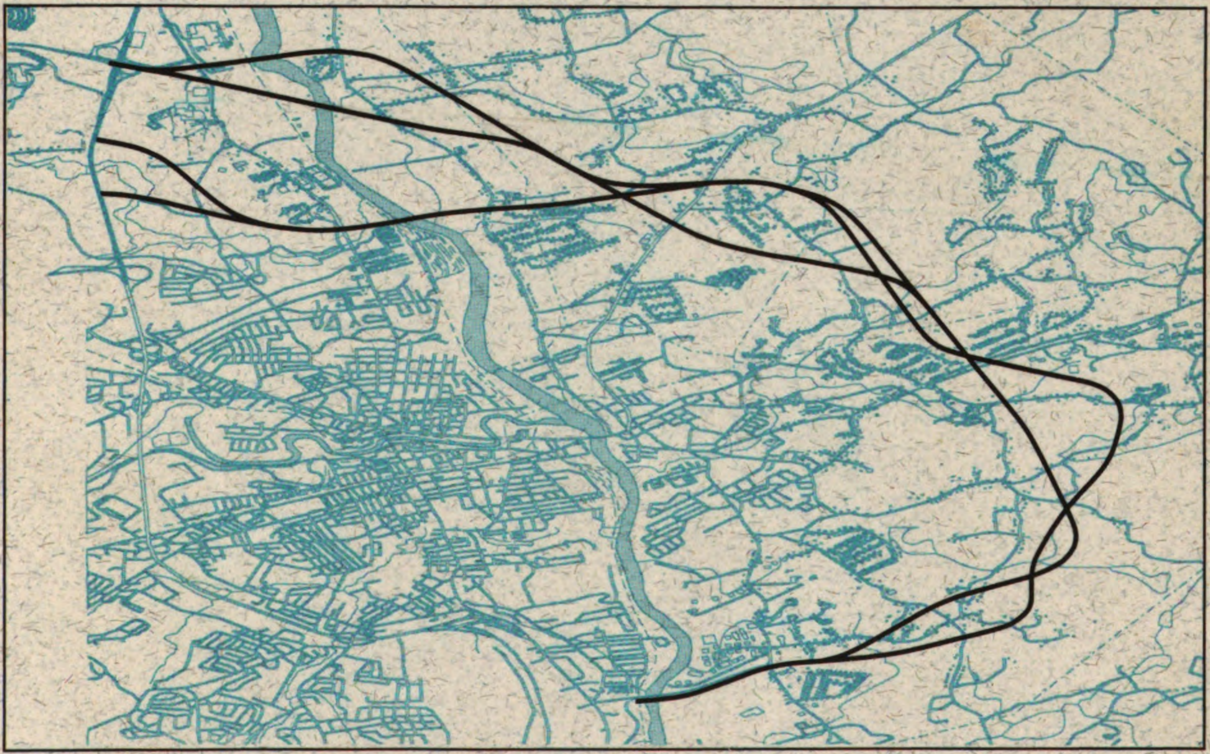
NASHUA-HUDSON
CIRCUMFERENTIAL HIGHWAY

FINAL
ENVIRONMENTAL IMPACT STATEMENT

VOLUME I

OCTOBER 1993



U.S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DIVISION

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NASHUA-HUDSON CIRCUMFERENTIAL HIGHWAY

LEAD AGENCY: U.S. Department of the Army, Corps of Engineers

Cooperating Agencies: U.S. Environmental Protection Agency
U.S. Fish & Wildlife Service
U.S. Department of Agriculture, Soil Conservation Service

State Coordinating Agencies: NH Department of Environmental Services
NH Division of Historic Resources

Applicant: New Hampshire Department of Transportation

AFFECTED JURISDICTION: Hillsborough County, New Hampshire towns of: Hudson, Litchfield, and Merrimack; City of Nashua

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ABSTRACT: This Final Environmental Impact Statement (FEIS) describes impacts of the proposed Nashua-Hudson Circumferential Highway, a limited access toll road in the City of Nashua and the towns of Hudson, Litchfield and Merrimack, Hillsborough County, New Hampshire. The project purpose is to better serve east-west traffic and relieve existing traffic congestion in the Central Business Districts of the City of Nashua and Town of Hudson by providing alternative crossings of the Merrimack River. A DEIS was prepared in 1984 for this proposed project. At that time, the proposed highway was included in the Federal-Aid Highway Program, and the sponsoring Federal agency was the Federal Highway Administration. Before development of a FEIS, the project was withdrawn from the Federal-Aid Highway Program and added to New Hampshire's Turnpike Program. The responsibility for compliance with Section 404 of the Clean Water Act, and Section 10 of the Rivers and Harbors Act was placed with the U.S. Army Corps of Engineers. Preparation of a revised DEIS was initiated in 1990 and was completed in October 1992. A Public Hearing was then held on January 4, 1993. Based on comments received during the Public Hearing and subsequent review period, further refinements were made to the document, culminating in this FEIS, issued October 1993. Seven Full Build Alternative alignments, Partial Build Alternatives, Transit/Transportation Demand Management and Transportation Systems Management Alternatives, and the No Build Alternative are presented in this FEIS. In addition to transportation requirements, the major concerns described are impacts on wetlands and water resources; wildlife; socioeconomic impacts including displacement, cumulative development, and compatibility with community and regional plans; noise and air

quality; and historic and archeological resources. Changes based on review of the DEIS are incorporated into this FEIS in italics.

Public comments may be provided to Ms. Theresa Flieger at the Corps of Engineers, New England Division (Attn: CENED-OD-R), 424 Trapelo Road, Waltham, MA 02254-9149 or by telephone: (617) 647-8336 or Toll Free 1-800-362-4367 (Massachusetts only), 1-800-343-4789 (other New England States). Comments on the Final EIS must be received within 30 days of Publication in the Federal Register.

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SUMMARY

S.1 INTRODUCTION

The National Environmental Policy Act (NEPA) of 1969 (42 U.S.C. 4322 et seq.) requires that all Federal proposals for major actions which significantly affect the human environment be accompanied by an environmental impact statement (EIS). This document represents the Final EIS (FEIS) which documents three fundamental aspects of the proposed highway project under consideration. First, it identifies the purpose and need for the project. Second, it identifies all reasonable alternatives which can satisfy that purpose and need. Third, it quantifies, to the extent appropriate, all impacts which are attributable to each of the reasonable alternatives identified.

The objective of this process is to insure that environmental information is available to public officials and citizens before decisions are made and actions are taken. It is undertaken by the US Army Corps of Engineers, New England Division, (Corps), and supports its evaluation of whether or not to authorize the proposed construction of a Circumferential Highway which would impact the New Hampshire communities of Hudson, Litchfield, Nashua, and Merrimack. The authority and rules by which the Corps takes this action are embodied in two federal acts: the Rivers and Harbors Act, and the Clean Water Act.

S.2 JURISDICTIONAL AUTHORITIES

Section 10 of the Rivers and Harbors Act approved March 3, 1899, (33 U.S.C. 403) prohibits the unauthorized obstruction or alteration of any navigable water of the United States. The construction of any structure in or over any navigable water of the United States, the excavation from or depositing of material in such waters, or the accomplishment of any other work affecting the course, location, condition, or capacity of such waters is unlawful unless the work has been recommended by the Chief of Engineers and authorized by the Secretary of the Army. The instrument of authorization is designated a permit. The Merrimack River in this portion of the study area is considered a navigable water of the United States.

Section 404 of the Clean Water Act (33 U.S.C. 1344) authorizes the Secretary of the Army, acting through the Chief of Engineers, to issue permits, after notice and opportunity for public hearing, for the discharge of dredged or fill material into the waters of the United States. Prepared by the Environmental Protection Agency (EPA) in consultation with the Corps, the Section 404(b)(1) Guidelines (40 CFR Part 230) are the federal environmental regulations for evaluating the filling of waters and wetlands. These guidelines restrict discharges of dredged or fill material where less environmentally damaging, practicable alternatives exist. The Corps is following these guidelines in its evaluation of the present proposed project.

S.3 PROJECT PURPOSE AND NEED

The purpose and need of this project is to provide a transportation improvement to assist east-west traffic movements and to reduce congestion on existing bridges and streets in and near the Central Business Districts of Nashua and Hudson by adding new crossings of the Merrimack River. In addition, the goal is to improve and reduce traffic congestion as described above in the highway design year over the existing levels.

S.4 ALTERNATIVES

The proposed Nashua-Hudson Circumferential Highway would be a limited access toll road in the City of Nashua and the towns of Hudson, Litchfield and Merrimack, Hillsborough County, New Hampshire. Initial evaluations were made of potential alternatives designed to avoid impacts on identified resources such as wetlands and structures. That study evaluated 33 alternative alignments. Subsequent analyses in compliance with public and agency coordination following the Corps Highway Methodology, resulted in identification of six Full Build Alternative alignments, a series of Partial Build Alternatives, in addition to No Build, Transit/Transportation Demand Management and Transportation Systems Management Alternatives. Full Build Alternatives were studied in detail in this FEIS.

Subsequent to the October 1992 publication of the DEIS, a new Full Build Alternative alignment, Alternative 9, was defined (see page 2-39, Figure 2-5, "clear overlay"). This new alternative alignment consists of selected sections of Alternatives 3 through 6 and, 7 and 8. In the southern section of the study area, Alternative 9 follows the same corridor that is shared by Alternatives 3 through 6. Immediately north of Second Brook, Alternative 9 departs from Alternatives 3 through 6 and follows the common alignment shared by Alternatives 7 and 8. Alternative 9 continues along this route across the Merrimack River until the point where Alternatives 7 and 8 split just east of Manchester Street. Beyond this point, Alternative 9 follows a route shifted slightly to the south of Alternative 8. Alternative 9, like Alternative 8, connects to the F.E. Everett Turnpike by the same proposed interchange at

Exit 9. Alternative 9 was derived based on examination of pertinent data presented in the DEIS and review of input from cooperating agencies and the public. Alternative 9 is a viable alternative that meets the Project Purpose and Need and which may further minimize environmental impacts. Its derivation and environmental consequences are provided in Chapter 2 of this FEIS (See Section 2.4.2).

S.5 BENEFICIAL/ADVERSE EFFECTS

Beneficial effects expected if the project were implemented:

- Relief of existing traffic congestion in the Central Business Districts of Nashua and Hudson.
- Improvement of air quality relative to traffic congestion relief.
- Relief of congestion on existing bridges by the construction of an additional crossing of the Merrimack River north of the existing Taylor Falls Bridge, and an additional structure at the Sagamore Bridge.
- Construction of a connecting highway to link all major arterials in the study area.
- Completion of a significant piece of the long standing regional infra-structure development plan.
- Support of a planned course of land development opportunity enabled by the project.

Adverse effects expected, were the project implemented:

- Continued fragmentation of the environment of southern New Hampshire.
- Filling between 21 and 51 acres of National Wetland Inventory (NWI) wetlands and between 48 and 71 acres of hydric soils.
- Acceleration by ten years of anticipated land development.
- Removal of between 11 and 53 residences, and between 2 and 3 business structures.
- Potential impacts to the Pennichuck water supply and/or watershed.

S.6 MAJOR ISSUES

Three major issues surfaced during the preparation of this EIS.

- Achieving the project purpose and need requires an assessment of the adequacy of existing and predicted transportation characteristics. Confidence in that assessment is dependent on the level of confidence that experts have in the transportation model used and the traffic information it provides.

- The second issue is related to the first. EPA and Department of Interior, Fish and Wildlife Service (FWS) representatives questioned whether the whole project was required in order to meet the project purpose and need. The question pursued was whether "partial build" alignments could satisfy the basic transportation-driven project purpose and need.

- The third distinct issue concerned public comment in opposition to all aspects of the proposal due to the inclusion of tolls as part of the highway.

S.7 MAJOR FINDINGS AND CONCLUSIONS

- Because transportation planning is central to evaluation of the project purpose and need of the proposed action, the Corps requested and received expert advice from the Federal Highway Administration of the US Department of Transportation (FHWA). FHWA reviewed the traffic model and its projections as they applied to this project.. It concluded that all "...traffic projections were reasonable." It similarly reviewed alternative alignments in light of traffic projections and concluded that "the Full Build Alternatives meet the project purpose and need." It similarly reviewed all Partial Build Alternatives and concluded that in each and every instance, the Partial Build Alternatives do "...not appear to meet the project purpose and need."

- Based on its evaluation of the data, and in consideration of the expert advice provided by FHWA, the Corps determined that only Full Build Alternative alignments meet the purpose and need of this project. The Corps has agreed, however, at the request of the EPA, to display the Partial Build Alternatives and their respective Level of Service (LOS) projections and environmental impacts in the alternatives section of the FEIS. Displaying the information in this manner will further ensure the public's opportunity to effectively comment on them and compare environmental trade-offs with the Full Build Alternatives.

- The Corps finds that all information relevant to its evaluation of this proposed project is defined and documented by this FEIS and it is, therefore, sufficient to serve as the basis to define the project and its probable environmental impacts. As such, this document serves to fully disclose the alternative alignments being considered, including the No Build Alternative, Transportation Systems Management, and the Transit/Transportation Demand Management Alternatives.

- After the publication of the DEIS, the NHDOT selected Alternative 8 to present at the January 4, 1993 Public Hearing as its preferred alternative. Subsequent to this, a new alternative, Alternative 9, was defined that further minimizes environmental impacts in compliance with the requirements of the Clean Water Act. This alternative is now the NHDOT's proposed action for a Corps permit decision.

- The Corps will determine a Least Environmentally Damaging Practicable Alternative (LEDPA), subsequent to a Public Hearing, and review of all public comments relative to the project.

- Project financing by tolls, or other means, is a consideration wholly under the purview of the applicant, the State of New Hampshire. Therefore, comment on this and any subject related to amortizing project financial costs is deferred to the State of New Hampshire. Those considerations are not part of this FEIS. Only those impacts germane to toll booth siting and consequent impacts on the human and the natural environment have been assessed by this present analysis.

Chapter 1
Project Purpose and Need for Action

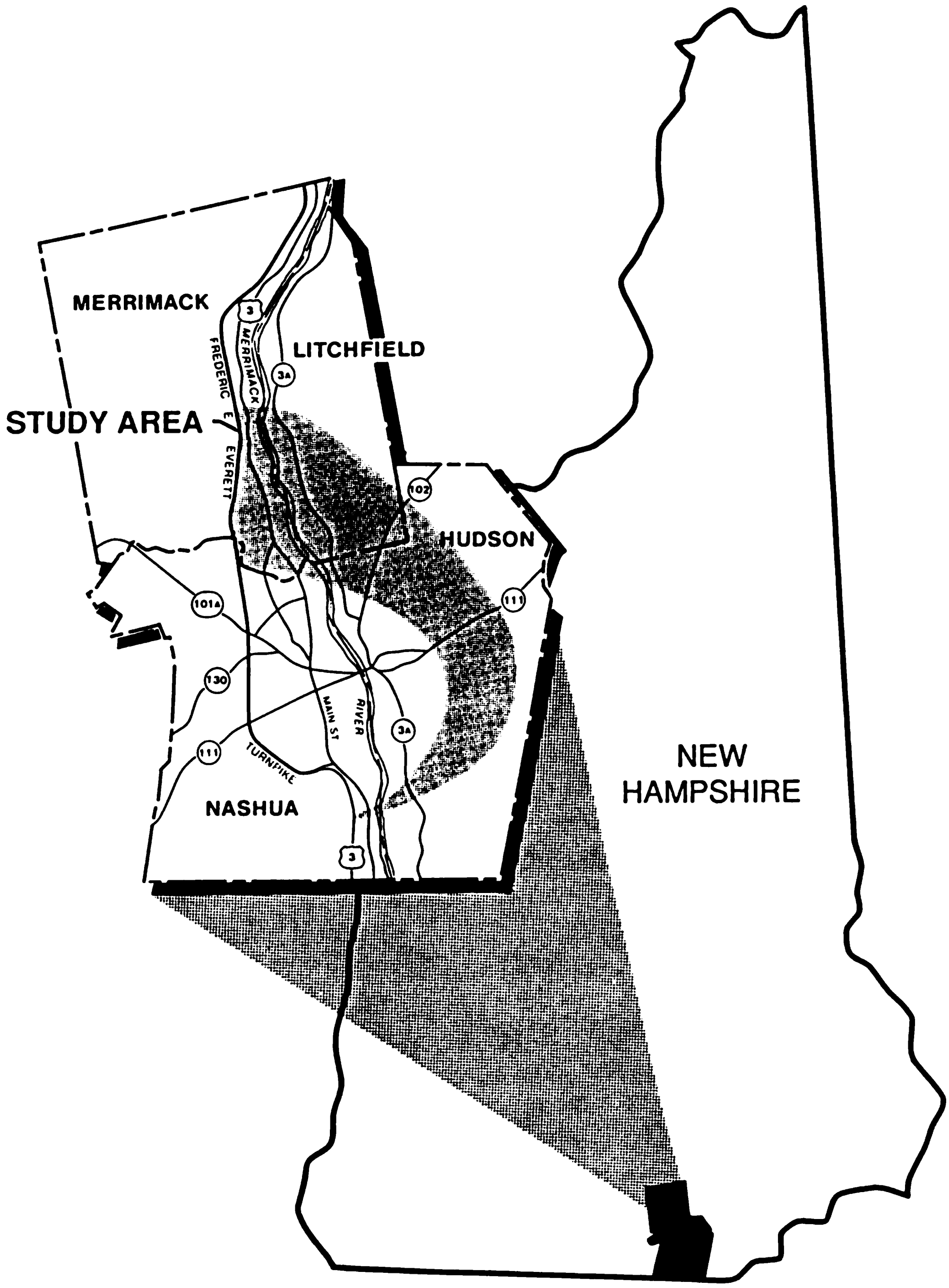
Chapter 1
PROJECT PURPOSE AND NEED FOR ACTION

1.1 STUDY AREA DESCRIPTION

The Nashua-Hudson Circumferential Highway study region is located in Hillsborough County in southern New Hampshire, approximately 35 miles south of Concord, New Hampshire, and 35 miles north of Boston, Massachusetts. See Figure 1-1 for the study area location. The four municipalities which will be directly affected by the proposed Circumferential Highway are Nashua, Hudson, Litchfield, and Merrimack.

The Merrimack River, which flows north to south, divides the area and creates a transportation barrier between the towns of Merrimack and Litchfield and between the City of Nashua and the town of Hudson. All east-west traffic must use either the Taylor Falls or Sagamore Bridges. The principal arterial routes serving both east-west and north-south traffic east of the Merrimack River--N.H. Routes 111, 102, and 3A--all converge on the approach to Taylor Falls Bridge.

The study area is served by a number of major freeway and arterial roadway systems. The major express highway in the area is the F.E. Everett Turnpike, which provides north-south travel from the Massachusetts border north to Concord. From the Massachusetts State Line to Interchange 7 in Merrimack, this roadway is designated as U.S. Route 3. North of Exit 7, it continues as a toll road extending north to Interstate 293 in Manchester. Interchanges along the Turnpike provide connections to major arterials in the Nashua area. The arterial roadway system generally forms a radial network around the central portion of the City of Nashua. The Daniel Webster Highway is the major north-south arterial, which basically runs parallel to the Turnpike through the study area. North of Exit 7 in Nashua, it is known as U.S. Route 3. N.H. Route 3A east of the Merrimack River is another north-south arterial which passes through the study area in Hudson and Litchfield. N.H. Route 102 runs in a northeasterly direction from the Taylor Falls Bridge in the Hudson area.



NORTH
NO SCALE

NASHUA-HUDSON CIRCUMFERENTIAL HIGHWAY

FIGURE 1-1
STUDY AREA LOCATION

NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

Among the major east-west arterials in the study area are N.H. Route 111, which runs through the study area from the western portions of Nashua across the Merrimack River over the Taylor Falls Bridge and through Hudson to the east, and N.H. Routes 101A and 130, both of which originate in the central portion of Nashua and travel in a westerly direction towards Hollis and Merrimack. N.H. Routes 111, 101A and 130 all have interchanges with the F.E. Everett Turnpike.

1.2 PROJECT PURPOSE

The purpose of this project is to provide a transportation improvement to assist east-west traffic movements and to reduce congestion on existing bridges and streets in and near the Central Business Districts of Nashua and Hudson by adding new crossings of the Merrimack River. In addition, the goal is to improve and reduce traffic congestion as described above in the highway design year over the existing levels. This purpose was derived based on consideration and analysis of existing and projected traffic volumes in the regional study area, as described in the "Need for Action" section that follows.

1.3 NEED FOR ACTION

Regional transportation planning in the area is the responsibility of the Nashua Regional Planning Commission (NRPC).

Twelve towns, shown in Figure 1-2, are included in the NRPC region. The Nashua Primary Metropolitan Statistical Area (PMSA) includes all but two of the smallest, least urbanized towns - Lyndeborough at the west end and Pelham at the east end of the NRPC region.

During a 30-year period from 1960 to 1990, the population of the Nashua PMSA rose from 63,000 to more than 180,000. Along with the growth in population and employment opportunities, came an increase in auto ownership, usage and traffic congestion.

Within the Nashua PMSA, the towns of Hudson, Litchfield and Merrimack are the ones that would be traversed by the proposed Nashua-Hudson Circumferential Highway. In these communities, a significant portion of recent growth has taken place, increasing in population from 9,500 in 1960 to almost 50,000 by 1990. While current economic conditions have slowed the regional rate of growth, a 31 percent increase in total housing units and 69 percent growth in population based on 1980 census data are projected over

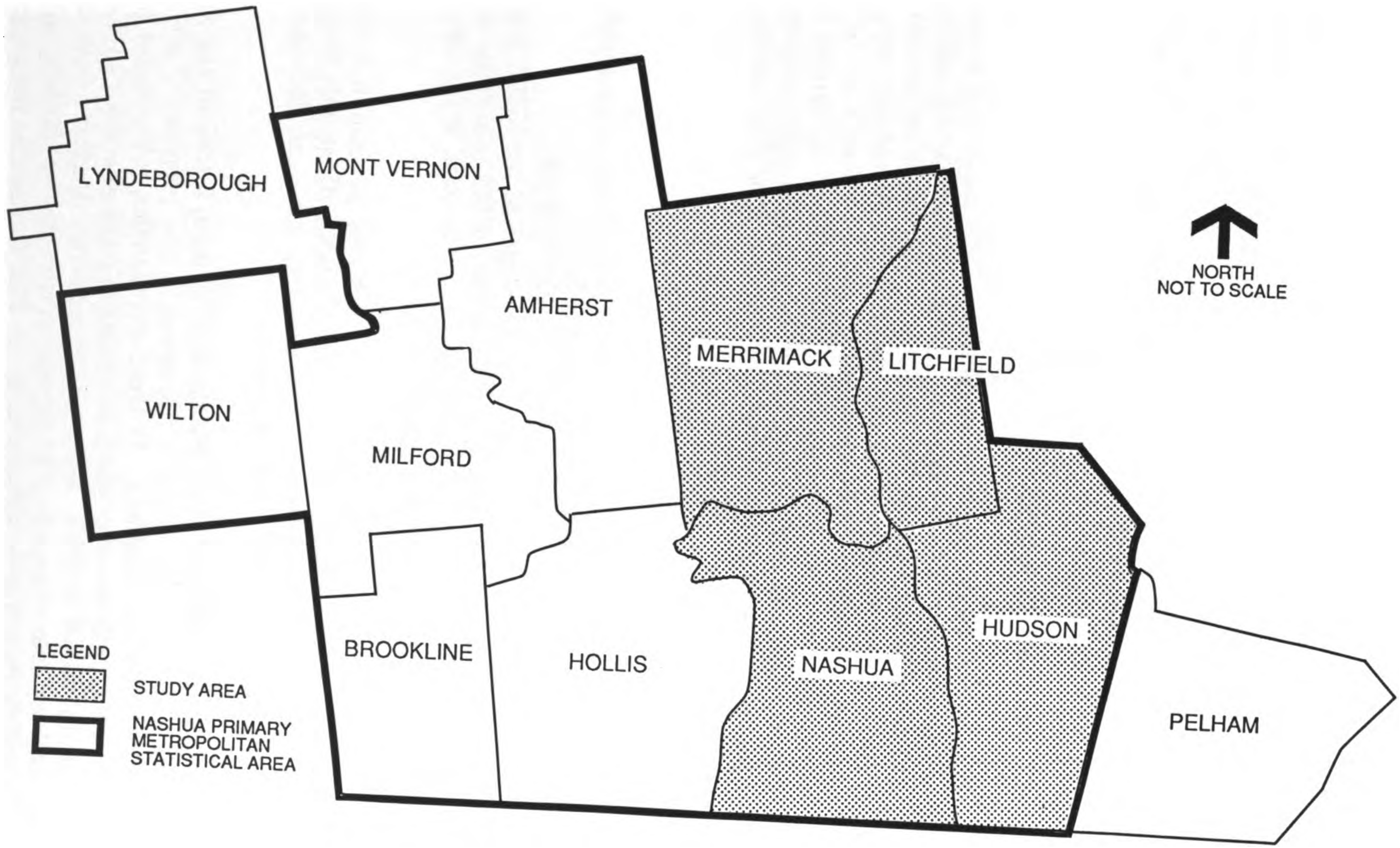


FIGURE 1-2
PLANNING COMMISSION REGION
AND HIGHWAY STUDY AREA

the next 20 years (1990-2010) for the three communities. This is slightly higher than the 67 percent growth projected for the entire PMSA.

Traffic congestion on Taylor Falls Bridge, linking the Central Business Districts of Nashua and Hudson, is presently significant. With average weekday traffic volumes approaching 50,000 vehicles, the bridge and approaches are operating at Level of Service F throughout much of the day. Capacity problems are expected to worsen with the continuing growth of traffic.

The principal arterial routes serving both east-west and north-south traffic east of the Merrimack River--N.H. Routes 111, 102, and 3A--converge on the approach to Taylor Falls Bridge. Congestion on these routes in the vicinity of the bridge is already severe and is expected to worsen over the next two decades.

At the Sagamore Bridge, linking south Nashua with the developing commercial/industrial area along N.H. Route 3A in south Hudson, traffic volumes have already reached capacity. Serious congestion is projected on the entire arterial network by the year 2010.

1.4 TRAFFIC VOLUMES - EXISTING

The network diagram in Figure 3.1-1 shows existing Average Daily Traffic (ADT) volumes along major roadways in the study area. Data reported for the existing network represents 1990 conditions. The most heavily travelled roadways are located in Nashua. The ADT volumes on the F.E. Everett Turnpike range from 54,000 to 92,000. The Daniel Webster Highway in South Nashua carries up to 41,600 vehicles a day, and N.H. Route 101A near the Turnpike has a daily volume of 40,100. In Hudson, the highest volumes are carried by N.H. Route 3A where daily traffic ranges from 20,300 to 25,800 vehicles.

The primary through traffic routes in the study area include the F.E. Everett Turnpike, the Daniel Webster Highway, N.H. Route 102 and U.S. Route 3 for north-south traffic and N.H. 130, N.H. 101A, and N.H. 111 including the Taylor Falls Bridge for east-west traffic movements. The Taylor Falls Bridge with an ADT of 48,600, carries the largest non-expressway traffic volumes in the study area. The Sagamore Bridge to the south is used by 28,700 vehicles a day.

1.5 TRAFFIC VOLUMES - FUTURE

The 2010 trip table was assigned to the No-Build network which provides a baseline condition for comparison of other Full Build and Partial-Build Alternatives, and to all Full Build and Partial-Build networks.

The projected ADT volumes in Figure 4.1-1 show that if none of the Full Build or Partial Build Alternatives were constructed by the year 2010, as many as 73,300 vehicles a day, or far above its capacity, would attempt to cross Taylor Falls Bridge. Approach roads to Taylor Falls Bridge would have to carry from 32,000 to 40,200 vehicles daily. Volumes on Sagamore Bridge would rise to 42,100 vehicles a day, and the F. E. Everett Turnpike would carry 157,400 ADT.

With the Build Alternatives (see Figure 4.1-6 as an example of Alternative 7), traffic on Taylor Falls Bridge would actually drop to 34,000-38,100 ADT, well below the existing daily volume of 48,600, while volumes on the nearby arterials would also be reduced or remain the same as they are today. The new bridge to the north would divert from 35,000 to 41,000 trips a day, while on the Sagamore Bridge daily traffic would rise to 59,400. Traffic volumes on the new bridge would be highest with Alternatives 7 and 8, which would place this bridge closer to the urban core, with corresponding decreases on the Taylor Falls and Sagamore Bridges.

1.6 SUMMARY

The previous section documents the need for a transportation improvement that will reduce traffic volumes and congestion as stated in the project purpose. Since all the major arteries are radial to the Nashua/Hudson CBD's, the flow of traffic must be to or from those CBD's. A solution to reduce the traffic congestion is to provide a non-radial route where traffic can move beyond the congested CBD's. This is best met by a circumferential route which intersects the radial routes before the area of congestion is encountered.

A number of major highway improvements have been implemented over the years to cope with traffic congestion, and other projects are now under way. The Sagamore Bridge was built in 1971, and in 1973, a second bridge was constructed at the Taylor Falls location. A $160 million improvement of the F.E. Everett Turnpike from the Massachusetts border to Exit 7 was started during the summer of 1992.

While all of these projects have helped or will help alleviate some of the more severe congestion points, the analysis conducted during earlier studies and reinforced by this study have shown that they alone will not be able to relieve congestion, either on river crossings or on existing major arterials, which cannot be substantially improved because of limited right-of-way and intense urban development.

To alleviate congestion and improve east-west traffic flow, the Nashua-Hudson Circumferential Highway has been proposed and is presented in this study as the Build Alternatives.

The summary of river crossings in Table 1-1 shows that all Build Alternatives would be successful in diverting traffic away from Taylor Falls Bridge and thereby reducing congestion on east-west arterials through the Central Business Districts of Nashua and Hudson.

The summary evaluation in Table 1-2 shows that all Build Alternatives will also be more effective in diverting future traffic volumes onto the expressway system, thus reducing total travel time, improving operating speeds, and minimizing accidents than No-Build.

From this analysis it can be determined that the Nashua-Hudson Circumferential Highway will permit more direct east-west travel in this area through an additional northern crossing of the Merrimack River and improvements to the existing Sagamore Bridge southern river crossing. As a result, trips will be diverted from the congested Taylor Falls Bridge and the central areas of Nashua and Hudson. Chapter 2 describes the various Build Alternatives that were evaluated in respect to meeting the purpose of this project.

Table 1-1

SUMMARY OF MERRIMACK RIVER CROSSINGS

Alternative	ADT Volumes North Merrimack	Taylor Falls	Sagamore	Total
Existing - 1990	-	48,600	28,700	77,300
Baseline - 2010 (No-Build)	-	73,300	42,100	115,400
Build Alternatives (range)	34,900-41,600	33,900-38,600	34,700-59,800	129,500-134,500

Table 1-2
(Revised)
STUDY AREA TRANSPORTATION SERVICE SUMMARY

Alternative	Average Weekday Vehicle Miles of Travel	Percent of Total Travel on Expressway	Average Weekday Vehicle Hours of Travel	Average System Speed (m.p.h.)	Total Accidents (Annual)
Existing - 1990	3,316,000	23.1	128,400	25.8	8,716
Baseline - 2010 (No-Build)	5,469,000	24.8	337,600	16.2	13,880
Build Alternatives (range)	5,497,000-5,522,000	31.1-31.2	237,200-239,200	23.1-23.2	13,245-13,313

Chapter 2
Description of Alternatives

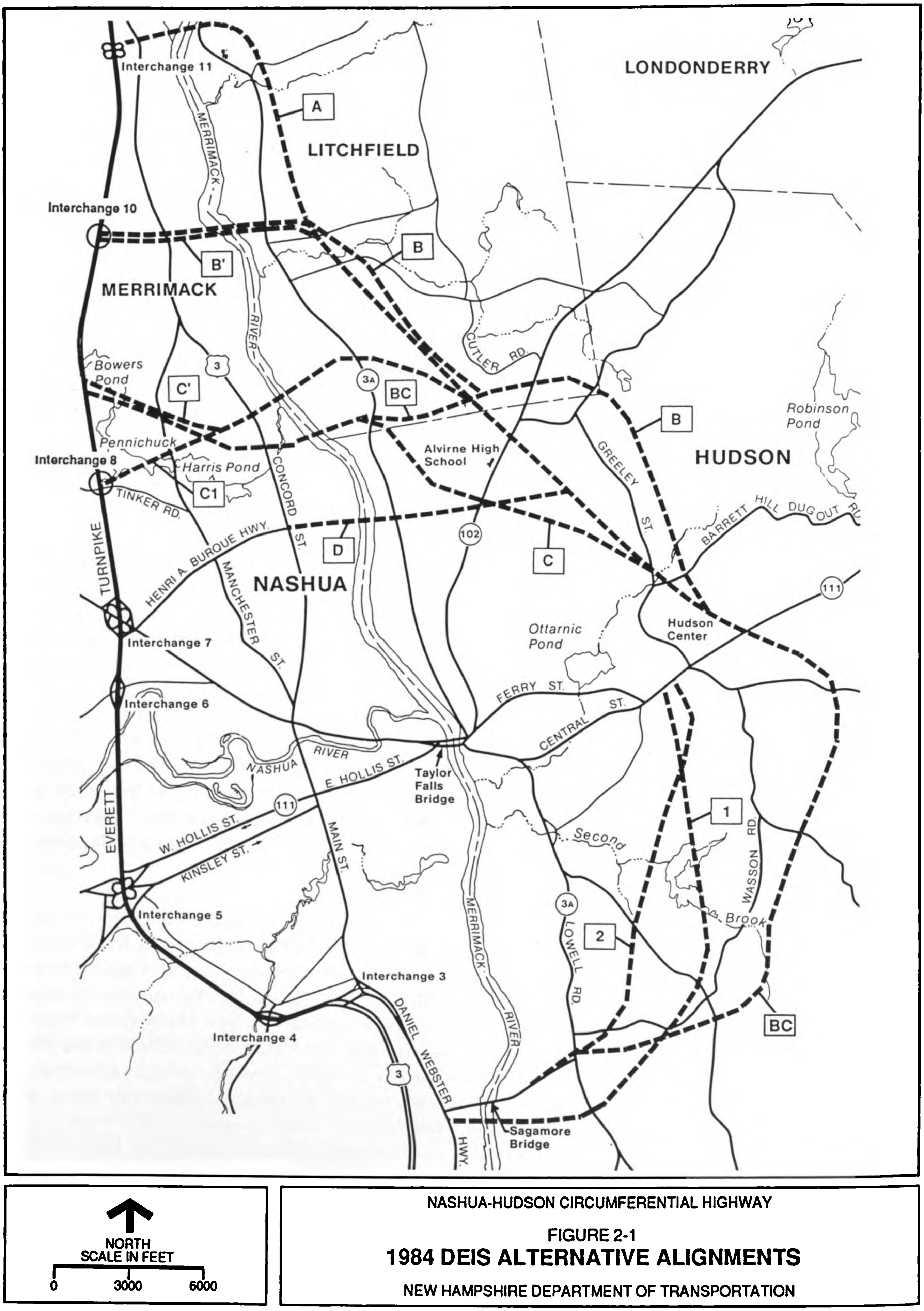
Chapter 2
DESCRIPTION OF ALTERNATIVES

2.1 HISTORY OF PREVIOUS ALTERNATIVES

The Nashua-Hudson Circumferential Highway project was initially proposed in 1959. At that time, the existing bridge at Taylor Falls was the only east-west connector across the Merrimack River between the towns of Nashua and Hudson. It was recognized that additional facilities were required to alleviate the congestion that existed at the time, and to allow for future traffic growth. The proposed Circumferential Highway was to be located to the east of the town of Hudson with crossings of the Merrimack River to the north and south of the Nashua-Hudson town center.

In 1971, the Sagamore Bridge was constructed across the Merrimack River south of Taylor Falls Bridge; and, in 1973, a second bridge was constructed at the Taylor Falls location. These additional river crossings provided some relief to the traffic congestion. Since the early 1970's, the Nashua-Hudson region has experienced rapid population and economic growth. This growth has increased the congestion on roadways in the Central Business Districts of Nashua and Hudson, as well as the surrounding roadway network. In 1984, a DEIS for the Nashua-Hudson Circumferential Highway was published by the State of New Hampshire Department of Public Works and Highway in cooperation with the FHWA. The alternative alignments that were studied are shown in Figure 2-1. Of the alignments studied, the "B-C" Alternative was selected as the preferred alternative by the New Hampshire Department of Public Works and Highways.

That alignment, as well as the other alternative alignments, traversed wetlands and other water resources, and required permit approval by the Corps under the Clean Water Act (CWA). In order to ensure that all viable alternatives had been investigated, and that the impact on the environmental resources had been minimized, the Corps required that the New Hampshire Department of Transportation (NHDOT) restudy alternative alignments for the Nashua-Hudson Circumferential Highway in 1990. Specific consideration was to be given to any potential impact on the Pennichuck Reservoir area, and to wetlands and other water resources.



NASHUA-HUDSON CIRCUMFERENTIAL HIGHWAY

FIGURE 2-1
1984 DEIS ALTERNATIVE ALIGNMENTS

NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

On June 28, 1990, a public scoping meeting was held with representatives of the local, State and Federal governments. As a result of the scoping meeting, the 1984 DEIS alternative alignments and new alternative alignments which were developed based upon the scoping meeting comments were selected and were to be used to revise the 1984 DEIS. These alternatives, shown in Figure 2-2, were presented at a joint State and Federal agency meeting on October 18, 1990. The representatives reviewed the revised scoping meeting alternatives, and recommended that a new study of alternatives for the revised DEIS be unbiased by previous studies. The new study would be based on updated resource data and mapping, and the previously preferred B-C Alternative would be evaluated along with other alternatives developed with the latest inputs from the community.

2.2 DEVELOPMENT OF ALTERNATIVES

For this FEIS, a wide range of transportation alternatives were identified and evaluated as a means of meeting the transportation needs of the Nashua-Hudson metropolitan area. These included baseline (or No Build), Transit/TDM and TSM (improved transit/existing roadway facilities), and construction of a new limited expressway facility (Nashua-Hudson Circumferential Highway). This section describes each of these options in detail.

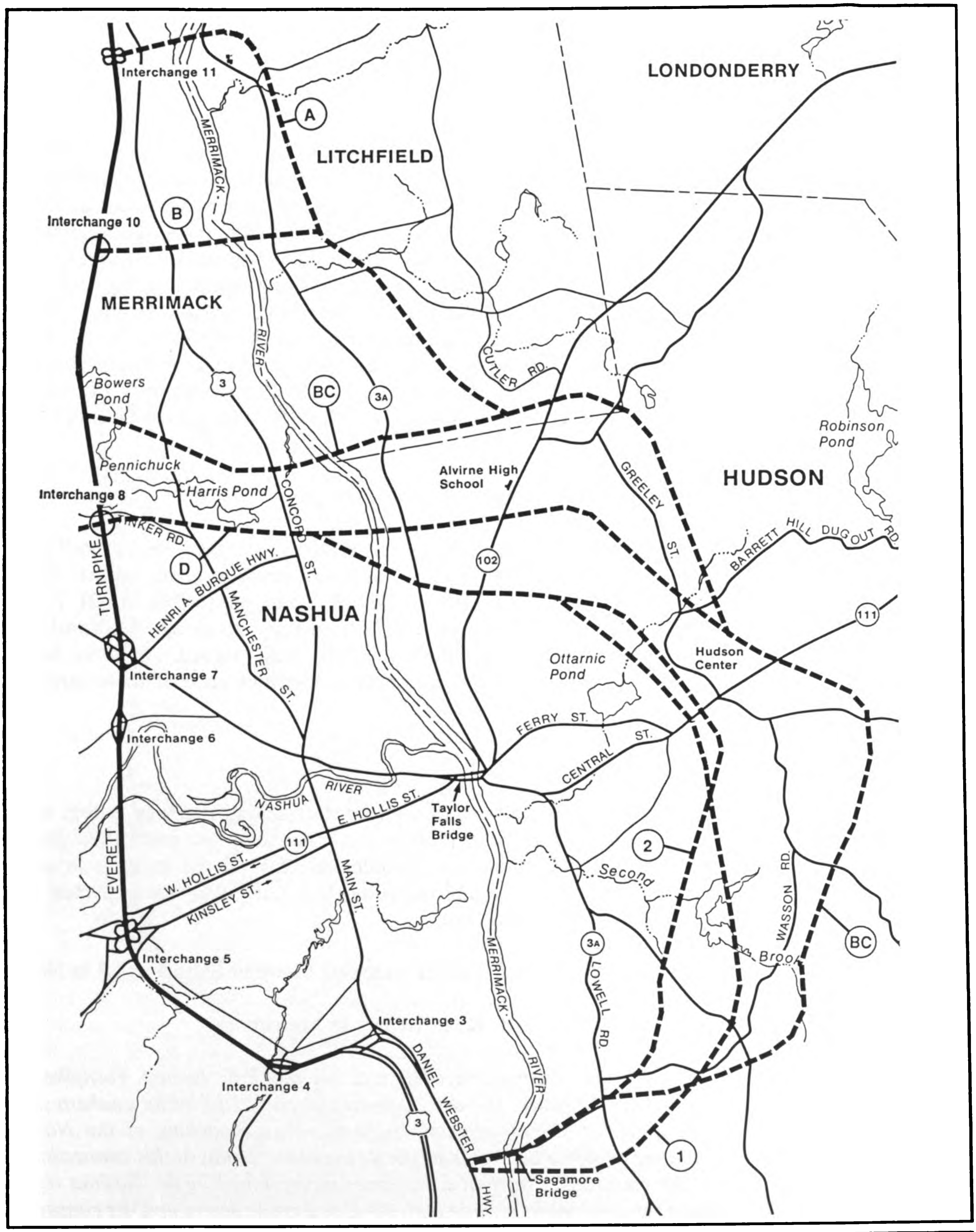
2.2.1 No Build

The No Build Alternative assumes that the existing roadway system will be maintained in its current condition, and other than two committed projects, no further major improvements would be made to the existing street and highway system. The committed projects listed below are expected to be completed by 2010. They are:

1. F.E. Everett Turnpike widening between Exits 3 and 7 in Nashua.

2. Camp Sargent Road Bypass in Merrimack.

Historically, the construction of Exit 2 on the F.E. Everett Turnpike as a connection to the Daniel Webster Highway was part of the initial southern section of the proposed Circumferential Highway. The modelling of the No-Build Alternative therefore did not incorporate the construction of this connection. In fact, the construction of Exit 2 has been incorporated in the Nashua regional transportation plans to include both the Exit 2 construction and the construction of a parallel span to the Sagamore Bridge.



NORTH
SCALE IN FEET
0 3000 6000

NASHUA-HUDSON CIRCUMFERENTIAL HIGHWAY
FIGURE 2-2
1990 REVISED SCOPING MEETING
ALIGNMENT ALTERNATIVES
NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

The existing pattern of roadway facilities was described briefly in Chapter 1. The primary cause of congestion is that under the existing network configuration, the radial highways converge on the Central Business Districts of Nashua and Hudson, overloading the local street system and Taylor Falls Bridge with heavy east-west traffic flow. There would be no construction costs associated with this alternative and no right-of-way taken. The projected increase in traffic volumes would result in the worsening of traffic congestion and unacceptable levels of traffic service.

The No Build Alternative was used as the baseline condition to which other options could be compared during the alternatives evaluation.

2.2.2 Transit/TDM and TSM Alternatives

TSM and Transit/TDM Alternatives were also evaluated along with other preliminary alternatives. The TSM Alternative consists of measures to "spot" locations within the project area. TSM measures are defined as low-cost improvements that have limited environmental and socio-economic impacts and involve limited or no construction. Such measures might include the addition of a turn lane at a particular intersection, signal installation or timing changes, or interconnection of signal systems. Such improvements can be effective where traffic congestion is limited to a particular "spot" location.

Transit improvements and the application of TDM measures work together as a means to reduce travel made by single occupant vehicles (SOV). Improvements to transit, provision of additional transit and rideshare facilities, and an incentive system to encourage transit and rideshare usage are all integral parts of a Transit/TDM Alternative. The Transit/TDM Alternative tested in the Nashua region incorporated elements of transit improvements and TDM actions following research into a full range of such improvements utilized throughout the country. Those elements that showed the greatest promise for producing a measurable level of traffic reduction were tested as part of the Transit/TDM Alternative. These measures included the extension of five of the CITYBUS transit routes and reinstatement of another that was recently discontinued. The extension of the commuter rail to Boston from its current terminal point at Lowell, Massachusetts into Nashua was also incorporated in the Transit/TDM Alternative. Increased commuter bus to Boston and Manchester, introduction of express bus service from Merrimack to Manchester, and increased parking charges downtown and imposition of parking charges at large suburban employers with no charge for carpools were some of the specific measures incorporated in the Transit/TDM Alternative. Additional measures included improvements in the transit system that could be accommodated through simplified fare collection, reduced fares, monthly passes, schedule coordination, construction of bus shelters, increased *transit marketing, subsidies for ridesharing use and parking, and increased carpool matching services. Such measures would obviously require detailed study by CITYBUS or the NRPC prior to implementation.*

The Transit/TDM Alternative represents a very aggressive program to get motorists out of their SOV's. For example, this alternative would result in a ten-fold increase in transit ridership increasing from its current 900 passenger trips per day to 9,040 passenger trips per day in 2010. In addition, the commuter rail service is projected to carry more than 600 passengers per day in 2010. In total, the full set of Transit/TDM measures analyzed for the Nashua region could, if all measures were successfully implemented, result in a 5.5 percent decrease in daily trips.

2.2.3 Build Alternatives

The proposed Circumferential Highway would be a limited access, expressway facility with 400-foot-wide right-of-way in most areas. This allows for two 12-foot lanes in each direction and a varying median. Although the posted speed limit would be 55 mph, the design speed would be 70 mph to provide a high level of safety and comfort. This would help assure that most of the through travel would be diverted from existing streets to the new highway. Grade-separated interchanges would be provided at six locations. Other roads would be either grade-separated, relocated or terminated at the new facility.

The projected design year Average Daily Traffic (ADT) volumes generally range from 30,000 to 40,000 ADT for the proposed expressway and the northern river crossing. On Sagamore Bridge, forecasts range up to 59,800 ADT. To assure a high level of service, these traffic volumes require a four-lane, limited access facility. Use of lower design standards would result in a facility with periodic traffic congestion, delays and higher accident rates. Such a facility would not achieve the main objective of diverting traffic from Taylor Falls bridge and Central Business District streets.

General guidelines were established for the selection of feasible Build Alternative alignments:

1. The alternatives must satisfy the project purpose.

2. The southern terminus should tie into the planned Exit 2 interchange of the F.E. Everett Turnpike at the existing Sagamore Bridge.

3. The northern terminus should tie into the F.E. Everett Turnpike at, or between, Exits 7 and 11.

4. The alignment alternatives should connect the southern and northern termini by a semi-circular route to the east of the town of Hudson.

The project corridor is shown in Figure 2-3.

The process of the development associated with the location of each Build Alternative presented in this document is based on the concept of design by avoidance. This process is two-phased and follows the general guidelines set out in the Corps New England Division Highway Methodology as described below.

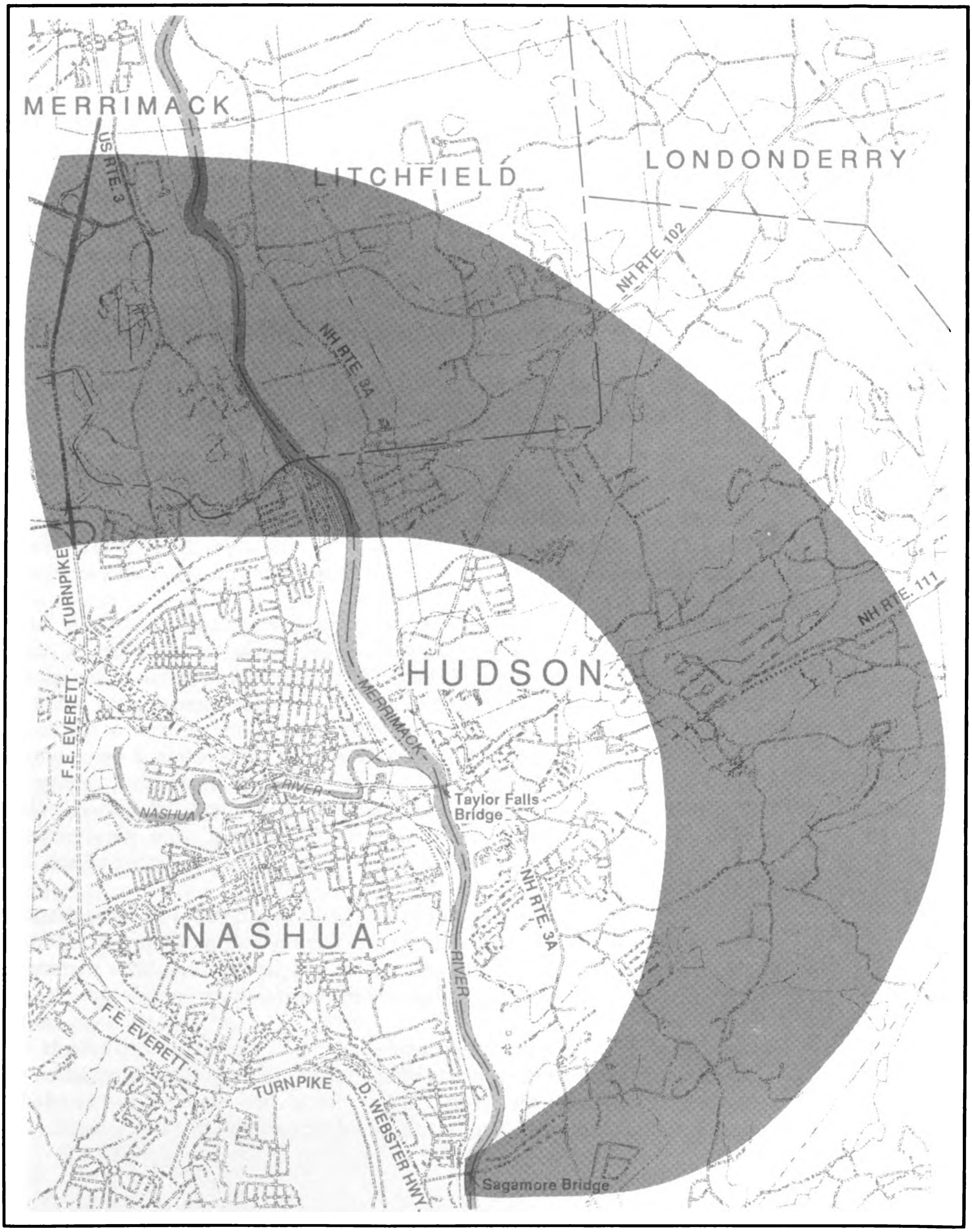
Phase I

Phase I of the process began with the collection of base resources data. Table 2.1 presents a list of data collected for Phase I analysis, and their sources.

