furthermore, to ensure that the decibel limits are followed, the operator of any OHRV can have the vehicle's decibel limit tested if requested by any law enforcement officer (NHRSA, 2007). The responsibility of enforcing this law and all laws related to this park is that of the NH Fish and Game Department, the NH Bureau of Trails, and the Berlin City Police Department (Horizons, 2007). To this point there have been minimal public issues related to noise. However, noise related disturbances have been reported by residents in proximity to other popular riding areas throughout the State. Furthermore, it does not take too much searching on the internet to find news stories related to local residents and their complaints of excessive noise from ATVs. One factor that might be related to the lack of noise-related complaints could be the relative rural location of the park.

FGC (c): Adequate parking exists or will be developed for the type of trail being proposed and the number of expected riders.

According to the parks Comfortable Carrying Capacity (CCC) model, developed by Horizons Engineering LLC., the park, during peak visitor days, will have parking enough to accommodate 720 total visitors (Horizons, 2007). This figure includes 670 active ATV users as well as 50 visitors not using ATVs. It is unclear if a proper build-out analysis has been conducted to account for growth past the initial 5yr master plan.

FGC (e): The proposed trail does not pass through a parcel with deed restrictions.

As described in detail, in earlier sections of this study, the final Jericho State Park is composed of several parcels of land: 1) the 293 acre Jericho Lake Park parcel, 2) two tracts of land purchased from Thomas R. Dillon and Scott A. Dillon equaling 7200 acres. Additionally, the Dillon's gifted to the state a 6.6 mile by 30ft wide recreational trail easement also within the Township of Berlin. The deeds for these parcels were cross-referenced with the current NH Conservation Lands data layer and were shown to have no restrictions. It should be noted that there are trails evident from the data and aerial photos that existed before the state acquired the land and thus do not need to meet this criteria because they are grandfathered into the law.

FGC (f): The bureau has given due consideration to local noise and obnoxious use ordinances.

There were several ordinances that were reviewed for this criterion. Chapter 17 (ZONING ORDINANCE), Article XVIII, Section 17-192 of the Berlin City Codes states that, "No structure or use in the City of Berlin shall emit noise, odors, air emissions, glare, heat, light, vibration or liquid and solid waste, which is found to be obnoxious, harmful or a nuisance to the municipality and its residents." However, the ordinance does not make mention to noise that originates from some other source other than a business or industrial use. The only mention of noise restraints is found in Section 17-193.5, which mentions that businesses cannot exceed 70 decibels at the A-weighted response scale, between 6:00 am and 10:00 pm, Monday through Saturday and 8:00 am to 10:00 pm on Sunday. Normal noise levels related to public or state owned areas have not yet been addressed.

In Chapter 10.5 (OFFENSES AND MISCELLANEOUS PROVISIONS), Article II, Section 10.5-16.3.G, there is mention of excessive noise in a public place. It states that a person will be found guilty of disorderly actions if a person causes a breach of the peace, public inconvenience, annoyance or alarm or creates a risk thereof by the following occur (Offensive, 2000):

> Operating any motor vehicle in a public place so as to make excessive noise by any of the following means:
>
> > 1. Misuse of power, acceleration or traction so as to spin the wheels or lose traction.
> >
> > 2. Misuse of brake and stopping power in the deceleration of a motor vehicle where no legitimate emergency exists.

3. There shall be no use of engine (Jake) brakes in the City of Berlin.

4. Racing of engine by means of the accelerator, carburetor or gear selector, either when the motor vehicle is in motion or stationary.

5. Use of the horn other than as a warning signal or to use the vehicle in any manner to create noise, which is not incidental to the vehicle's use as a mode of transportation.

Also, according to NH RSA Title XXI (MOTOR VEHICLES), Chapter 259, Section 259:60, ATVs and ORHVs are not excluded from the definition of a *motor vehicle.* Therefore these offences apply to the operators of ATVs and ORHVs. Penalties can range from $50.00 to $1000.00 if found guilty of aforementioned offences. The responsibility of enforcement will fall to the State and will require regular patrols.