The data collected on resources was represented graphically as separate layers within computer files using a Computer Aided Design and Drafting (CADD) system. Clear acetate plots of each of the layers were produced at scales of 1:24000 and 1:12000 so that detailed study of the resource data could be conducted either individually or in combinations of one or more of the layers. The acetate plots, when used in combination with each other, formed a basis for the determination of segments of alignments which avoided the constraints imposed by the various resources. This process resulted in the development of 22 different segments which were then combined into 33 alternative alignments. These alignments are shown in Figure 2-4 and listed in Table 2-2.

The 33 alternatives were presented to the federal and state reviewing agencies at a meeting held on February 20, 1991. The reviewing agencies agreed that the 33 alignments represented a reasonable selection of alternative alignments for study, and that no further alternatives needed to be considered.

Each of the 22 segments which made up the 33 alternative alignments was studied to determine the impacts which each of the segments imposed on the environmental resources. Additional resource data was collected as needed so that the impacts on all resources could be quantified.



NORTH
SCALE IN FEET
0 4000 8000

NASHUA-HUDSON CIRCUMFERENTIAL HIGHWAY

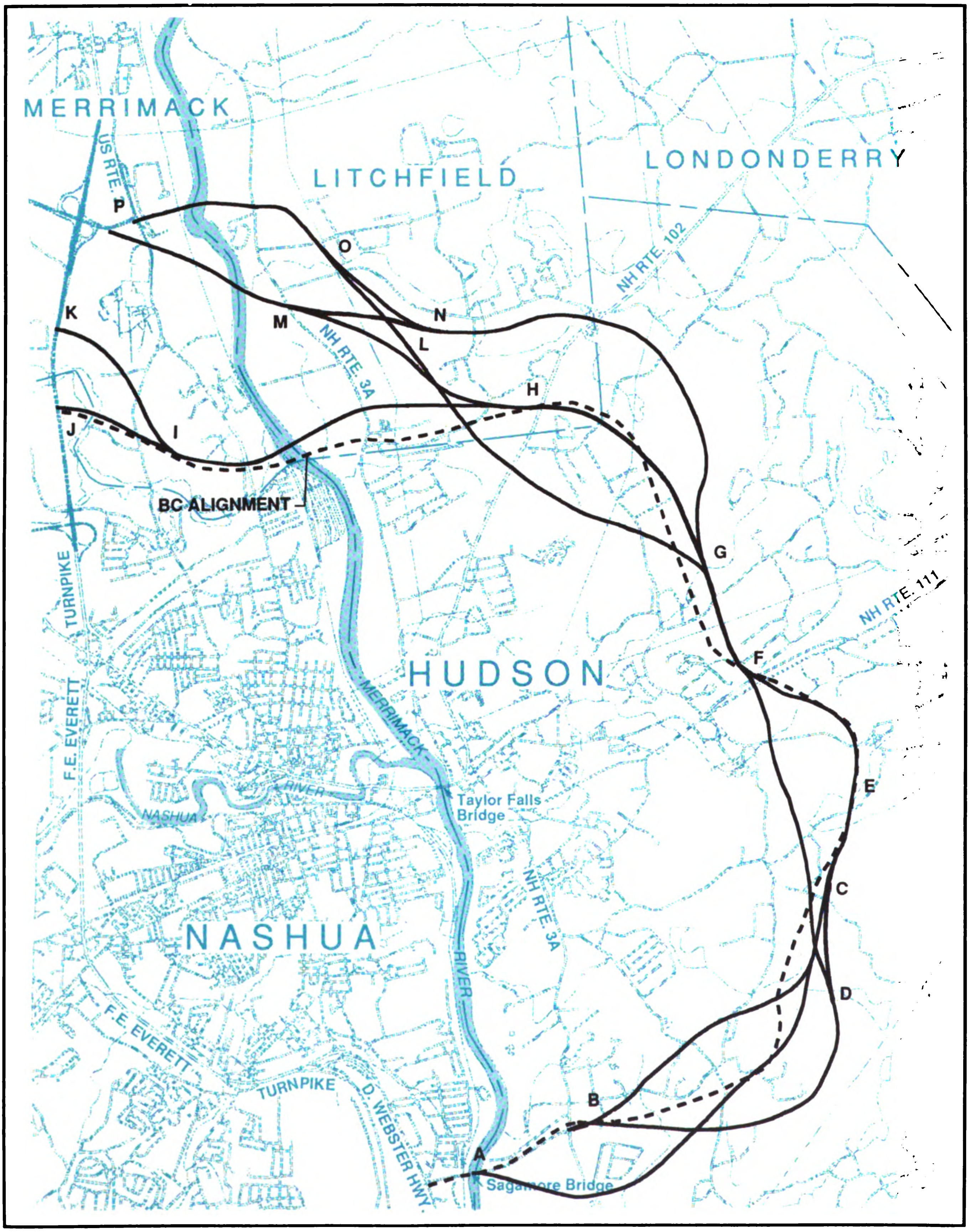
FIGURE 2-3
GENERAL HIGHWAY CORRIDOR

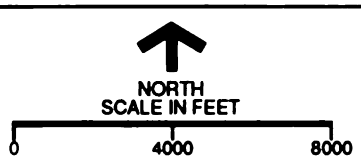
NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

Table 2-1

PHASE I RESOURCE DATA

Resource	Source
Wetlands	National Wetland Inventory Soil Conservation Service (S.C.S.)
Wildlife Habitat Areas	Aerial Photography
Developed Land	U.S.G.S. Mapping Aerial Photography
Prime and Statewide Important Farmland	Digitized S.C.S. Mapping provided by the University of New Hampshire S.C.S. Mapping
Drainage Basins	U.S.G.S. Water Resource Investigations Report 86-4358
Wells	U.S.G.S. Water Resource Investigations Report 86-4358 1984 DEIS
Aquifers	U.S.G.S. Water Resource Investigations Report 86-4358
Contamination Sites	NH Groundwater Protection Bureau
Asbestos Waste Disposal Sites	NH Department of Environmental Services
Archeological and Historic Sites	NH Division of Historic Resources NHDOT, Environmental Division NH State Library NH Historical Society NH Archeological Society Hudson Historical Society Hudson Public Library Nashua Public Library





NASHUA-HUDSON CIRCUMFERENTIAL HIGHWAY

FIGURE 2-4
ALIGNMENT ALTERNATIVES, PHASE I ANALYSIS

NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

Table 2-2

PHASE I ALTERNATIVES

Alternative No.	Description
1	ABCEFGHIJ
2	ABCEFGHIK
3	ABCEFGHLMP
4	ABCEFGHLOP
5	ABCEFGLMP
6	ABCEFGLOP
7	ABCEFGNMP
8	ABCEFGNOP
9	ABDFBHIJ
10	ABDFGHIK
11	ABDFGHLMP
12	ABDFGHLOP
13	ABDFGLMP
14	ABDFGLOP
15	ABDFGNMP
16	ABDFGNOP
17	ABDEFGHIJ
18	ABDEFGHIK
19	ABDEFGHLMP
20	ABDEFGHLOP
21	ABDEFGLMP
22	ABDEFGLOP
23	ABDEFGNMP
24	ABDEFGNOP
25	ACEFGHIJ
26	ACEFGHIK
27	ACEFGHLMP
28	ACEFGHLOP
29	ACEFGLMP
30	ACEFGLOP
31	ACEFGNMP
32	ACEFGNOP
33	ALTERNATIVE BC

The results of the quantification of the impacts were summarized and represented in a matrix. At a meeting held on June 5, 1991, the reviewing agencies agreed on a reduction in the number of alternatives, from 33 to six. The six alternative alignments were studied, in detail, as part of Phase II and were represented in the DEIS. The reviewing agencies requested that Partial-Build Alternatives also be assessed during the DEIS process along with the six Full Build Alternative alignments. It was agreed that the six Full Build Alternatives would be evaluated as entire alignments but that separate summaries would be prepared of all information and analysis results for each section. The sections to be reported on for each whole alignment were from the southern terminus to N.H. Route 111, from N.H. Route 111 to N.H. Route 102 and from N.H. Route 102 to the northern terminus with the F.E. Everett Turnpike.

An adjustment was made to the alternatives which contained segments ABCEF to avoid a wetland in the vicinity of node C, and to provide a connection from the ABC segment combination to node F without passing through node E. Of the 33 alternatives, 28 were eliminated due to the following reasons:

1. The B-C alignment was carried forward into Phase II. If two alignments were parallel and in close proximity, and one of these alignments was B-C, the B-C alignment was recommended for that portion of roadway if there were no material difference between impacts to aquatic resources.

2. Among those alignments in the southern section (south of N.H. Route 111), Alignment ABCEFG was chosen because it had the least damaging environmental impacts; later it was revised to ABCFG. This eliminated Alternatives 9 - 32.

3. It was agreed that at the north end an alignment should be retained connecting to the F.E. Everett at each terminal node (i.e., J, K, and P).

4. Segment IJ was eliminated, as it is in close proximity to the B-C alignment through the Pennichuck watershed, and there was no material difference in environmental impacts. This eliminated Alternatives 1, 9, 17, and 25.

5. Segment HI was eliminated, as it impacts more wetlands than the B-C alignment in the same area. This eliminated Alternatives 1, 2, 9, 10, 17, 18, 25, and 26.

6. It was agreed that segment IK be included as the terminus to a modified B-C alignment, as it avoids the Pennichuck ponds. This new alignment was to be called BC-K.

7. Segment GN was eliminated, for numerous reasons, as it impacts residences, structures at the intersection with N.H. Route 102, a major well, and Brox Industry reserves. This eliminated Alternatives 7, 8, 15, 16, 23, 24, 31, and 32.

8. As there were no material differences in environmental impacts between Segment NO and Segment LO, Segment NO was eliminated since it goes through archaeologically sensitive areas. This eliminated Alternatives 8, 16, 24, and 32.

Phase II

As a result of the Phase I study, six Build Alternatives were selected for further detailed analysis. They are shown in Figure 2-5 and listed in Table 2-3.

Table 2-3

PHASE II ALTERNATIVE ALIGNMENTS

Alternative No.	**Description**
1	No Build
2	Transit/TDM and TSM
3	ABCFGHLMP
4	ABCFGHLOP
5	ABCFGLMP
6	ABCFGLOP
7	BC
8	BC-K

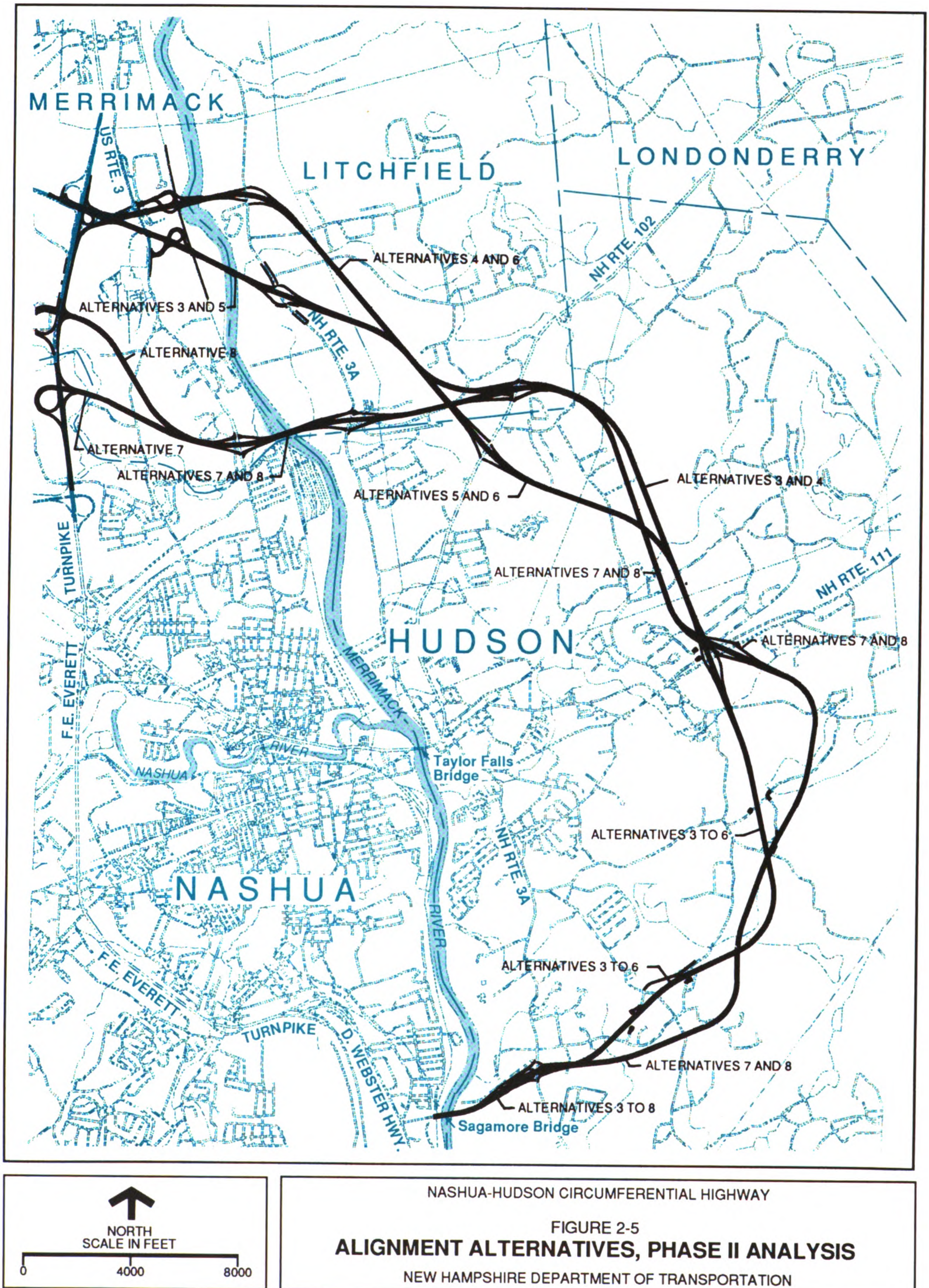
Interchanges. The location of interchanges is common to all of the Full Build Alternatives. Interchanges are proposed for the intersection of the Circumferential Highway and N.H. Route 3A in the south, N.H. Route 111, N.H. Route 102, N.H. Route 3A in the north, U.S. Route 3 (Daniel Webster Highway) and the F.E. Everett Turnpike. The location and configuration of these interchanges varies as the location of the intersection point varies for each alternative. The interchange types for each of the alternatives are described in Table 2-4.

Table 2-4

INTERCHANGE TYPES

Alternative No.	Interchange Location	Interchange Type
3, 4, 5, 6, 7, 8	NH Route 3A	Urban
3, 4, 5, 6, 7, 8	NH Route 111	Diamond
3, 4, 5, 6, 7, 8	NH Route 102	Diamond
3, 4, 5, 6, 7, 8	NH Route 3A	Diamond
3, 4, 5, 6, 7, 8	US Route 3	Diamond
3, 4, 5, 6	F.E. Everett	Specialized
7, 8	F.E. Everett	Trumpet

The specialized interchange layouts required at the F.E. Everett Turnpike utilize the existing configuration at Exit 10 (Industrial Drive) as much as possible; while, at the same time, maintaining a separation between the local traffic and the Circumferential Highway traffic.



NASHUA-HUDSON CIRCUMFERENTIAL HIGHWAY

FIGURE 2-5
ALIGNMENT ALTERNATIVES, PHASE II ANALYSIS
NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

2.3 ALTERNATIVES ELIMINATED FROM FURTHER STUDY

2.3.1 Alternatives Eliminated in Previous Studies

During the 1984 DEIS two alternatives for the northern terminus were investigated. The first tied into the existing Exit 7 of the F.E. Everett Turnpike and followed the route of the existing Henry Burque Highway. The existing interchange configuration at Exit 7 is currently under considerable stress due to the high traffic volumes generated by the intersection of Henry Burque Highway, N.H. Route 101 and F.E. Everett Turnpike. Adding the traffic expected to use the Nashua-Hudson Circumferential Highway to this intersection would require the construction of a complex and multi-level interchange. The impacts of this type of interchange on the area in the vicinity of the interchange and along the Henry Burque Highway would result in the destruction of existing housing, a church and numerous businesses. In addition, there is insufficient distance between Exits 6, 7 and 8 to develop the weaving lengths required to accommodate the additional traffic volumes and movements which the Nashua-Hudson Circumferential Highway would introduce.

The second alternative that was investigated tied into the existing Exit 8 of the F.E. Everett Turnpike. This alternative also had a significant impact on the residential neighborhoods east of Exit 8 and was eliminated for that reason.

2.3.2 Alternatives Eliminated from Further Detailed Study

TSM Alternative. *As a set of measures to improve the traffic operations at "spot" locations, TSM would be an important element of any alternative. TSM, however, would have very limited effectiveness as a stand-alone alternative. This is because, while intersections and other "spot" locations are often the "pinch" points on a roadway system, and TSM measures would result in more efficient operations at these locations, the traffic volumes projected on study area roadways in 2010 are in excess of what could be accommodated along the roadway segments between intersections. Improvements would therefore require substantial roadway widening along entire corridors in order to be effective. Such large-scale improvements would involve substantial costs, additional right-of-way, and cause considerable community disruption and would therefore no longer be considered TSM improvements, but would rather be considered a large-scale project upgrade. An Upgrade Alternative was evaluated and determined not to be practicable due to the large socio-economic impacts. Refer to the Revised Traffic and Transportation Technical Report Appendix D for this analysis.*

Transit/TDM Alternative. *The Transit/TDM Alternative, which incorporates improvements and expansion of the CITYBUS system, extension of commuter rail service from Boston to south Nashua and downtown Nashua, an increase in commuter buses that run between Manchester and Boston, introduction of express bus service between Manchester and Merrimack, increased parking charges in downtown Nashua and at large employment locations in outlying areas, provision of free parking for carpools at all locations, and other area-wide efforts to increase transit ridership and decrease SOV travel, was estimated to reduce overall regional travel by 5.5 percent. Of this 5.5 percent reduction in overall regional travel, it is estimated that approximately one-half or 2.75 percent, will be attainable based on the limited number of Transit/TDM measures available to the NHDOT for implementation. Along the downtown streets in Nashua, the Transit/TDM Alternative would reduce traffic, as compared to the No Build, between 5 and 8 percent. At the Taylor Falls Bridge, the Transit/TDM Alternative would reduce daily traffic by 7.6 percent. The projected volume at the Taylor Falls Bridge for the Transit/TDM Alternative would be almost twice what is projected under the Full Build Alternatives (67,700 vehicles for the Transit/TDM Alternative versus 34,500 vehicles for Alternative 8). Intersection Levels of Service would be nearly identical for the Transit/TDM Alternative as for the No-Build. While the measures included in the Transit/TDM Alternative would contribute to the efficiency of the regional transportation system, they do not meet the project purpose of reducing congestion within the downtown areas of Nashua and Hudson.*

Partial Build Alternatives. Four Partial Build Alternatives were evaluated as to their feasibility to accomplish the project purpose as stated in Chapter 1.

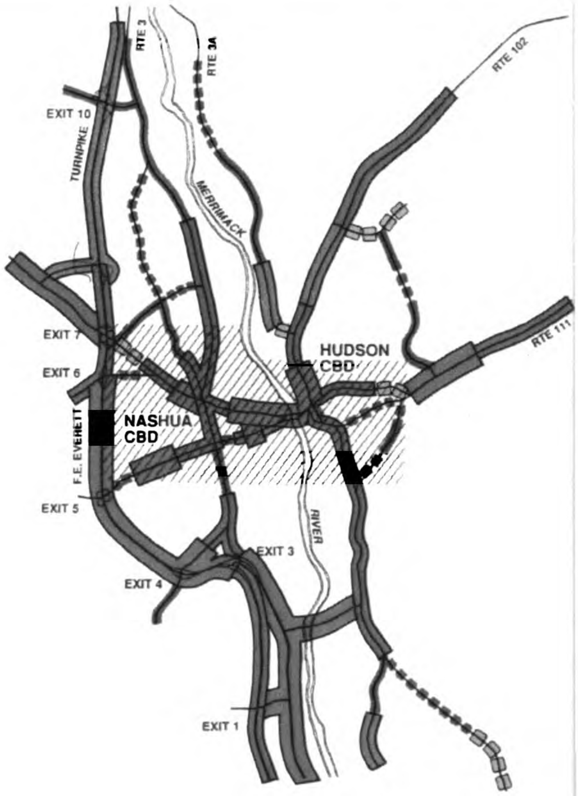
The results of the traffic analysis evaluating the No Build, Full Build, four Partial Builds and the Transit/TDM Alternative are illustrated graphically in Figure 2-6. Refer to Figure 3.1-2 for the existing network Level of Service (LOS). Table 2-5 shows LOS at selected intersections.

As shown in Figure 2-6 and as compared to Figure 3.1-2, the Partial Build Alternatives in the projected design year do not improve or reduce traffic volumes over the existing levels in the Central Business District. Partial Build Alternatives result in LOS of F or F° for the majority of the roadway links and intersections, and only reduce traffic volumes slightly on two minor roadway links within the CBD. Levels of service of the roadway links are more indicative of traffic than levels of service of intersections. For these reasons, they fail to accomplish the project purpose and were eliminated from further detailed study in the FEIS. The FHWA conducted an independent review of the Partial Build Alternatives and also concluded that Partial Build

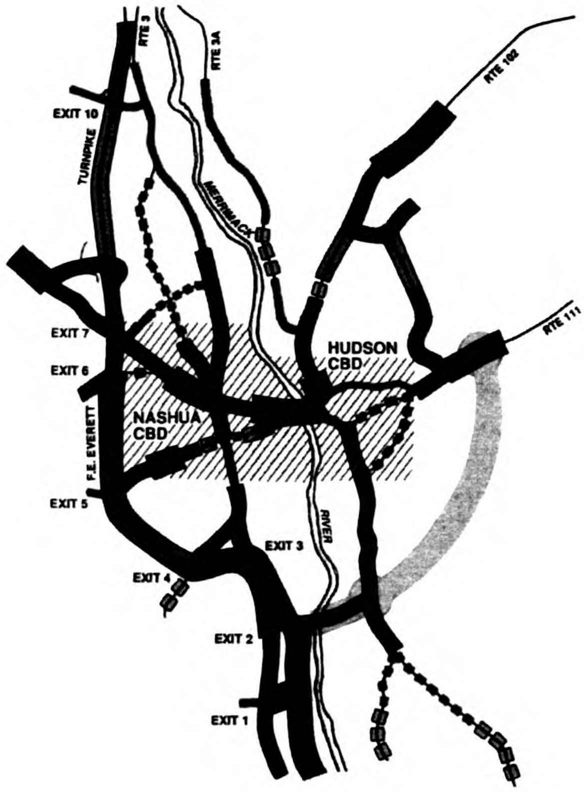
Table 2-5
(REVISED)
LEVEL OF SERVICE ANALYSES RESULTS
CIRCUMFERENTIAL HIGHWAY ALTERNATIVES

Location	1990 Existing	2010 No Build	2010 Alternative 3	4	5	6	7	8	9* Partial-Build to NH111	10* Partial-Build to NH102	11* Partial Build Exit 10-NH102 Only	12* Partial Build w/o NH111-NH 102	Transit/TDM[1]
Intersections													
HBW/Concord	B	F	C	C	C	C	F	F	F	F	F	D	F
HBW/Manchester	A	B	B	B	B	B	B	B	B	B	B	B	B
Lowell/Central	D	F	C	C	C	C	C	C	D	C	F	E	F
DWH/Spit Brook	F	F	F	F	F	F	F	F	F	F	F	F	F
Amherst/Concord	F	F	F	F	F	F	F	F	F	F	F	F	F
Main/Canal	F	F	F	F	F	F	F	F	F	F	F	F	F
Taylor Falls Bridge/NH102	F	F	D	D	D	E	C	D	F	F	F	F	F

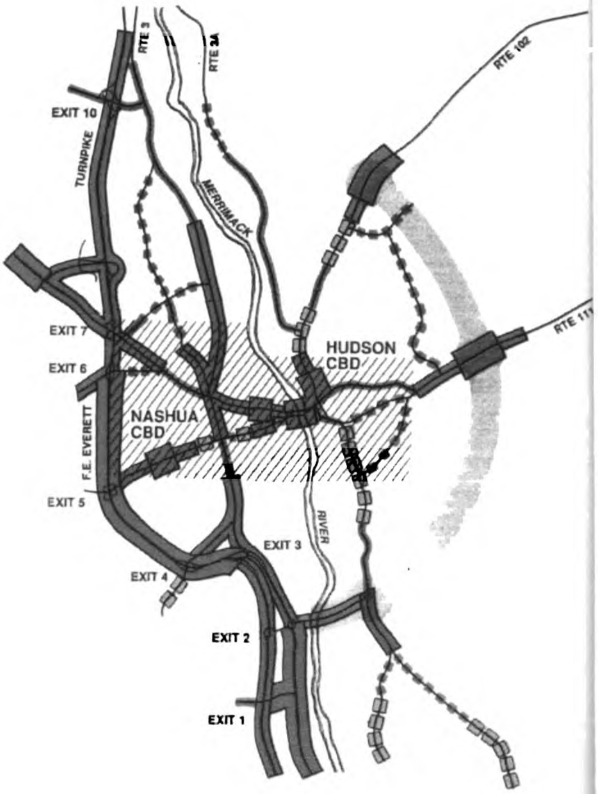
[1]Column changed based on comments on the DEIS requesting additional analysis of the Transit/TDM Alternative.



NO BUILD - 2010



PARTIAL BUILD TO NH 111



PARTIAL BUILD TO NH 102

LEGEND

LOS A-B

LOS C

LOS D

LOS E

LOS F

LOS OF (V/C RATIOS GREATER THAN 1.5)

NASHUA-HUDSON CENTRAL BUSINESS DISTRICT

Note:
The analysis presented here represents Level of Service projections based on volume / capacity (v/c) ratios.

NORTH
NOT TO SCALE

NASHUA-HUDSON CIRCUMFERENTIAL HIGHWAY

FIGURE 2-6
LEVEL OF SERVICE BY ALTERNATIVE

NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

Alternatives do not meet the project purpose and need. (See FHWA letters and memos in Appendix A.) Additional information on the Partial Build Alternatives and the Transit/TDM Alternative can be obtained from the revised Traffic and Transportation Technical Report, and LOS table in Appendix A.

2.4 ENVIRONMENTAL IMPACTS

Environmental impacts of the Full Build Alternatives are quantified in the matrix labeled Table 2-6 (Revised). In addition, environmental impacts for the Partial Build Alternatives are quantified in this table as well. Partial Build Alternatives correspond to the southern, central and northern sections as identified in the matrix. Information in this table was organized in this fashion at the request of the EPA for public commenting purposes, in respect to weighing environmental tradeoffs of the Partial Builds verses the Full Build Alternatives. Note: Partial Build to N.H. Route 111 corresponds to the "southern" section; Partial Build to N.H. Route 102 corresponds to the "southern" and "central" sections combined; Partial Build Turnpike south to N.H. Route 102 corresponds to the "northern" section; and Partial Build without N.H. 102 to N.H. 111 corresponds to the "southern" and "northern" sections combined.

The narrative that follows, however, focuses only on the comparative impacts of the Full Build Alternatives, as the Partial Builds and Transit/TDM and TSM Alternatives were eliminated from detailed study for the reasons as described in Section 2.3.2.

2.4.1 Comparison of Alternatives

This section compares the environmental consequences of Full Build Alternative alignments 3 through 8. Section 2.4.2 addresses the environmental impacts associated with Alternative 9 by itself as it was developed at a later stage through the DEIS process.

Displacement

It is estimated that the largest number of households displaced would occur with Alternative Alignment 4, consisting of 53 residences, 3 businesses, and 1 large garage (vacant). The least number of households displaced would occur with the Alternative Alignment 7 consisting of 11 residences, and 3 businesses.

Alternatives	Wetlands: NWI & Hydric Soils (affected acres)	Wetlands: NWI & Hydric Soils (affected acres)	Wetlands: # Wetlan Impacte / # Key Wetland Impacte (each)	Environmental Risk Sites Directly Impacted (each)	Structures Directly Impacted: Residences (each)	Structures Directly Impacted: Business (each)	Estimated Construction Costs ($ million)
Full Build							
3	78	34 / 71	28 / 4	5	51	2	180
4	67	28 / 59	28 /5	4	53	3	183
5	66	28 / 60	34 / 4	5	50	2	177
6	54	21 / 48	34 / 5	4	51	3	181
7	94	55 / 70	45 / 6	2	11	3	183
8	88	51 / 68	43 / 4	2	14	3	185
9	71	37 / 50	41 / 5	3	49	3	186
Southern Section (Sagamore Br. north to NH Route 111)							
3	17	10 / 14	17 / 3	1	34	1	55
4	17	10 / 14	17 / 3	1	34	1	55
5	17	10 / 14	17 / 3	1	34	1	55
6	17	10 / 14	17 / 3	1	34	1	55
7	45	23 / 37	24 / 3	0	4	3	57
8	45	23 / 37	24 / 3	0	4	3	57
9	22	13 / 13	18 / 3	1	39	3	58
Central Section (NH Route 111 north to NH Route 102)							
3	16	10 / 12	4 / 0	2	11	1	85
4	16	10 / 12	4 / 0	2	11	1	85
5	10	3 / 8	10 / 0	2	9	1	82
6	10	3 / 8	10 / 0	2	9	1	82
7	17	12 / 10	8 / 0	2	0	0	85
8	17	12 / 10	8 / 0	2	0	0	85
9	17	12 / 10	8 / 0	2	0	0	85
Northern Section (NH Route 102 north to FE Everett Turnpike)							
3	45	14 / 45	7 / 1	2	6	0	40
4	33	8 / 33	7 / 2	1	8	1	43
5	38	15 / 38	7 / 1	2	7	0	40
6	26	8 / 26	7 / 2	1	8	1	44
7	32	20 / 23	13 / 3	0	7	0	41
8	26	16 / 21	11 / 1	0	10	0	43
9	32	12 / 27	15 / 2	0	10	0	43

[1]This table has been revised to include impact quanti

[2]Historic Properties refers to both structures and distr gation plan for the former Benson's Property.

These data are analyzed in more detail in the following techni

- Air Quality Analysis
- Cumulative Development and Associated Impa
- Environmental Risk Sites
- Farmland and Agricultural Resources
- ffic and Transportation (Revised August 1993)
- lls and Aquifers
- tlands
- ldlife Resources

In general, the social and economic characteristics of the majority of the displacees appear to place them in the middle income bracket. There appears to be no special ethnic or racial make-up of the families likely to be displaced. Any relocated individuals who are handicapped or elderly will be identified prior to the acquisition stage and their special needs addressed accordingly.

Alternatives 4 and 6 would bisect the Anheuser-Busch brewery property in Merrimack. The impact on this major employer would be substantial. The alignment crosses the firm's emergency water supply well fields and recreational area and runs between the factory and the company's stables, where they house the Budweiser Clydesdale Horses. The brewery is a major tourist destination, and the highway would disrupt their ability to continue this aspect of their business, according to company officials.

Land Use

When evaluating the land use impacts, it is anticipated that all six of the Build Alternative alignments would have substantially the same effects in terms of inducing growth. That is, the movement of the highway corridor to either one side or the other would not significantly alter the number of housing units or commercial/industrial development that is expected to be developed.

The town of Litchfield has officially recognized the B-C Alignment (from the 1984 DEIS) as part of their master plan. Litchfield rezoned a significant portion of the town, through which the highway would pass, for commercial and industrial development. Alternatives 3, 4, 5 and 6 for the most part, bisect land that is zoned residential, negating the master plan's attempt to isolate commercial and industrial development in the southernmost part of town, in the area of the highway.

Secondary and Cumulative Development

Under the No Build Alternative, the stimulus for growth within the next 20 years would be greatly reduced. Although the study area towns would still be expected to eventually reach the growth levels predicted under Full Build, they will not be reached by the year 2010. This is an important distinction to make because it suggests that the highway will not actually generate more development, but will instead accelerate the rate of growth that would have eventually occurred over a longer period of time, with or without the highway. This is considered a likely scenario because the Nashua Region has historically been a growth center for New Hampshire, and it is again expected to fill that role once the current economic recessionary conditions begin to subside.

Residential developments are predicted to double in most of the area along the length of the limited access highway. In analysis zones one tier removed, housing density increase is anticipated to be slight. Significant increases in square footage of non-residential building space are predicted near proposed highway interchanges with N.H. Routes 3A, 111, 102, U.S. Route 3 and the F.E. Everett Turnpike. These increases are an obvious consequence of increased access provided to these areas by the highway and are, therefore, most appropriately categorized as secondary development impacts.

It is at these interchange locations that secondary and cumulative development will impact the various resources evaluated in this document (farmlands, historic resources, air, noise, wildlife, water resources, wetlands and environmental risk sites.)

Public/6(f) Lands and Institutional Resources

No lands within any of the proposed Nashua-Hudson Circumferential Highway alternative corridor rights-of-way have been acquired or developed with Land and Water Conservation Fund assistance. Thus, Section 6(f) documentation is not required.

The Hudson Historical Society & Cultural Center on N.H. Route 102 in Hudson, on the National Register of Historic Places, would be completely impacted by Alternatives 5 and 6.

A portion of the parking lot for the Tabernacle Baptist Church on N.H. Route 102 would be impacted by Alternatives 3, 4, 7, and 8. No portion of the Church structure would be impacted.

A portion of the agricultural fields of Alvirne High School would be impacted by Alternatives 5 and 6.

Farmlands

Farmland impacts include: lost active farmland, lost Prime or Statewide Important farmland soils, disrupted and restricted or lost access to farm areas, and increases in development pressure and resulting loss of farmland through development.

Of the Build Alternatives, Alternative 3 would have the least impact to active farmlands (15.0 acres), while Alternative 6 would have the greatest, with a loss of 45.4 acres. Alternatives 5 and 6 impact Alvirne High School's agricultural fields in Hudson, and Alternative 6 goes on to impact Wilson's

Farm in Litchfield. Alternatives 3, 7, and 8 would be the least disruptive of active farmlands.

All Build Alternatives would disrupt areas of active farmland, and would result in increased development pressure. However, under the No Build Alternative, development pressure would continue even in the absence of a new roadway.

Historic and Archeological Resources

Historic Resources. *An intensive survey was undertaken in autumn of 1992. It identified 25 individual historic buildings (outside of districts) and eight historic districts (including approximately 70 additional properties within the districts for which individual forms were prepared). The Determination of Eligibility Committee's review of the information found that 16 individual structures and three historic districts were eligible for the National Register of Historic Places. One additional individual property, the Hills House, "Alvirne", was already listed on the National Register of Historic Places.*

Of the one already listed and sixteen individual properties and three historic districts determined eligible for the National Register, three individual properties and all three districts would be adversely affected by a number of the proposed Build Alternatives. In addition, the setting of two historic properties would be affected by all Build Alternatives, although the effect would not be adverse.

None of the Build Alternatives directly affect Benson's Wild Animal Farm Historic District on Kimball Hill Road in Hudson. However, the proposed construction of 9.4 acres of wetlands within the 38 acre historic portion of the 165.81 acre property would have an adverse effect on the unique and significant historic district.

In the southern section of the project area, from the start of the project north to N.H. Route 111 in Hudson, no historic resources are adversely affected by any of the proposed Alternatives. However, each of the Build Alternatives will affect the setting of two eligible properties.

In the central portion of the project, between N.H. Routes 111 and 102 in Hudson and Litchfield, the Build Alternatives would present a choice between the acquisition of the Hills House, "Alvirne", already listed on the National Register, under Alternatives 5 and 6, and the loss of the National Register eligibility of the Jasper Poultry Farm Historic District under the remaining Build Alternatives 3, 4, 7 and 8. In both cases, National Register eligibility would be lost and *mitigation measures unsatisfactory. One contributing building in the Jasper Poultry Farm Historic District would be acquired under Alternatives 3, 4, 7 and 8.*

Alternatives 3, 5, 7 and 8 would present further adverse effects in the northern section of the project area, leaving Alternatives 4 and 6 as the least damaging to National Register eligible properties. Alternatives 3 and 5 would require the acquisition and removal of the one historic structure in Litchfield and the acquisition of 3.8 acres of another historic parcel, although no historic contributing buildings would be acquired on this parcel. As noted above, the National Register eligibility of the Jasper Poultry Farm Historic District would be lost under Alternatives 3, 4, 7, and 8, whereas Alternatives 5 and 6 would require the acquisition and loss of the Hills House, "Alvirne", already listed on the National Register.

Alternatives 7 and 8 avoid adverse impacts to three individual properties, but would introduce adverse effects to the Pennichuck Water Works Historic District, in addition to adverse impacts to the Jasper Poultry Farm Historic District. Although Alternatives 7 and 8 would not adversely affect the historic and continuing use of the water works, both alignments would bisect the natural wooded landscape of the district, causing diminished integrity of setting, feeling and association.

Only Alternative 1, the No-Build Alternative, would avoid adverse effects to National Register historic properties in the project area. No detailed plans for Alternative 2, the Transit/TDM and TSM Alternative, have been determined; therefore, its effects on historical resources are currently unknown and would have to be addressed if necessary. All of the Build Alternatives will result in an adverse effect on the Benson's Wild Animal Farm Historic District because of wetland creation.

Archeological Resources. Archeological sensitivity within the study area largely coincides with the first and second Merrimack River terraces, as well as the margins of interior water features. The Full Build Alternative alignments would affect 17 of the 25 areas assigned archeological sensitivity. All alternatives are likely to affect sensitive areas located on the first Merrimack River terrace, as well as sites located on the second tier above the Merrimack River, and those associated with interior surface water features. Alternative alignments 7 and 8 would affect the archeologically sensitive area in the uplands. Archeologically sensitive areas would not be affected in their entirety; instead, margins or segments of individual areas may be cross-cut by Alternative alignment corridors.

Air Quality

The proposed highway project is included in the NRPC's Transportation Program, which is in conformance with the New Hampshire's State Implementation Plan (SIP).

Because of the federal motor vehicle emissions control program and the state of New Hampshire Inspection and Maintenance (I/M) program, 8-hour carbon monoxide (CO) concentrations at all receptor locations in 2000 will be significantly lower than their 1990 counterparts. No violations of the 8-hour standard are anticipated anywhere - with either the No Build or any of the Build Alternatives. At the intersection of Daniel Webster Highway and Spit Brook Road, the Build Alternatives are expected to result in a slight increase in CO concentrations when compared with the No Build. But at a number of other locations - especially in the downtown Nashua area, such as at Library Hill or the intersection of Main and Canal Streets - the Build Alternatives would result in a decrease of between 0.5 to 1.5 ppm in 8-hour CO concentrations when compared with the corresponding No Build concentrations. Differences in concentrations from one Build Alternative to another are quite small.

Because the proposed Circumferential Highway is not expected to result in creating any new violations of either the 8- or the 1-hour standards, or to exacerbate an existing violation, the proposed project is in conformance with the SIP for the CO standards compliance.

As for nonmethane hydrocarbon (NMHC) emissions, these are less for all Full Build Alternatives than the No Build Alternative in both the short- and long-term scenarios. In all instances, the 2010 emissions are lower than the 1990 conditions.

Visual Impacts

Resource impacts would adversely affect the visual and aesthetic quality of the environment for residents with a direct view of the roadway. The impact would be strongest in areas where interchanges encroach on residential districts, namely in the vicinity of N.H. Routes 102, 111, and 3A. The urban character of this landscape unit is more visually compatible with new roadway development than undeveloped areas, but neighbors of the highway will find it obtrusive.

Terrestrial Ecology

Of the four unique natural community types found within the study area as identified by the New Hampshire Department of Resources and Economic Development (NHDRED), only Alternatives 4 and 6 would impact one of these natural community types. These Alternatives would each impact two wetlands in Litchfield characteristic of Inland Basin Marsh communities.

Some local modification to terrain and soils within the impact areas of the project would occur. No significant adverse impacts to soils or geology within the study area are anticipated.

Endangered and Threatened Plant Species. No Federally listed, Threatened, Endangered, or Candidate plant species have been identified within the study area; hence, no impacts are anticipated.

NHDRED, Natural Heritage Inventory, has identified one State Endangered plant species as having occurred in the vicinity of one alignment. Alternatives 7 and 8, along a common alignment, cross an area identified as having an historical record of Walking Fern Spleenwort (*Camptosorus rhizophyllus*.) This plant was last observed in 1939, and is believed to no longer occur in the vicinity of the alignments. No impact to this state-listed, Endangered species is anticipated.

Wildlife

Undeveloped land considered as wildlife habitat areas has been quantified and listed in Table 2-6. Alternatives 3, 4, 5 and 6 would impact nearly the same amount of undeveloped land (approximately 520 acres). Alternatives 7 and 8 both impact almost 20 percent more undeveloped land (641 acres).

Field assessment of habitats along the proposed corridors reveals six important wildlife habitat areas. These include: Second Brook wetland system, Upper Limit Brook, Lower Pennichuck Brook, Pocket wetlands in Litchfield characteristic of basin marshes, the bottom land swamp near the Anheuser-Busch plant, and the Pennichuck Reservoir. Alternatives 3, 4, 5 and 6 impact only two of these habitats, while Alternative 8 impacts three and Alternative 7 impacts four habitats.

The entire study area contains a typical assemblage of wildlife species for southern New Hampshire. The effects of development (urbanization) and fragmentation of the region are evidenced by the species composition. Most species occupying the study area will continue to occupy the region even with the addition of a new roadway. Changing the existing landscape as a result of the proposed roadway will affect some local species distributions, but in context of the already changing character of the study area, these impacts will be less noticeable.

Rare, Threatened, or Endangered Species. *A Biological Assessment entitled,* ***Bald Eagle Impacts Associated with the Proposed Nashua-Hudson Circumferential Highway,*** *dated April 1993, was prepared by the Corps in accordance with Section 7(c) of the Endangered Species Act of 1973 (ESA), due to the presence of the endangered Bald Eagle* Haliaeetus leucocephalus), *in the area of a major federal construction project. Bald Eagles which winter along the Merrimack River, are the only species listed pursuant to the ESA that are known to be present in the Nashua-Hudson Circumferential Highway project area. No federally designated critical habitat is present.*

The Biological Assessment was forwarded to the FWS, who concurred with the Corps findings that Alternatives 1, 2, 7 and 8 are not likely to adversely affect the Bald Eagle, whereas alternatives 3, 4, 5 and 6 are likely to adversely affect the Bald Eagle. If Alternatives 3 through 6 are determined to be the LEDPA, formal consultation will be required under the ESA prior to a permit decision.

Water Resources

Study Area Drainage Basins. All streams and waterbodies within the study area have water quality classification B, suitable for recreational use, fish and wildlife habitat and agricultural and industrial use. Dissolved and suspended contaminants in roadway and urban runoff presently enter these waterbodies as a result of the existing land use occurring in the drainage basins. Water from the Pennichuck Brook is used to supply drinking water to the City of Nashua. The Merrimack River provides drinking water to several towns down stream in Massachusetts. These two water sources are treated before use.

Alternatives 7 and 8 pass through the Pennichuck Brook drainage basin. Without mitigation, these alignments could affect the Pennichuck's water quality. Alternative 7 passes over Bowers Pond, part of Pennichuck Brook, increasing the risk of hazardous material spills directly into the waterbody.

Wells and Aquifers. All Build Alternative alignments cross substantially similar amounts of surface acres underlain by aquifers. There are essentially six locations along a generic corridor that deserve special consideration. They include, from south to north: the Ottarnic Pond aquifer underlying Brox Industries; the aquifer and wells in the vicinity of N.H. Route 102; the high production Weinstein Well near Cutler Road in Litchfield; the southwestern corner of Litchfield along N.H. Route 3A; the aquifer and wellfield associated with the Anheuser-Busch property; and the Pennichuck Reservoir.

Build Alternative Alignments 3 through 6 pass in proximity to the Weinstein Well, the major public groundwater supply in the Hudson-Litchfield region. The Pennichuck Reservoir, the major surface water supply, is crossed by Alternative 7.

All Build Alternative Alignments cross N.H. Route 102 between Alvirne High School and the Tabernacle Baptist Church. Many wells occupy this area and may be impacted to differing degrees but to differentiate which alignment is better in this region is difficult. There are nine wells in the vicinity of N.H. Route 102 that include community wells (H7, H8 H9) and non-community wells (H10, H11, 14, 15, L15, L16, L17). Of these wells, only well H10 will be affected by a direct taking (Alternatives 5 and 6) with the other wells affected by indirect impacts.

Alternatives 4 and 6 cross an area underlain by the aquifer associated with the Anheuser-Busch property as well as encroach upon the extensive wellfield situated in this resource.

Considering Alternatives 7 and 8, on the western side of the Merrimack, Alternative 8 would be the alternative of least impact with respect to groundwater. This is because it does not cross the Pennichuck Reservoir and its associated aquifer. Instead, the alignment is designed to diverge from Alternative 7 just prior to crossing the reservoir and travel up and around the reservoir to the north where it ultimately connects with the F.E. Everett Turnpike.

Floodplains

The most significant concerns regarding development in a designated floodplain are the loss of storage capacity and an increase in water surface elevations. The placement of fill or structures in a 100-year floodplain reduces the flood carrying capacity, thus increasing the flood heights and channel velocities of streams and rivers as well as increasing flood hazards beyond the actual encroachment. In all instances involving smaller streams, the loss of existing storage capacity in the immediate area of the crossing is anticipated, albeit minimal. Extensive networks of ponds and wetlands located adjacent and downstream of the crossings (especially Second Brook and Chase Brook) will more than adequately compensate for the loss of flood storage capacity resulting from the encroachment of the 100-year floodplain.

The roadway would be designed with culverts capable of passing a 100-year flood without substantial increases in flood heights.

No substantial impacts related to the Merrimack River Bridges are anticipated because design criteria require adequate hydraulic capacity for bridges. A "HEC-2" Water Surface Profile analysis was conducted in 1989 to predict the effect that proposed Circumferential Highway bridges would have on the water surface profile. The 50-year flood is the design storm and the 10-, 100-, and 500-year floods were also analyzed. The backwater produced by the two bridges would be 0, 0.01, 0.03, and 0.04 feet for the 10-, 50-, 100-, and 500-year floods, respectively. The 500-year flood is not contained within the channel, but the other floods will remain within the river banks. The present bridge designs are of similar style and are predicted to have similar impacts.

Wetlands

An overview and comparison of wetland impacts for each of the Build Alternatives is represented in Table 2-6. These data reflect both hydric soil and National Wetland Inventory (NWI) delineated wetland areas which together constitute the approximate federal wetlands boundary. All wetlands were field visited; adjustments to the digitized mapping were made based on field observations.

In terms of acreage, Alternative 6 has the least wetland impact (54.0 acres) while Alternative 7 has the greatest (93.5 acres). Alternatives 3 and 4 impact the fewest number of discrete wetlands (28), and Alternative 7 impacts the most (45). Alternatives 3, 5, and 8 impact the fewest number of key wetlands (4), and Alternative 7 impacts the most (6).

All Build Alternative alignments impact more palustrine forested habitat than any other wetland class. This is consistent with the predominance of wooded wetland habitat found in the study area. Alternative 7 and 8 impact a disproportionately higher amount of palustrine forested wetland than the other four Build Alternative alignments. This may be attributed to the previous efforts by the state of New Hampshire to purchase right-of-way along the Alternative 7 (B/C) corridor. The arrested land development brought on by State acquisition of this corridor may account for the predominance of forested habitat that is being impacted by Alternatives 7 and 8, while no such arrest of development was applied to other corridors. Except for palustrine emergent and lacustrine, all other wetland types are more evenly impacted by each of the Alternative alignments. Crossings of the Merrimack River and Chase Brook account for the riverine impact, while the Pennichuck Reservoir represents the only lacustrine impact.

For all Alternative alignments, wildlife Principal Valuable Function is associated with the highest acreage impact. As with the wetland class impact, the disproportionately large amount of impact to wildlife function along Alternatives 7 and 8 appears to reflect the State's acquisition of sections of the Alternative 7 (B/C) right-of-way.

Waterbody Modifications

The Build Alternatives will traverse several perennial and intermittent streams, the Merrimack River, and unnamed open waterbodies, such as ponds. Important streams in the study area are Limit, Second, Merrill, Glover, Chase and Pennichuck Brooks. The Merrimack is the receiving river for all drainages within the study area. Several unnamed streams, tributaries to the aforementioned brooks, are also crossed by all Build Alternatives.

Highway crossings over the Merrimack River (and Bowers Pond of the Pennichuck Reservoir, if Alternative 7 is selected) would be made by bridge. No major rechannelization would occur other than excavation to construct culverts and bridge piers. Stream crossings would create a loss of habitat for some aquatic organisms and fish species. An incremental loss of stream habitat approximating 300 linear feet per crossing is anticipated. The placing of culverts or fill in stream crossings would temporarily increase turbidity and sedimentation in the stream. Construction of piers for the bridges over the Merrimack River, for all Build Alternatives, and over Bowers Pond for Alternative 7 may cause some short-term increase in turbidity and sedimentation.

All major drainages, such as the aforementioned brooks, and some of the unnamed tributaries to these brooks, have been traversed by previously constructed roadway crossings. These existing crossings utilize pipes, culverts and bridges with no significant impact to the watercourse. With properly designed and constructed bridge or culvert crossings, no significant change to any stream ecology, hydrology or hydraulics is anticipated.

Environmental Risk Sites

Without performing a field survey, it is impossible to locate the environmental risk site precisely on the property listings. It must therefore be assumed that an impact to a property, or site, will directly impact the material/materials producing the environmental risk status.

In the southern section, Alternatives 3 through 6 would impact Site 21, 4 Gregory Street, containing asbestos. In the central section, all Build

Alternatives would impact Site 46, Hudson Paving, Inc., and Site 47, Brox Industries and Brox Paving Materials, Inc., containing underground storage tanks. In the northern section, Alternatives 3 and 5 would impact Site 61, Lockheed Sanders, Inc., containing underground storage tanks. This site covers a vast land area and is susceptible to being directly impacted. In the northern section, Alternatives 3 through 6 would impact Site 63, Anheuser-Busch, Inc., containing underground injection control, discharging benign wastewaters not requiring a groundwater permit. This site cover a vast land area and is susceptible to being directly impacted.

All Build Alternatives impact environmental risk sites. However, Alternatives 7 and 8 impact the fewest sites.

Energy

The energy impacts for the Candidate Build Alternative alignments require evaluation of the direct consumption of energy by vehicles using the alternative and the indirect consumption of energy needed to construct that alternative. This analysis considers the total energy consumed by each alternative over a 20-year service life.

Over the 20-year service period, the direct motive energy required by vehicles which travel the roadway network greatly exceeds the indirect energy utilization for the construction of Build Alternatives. In the case of the Build Alternatives, roughly 98 percent of the total energy used over the 20-year service period is for motive energy. As a result, the No Build 2010, Transit/ TDM and TSM Alternatives require more energy than the Full Build Alternatives. The TSM Alternative and No Build require roughly 3.5 to 4 percent more energy over the 20-year service period because of the higher number of vehicle miles traveled.

The Full Build Alternatives differ by .5 percent in their use of energy over the 20-year service period.

Considerations Relating to Pedestrians and Bicyclists

As shown in Figure 3.1-3 in Chapter 3, there are several existing walkways/ bikeways in the project area, and an extensive network of pedestrian and bicycle facilities planned in the region. While walkways and bike paths will be taken into consideration in the design of the Circumferential Highway, the state can expend funds for these facilities within the highway right-of-way only if they connect to existing trails. Regarding a pedestrian walkway on the proposed northern Merrimack River bridge, requested by the Town of

Litchfield, such a walkway will be provided if the Town has constructed a trail leading to the bridge at the time the NHDOT is preparing for construction of the bridge.

A walkway will be provided at the Sagamore Bridge between Nashua and Hudson.

Construction Impacts

The maintenance and protection of traffic during construction will be a prime consideration at the northern terminus with the F. E. Everett Turnpike, the southern terminus area surrounding the Sagamore Bridge, and at the interchanges with U.S. Route 3 and N.H. Routes 3A, 102, and 111 for the length of the construction period.

The impacts to the ambient air quality and noise quality of the study area during the period of construction will be of equal magnitude in all six of the Build Alternatives.

Impacts to the environment during construction may also include an increase in sediments in runoff, turbidity, fuel or oil spills, all of which may impact an aquifer or surrounding waters if un-mitigated. Blasting in bedrock may alter groundwater flow patterns and volumes, resulting in improvement or deterioration of water quality and yield from wells in the area. This effect is difficult to predict even by the most experienced geologists and groundwater hydrologists. Overall, no significant impact to public water supplies is anticipated. Accelerated erosion and sedimentation caused by land-disturbing activities during construction is the major short term impact.

In addition to soil erosion and sedimentation, there are other potential pollutants associated with construction activities including gasoline, oils, grease, paints, cements, and solvents, and other contaminants. Non-toxic materials such as paper, cardboard, and wood are potential pollutants if they are washed in to the drainage system in large quantities.

Some loss of vegetation may result in the wetlands lying adjacent to construction areas. These areas will not result in permanent loss and will re-generate.

The construction of bridges over the Merrimack River at the northern and southern termini of all alternative alignments will involve setting cofferdams for the construction of piers. Water is removed from within the cofferdams to facilitate excavation to footing level and the construction of the pier. The pumping of water from inside the cofferdam to outside will not impact the waterbodies to any measurable degree. Disturbance of other sediments surrounding the cofferdams is not expected to occur. Construction equipment for pier construction, may be at risk of spillage of hazardous materials such as oil and gasoline directly in the waterbody.

Alternative 7 would cross Bowers Pond, a portion of the Pennichuck water supply. The construction of the bridge spanning Bowers Pond would involve land disturbance on the east and west banks, possibly increasing the turbidity of the water. A structure type study will be done to determine the best pier and span configuration to protect the water supply. The bridge should have no intermediate piers or as few as possible constructed in the pond to limit sediment disturbance and minimize spill potential.

The various construction permits that will be required for this project may have requirements which dictate specific construction techniques, construction constraints, time periods and maximum allowable increases in turbidity in which to implement these requirements.

2.4.2 Summary of Alternative 9 Impacts

Based on available information, including the testimony given at the Public Hearing, and in light of the answers provided in this FEIS, a new Full Build Alternative project alignment, Alternative 9, was defined. This new Alternative alignment essentially follows the same corridor as Alternative 8 with a few exceptions. In the southern portion of the study area, all alternatives (including Alternative 9) follow the same corridor until they split just east of Lowell Road. At this point, Alternative 9 follows Alternatives 3 through 6 around the northern end of Upper Limit Brook in the vicinity of Wasson Road. Alternative 9 then joins Alternatives 7 and 8 just north of Second Brook and follows this corridor across the Merrimack River until Alternatives 7 and 8 split just east of Manchester Street. Here, Alternative 9 shifts slightly to the south of Alternative 8. It follows this route until its ultimate connection with the F.E. Everett Turnpike at proposed Exit 9. (For location of Alternative 9, see Figure 2-5 "clear overlay" on the following page.) The objective of Alternative 9 is to minimize environmental impacts in compliance with the requirements of the Clean Water Act. This alternative is now the NHDOT's final proposal for a Corps permit decision.

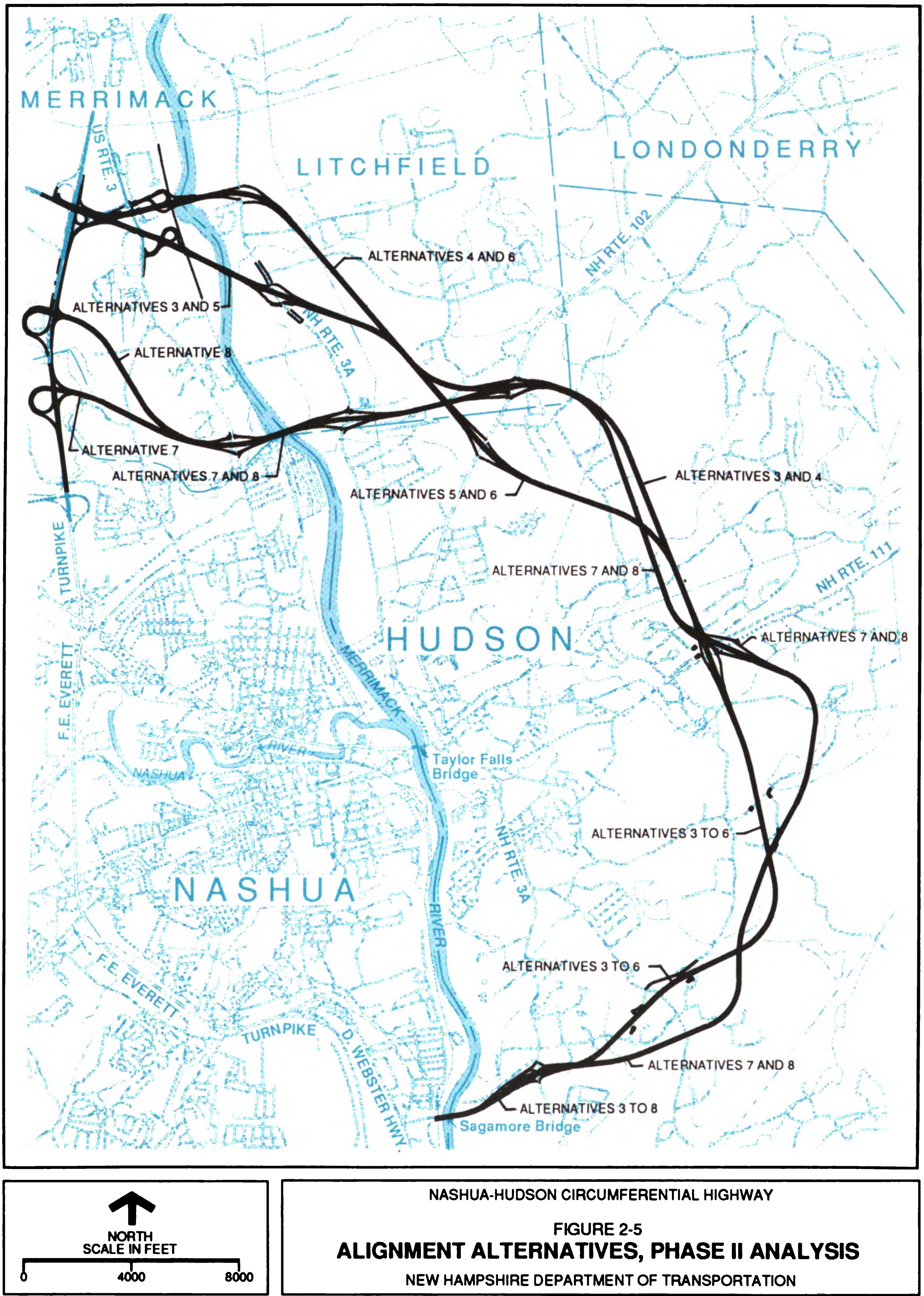
Traffic

The interchanges for Alternative 9 are located at N.H. Routes 111, 102, 3A, U.S. Route 3, and the F.E. Everett Turnpike and are identical to the interchange *locations and configurations of Alternative 8. Since the access and egress points along the Circumferential Highway are the same for both Alternatives 8 and 9, the Average Daily Traffic (ADT) volumes reported for Alternative 8 in Figure 4.1-7 of this FEIS are the same for Alternative 9. The operational characteristics determined for Alternative 8 and presented in the Level of Service by Alternative section in Appendix A of this FEIS will be the same for Alternative 9.*

Displacement/Acquisitions

Alternative 9 will displace 19 single family residences, 13 duplexes (26 residences), and 2 condexes (4 residences) for a total of 49 displaced residences. In addition to residences, three businesses, and one non-profit organization will also be directly impacted by this alternative. The total cost of acquisitions and relocations for Alternative 9 is $7,075,800. Compared to the other Full Build Alternatives, Alternative 9 ranks third with respect to displacement impacts and fifth with respect to acquisition and relocation costs. In terms of displacements, Alternative 7 has the least impact, affecting 11 residences and 3 businesses followed closely by Alternative 8 which impacts 14 residences and 3 businesses. Alternative 9 and Alternative 5 are comparable in that Alternative 9 impacts 49 residences and 3 businesses whereas Alternative 5 impacts 50 residences but only 2 businesses. Alternative 3 (51 residences and 2 businesses), Alternative 6 (51 residences and 3 businesses) and Alternative 4 (53 residences and 3 businesses) conclude the ranking. As for acquisition and relocation costs, the ranking is as follows: Alternative 7 ($2,736,400), Alternative 8 ($3,291,700), Alternative 5 ($6,802,700), Alternative 3 ($6,885,700), Alternative 9 ($7,075,800), Alternative 6 ($7,653,900), and Alternative 4 ($8,480,400).

In the south, where Alternative 9 traverses the Wasson Road neighborhood, a total of 18 residences housing 22 families will be impacted. Additional acquisitions may also be considered for properties immediately adjacent to the alignment. Alternatives 3 through 6 impact the same number of residences and families in this neighborhood since they share the same corridor with Alternative 9. Alternatives 7 and 8 follow a corridor south of Wasson Road through a large wetland complex associated with Limit Brook. Few houses are impacted by this southerly route. In the central section of the study area from N.H. Route 111 to N.H. Route 102, Alternative 9 follows the same corridor as Alternatives 7 and 8 and therefore has no additional acquisitions. North of N.H. Route 102, Alternative 9 follows Alternatives 7 and 8 across the Merrimack River until a point just east of Manchester Street. Here, Alternative 9 is shifted slightly to the south of Alternative 8, thus passing to the south of the Nashua Fish and Game Association. This shift avoids the displacement of this recreational facility.



NASHUA-HUDSON CIRCUMFERENTIAL HIGHWAY

FIGURE 2-5

ALIGNMENT ALTERNATIVES, PHASE II ANALYSIS

NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

As with the other alignments, the general social and economic characteristics of the majority of Alternative 9 displacees appears to place them in the middle income bracket. There appears to be no special ethnic or racial make-up of the families likely to be displaced.

Socio-Economics

The socio-economic impacts of Alternative 9 will closely mirror those other alternatives from which it was derived. Following the same methodology used in the Socio-Economics Technical Report, Alternative 9 ranks fifth out of seven in estimated total direct impact value, as shown in Table 2-7 below. The methodology used in the Technical Report differs somewhat from that used in the final analysis and reflects fewer home takings due to the level of detail available during the earlier analysis.

Table 2-7

DIRECT ECONOMIC IMPACTS: FULL BUILD ALTERNATIVES (in $1000s)

Alternative	Est. Number Acres	Est. Land Value	Est. Number Homes	Est. Value	Other Est. Value	Est. Change in New Public Tax Benefit	Est. Total Value	Rank Order
8	713	$9,550	13	$1,220	$ 400	$5	$11,175	1
7	713	9,550	14	1,220	500	4	11,254	2
3	588	8,490	30	3,640	1,900	6	14,036	3
5	584	8,450	27	3,500	2,350	3	14,303	4
9	711	9,330	39	4,540	500	9	14,379	5
4	624	8,670	31	3,860	2,400	10	14,940	6
6	620	8,630	28	3,720	2,850	7	15,207	7

Land Use

Alternative 9 is likely to have similar effects in terms of induced growth when compared to the other Full Build Alternative alignments. One benefit of this alignment relates to the town of Litchfield's development plans. Litchfield rezoned a significant portion of the town for commercial and industrial developments based on the original B-C alignment that was studied in the 1984 DEIS. Alternative 9 (like Alternatives 7 and 8) follows the same corridor as that original B-C corridor and therefore will not result in a restructuring of Litchfield's master plan of development. Restructuring of that plan would be necessary if Alternatives 3, 4, 5, or 6 were selected as the preferred route for the Circumferential Highway.

Cumulative Development

Alternative 9, like all of the Full Build Alternative alignments, will not actually generate more development, but will instead result in an acceleration of growth that would have eventually occurred regardless of a new highway facility through the region. The new highway, however, will dictate the location of development to a certain extent based on the location of interchanges. Since Alternatives 8 and 9 are identical in terms of interchange locations, developments subsequent to the highway's construction are expected to evolve in these areas. For a discussion of secondary and cumulative development and associated resource impacts, refer to Section 4.23 of this FEIS. This section also provides suggested mitigation measures that are applicable regardless of which alternative alignment is selected as the preferred route for the Circumferential Highway.

Public/6(f) Lands and Institutional Resources

No lands within the right-of-way of Alternative 9 have been acquired or developed with Land and Water Conservation Fund assistance. Therefore, Section 6(f) documentation is not required. This is true for the other Full Build Alternative alignments as well.

Alternative 9, like Alternative 3, 4, 7, and 8, will impact a portion of the parking lot associated with the Tabernacle Baptist Church on N.H. Route 102. No portion of the Church structure will be impacted by any of these alternative alignments.

Farmland

Direct impacts to active farmland are minimal with Alternative 9. Approximately 16.6 acres of active farmland will be impacted, primarily in the north, identical to the impact of Alternative 8. Shifting the alignment from Alternatives 3 through 6 to Alternatives 7 and 8 in the south near Bush Hill Road, brings Alternative 9 closer to an active tree farm on Bush Hill Road. However, no direct impacts to this active farm are anticipated. Alternative 9 will impact 11.6 acres of active prime farmland soil, 48.4 acres of non-active prime soil, and 2.3 acres of active statewide important and 39.6 acres of non-active statewide important soil. Active non-prime non-statewide important soils will experience approximately 2.7 acres of impact.

Alternative 3 has the least impact on active farmlands as it affects only 15.0 acres. Alternatives 7, 8, and 9 rank second with an impact of approximately 17.0 acres. Alternative 4 impacts 23.0 acres and Alternative 5 impacts 37.0 acres.

The greatest impact is associated with Alternative 6 which impacts 45.0 acres of active farmland.

Mitigation to reduce farmland impacts includes: (1) reducing right-of-way requirements, (2) re-routing or slightly shifting the alignment in order to minimize impacts, (3) maintaining or providing new or additional access to farmlands isolated by the roadway, and (4) purchase of development rights to a farmland property to avoid secondary and cumulative development impacts. These mitigation measures are applicable to all Full Build Alternative alignments included in this FEIS.

Historic Resources

In the southern portion of the study area, Alternative 9, like all of the Full Build Alternative alignments, will affect the setting of two properties listed as eligible for inclusion onto the National Register of Historic Places. These properties include the Asa Davis House (#23) and the Bartlett House and Office Complex (#107). The impact to these properties, however, will not impair their National Register eligibility status.

In the central section of the study area, the Jasper Poultry Farm Historic District (Area BB) would be severely impacted by Alternative 9 and suffer an adverse effect due to the loss of integrity of setting, feeling and association. The alignment would bisect the district, thus destroying its historic coherence and significance. It would also require the acquisition of one contributing structure, the Crockett House (#62). These impacts are similar for Alternatives 3, 4, 7 and 8 in this area. Alternatives 5 and 6 require the acquisition of the Hills House (#106).

In the northern portion of the study area, Alternative 9 would impact a portion of the white pine upland along the eastern edge of the approximately 1090 acre Pennichuck Water Works Historic District. Under this Alternative, the historic physical plant would not be directly affected; the buildings' functions would not change; the buildings would remain in use, and the water works operations would continue uninterrupted.

This Alternative, like all others, will not directly impact Benson's Wild Animal Farm Historic District on Kimball Hill Road in Hudson. However, the proposed creation of 9.4 acres of wetlands within the 38 acre historic portion of the 165.8 acre property would have an adverse effect on the unique and significant historic district regardless of which Full Build Alternative alignment is selected.

Preferred mitigation is to design the alignment so that it avoids the historic property completely. If this is not a prudent or feasible option, then the following mitigation measures can be examined in an effort to minimize impacts on historic resources: (1) documentation of the adversely affected property using Historic American Buildings Survey (HABS) standards, (2) marketing the documented structure for relocation with priority given to relocation on the same parcel and/or within the district or area, (3) minimizing land acquisition through right-of-way adjustments and maximizing the distance between the highway corridor and the historic structure, (4) providing access as necessary to maintain existing land uses, and (5) providing landscaping and screening to minimize visual and noise impacts.

As previously mentioned, Alternative 9 would adversely affect three historic districts. Two of them, the Jasper Poultry Farm Historic District and the Pennichuck Water Works Historic District, are directly impacted by the alignment while the third, Benson's Wild Animal Farm Historic District, would be affected by the proposed wetland mitigation plan. Mitigation measures proposed for these three districts discussed in Section 4.6 of this FEIS are also applicable to Alternative 9.

Archeological Resources

Archeological sensitivity within the study area largely coincides with the first and second Merrimack River terraces, as well as the margins of interior surface water features. All alternative alignments encroach upon archeologically sensitive areas, yet none of the areas is affected in its entirety. This is because only margins or segments of individual areas are cross-cut by alternative alignments. Alternative 9 impacts a total of 10 archeologically sensitive areas, one fewer than Alternatives 7 and 8 and three more than Alternatives 3 through 6. The following is a breakdown by stratum of the number of archeologically sensitive sites affected by Alternative 9.

Number of Sites	***Stratum***
3	*First Merrimack River Terrace*
3	*Second Tier and Juncture of the First Terrace*
0	*Second Merrimack River Terrace*
3	*Interior Surface Water Feature*
1	*Upland*

Alternative 9 falls into the middle range in terms of archeological rank when compared to the other Full Build Alternative alignments.

Archeological Rank	*Alternative*
1	*3, 4, 5, and 6*
2	*9*
3	*7 and 8*

If archeological properties are found which meet National Register criteria, then either preservation in place or the implementation of a data recovery plan consistent with the Secretary of the Interior's "Standards for Documentation" (48 FR 44754-37) and the Advisory Council on Historic Preservation's (ACHP) handbook, "Treatment of Archeological Properties," will be developed and submitted by NHDOT to the SHPO, the Corps, and the ACHP for approval.

Air Quality

Given that Alternative 9 has the same access and egress points as Alternative 8 and that the overall length of Alternative 9 is approximately one-tenth of a mile longer than Alternative 8; the effect that Alternative 9 has on air quality is expected to be similar to that of Alternative 8. No new receptor sites are associated with Alternative 9 because the corridor primarily follows Alternative 8, with the exception of a shift onto a segment of Alternative alignments 3 through 6 in the southern portion of the study area near Wasson Road. Receptor sites in this area have been modeled for these alternatives.

As with all Full Build Alternative alignments, 8-hour CO concentrations at all receptors along Alternative 9 will be significantly lower for the year 2000 as compared to 1990. No violations of the 8-hour standards are anticipated. Because all of the Circumferential Highway Full Build Alternatives are not expected to create any new violations of either the 8- or 1-hour CO standards, or to exacerbate an existing violation, the project is in conformance with the SIP for CO standards compliance regardless of the Alternative that is selected.

The effect of Alternative 9 on non-methane hydrocarbon emissions is similar to that expected for all Full Build Alternative alignments. Table 4.7-1 of this FEIS presents estimated total emissions for all Full Build Alternatives in the years 1990, 2000, and 2010. Alternative 9 emissions will be similar to those reported for Alternative 8. This is also true for the intersection emissions analysis presented in Tables 4.7-2 and 4.7-3 of this FEIS. Finally, NO_x *emissions are estimated to be slightly higher for all Full Build Alternative alignments (including Alternative 9) than the No Build Alternative.*

The existing mandatory Federal Motor Vehicle Emissions Control Program, as well as the New Hampshire Inspection and Maintenance Program, have been, and will continue to be successful in minimizing auto emissions. Based on the air quality analysis results presented in Section 4.7 of this FEIS, all Full Build Alternative alignments, including Alternative 9, will result in similar air quality impacts. These impacts, however, will not result in any violations of existing air quality standards, nor will they exacerbate any existing violations. Therefore, no additional mitigation measures are proposed.

Visual and Aesthetic

Views from Alternative 9 will be similar to those views obtained from Alternative 8 and would consist primarily of rural scenery. The extensive Second Brook system, the Merrimack River and the undisturbed white pine upland associated with the Pennichuck Reservoir would be the visual highlights along the Alternative 9 corridor.

As with all Alternative alignments, visual and aesthetic impacts associated with Alternative 9 would be strongest in areas where interchanges encroach upon residential districts, specifically in the vicinity of N.H. Routes 111, 102, and 3A. The more urbanized character of these interchange locations is more visually compatible with new roadway development than undeveloped areas, but abutters of the highway will find it obtrusive. Overall, visual and aesthetic impacts associated with Alternative 9 will be similar to those described for all alternative corridors.

Mitigation measures to reduce visual and aesthetic impacts are similar for all alternative alignments included in this FEIS. These measures are listed in section 4.9 of this FEIS.

Wildlife

Potential wildlife impacts associated with Alternative 9 are similar to the other Build Alternative alignments. A loss of 633 acres of habitat are expected, along with 18 wetlands with wildlife habitat as a principal wetland function. Three of these 18 wetlands were identified as key wetlands. Alternative 9 will impact two Notable Wildlife Habitats, (Second Brook Notable and Pennichuck Notable), and the anticipated habitat fragmentation impacts will be similar to the other Alternatives. This Alternative will affect Habitat Blocks 2, 3, 4, 5, 6, 11, 12, and 13 (See Figure 3.11-1 of this FEIS) with nearly identical impacts as Alternative 8 with the exception of Block 2. The effect on wildlife species is indistinguishable from the other alternatives.

In terms of reducing impacts to wildlife, general mitigation recommendations applicable to all Full Build Alternative alignments are discussed in Section 4.11 of this FEIS. In addition to these general mitigation measures, site specific recommendations applicable to Alternative 9 include: (1) crossing the Second Brook wetland system with a bridge or culvert that allows for wildlife movement along the riparian corridor and (2) crossing the Lower Pennichuck Brook by a bridge or culvert, in order to minimize riparian disturbance.

Rare, Threatened, or Endangered Species

Alternative 9 will not have an adverse effect on the federally-listed endangered Bald Eagle. The northern section of Alternative 9 and its associated Merrimack River crossing is nearly identical to Alternative 8 for which the Biological Assessment concluded that there would be no adverse effect on the Bald Eagle.

Water Resources

Alternative 9, like Alternative 8, passes through the Pennichuck Brook drainage basin. Without mitigation, Alternative 9 could affect the water quality of the Pennichuck Reservoir and holding ponds. However, mitigation measures that are proposed for Alternative 8, namely a closed drainage system, will also be implemented for Alternative 9, thus allowing for maximum protection of the water supply.

As with all Alternative alignments, the concentration of deicing salts in runoff will increase with Alternative 9 by an amount proportional to its length, which is similar to Alternative 8. Additionally, the potential for a transportation related hazardous materials spill is dependent on the length of roadway and the amount of truck traffic that travels along that roadway over a given time period. Estimated recurrence intervals for different magnitudes of spills was modeled for all Alternatives and is presented in Table 4.12-2 of this FEIS. Alternative 9 results would be similar to the results obtained for Alternative 8 due to similarities in corridor length and truck traffic.

Generally, all Alternative alignments will have similar effects on water resources, with the exception that Alternatives 7, 8, and 9 will encroach on the Pennichuck Brook drainage basin, thus requiring a closed drainage system to mitigate any potential water quality impacts to the reservoir and associated holding ponds.

Runoff from Alternative 9 will be discharged to vegetative controls such as grassy drainageways, filter strips, or wetlands in order to remove suspended solids and other roadway contaminants prior to the runoff entering a surface or groundwater *resource. This same approach is applicable to all Full Build Alternative alignments.*

Wells and Aquifers

Impacts to wells in the vicinity of the Alternative 9 corridor are comparable to those impacts described for Alternative 8. In the southern section of the study area where Alternative 9 splits from Alternatives 7 and 8 just east of Lowell Road, no additional community well impacts are anticipated. North of Second Brook where Alternative 9 rejoins Alternatives 7 and 8, well impacts are identical to Alternative 8. Compared to the other alternatives under study, Alternatives 7, 8, and 9 impact the most community wells (3). Alternatives 5 and 6 do not impact any community wells and Alternatives 3 and 4 impact only one community well. Alternative 9 crosses 187 acres underlain by stratified drift aquifers. Of these 187 acres, 19 acres are underlain by high yield stratified drift deposits with a transmissivity greater than 2,000 ft^2 per day. Compared to other alternatives, Alternative 9 resides in the middle range with respect to total acres crossed underlain by stratified drift aquifers. Alternatives 3, 4, 5, and 6 impact fewer surface acres, whereas Alternatives 7 and 8 impact more. In terms of impacts to surface acres underlain by high yield aquifers, Alternatives 6 and 9 cross the largest amount of acreage when compared to the other alternatives.

Like Alternative 8, Alternative 9 will cross the same four sensitive groundwater regions described in Table 4.12-1 of this FEIS, and will include closed drainage in the vicinity of the Pennichuck Reservoir. General mitigation measures applicable to all Full Build Alternative alignments, including Alternative 9, are listed in section 4.12 of this FEIS.

Floodplains

Alternative 9 will impact the same number of acres of 100-year floodplain as Alternative 8, 12.1 acres. The deviation from Alternative 8 in the southern section of the study area does not result in any additional 100-year floodplain impacts, nor does the minor shift from Alternative 8 in the northern portion of the study area. A breakdown of the 100-year floodplain impacts by watercourse is presented in Table 4.13-1 of this FEIS. Alternatives 7, 8, and 9 impact approximately twice the amount of 100-year floodplain acres as do Alternatives 3 through 6. Mitigation of Alternative 9 floodplain impacts is the same as that described for all Full Build Alternative alignments in Section 4.13 of this FEIS.

Wetlands

Alternative 9 impacts approximately 71 acres of wetland. It affects approximately 41 individual wetland sites, 5 of which have been identified as key wetlands. Alternative 9 is similar to Alternative 7 and 8, with exceptions and modifications in the southern and northern sections of the study area. In the south, Alternative 9 combines sections of the two possible routes (Alternatives 3-6 and Alternatives 7 and 8), such that 23 acres of wetland impact is avoided. In the central section, between N.H. Routes 111 and 102, Alternative 9 is identical to Alternatives 7 and 8. In the north, between N.H. Route 102 and the F.E. Everett Turnpike, wetland impacts are also similar to Alternatives 7 and 8, except toward the western end, between U.S. Route 3A in Merrimack and the F.E. Everett Turnpike. Due to a minor shift in this section, Alternative 9 impacts six additional acres of wetlands compared to Alternative 8, and the same amount of wetlands as Alternative 7.

These impacts place Alternative 9 in the middle range for the three categories used to rank alternatives. Compared to the other alignments, Alternative 9 ranks fourth for wetland acreage impact (Alternatives 4, 5 and 6 have fewer impacts and Alternatives 3, 7 and 8 have more). Alternative 9 ranks third for number of individual wetlands impacted (Alternatives 3, 4, 5 and 6 impact fewer wetlands, Alternatives 7 and 8 impact more). Alternative 9 impacts five key wetlands, as do Alternatives 4 and 6, which is one more than Alternatives 3, 5 and 8 and one less than Alternative 7. In terms of functions and values, Alternative 9 reduces impacts at two of the major wetland systems in the south when compared to Alternative 8. Alternative 9 avoids the Limit Brook wetland system, and crosses the Second Brook system at a narrow, least damaging location. In terms of functions and values in the north, Alternative 9 avoids the Pennichuck Reservoir and stays outside of its restricted buffer area. Function and value impacts for Alternative 9 are similar to Alternative 8 with the addition of one key wetland as well as additional impact to wildlife and recreational value.

Rank	***Wetland Acreage Impacted***	***# of Discrete Wetlands Impacted***	***# of Key Wetlands Impacted***
1	*Alt. 6*	*Alt. 3,4*	*Alt. 3,5,8*
2	*Alt. 5*	*Alt. 5,6*	*Alt. 4,6,9*
3	*Alt. 4*	*Alt. 9*	*Alt. 7*
4	*Alt. 9*	*Alt. 8*	
5	*Alt. 3*	*Alt. 7*	
6	*Alt. 8*		
7	*Alt. 7*		

The wetland mitigation discussion presented in Section 4.14 of this FEIS applies to Alternative 9 as well as all Full Build Alternative alignments. The Corps guidelines suggest an in-kind and functionally similar replacement of wetland habitats based on a minimum ratio of 1:1.

Water Body Modifications

Alternative 9 will cross 19 streams, similar to the number of crossings for Alternatives 7 and 8. This total is the highest among the Full Build Alternative alignments. No significant impacts are anticipated from these crossings. Major streams include: Merrimack River, Limit Brook, Second Brook, Merrill Brook, Glover Brook, and Pennichuck Brook. The fewest number of stream crossings, 16, is associated with Alternative 3.

Environmental Risk Sites

Alternative 9 will impact three environmental risk sites. In the southern section of the study area, where Alternative 9 follows the same corridor as Alternatives 3, 4, 5, and 6, an asbestos site located at 4 Gregory Street will be impacted as it is located within the proposed right-of-way of the alternatives. In the central section of the study area between N.H. Routes 111 and 102, two additional sites will be impacted. One site is associated with Hudson Paving, Inc. and the other with Brox Industries and Brox Paving Materials, Inc. Both sites contain underground storage tanks and may be impacted by all Full Build Alternative alignments. Alternative 9 impacts the second fewest sites when compared to all Full Build Alternative alignments. Alternatives 7 and 8 impact the fewest sites (2) followed by Alternative 9 (3), Alternatives 4 and 6 (4); Alternatives 3 and 5 impact the most environmental risk sites (5).

Appropriate Federal and State procedures will be followed in performing the removal of environmental risk material from any impacted site. These procedures apply to all impacted environmental risk sites regardless of the impacting alternative alignment.

Energy

Energy consumed by the operation of Alternative 9 and all other Full Build Alternatives is essentially the same because all proposed corridors have similar lengths and operating conditions This energy, labeled motive energy, comprises approximately 95 percent of the calculated energy budget for each alternative. The remaining 5 percent of the energy budget is comprised of energy involved in the construction of a particular alternative. A longer alternative requires more energy to construct. All alternatives differ in length, with Alternative 9 being the *longest, approximately one-tenth of a mile longer than Alternative 8. This slight difference in road length results in an inconsequential difference in the energy budget of Alternative 9 as compared to the other alignments, due to the fact that construction energy only comprises 5 percent of the total energy budget. Therefore, it is concluded that energy use by Alternative 9 is similar to, or slightly greater than Alternative 8.*

Noise

Compared to other Full Build Alternative alignments, it is anticipated that Alternative 9 will adversely affect the largest number of noise receptors for the following reasons: (1) Alternative 9 is similar to Alternative 8, which adversely affects 123 receptors, and (2) the shift of Alternative 9 from Alternatives 7 and 8 to Alternative 3 through 6 in the southern section of the study area brings the alignment through a residential district near Wasson Road in Hudson. This creates the potential for an additional number of adversely affected noise receptors beyond the 123 associated with Alternative 8. Suggested noise barrier locations along Alternative 8 and in the vicinity of Wasson Road would also apply for Alternative 9, thus helping to minimize noise impacts on nearby receptors such as schools, houses, and places of worship.

Noise mitigation measures are presented in Section 4.8 of this FEIS. These measures are considered for all Full Build Alternative alignments for any receptor sites that approach or exceed the FHWA's noise abatement levels or New Hampshire's relative criterion.

Construction Impacts

Construction impacts will be similar for all Full Build Alternative alignments. These include such potential impacts as an increase in sediments in runoff, accelerated erosion, turbidity increases, increases in dust affecting localized air quality, localized increases in noise levels from equipment operations, and potential spills of oil, gasoline, and solvents. Best management practices will be employed to minimize construction impacts to the maximum extent practicable.

Terrestrial Ecology

Alternative 9 will not impact any of the four unique natural community types found within the study area as identified by NHDRED. Some local modifications to the terrain and soils within the impact areas of Alternative 9 are expected. These types of impacts are expected for all Full Build Alternative alignments.

Wild and Scenic Rivers

No wild and scenic rivers are located within the study area.

Coastal Barriers

No coastal barriers are located within the study area.

Coastal Zones

No coastal zones are located within the study area.

2.4.3 Summary of Considerations

In overall consideration of the environmental and socio-economic factors quantified by this EIS and summarized in this chapter, the choice of a particular alignment requires a human judgment in order to overcome otherwise mutually exclusive missions. On the one hand, strong socio-economic interests exist that endorse and seek to implement the regional plan of development and the infrastructure which that plan defines (such as the Nashua-Hudson Circumferential Highway.) On the other hand, extreme environmental preservation interests call for either building only selected portions of the project (e.g., Partial Build options), or building none of it. Such basically irreconcilable postures often characterize environmental impact assessment. The task of the responsible permit authority is to weigh alternatives and balance its judgment to serve "the greater good" in conformance with law.

In the present EIS, the basis of choosing an alternative alignment recognizes three characteristics. First, that the body politic is dedicated to managing its resources. Second, that appropriate environmental management calls for the choice of an alternative that satisfies the basic project purpose and need. Third, that natural resource value must be appropriately balanced in light of economic social value. Therefore, it is intended that this EIS focus on all pertinent issues so that evaluators of this project will be confident after the public hearing in their choice of the least environmentally damaging practicable alternative.

Chapter 3
Existing Environment

Chapter 3
EXISTING ENVIRONMENT

3.1 TRAFFIC AND TRANSPORTATION

Existing Roadway System

The south central portion of the State of New Hampshire and the Nashua-centered region comprise the study area for this work. The study area is served by a number of major freeway and arterial roadway systems.

The major express highway in the area is the F.E. Everett Turnpike, which provides north-south travel from the Massachusetts border north to Concord. From the Massachusetts State Line to Interchange 10 in Merrimack, this roadway is designated as US Route 3. North of Exit 10, it continues as a toll road extending to Interstate 293 in Manchester. Interchanges along the Turnpike provide connections to major arterials in the Nashua area. The arterial roadway system generally forms a radial network around the central portion of the City of Nashua. The Daniel Webster Highway is the major north-south arterial, which basically runs parallel to the Turnpike through the study area. North of Exit 7 in Nashua, it is known as US Route 3. NH Route 3A east of the Merrimack River is another north-south arterial which passes through the study area in Hudson and Litchfield. NH Route 102 runs in a northeasterly direction from the Taylor Falls Bridge in the Hudson area.

Among the major east-west arterials in the study area are NH Route 111, which runs through the study areas from the western portions of Nashua across the Merrimack River over the Taylor Falls Bridge and through Hudson to the east, and NH Routes 101A and 130, both of which originate in the central portion of Nashua and travel in a westerly direction towards Hollis and Merrimack. NH Routes 111, 101A and 130 all have interchanges with the F.E. Everett Turnpike.

There are only two crossings of the Merrimack River in the study area. Taylor Falls Bridge, consisting of two two-lane structures, provides a connection between the central portions of Nashua and Hudson. The other crossing of the Merrimack River, the Sagamore Bridge, is approximately three miles south of the Taylor Falls Bridge.

Traffic Volumes and Circulation

During the period from 1980-1990, the highway system in the Nashua-Hudson urbanized area experienced major growth in Average Daily Traffic (ADT). The 1980 and 1990 traffic counts for major network segments and percent change in ADT over the decade are shown in Table 3.1-1.

Average weekday traffic on the F.E. Everett Turnpike in Nashua grew at a rate of from approximately 4.6 percent per year north of Exit 6 to 7.1 percent per year north of Exit 1, between 1980 and 1990. Traffic on NH Route 111 grew at an average annual rate of 8.2 percent for the same period. For annual growth rates at selected locations, see Table 3.1-2.

The network diagram in Figure 3.1-1 shows existing ADT volumes along major roadways in the study area. Data reported for the existing network represents 1990 conditions. The most heavily travelled roadways are located in Nashua. The ADT's on F.E. Everett Turnpike range from 54,000 to 92,000. The Daniel Webster Highway in South Nashua carries up to 41,600 vehicles a day, and NH Route 101A near the Turnpike has a daily volume of 40,100. In Hudson, the highest volumes are carried by NH Route 3A where daily traffic ranges from 20,300 to 25,800. The Taylor Falls Bridge with an ADT of 48,600, carries the largest non-expressway traffic volumes in the study area. The Sagamore Bridge to the south is used by 28,700 vehicles a day.

This information on existing traffic movement was derived from the region's transportation modelling process, which was calibrated to traffic counts collected by the NHDOT and the NRPC.

Service Levels of Existing Roadways

The traffic volumes discussed in the previous section create moderate to heavy levels of congestion at many locations on the study area street system.

One group of criteria for the evaluation of traffic performance quantifies typical peak hour conditions. Measures of these peak hour conditions include the Level of Service (LOS) as defined by the average operating speed, the ratio of hourly traffic volumes to road capacity (v/c ratio), and the traffic density. The operating performance attributes associated with the LOS determination are summarized based on Chapter 3 of the *Highway Capacity Manual.*

Table 3.1-1

GROWTH OF AVERAGE DAILY TRAFFIC
1980-1990

Location	ADT 1980	ADT 1990	Change in ADT (Percent)
Everett Turnpike			
South of Interchange 1	N/A	60,800	--
Interchange 1-Interchange 3	35,000	69,800	+99.4
Interchange 3-Interchange 4	47,000	92,000	+95.7
Interchange 4-Interchange 5	46,000	75,500	+64.1
Interchange 5-Interchange 6	60,000	85,500	+42.5
Interchange 6-Interchange 7	48,000	75,000	+57.1
Interchange 7-Interchange 8	N/A	54,000	--
Interchange 8-Interchange 10	N/A	52,400	--
North of Interchange 10	20,000	52,400	+162.0
Daniel Webster Highway			
South of Sagamore Bridge	22,000	37,300	+69.5
Sagamore Bridge-Oldfield Road	23,000	28,500	+23.9
Oldfield Road-NH 101A	28,500	28,100	(-1.4)
NH 101A-Burque Highway	11,000	17,000	+54.5
Burque Highway-Manchester Road	15,000	14,700	(-2.0)
Manchester Road Interchange 10 Feeder	13,000	16,300	+25.4
North of Interchange 10 Feeder	N/A	17,400	--
Sagamore Bridge	11,400	28,700	+151.8

Table 3.1-1 (Continued)

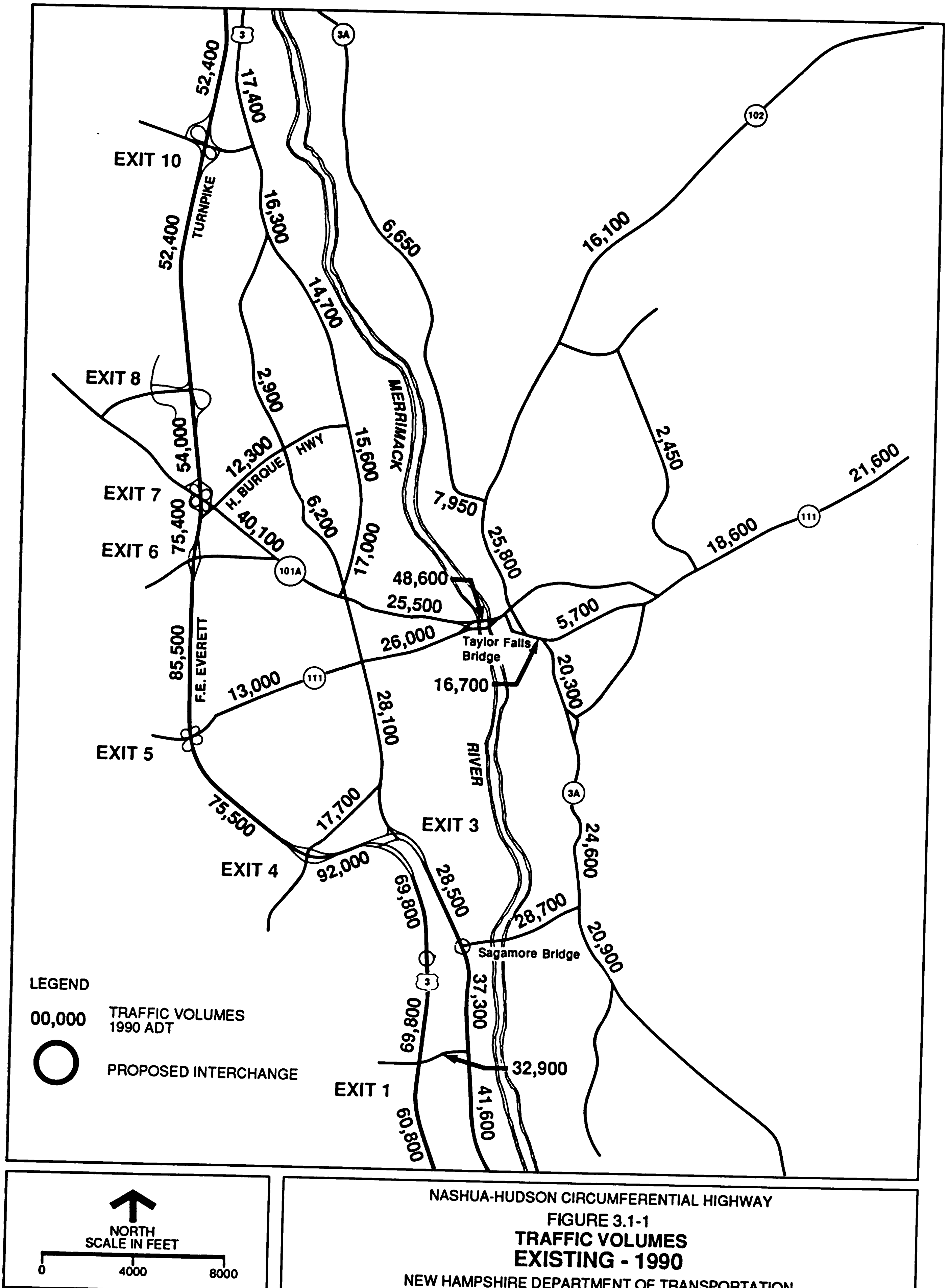
Location	ADT 1980	ADT 1990	Change in ADT (Percent)
NH Route 3A			
South of Sagamore Bridge	12,000	20,900	+74.2
North of Sagamore Bridge	17,000	24,600	+44.7
South of Central Street	12,900	20,300	+57.4
North of Highland Street	24,400	25,800	+5.7
North of Elm Avenue	4,200	6,650	+58.3
NH Route 102			
North of Elm Avenue	13,000	16,100	+23.8
Taylor Falls Bridge	31,200	48,600	+55.8
NH Route 111			
Interchange 5-Main Street (one way)	12,000	13,000	+8.3
Main Street-Taylor Falls Bridge	14,000	26,000	+85.7
East of Greeley Street	10,900	21,600	+98.2
Central Street			
West of NH Route 3A	14,600	16,700	+14.4
East of NH Route 3A	4,800	5,700	+18.8
NH Route 101A			
Interchange 7-Daniel Webster Highway	22,000	40,100	+82.3
West of Taylor Falls Bridge	19,000	25,500	+34.2

Table 3.1-2

ANNUAL GROWTH RATE FOR AVERAGE DAILY TRAFFIC AT SELECTED LOCATIONS

Town	Location	ADT 1980	ADT 1990	Annual Growth Rate
Nashua/ Hudson	Taylor Falls Bridge	31,300	48,600	4.5%
Nashua/ Hudson	Sagamore Bridge	11,400	28,700	9.7%
Hudson	NH 102 north of Elm Avenue	13,000	16,100	2.2%
Hudson	NH 111 east of Clement Street	9,800	21,600	8.2%
Litchfield	NH 3A at Manchester City Line	3,400	6,650	6.9%
Merrimack	US 3 south of Greeley Street	14,000	17,400	2.2%
Nashua	Turnpike north of Exit 1	35,000	69,800	7.1%
Nashua	Turnpike north of Exit 6	48,000	75,400	4.6%
Nashua	Main Street south of Kinsley Street	22,000	28,100	2.0%

Source: Nashua Area Transportation Study Data



NASHUA-HUDSON CIRCUMFERENTIAL HIGHWAY

FIGURE 3.1-1

TRAFFIC VOLUMES

EXISTING - 1990

NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

Performance characteristics may be described as follows:

LOS A: A condition of free flow, with low volumes and relatively high speeds. There is little or no restriction of freedom to maneuver.

LOS B: A condition of stable flow, with desired operating speeds relatively unaffected, but with a slight deterioration of maneuverability within the traffic stream.

LOS C: A condition still representing stable flow, but speeds and maneuverability begin to be restricted. The general level of comfort begins to deteriorate noticeably at this level.

LOS D: A high-density traffic condition approaching unstable flow. Speeds and maneuverability become more seriously restricted, and the driver experiences a poor level of comfort.

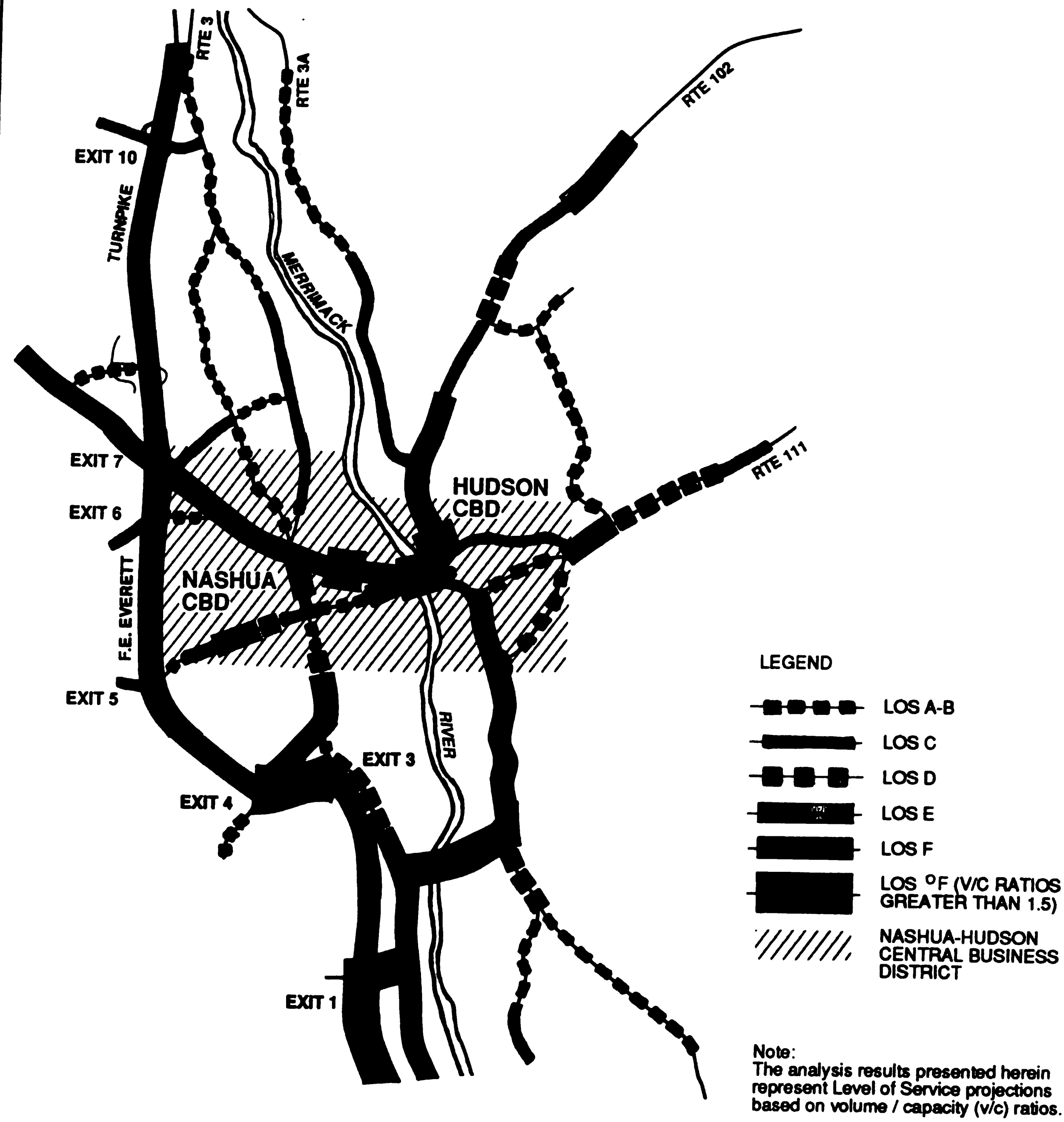
LOS E: Conditions at or near the capacity of the facility. Flow is usually unstable, and freedom to maneuver within the traffic stream becomes extremely difficult.