FGC (h): The proposal does not violate federal, state, or local laws, FGC (i) : The proposal includes a monitoring and response system designed to detect and correct adverse environmental impacts, FGC (p): All stream crossing structures meet 5-year flood design criteria, FGC (z): The proposed trail layout has a safe and appropriate trail design, FGC (aa): Safety standards for highway crossings are met, FGC (bb): Any planned use of the proposed trail with other uses is safely accommodated, FGC (cc): Local enforcement officers have been contacted to review and provide input regarding enforcement issues.

As the intent of this study is neither to propose new trails, create trail park plan, nor to evaluate such plans, it was determined that discussion of these criteria is not relevant.

Spatial fine-grained criteria (Base map data layers)

The spatial fine-grained criteria are perhaps the most important aspect of this study. The final results of these of analyzing these criteria will have implications on whether or not the 7500 acres of land purchased by the state will be able to accommodate a multiuse trail park. The possibility of having enough area of unfragmented land on which to construct trails, which pass the criteria, is a real concern to those stakeholders of the park.

FGC (d): The bureau has given due consideration to local planning and zoning ordinances

There are two zoning districts that fall within the boundaries of the project site: 1) Jericho Gateway Zone and 2) Rural Residential Zone. Approximately 37% of the project site is designated *Jericho Gateway Zone*. In the *City of Berlin Zoning Ordinance Article 5A, Section 502.a. Uses*, lists all permitted uses within this zone. Included in the list is #12—Recreation facility, commercial-indoor, and outdoor. Also listed is #20—Accessory uses to the above (The City of Berlin, NH Zoning, 2007). These two uses suggest that a multi-purpose trail park and all activities associated with it are permitted. The other 63% of the project site is designated as *Rural Residential*. The *Rural Residential* zone designation for the City of Berlin has no "uses" permitted or "uses" with special exception that would allow for a recreational trail park or trail use. These results could potentially hinder park construction going forward and will need to be addressed by the sponsoring trail club and NH Bureau of Trails. Potentially, the State will need to

petition for waivers to this criteria, which is not unprecedented in New Hampshire.

FGC (g): The proposal is reasonably compatible with existing uses

The area immediately surrounding Jericho Lake is already a recreational facility. Furthermore, there is another area located within close proximity with the Jericho State Park and that is the Success Trail, maintained by the Androscoggin Valley ATV Club. There is also a network of existing ATV trails throughout the Jericho State Park currently. Therefore, it seems reasonable that the proposed use is compatible with the existing uses. Certainly, this proposal would help to put into place proper management and maintenance plans for the park and prevent potentially damaging activities related to ATV riding. So, not only is this use compatible, but it seems to be critical to the environmental health of the area.

FGC (j): The proposed trail layout incorporates existing motorized travel corridors whenever possible

Through the process of creating the *Trail & Access Roads* datalayer, it was determined that there was approximately 36 miles of existing well-traveled ATV trails and approximately 22 miles of less-traveled ATV trails. All of these trails are being considered for incorporation into the proposed trail layout. It was important to the state to incorporate these trails as to not further fragment the landscape.

FGC (l): The proposed trail does not pass through a wellhead protection area as determined by the department of environmental services under RSA 485: 48, II.

According to the Wellhead Protection Area data acquired from the NH DES (NH DES Water, 2007), there are no wellhead protection areas within the Jericho State Park. In fact, the closest wellhead protection area lies approximately 2 miles northeast of the upper unit of the site boundaries and is not a concern for trail construction.

FGC (m): The proposed trail is not located on earthen dams, dikes, and spillways.

The shapefile created to represent the area of the dam, dike, and spillway located within the Jericho State Park boundaries showed these features to cover approximately 15 acres. This area would be excluded from any existing and future trail proposals. There is a portion of an existing trail that is approximately 550ft in length that rides over the southwestern end of the dike located on the northeast side of Jericho Lake. This section of trail will need to be looked at more closely and perhaps re-routed to avoid any violation which could cause delay in the parks construction. Another alternative would be for the State to seek a waiver to his criteria.