LOS F: Forced-flow or breakdown conditions with queuing along critical approaches. Operating conditions are highly unstable as characterized by erratic vehicle movements along each approach.

Figure 3.1-2 shows LOS at key locations for existing (1990) conditions during the peak periods. LOS data on selected intersections are summarized in Table 3.1-3.

Level of service is defined as a qualitative measure describing operational conditions within a traffic stream and LOS "D" is generally accepted as the minimum design level for urban street systems. Poor level of service operations are particularly noticeable along the main arterial approaches to the Taylor Falls Bridge in the urbanized center of Nashua and Hudson, including NH Route 111 in Nashua and Hudson, NH Route 102 in Hudson, and Bridge Street in Nashua. The Daniel Webster Highway/Main Street corridor in Nashua as well as the southern portion of F.E. Everett Turnpike are currently operating at LOS "F" or worse.

Other measures relating to overall operating conditions of the study area street network are shown in Table 3.1-4. Table 3.1-4 shows the average speed for the network, as well as network Vehicle Miles of Travel (VMT) and Vehicle Hours of Travel (VHT).



NORTH
NOT TO SCALE

NASHUA-HUDSON CIRCUMFERENTIAL HIGHWAY

FIGURE 3.1-2

NETWORK LEVEL OF SERVICE

EXISTING - 1990

NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

Table 3.1-3

1990 EXISTING LEVEL OF SERVICE

Intersection Location	LOS
H.B. Hwy/Concord	B
H.B. Hwy/Manchester	A
Lowell St. (NH3A)/Central	D
D.W. Highway/Spitbrook Rd.	F
Concord/Amherst	F
Main/Canal	F
Taylor Falls Bridge/NH102	F

Table 3.1-4

1990 EXISTING TRAFFIC OPERATING CONDITIONS

Vehicle Miles of Travel	3,315,695
Vehicle Hours of Travel	128,403
Average Speed (mph)	25.82

These measures relating to the operating conditions and efficiency of the highway network were used to evaluate and compare proposed alternative network improvements.

Public Transportation

Public transportation services in the study area are limited. Regularly scheduled bus service between the study area and Boston, and to points north of the study area in New Hampshire and Vermont are presently provided by Vermont Transit. Total intercity bus departures by this carrier are approximately 125 per day.

Hudson Bus Lines operates an express bus service between the study area and Logan Airport in Boston.

Terminal facilities for intercity and local bus services are located in the Central Business District of Nashua. Limousine and private taxi services are also available.

Regularly scheduled passenger railroad service has not been available in the study area since 1966, when the Boston and Maine service from Concord, New Hampshire to Boston was discontinued. The closest rail service to the study area is now found in Lowell and North Billerica, Massachusetts.

Local public transit is provided by the City of Nashua CITYBUS system, which began operations in 1984. The service consists of a timed transfer system operated six days per week on seven routes. Ridership on the system has grown from about 400 passengers per day in 1985 to approximately 900 passengers per day. This ridership level reflects primarily a "transit captive" market.

This service has minimal potential for reducing traffic volumes in any portion of the study area except downtown Nashua. Because the service is patronized mostly by off peak hour riders, and because buses traveling on city streets are impacted by congestion, minimal reductions in peak hour traffic volumes in downtown Nashua are expected, even with increased service.

A demand responsive paratransit service for the elderly and handicapped has also been in operation in the study area since 1979.

Transportation Demand Management

In addition to public transportation services, the NHDOT, the NRPC, and a number of large employers in the area are actively pursuing measures to reduce the use of single occupant vehicles and to shift some of the peak period travel to less congested times through transportation demand management (TDM) programs.

The focus of these programs are the peak period home to work commute trips. Commuting patterns in the study area were recently analyzed by the NRPC using updates of 1980 Census data. (See Table 3.1-5.) Data on commuting by residents of Hudson, Litchfield and Merrimack to surrounding work destinations in the region indicated that 30.5 percent of the estimated resident labor force of more than 18,600, also work in one of these same three communities. An additional 36.3 percent of the area residents commute to other destinations within the Nashua PMSA. The City of Nashua is the most prevalent single destination among local workers, representing the work place of 34 percent (6,300) of the study area labor force. The remaining 33.2 percent of the local work force either commute to destinations outside of the Nashua PMSA, or their commuting patterns are unknown.

To address the needs of daily commuters, NHDOT has developed more than 1,000 park and ride spaces along the major highways in southern New Hampshire. Two of these lots, with 60 spaces each, were developed in the Nashua area along the F.E. Everett Turnpike. In addition to park and ride activity, the lot at Exit 5 is also served by Vermont Transit, a private bus carrier, which provides about six round trips daily between Nashua and Boston.

In addition to the NHDOT park and ride program, three major private firms in southern New Hampshire actively promote ridesharing by their employees. Digital Equipment Corporation, which employs more than 8,000 people in this part of the state, supports eight van pools serving about 120 employees in Merrimack and Nashua. Teradyne Connection Systems, Inc., with 1,100 employees, has about 30 persons participating in three van pools in the Nashua area. Finally, Sanders Associates, Inc., which employs 8,500 persons in southern New Hampshire, assists employee carpooling efforts by maintaining a list of names and addresses of employees interested in ridesharing. Sanders Associates also has flexible work hour schedules at its facilities that employees can utilize at their request. Refer to Appendix B of the revised Traffic and Transportation Technical Report for additional information on TDM measures.

Table 3.1-5

ESTIMATED COMMUTING PATTERNS OF LOCAL RESIDENTS
(Hudson, Litchfield and Merrimack)

	Place of Residence			Study Area Totals	
Work Destination	Hudson	Litchfield	Merrimack	Work Force	% of Total
STUDY AREA					
Hudson	2,176	274	86	2,536	13.6%
Litchfield	44	150	17	211	1.1%
Merrimack	319	98	2,503	2,920	15.7%
STUDY AREA SUBTOTAL:	2,539	522	2,606	5,667	30.5%
BALANCE OF NASHUA PMSA					
Amherst	0	0	113	113	0.6%
Hollis	0	0	63	63	0.3%
Milford	0	0	160	160	0.9%
Nashua	2,933	776	2,625	6,334	34.0%
Londonderry	56	33	0	89	0.5%
BALANCE OF PMSA SUBTOTAL:	2,989	809	2,961	6,759	36.3%
OUTSIDE PMSA					
Bedford	0	0	221	221	1.2%
Concord	0	0	78	78	0.4%
Derry	48	0	0	48	0.3%
Manchester	280	545	1,047	1,872	10.1%
Salem	31	34	0	65	0.3%
Other N.H.	0	5	10	15	0.1%
Massachusetts	490	109	411	1,010	5.4%
Unknown	1,448	380	1,041	2,869	15.4%
OUTSIDE PMSA SUBTOTAL:	2,297	1,073	2,808	6,178	33.2%
TOTALS:	7,825	2,404	8,375	18,604	100.0%

Source: Nashua Regional Planning Commission Estimates, 1989.

Bicycle and Pedestrian Circulation

An extensive system of walkways/bikeways is planned throughout the area. On the west side of the Merrimack River, impetus to this system comes from the New Hampshire Heritage Trail, which is planned as a recreational path stretching 230 miles along the State's major rivers. The trail would pass through Merrimack and Nashua, linking historic, cultural, and natural assets, such as parks, with a continuous network of paths for walking, jogging, and cross-country skiing.

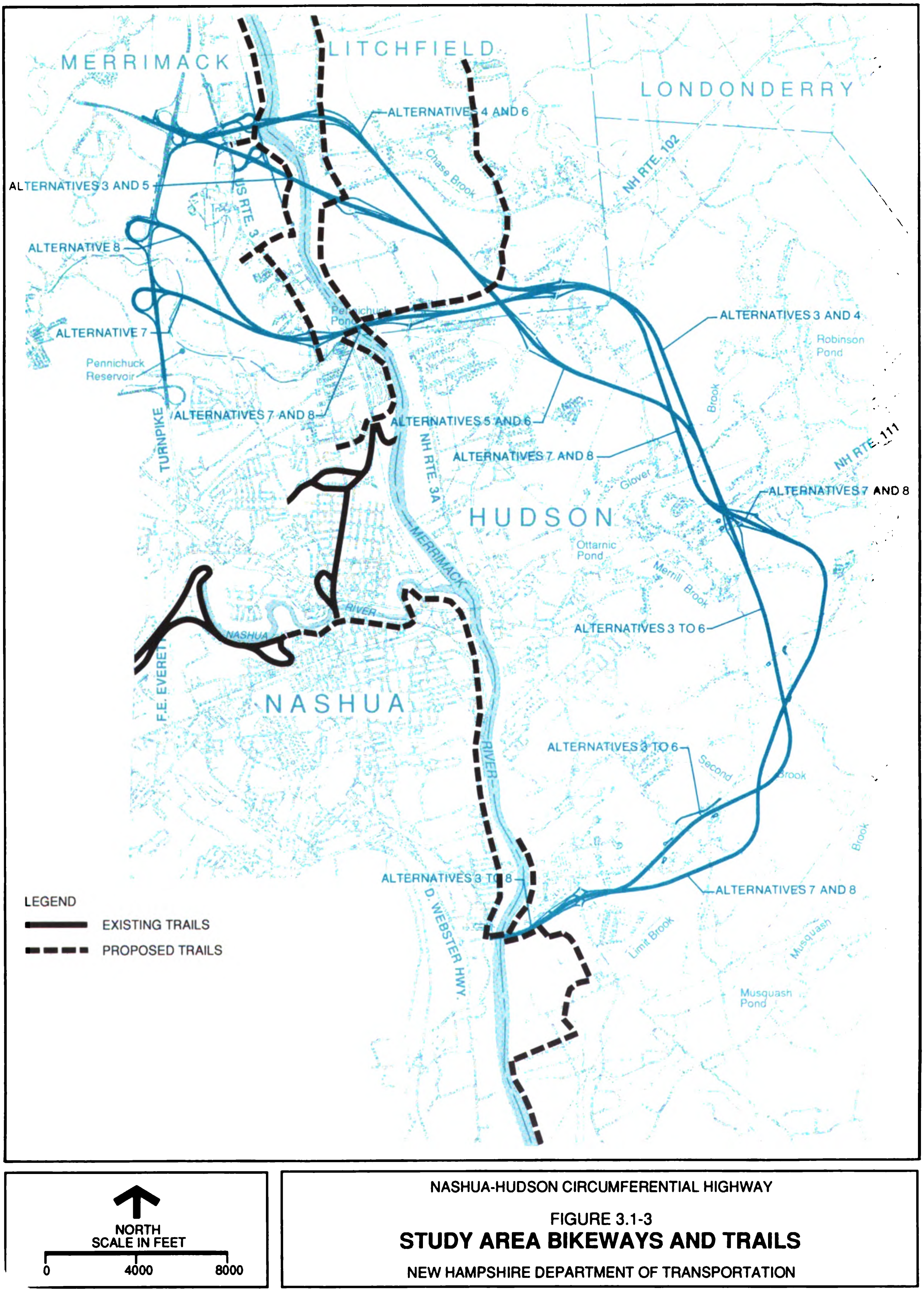
On the east side of the Merrimack River, Litchfield's Master Plan includes several large loops of trails for recreational activities, such as hiking, bicycling, cross-country skiing and walking. The Litchfield Town's standard arterial cross-section includes provision for walkways/bikeways. Litchfield expects to implement most of this system with local funds and as part of subdivision development. The town of Hudson has secured numerous pedestrian easements for its proposed trail system. The proposed trail systems in Litchfield and Hudson as well as the proposed Heritage Trail System in Merrimack and Nashua, are shown in Figure 3.1-3.

The planned Circumferential Highway should take these walkways/bikeways into consideration; however, the state can expend funds for these facilities within the highway right-of-way only if they connect to existing trails.

In terms of existing pedestrian activity, downtown Nashua is the only portion of the study area where such activity is presently significant. The majority of this activity occurs during off-peak periods, and is easily accommodated by the existing walkways in this area. This activity has minimal effect upon traffic flows.

Parking

Downtown Nashua is the only portion of the study area which has substantial demand for parking. It was determined by a recent study completed by the NRPC that currently, there is sufficient parking for both long-term and short-term needs.



NASHUA-HUDSON CIRCUMFERENTIAL HIGHWAY

FIGURE 3.1-3
STUDY AREA BIKEWAYS AND TRAILS

NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

3.2 LAND USE

Historic settlement areas (particularly along the Merrimack River), the radial roadway system, topography, streams and wetlands have been major factors in shaping the existing land use patterns in the study area. Land uses in Hudson, Litchfield, and Merrimack are shown in Figure 3.2-1.

Town of Hudson

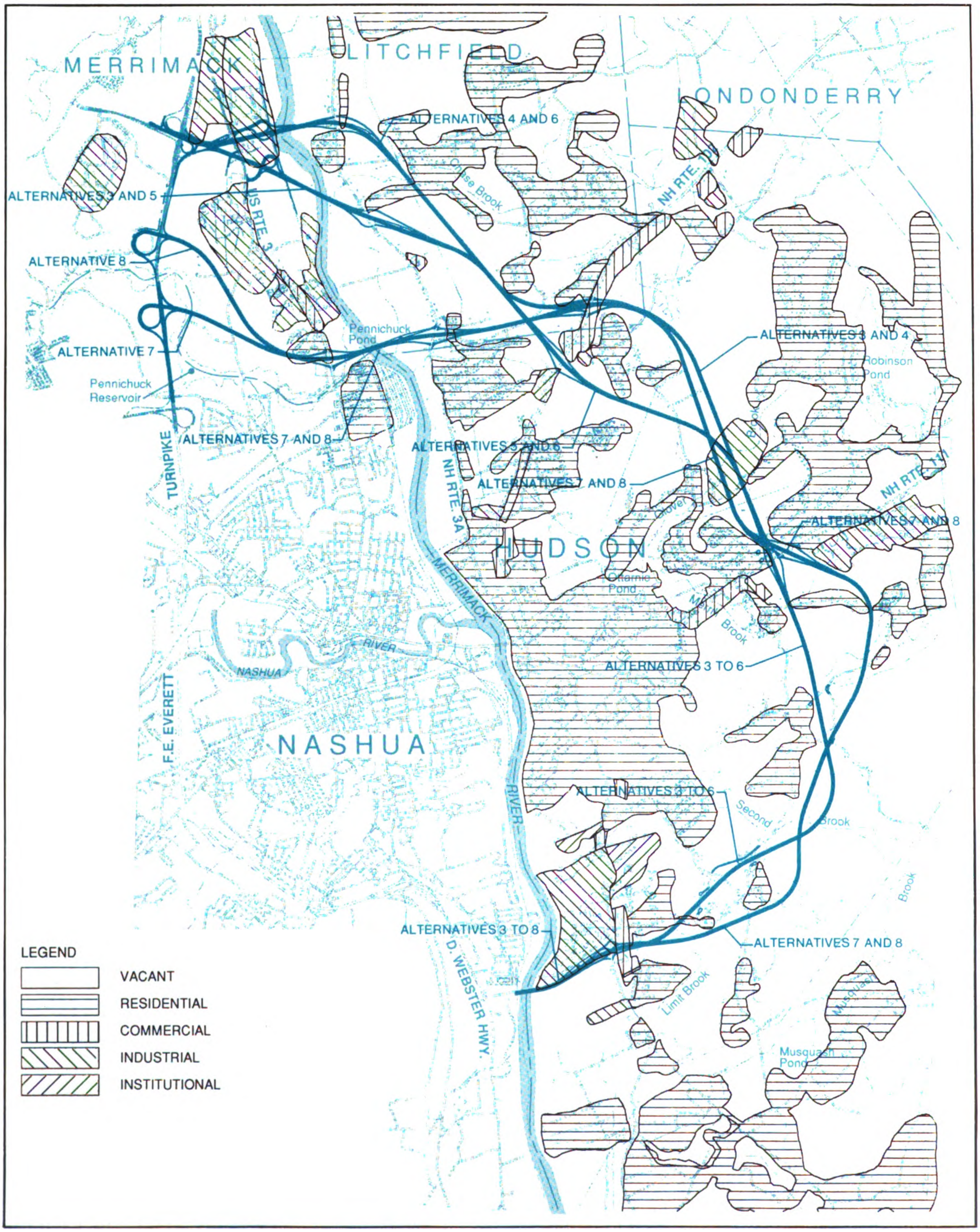
Figure 3.2-1 illustrates Hudson's radial pattern of land use expansion. Central to this radial pattern is the densely developed residential (and mixed use) core on the west side of town, adjacent to the Merrimack River where it is crossed by the Taylor Falls Bridge from the City of Nashua. From this core area, development branches to the north along NH Routes 3A and 102, east along NH Route 111, and south along Lowell Road.

Of those portions of Hudson that have been developed, residential uses are by far the dominant type of existing land uses. Aside from the central core, a significant concentration of residential development has occurred in the Robinson Pond area. Housing growth has expanded in this area such that it has created a swath of residential subdivisions linking NH Routes 111 and 102. Significant residential growth is apparent in the southern part of Hudson, along Lowell and Sanders Roads, adjacent to the Massachusetts state line. Other noticeable subdivision activity has taken place along NH Routes 102 and 3A, approaching the Litchfield town line.

According to Hudson's 1987 Master Plan, residential development totalled approximately 4,200 acres, accounting for more than 21 percent of the town's 19,000 acres. Comparing the 1987 Existing Land Use map to the map prepared for this EIS indicates that only a modest increase in residential expansion has occurred since the Master Plan was completed.

Commercial development within Hudson has occurred as "strip development" at a number of locations, in particular, near major intersections along primary roadways such as NH Routes 111, 102, and Lowell Road (NH Route 3A). Hudson's commercial development includes both retail and office uses, and tends to be relatively small-scale in size. In 1987, Hudson had approximately 400 acres of commercial development.

Industrial uses are concentrated in two primary areas within Hudson. These include the Centronics, Clement, Sagamore, and Executive Industrial Parks, located on NH Route 102 and Lowell Road. The Sagamore Park, located adjacent to the Sagamore Bridge, is completely built-out at this point. The



NORTH
SCALE IN FEET
0 4000 8000

NASHUA-HUDSON CIRCUMFERENTIAL HIGHWAY

FIGURE 3.2-1
EXISTING LAND USE

NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

other industrial parks on NH Route 102 are not completely built, but have received approvals to build on most of the available acreage. Hudson had approximately 550 acres of industrial developed land as of 1987.

Two other significant industrial uses are the earth materials excavating and processing operations of Brox and Pike Industries. Brox is located off Greeley Road, and the Pike operation straddles the Londonderry town line.

The remaining areas on Figure 3.2-1 are predominantly vacant areas. Development in the southeastern portion of Hudson has been slowed to some extent by the steeper topography around Merrill Hill. Scattered wetlands have also apparently restricted development throughout the town. As of 1987, there were approximately 9,000 acres of vacant land, 47 percent of the total land area. The Master Plan estimated that only 6,500 acres would be buildable due to wetlands, steep slopes, and other natural constraints.

Town of Litchfield

Litchfield is the smallest of the three communities, with a total land area of just over 9,900 acres. It also has the least amount of commercial and industrial development of the three. Only the land uses located in the southern half of town have been examined in this section, based on the location of the Build Alternative alignments under study.

Litchfield's existing land use pattern is distinctly different from the town of Hudson. Development has occurred in a linear fashion, but is oriented in a north/south direction, as opposed to radially. In addition, no village or town center has ever emerged.

Similar to Hudson, Litchfield's primary type of development has been residential. Subdivisions have been concentrated in the central and eastern portion of the town, along the primary collector roadways of Pinecrest Road, Talent Road, and Albuquerque Avenue. These areas are illustrated on Figure 3.2-1. According to Litchfield's Master Plan, there were 2,400 acres of residential development in 1989, approximately 50 percent of the developed land area.

Commercial and industrial development has been very limited within Litchfield. As of 1989, an estimated 65 acres of combined industrial/ commercial uses were identified in the Master Plan. Some of this development has occurred in a strip along NH Route 102, which is merging with Hudson's commercial growth along this corridor. The remaining commercial development is comprised of service/retail oriented uses such as service stations, medical offices, restaurants, greenhouses, and scattered farm stands along NH Route 3A.

Vacant acreage in Litchfield was estimated at 4,500 acres in 1989. However, over 2,100 acres were considered unbuildable due to natural constraints. Much of the vacant land illustrated on Figure 3.2-1 will be subject to these development constraints. A significant amount of these floodplain/wetland areas are situated along NH Route 3A and the Merrimack River and are actively being farmed. Litchfield has actively pursued a policy of trying to preserve these farmlands from development.

Town of Merrimack

Merrimack is the largest of the three municipalities examined here, encompassing a total land area of approximately 21,600 acres. However, only the southeastern corner of the town is considered here, due to its proximity to the Build Alternative alignments under study. The area is more specifically defined by the Merrimack River on the east, the City of Nashua to the south, the F.E. Everett Turnpike on the west, and the town's government center to the north. This portion of the town of Merrimack is also bisected by US Route 3.

The excellent highway access available in the southern corner of the town of Merrimack has resulted in most of the developed land area being used for industrial and commercial purposes. Many of Merrimack's larger manufacturing firms are located here in close proximity to the Exit 10 interchange of the F.E. Everett Turnpike. Industrial development identified in this area on Figure 3.2-1 includes companies like Anheuser-Busch, Sanders Associates, Kollsman Instruments, and Digital Corporation.

Although industrial uses are the dominant land use within this area, commercial development has also evolved along the US Route 3 strip, providing shopping and services to area employees and residents. Approximately one-third of the land area in this portion of the town is still vacant, although some has already been targeted for industrial expansion, and some has been identified as wetlands.

North of this industrially developed area, a greater blend of land uses has evolved. Commercial uses continue along the frontage of US Route 3, interspersed with residential subdivisions. Also located here are the town of Merrimack's municipal offices, schools, and other institutional land uses.

Zoning Regulations

Figure 3.2-2 identifies the location of study area zoning districts.

Town of Hudson. The town first adopted its zoning ordinance in 1942 and has made numerous revisions to it since that time. The ordinance divides Hudson into seven separate districts; three residential, two commercial, one industrial, and one rural. There is also a wetlands overlay district that regulates development in all of the zones.

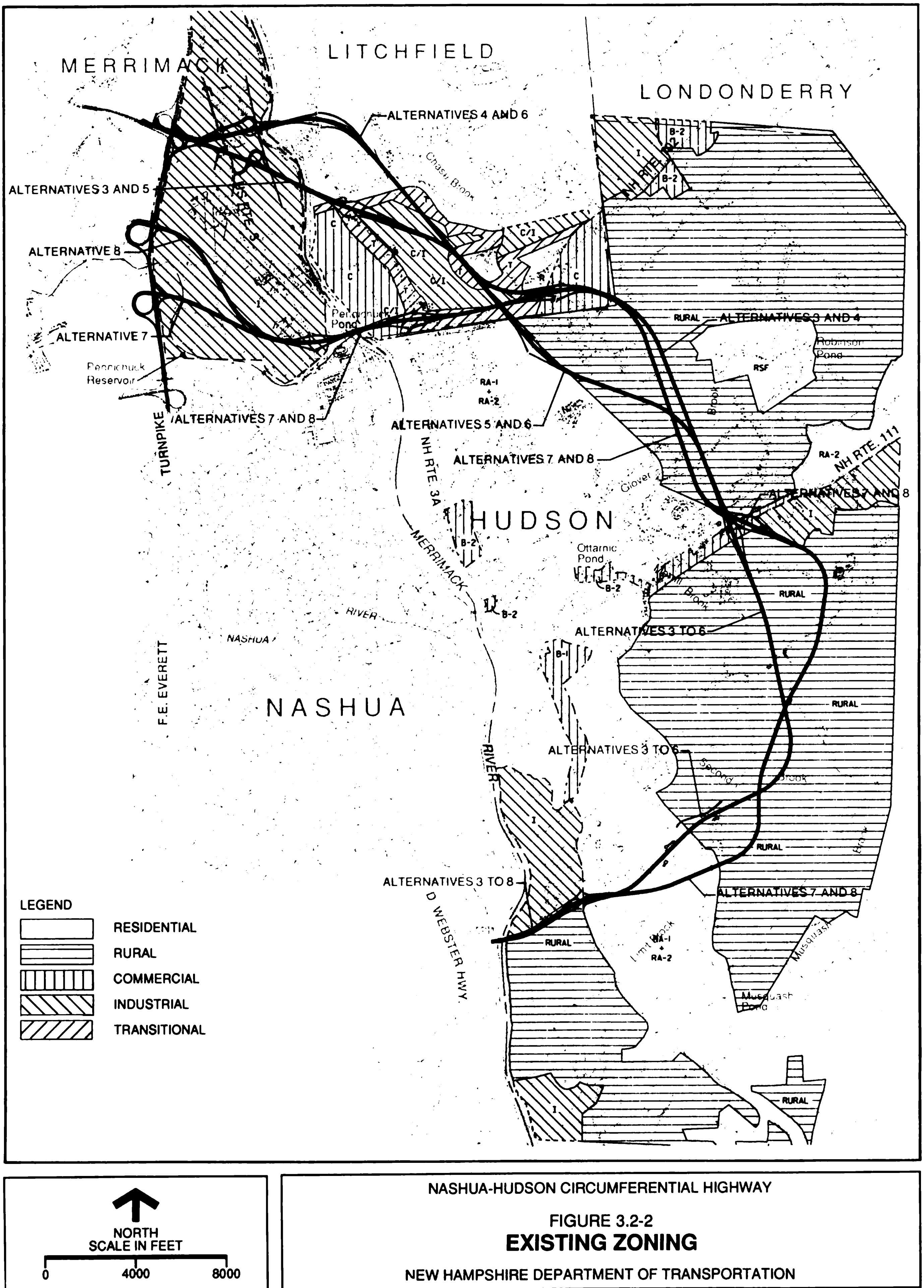
The three residential districts are identified on the Zoning Map (Figure 3.2-2) as the RA-1, RA-2, and RSF zones. These districts are located primarily in the western half of the town, extending from the Litchfield town line down to the Massachusetts state line. Additional residential districts are found along the eastern end of NH Route 111 and in the Robinson Pond area. The combined total of these districts exceeds 6,500 acres, about 34 percent of the Town's land area. Residential development within these zoning districts is restricted to one- and two-family dwellings. Nonresidential uses are restricted to churches, recreational facilities, funeral homes, and home occupations.

The two types of commercial zones are identified as B-1 and B-2 on Figure 3.2-2. The B-1 zone is considered a highway business district, while the B-2 zone is more oriented to neighborhood commercial uses. All of these districts are situated along the primary highway corridors of NH Routes 111, 102, 3A, and Lowell Road.

Permitted uses in both districts include retail, service, and office establishments, as well as multi-family residential developments. Light manufacturing, wholesaling, and warehousing uses are also permitted in both districts. Only 600 acres, or 3 percent of Hudson, is zoned specifically for commercial uses.

Hudson's industrial (I) zoning districts are situated in four locations. One is adjacent to the Sagamore Bridge, one along the eastern end of NH Route 111, and one at the northern end of NH Route 102 adjacent to Litchfield and Londonderry. The fourth is located in the southwest corner of the town, and is being developed primarily for earth materials.

Permitted uses include: light and heavy manufacturing; mining and quarrying; truck servicing; warehousing; as well as shopping centers; hotels; transportation terminals; and a number of institutional uses. Approximately 900 acres (5 percent) of the town is zoned as industrial land. Most of the acreage has already been developed.



NASHUA-HUDSON CIRCUMFERENTIAL HIGHWAY

FIGURE 3.2-2
EXISTING ZONING

NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

The remaining and most extensive zoning district is the Rural zone. Encompassing most of the eastern half of Hudson, as well as the southwest corner, its total acreage is approximately 11,000 acres, or 58 percent of the town's total land area. Most of Hudson's vacant land area is contained within this zone.

The Rural zone actually constitutes the absence of zoning. All uses that are permitted in the previously described districts, are also permitted land uses in the Rural zoning district.

Because some portions of Hudson are serviced by municipal water and sewer, the density of development varies accordingly. A single family residence with water and sewer needs a minimum lot size of 30,000 square feet and 120 feet of road frontage. Without utilities it would require 45,000 square feet and 150 feet, respectively. An increase in the number of dwelling units requires a corresponding increase in minimum lot dimensions. All nonresidential uses must comply with the requirements for single-family houses, but are also subject to approval by the Planning Board.

Town of Litchfield. Litchfield's zoning regulations have undergone fairly significant changes within the last few years. Although most of the town is still contained within a single family residential-type district requiring a one-acre minimum lot size, recent amendments to the ordinance have created additional commercial and industrially zoned land. Overlay districts pertaining to wetlands and floodplains also regulate development in all other zoning districts.

As illustrated in Figure 3.2-2, these commercial and industrial zones are situated along the Hudson town line and were created largely in response to the then proposed location of the Circumferential Highway. Other areas in the northern part of Litchfield were also rezoned for commercial/industrial uses, but are not depicted in Figure 3.2-2.

Uses permitted in the commercial (C) zone are quite broad and include: retail establishments; banks and offices; restaurants; services; hotels; recreation facilities; and research and testing laboratories. New residential development is not permitted.

Although some conventional dimension standards such as setbacks and road frontage are enforced in these districts, "performance standards" are also applied which evaluate a proposed development's impact on air quality, noise, odor, glare and heat, and the ability to accommodate sewage and solid waste disposal. Site plan approval by the Planning Board is also required.

The commercial/industrial zone (C/I), while allowing a limited amount of commercial uses, is oriented primarily towards light industrial development. Permitted uses include: assembly operations; warehousing; wholesaling; research and testing; transportation terminals; and excavation operations.

Similar to the commercial zone, development in the commercial/industrial zone is regulated with performance standards, and is subject to Planning Board approval. Approximately 20 percent of Litchfield is zoned for commercial and industrial uses. Most of the acreage in the southern part of the town still remains undeveloped, with the exception of the commercial strip along NH Route 102. However, much of the vacant land area is either being farmed or has been identified as wetlands.

The remaining district illustrated on Figure 3.2-2 is the Transitional (T) zone. This zone was established in an attempt to create a buffer zone between less compatible land uses and zoning districts. Permitted uses include: offices; schools; churches; recreational facilities; and agricultural uses.

Town of Merrimack. All of Merrimack's land that is contained within the study area is zoned for industrial uses. Permitted uses in this district include: manufacturing; warehousing and wholesaling; offices; service stations; research and testing; fuel storage and distribution; breweries and bottling facilities; and trucking terminals.

There is no minimum lot size requirement within this zoning district. However, all development must be connected to the municipal water and sewer system, and is subject to Planning Board approval based on performance standards criteria. Development is also regulated by wetland and floodplain overlay districts.

Summary

The level of municipal services within Study Area communities varies according to the size of the town in terms of population and the types of land uses that occur there. Although Litchfield has grown significantly, it is still considerably smaller than the other two, and as a result, provides fewer and lower levels of service. Conversely, the lack of services such as municipal water and sewer systems, combined with less suitably zoned land and limited highway access, has not allowed Litchfield to attract the commercial and industrial development that is found in Merrimack and Hudson. However, Litchfield has recently rezoned land for nonresidential development in an effort to capture a larger share of the region's commercial and industrial growth.

From a fiscal perspective, the existence of a larger nonresidential property tax base in Merrimack and Hudson has enabled those communities to better offset the costs associated with providing municipal services to their residential properties. In Litchfield, increased costs in services, particularly educational facilities, have been borne primarily by residential properties.

3.3 SOCIOECONOMIC CHARACTERISTICS

Regional Trends

The Nashua Metropolitan Area has been one of the fastest growing regions in New Hampshire for the last 30 years. Between 1960 and 1990, the Nashua PMSA's population increased at a rate that was double the rate for the State as a whole. The PMSA consists of the towns of Nashua, Hudson, Litchfield, Merrimack, Milford, Amherst, and Hollis. The three study area towns of Hudson, Litchfield, and Merrimack absorbed a significant portion of that growth, and actually grew at a faster rate than both the PMSA and the state of New Hampshire during that time period.

Although all three study area towns have grown rapidly, Merrimack has undergone the most significant transformation, and now has the second largest total population in the PMSA following the City of Nashua. Due to its excellent highway access via the F.E. Everett Turnpike, the availability of municipal water and sewer, and a sizeable land area, Merrimack was better positioned to capture a large portion of the study area's historical population and employment growth. Hudson's employment base has also expanded significantly, but as of 1989, Merrimack's businesses and industries employed approximately 3,700 more workers than did those located in Hudson.

On the other hand, Litchfield has been able to attract very little of the region's employment growth due to its relatively poor highway access, lack of municipal water and sewer systems, and restrictive land use regulations. Therefore, Litchfield has become a bedroom community providing housing for employees of the area's industries.

Industrial and commercial growth within the area has resulted in noticeable economic prosperity for residents. As a result of employment growth over the decade of the 1980's, study area income levels in 1990 were approximately 12 percent higher than the State as a whole. This is largely attributable to the concentration of high-paying manufacturing jobs which provide average annual wages at a level well above the State average. In 1989, the average local wage rate for study area towns was reportedly 33 percent higher than the New Hampshire average.

The increase in employment opportunities within the Nashua Region that has attracted people to move to the area has also resulted in a greater demand for housing which has, in turn, driven up the cost of obtaining housing. Between 1985 and the middle of 1990, average residential sale prices for housing in the Greater Nashua area increased by approximately 62 percent.

Growth in the number of housing units has also necessitated the provision of additional municipal services such as schools, police, fire, and solid waste disposal. Although this growth does provide an expanded property base from which the towns can levy tax dollars to pay for these services, taxes paid by residential properties are insufficient to pay for the total costs of these additional services and must therefore be offset by tax revenues from commercial properties, as well as other sources of revenue.

Current economic conditions, however, present a sharp contrast to the unprecedented expansion which much of the State experienced in the boom of the mid-1980s. Beginning around 1988/89, recessionary conditions began to exhibit themselves in the form of fewer jobs, increased unemployment rates, and declining residential property values as a result of overbuilding and inflated prices. These stagnant or declining economic conditions were still prevalent at the end of 1991 in the study area towns, the Nashua region, and most of New England, with no clear indication as to when they will begin to reverse themselves.

As economic conditions do begin to improve in the 1990's, future levels of growth are not expected to reach those that had been attained during the previous decade. In the ten years between 1980 and 1990, the number of housing units within the study area increased by approximately 66 percent. Projections prepared by the NRPC estimate only a 31 percent increase in total housing units over the next 20 years within the area. Despite this anticipated slower rate of growth for the future, traffic conditions on existing local roadways are expected to worsen if no improvements are made to the region's transportation system.

Municipal Trends

From a fiscal perspective, the sustained growth which all three towns have experienced over the last three decades has resulted in marked increases in their respective tax bases. However, the important distinction in total growth lies in the split between residential and nonresidential properties. Since residential properties typically do not pay for the services they require, paying for the costs of municipal services must be balanced with growth in commercial and industrial tax base. The Town of Merrimack has been quite successful in accomplishing this and presently has approximately 30 percent of its total tax base in commercial and industrial properties. This has resulted in Merrimack's ability to maintain in a lower and more stable tax rate, while still providing relatively high levels of service.

Hudson has also been able to attract a good amount of the region's nonresidential growth, resulting in 23 percent of its total tax base being commercial and industrial properties. However, despite this fact, Hudson's nonresidential tax base does not completely offset the cost of providing services to residential properties within the community.

Litchfield has the smallest amount of nonresidential property, with approximately 9 percent of its tax base in commercial and industrial land and buildings. Therefore, in order to hold down its tax rate, fewer services are provided and little infrastructure has been built. Thus far, Litchfield has been able to accomplish this because of its still relatively low total population.

It is important to note that all three study area communities have attempted to better position themselves, from a planning and zoning perspective, for growth that may be generated by construction of the Circumferential Highway which has been in the public planning process since 1958. Both Hudson and Litchfield have officially recognized the highway as part of their master plans. Litchfield rezoned a significant portion of the town through which the highway would pass, for commercial and industrial development. Hudson's zoning allows a wide array of land uses in most areas, with denser development encouraged inside the highway corridor. The portion of Merrimack physically impacted by the highway is also zoned for industrial uses in order to take advantage of the new interchange at the F.E. Everett Turnpike that would result from the Full Build Alternatives.

3.4 PUBLIC/6(f) LANDS AND INSTITUTIONAL RESOURCES

Public/6(f) Lands

Section 6(f) of the Land and Water Conservation Act (LAWCON), as amended, was enacted to ensure that property acquired or developed with LAWCON assistance is retained and used for public outdoor recreation use. Any property so acquired or developed, shall not be wholly or partially converted to other than public outdoor recreation uses without the approval of the director of the U.S. Department of the Interior. Such approval is only given upon conditions as the director deems necessary to assure that the substitution of other outdoor recreation properties, of at least equal fair market value, and of reasonably equivalent usefulness, quality, and location are provided.

The following list of 6(f) lands lie within the study area towns of Nashua, Hudson, Litchfield, and Merrimack. This information was provided by the U.S. Department of the Interior, National Park Service.

Project Title	Project Sponsor
Central Nashua Playlots	City of Nashua
Crown Hill Swimming Pool	City of Nashua
Fields Grove	City of Nashua
Mine Falls Park	City of Nashua
Mine Falls Park II	City of Nashua
Mine Falls Park III	City of Nashua
Mine Falls Park IV	City of Nashua
Nashua River Island	City of Nashua
Rotary Pool	City of Nashua
Shady Lane and North Common	City of Nashua
Spit Brook	City of Nashua
Birchcroft/Merrill	Town of Hudson
Merrill Park (Nutting Land)	Town of Hudson
Parker Natural Area	Town of Hudson
Corning Road Park	Town of Litchfield
Merrimack Tennis Courts	Town of Merrimack
Merrimack Tennis Courts II	Town of Merrimack

Municipal Services

1. Public Safety Services - Fire, Ambulance, and Police

Hudson - The Town of Hudson presently receives fire protection services from three fire stations. The Department is staffed by full-time and volunteer firefighters. The Central Fire Station adjacent to the Town Hall is the headquarters for the Department. Two fire substations are located in outlying portions of the town on Robinson Road in the north, and Burns Hill Road in the south. The geographical distribution of these three facilities should provide adequate coverage for serving future growth. However, the additional equipment and personnel required to serve projected growth may necessitate the expansion of one or more of the existing stations. The Department also provides emergency medical and ambulance service to town residents.

The Police Department is housed in the lower level of the Town Hall. Existing building space is inadequate to meet the needs of the current personnel and Department operations. Future needs are expected to encompass either an expansion of the existing facility, or construction of a new station. It is also anticipated that future development will require hiring of additional officers, as well as upgrading existing Department equipment.

Litchfield - Fire services are provided for Litchfield from one fire station located near the Town Hall on NH Route 3A. Most of the Department's personnel are part-time firefighters. Although the existing station is centrally situated, longer response times to the north and south ends of town may eventually warrant the construction of additional substations, particularly if commercial and industrial development occurs as the town has planned for. Equipment upgrade is a major goal of the Department, and future growth may necessitate additional staffing by full-time firefighters. Ambulance services are provided to Litchfield on a contractual basis by the Town of Hudson.

Police services for Litchfield are provided with both full and part-time officers. The station is contained in the lower level of the Town Hall, which is centrally located on NH Route 3A. Although the location provides generally good access to all parts of town, existing building space is inadequate to meet current Department needs. If a new station is not constructed, the existing facilities will eventually need to be expanded, particularly if additional personnel are hired to accommodate future projected growth.

Merrimack - Merrimack's fire protection services are provided with full-time and volunteer firefighters, operating out of three station locations: Central, Reeds Ferry, and South Merrimack. The Central Station located on US Route 3 is the Department headquarters, and is currently inadequate to meet present needs. Ambulance services are provided by the Merrimack Ambulance Rescue Service.

The Town of Merrimack has considered closing the Central Station in order to create a new public safety complex that would house fire, police and ambulance services. Also considered was a new station in the US Route 3 south area that would better serve the industrialized portion of town.

Police services are provided from the lower level of the Town Hall. The size and location of this facility appears to be adequate to meet current needs, but additional personnel and equipment will be required to service future population growth.

2. Educational Facilities

Hudson - The Town of Hudson provides educational facilities for grades one through twelve at five school buildings. The Smith, Library, and Nottingham West elementary schools house grades one through four. Nottingham West began operation within the last two years replacing the Webster School, which now contains administrative offices. The Memorial Middle School contains grades five through eight, and Alvirne High School, grades nine through twelve.

The Middle School is reportedly at, or exceeding its recommended capacity rating. Hudson will need to address this situation in the near future. An addition was recently constructed at Alvirne High School to house the new vocational education facilities.

Litchfield - The town currently provides elementary education for grades one through five at the Griffin Memorial School, and at the Memorial Middle School for grades six through eight. These facilities are expected to serve Litchfield's needs for the next five to ten years.

High school students are currently sent to Alvirne High School in Hudson on a tuition basis. No change is expected in this arrangement for the foreseeable future.

Merrimack - Merrimack delivers its educational services from five school facilities: three elementary, one middle, and one high school. They are:

Mastricola, Reeds Ferry, and Thorntons Ferry elementary schools; Mastricola Middle School; and Merrimack High School.

Current enrollment levels indicate that capacity is still available at all grade levels. A recent addition to the Mastricola elementary school has helped to stabilize space needs at those grade levels. The High School has room for a few hundred students, but the Middle School capacity is somewhat more limited. The town has purchased vacant land for additional school facilities; however, none are presently proposed for construction.

3. Public Utilities - Water, Sewer, Solid Waste

Hudson's municipal water system currently serves the eastern third of the town, as well as the commercial and industrial areas along NH Route 111. Water is provided to the system by the Southern New Hampshire Water Company (SNHWC), a privately-owned company. The municipal sewer system serves approximately 40 to 50 percent of the existing population, with sewage being treated at the City of Nashua's wastewater treatment plant. The remainder of the town is served by either individual or community wells and septic systems.

The Town of Litchfield receives half of its water supply from the SNHWC from wells that the company owns in Litchfield. The balance of residents obtain water from private wells. There is no municipal sewer system in the town, as sewage is treated by individual septic systems.

Merrimack has two separate water systems. One is the municipally operated Water District that serves the majority of the town. The other is the privately franchised Pennichuck Water Works that serves the southeastern part of town. The municipal sewage system services approximately 50 percent of the town. The remainder are serviced by individual wells and septic systems.

For disposing of solid waste, both Hudson and Merrimack have operating sanitary landfills. Litchfield uses an incinerator to dispose of its solid waste and then must landfill the remaining ash residue.

3.5 FARMLAND

The Nashua-Hudson area, with high quality agricultural soils adjacent to the Merrimack River, has been an important agricultural contributor to the region. The greatest concentration of farms is primarily within or immediately adjacent to the relatively flat Merrimack River floodplains east of the river in Litchfield and Hudson. In the more urbanized communities of Nashua and Merrimack, west of the river, considerably less farmland remains.

Most of the farmland in Hillsborough County is used for crops, primarily silage corn, hay, vegetables, and apples (Bond and Handler 1981). Within the immediate study area, vegetables are the principal produce, but lawn sod is becoming an important product. Other agricultural uses, such as poultry farms, can be found within the study area. These farms almost exclusively import feed grains and are not growers of poultry feed on site.

Geographic location, attractiveness of the area and local economic growth have placed continued development pressures on these farmlands. The result has been a significant increase in land development activity, a decrease in the available tillable lands, and a loss of several farms. U.S. Department of Agriculture (USDA) data for 1969-1974 is the latest available for Hillsborough County. In 1974, there were 353 farms in the county, 89 fewer than were recorded in the census of 1969. Between 1969 and 1974, about 11,000 acres of farmland in the county were converted to nonfarm use (Bond and Handler 1981.)

Soils in this region include those recognized by the USDA Soil Conservation Service (SCS) as **Prime farmland**. These are characterized as land that has the best combination of physical and chemical characteristics for "producing food, feed, forage, fiber and oilseed crops" (USDA 1982). Additionally, Prime farmland soils have the "soil quality, growing season, and moisture supply needed to economically produce a sustained high yield of crops when the land is treated and managed using acceptable farming methods" (USDA 1982). In general, sufficient moisture, favorable temperature and growing season, pH, salt, sodium and minerals along with few or no rocks, and good permeability help to make these soils optimum as agricultural areas.

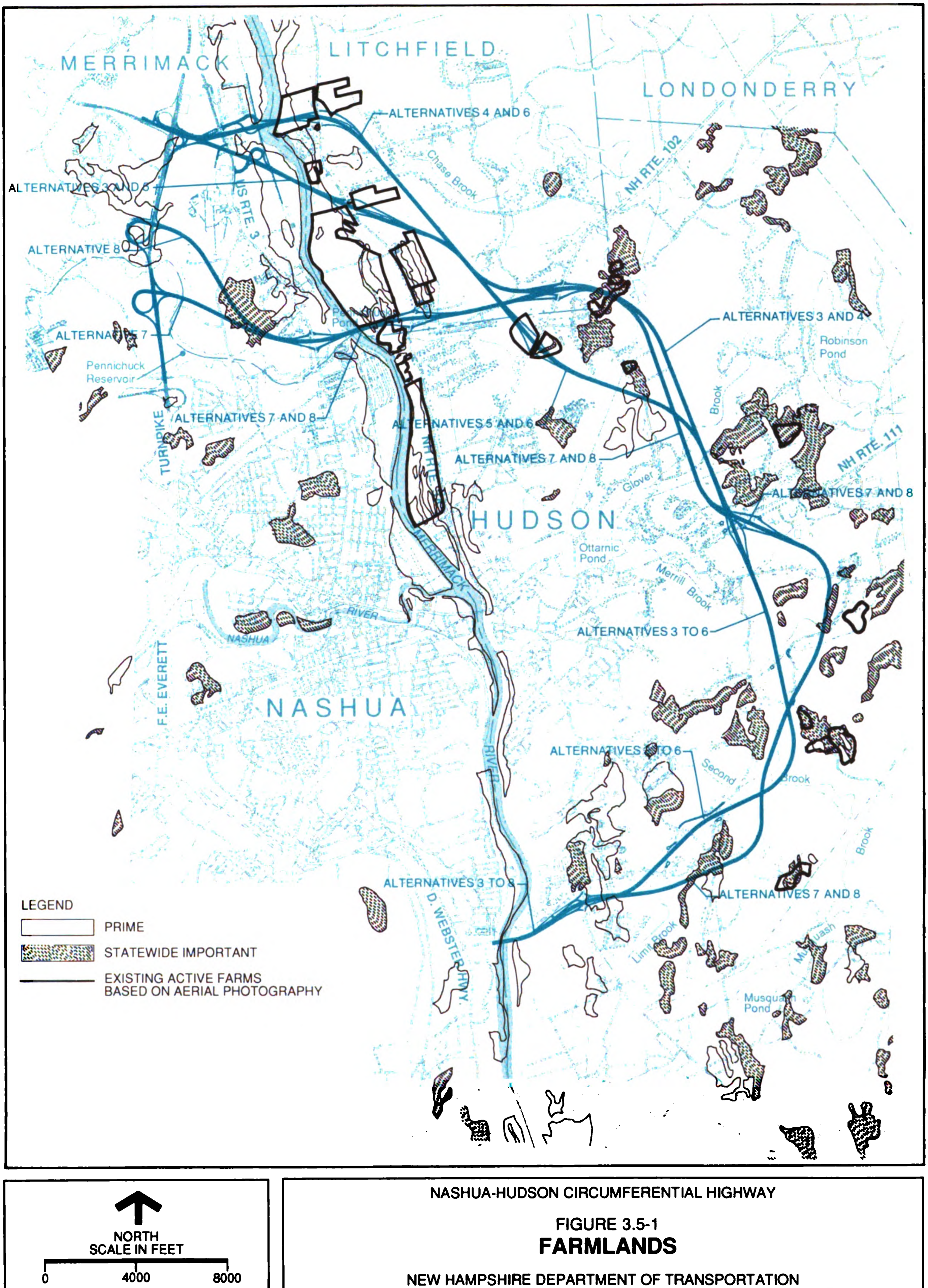
Other soil types have been recognized as **Statewide Important farmland** soils and **Locally Important farmland** soils. Statewide Important soils are not prime or unique farmland but are important for the production of food, feed, fiber, forage, and oilseed crops (USDA 1982). Locally Important farmlands include additional soil types recognized by the SCS with essentially the same crop-growing characteristics.

Prime and Statewide Important farmland soils are designated based upon soil quality and characteristics and not on current land use. Therefore, these areas may or may not be presently farmed. Several areas of soils meeting the criteria of quality farmland are woodland or are in various successional stages reverting back to woodland from previously open farmland.

All soil types in the study area were computer-mapped using digitized soils survey data provided by the University of New Hampshire. Supplementing this soils information, boundaries of active farms were added, based upon interpretation of current aerial photography (July 1990) and ground observation. Active farmland can be described as cultivated lands or land under various forms of agricultural management; inactive areas include unmanaged woodland, overgrown fields, lawns and unused farmlands. Figure 3.5-1 shows active farms, together with all land in the study area containing soils classified by the SCS as Prime or Statewide Important farmland.

During the development of alternatives, the designated Prime or Statewide Important farmland soils were considered constraints in the placement of new roadway alignments. Alternatives were developed that avoided or crossed farmland soils in the least disruptive manner possible, given other constraints such as wetlands, wells, aquifers and developed areas.

Because land use changes have occurred since the publication of the Hillsborough County-East soil survey in 1981, actual farmland soils impact acreages are anticipated to be slightly lower than those presented. Several areas designated as soils suitable for farmland in 1981 have since been developed as residential, industrial or commercial land uses. Soils in these developed areas no longer meet the SCS criteria as farmland soils. Furthermore, data presented in the 1981 publication were gathered by the SCS over the period from 1970 through 1979 (Bond and Handler 1981). Determining the extent of disturbances and re-designating the soil types in the developed areas would require an extensive soil survey beyond the scope of this project. Therefore, farmland soils represented in this report may be considered the maximum impacted acreage possible.



NASHUA-HUDSON CIRCUMFERENTIAL HIGHWAY

FIGURE 3.5-1
FARMLANDS

NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

3.6 HISTORIC AND ARCHEOLOGICAL RESOURCES

Historic Resources

In October 1991, NHDOT, New Hampshire Division of Historic Resources (NHDHR) and Corps approved a methodology to identify historical and architectural resources. The preliminary identification of historic resources was completed for the Nashua-Hudson Circumferential Highway project area in the communities of Nashua, Hudson, Litchfield, and Merrimack, New Hampshire. This initial Phase I study in 1991 included historical research, windshield survey, constraints mapping, and preparation of reconnaissance level survey forms. This effort resulted in the identification of 118 individual historic properties and seven historic districts. These forms were reviewed by the Determination of Eligibility (DOE) Committee, comprised of representatives from NHDOT, NHDHR, and Corps, which identified the properties that were clearly ineligible for the National Register, resulting in a refined list of seventy-nine individual properties and seven districts to be researched.

The intensive level survey was undertaken in autumn of 1992. It identified twenty-five individual historic buildings (outside of districts) and eight historic districts (including approximately seventy additional properties within the districts for which individual inventory forms were prepared). The DOE Committee reviewed the information and found that sixteen individual structures and three historic districts were eligible for the National Register of Historic Places. One additional individual property, the Hills House, "Alvirne" (#106), was already listed on the National Register of Historic Places.

Regulatory Overviews

1. Federal Requirements

Historic resources that are listed or eligible for listing in the National Register of Historic Places are afforded consideration by Section 106 of the National Historic Preservation Act. This section requires a Federal agency with jurisdiction over a federal, federally assisted or federally licensed undertaking to take into account the effects of the agency's undertakings on properties included in or eligible for the National Register of Historic Places and, prior to approval of an undertaking, to afford the Advisory Council on Historic Preservation a reasonable opportunity to comment on the undertaking. Before the Advisory Council comments on a project, the resources and effects on those resources are evaluated by the State Historic Preservation Office (SHPO) and the Federal agency having jurisdiction, in this case Corps. Review by the SHPO and Corps is required by the Section 106 process. In New Hampshire the SHPO is the NHDHR.

Within the study area, one property, the Hills House, "Alvirne" (#106) is already listed on the National Register of Historic Places. Following the survey, an additional sixteen individual properties and three districts were determined eligible for the National Register.

2. State Requirements

The Division of Historical Resources of the State of New Hampshire has established a methodology to meet the requirements of the historic preservation review process. The purposes of this process are to (1) locate and identify historical, architectural and archeological resources within a project impact area; (2) apply the criteria for evaluation of significance of a resource for possible eligibility for the National Register of Historic Places, if not already listed or nominated; and (3) assess the probable effects a project would have on resources listed in or eligible for the National Register.

3. Local Requirements

Although the main consulting parties in the historic preservation review process are the federal and state agencies, the SHPO and the Advisory Council on Historic Preservation, members of the public must also have adequate opportunities to receive information and to share their views. In addition, provision is made by the Advisory Council's regulations for other interested parties to become consulting parties. These interested parties may include local governments, applicants for federal licenses and assistance permits, Indian tribes, and the public, e.g. historical societies or advocacy groups.

Local surveys are coordinated with the NHDHR. Ideally, identification of historical resources at the local level is part of the comprehensive planning process. When it is not, NHDOT and NHDHR encourage communities to use the inventory information generated by transportation planning for local planning and promotion, and for initiating community-wide historical resources inventories.

Methodology

The U.S.G.S. topographic sheets for the area and base maps served as the primary recording tools for the location of historic resources. Data on the location of historic resources (standing historic structures and historic districts) were compiled from a number of sources, including primary and secondary documents and visual inspection. The primary objective of this study was to provide a broad overview of the constraints represented by historic resources.

Preliminary assessment of historic structures entailed identification of those elements built before 1950, defined as "possibly eligible" for listing in the National Register of Historic Places.

The criteria (36 CFR part 60) by which National Register eligibility is determined are:

Criterion A: *Resources that are associated with events that have made a significant contribution to the broad patterns of our history.*

Criterion B: *Resources that are associated with the lives of persons significant in our past.*

Criterion C: *Resources that embody the distinctive characteristics of a type, period or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguished entity whose components may lack individual distinction.*

Criterion D: *Resources that have yielded, or may be likely to yield, information important in prehistory or history.*

To be eligible for inclusion, resources must also retain integrity, defined as the quality of location, setting, design, materials, workmanship, feeling and association sufficient to clearly convey their history and significance.

Background research and historic data collection were undertaken to provide a regional context for assisting in structural identification. This included a library search for primary and secondary historic sources at local libraries and historical societies, the New Hampshire Historical Society and the New Hampshire State Library. Some of the most valuable information was gathered from interviews with property owners and local historians. Historical photographs were reproduced on continuation sheets of survey forms. Copies of historic maps were obtained for all towns in the project area to reveal the historic location of farms, dwellings, industries, special-function buildings, cemeteries, roads and railroads. Most commonly used maps include:

1805, survey by town, compiled by Carrigain
1860, county wall maps
1892, Atlas of the State of New Hampshire

For historic bridges and cemeteries, existing survey information was provided by the NHDOT and the New England Old Graveyard Association.

The preliminary assessment of historic structures, buildings and features entailed identification of those elements built before 1950 that were considered potentially significant from a historical perspective. Historical resources within the study area were evaluated in accordance with the approved methodology and reviewed by the Corps, NHDHR and NHDOT. Information on identified resources and historic districts was compiled on intensive inventory forms prepared for each property built prior to 1950. The intensive level survey information was deemed sufficient to determine significance and eligibility for the National Register of Historic Places. These historic resources were evaluated by a committee meeting of representatives from the Corps, NHDHR and NHDOT in December 1992; a consensus determination was reached in all cases. The intensive level inventory forms and Determination of Eligibility forms for all properties are on file at NHDHR, Corps and NHDOT. The following seventeen individual structures and three districts were determined eligible for/or are already listed in the National Register. They are shown in Figure 3.6-1.

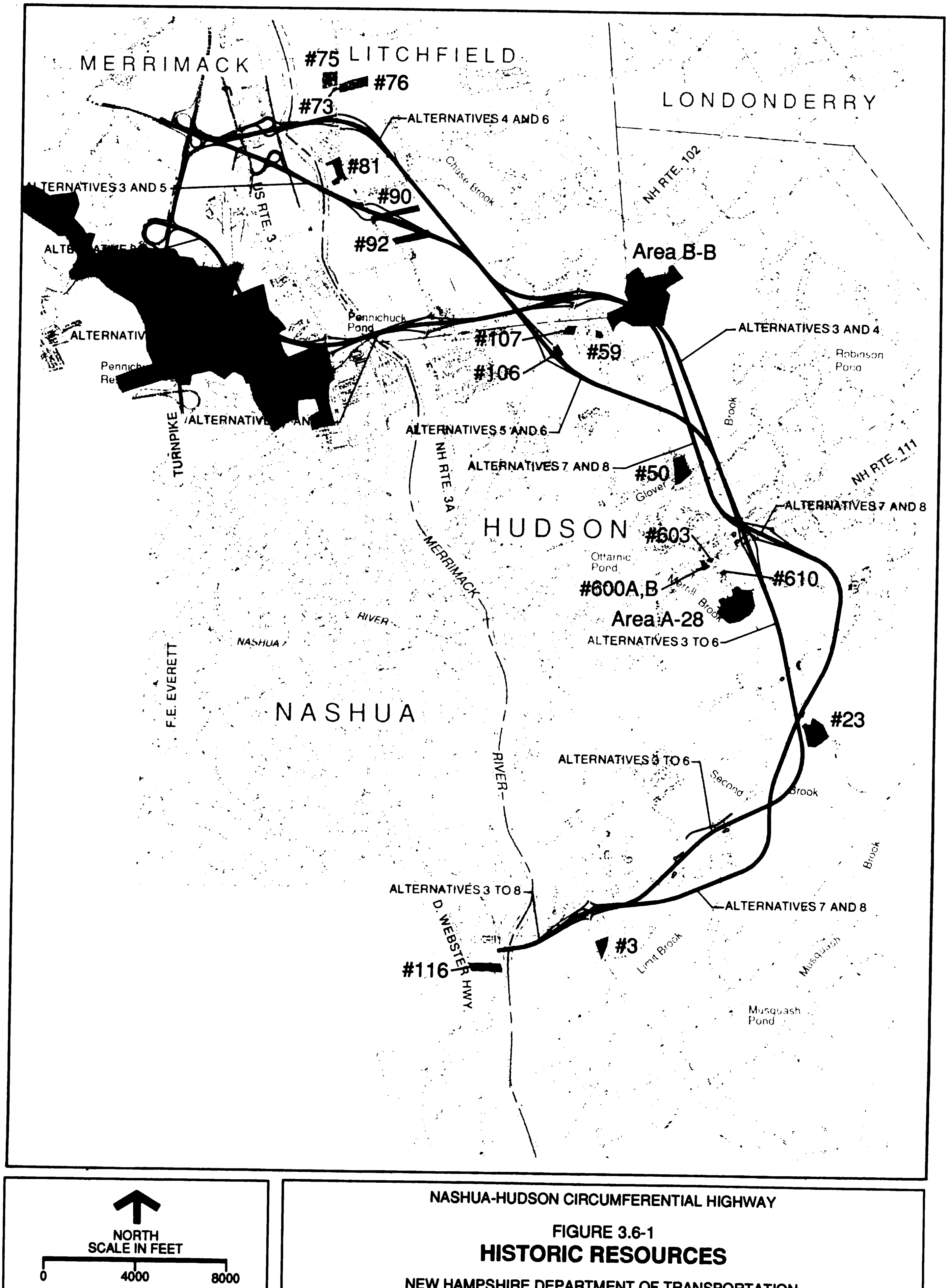
Individually Eligible Properties

1. Fred Giddings House (#3)

The Fred Giddings House (#3) is individually eligible for the National Register under Criterion C as a good example of the vernacular Craftsman style. It is the only residence of its style in the town of Hudson and has remained virtually unchanged since its construction in 1910. The boundary encompasses the house, a period garage and the 5.3 acre tax map parcel that has been historically associated with the conveyance of the ownership of the property.

2. Asa Davis House (#23)

Built c.1780 and historically one of Hudson's largest and most prosperous farms, the Asa Davis House (#23) is significant for its historical associations with Hudson's 18th and 19th century agricultural development. It also is architecturally significant as a rare surviving example of an early $2^1/_2$ story three bay, center entry house and for its high degree of original interior features and finishes. The remaining property associated with the farm consists of two parcels flanking Bush Hill Road, totalling 16.4 acres of land. The National Register boundary includes the house, cider press, well house, privy, outbuilding ruins, orchards, stone walls, ornamental trees, cultivated land, meadow and wooded land that have historically been part of the Davis Farm; they maintain historic integrity and contribute to the property's significance under Criteria A and C.



NASHUA-HUDSON CIRCUMFERENTIAL HIGHWAY

FIGURE 3.6-1
HISTORIC RESOURCES

NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

3. Smith-Walch House (#50)

The Smith-Walch House (#50) is individually eligible for the National Register under Criterion C as a well-preserved example of a vernacular Greek Revival sidehall farmhouse and as a locally unique example of its type with laterally connected outbuildings. Although the agricultural land historically associated with the farmhouse is reduced in size from the 19th century farm holdings, the thirteen acres of mowed fields and former orchards and cranberry bogs continue to document the farmhouse's domestic and agricultural setting.

4. Jeremiah and William Hills House (#59)

The Jeremiah and William Hills House (#59), on 1.57 acres, is individually eligible for the National Register under Criterion C as the earliest and most architecturally significant house remaining from "Hills Row" on Old Derry Road in Hudson. The house has an unusual origin; it appears to represent the amalgamation in the mid-19th century of two earlier structures. The house illustrates characteristics of both the Federal and the Greek Revival styles; the addition of an Italianate door hood conveys the farm's continuing prosperity in the latter part of the 19th century. The Jeremiah and William Hills House is the best example of a 19th century 5 X 3 bay house form in Hudson and retains a high degree of evolutionary integrity.

5. Hills House, "Alvirne" (#106)

The Hills House (#106), known as "Alvirne" and now owned by the Hudson Historical Society, is the only Shingle Style residence in Hudson. The c.1890 former summer residence ranks with the finest examples of the style in the state of New Hampshire; most others are found in wealthy suburbs or mountain and seashore resort communities. The house, located on a 2.5 acre lot, was nominated to the National Register of Historic Places by the Hudson Historical Society and listed in 1983 under Criterion C for its statewide architectural significance.

6. Bartlett House and Office Complex (#107)

The Bartlett House and Office Complex (#107) is a singular combination of two distinctive architectural influences, the Tudor and Craftsman styles, into a small brick residence on a 1920's 1.73 acre suburban lot. In Hudson, it is the most articulated example of an early 20th century residence, urban in form due to its original owner's and builder's associations with the city of Boston. The house retains its key architectural features and is eligible for the National Register under Criterion C.

7. Baptist Meeting House (#600A)

The Baptist Meeting House (#600A), built in 1841, is one of several Greek Revival style buildings, including a high posted cape and the town hall, constructed in Hudson center during a period of expansion. The building is Hudson's only example of the Greek Revival style used as a church. It retains a great deal of integrity, and changes made during the Queen Anne period, including stained glass windows and a $2^1/_2$ story vestry to the rear, do not diminish the original design intent. The church is now located on a 1.3 acre lot, along with the Greeley House (#600B), used as the Baptist Church parsonage since 1964. Only land historically associated with the church, the eastern 0.65 acres of the parcel, contributes to its National Register significance under Criterion C.

8. Greeley House (#600B)

The Greeley House (#600B) is individually eligible for the National Register under Criterion C as the best example of an uncommon form in Hudson, the Greek Revival high posted cape. It was built in the 1840's as Hudson center was rising in prominence within the town. The Greeley House is now used as the Baptist Church parsonage; the house and church (#600A) are now grouped together on the same 1.3 acre tax parcel. Only the land that continues to be historically associated with the Greeley House, the western 0.65 acres of the parcel, contributes to its National Register significance under Criterion C.

9. Hudson Town House (#603)

The Hudson Town House (#603) is an excellent, well-preserved example of the Greek Revival style, typical of many town houses constructed across the state during the mid-19th century. The small 0.30 acre lot, with roadside frontage on the historically important Windham Road, contributes to the property's historic setting. Built c.1857, the town house is eligible for the National Register under Criterion C.

10. Hudson Center School (#610)

The Hudson Center School (#610), constructed in 1908, is individually eligible for the National Register under Criterion C both as a good example of the Shingle Style and as a little-altered early 20th century school building in Hudson. The town's only other example of the Shingle Style is a residence, the Hills House (#106). The building is located near the edge of Hudson center on a 0.54 acre parcel of land, which forms the National Register boundaries.

11. McQuesten-Calawa House (#73)

The McQuesten-Calawa House (#73) retains a great deal of integrity and is the only example of a high-posted Greek Revival cape in Litchfield. The house is a vernacular interpretation of the style and form; architectural trim is limited mainly to the entry, and the house is only one room deep, with rear wall chimneys. A relatively small example of a farmhouse, the house historically operated as part of a large family agricultural compound with property #75. The house, on a 0.78 acre lot, is eligible for the National Register under Criterion C; the c.1952 Colonial Revival style garage on the property does not contribute to its architectural significance.

12. McQuesten-Leary House (#75)

The McQuesten-Leary House (#75) is the best preserved local example of a $1^{1}/_{2}$ *story sidehall Greek Revival farmhouse, a common form in Litchfield. The house was built c.1840, as the town's farming and canal trade economy rapidly expanded. Other local examples of the style and form were updated with late 19th century additions such as porches or modified in the late 20th century, which resulted in a loss of integrity. Historically part of one of the largest farms in Litchfield, the house is now located on a 50.1 acre tax parcel. The house is individually eligible for the National Register under Criterion C; the boundary encompasses the historic buildings and approximately ten acres of surrounding cleared land.*

13. Chase-Parker House (#76)

The Chase-Parker House (#76) is an unusual example of an urban form, a $2^{1}/_{2}$ *story brick Greek Revival sidehall house, in an agricultural setting. Built c.1840, the house was part of a large farm that remained in operation until the mid-20th century. Today the property comprises 30.5 acres of cleared and wooded land, but only that portion of the lot that contributes to the house's significance under Criterion C is eligible for the National Register. The boundary encompasses approximately fifteen acres of cleared land between the Charles Bancroft Highway and the Public Service of New Hampshire power lines to the east.*

14. Leary-Center House (#81)

The Leary-Center House (#81) was determined eligible for the National Register in 1983 and remains eligible because it has retained its architectural and historical integrity. It continues to be architecturally significant as an example of late 19th century hybrid architecture; an 1842 Greek Revival high posted cape was moved to the site and raised to form the second story of the new house with

Eastlake ornamentation in 1896. The Leary-Center House and the Adams-Bergeron House (#92) are the only remaining representatives of the Queen Anne style in Litchfield. The house is historically important for its associations with the Center and McQuesten families of Litchfield, who worked for several generations in agriculture and the canal, milling and brick making trades. The house and its 11.9 acre lot are eligible for the National Register under Criteria B and C. Parcels located across N.H. Route 3A to the east (parcels 3/28 and 3/29), historically associated with the property have archeological significance under Criterion D due to the presence of grist mill remains, but are not included in the property that is eligible under Criteria B and C.

15. Bathalon-Hayes House (#90)

The Bathalon-Hayes House (#90), a c.1930 small-scale poultry farm, is one of the most intact agricultural properties in Litchfield. The house, garage and two chicken coops on a narrow 9.8 acre lot were built in the 1930's, during a period of both suburbanization and widespread part-time poultry farming by individuals whose main employment was in nearby factories and cities. As a well-preserved example of both these historic trends, the property is eligible for the National Register under Criterion A.

16. Adams-Bergeron House (#92)

The Adams-Bergeron House (#92) is a distinctive example of a Greek Revival farmhouse updated in the Queen Anne style during a period of regional progressive agricultural reform. The Adams-Bergeron House and the Leary-Center House (#81) are the only two Greek Revival/Queen Anne hybrids in Litchfield and are also the only remaining representatives of the Queen Anne style in Litchfield. Also contributing to the property's significance is a recently renovated, large, detached English barn northeast of the house. As with other historical agricultural properties on the Charles Bancroft Highway in Litchfield, the Adams-Bergeron House is located on a narrow parcel (19.4 acres) that extends to the east. Only that part of the property that defines the domestic space of the house is eligible for the National Register under Criterion C. This includes approximately ten cleared acres located between the highway and the Public Service of New Hampshire power lines to the east.

17. LaBombarde Estate (#116)

The LaBombarde Estate (#116) was determined eligible for the National Register in 1984 and remains eligible because it has retained its architectural and historical integrity. It continues to be architecturally significant as one of the best examples of the Jacobethan Revival architecture in the region; and it remains *historically significant for its associations with inventor Harold S. LaBombarde, chief executive officer of the International Paper Box Company in Nashua. The house, located on a ten acre tax parcel landscaped with c.1930 walks, patios, stone walls, lawns, mature trees, in ground pool and clay tennis court, is eligible for the Register under Criteria B and C.*

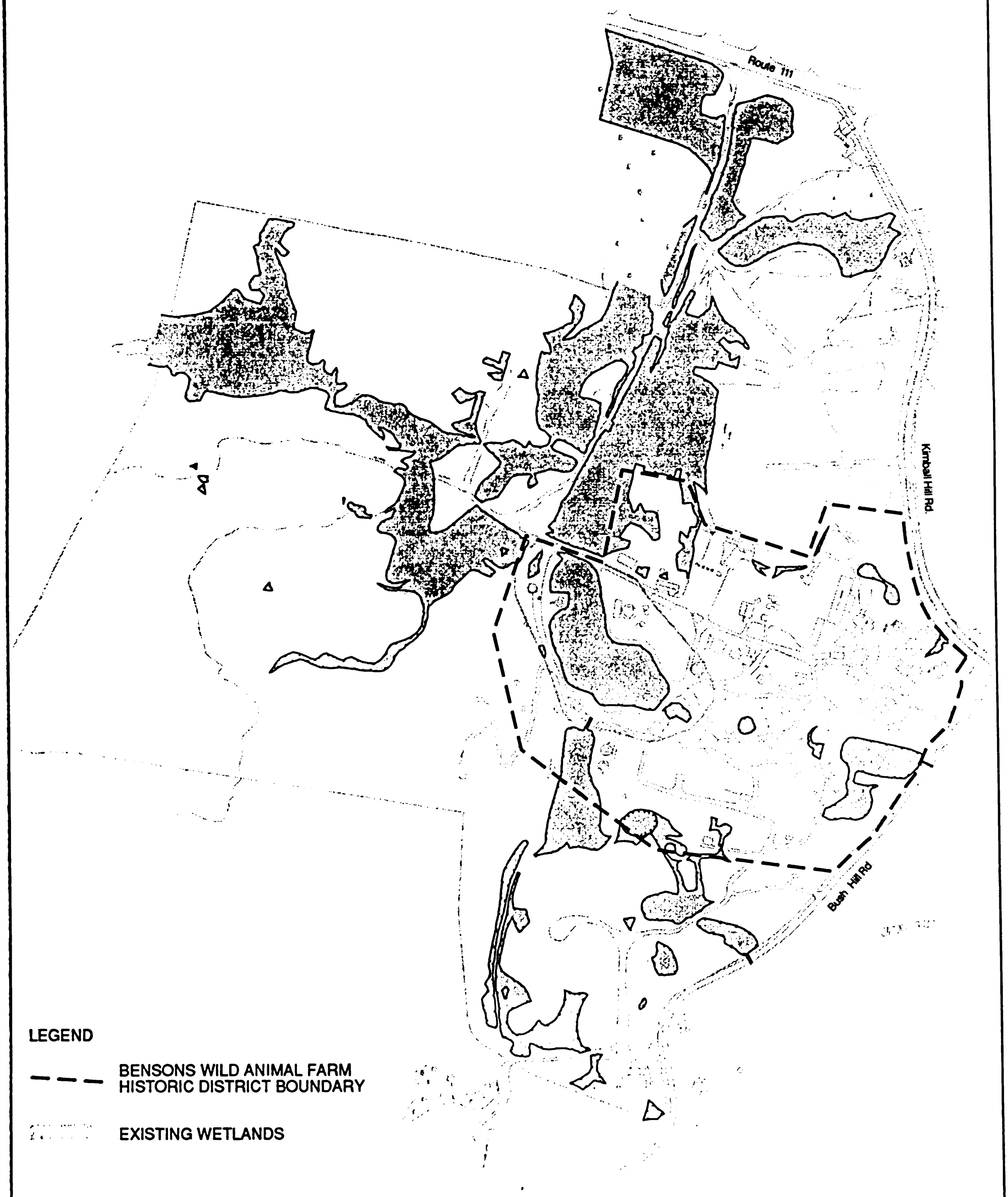
Eligible Historic Districts

1. Benson's Wild Animal Farm (Area A-28)

Benson's Wild Animal Farm (Area A-28) is eligible for the National Register as a historic district under Criteria A, B and C. It is an important example of an early 20th century animal training/shipping facility and zoo, presented in a naturalistic rather than monumental setting, of which few comparable examples survive. It is significant as the property that best represents the achievements of John T. Benson, an animal authority, scout, trader and trainer; zoo designer and curator; showman, and author. The contributing structures and landscape associated with Benson's Wild Animal Farm are collectively eligible for the National Register as examples of animal keeping and showing facilities; many are rare survivors of the earliest era of modern zoo technology. The historic built areas, cleared grazing areas and Swan Lake form the core of Benson's Wild Animal Farm. This historic section at the intersection of Kimball Hill and Bush Hill Roads covers approximately thirty-eight acres of a larger 165.81 acre tax parcel and forms the National Register boundary for this unusual historic district. This is shown in Figure 3.6-2.

2. Jasper Poultry Farm Historic District (Area BB)

The Jasper Poultry Farm (Area BB) is eligible for the National Register under Criteria A, B and C as an outstanding example of a 20th century poultry farm of state-wide significance; for its association with Grant Jasper, a widely-known innovator and leader in poultry production on the local, state and national levels, and as the largest, most complete collection of early to mid-20th century poultry farms/structures in the state. At the peak production and influence of the Jasper Poultry Farms, the poultry industry ranked fourth in the value of U.S. agricultural products. The district comprises approximately 112.1 contiguous acres on the east and west sides of Old Derry Road. Grant Jasper founded Jasper Poultry Farm in 1916, when he purchased the first of four farms on Old Derry Road; at its largest, farm acreage totalled more than three hundred acres, with more than thirty permanent farm buildings, hundreds of range shelters, timber lots, gravel pits and four brook-fed ponds. The National Register boundary includes acreage from the four farms, known as the Home Farm and Annex #1, #2 and #3,



LEGEND

BENSONS WILD ANIMAL FARM HISTORIC DISTRICT BOUNDARY

EXISTING WETLANDS

NORTH
SCALE IN FEET
0 250 500

NASHUA-HUDSON CIRCUMFERENTIAL HIGHWAY

FIGURE 3.6-2
BOUNDARY OF BENSONS WILD ANIMAL FARM HISTORIC DISTRICT

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totalling 112.1 acres, and thirty-one historical buildings that contribute to the district's historic and agricultural significance.

3. Pennichuck Water Works (Area B-115)

Pennichuck Water Works (Area B-115) is eligible for the National Register under Criteria A and C for its statewide significance as a pioneering modern water works complex. The "Nashville Aqueduct," established in 1852, became the Pennichuck Water Works in 1853; it was the first comprehensive effort by a New Hampshire city to address water supply, distribution, and fire protection on a municipal scale; and it preceded the establishment of public water works in other large New England cities such as Manchester, Lawrence and Lowell by twenty years. The Pennichuck Water Works is also eligible for the National Register because of its architectural and engineering significance; the pumping stations are a well-preserved collection of structures depicting the evolution of pumping station technology and architecture from the late 19th into the early 20th century; collectively the buildings are significant as the most extensive complex of pumping station structures in New Hampshire. The National Register boundary comprises 1090 acres (including forty acres in the F.E. Everett Turnpike right of way) near the border between Merrimack and Nashua linked by a series of dams and ponds, Supply Pond, Harris Pond, Bowers Pond and Holt Pond.

ARCHEOLOGICAL RESOURCES

Summary of Prehistoric Results

A prehistoric archeological resources study in the study area resulted in identification of two archeological districts, 13 previously recorded prehistoric sites and 25 locations of prehistoric resource potential. Areas exhibiting resource potential were identified on the basis of qualities developed in a predictive model coupled with results of windshield survey, pedestrian inspection and review of aerial photography. Sites and areas of site potential are located on the first terrace above the Merrimack River, on the margin of the second tier above the river, on interior stream or water feature margins, or in upland locations. Soil drainage, proximity to surface water, and overall landscape setting are believed to be important variables for site location. No recorded sites occur in poorly drained settings and none are expected. Unfortunately, extensive residential, industrial and commercial development has obscured or obliterated many locations which would have exhibited archeological resource potential. The effects of this development are irreversible and it is impossible to assess the quantity or quality of lost data. This is particularly true in the communities of Nashua, Hudson and

Merrimack. However, with large tracts in agricultural use, many archeologically sensitive areas are preserved in the town of Litchfield.

Seven archeologically sensitive areas occur on the first Merrimack River terrace. All of these locations are associated with a perennial stream or seasonal swale. Six archeologically sensitive areas occur at the margin of the second tier above the river. These areas may also extend onto the far reaches of the first river terrace. Three of these areas are associated with a perennial stream. One archeologically sensitive area occurs exclusively on the second tier with no apparent association to the first terrace; this area is associated with a bog. There are ten archeologically sensitive areas that are associated with interior water features. Of these areas, three are associated with a perennial stream; four with a stream/wetland complex; one with a minor tributary stream; one with a pond; and one with a stream and pond complex. One archeologically sensitive area occurs in the full uplands; this area is associated with a spring.

Seven previously recorded archeological sites occur on the first Merrimack River terrace. These are Danforth Field (NH 45-78), River Bank (NH 45-79), Thebodeau site (NH 45-70), Campbell (NH 45-73), Smolt (45 - 67), Michelob (NH 45-76), and Sargent's (NH 45-80). Two of these sites are associated with perennial streams. Another area, shown as a Moorehead tepee, is also located on the first Merrimack River terrace. The Danforth Sand Bank (NH 45-56) site is located on the margin of the second tier and is associated with a stream. The Danforth Archeological District crosses both the first terrace and second tier. The Thebodeau District is located on the first terrace. Three previously recorded sites occur on interior waterways. These are Leary Spring West (NH 45-71), Leary Spring East (NH 45-72), and Chase Brook (NH 45-82). One previously recorded site occurs in the uplands. This is the Ford Sand Bank site (NH 45-47).

At the request on the New Hampshire State Historic Preservation Officer, archeological site locations are not disclosed in this FEIS, as they are exempt from mandatory disclosure pursuant to Federal and State Laws.

Summary of Historic Archeological Survey

An historic archeological resources study in the study area resulted in identification of 39 sites or sensitive locations. These were defined on the basis of observed or likely site presence through a combined strategy of background research, field observation and coordination with results of historic architectural study.

Historic archeological resources are distributed throughout the study area in patterns which echo the distribution of standing historic structures and reflect use of the historic landscape. A number of landscape features made the area attractive for development throughout the historic period. These included water power from the streams which flowed into the Merrimack, the Merrimack River itself as a navigational avenue, the alluvial terraces of the valley which provided fertile farm land, and the forested uplands which were cleared for lumbering and agriculture. Historic contexts which may be applied to archeological remains include: Early exploration and settlement in the interior of NH 1623-1770 (DHR context #3); The French and Indian Wars in NH (DHR context #4); Revolutionary NH (DHR context #5) or Civil War (no DHR context); Small to mid-scale lumbering and mill working, 1620 - present (DHR context #17); Brick-making for local and regional markets, 1650 - 1920 (DHR context #25); Mixed agriculture and the family farm, 1630 - present (DHR context #45); and River and canal navigation, 1790 - 1890 (DHR context #56).

Domestic, agrarian and family farm sites are the most common historic archeological resource noted within the study area. A total of 31 such resources were discovered including five in Nashua (two sites and three sensitive areas), 21 in Hudson (14 sites and seven sensitive areas), one in Litchfield (one site) and four in Merrimack (three sites, one sensitive area). These include house and barn foundations with associated features such as dumps, wells or walls, most of which are represented on maps of 1858 or 1892.

Mills constitute the second most common type of historic archeological resource within the study area. These include both saw and grist mills, located on perennial streams which supplied adequate flow to power machinery. Dams are also present to regulate and enhance the flow. These include one site in Hudson, one site and one sensitive area in Litchfield, and one sensitive area in Merrimack.

Other contexts are represented by single sites or sensitive areas. River and canal navigation is represented by the Cromwell's Lock site in Merrimack. Brick-making is represented by an archeologically sensitive area in Litchfield. The Revolutionary War or the Civil War are represented by Black settlement in an archeologically sensitive area in Hudson. The French and Indian War is represented by an archeologically sensitive fort or blockhouse location in Nashua. Early exploration and settlement is represented by the Cromwell's Trading Post location discussed in the section on prehistoric archeological resources.

At the request on the New Hampshire State Historic Preservation Officer, archeological site locations are not disclosed in this FEIS, as they are exempt from mandatory disclosure pursuant to Federal and State Laws.

3.7 AIR QUALITY

An air quality analysis was performed on the study area. The analysis compiled data on existing measured ambient air quality; estimated areawide emissions inventories of nonmethane hydrocarbons (NMHC), oxides of nitrogen (NOx), and carbon monoxide (CO); and estimated ambient CO concentrations at various receptor locations. The emissions and concentrations were estimated by using EPA's most current models and emission factors data bases.

These pollutants were selected because they represent the major pollutants that are emitted from motor vehicles, and for which health standards and criteria have been promulgated to prevent unhealthful exposures.

Receptors chosen to monitor changes in ambient CO concentrations include residences, public and private buildings, as well as sidewalk locations in the vicinity of street intersections. Receptors are generally chosen to represent areas of anticipated high CO concentrations that the public has reasonable access to.

Existing Air Quality

Based on data from EPA Region I, the measured 1- and 8-hour CO concentrations in 1990 at a monitoring site on Main Street in Nashua were 19.5 and 8.8 parts per million (ppm) respectively. The 1-hour level was well below the 1-hour standard of 35 ppm, but the 8-hour level was very close to the corresponding 9-ppm standard.

The first and second maximum 1-hour ozone levels recorded in 1990 at a monitoring site in Nashua were 0.115 and 0.104 ppm, respectively. There were no violations of the 0.125 ppm standard. However, because of high ozone levels in the period from 1987 to 1989, the Nashua area is presently classified as exhibiting "serious nonattainment" of air quality standards with respect to ozone.

Areawide Emissions Inventory

EPA's MOBILE4.1 program was used to estimate the emissions from motor vehicle sources on existing arterials. Under the existing condition, motor vehicles in the study area were estimated to emit approximately 8.65 tons/day (or 3,156 tons/yr) of NMHC.

CO Concentrations Analysis

EPA's CAL3QHC dispersion model was used to estimate maximum 8-hour CO concentrations at selected locations. For the 1990 Existing Condition, the modeling analysis estimated 8-hour CO concentrations that exceeded the 9-ppm standard at a number of receptor locations at various intersections in the study area including Daniel Webster Highway and Spit Brook Road, Main and Canal Streets, Taylor Falls Bridge and NH Route 3A, and Amherst and Concord Streets (the Library Hill area). These CO concentrations included a background CO level of 2.0 ppm in 1990.

Maximum 1-hour CO concentrations were estimated from the 8-hour modeling results by the use of an inverse persistence factor. The 1-hour concentrations in 1990 were estimated to range from approximately 5 ppm for a house at the intersection of Daniel Webster Highway and Sagamore Bridge, to a little over 30 ppm for a curbside receptor at the intersection of Daniel Webster Highway and Greeley Street. These concentrations are below the 1-hour standard of 35 ppm.

3.8 NOISE

The noise analysis of the proposed Nashua-Hudson Circumferential Highway consisted of measuring existing ambient noise levels at various sensitive receptor locations in the study area, predicting future noise levels with and without the project, and assessing the appropriate mitigation for adversely impacted receptors.

Noise Descriptions and Criteria

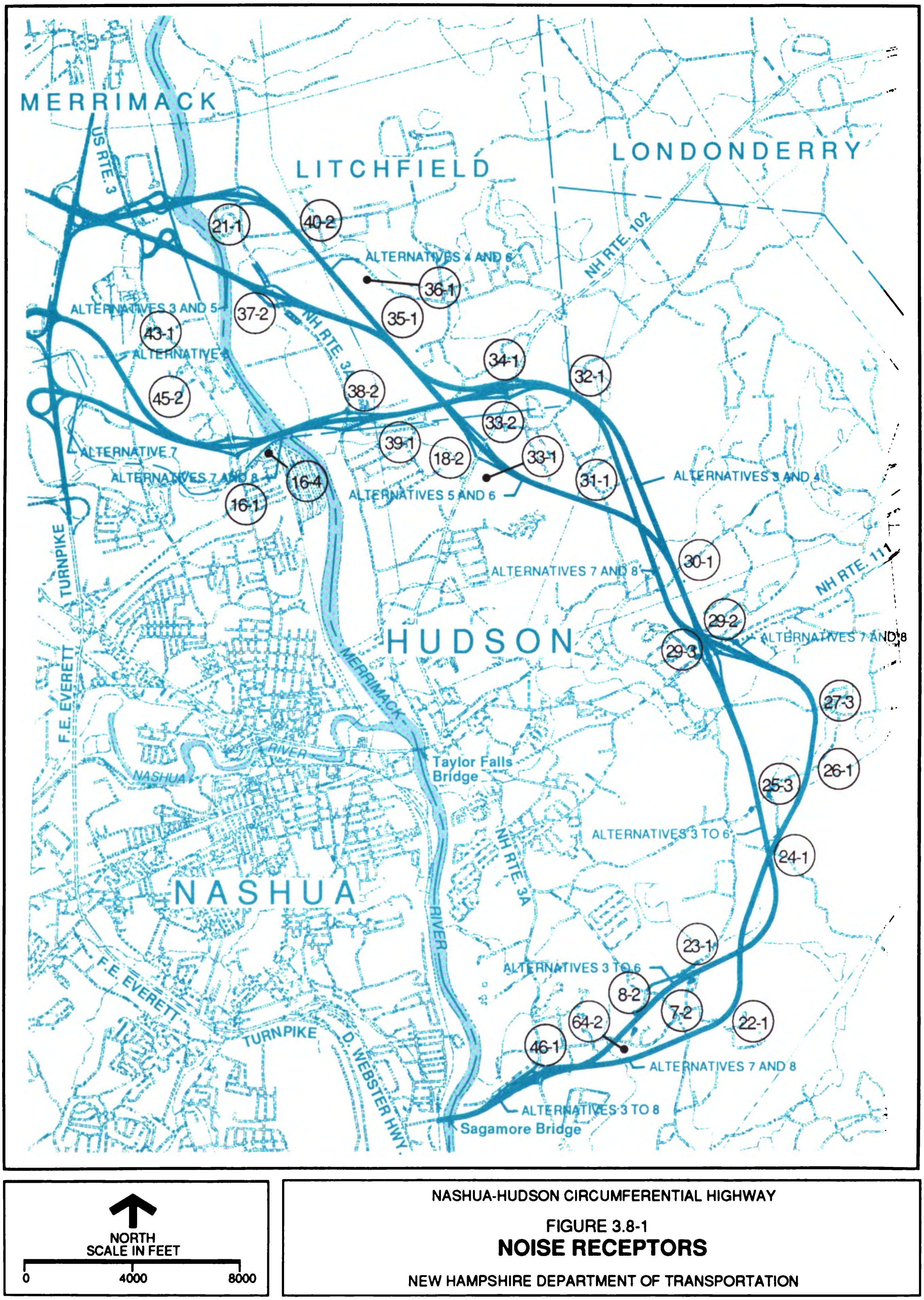
The noise unit that is used to describe existing and future noise levels for the project is the A-weighted decibel (dBA). The A-weighting attempts to reflect the human ear's response to sound with varying frequencies or pitch. The decibel is a logarithmic measure. Consequently, a 10 dBA change in levels would correspond to a doubling or halving of loudness. A 3 dBA change would be barely perceivable by most people.

The peak traffic hour Leq is commonly used to describe the effects of noise from highway projects. The Leq is the equivalent steady-state sound level which has the same acoustic energy as the time-varying sound levels during the averaging time period.

The FHWA regulations on traffic noise (23 CFR § 772) include Noise Abatement Criteria Levels, which if approached or exceeded, require that noise abatement measures be considered. At receptor sites such as residences, schools, hospitals, places of worship, libraries, and recreation areas, the FHWA criteria level is 67 dBA (Exterior hourly Leq). The relative criteria adopted by the NHDOT considers a receptor to be severely impacted if the increase in noise over existing condition exceeds 15 dBA.

Existing Conditions

Noise measurements were made at various times during the weekday in September and October 1991. A total of 30 sites along the project corridor were monitored. These sites generally represent locations where the crossings of the various project alignments with major existing arterials are anticipated. As shown in Figure 3.8-1, most of these sites are in Hudson, but other sites are also located in Litchfield, Merrimack, and Nashua.



NASHUA-HUDSON CIRCUMFERENTIAL HIGHWAY

FIGURE 3.8-1
NOISE RECEPTORS

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Along with the noise measurements, actual concurrent observation of traffic volumes and vehicle speeds were used to estimate hourly Leq's using FHWA's STAMINA 2.0 program. The model was determined to be performing satisfactorily because for the most part, the differences between modeling predictions and actual measurements were within 3 dBA of each other.

The measured hourly Leq's, in dBA, ranged from the mid forties to the low sixties. These levels are quite typical of suburban and semi-rural communities in these areas. A total of 22 receptors were estimated to exceed the FHWA criteria of 67 dBA.

3.9 AESTHETIC AND VISUAL CHARACTER

Affected Environment

Glaciation is the most significant factor in the development of the regional landscape of Southern New Hampshire as reflected by the dominance of rolling/undulating hills and outwash plains. Low relief regionally provides open views of various land uses and vegetation cover types. Elevations range from 500 feet above mean sea level (aMSL) in eastern sections of Hudson to 120 feet aMSL along the Merrimack River corridor. Palustrine forested wetlands are found throughout the study area with palustrine emergent, scrub-shrub, and unconsolidated bottom habitats occurring with less frequency. Agricultural lands and forested uplands are also prevalent. In addition to the Merrimack River, an intricate network of smaller stream corridors exists within the study area. The overall character of the Nashua-Hudson region can be described as a river valley in various stages of transition from rural to urban land-use.

Landscape Units

The assessment and management of visual and aesthetic resources relative to highway project impacts can best be accomplished within a landscape unit framework. Landscape units are defined by a distinct change in visual attributes and spatial experience. Each landscape unit incorporates a variety of landscape types characterized by homogenous combinations of landform and landcover. The Nashua-Hudson region consists of four different landscape units: 1) The Merrimack River Corridor, 2) Undeveloped Area, 3) Agriculture, and 4) Mixed-Use. Although not graphically depicted, these units can be visualized by referring to the Landcover classification figures associated with the Technical Report entitled, "Wildlife Resources." This figure portrays landcover types as an aid to wildlife habitat assessment and can also be used to identify the different landscape units associated with the study area.

The most scenic landscape unit within the Phase II study area is the Merrimack River Corridor. Although not classified as a wild or scenic river, scenic views exist to the north and south when crossing the Taylor Falls and Sagamore Bridges. From the river itself, steep wooded banks screen unsightly views of development along the corridor, thus creating a visually pleasing scene. The river also provides ample opportunity to view many species of birds and wildlife.

A second sensitive landscape unit, in terms of its scenic attributes, is Undeveloped Area. Within the study area, two such units exist. A large region to the east and southeast of the proposed corridor remains relatively free of development. Here, the extensive Second Brook system meanders westward towards the Merrimack River. Wooded wetlands and undulating forested hills are common to this region. Elevations there are among the highest in the study area. Thus, the potential for panoramic views of nearby landscapes is dependent on one's vantage point. The second undeveloped landscape unit is associated with the Pennichuck Reservoir. A coniferous upland forest dominated by white pines surrounds a major portion of this surface water resource. Selective tree farming presently occurs in the uplands on the eastern side of the reservoir, but for the most part the area remains undisturbed. Access is restricted to this area, so the potential to experience its scenic beauty is limited.

The Agricultural landscape unit, which at one time was expansive, is restricted to an area along the Merrimack River in Litchfield. The unit is characterized by flat topography, open fields, and low density single family residences. Open, natural views are encountered at most locations, with direct views of the Anheuser-Busch factory and the western banks of the Merrimack River being most noticeable.

The most diverse and expansive landscape unit within the corridor is that of Mixed Land Use. This unit essentially encompasses the remaining sections of the Phase II study area and is characterized by residential, commercial, industrial and recreational land use blended with natural scenic areas. Most sections of this unit are dominated by development and thus are low in aesthetic quality. Land use along NH Routes 111, and 102 and US Route 3 falls into this category. However, wooded wetlands, agricultural areas, streams, ponds, and golf courses are scattered throughout the unit, providing isolated scenic views. This unit is characteristic of the rural to urban transition that is occurring in south-central New Hampshire.

3.10 TERRESTRIAL ECOLOGY, SOILS, AND GEOLOGY

Topography/Landform

All of the study area falls within the 5,010 square mile Merrimack River watershed. Starting at the confluence of the Pemigewasset and the Winnipesaukee Rivers in Franklin, the Merrimack flows for 116 miles to the Atlantic Ocean in Newburyport, Massachusetts. Once considered one of the ten most polluted rivers in the United States, land use legislation and advances in wastewater treatment have greatly improved the condition of the River. Land use along the River is a mixture of residential, industrial, and commercial. The Merrimack River Watershed Council has nominated a 15-mile segment of the Merrimack River from the Merrimack-Bedford town line to the Massachusetts border for designation into the New Hampshire Rivers Management and Protection Program (NH DES 1990).

The Nashua-Hudson Circumferential Highway study area is located within the towns of Hudson, Litchfield, and Merrimack, New Hampshire. The landscape is nearly level to hilly and can be characterized as an area of predominantly sandy and gravely soils. Relief is gradual with the highest elevation at 495 feet above mean sea level at the summit of Barrett Mountain in Hudson, and the lowest elevation less than 115 feet above sea level where the Merrimack River flows under the Sagamore Bridge. The study area can also be described as a formerly rural region that is becoming increasingly more developed in residential and commercial land uses.

The following section briefly describes the study area in terms of physical, biological, and cultural features. Physical features include bedrock/surficial geology, topography, landform, and soils. Biological attributes relate to upland and wetland plant community associations, wildlife, and conservation areas.

Terrestrial Ecology

Most of the study area is wooded, comprised of mixed age class forest species, including white pine, red oak, white oak, hickory, beech, sugar maple, red maple, and hemlock. The vegetative community can be described as a typical diverse southern New England species mixture, with several hundred species occurring in the study area. Most of the area was abandoned from agriculture during the past 100 years, and allowed to re-establish as a post-agricultural forest.

The majority of wetlands occurring in the study area are palustrine habitats, dominated either by trees (palustrine forested), shrubs (palustrine scrub-shrub), or emergent vegetation (palustrine emergent). The larger bodies of open water, such as the Pennichuck Reservoir, Ottarnic Pond, and parts of Second Brook account for the Lacustrine wetlands. The Merrimack River and sections of the Chase Brook are classified as Riverine wetland systems.

NHDRED, Natural Heritage Inventory, collects and analyzes data on the status, location, and distribution of rare or declining native plant and animal species and exemplary natural communities in the state. The inventory has identified natural communities that occur in the study area. One community; **Inland Basin Marsh**, occurs in the northern reaches of the study area, predominantly in the Litchfield area. It is an herbaceous or mixed herbaceous/shrub dominated community, which occurs in the lower Merrimack River Valley. This community has been identified by the Natural Heritage Inventory as being potential habitat for at least one rare plant species. Three additional communities have been identified in the study area. These include *Northern New England Level Bog* and *Southern New England Dry Colluvial Slope Forest on Acidic/ Circumneutral Bedrock/Till and Southern New England Basin Swamp* (NHDRED 1991).

Soils

Over 50 soil types occur within the study area, most of which were formed in glacial deposits which rest on bedrock. Soil deposits include both glacial till and stratified drift sand and gravel deposits. Most of the upland sites were covered by glacial till, except those sites where bedrock is exposed. Productive, higher quality farmland soils are concentrated along the Merrimack River Valley. Sand and gravel deposits occur in the form of kame terraces or alluvial outwash plains. In other areas, soils are mostly organic muck deposits associated with wetlands.

Geology

The study area consists of hills and low mountains underlain by metamorphic and igneous rocks. Schist, phyllite, and granite comprise the bedrocks. The Merrimack River Valley is located within a depression in the Seaboard physiographic region (Soil Survey of Hillsborough County, New Hampshire, Eastern Part 1981). Generally, elevations increase in an easterly or westerly direction away from the Merrimack River.

Endangered and Threatened Plant Species

No Federally listed, Threatened, Endangered, or Candidate species of plants have been identified within the study area.

New Hampshire Natural Heritage Inventory (NHNHI) has identified nine State Threatened plant species as known or potentially occurring in the study area. Three plant species that are State listed Endangered species, are known to have historically occurred within the study area (NHDRED 1991). A listing of these elements can be found in Appendix D of the Technical Report entitled, "Wildlife Resources".

At the request of the NHNHI, specific locations of these elements have not been mapped for publication.

3.11 WILDLIFE

Wildlife Habitats

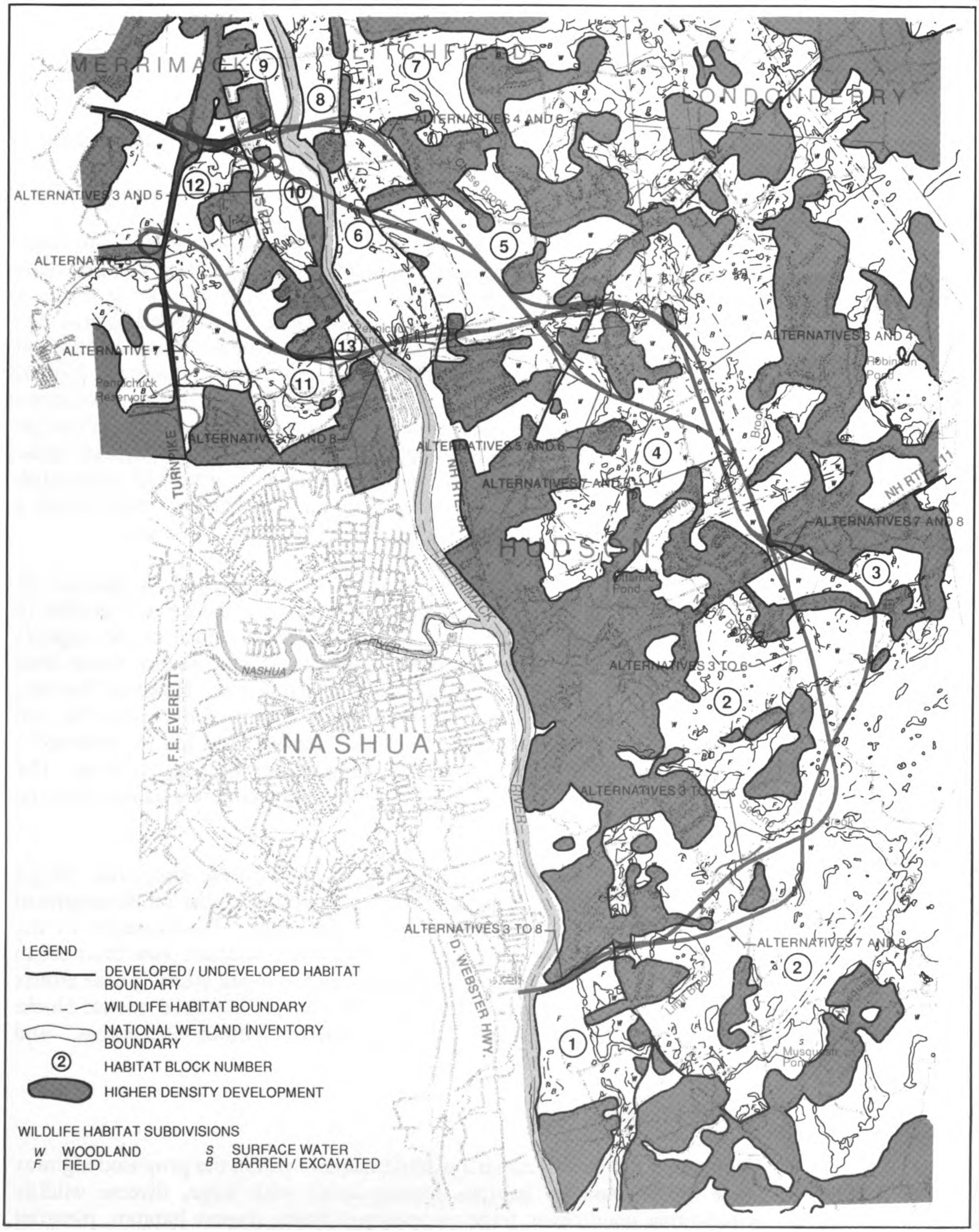
As seen in Figure 3.11-1, a network of developed areas, predominantly residential, has made the study area "patchy" with virtually no large sections of unfragmented landscape remaining. Although developed areas do have some wildlife habitat function, they are not described as wildlife habitat areas in this report. The remaining areas, wildlife habitats found within the Nashua-Hudson region, can generally be described as a combination of mixed hardwood-conifer forests, fields/agricultural areas, heavily disturbed or barren ground sites, open water, lakes, ponds and rivers, and various classifications of wetlands. Wetlands have been identified as components of these undeveloped areas important for wildlife. Throughout this region of south-central New Hampshire, almost all upland and wetland sites experienced a significant amount of land use activity during the past 250 years.