FGC (n): The proposed trail avoids areas having soil types classified as important forest soil group IIA or IIB as defined and mapped by the Natural Resources Conservation Service, unless there is an existing soil condition or surface roadway that can be used to reduce adverse environmental impacts.

The analysis of the USDA soil data within the site revealed approximately 810 acres or roughly 11% of the area would need to be excluded from proposed trail development. The Forest Soil Group IIA comprised 330.71 acres and was not Hydric in nature. These soils are typically the most costly for trail development and maintenance due to their steep slopes, bedrock outcrops, erosive textures, surface boulders, and extreme rockiness. The Forest Soil Group IIB comprised 479.60 acres and was Hydric in nature. Further protection of these areas will be a formidable task because the inherent dangerous nature of the terrain is highly desirable to ATV riders looking for more challenging and technical experiences. Should the areas to be excluded become a concern, a new soil survey could be conducted to gain insight as to any anomalies in the current survey.

FGC (o): The proposed trail is not within 100 feet of the ordinary high water mark of first and second order streams, 330 feet of third order streams, and 600 feet of fourth order and higher streams, except for the purposes of stream crossing.

As was stated in earlier sections, due to time restraints and the complex nature of the OHWM data, the NHD stream boundaries were used. Therefore, there may be some differences in the final quantification of area to be excluded. The data layer created here should be used as a guide during ground referencing. There were 18.4 miles of 1st, 2nd, and 3rd order streams within the

site boundaries. When accounting for the 100ft buffers at the 1st and 2nd order, and 330ft buffer at the 3rd order, this equates to 687.93 acres of land that would need to be excluded from the trail proposal. There were no 4th order streams located within the site boundary. At the time of construction for certain trails, it will become necessary for a licensed hydrologist to be on-site and field-verify the exact location of the OHWM. Due to the fluctuation of this feature and the increase in flooding events this determination may be difficult.

FGC (q): The proposed trail is not within 200 feet of any water body, forested or non-forested wetland, or vernal pool.

There were 4 water bodies with the *lake/pond* designation. The three smaller unknown lakes and ponds totaled 2.86 acres. Jericho Lake, which is the only major lake within the site boundaries, is 126.54 acres. Additionally, several classes of wetlands were identified including emergent, forested, scrub-shrub, and unconsolidated bottom. The total area designated as wetlands within the site was 236.53 acres. The total area to be excluded for this criterion is 365.93 acres. The identification of vernal pools will be a difficult task. Although there are reoccurring pools, many change location from year to year depending on precipitation amounts. A walking survey of the area may be necessary before and after construction to determining any existing pools as well as any new pools that may be formed as a result of the construction. Vernal pools are critical to the preservation of our natural environment.

FGC (r): The proposed trail avoids elevations over 2700 feet

The areas within the site above an elevation of 2700 feet made up less than 2% of the total area within the site. This equated to 134.4 acres of land that would need to be excluded due to elevation. It seems that because the total area is so small, that possibly the NH Bureau of Trails could avoid this area for inclusion into their trail network while still creating an adequate trail network. In that situation, a petition for a waiver would not be necessary.

Statutes with no known data

FGC (s) The proposed trail avoids important wildlife habitat features for species of concern, (t) The proposed trail avoids known locations of federally and state listed endangered or threatened species, or their habitat, as specified on a site-specific basis by the fish and game department, (u) The proposed trail avoids known locations of rare plants and exemplary natural communities, as specified on a site-specific basis by the natural heritage inventory, (x) The proposed trail is not within 330 feet of known raptor nest trees, or within 650 feet of trees with eagle or osprey nests, and (y) The proposed trail is more than 650 feet from eagle winter roosting areas and 330 feet from the edge of wetlands containing heron rookeries.