During the 18th and 19th centuries, most of the region was cleared for agricultural use (pasture and cultivation). Following the general decline in agricultural land use during the mid and late-1800s, much of the region's undeveloped land reverted to forest. Mixed-age and quality forest land currently comprise more than 50 percent of the landscape. However, forested land in this region is becoming increasingly fragmented by residential and commercial development. Likewise, most forested land has experienced a moderate to high level of timber harvesting during the past 50 years. The result is a more fragmented, monotypic, and even-aged forest habitat than the original primeval forest.

Figure 3.11-1 indicates the extensive fragmentation of the study area. Major roadways, residential development, commercial and industrial development have contributed to the "patchiness" of this area. Development in the municipalities of Nashua and Hudson is expanding outward from their urban centers and steadily filling in and replacing undeveloped areas. These effects are evidenced by the greater number of smaller undeveloped habitat blocks identified in the Technical Report entitled, "Wildlife Resources," and illustrated in Figure 3.11-1.

Notable Habitats

There are a number of notable wildlife habitats within the proposed highway study area. Notable habitats include areas with large, diverse wildlife populations, good cover, large undeveloped tracts, diverse habitats, plentiful



NORTH
SCALE IN FEET
0 4000 8000

NASHUA-HUDSON CIRCUMFERENTIAL HIGHWAY

FIGURE 3.11-1
WILDLIFE HABITATS

NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

wildlife food supplies, or habitat characteristics essential for less common, rare or unique species. These warrant special consideration in terms of highway siting or construction. All of these habitat types include wetland community associations which are presented below.

Figure 3.11-2 illustrates these notable habitat areas. (See also Section 3.14.)

Second Brook Wetland System

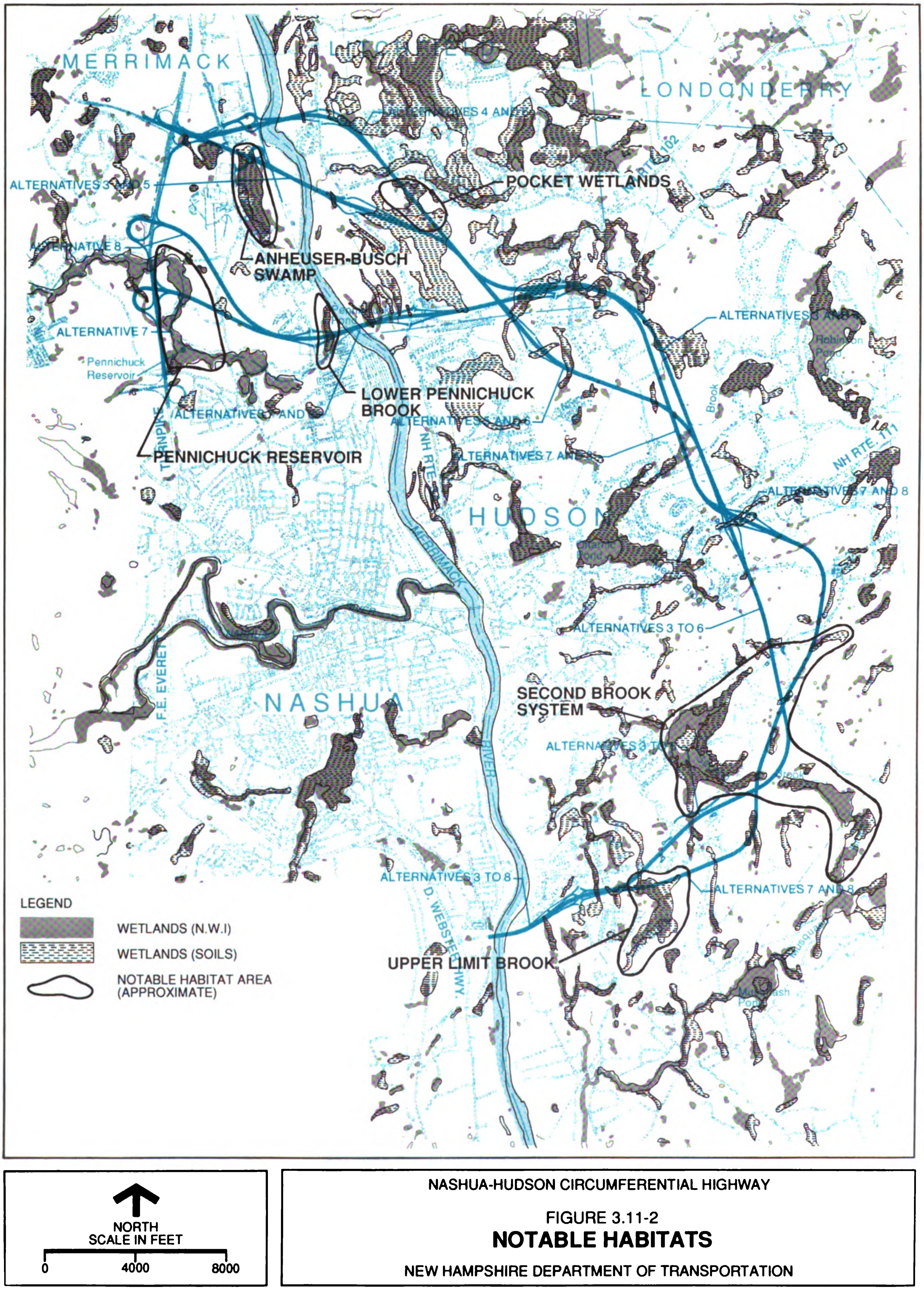
The Second Brook watershed encompasses more than 3,330 acres and includes the largest "less disturbed" expanse of land in Hudson. Composed of a variety of wetland classes and life forms (e.g., red maple swamp, shrub swamp, riparian, marsh), it has considerable plant species and structural diversity. Several wetland areas of the Second Brook system are relatively flat wet meadows, scrub-shrub, and emergent complexes surrounded by wooded hillsides from 3 to 15 percent slopes. This wetland complex receives water flow from three tributaries, flows west to the Merrimack River, and is heavily influenced by beaver activity. As described by the Hudson Conservation Commission, the Second Brook watershed exhibits the greatest diversity of topography, ecological communities, and scenic areas in the Town of Hudson.

Upper Limit Brook

This 44-acre wetland complex is located along the upper reaches of Limit Brook in southern Hudson. Although relatively small in total area, this site contains a great diversity of wetland classes and vegetative life forms including red maple/shrub swamp, emergent marsh, and open water habitats. This wetland habitat has a high degree of structural diversity, vertical stratification (layering), interspersion, and patchiness. As a former beaver impoundment, there are a considerable number of cavity, downed, and standing-dead trees that are used by cavity nesting birds and mammals. This habitat is also enhanced by the relatively undisturbed, mature upland forest that surrounds most of the wetland. Considerable wildlife food sources grow within or near the wetland. Compared to most upland sites in southern New Hampshire, there is a relatively high number of large, mast-producing red and white oaks at this site.

Lower Pennichuck Brook

This approximately 16-acre riparian habitat is located in Merrimack between the Pennichuck Reservoir and the Merrimack River. Although the streambelt habitat is rather narrow in width, the adjacent upland area is comprised of



NASHUA-HUDSON CIRCUMFERENTIAL HIGHWAY

FIGURE 3.11-2

NOTABLE HABITATS

NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

mature, old-growth conifer/hardwood species. Age-class diversity is high and there are number of large, cavity trees. The downed/dead tree ratio is quite high and there is considerable vertical and horizontal vegetative stratification. Compared to most other habitats in the study area, wildlife species diversity and abundance are greater. The U.S. Fish and Wildlife Service has suggested that this streambelt may "contain essential habitat features" for use as a roosting site for wintering Bald Eagles (Beckett 1992).

Pocket Wetlands

There are at least two wetlands located south of Page Road in Litchfield that can best be described as pocket depressions. These glacially-formed wetlands occur as small shallow ponds with vegetation arranged in concentric circles around a central section of open water. Somewhat bog-like in appearance, these wetland habitats have some of the characteristics of the "coastal plain pondshores" and "basin marshes" described by the NHNHI as unique natural communities. Although not confirmed at these particular sites, Blanding's turtles are known to occupy this type of habitat. These sites are located within a relatively large, undeveloped upland area of Litchfield. Deer and moose were found in this area, along with several other wildlife indications.

Anheuser-Busch Swamp

This bottomland hardwood forest wetland occurs south of the Anheuser-Busch Brewery. Approximately 75 acres in size, it is a generally even-aged, monotypic hardwood forest that does not exhibit a great degree of plant species or structural diversity. However, as part of a relatively large and undisturbed forested area that is adjacent to the Merrimack River, it has been suggested by the FWS that this type of riparian forest habitat may "contain essential habitat features" for use as a roosting site for wintering Bald Eagles.

Pennichuck Reservoir

The Pennichuck Reservoir is an open water habitat approximately 200 acres in size. The upland border is a white pine stand that is managed as a tree farm. Since the reservoir is managed as a public water supply, the water is rather nutrient poor (oligotrophic), it does not support a greater variety of aquatic emergent or floating vegetation. Because this area is well-buffered and protected from human activity, it tends to serve as a refuge for small mammal and avian wildlife species. Waterfowl utilize this well protected open water habitat.

Wildlife Species

Vertebrate wildlife species that potentially occur in the study area of the proposed highway development are discussed below. A complete listing of these species can be found in the Technical Report entitled, "Wildlife Resources."

These determinations were made through field observations and other analysis including literature searches, and identification of potential species based upon evaluation and analysis of habitats.

Field observations included modified variable width line transects and point centered counts (Ralph and Scott 1981). These descriptive survey techniques are useful in providing a general assessment of wildlife species occurrence and relative abundance. Observation techniques included both direct (i.e., visual or auditory) and indirect (e.g., scats, tracks, feeding sites, trails, dens, etc.). In addition, site specific wetland visits recorded wildlife species seen or heard, as well as by indirect signs.

Mammals. Of the 46 species that may occupy one or more of the habitats located in the study area, 21 (46 percent) were observed during field work.

The most commonly observed furbearers included raccoon, red fox, muskrat, and beaver. Red fox signs (e.g., burrows, tracks, scats) were observed in the Pennichuck Reservoir woodlands. Red fox were often found near the powerline cuts and banks adjacent to the sand and gravel pits such as the area south of Griffin Road. Beaver signs (e.g., dams, lodges, felled trees, trails) were observed in many palustrine and riparian habitats. In some survey areas, muskrats were recorded in beaver ponds. Fisher and river otter were also recorded. A river otter was sighted on the Merrimack River near the Sagamore Bridge. Fisher signs were observed near two small ponds at a survey site west of Greeley Street in Hudson. Local residents remarked that fishers were frequently heard although rarely seen in the immediate vicinity.

White-tailed deer appear to be abundant in the Pennichuck Reservoir area west of the Merrimack River in Nashua and Merrimack, and in the woodlands north of Talent Road in Litchfield. No overwintering concentrations or deer yards have been reported in the area of the proposed highway corridor (Nowell 1984). A few moose signs were found along the shores of several ponds in the area immediately north and east of Hudson and in Litchfield. Local residents offered that moose are uncommon in the Nashua and Hudson areas.

For small mammal populations, the Eastern chipmunk, short-tailed shrew, white-footed mouse, and meadow vole were the most frequently observed species. There were many direct and indirect observations of gray and red squirrel, and one observation of a southern flying squirrel.

Birds. Seventy-seven of 136 potential species (56 percent) were observed during field surveys within the study area. The most commonly observed type was songbirds, followed by waterfowl and raptors. A number of species were fall/spring migrants (e.g., peregrine falcon, northern pintail, long-eared owl) and do not normally breed or overwinter in the area. Overall, observed avian species associations by habitat type (e.g., forested, wetland, field, barren ground) were basically similar to lists in Degraaf and Rudis (1986).

Amphibians/Reptiles. Nine of a total of 16 potential species (56 percent) of amphibians and five of 15 potential species (33 percent) of reptiles were observed during field surveys. The most commonly observed amphibian was the Northern Spring Peeper which was recorded in almost all Palustrine habitats and wooded wetland sites. The green frog was the most common pond/marsh species even inhabiting several small excavated ponds adjacent to sand and gravel sites. Most observed species of turtles and snakes were found in association with aquatic habitats. Ottarnic Pond and the Second Brook area had the greatest diversity and abundance of amphibians and reptiles.

Fish. Approximately 33 species of finfish are likely to occur within the study area. Important warm water fish that are usually found in small lakes, ponds, and streams include various species of sunfish, perch, pickerel, and both large-mouth and smallmouth bass. Brook trout are stocked in Glover and Second Brooks.

Anadromous fish species (e.g., those that spend their adult lives in salt water but return to fresh water to spawn) are beginning to return to the lower Merrimack River as a result of a federal-state cooperative restoration program that began in 1969 (NHDES 1990). The completion of fish passage facilities at the Pawtucket Dam at Lowell, Massachusetts, in 1986, and the Amoskeag Dam in Manchester, New Hampshire in 1990, has allowed American shad, alewife, and blueback herring to move upstream as far north as Hooksett, New Hampshire. Adult Atlantic salmon returning from the ocean are normally captured at the Essex Dam fish lift facility in Lawrence, Massachusetts, and transported to the Nashua fish hatchery for use in a stocking program. From 1975 - 1987, over three million juvenile salmon were released into the Merrimack River system. The lower Merrimack River and its tributaries are considered important habitat in terms of the reintroduction of Atlantic Salmon and American Shad (NRPC 1989).

Threatened or Endangered Wildlife Species

The federal government and the State of New Hampshire have identified fish and wildlife species (including both invertebrate and vertebrate species) which are threatened, endangered, or otherwise listed as species of special concern within the state. These species are listed in Table 3.11-1.

Federally-listed Species. Based on information provided by the FWS, the only federally-listed or proposed, threatened, and endangered species that is known to occur in a portion of the project area is the **Bald Eagle**. Based on information obtained from the NHFG, the Merrimack River is one of four or five wintering areas for bald eagles in the state. The lower Merrimack River from Concord south to the Massachusetts border is second only to the Great Bay estuary in importance as wintering habitat for bald eagles in New Hampshire. The lower Merrimack River also serves as a corridor for winter eagle movement. The occurrence of this species at the mouth of Chase Brook and potential for occurrence at the mouth of the Pennichuck Brook has been documented by NHF&G and confirmed by the Audubon Society of New Hampshire (G. Beckett, FWS, pers. comm. 1992).

In accordance with Section 7 of the Endangered Species Act of 1973, a biological assessment of any impacts to bald eagles was implemented. The assessment focused upon potential roost sites, with field work being conducted during late February 1992. No evidence of Bald Eagle roosting was found at either site, however, their winter utilization of this portion of the river is well documented (Proctor 1992) (see Appendix C of the Technical Report entitled, "Wildlife Resources").

During field inventories performed in conjunction with this study, a **Peregrine Falcon** was sighted in the Second Brook wetland. As a federally-listed endangered species, the peregrine falcon occurs primarily as a migrant throughout the New England region, frequenting coastal areas and major river systems. In several Northeastern states, there are captive rearing and release programs being conducted by the FWS in an attempt to re-establish territorial breeding pairs. None of these rearing or release sites are in the Nashua-Hudson region. The most likely site within the study area for peregrine falcons to occur during migration would be along the shoreline of the Merrimack River or within the Second Brook wetland complex.

Table 3.11-1

FEDERAL AND STATE-LISTED ENDANGERED/THREATENED WILDLIFE SPECIES POTENTIAL TO STUDY AREA

Species	List	Rank	Status	Last Obs
Insects:				
Cobweb Skipper (*Hesperia metea*)	NHI	-	-	1985
Persius Dusky-wing (*Erynnis persius*)	NHI	-	-	1975
A Geometrid Moth (*Metarphanthis apiciaria*)	NHI	S2, G5	-	1973
Fish:				
Shortnose Sturgeon (*Acipenser brevirostrum*)	Fed/NH	-	FE, SE	-
Banded Sunfish (*Enneacanthus obesus*)	NHI	-	-	1938
Amphibians:				
Blue-Spotted Salamander (*Ambystoma laterale*)	NHI	S4, G5	-	1938
Four-toed Salamander (*Hemidactylium scutatum*)	NHI	S4, G5	-	1938
Reptiles:				
Hognose Snake (*Heterodon platyrhinos*)	NHI	S3, G5	-	1936
Blanding's Turtle (*Emydoidea blandingii*)	NHI	S3, G4	-	1990
Birds:				
Common Loon (*Gavia immer*)	NH	-	ST	-
Pied-billed Grebe (*Podilymbus podiceps*)	NH	-	SE	-
Bald Eagle (*Haliaeetus leucocephalus*)	Fed/NH	-	FE, SE	1992
Peregrine Falcon (*Falco peregrinus*)	Fed/NH	-	FE, SE	1991
Cooper's Hawk (*Accipiter cooperii*)	NH	-	ST	-
Northern Harrier (*Circus cyaneus*)	NH	-	ST	-
Common Nighthawk (*Chordeiles minor*)	NH	-	ST	-
Purple Martin (*Progne subis*)	NH	-	ST	-

Key

List: Fed = Federal Government (FWS), rev. 11/14/91
NH = NH Fish and Game Department, eff. 6/29/87
NHI = NH Natural Heritage Inventory, 8/5/91

Rank: See Table 3.11-2 for description.

Status: FE = Federal Endangered
FT = Federal Threatened
SE = State Endangered
ST = State Threatened

Last Obs: Based on NHNHI listing dated 9/25/91, or more recent observations.

Although not documented, it is possible that the **Shortnose Sturgeon** may occur in portions of the study area (e.g., the Merrimack River). The only federally-listed endangered/threatened species of fish in New Hampshire, the shortnose sturgeon typically inhabits inshore coastal areas and major estuaries of the Atlantic Ocean. An anadromous species, this sturgeon species migrates upstream to freshwater spawning habitats during the spring spawning period. While is it likely that sturgeon were historically found in almost all major river systems in the New England region, impoundments (dams), pollution, and over-harvesting have been the principal causes for the decline of this species. Although it is not known for certain if the shortnose sturgeon is currently found in the lower Merrimack River, it is unlikely.

State-listed Species. The NHFG has legal authority regarding all wildlife occurring in the state. In cooperation with non-profit conservation organizations and educational institutions, the Nongame and Endangered Wildlife Program at NHFG compiles a list of *Endangered and Threatened Species in New Hampshire*. Table 3.11-1 includes a listing of New Hampshire State-listed species that may occur within the Nashua-Hudson study area.

The NHNHI, a program within the NHDRED, collects and analyzes data on the status, location, and distribution of rare or declining native plant and animal species and exemplary natural communities within the state. Using a ranking system developed by the Nature Conservancy, the NHNHI assesses the rarity of a species on a global and state level. A description of the ranking system may be found in Appendix D of the Technical Report entitled, "Wildlife Resources." Table 3.11-2 is a summary of the wildlife and habitat elements within the study area taken from the NHNHI listing.

Table 3.11-2

KNOWN WILDLIFE AND HABITAT ELEMENTS IN STUDY AREA
(Rare Animals and Noteworthy Natural Communities)
(Taken from NHNHI 1991)

Species	**Rank**[1]	**Status**[2]
Emydoidea blandingii (Blanding's turtle)	S3, G4	ST
Heterodon platyrhinos (Eastern hognose snake)	S3, G5	
Ambystoma laterale (Blue Spotted salamander)	S4, G5	
Hemidactylium scutatum (Four-toed salamander)	S4, G5	
Enneacanthus obesus (Banded sunfish)	S2, G5	
Metarrhanchis apiciaria (A geometrid moth)	S2?, GU	
Erynnis persius (Persius dusky wing)	S1, G4T3	SE

Natural Communities

Southern New England Basin Swamp
Northern New England Level Bog
Southern New England Dry Colluvial Slope Forest on Acidic/Circumneutral Bedrock/Till
Inland Basin Marsh

[1]Rank
- S1 = Critically imperiled in state because of extreme rarity (5 or fewer occurrences or very few remaining individuals or acres) or because of some factor of its biology making it especially vulnerable to extirpation from the state. (Critically endangered in state.)
- S2 = Imperiled in state because of rarity (6 to 20 occurrences or few remaining individuals or acres) or because of other factors demonstrably making it very vulnerable to extirpation from the state. (Endangered in state).
- S3 = Rare in state (on the order of 20+ occurrences). (Threatened in state).
- S4 = Apparently secure in state.
- G4 = Apparently secure globally, though it may be quite rare in parts of its range, especially at the periphery.
- G5 = Demonstrably secure globally, though it may be quite rare in parts of its range, especially at the periphery.

[2]Status
- ST = State Threatened
- SE = State Endangered

3.12 WATER RESOURCES

Study Area Drainage Basins

Seven principal watercourses flow through the Nashua-Hudson Circumferential Highway corridor area: the Merrimack River, and Limit, Second, Merrill, Glover, Chase, and Pennichuck Brooks. These watercourses and major and minor drainage divides are shown in Figure 3.12-1. The highway drainage area sections that are depicted represent those highway sections that will drain to the adjacent streams. For purposes of analysis, the Circumferential Highway corridor was divided by drainage basin boundaries into separate drainage areas. These basins and their receiving waterbodies, shown in Figure 3.12-1, are as follows:

1. South Merrimack River
2. Limit Brook
3. Second Brook
4. Merrill Brook
5. Glover Brook
6. Chase Brook
7. Central Merrimack River
8. Lower Chase Brook
9. Northern Merrimack River
10. Pennichuck Brook
11. Western Merrimack River

The Water Quality Designation of all waterbodies is Class B. Class B water quality is suitable for recreational use, fish and wildlife habitat, and agricultural and industrial water supplies.

The Pennichuck Brook and ponds serve as a public water supply reservoir for the City of Nashua.

The Merrimack River currently provides all or a portion of the public water supply to six communities in Massachusetts and two in New Hampshire with future supplies proposed for three additional areas in Massachusetts and one in New Hampshire. Six of the communities withdraw water directly from the River and either store it in holding ponds or use it immediately after treatment. Two of the communities rely on groundwater sources very near the Merrimack River and there is believed to be some direct recharge of the aquifer from the river.

No other surface waterbodies are used for potable drinking water supplies, although these surface waterbodies feed underlying aquifers which may be used for public and private drinking water.

Water Quality Standards

Current Federal (EPA) standards have been used as the measure against which design goals can be defined in order to meet or exceed present and planned surface water criteria.

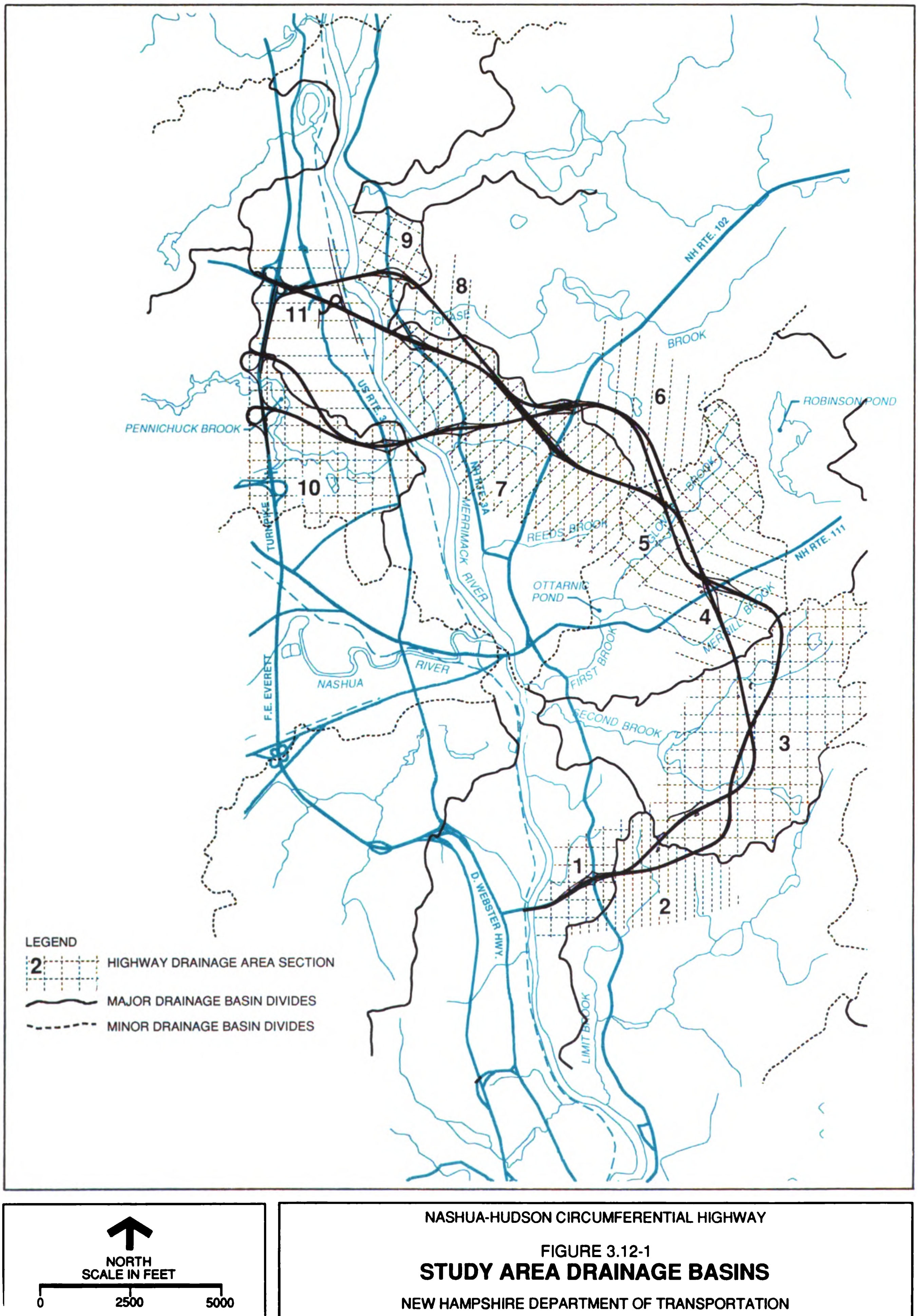
The standards below are set for acute and chronic levels acceptable to protect freshwater and marine aquatic life. Zinc and Nickel standards are for 24 hour averages and represent a maximum never to be exceeded. These standards assume a hardness of 200 mg/l in the form of calcium carbonate for Chromium, Cadmium, Copper, Lead, Nickel and Zinc.

Table 3.12-1

FEDERAL STANDARDS μg/L

	Fresh Water		Marine	
	Acute	Chronic	Acute	Chronic
Chromium	16	11.0	1100.0	50.0
Copper	18	12.0	2.9	--
Lead	82	3.2	140.0	5.6
Nickel	1800	96.0	140.0	7.1
Zinc	320	47.0	170.0	58.0
Phosphate	940	3.0	2944.0	3.4

The EPA (EPA, 1990) has set current drinking water standards for maximum contaminant levels under the safe drinking Water Act. These values are listed in Table 3.12-2.



NASHUA-HUDSON CIRCUMFERENTIAL HIGHWAY

FIGURE 3.12-1
STUDY AREA DRAINAGE BASINS

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Table 3.12-2

DRINKING WATER STANDARDS

Parameter	**EPA Standard mg/l Maximum Contaminant Levels (MCLs)**
Chloride	250.0
Nitrate	1.0
Copper	1.0 (Action Level 1.3 mg/l)
Lead	0.05 (Action Level 0.015 mg/l)
Zinc	5.0
Cadmium	0.005
Chromium	0.1
Nickel	0.1
Asbestos	7 MFL * = 272 mg/l

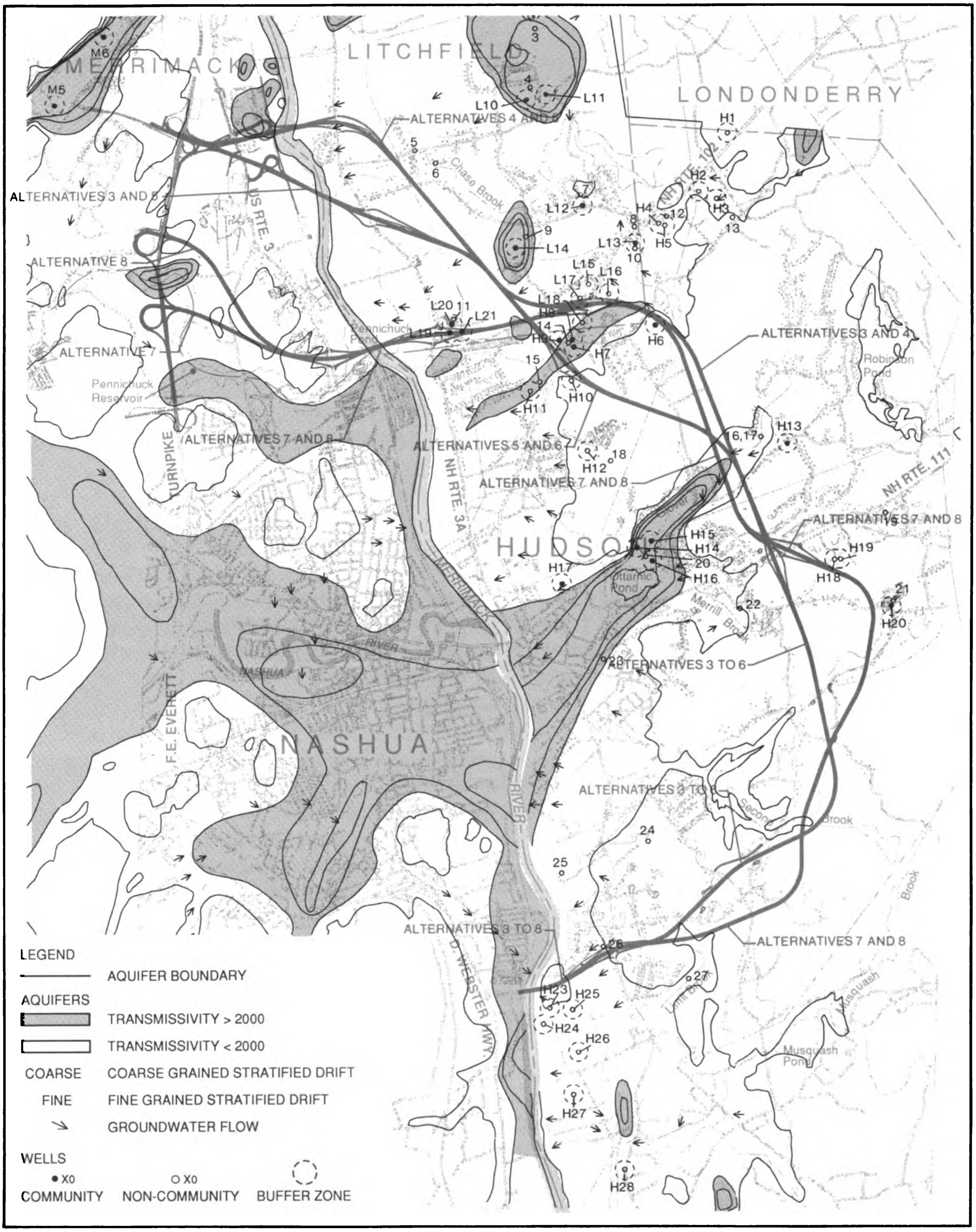
*Million Fibers per Liter. *One fiber = 4.0 X 10^{-10} mg based on data in Casarett and Doull's Toxicology. Second Edition, 1980.*

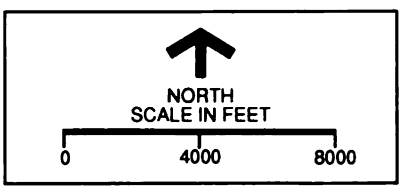
Wells and Aquifers

South-central New Hampshire is an area rich in underlying stratified drift aquifers. These areas, where sufficiently saturated and highly permeable, form the most productive sources of groundwater in the region (Toppin 1987). The most outstanding aquifer feature in the study area coincides with the Merrimack River Valley. Here, a wide expanse of outwash plain deposits forms a nearly continuous aquifer throughout the four communities within the study area. Another prominent aquifer in the region originated from what was once Glacial Lake Merrimack (Toppin 1987). This aquifer, located in northern Hudson, Litchfield, and Merrimack consists of fine grained stratified lake bottom sediments. Although not as permeable or productive as a stratified drift aquifer, this glacial lake bottom deposit has been shown to have a maximum total porosity of 44 percent in some locations in Litchfield (Toppin 1987). In addition to these prominent aquifer features, a number of small, isolated stratified drift and till deposits are also found within the study area.

There are 14 community water supply wells, 28 wells classified as either non-community or non-transient non-community supplies, an undetermined number of private supplies and two wellfields within 5,000 feet of the Build Alternative Alignments. Community, non-community, and non-transient non-community wells are considered public wells, and private supplies refer to individual household wells. The State of New Hampshire Department of Environmental Services (NHDES) is in the process of implementing a Wellhead Protection Program in an effort to determine appropriate zones of protection for its public wells. This comes as a result of legislation passed in 1990 entitled the "Groundwater Protection Act" (RSA 485-C). A wellhead protection area is defined as, "the surface and subsurface area surrounding a water well or wellfield supplying a public water system, through which contaminants are reasonably likely to move toward and reach such water or wellfields" NHDES July 1990). The department is considering a 400 foot radius as a buffer zone around each well unless local conditions call for a larger protective area to be used NHDES Groundwater Protection Bureau, Paul Currier, Telephone conversation 1991). Wells, aquifers, and wellhead buffers are shown in Figure 3.12-2.

In general, the direction of groundwater flow normally approximates that of surface water flow regimes (EPA 1982). This is evident in the study area as groundwater within the stratified drift aquifer associated with the Merrimack River tends to flow toward the river and downslope. However, this is not always the case, especially where aquifers are geohydrologically complex due to heterogenous soil properties, layering, or unusual boundaries or internal





NASHUA-HUDSON CIRCUMFERENTIAL HIGHWAY

FIGURE 3.12-2
AQUIFERS AND WELLS

NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

conditions (Cleary 1984). In these situations, the direction of the flow is governed by intricate hydraulic gradients, and thus groundwater will move in response to differences in hydraulic head (Miller 1984). This is the case when a high-yield well is introduced. The existing groundwater flow pattern is altered in response to the well's creation of a new hydraulic gradient. Because of the complexities, groundwater flow patterns within the study area must be considered on an individual basis as theoretical.

Groundwater quality varies within the study area. Despite this, some common characteristics exist, especially in stratified drift aquifers. Here chemically reducing conditions facilitate the solubilization of iron and manganese from the surrounding geologic matrix resulting in naturally elevated levels of these two metals (Cleary 1984). The EPA's secondary maximum contaminant levels (SMCL) for drinking water are based on aesthetic considerations. The SMCL for iron is 0.3 mg/l and 0.05 mg/l for manganese (EPA 1990). According to Toppin (1987), concentrations in south-central New Hampshire averaged 3.6 mg/l for iron and 0.20 mg/l for manganese.

Elevated levels of sodium and chloride also exist in the region, primarily as a result of widespread application of highway deicing salts. Groundwater sampling has shown that sodium concentrations average 24 mg/l and chloride 33 mg/l with the highest concentrations identified in shallow stratified drift wells (Toppin 1987). The Federal and State aesthetically based drinking water standard for chloride is 250 mg/l. There is no current standard for sodium but a recommended value of 20 mg/l has been suggested even though sodium in water is considered to be of minimal health concern (NHDES July 1990b). Hardness, taste, odors, and other aesthetic considerations vary throughout the study area.

The following is a breakdown by community of the existing aquifers, wells and their associated groundwater characteristics within the study area.

Hudson. The most prominent stratified drift aquifer in Hudson is associated with the Merrimack River outwash deposits. The aerial extent of this aquifer is approximately 36 percent of Hudson's total area (Toppin 1987). Although this is the largest aquifer in town, it is by no means the most productive. The most productive is the Ottarnic pond aquifer which stretches from near Brox Industries along Glover Brook southwestward to the Merrimack River. This stratified drift aquifer contains coarse grained sand and cobble sized gravel which in some locations has a saturated thickness of greater than 60 feet. The transmissivity, or the rate at which water is transmitted through a unit width of aquifer under a unit measure of hydraulic gradient, is estimated to be greater than 8,000 ft^2/day in the central portion of this deposit [South-Central New Hampshire (Wells and Aquifers) 1984].

Hudson is a community that relies totally on groundwater for its public drinking water supply. Prior to 1988, a series of four Southern New Hampshire Water Company (SNHWC) community wells -- the Highland well, Glover well, Greeley No. 1 well, and Tarnic well, located in the vicinity of Ottarnic pond -- served a population of 4,500. (EPA 1988). These wells were shut down when levels of iron and manganese were found to exceed SMCL's designated by the EPA. Presently, Hudson relies on groundwater from Litchfield, an adjacent community underlain by a wide expanse of stratified drift aquifer deposits totaling 93 percent of the town's area (Toppin 1987). Areas southwest of Ottarnic pond had been considered for groundwater development but the quality of the water is presumed to be unfavorable for community drinking water purposes due to excessive land use and high population densities. As a result, most residents in this region receive water that is piped into their home via a public water supply system. Groundwater extracted from the area southwest of Ottarnic Pond is currently being used in industrial processes and for recreational uses such as golf course maintenance.

Another substantial aquifer located in Hudson lies along NH Route 102 in the vicinity of Alvirne High School and the Hudson Motor Inn. This aquifer appears to be an extension of the large Merrimack River aquifer but, according to Toppin (1987), it actually consists of permeable kame delta deposits which have limited groundwater supply potential.

Aside from stratified drift deposits, groundwater in the town of Hudson is also obtained from unconsolidated till deposits, and fractured bedrock. The majority of the wells situated here are individual supply wells as the supply of groundwater contained within these geologic features is limited (Hudson Conservation Plan, November 1990).

Litchfield. As previously mentioned, 93 percent of Litchfield is underlain by stratified drift deposits, the major portion of which is derived from Glacial Lake Merrimack bottom deposits. Only the southwestern corner of Litchfield is included in the study area. This region, dominated by farmland, is completely underlain by fine grained lake bottom sediments of limited groundwater storage potential. The groundwater table in some locations is very shallow, on the order of 5 to 10 feet, based on an examination of well depths in the region. The majority of high yield stratified drift aquifers occupy locations in northern and central Litchfield, well out of the range of the study area being addressed. There is, however, a substantial groundwater source located immediately south of Chase Brook near Cutler Road in the south-central section of town. This stratified drift deposit consists of coarse sand and gravel. It has a saturated thickness in the range of 80 feet and a transmissivity greater than 8,000 ft^2/day in central locations (Toppin 1987).

The SNHWC operates the high production Weinstein well situated in the heart of the coarse sand and gravel constituents of this aquifer. The well has the capacity to pump 1,000,000 gallons per day (GPD) and presently serves a population of 4,500, most of whom reside in the community of Hudson to the south. The groundwater associated with this aquifer is of higher quality than that which comes from the Ottarnic pond aquifer (Toppin 1987).

A small section of southern Litchfield along NH Route 102 is underlain by the same kame delta deposit previously described for Hudson. Community and non-community wells associated with this aquifer serve populations ranging from five to 150. The only other wells that fall within the study area are associated with Olson's Mobile Home Park, a 45-unit establishment located on Darlene Lane, slightly east of NH Route 3A and south of the Rodonis Farm. This cluster of four shallow wells is situated in overburden. Since the groundwater table in this region is located close to the surface, a one mile wellhead protection zone is justifiably associated with these wells.

Merrimack. Approximately 57 percent of Merrimack's area is underlain by stratified drift deposits (Toppin 1987). In terms of the proposed highway, only the area east of the F.E. Everett Turnpike and south of the Anheuser Busch factory will be considered. Within this location are five pockets of glacial till deposits surrounded by fine grained sediments which originated from Glacial Lake Merrimack. Merrimack's southern boundary is the east-west flowing Pennichuck Brook. This area is associated with a stratified drift aquifer whose eastern end is composed of buried coarse grained deposits. Its western reaches consist of fine grained materials reflecting the influences during deposition by the Merrimack River. Along the Merrimack River near the Anheuser Busch facility is a high capacity coarse grained stratified drift aquifer.

Merrimack relies both on groundwater and surface water for its consumptive purposes. Northern parts of the town near Naticook Brook utilize groundwater from community wells operated by the Merrimack Village District (MVD) whereas most southern residents depend on the Pennichuck reservoir (Merrimack River Corridor Management Plan, September 1989). Anheuser Busch is the Pennichuck Water Works' primary customer but the company also has an extensive wellfield established in the aquifer beneath its property. Although currently not in use, the wellfield can be used as a primary water supply in the event of a contamination problem at the

Pennichuck (Anheuser Busch, Jim Deingnan Outside Consultant and Bob Hanson Plant Manager, meeting summary, 1990). There are no known community supply wells located within the study area in southern Merrimack.

Nashua. The City of Nashua lies completely outside of the study area. Only the Pennichuck Brook, the city's northern boundary, will be addressed. The reservoir is the exclusive water supply source for the city. Groundwater quality within Nashua is considered to be unfavorable for drinking water purposes due to extensive development (Toppin 1987). It must be noted, however, that groundwater is utilized in many industrial processes in Nashua.

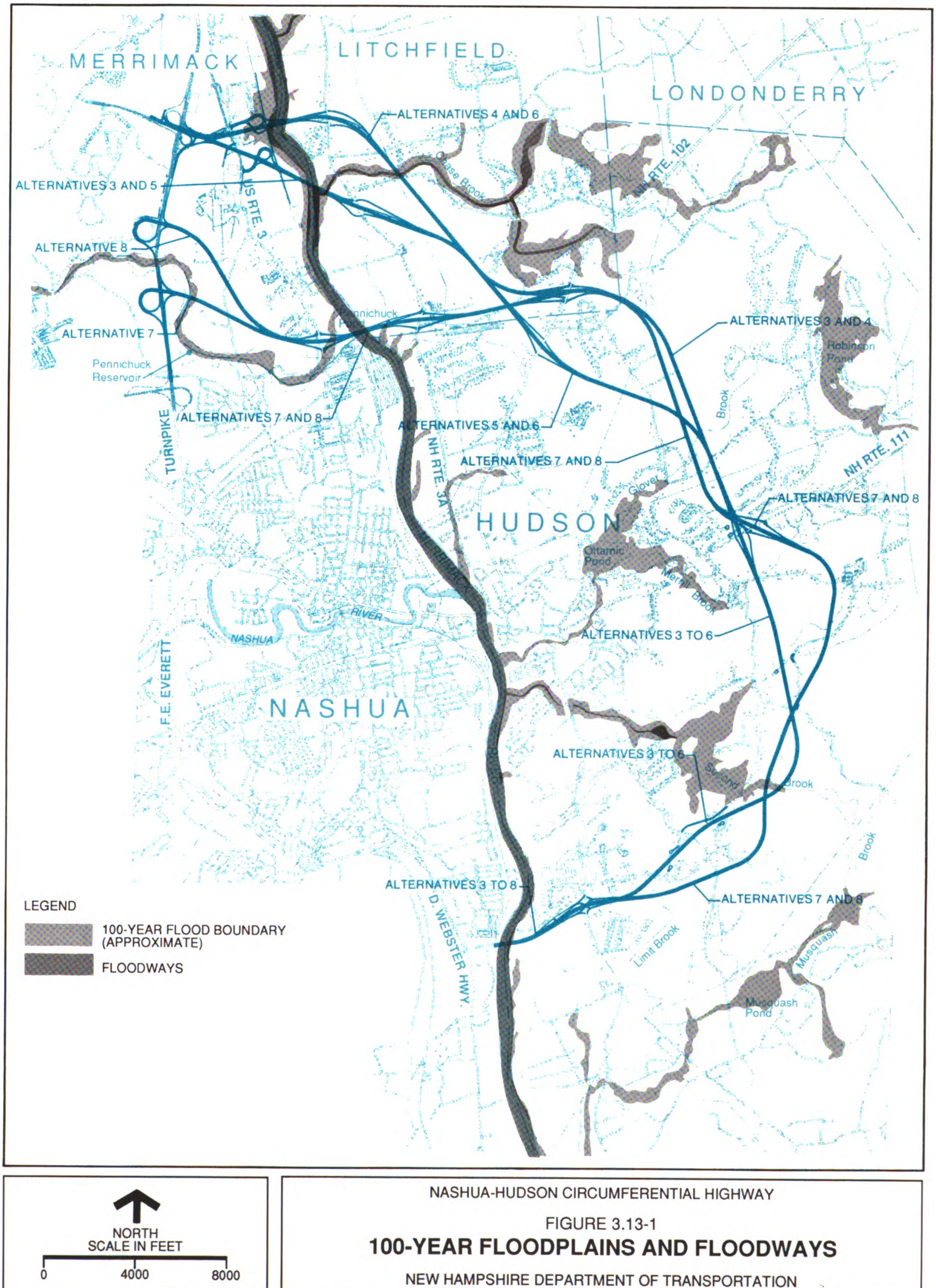
3.13 FLOODPLAINS

Floodplain data within the Nashua-Hudson Circumferential Highway study area was obtained from the most recent U.S. Federal Emergency Management Agency (FEMA) Flood Insurance Study for the Towns of Hudson, Litchfield and Merrimack. This data, presented in Figure 3.13-1 was analyzed with respect to potential impacts that the proposed highway may have on 100-year floodplains and floodways.

The principal watercourse in the study area is the Merrimack River, which originates in Franklin, New Hampshire, at the confluence of the Winnepesaukee and Pemigewasset Rivers. In Hudson, the 100-year floodplain associated with the river ranges in width from 500 to 1,200 feet. In Litchfield, it is slightly larger, approaching 2,300 feet in width at some locations. The floodplain in northern Hudson and Litchfield consists primarily of agricultural areas with low density residential and commercial development. In Merrimack, a railroad parallels the Merrimack River and intersects the 100-year floodplain at many locations. The floodplain is most extensive in areas just south of the Anheuser-Busch factory.

Major flooding is most likely to occur in early spring as a result of heavy rains and snow melt in conjunction with ice-jams. In the fall, storms of tropical origin may also result in elevating surface waters to dangerous levels. The potential for severe floods along the Merrimack River has been mitigated as a result of flood protection measures instituted by the Corps. A series of five dams, the Franklin Falls, Edward MacDowall, Blackwater, Hopkinton, and Everett, have substantially reduced flood problems since the 1960's.

Other watercourses in the study area that may be crossed by the highway corridor are Second Brook in Hudson, Chase Brook in Litchfield, Pennichuck Brook in Merrimack, as well as an unnamed stream west of NH Route 3A in southern Litchfield. Extensive hydraulic studies were performed on each of these streams by FEMA to determine 100-year floodplain limits. These floodplains are generally less expansive than the floodplain associated with the Merrimack River. Along many of these streams are numerous wetlands and ponds which combine to provide substantial storage resulting in more moderate peak flows and attenuated flood periods. As with the Merrimack River, flood elevations along these watercourses can be raised as a result of ice-jams or the accumulation of uprooted trees, brush and other debris near bridges and culverts. The flood elevations in these watercourses will also be elevated by the backwater from the Merrimack River.



NASHUA-HUDSON CIRCUMFERENTIAL HIGHWAY

FIGURE 3.13-1

100-YEAR FLOODPLAINS AND FLOODWAYS

NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

3.14 WETLANDS

As is typical in New England, glacial effects account for the location and type of wetlands found in the study area. Some occur as hillside pocket wetlands underlain by unsorted glacial till. Most are riparian habitats, associated with the tributaries of the major watercourses in the study area such as the Merrimack River, and the Chase, Limit, Pennichuck, Merrill, Glover and Second Brooks. Some are bottomland hardwood swamps, associated with the low-lying flat floodplain of the Merrimack River. Many are underlain by stratified drift, and are therefore significant areas for groundwater interchange. Some wetlands, such as the irrigation and detention farm ponds and the sediment basins at Brox Industries in Hudson, have been created for utilitarian purposes.

Wetlands across the United States have been inventoried and classified by the National Wetland Inventory (NWI), under the auspices of the FWS. Each of the NWI-delineated wetlands has been classified according to the Cowardin system (Cowardin, 1979). The majority of wetlands occurring in the study area are palustrine habitats, dominated either by trees (palustrine forested), shrubs (palustrine scrub-shrub), herbaceous vegetation (palustrine emergent), or open water (palustrine unconsolidated bottom). Beavers account for areas of dead standing trees and pockets of open water in many of the stream-associated forested wetlands. The larger bodies of open water, such as the Pennichuck Reservoir, Ottarnic Pond, and parts of Second Brook are lacustrine wetlands, while the Merrimack River and sections of the Chase Brook are classified as riverine wetland systems.

Hydric soils (as delineated by the SCS), as well as the NWI mapping, indicate wetlands. In most areas, the NWI wetlands and hydric soils are closely associated. In many locations, the hydric soils mirror the NWI-delineated wetlands. Generally, the hydric soils are more extensive than the NWI areas. The combination of NWI wetlands and hydric soils together is considered the approximate federal wetlands boundary.