The datum that would be associated with these criteria simply does not exist. This type of information is generally held by professionals working in the field. Efforts have not been made to create data in these areas. However, as was stated prior, the federal government helped fund and mandate the Wildlife Action Plan (WAP) with the purpose of providing decision-makers with better tools and data that would help to restore and maintain critical habitats and populations of the state's species of conservation and management concern (NEW

HAMPSHIRE STATE FISH & GAME, 2006). According to the *New Hampshire's Changing Landscape* report of 2005, prepared by Sundquist and Stevens (1999), our increasing footprint on this environment has put us in a situation where we need to improve out habitat conservation to preserve many important wildlife and habitat. Many of the specifics of the above statutes—"...species of concern...", "...endangered or threatened species or their habitat...", "...locations of rare plants and exemplary natural communities...", "...known raptor nest or nesting trees...", "...eagle winter roosting areas...", "...heron rookeries..."—are covered by Wildlife Action Plan. This datum should not only adequately address the criteria but it should also serve as a starting point for identifying priority areas within the site, city, county, and state for land conservation activities. In general 44% of the project site already contains some of the highest ranked habitat in the state and biological region.

FGC (v) The proposed trail avoids alteration or disturbance of unique geologic features, formations, and designated state geologic waysides, as specified on a site-specific basis by the state geologist, and (w) The proposed trail avoids alteration, disturbance, and adverse impacts to cultural and historic resources.

Data have not yet been created for these two statutes. Although the NH GIS data clearinghouse (NH GRANIT) does have some geologic data related to unique features in the southern portion of the state, there are currently no known data nor plans to create data for the northern part of the state. Similarly, there is datum related to "key destinations" within the state, but an investigation into this datum showed that it was more of a list of critical infrastructure in the state. A

spatial exploration of this datum showed no "key destination" points within the project site. Locating valuable geologic features and cultural and historical points of interest should be a goal as the multi-use trail project proceeds.

FGC (k) The proposed trail layout minimizes further fragmentation of blocks of forestland by locating trails on areas with existing development whenever possible.

Due to the fact that the logging rights were retained by the former owners, it is anticipated that the project site will undergo some logging practices. It is not clear at this point what the former owner's intend to do. However, once again it is important to reiterate the value of the land as it stands in situ. Any logging practices on this land could severely alter the landscape and any key habitat types that are inherent to forested lands.

Areas excluded from building ATV trails

The final co-occurrence map was a culmination of all the data resulting from the overlay analysis. The final ranking of land was set on a relative scale such that decision makers involved in the Jericho project would have a better understanding of the value of land within the project site.

Overall, there are 1835 acres or 25% of the project site that has been categorized as being land with co-occurrence with one or more evaluation criteria. That is, 25% of the area was prohibited from trail construction because it did not pass one of the fine-grained evaluation criteria. Furthermore, those 1835 acres of land are highly fragmented. Despite the fact that the land prohibited

from building trails only makes up 25%, the implications of it being so fragmented and dispersed carries a much higher impact on the site as a whole. If the vision of the park is to be realized, then the New Hampshire Bureau of Trails in working with Horizon's Engineering, will need to consider adjustments to their design or will need to seek special waivers for some, if not all of the fine-grained evaluation criteria outlined in RSA 215-A: 43 II.

Lessons Learned and Recommendations

Using Geographic Information Systems (GIS) on this project proved to be a critical and effective tool for several reasons including:

1) As most any project involving law or scientific terminology, the meaning and interpretation of key concepts or ideas can often become muddled by overly complex or wordy explanations. GIS helped to illustrate these laws in such a way that it made it easy for anyone to understand. One only need to study a data layer or map produced by GIS to fully understand the implications a particular statute had on the placement of trails within the project site. When you tie each statute to a map display, the effects are powerful, often inciting questions and comments from an audience that otherwise might have been confused or mistaken in their assumptions.

2) The GIS can offer a reality check for the user as well, often helping to direct the user to the next steps necessary in achieving the goal of the study. For example, finding discrepancies between base-map data and aerial photos suggest the need for ground reference data; seeing a definite boundary for data

that often changes too frequently to have one, serves as a reminder that GIS data is often limited in its accuracy with respect to scale. That is, certain data layers such as soil units, land cover, hydrography, etc..., cannot be treated as exact. If anything, these types of layers are relevant only for a point in time or may be the interpretation of a few individuals and may need additional data to validate its representation.

3) The GIS can also help us understand change over time. Throughout this project the ability to see the same data at different time intervals has been invaluable. For example, discerning when a trail appeared on the landscape helped to understand why certain trails were lying in areas where the statutes clearly prohibited them. After an evaluation of aerial photos from several different years, decades apart in some instances, it was obvious that some trails existed well before the land was acquired by the state for the use as a trail park. Additionally, as this project proceeds into the future, the NH Bureau of Trails, together with other stakeholders will be able to re-evaluate the project site periodically, as new data becomes available or existing data is updated. The Wildlife Action Plan data is an example of this. The new WAP data may highlight certain habitat that was not previously unknown or it may even eliminate an area which was previously marked as undevelopable.

4) Identifying gaps in data was an important process in this project. The Wildlife Action Plan data were an effective substitution for several undeveloped data layers. The plan clearly delineated areas that the state should consider when developing trails on this or any other state owned property. The scientific

research behind the data supports its use and the consistency for which it is being updated shows that it can be counted on in the future. Furthermore, other organizations concerned with wildlife and habitat issues have already turned to using this data to help answer questions related to conservation efforts.

5) Finally, with the technological prowess of most people today, there exists the possibility for the NH Bureau of Trails to enlist the help of OHRV/ATV enthusiasts and others using the multi-use trail park. Sightings of wildlife, vegetation loss, trail erosion, as well as safety and enforcement violations could all be captured and reported using the average cell phone and/or GPS unit. GIS users at the NH Bureau of Trails could then upload this data into their GIS and assign it some follow-up action.

CHAPTER VI

EPILOGUE

Changes to the NH RSA

Horizon's Engineering wrote in their report, "... [That] there are several areas where some of the proposed full build-out trails cannot be constructed given the current Statutes" (Horizon's Engineering, 2007). So, it was evident early on in the project that these restrictions would need to be addressed or the extent of trail development would need to be downsized. The report further suggested that the current statutes were meant to be parameters with which to measure trail development plans on a case-by-case basis, alluding to the need to re-evaluate the current statutes. Their final report summary stated, "...it is unlikely that all 136 miles of proposed trails will be feasible given strict adherence to several of the fine filter criteria in the current Statutes", and they especially had issue with Section 215-A: 43: (n), (o), (q), (r), (s), (t), (u), (x), and (y):

(n) The proposed trail avoids areas having soil types classified as important forest soil group IIA or IIB as defined and mapped by the Natural Resources Conservation Service, unless there is an existing soil condition or surface roadway that can be used to reduce adverse environmental impacts.

(o) The proposed trail is not within 100 feet of the ordinary high water mark of first and second order streams, 330 feet of third order streams, and 600 feet of fourth order and higher streams, except for the purposes of stream crossing.

(q) The proposed trail is not within 200 feet of any water body, forested or non-forested wetland, or vernal pool.

(r) The proposed trail avoids elevations over 2700 feet.

(s) The proposed trail avoids important wildlife habitat features for species of concern

(t) The proposed trail avoids known locations of federally and state listed endangered or threatened species, or their habitat, as specified on a site-specific basis by the fish and game department

(u) The proposed trail avoids known locations of rare plants and exemplary natural communities, as specified on a site-specific basis by the natural heritage inventory

(x) The proposed trail is not within 330 feet of known raptor nest trees, or within 650 feet of trees with eagle or osprey nests

(y) The proposed trail is more than 650 feet from eagle winter roosting areas and 330 feet from the edge of wetlands containing heron rookeries.

As a result of this, there have been several revisions to RSA 215. Section 215-A 43 now has parts VI, VII, and VIII which address the Jericho Mountain state park (NHRSA, 2007):