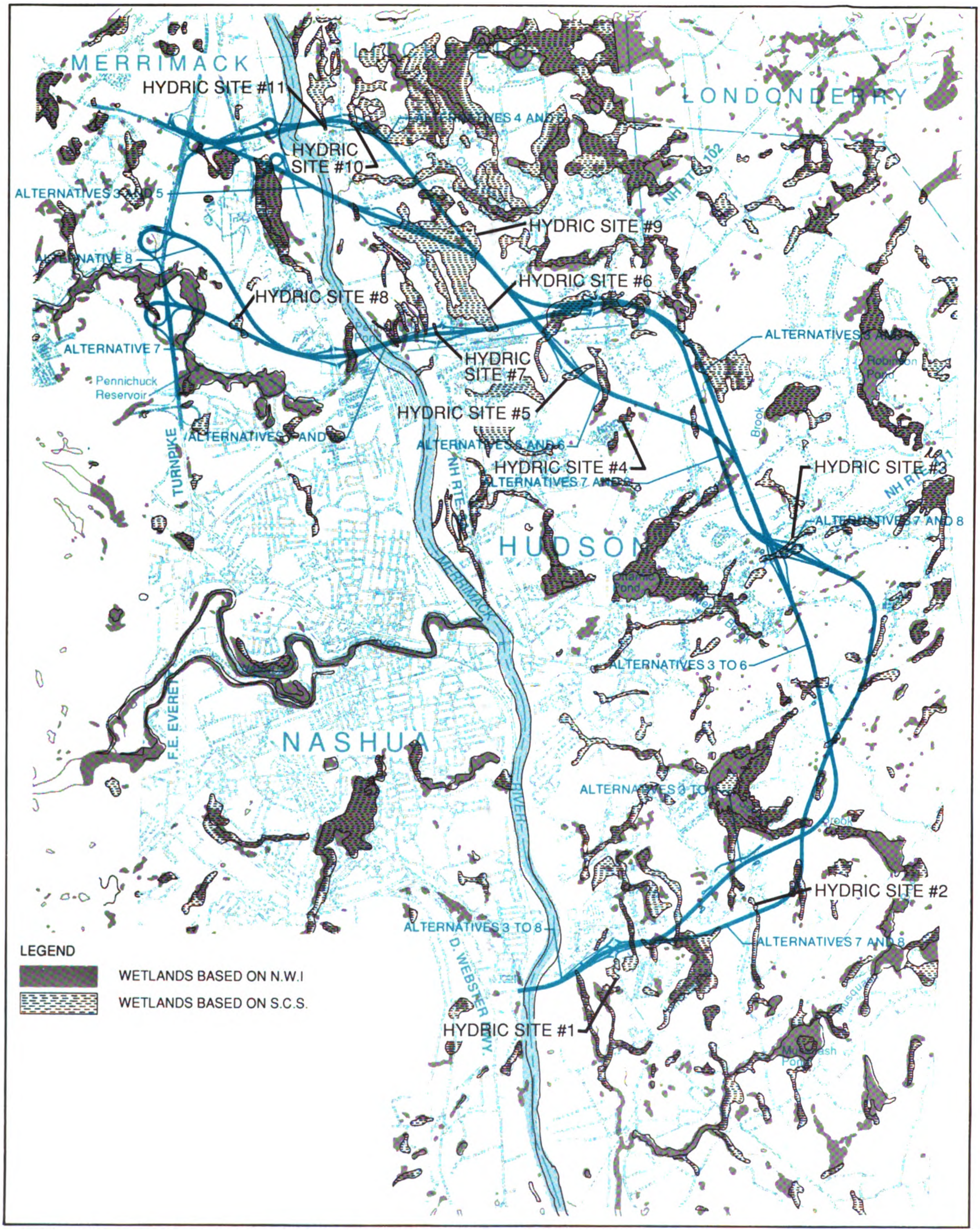
The Corps Highway Methodology was used to guide this study of wetland resources associated with the Nashua-Hudson Circumferential Highway. Phase I involved the collection of base information on the 102-square-mile study area. Wetlands within this study area were identified and digitized using Computer Aided Design and Drafting (CADD) techniques. Wetlands are identified by letter and number designations according to their position along alignment segments. The base information obtained during Phase I included the location of: NWI wetlands, hydric soils, critical habitats, and endangered species. This base information was used, along with other base constraint information, to reduce an original 33 Phase I Build Alternative alignments to six.

During Phase II, the base data were refined, and more detailed information about the potentially-impacted wetlands was gathered and studied through field work and additional office investigations.

Sixty-five individual potentially-impacted NWI wetlands occur along the six Build Alternative alignments. (See Figure 3.14-1.) Most NWI-delineated wetlands are associated with hydric soils. Hydric soils areas not associated with NWI wetlands were not field evaluated, but were considered in impact quantifications. Locations of these eleven unevaluated hydric soils areas are shown in figure 3.14-1. Each of these 65 wetlands were field evaluated for 13 possible functions according to a newly developed Function-Value Assessment Methodology. A Loran-C hand-held navigational device was used to aid in the location of the wetlands in the field. The most common functions occurring in the evaluated wetlands are groundwater interchange, wildlife habitat, sediment/toxicant retention, nutrient removal, and floodflow alteration. Figure 3.14-2 shows the functions associated with each potentially impacted wetland. Appendix A of the Wetlands Technical Report contains detailed information on each wetland system evaluated in the field.

Twelve of these 65 habitats are key wetlands, designated as such because of their uniqueness in the Southern New Hampshire region, or because, based on the Corps Function-Value Assessments, they perform most of the 13 functions. (See Figure 3.14-3.) Six of these 12 key wetlands are within the southern section (between the Sagamore Bridge and NH Route 111), no key wetlands occur in the relatively short central section (between NH Routes 111 and 102), and six occur in the northern section (between NH Route 102 and the F.E. Everett Turnpike.)

No protected plant species were found along any of the Build Alternative alignments. Two wetlands, LO1 and NM1, exhibit characteristics typical of a an Inland Basin Marsh, which is listed as a critical habitat in the New Hampshire Region.

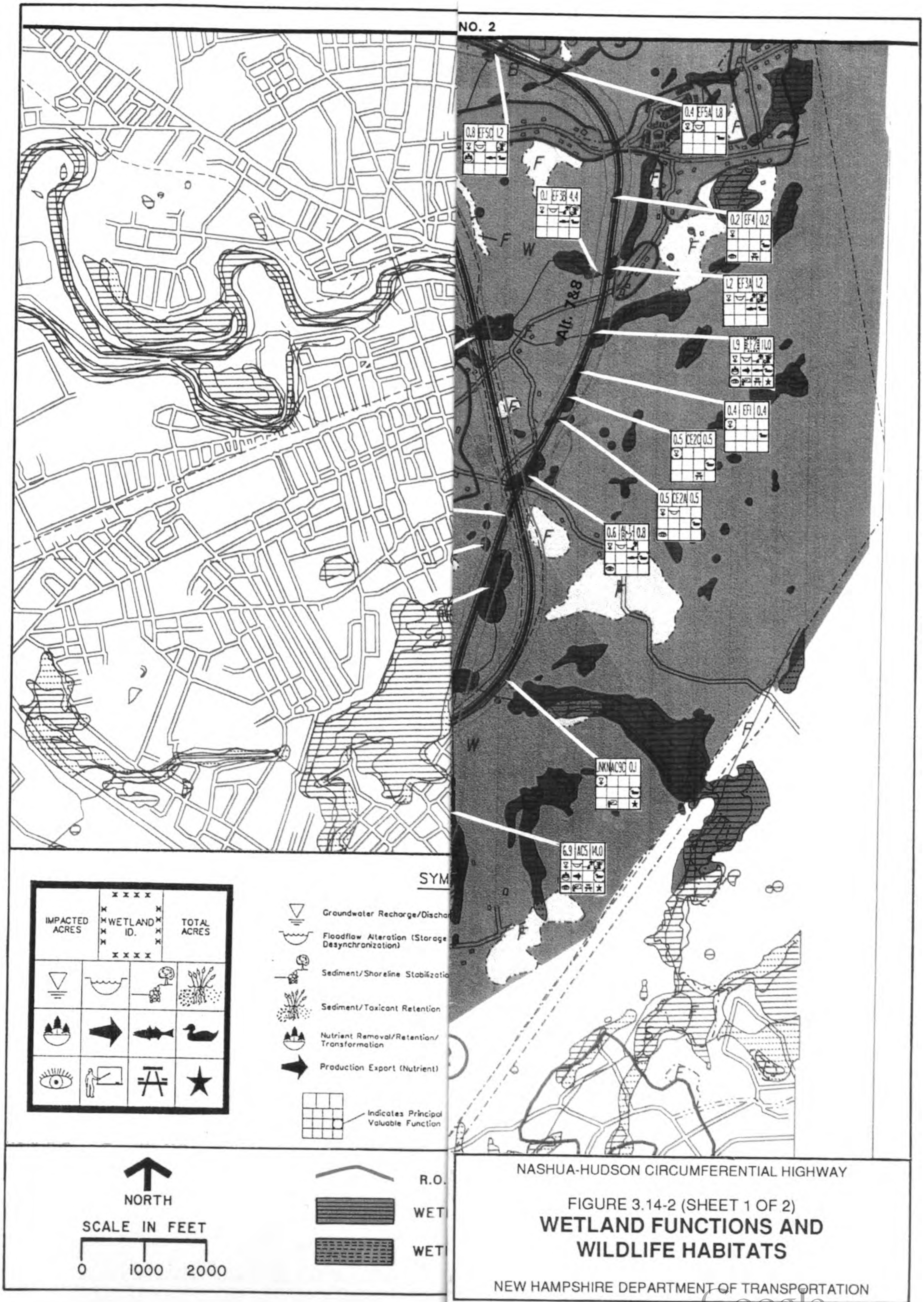


NORTH
SCALE IN FEET
0 4000 8000

NASHUA-HUDSON CIRCUMFERENTIAL HIGHWAY

FIGURE 3.14-1
WETLANDS

NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

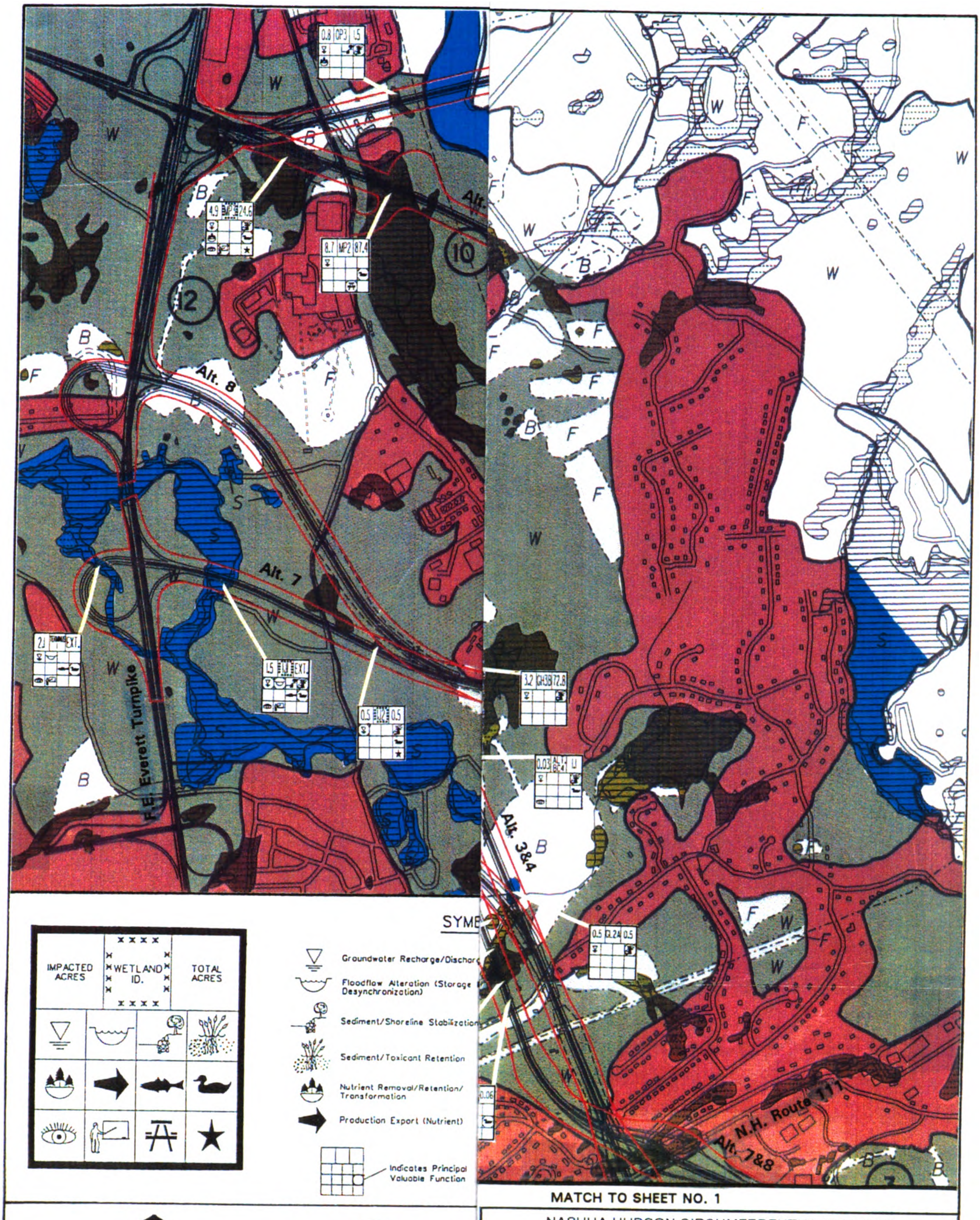


NASHUA-HUDSON CIRCUMFERENTIAL HIGHWAY

FIGURE 3.14-2 (SHEET 1 OF 2)

WETLAND FUNCTIONS AND WILDLIFE HABITATS

NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

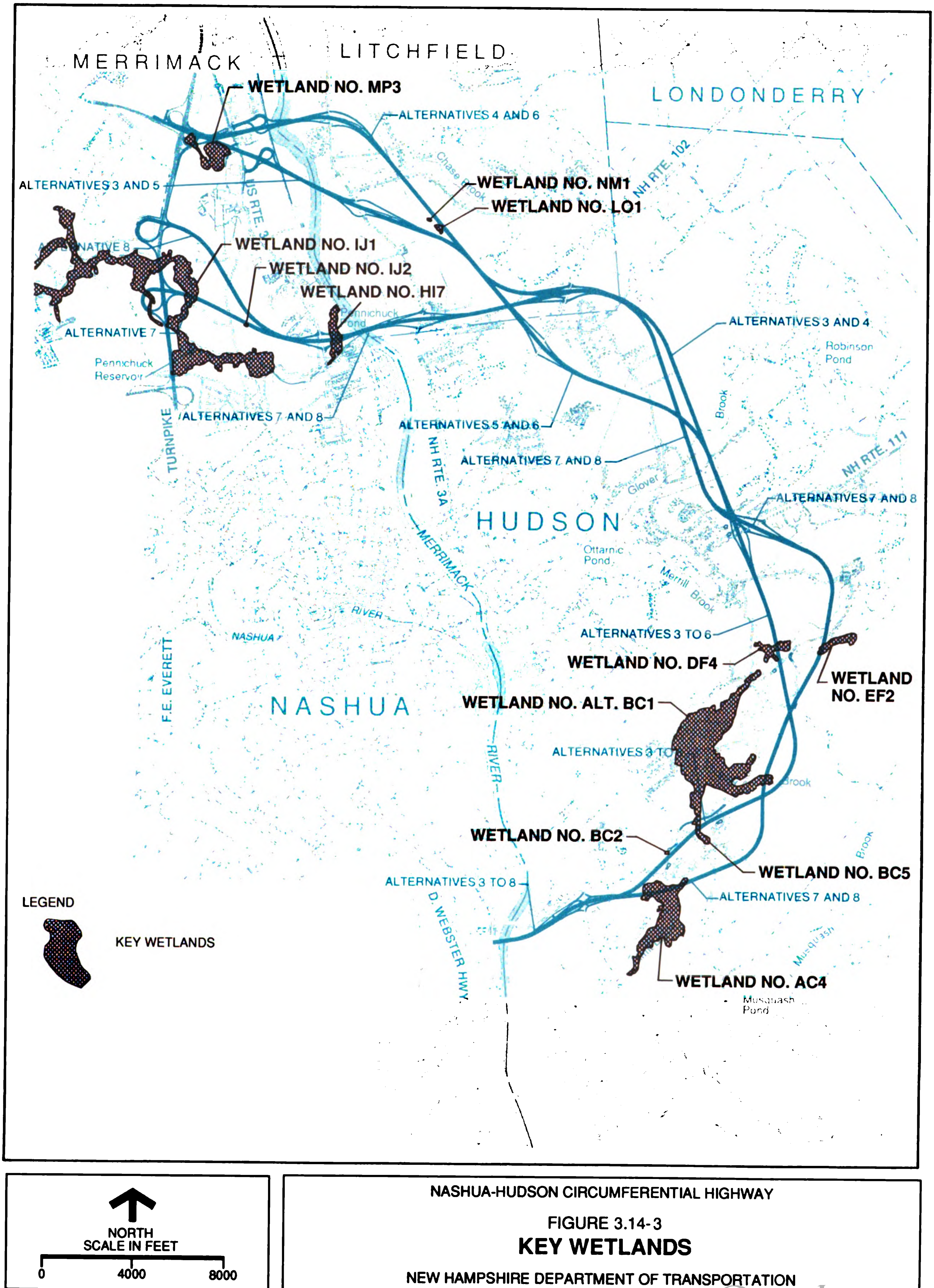


NASHUA-HUDSON CIRCUMFERENTIAL HIGHWAY

FIGURE 3.14-2 (SHEET 2 OF 2)

WETLAND FUNCTIONS AND WILDLIFE HABITATS

NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION



NASHUA-HUDSON CIRCUMFERENTIAL HIGHWAY

FIGURE 3.14-3

KEY WETLANDS

NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

3.15 ENVIRONMENTAL RISK SITES

More than 60 environmental risk sites within the study area were identified from various sources of information, including:

1. U. S. EPA records and databases -

    - National Priorities List (NPL)
    - Facilities Index Systems (FINDS)
    - Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS)
    - Resource Conservation and Recovery Act (RCRA) Notification System
    - Solid Waste Facilities Not in Compliance with RCRA Subtitle D Criteria (OPEN DUMP SITES)
    - Emergency Response Notification System (ERNS)

2. State of New Hampshire databases -

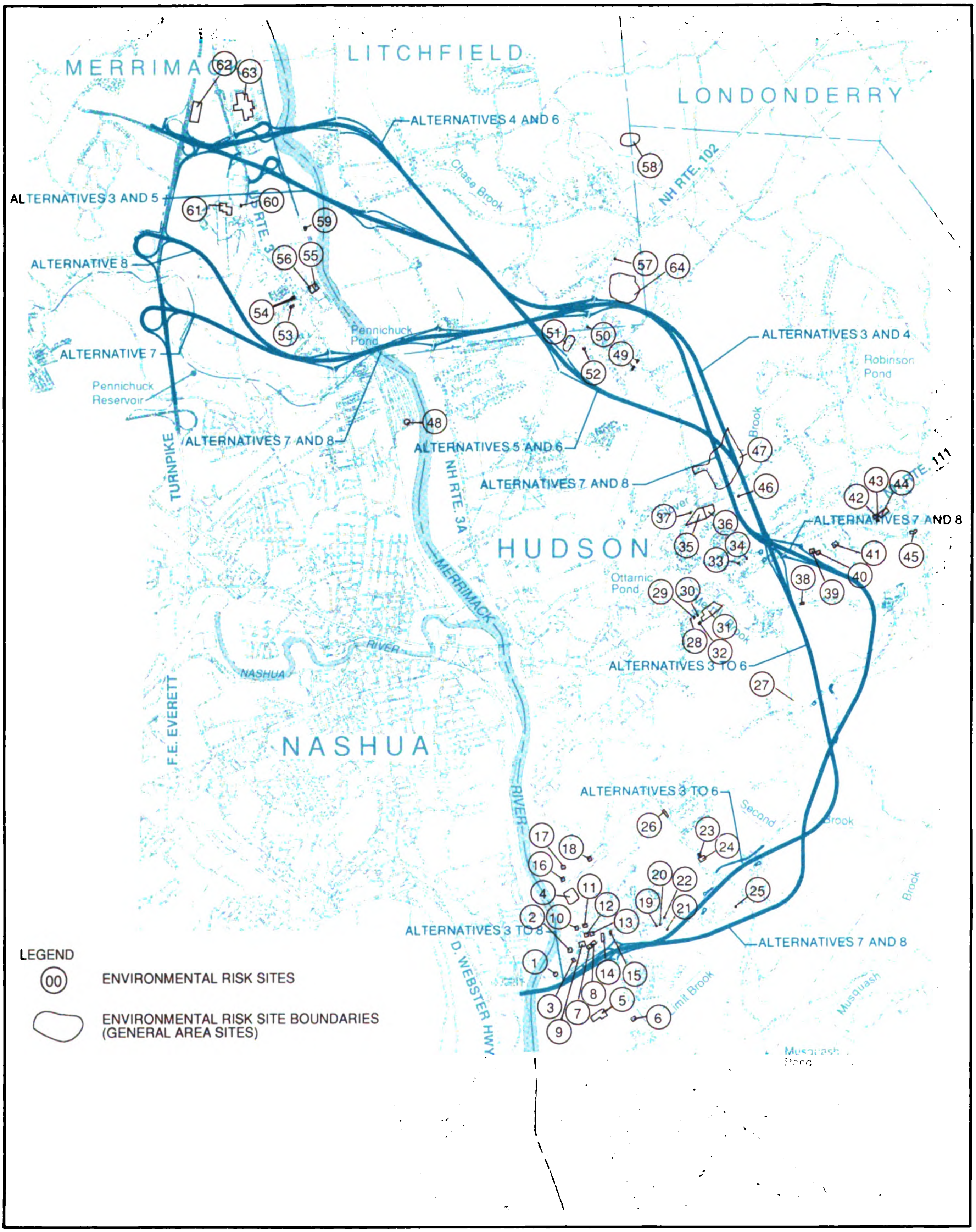
    - State Priority List
    - Underground Storage Tank Facility Information
    - Solid Waste Facility Information

3. Additional data sources -

    - NHDES Contaminated Sites Listing - based on preliminary information provided by the New Hampshire Groundwater Protection Bureau, May 28, 1991. Information has not been field checked.
    - NHDES Asbestos Disposal Sites Listing - confirmed and suspected asbestos waste sites provided by the NH DES, April 17, 1991.
    - U. S. EPA Groundwater Contamination Sites Listing
    - Town of Hudson - Conservation Commission Listing of Underground Storage Facilities

Sites are shown in Figure 3.15-1 in relation to Build Alternatives. This information was analyzed for the six Build Alternative Alignments, as well as the No-Build and the Transit/TDM and TSM Alternatives.

These sites are fully described in the Technical Report, entitled, "Environmental Risk Sites".



NASHUA-HUDSON CIRCUMFERENTIAL HIGHWAY

FIGURE 3.15-1
ENVIRONMENTAL RISK SITES

NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

Chapter 4
Environmental Consequences

Chapter 4
ENVIRONMENTAL CONSEQUENCES

4.1 TRAFFIC AND TRANSPORTATION

Future Traffic Forecasts

The future travel demand forecasts were based on the locally adopted land use and development plans, and the corresponding socio-economic projections of future population, dwelling units, employment and other factors.

A computer-based modeling process was undertaken to develop current and future Average Daily Traffic (ADT) volumes for the study area roadway network. Roadway link volumes were estimated for the design year (2010) scenarios, including the future baseline 2010 No Build Alternative.

The key transportation measures used for the evaluation of the Circumferential Highway alternatives were also derived from the modeling process. These included:

- Design Hour Volumes (DHV) - These were estimated from ADT data based on existing traffic characteristics, and consultation with the NHDOT.

- Vehicle Miles of Travel (VMT), Vehicle Hours of Travel (VHT), network speeds, and Volume/Capacity (V/C) ratios were all obtained from the traffic assignment outputs.

Technical Approach and Assumptions

Highway planning projects are designed to accommodate projected future traffic volumes. For this study, the year 2010 was selected as the design year and traffic forecasts were developed with the regional traffic forecasting model developed by the NRPC, with future travel demand based on the officially adopted local land use plans.

Highway Network and Traffic Modeling. The proposed 13-mile-long Nashua-Hudson Circumferential Highway would begin at the east end of Sagamore Bridge in Hudson and would pass through the Towns of Hudson and Litchfield, and complete the loop with an interchange with the F.E. Everett Turnpike in Merrimack. However, the transportation planning model used for this study included essentially the entire Nashua PMSA consisting of the towns of Nashua, Hudson, Litchfield, Merrimack, Milford, Amherst and Hollis.

The MinUTP traffic model that was developed for the Nashua Area Transportation Study (NATS) by the NRPC has been continually refined since the 1970's, and serves as the region's vehicle for transportation planning. Because the highway network built into this model includes the proposed Circumferential Highway as well as all other major existing and proposed streets and highways in the area, the NATS model is the appropriate procedure for developing the traffic volumes for this study. The results produced by it have been accepted as valid by the NHDOT and the FHWA.

Traffic volumes and turning movement counts were used to calibrate the model and to evaluate the existing network. The travel forecasting process included estimation of 1990 base year average daily traffic volumes and subsequent completion of a calibrated 2010 model which reflected future land use development and the highway network. This work was completed by the NRPC prior to the use of this model for the Circumferential Highway FEIS.

Measures of Effectiveness. Five basic measures of effectiveness were used as criteria to compare the Circumferential Highway alternatives, and to evaluate how well each of them could achieve the objectives of this study. At the beginning of this project, five transportation and traffic-related objectives were identified by the sponsoring agencies. They were:

1. Increased directness of east/west trips
2. Improved network efficiency
3. Improved regional accessibility
4. Improved network safety
5. Improved air quality

This section discusses how the measures of effectiveness designed to rate the alternatives were defined and how they were used to evaluate the transportation benefits of each Circumferential Highway alternative.

1. **Vehicle Miles of Travel (VMT).** This figure represents the total vehicular travel on the study area highway network on an average day. Decrease in VMT generally represents the use of more direct routes which previously were either unavailable or congested; increase in VMT may occur when drivers use a less direct but faster route. Decreases in VMT are beneficial because it represents savings in terms of cost and energy.

VMT data were determined for each alternative from the traffic assignment output.

2. **Vehicle Hours of Travel (VHT).** Defined as the total time spent by motorists traveling on the study area streets and highways on an average day. A reduction in VHT is regarded as an indication that traffic is encountering fewer delays from congestion and poor driving conditions. Reduction in VHT is therefore regarded as an indication of a more efficient highway network.

3. **Average Speed.** Average speed is defined as the ratio of VMT to VHT. An increase in average speed is generally regarded as an indication of a more efficient highway network. When considering the size of this network and the large number of vehicle miles of travel each day, even a small increase in average operating speeds can result in a very significant benefit to the region. The average network speeds used in the analysis for this project were derived from the VMT and VHT data discussed above.

4. **Level of Service.** Level of service is a qualitative measure which describes operational conditions within a traffic stream. Six levels of service are defined and these range from A to F where LOS A represents the best operating conditions and LOS F represents the worst. LOS °F is used herein to designate the condition where volume exceeds capacity by more than 50 percent. Level of service D is generally the lower limit for acceptable urban traffic conditions, although levels of service E, F, and even °F are frequently found, as they are in the project study area.

   A level of service analysis was completed for seven signalized intersections in the study area. All intersection analyses were conducted according to the methods found in the 1985 Highway Capacity Manual (HCM).

5. **Expressway VMT.** The changes in this criteria are used to measure the safety and operating efficiency improvements of various test networks against baseline conditions. It is generally assumed that improvements in safety will occur for the total network as traffic diverts from the arterial roadway system to the expressway system. This diversion will also reduce total travel time (VHT) and improve average operating speeds. Expressway VMT data were derived from the traffic assignment runs.

   Expressways are safer facilities because they have limited access resulting in more uniform traffic flows and fewer conflicts. This is borne out by accident rate statistics furnished by the NHDOT. Statewide urban area statistics for 1989 are presented in Table 4.1-1.

For this study, rates for two basic classifications of roads were used: (1) Non-Interstate Freeways and Expressways; and (2) Other Arterials. The composite rate for Other Arterials was derived from the data provided by the NHDOT. The VMT and the number of accidents, by class, were summarized for Principal Other Arterials and Minor Arterials and composite rates were calculated from the combined totals. These composite rates, also shown in Table 4.1-1, were used to estimate non-expressway accidents for alternative networks.

No Build Alternative. The No Build Alternative assumes that two committed projects will be completed by 2010, but that no further significant improvements would be made to the existing street and highway system. The committed projects are:

1. F.E. Everett Turnpike widening between Exits 3 and 7 in Nashua.

2. Camp Sargent Road Bypass in Merrimack.

Traffic Forecasts

Traffic assignments were made to a total of 11 different future networks, in addition to the assignment of 1990 trip tables to the existing network which was presented in Chapter 3 (see Figure 3.1-1). The 2010 trip table was assigned to the No Build network which provides a baseline condition for comparison of other Build and Partial-Build Alternatives, and to all Build and Partial-Build networks. The results of these traffic assignments are shown in Figures 4.1-1 through 4.1-7.

The projected ADT volumes in Figure 4.1-1 show that if nothing is done by the year 2010, as many as 73,300 vehicles a day, or far above its capacity, would attempt to cross Taylor Falls Bridge. Approach roads to Taylor Falls Bridge would have to carry from 32,000 to 40,200 vehicles daily. Volumes on Sagamore Bridge would rise to 42,100 vehicles a day, and the F. E. Everett Turnpike would carry 157,400 ADT. The future traffic volumes under the Transit/TDM and TSM options would be only 1 to 2 percent smaller.

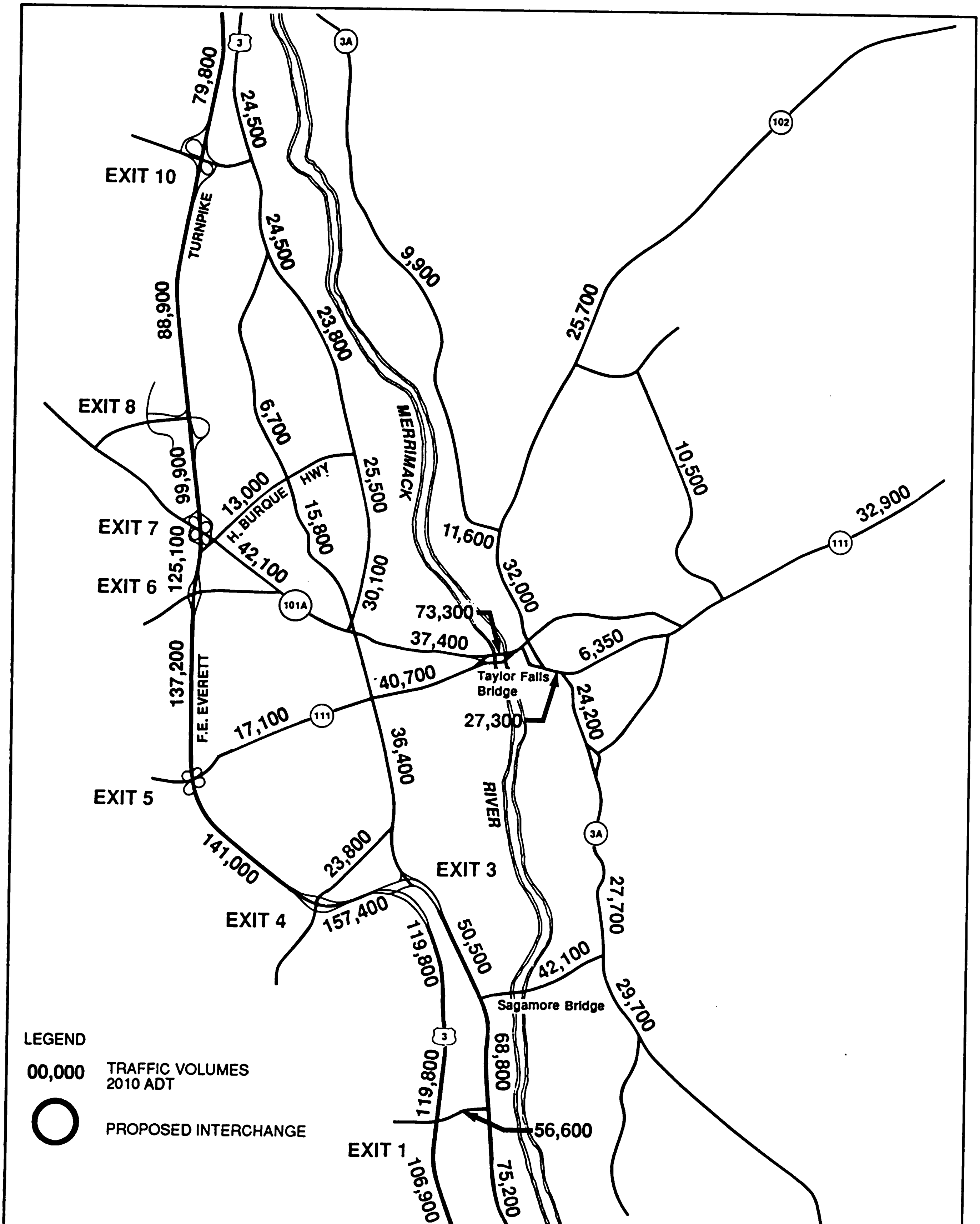
With the Build Alternatives (see Figures 4.1-2 through Figure 4.1-7), traffic on Taylor Falls Bridge would actually drop to 34,000-38,100 ADT, well below the existing daily volume of 48,600, while volumes on the nearby arterials would also drop slightly or remain the same as they are today. The new bridge to the north would divert from 35,000 to 41,000 trips a day, while on Sagamore Bridge daily traffic would rise to 59,400. Traffic volumes on the new bridge would be highest with Alternatives 7 and 8, which would place this

Table 4.1-1

NEW HAMPSHIRE ACCIDENT RATES
BY ROADWAY TYPE FOR 1989
(Accidents per 100,000,000 Vehicle Miles)

Type of Facility	Property Damage	Accident Rates Injury Rate	Fatality Rate
Principal Arterials			
Interstate	30.186	9.321	0.153
Other Frway & Exp.*	120.654	22.395	1.222
Other	723.198	168.438	0.780
Minor Arterials	703.721	187.694	1.746
Collector	658.143	166.667	3.036
Local	867.711	133.856	1.575
Total Urban	521.215	123.793	1.234
Composite Other Arterials* (Average of Principal Other Arterials and Minor Arterials)	713.698	178.303	1.253