> **VI.** The property acquired for the purposes of developing ATV and trail bike trails in the city of Berlin by the department of resources and economic development, division of parks and recreation, bureau of trails, and any abutting land donated or acquired after the effective date of this paragraph, shall hereby be known as Jericho Mountain state park.
>
> **VII.** Notwithstanding the provisions of this section to the contrary, at Jericho Mountain state park:
> (a) An ATV or trail bike trail may be established and subsequently maintained within Jericho Mountain state park even though it:
> (1) Is within 330 feet of a known raptor nest provided that it is not within 650 feet of trees with eagle or osprey nests; or
> (2) Fails to comply with the criteria in RSA 215-A:43, II(o) and (q) to the extent that it is utilizing an existing surface roadway located within the protected area which would reduce adverse environmental impacts.
> (b) Site specific waivers of the criteria specified in RSA 215-A:43, II(o) and (q) are only allowed on trails in Jericho Mountain state park provided that all of the following criteria

are met:
(1) There is no practicable alternative location of the trail that would meet the criteria in RSA 215-A:43, II;
(2) The proposed trail location and construction is the least impacting alternative; and
(3) Conditions of the site specific waiver are authorized in writing by:
(A) The department of resources and economic development, in agreement with the fish and game department, for waivers at Jericho Mountain state park that will have no impact on water quality; or
(B) The department of resources and economic development, in agreement with the fish and game department and the department of environmental services for waivers at Jericho Mountain state park that may have an impact on water quality.
(c) A person may operate an OHRV within Jericho Mountain state park which weighs up to 1,200 pounds and is no wider than 60 inches.

VIII. This section shall not apply to department of transportation property required for trail crossing or connector permits at, or which directly connect to, Jericho Mountain state park.

The first change is to the size and weight of allowable ATVs within Jericho Mountain State Park. The weight limit has increased from 1000lbs to 1200lbs and the width of the ATVs has increased from 50in to 60in. The second change is that statutes (o), (q), and (x) no longer have to be adhered to within the park boundaries:

(o) The proposed trail is not within 100 feet of the ordinary high water mark of first and second order streams, 330 feet of third order streams, and 600 feet of fourth order and higher streams, except for the purposes of stream crossing.

(q) The proposed trail is not within 200 feet of any water body, forested or non-forested wetland, or vernal pool.

(x) The proposed trail is not within 330 feet of known raptor nest trees, or within 650 feet of trees with eagle or osprey nests

These changes as well as design changes to the trail plan will no doubt affect the total mileage of trails that can be developed.

Other Changes

There have been other changes as a result of the Jericho Mountain State Park as well. The City of Berlin has amended its Zoning Ordinance. The Rural Residential zone which made up 63% of the project site and did not allow recreational facilities or their accessory uses has been added to that designation. As of July 19th, 2004, public recreational facilities and their accessory uses are now permitted (Zoning, 2004).

Current State of Jericho Mountain State Park

Currently, Jericho Mountain has over 50 miles of scenic ATV trails. These trails are open to the public year round except during the muddy season, approximately April – May (Jericho, 2009). There are many ATV events taking place including jamborees and ATV festivals. A network of trails complete with color-coded difficulty ratings (Green = very easy, Blue = medium, Black = advanced/technical). Although the park is not complete yet, there have been making steady progress towards the new goal of 136 miles of trails.

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APPENDIX A

Section 215-A:43

215-A:43 Evaluation Process. – Any new ATV or trail bike trail proposal on state-owned property shall be evaluated by the department of resources and economic development using a 2step process. I. The new ATV or trail bike trail proposal shall be considered to have passed the initial screening process if the following coarse filter criteria are met: (a) There are no deed restrictions, laws, or purchase funding source restrictions that prohibit the use of ATVs or trail bikes on the property. (b) Less than 90 percent of the property is composed of the following types of areas in combination: (i) Exemplary natural communities as identified by the natural heritage bureau as defined in RSA 217-A:3, XVI; (ii) Habitat necessary for the successful breeding or survival of federal or state listed endangered or threatened species; and (iii) Forested wetlands consisting of group IIB forest soils as defined and mapped by the Natural Resources Conservation Service or non-forested wetlands as defined by the department of environmental services. (c) If it is to be a self-contained trail network, at least 700 contiguous acres are available within which the trail network can be situated, in either single state ownership or as a combination of abutting state properties. (d) If it is to be a trail corridor link, the trails which are being connected exist or will exist when the trail corridor link is established, or shortly thereafter. (e) The use of ATVs or trail bikes on the property does not conflict with the purpose for which the property was acquired by the state as provided by law, or as attested to by

letters from grantors, department memoranda, historic records, or other credible documents, or, if such conflict exists, it has been set aside by some legal means that includes a formal review process by the custodial state agency. (f) The use of ATVs or trail bikes on the property is not prohibited by an existing management plan for the property. II. A new ATV or trail bike trail proposal that has passed the initial screening process of the coarse filter criteria under paragraph I shall proceed into a planning and layout phase and shall be considered to have passed such phase if the following fine filter criteria are met: (a) The new trail is supported by an organized ATV or trail bike club recognized by the bureau. (b) ATVs or trail bikes operated on the trail will comply with maximum decibel limit established by law. (c) Adequate parking exists or will be developed for the type of trail being proposed and the number of expected riders. (d) The bureau has given due consideration to local planning and zoning ordinances. (e) The proposed trail does not pass through a parcel with deed restrictions. (f) The bureau has given due consideration to local noise and obnoxious use ordinances. (g) The proposal is reasonably compatible with existing uses. (h) The proposal does not violate federal, state, or local laws. (i) The proposal includes a monitoring and response system designed to detect and correct adverse environmental impacts. (j) The proposed trail layout incorporates existing motorized travel corridors whenever possible. (k) The proposed trail layout minimizes further fragmentation of blocks of forestland by locating trails on areas with existing development whenever possible. (l) The proposed trail does not pass through a wellhead protection area as determined

by the department of environmental services under RSA 485:48, II. (m) The proposed trail is not located on earthen dams, dikes, and spillways. (n) The proposed trail avoids areas having soil types classified as important forest soil group IIA or IIB as defined and mapped by the Natural Resources Conservation Service, unless there is an existing soil condition or surface roadway that can be used to reduce adverse environmental impacts. (o) The proposed trail is not within 100 feet of the ordinary high water mark of first and second order streams, 330 feet of third order streams, and 600 feet of fourth order and higher streams, except for purposes of stream crossing. (p) All stream crossing structures meet 5-year flood design criteria. (q) The proposed trail is not within 200 feet of any water body, forested or non- forested wetland, or vernal pool. (r) The proposed trail avoids elevations over 2700 feet. (s) The proposed trail avoids important wildlife habitat features for species of concern. (t) The proposed trail avoids known locations of federally and state listed endangered or threatened species, or their habitat, as specified on a site-specific basis by the fish and game department. (u) The proposed trail avoids known locations of rare plants and exemplary natural communities, as specified on a site-specific basis by the natural heritage inventory. (v) The proposed trail avoids alteration or disturbance of unique geologic features, formations, and designated state geologic waysides, as specified on a site-specific basis by the state geologist. (w) The proposed trail avoids alteration, disturbance, and adverse impacts to cultural and historic resources. (x) The proposed trail is not within 330 feet of known raptor nest trees, or within 650 feet of trees with eagle or osprey nests. (y) The proposed trail is

more than 650 feet from eagle winter roosting areas and 330 feet from the edge of wetlands containing heron rookeries. (z) The proposed trail layout has a safe and appropriate trail design. (aa) Safety standards for highway crossings are met. (bb) Any planned use of the proposed trail with other uses is safely accommodated. (cc) Local enforcement officers have been contacted to review and provide input regarding enforcement issues. III. The bureau shall hold at least one meeting to inform the public and local cities and towns of the plan and layout for a proposed ATV or trail bike trail, consistent with the fine filter criteria in paragraph II, and to provide an opportunity for the public to comment. Information on the plan and layout shall be made available to the public at a place in the local area in which the proposed trail is to be located, at the bureau's office in Concord, and on a public accessible Internet site maintained by the bureau. The meeting and the places to obtain the information on the plan and layout shall be advertised at least 14 days prior to the meeting in a newspaper of statewide circulation and also in any local newspapers to the cities and towns in which the state property is located. IV. No person shall operate an OHRV wider than 50 inches or over 1000 pounds on any state-owned trails. V. This section shall not apply to the change in use designation of rail trails to include ATV and trail bike use.