*Rates used for evaluation of alternative networks



NORTH
SCALE IN FEET
0 4000 8000

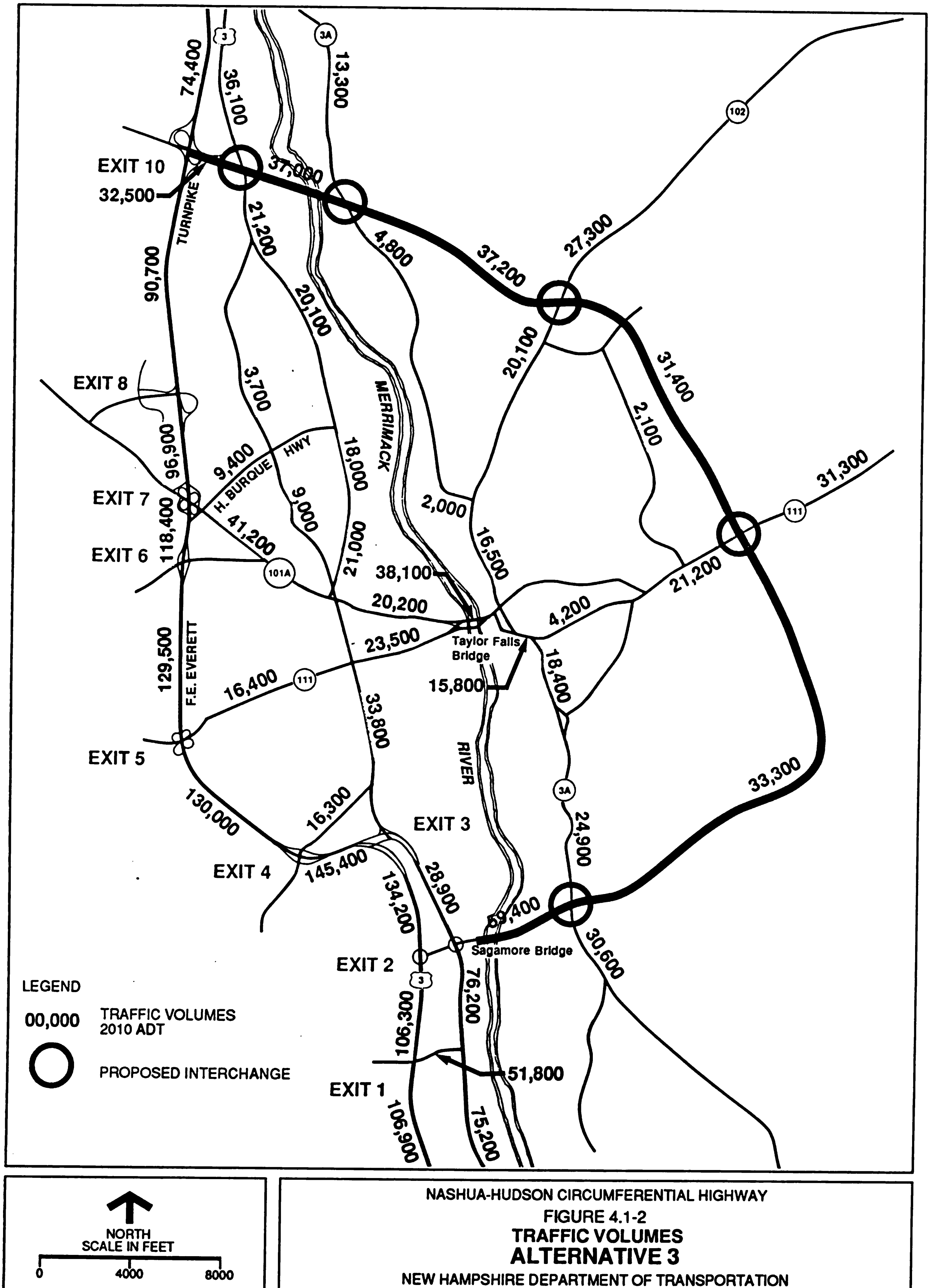
NASHUA-HUDSON CIRCUMFERENTIAL HIGHWAY

FIGURE 4.1-1

TRAFFIC VOLUMES

NO BUILD - 2010

NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION



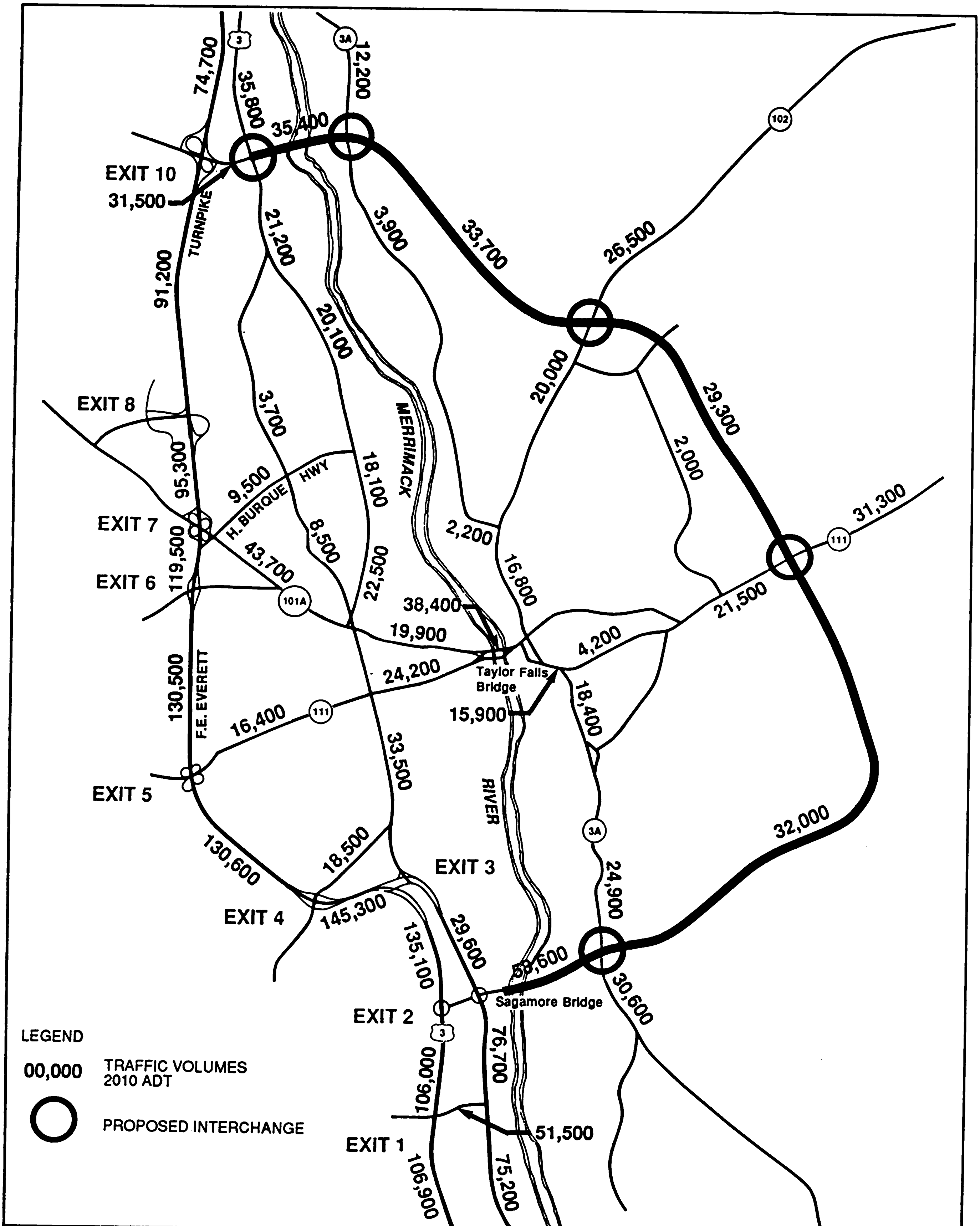
NASHUA-HUDSON CIRCUMFERENTIAL HIGHWAY

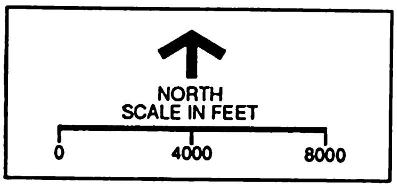
FIGURE 4.1-2

TRAFFIC VOLUMES

ALTERNATIVE 3

NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION





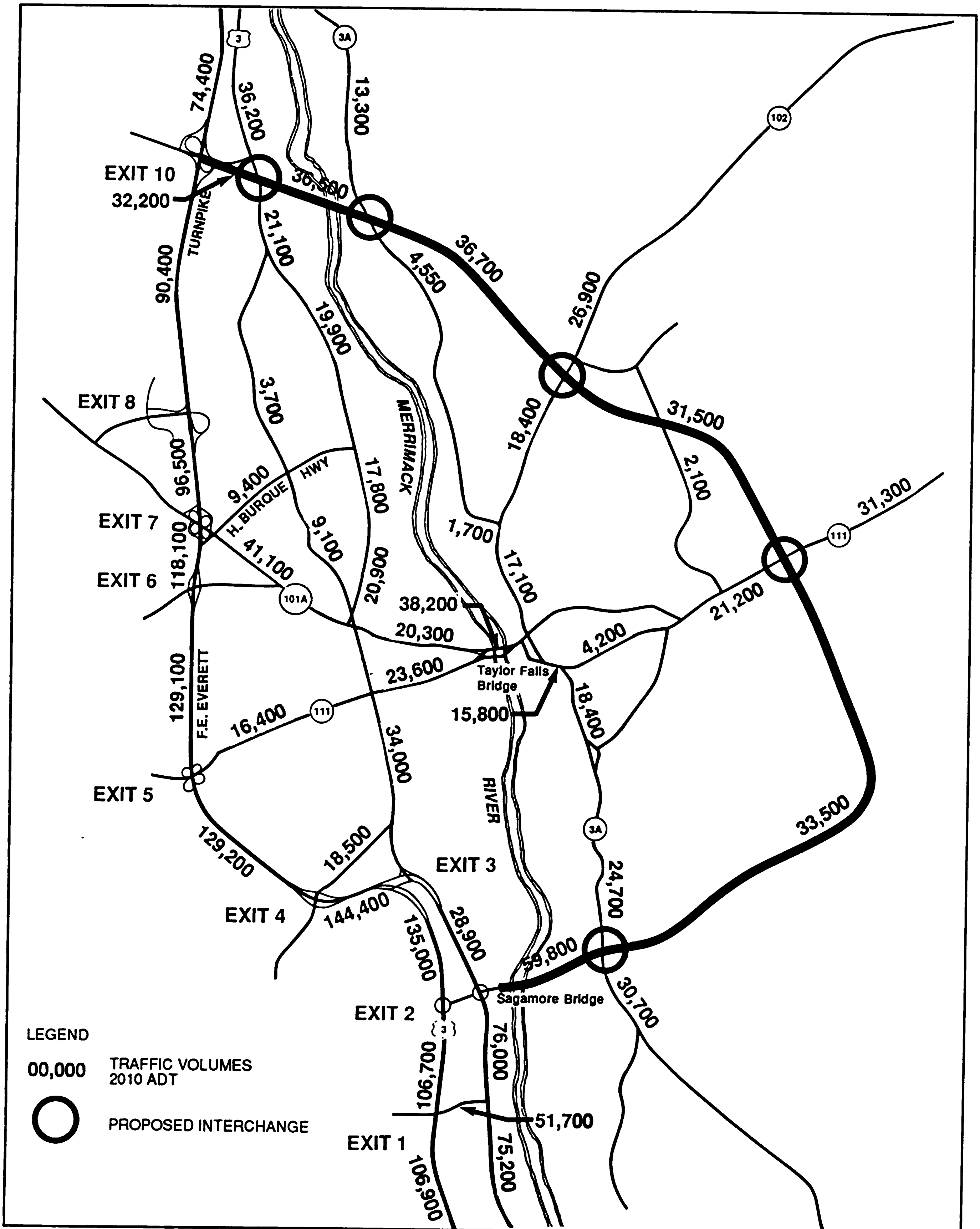
NASHUA-HUDSON CIRCUMFERENTIAL HIGHWAY

FIGURE 4.1-3

TRAFFIC VOLUMES

ALTERNATIVE 4

NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION



NORTH
SCALE IN FEET
0 4000 8000

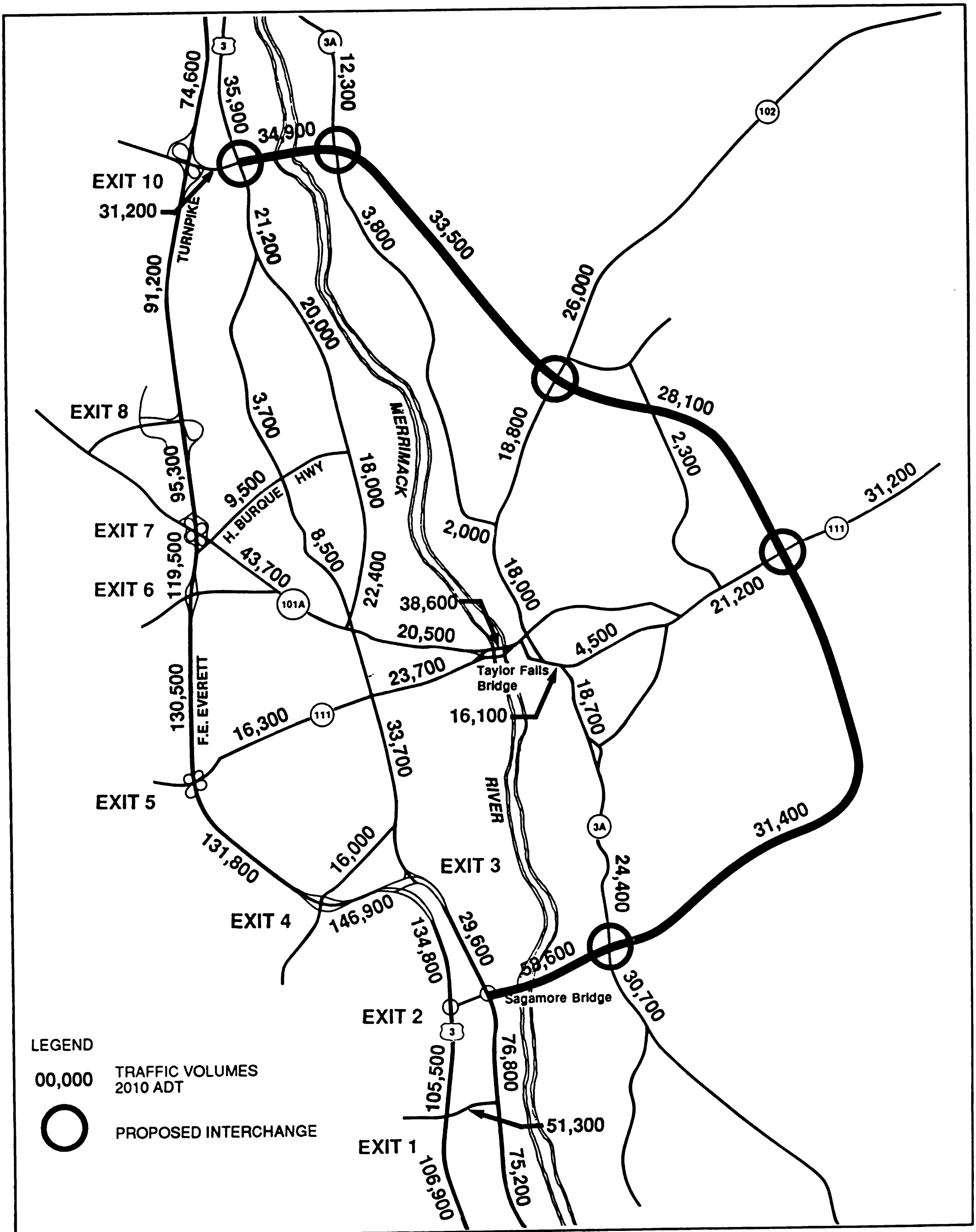
NASHUA-HUDSON CIRCUMFERENTIAL HIGHWAY

FIGURE 4.1-4

TRAFFIC VOLUMES

ALTERNATIVE 5

NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION



NORTH
SCALE IN FEET
0 4000 8000

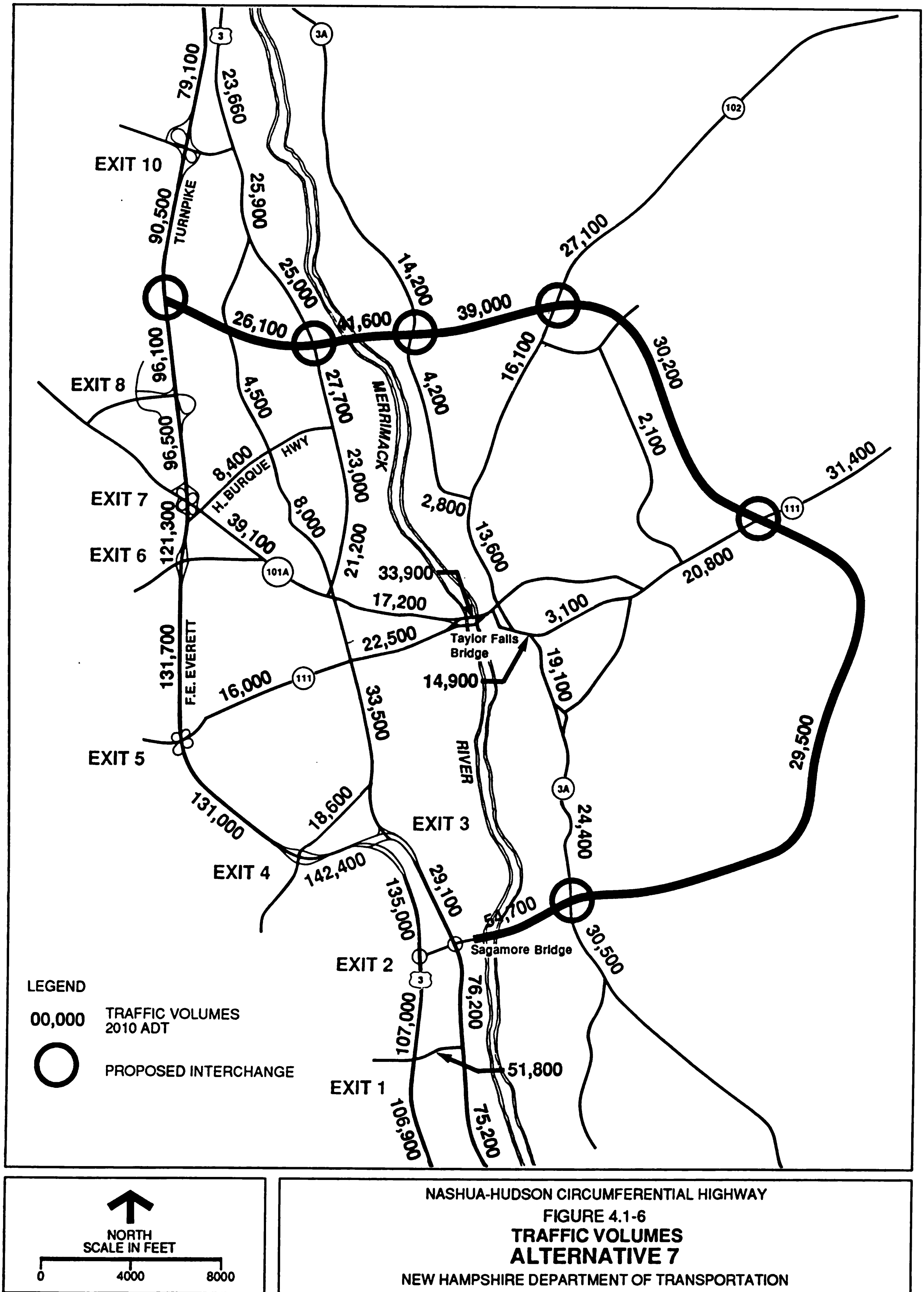
NASHUA-HUDSON CIRCUMFERENTIAL HIGHWAY

FIGURE 4.1-5

TRAFFIC VOLUMES

ALTERNATIVE 6

NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION



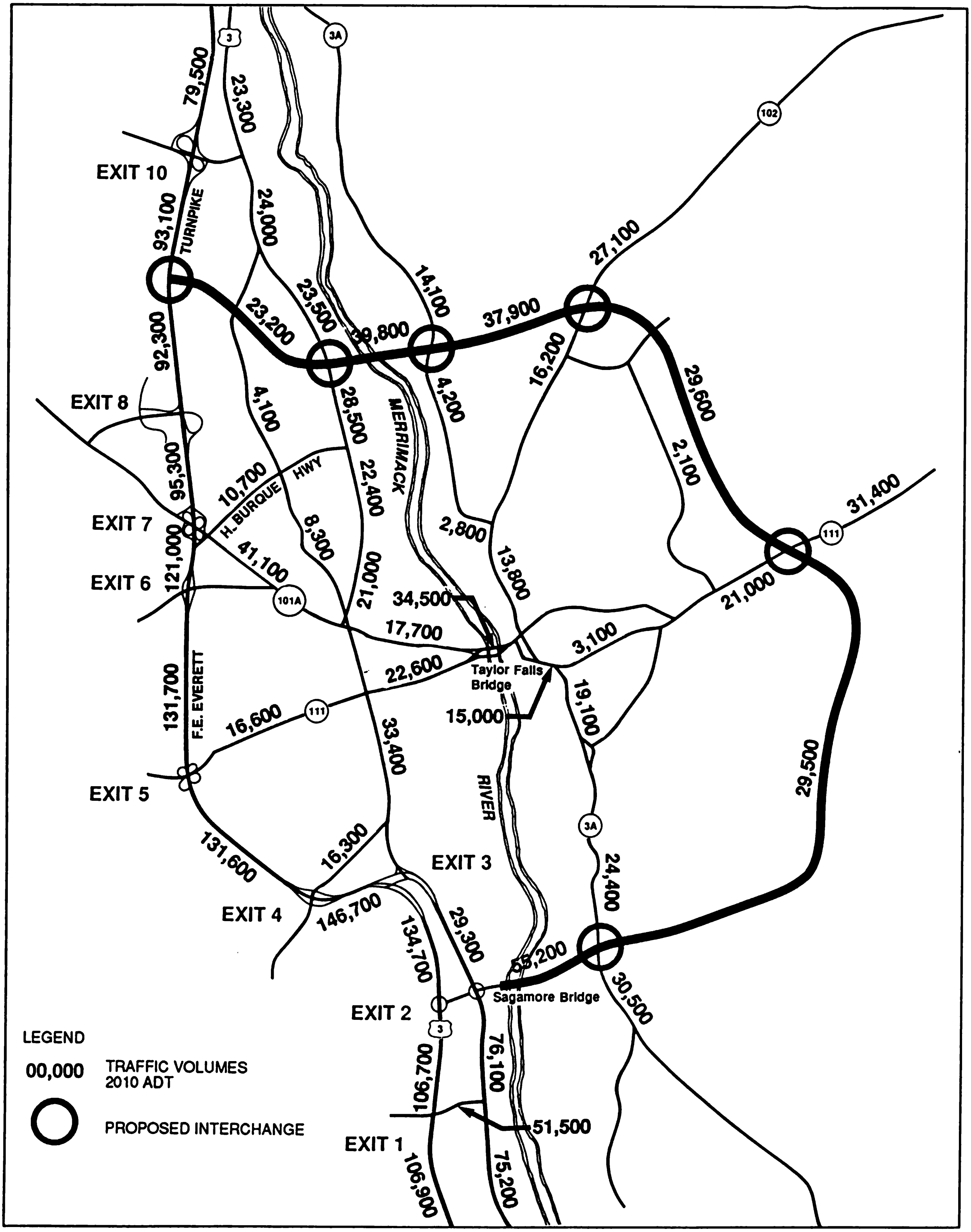
NASHUA-HUDSON CIRCUMFERENTIAL HIGHWAY

FIGURE 4.1-6

TRAFFIC VOLUMES

ALTERNATIVE 7

NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION



NORTH
SCALE IN FEET
0 4000 8000

NASHUA-HUDSON CIRCUMFERENTIAL HIGHWAY
FIGURE 4.1-7
TRAFFIC VOLUMES
ALTERNATIVE 8
NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

bridge closer to the urban core, with corresponding decreases on the Taylor Falls and Sagamore Bridges.

Traffic Volume Growth

The trip generation procedure used to estimate future travel demand showed that the total daily vehicular trips will increase by 54.2 percent from 638,500 in 1990 to 984,600 by year 2010 in the study area. The comparison of traffic assignments to various future alternatives with the existing 1990 volumes can be done graphically to illustrate projected changes. Figure 4.1-8 shows changes in network link volumes for a representative build alternative. It shows that the largest increases would be on the F.E. Everett Turnpike, Daniel Webster Highway and radial arterials along the perimeter of the urbanized area. Construction of the Circumferential Highway would result in an actual decrease in volumes on Taylor Falls Bridge and on major arterials that pass through the CBDs of Nashua and Hudson.

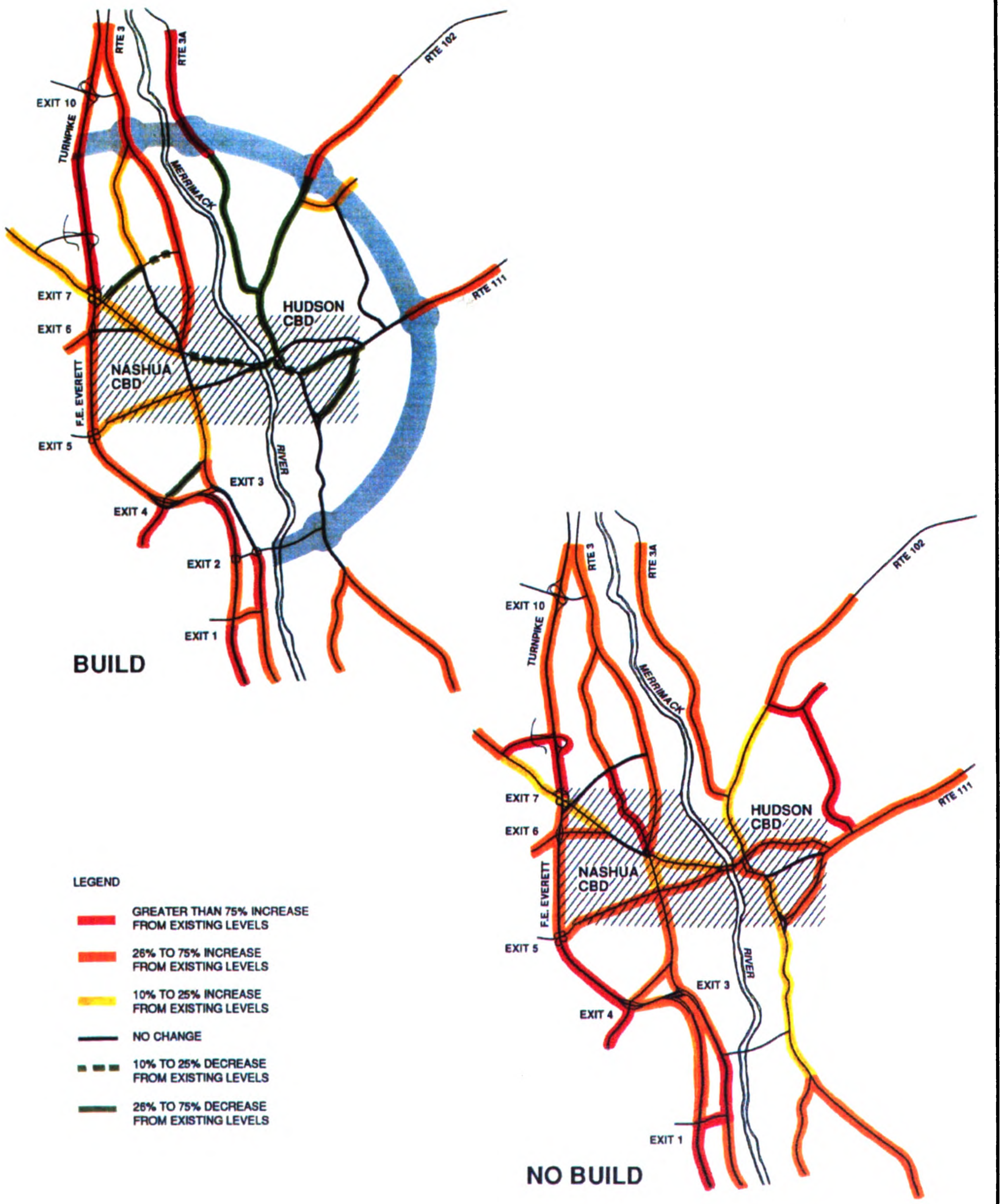
Partial-Build Alternatives were investigated but were dismissed since they would only relieve arterials within the area of their direct influence and thus would not satisfy the project purpose. (See detailed analysis in the Revised Technical Report entitled, "Traffic and Transportation.")

The river crossing volumes for all alternatives are summarized in Table 4.1-2. It should be noted that the total river crossings vary between the alternatives. Since the same total trip table was assigned to all 2010 networks, this indicates that a greater number of double-crossings of the river would take place with the Circumferential Highway in place as motorists are able to bypass the city centers via the new facility.

Assessment of Alternative Networks

This section presents the relative performance of the various Circumferential Highway alternatives in terms of the evaluation criteria discussed in the previous section. The results are presented for all Build Alternatives as well as for existing 1990 and 2010 No Build networks.

The total network VMT as well as the split between expressway and other arterials are shown in Table 4.1-3 (Revised). Of the Build Alternatives, Alternative 8 resulted in the fewest network vehicle miles, with a total of 5,494,278. This represented an increase of 25,187 from the No Build Alternative. The next smallest increase in network VMT was in Alternative 7, which had a total of 5,505,075 network VMT, an increase of 35,984 over the No Build Alternative; Alternative 7 also had the highest percentage of



NORTH
NO SCALE

NASHUA-HUDSON CIRCUMFERENTIAL HIGHWAY

FIGURE 4.1-8

TRAFFIC VOLUME CHANGES

BUILD AND NO BUILD

NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

Table 4.1-2

SUMMARY OF MERRIMACK RIVER CROSSINGS

	ADT Volumes			
Alternative	**North Merrimack**	**Taylor Falls**	**Sagamore**	**Total**
Existing - 1990	-	48,600	28,700	77,300
Baseline - 2010 (No-Build)	-	73,300	42,100	115,400
3	37,000	38,100	59,400	134,500
4	35,400	38,400	58,600	132,400
5	36,500	38,200	59,800	134,500
6	34,900	38,600	58,600	132,100
7	41,600	33,900	54,700	130,200
8	39,800	34,500	55,200	129,500

Table 4.1-3
(Revised)
SUMMARY OF VEHICLE MILES OF TRAVEL FOR ALTERNATIVE NETWORKS

Alternative	Total VMT	Expressway VMT	Arterial VMT
Existing - 1990	3,315,695	766,528 (23.1)	2,549,167
No-Build - 2010	5,469,091	1,357,884 (24.8)	4,111,207
3	5,516,118	1,717,750 (31.1)	3,798,368
4	5,520,993	1,717,606 (31.1)	3,803,387
5	5,520,484	1,716,094 (31.1)	3,804,390
6	5,521,692	1,714,912 (31.1)	3,806,780
7	5,505,075	1,716,880 (31.2)	3,788,195
8	5,494,278	1,710,777 (31.1)	3,786,301

( ) Percent of Total VMT on Expressways

expressway VMT. Alternative 6 resulted in the most network VMT with a total of 5,521,692, an increase of 52,601 from the No Build Alternative. In terms of VMT, there is very little difference between the Build Alternatives, and all of them increase significantly the percent of total travel on the expressway system.

The degree to which diversion to the safer expressway facilities impacts projected accidents for various alternatives can be seen from the figures in Table 4.1-4 (Revised). The Build Alternatives would afford safer operating conditions than the No Build Alternative.

The relative performance of the Circumferential Highway alternatives, including the No Build, with respect to this criteria, is shown in Table 4.1-5 (Revised). Alternative 7 resulted in the smallest total VHT, with 237,160, a decrease of 100,428 from the No Build Alternative. Alternative 8 is almost equally effective.

The results of the level of service analysis conducted for the seven signalized intersections is summarized in Table 4.1-6. This includes comparable data for existing 1990 conditions as well as results of 2010 analysis, No-Build and Build Alternatives.

Table 4.1-6 indicates that the Circumferential Highway results in improvements in level of service at both signalized intersections in Hudson. The Lowell Street/Central Street intersection operates at LOS F in the 2010 No Build Alternative, but improves to LOS C in all 2010 Build scenarios. The other signalized intersection analyzed in Hudson was the Taylor Falls Bridge/NH Route 102 location in the Central Business District. This location operates at LOS F in the 2010 No Build Alternative, but improves in all six 2010 Build scenarios. The most improved operations at this location occur with Alternative 7, where the intersection operates at LOS C.

The LOS analysis also includes five signalized intersections in Nashua. The Henri Burque Highway/Concord Street intersection operates at LOS F with the 2010 No Build Alternative. Operations at this location improve to LOS C with 2010 Build Alternatives 3 through 6 and stay at LOS F in 2010 Build Alternatives 7 and 8. If improvements proposed under the TSM Alternative scenario are implemented, the operation of this intersection could be raised to LOS B.

Table 4.1-4
(Revised)
PROJECTED ANNUAL ACCIDENTS BY TYPE
FOR ALTERNATIVE NETWORKS

	Accidents			
Alternative	**Property**	**Injury**	**Fatal**	**Total**
Existing - 1990	6,980	1,722	14	8,716
Baseline - 2010 (No-Build)	11,308	2,787	25	14,120
3	10,652	2,612	25	13,289
4	10,665	2,615	25	13,305
5	10,666	2,616	25	13,307
6	10,672	2,616	25	13,313
7	10,624	2,605	25	13,254
8	10,616	2,604	25	13,245

Table 4.1-5
(Revised)
SUMMARY OF VEHICLE HOURS OF TRAVEL FOR ALTERNATIVE NETWORKS

Alternative	Total VHT	Free-Flow VHT		Congested VHT
Existing - 1990	128,403	104,317	(81.2)	24,086
No-Build - 2010	337,588	169,172	(50.1)	168,416
3	237,815	163,119	(68.6)	74,696
4	238,799	163,303	(68.4)	75,496
5	237,870	163,264	(68.6)	74,606
6	239,183	163,356	(68.3)	75,827
7	237,160	162,585	(68.6)	74,575
8	237,188	162,461	(68.5)	74,727

( ) Percent of Total VHT that is free flow.

Table 4.1-6

LEVEL OF SERVICE ANALYSES RESULTS
CIRCUMFERENTIAL HIGHWAY ALTERNATIVES

Location	1990 Existing	No Build	2010 Alternative 3	4	5	6	7	8
Intersections								
HBW/Concord	B	F	C	C	C	C	F	F
HBW/Manchester	A	B	B	B	B	B	B	B
Lowell/Central	D	F	C	C	C	C	C	C
DWH/Spit Brook	F	F	F	F	F	F	F	F
Amherst/Concord	F	F	F	F	F	F	F	F
Main/Canal	F	F	F	F	F	F	F	F
Taylor Falls Bridge/NH102	F	F	D	D	D	E	C	D

The Main Street/Canal Street and Concord Street/Amherst Street intersections will operate at LOS F in all 2010 scenarios analyzed. However, reductions in total delay are seen at these two locations in the 2010 Build scenarios when compared with the 2010 No Build Alternative. These reductions in total delay are the result of traffic diversions produced by the Circumferential Highway. The Daniel Webster Highway/Spit Brook Road intersection will remain at LOS F in all 2010 scenarios, and LOS at the Henri Burque Highway/Manchester Street intersection will be reduced from LOS A to B in all 2010 scenarios.

A more generalized LOS assessment was made of the entire network based on volume/capacity (V/C) ratios that were generated by the traffic assignment process, and then related to the LOS. The results of this analysis are shown graphically in Figure 4.1-9.

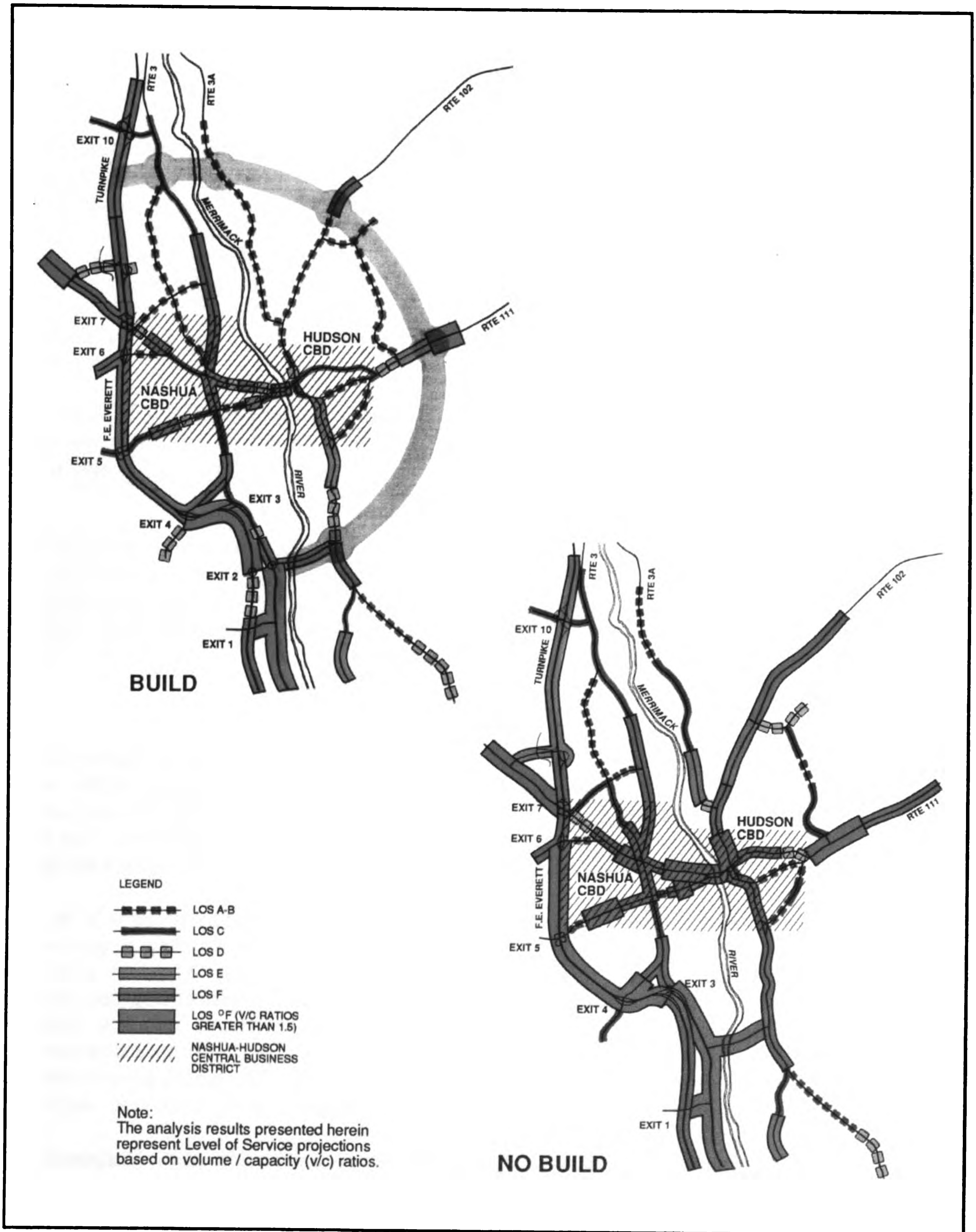
As Figure 4.1-9 shows, under the No-Build assumptions, practically all major north-south and east-west arterials will operate at LOS F or worse by 2010. With the Build Alternatives, while some segments will still have LOS F, a far greater number of arterial segments will operate at LOS A-E, especially through the central part of the study area.

Summary Comparison of Alternatives

The general transportation and traffic objectives which the Circumferential Highway alternatives are intended to serve were listed earlier in this section. This analysis has used the measures of effectiveness to compare the alternatives and estimate their ability to meet these objectives. The results of this process, summarized in Table 4.1-7 (Revised), are presented below.

The summary evaluation shows that all Build Alternatives will be more effective in diverting future traffic volumes onto the expressway system, thus reducing total travel time, improving operating speeds, and minimizing accidents than the No Build Alternative. The differences between the Build Alternatives are not significant, although Alternatives 7 and 8, which are nearer the urbanized area, are slightly more effective from a transportation perspective than other alternatives. Thus, other factors such as environmental impacts should play the major role in selection of the preferred alignment.

From this analysis it can be determined that the Nashua-Hudson Circumferential Highway will permit more direct east-west travel in this area through an additional northern crossing of the Merrimack River and improvements to the existing Sagamore Bridge southern river crossing, linked by a high-capacity limited-access roadway connecting with all major radial



NORTH
NO SCALE

NASHUA-HUDSON CIRCUMFERENTIAL HIGHWAY

FIGURE 4.1-9

LEVEL OF SERVICE

BUILD AND NO BUILD

NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

Table 4.1-7
(Revised)
STUDY AREA TRANSPORTATION SERVICE SUMMARY

Alternative	Average Weekday Vehicle Miles of Travel	Percent of Total Travel on Expressway	Average Weekday Vehicle Hours of Travel	Average System Speed (m.p.h.)	Total Projected Accidents (Annual)
Existing - 1990	3,316,000	23.1	128,400	25.8	8,716
No Build - 2010	5,469,000	24.8	337,600	16.2	14,120
3	5,516,000	31.1	237,800	23.2	13,289
4	5,521,000	31.1	238,800	23.1	13,305
5	5,520,000	31.1	237,900	23.2	13,307
6	5,522,000	31.1	239,200	23.1	13,313
7	5,505,000	31.2	237,200	23.2	13,254
8	5,497,000	31.1	237,200	23.2	13,245

arterial highways in the area. As a result, trips will be diverted from the congested Taylor Falls Bridge and the central areas of Nashua and Hudson.

Construction of the Nashua-Hudson Circumferential Highway would also result in improved accessibility throughout the study area and in Southern New Hampshire. Since the Circumferential Highway is a longer north-south route than the F.E. Everett Turnpike, it would not represent a viable alternative to the Turnpike under normal circumstances. However, in emergency conditions, or if the Turnpike were highly congested, the Circumferential Highway would provide a relief route for this north-south traffic.

In addition to the reduced travel times and increased travel efficiency, the Nashua-Hudson Circumferential Highway will result in improved travel safety throughout the region. Traffic in the area will be diverted from the area's arterial roadway system to the improved freeway system that will result from the project. More efficient traffic flows will also result in improvements in air quality, particularly in the central portions of the study area.

4.2 LAND USE, RELOCATION, AND JOINT DEVELOPMENT

A Conceptual Relocation Study was completed by NHDOT. This study investigated specific structure takings along the Build Alternative alignments and arrived at the same conclusions as those presented in the Socio-economics Technical Report using a different methodology.

The state study and reporting procedures follow the guidelines prescribed by the NHDOT Right-of-Way Relocation Policy and Procedures Manual, Chapter 10, and the FHWA Technical Advisory dated October 30, 1987.

The following is an estimate of the displacements that will likely occur - listed by total alignments. It is understood that design modifications may ultimately change the total number of displacements in the selected alignment.

Alignment #3 - Total Acquisitions

27 homes
12 duplexes (24 units)
2 businesses
1 barn (vacant)

* Total estimated Acquisition Costs:	$5,980,200.
Total estimated Relocation Costs:	$ 905,500.
Total Costs:	$6,885,700.

Alignment #3 - By Town - Hudson

20 homes
11 duplexes (22 units)
2 businesses

* Total estimated Acquisition Costs:	$4,728,200.
Total estimated Relocation Costs:	$ 709,500.
Total Costs:	$5,437,700.

* The above estimated acquisition costs include only those complete acquisitions which comprise land and buildings and do not reflect any partial acquisitions of land only.

Alignment #3 - By Town - Litchfield

7 homes
1 duplex (2 units)
1 barn (vacant)

* Total estimated Acquisition Costs:	$1,252,000.
Total estimated Relocation Costs:	$ 196,000.
Total Costs:	$1,448,000.

Alignment #4 - Total Acquisitions

31 homes
11 duplexes (22 units)
3 businesses
6 apartments
1 garage (vacant)

* Total estimated Acquisition Costs:	$7,421,900.
Total estimated Relocation Costs:	$1,058,500.
Total Costs:	$8,480,400.

Alignment #4 - By Town - Hudson

20 homes
11 duplexes
2 businesses

* Total estimated Acquisition Costs:	$4,728,200.
Total estimated Relocation Costs:	$ 709,500.
Total Costs:	$5,437,700.

Alignment #4 - By Town - Litchfield

11 homes
1 business
1 garage (vacant)

* Total estimated Acquisition Costs: $2,093,700.
Total estimated Relocation Costs: $ 305,500.

Total Costs: $2,399,200.

Alignment #4 - By Town - Merrimack

6 apartments

* Total estimated Acquisition Costs: $ 600,000.
Total estimated Relocation Costs: $ 43,500.

Total Costs: $ 643,500.

Alignment #5 - Total Acquisitions

26 homes
12 duplexes (24 units)
2 businesses
1 barn (vacant)

* Total estimated Acquisition Costs: $5,928,200.
Total estimated Relocation Costs: $ 874,500.

Total Costs: $6,802,700.

Alignment #5 - By Town - Hudson

22 homes
11 duplexes (22 units)
2 businesses

* Total estimated Acquisition Costs: $5,217,200.
Total estimated Relocation Costs: $ 755,000.

Total Costs: $5,972,200.

Alignment #5 - By Town - Litchfield

4 homes
1 duplex (2 units)
1 barn (vacant)

* Total estimated Acquisition Costs:	$ 711,000.
Total estimated Relocation Costs:	$ 119,500.
Total Costs:	$ 830,500.

Alignment #6 - Total Acquisitions

28 homes
11 duplexes (22 units)
6 apartments
2 businesses
1 garage (vacant)

* Total estimated Acquisition Costs:	$6,697,900.
Total estimated Relocation Costs:	$ 956,000.
Total Costs:	$7,653,900.

Alignment #6 - By Town - Hudson

20 homes
11 duplexes (22 units)
1 business

* Total estimated Acquisition Costs:	$4,545,200.
Total estimated Relocation Costs:	$ 683,500.
Total Costs:	$5,228,700.

Alignment #6 - By Town - Litchfield

8 homes
1 business
1 garage (vacant)

* Total estimated Acquisition Costs:	$1,552,700.
Total estimated Relocation Costs:	$ 229,000.
Total Costs:	$1,781,700.

Alignment #6 - By Town - Merrimack

6 apartments

* Total estimated Acquisition Costs:	$ 600,000.
Total estimated Relocation Costs:	$ 43,500.
Total Costs:	$ 643,500.

Alignment #7 - Total Acquisitions

9 homes
1 duplex
3 businesses

* Total estimated Acquisition Costs:	$2,432,900.
Total estimated Relocation Costs:	$ 303,500.
Total Costs:	$2,736,400.

Alignment #7 - By Town - Hudson

2 homes
1 duplex
3 businesses

* Total estimated Acquisition Costs:	$1,376,900.
Total estimated Relocation Costs:	$ 125,000.
Total Costs:	$1,501,900.

Alignment #7 - By Town - Litchfield

7 homes

* Total estimated Acquisition Costs:	$1,056,000.
Total estimated Relocation Costs:	$ 178,500.
Total Costs:	$1,234,500.

Alignment #8 - Total Acquisitions

12 homes
1 duplex
3 businesses

* Total estimated Acquisition Costs:	$2,911,700.
Total estimated Relocation Costs:	$ 380,000.
Total Costs:	$3,291,700.

Alignment #8 - By Town - Hudson

2 homes
1 duplex
3 businesses

* Total estimated Acquisition Costs:	$1,376,900.
Total estimated Relocation Costs:	$ 125,000.
Total Costs:	$1,501,900.

Alignment #8 - By Town - Litchfield

7 homes

* Total estimated Acquisition Costs:	$1,056,000.
Total estimated Relocation Costs:	$ 178,500.
Total Costs:	$1,234,500.

Alignment #8 - By Town - Merrimack

3 homes

* Total estimated Acquisition Costs:	$ 478,800.
Total estimated Relocation Costs:	$ 76,500.
Total Costs:	$ 555,300.

It is estimated that the largest number of households displaced would occur with Alternative Alignment 4 consisting of 53 residences, 3 businesses, and 1 large garage (vacant). The least number of households displaced would occur with the Alternative Alignment 7 consisting of 11 residences, and 3 businesses.

In general, the social and economic characteristics of the majority of the displacees appear to place them in the middle income bracket. There appears to be no special ethnic or racial make-up of the families likely to be displaced. Any relocated individuals that are handicapped or elderly will be specifically identified prior to the acquisition stage and their special needs addressed accordingly.

- A survey was conducted of available housing from the local Hillsborough County Multiple Listing Service. The survey indicates an adequate number of functionally similar, decent, safe and sanitary residential dwellings for sale and rent/lease in the project area to accommodate any and all displacees. The current market in the three towns (Hudson, Litchfield and Merrimack) in which displacement will occur indicates approximately 470 replacement homes for sale, in all styles, containing one to five bedrooms. Prices range from $50,000 to $400,000 with an average price of $150,000. There are approximately 174 rental/lease replacement units (apartments, duplexes, townhouses) containing one to four bedrooms, furnished and unfurnished. Rents range from $280 to $1,200 monthly with and without utilities. These rents are located in the Towns of Hudson, Litchfield, Nashua and Merrimack. (Actual listings on which the above analysis was made are retained in NHDOT files).

- There appears to be no discernable impacts on the neighborhood. It also appears that there is no need for special relocation considerations to resolve the needs of the displaced individuals.

- Available housing in the area appears to be sufficient and within the financial needs of the displacees. Last resort housing will be made available if the need presents itself in accordance with Chapter 10 of the NHDOT Right-of-Way Relocation Policy and Procedures Manual.

- The largest business impacts would occur with Alignment 4. It would impact 3 businesses: (gas station, vacant commercial building in the industrial park and a farm stand). A survey of replacement sites indicates there are approximately 57 commercial building/sites for sale/lease in the project area to accommodate the displacees. These include vacant land and land with buildings, prices ranging from $100,000 to $1,000,000. If these displacements occur, it appears there would be minor economic effects.

- Discussions with local realtors indicate that any displacements on the proposed project would have a positive effect on the real estate market. Presently, there is an overabundance of property available and a limited number of potential purchasers. Local officials are well aware of the proposed impacts, as this project has been ongoing for several years. Public information meetings have been held for any interested officials, groups and individuals to attend. As a result of these meetings, there appears to be no major concerns involving relocations.

- The acquisition and relocation program will be conducted in accordance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended. A Relocation Advisor will be assigned to the project to manage the relocation problems of the affected parties.

Any further information or assistance regarding displacements on this project may be obtained by contacting the NHDOT Relocation Section. Physical evidence of this report is available through the Bureau of Right-of-Way, John O. Morton Building, Hazen Drive, Concord, New Hampshire.

4.3 SOCIO-ECONOMICS

Direct Impacts: Build Alternatives

If the Circumferential Highway is constructed, the magnitude of direct economic impacts will vary depending on which alternative alignment is selected. Table 4.3-1 provides, in rank order, a summary of the direct economic impacts for the Full Build Alternative alignments. Included in the table are the impacts associated with the amount and estimated value of land and buildings that would have to be acquired, the net change in public tax benefit, and the combined total value for all of those items.

As the table illustrates, Build Alternative 8 ranks number one from an economic perspective in terms of taking the least amount of properties, with a total estimated value of approximately $11 million. It is followed closely by Alternative 7. The remaining Build Alternative alignments are grouped rather closely together, and are estimated to cost at least $3 million more than Alternatives 7 and 8. The primary reason for Alternatives 7 and 8 costing significantly less than the others is that Alternative 7 was originally selected as the preferred alignment in the 1984 DEIS and Alternative 8 is a variation of Alternative 7. Because Alternative 7 was anticipated to be the location of the Circumferential Highway, development was directed away from that alignment corridor, thus reducing the number of buildings which would need to be acquired. In fact, much of the corridor of Alternatives 7 and 8 has already been acquired by the State, although the estimated land taking costs are included in this analysis for comparative purposes.

Table 4.3-1

DIRECT ECONOMIC IMPACTS: FULL BUILD ALTERNATIVES
(in $1000s)

Alternative	Est. Number Acres	Est. Land Value	Est. Number Homes	Est. Value	Other Est. Value	Est. Change in Net Public Tax Benefit	Est. Total Value	Rank Order
8	713	$9,550	13	$1,220	$ 400	$ 5	$11,175	1
7	713	$9,550	14	$1,200	$ 500	$ 4	$11,254	2
3	588	$8,490	30	$3,640	$1,900	$ 6	$14,036	3
5	584	$8,450	27	$3,500	$2,350	$ 3	$14,303	4
4	624	$8,670	31	$3,860	$2,400	$10	$14,940	5
6	620	$8,630	28	$3,720	$2,850	$ 7	$15,207	6

Alternatives 4 and 6 bisect the Anheuser-Busch brewery property in Merrimack. The impact on this major employer would be substantial. The alignment crosses the firm's emergency water supply well fields and recreational area and runs between the factory and the company's stables, where they house the Budweiser Clydesdale Horses. The brewery is a major tourist destination, and the highway would disrupt their ability to continue this aspect of their business, according to company officials.

The town of Litchfield has officially recognized alignment 7 (termed the BC alignment in the 1984 DEIS) as part of their master plan. Litchfield rezoned a significant portion of the town, through which the highway would pass, for commercial and industrial development. Alternatives 3, 4, 5 and 6, for the most part, bisect land that is zoned residential, negating the master plan's attempt to isolate commercial and industrial development in the southernmost part of town, in the area of the highway.

Secondary Impacts

In terms of induced secondary impacts that may be generated from highway construction, the economic findings have been quantified for the Build Alternative and the No Build Alternative. This quantification was based on projections of housing and commercial/industrial growth (including number of employees). Both the existing (1990) and projected figures have been identified within small geographic areas referred to as community units (i.e., traffic zones). (For the methodology used to calculate specific locations of growth, see the Technical Report entitled, "Cumulative Development and Associated Impacts" as well as Section 4.23 of this FEIS.)

When evaluating the secondary impacts, it is anticipated that all of the Full Build Alternative alignments will have substantially the same effects in terms of inducing growth. That is, the movement of the highway corridor to either one side or the other will not significantly alter the number of housing units or commercial/industrial development that is expected to be developed.

From an overall perspective, Merrimack and Hudson would be expected to benefit sooner than Litchfield from anticipated future growth if the highway were constructed. This is considered likely because, although Litchfield has zoned land in anticipation of attracting commercial and industrial development, Merrimack and Hudson already have the infrastructure in place and provide more services than does Litchfield. Therefore, Litchfield may initially receive a disproportionate share of residential development until such time as water and sewer lines can be extended to its commercial and industrial zoning areas.

Although not specifically addressed as part of this study, there will also be additional regional socio-economic impacts generated in those towns which are adjacent to study area communities. Improved access is likely to stimulate increased housing demand and expanded commercial/industrial development under both the Full Build and No Build Alternatives. This type of regional growth will probably occur in close proximity to the existing regional highway corridors, but the timing and level of development cannot be accurately predicted.

In addition, selection of an alternative other than Alternatives 7 or 8 would potentially open up the land in Hudson already purchased by the State for the right-of-way. As this is dependent on future policies and actions which cannot be accurately foreseen, it is not analyzed further.

1. Build

Table 4.3-2 presents the number of housing units and additional square footage of commercial/industrial building space which would be induced under the Build Alternative. Under this scenario, it is expected that more than 3,600 housing units and 4.8 million square feet of commercial/industrial building space would be constructed within the study area by the year 2010. It is anticipated that Hudson would received the largest number of housing units, while Merrimack would attract the majority of the commercial/ industrial growth.

In terms of revenues and expenditures, a Build Alternative would be expected to generate slightly more tax dollars than it would require in additional municipal services. Revenues generated for the study area as a whole would be approximately $16.3 million, while expenditures would reach $16.2 million.

2. No Build

Under the No Build Alternative, the stimulus for growth within the next 20 years would be reduced. Although the study area towns would still be expected to eventually reach the growth levels predicted under Full Build, they will not be reached by the year 2010. This is an important distinction to make because it suggests that the highway will not actually generate more development, but will instead accelerate the rate of growth that would have eventually occurred over a longer period of time, with or without the highway. This is considered a likely scenario because the Nashua Region has historically been a growth center for New Hampshire, and it is again expected to fill that role once the current economic recessionary conditions begin to subside.

Table 4.3-2

ESTIMATED SOCIO-ECONOMIC IMPACTS OF THE FULL BUILD ALTERNATIVE YEAR 2010

A. Expenditures

	Additional Housing Units/1	Total Additional Cost For Housing	Additional Square Footage Commercial/Ind/1	Total Additional Cost For Commercial Industrial	Total Costs For Residential and Commercial/Ind
Hudson	2,676	$9,071,640	698,445	$586,694	$9,658,334
Litchfield	340	$1,157,700	356,400	$274,428	$1,432,128
Merrimack	633	$2,338,302	3,818,925	$2,826,005	$5,164,307
TOTAL	3,649	$12,567,642	4,873,770	$3,687,126	$16,254,768

B. Revenues

	Additional Housing Units/1	Total Additional Revenues For Housing	Additional Square Footage Commercial/Ind	Total Additional Revenue - Commercial and Industrial	Total Revenues For Residential and Commercial/Ind
Hudson	2,676	$6,344,796	698,445	$1,047,668	$7,392,464
Litchfield	340	$1,038,020	356,400	$1,022,868	$2,060,888
Merrimack	633	$1,519,200	3,818,925	$5,422,874	$6,942,074
TOTAL	3,649	$8,902,016	4,873,770	$7,493,409	$16,395,425

1/ Additional housing units and square footage figures pertain only to those traffic zones expected to be impacted by highway construction.

Table 4.3-3 presents anticipated economic impacts associated with the No Build Alternative. Under this alternative, housing growth would reach only 40 to 60 percent of the Full Build number of housing units. For the study area that would mean an additional 1,400 to 2,100 housing units by the year 2010. Commercial/industrial development would reach only 70 percent of the Full Build growth levels, resulting in the construction of approximately 3.4 million square feet of building space within the study area.

Revenues would still be expected to exceed expenditures at the end of 20 years under the No Build Alternative. Revenues would range from a low of $8.5 million to a high of $10.3 million, while expenditures would range between $7.6 and $10.1 million.

Table 4.3-3

ESTIMATED SECONDARY SOCIO-ECONOMIC IMPACTS OF NO BUILD ALTERNATIVE YEAR 2010

A. Expenditures

	Additional Housing Units/1		Total Additional Cost For Housing		Additional Square Footage Commercial/Ind/1	Total Additional Cost For Commercial Industrial	Total Costs For Residential & Commercial/Ind	
	Low	High	Low	High			Low	High
Hudson	1,070	1,606	$3,628,656	$5,442,984	318,038	$267,152	$3,895,808	$5,710,136
Litchfield	136	204	$463,080	$694,620	71,280	$54,886	$517,966	$749,506
Merrimack	253	380	$935,321	$1,402,981	3,055,140	$2,260,804	$3,196,124	$3,663,785
TOTAL	1,460	2,189	$5,027,057	$7,540,585	3,444,458	$2,582,841	$7,609,898	$10,123,426

B. Revenues

	Additional Housing Units/1		Total Additional Cost For Housing		Additional Square Footage Commercial/Ind	Total Additional Revenue - Commercial Industrial	Total Revenue For Residential & Commercial/Ind	
	Low	High	Low	High			Low	High
Hudson	1,070	1,606	$2,537,918	$3,806,878	318,038	$477,057	$3,014,975	$4,283,935
Litchfield	136	204	$415,208	$622,812	71,280	$204,574	$619,782	$827,386
Merrimack	253	380	$607,680	$911,520	3,055,140	$4,338,299	$4,945,979	$5,249,819
TOTAL	1,460	2,189	$3,560,806	$5,341,210	3,444,458	$5,019,929	$8,580,736	$10,361,139

1/ Additional housing units and square footage figures pertain only to those traffic zones expected to be impacted by highway construction.

4.4 PUBLIC/6(f) LANDS AND INSTITUTIONAL RESOURCES

No lands within any of the proposed Nashua-Hudson Circumferential Highway alternative corridor rights-of-way have been acquired or developed with Land and Water Conservation Fund assistance. Thus, Section 6(f) documentation is not required.

The following Institutional Resources will be impacted by various alternatives of the Circumferential Highway:

- The Hudson Historical Society & Cultural Center located on N.H. Route 102 in Hudson is on the National Register of Historic Places. This property will be completely impacted by Alternatives 5 and 6.

- The Tabernacle Baptist Church located on N.H. Route 102. This property will be impacted by Alternatives 3, 4, 7, and 8. The impact will be limited to a portion of the parking lot on the southeastern side of the Church. No portion of the Church structure will be impacted.

- Alvirne High School is located on N.H. Route 102 in Hudson. This property will be impacted by Alternatives 5 and 6. The impact will be limited to 25 of the approximate 45 acres of the school's agricultural fields that are actively farmed. There will also be a taking of at least one agricultural building.

4.5 FARMLANDS

Farmland impacts include: lost active farmland, lost Prime or Statewide Important farmland soils, disrupted and restricted or lost access to farm areas. Increases in development pressure and resulting loss of farmland through development are also considered.

Table 4.5-1 presents overall direct active farmland impacts, including both active Prime and Statewide Important farmland soils, and active farms with soils other than Prime or Statewide Important. Full Build Alternative alignments are ranked from least to greatest impact. No project-related impacts occur with the No Build and Transit/TDM and TSM Alternatives. Of the Build Alternatives, Alternative 3 would have the least impact to active farmlands (15.0 acres), while Alternative 6 would have the greatest, with a loss of 45.4 acres.

Table 4.5-1

OVERALL ACTIVE FARMLAND IMPACTS BY BUILD ALTERNATIVE (in acres)

Alternative	Total Active Farmland	Active Prime Farmland Soil	Active Statewide Important Farmland Soil	Active Non-Prime Non-Statewide Important Farmland Soil
3	15.0	1.6	2.3	11.1
7, 8	16.6	11.6	2.3	2.7
4	23.1	9.9	2.3	10.9
5	37.2	2.8	0.7	33.7
6	45.4	11.1	0.7	33.6

Detailed impacts are summarized in Table 4.5-2.

Least impact on **Prime** farmland soils (including active and inactive areas) would occur with Alternative 4 at 29.7 acres. Greatest impact on Prime farmland soils, including both active and in-active areas, would occur with Alternative 8 at 69.7 acres.

Impacts on **Statewide Important** farmland soils range from 0.7 acres with Alternatives 5 and 6, to a high of 56.6 acres with Alternative 8.

Table 4.5-2

FARMLAND IMPACTS - SOILS AND ACTIVE AGRICULTURAL AREAS
(in acres)

ALTERNATIVES	PRIME FARMLAND SOILS	PRIME FARMLAND SOILS ACTIVELY FARMED	STATEWIDE IMPORTANT FARMLAND SOILS	STATEWIDE IMPORTANT SOILS ACTIVELY FARMED	ACTIVE FARMLAND NON-PRIME SOILS NON-STATEWIDE IMPORTANT SOILS	TOTAL ACTIVE SOILS	TOTAL ACTIVE LAND	TOTAL NON-ACTIVE SOILS	TOTAL FARMLAND IMPACTS
FULL BUILD Sagamore Bridge to F.E. Everett									
3	52.3	1.6	7.2	2.3	11.1	3.9	15.0	59.5	74.5
4	19.8	9.9	7.2	2.3	10.9	12.2	23.1	27.0	50.1
5	61.5	2.8	0.0	0.7	33.7	3.5	37.2	61.5	98.7
6	29.0	11.1	0.0	0.7	33.6	11.8	45.4	29.0	74.4
7	39.9	11.6	37.8	2.3	2.7	13.9	16.6	77.7	94.3
8	58.1	11.6	54.3	2.3	2.7	13.9	16.6	112.4	129.0
SOUTHERN SECTION Sagamore Bridge to Route 111									
3	15.3	0.0	0.0	0.0	0.0	0.0	0.0	15.3	15.3
* 4	15.3	0.0	0.0	0.0	0.0	0.0	0.0	15.3	15.3
5	15.3	0.0	0.0	0.0	0.0	0.0	0.0	15.3	15.3
6	15.3	0.0	0.0	0.0	0.0	0.0	0.0	15.3	15.3
7	25.0	0.0	24.0	0.0	0.0	0.0	0.0	49.0	49.0
* 8	25.0	0.0	24.0	0.0	0.0	0.0	0.0	49.0	49.0
CENTRAL SECTION Route 111 to Route 102									
* 3	0.0	0.0	7.2	2.3	0.9	2.3	3.2	7.2	10.4
4	0.0	0.0	7.2	2.3	0.9	2.3	3.2	7.2	10.4
* 5	9.2	1.2	0.0	0.7	5.4	1.9	7.3	9.2	16.5
6	9.2	1.2	0.0	0.7	5.4	1.9	7.3	9.2	16.5
7	0.0	0.0	7.2	2.3	0.9	2.3	3.2	7.2	10.4
* 8	0.0	0.0	7.2	2.3	0.9	2.3	3.2	7.2	10.4
NORTHERN SECTION Route 102 to F.E. Everett Turnpike									
3	37.0	1.6	0.0	0.0	10.2	1.6	11.8	37.0	48.8
4	4.5	9.9	0.0	0.0	10.0	9.9	19.9	4.5	24.4
5	37.0	1.6	0.0	0.0	28.3	1.6	29.9	37.0	66.9
6	4.5	9.9	0.0	0.0	28.2	9.9	38.1	4.5	42.6
7	14.9	11.6	6.6	0.0	1.8	11.6	13.4	21.5	34.9
8	33.1	11.6	23.1	0.0	1.8	11.6	13.4	56.2	69.6

* Coincident alignments

Impacts on active farmland with soils not designated as Prime or Statewide important range from 2.7 acres with Alternatives 7 and 8, to a high of 33.6 and 33.7 acres with Alternatives 6 and 5, respectively.

Alternatives 5 and 6 impact Alvirne High School's agricultural fields in Hudson, and Alternative 6 goes on to impact Wilson's Farm in Litchfield. Alternatives 3, 7, and 8 are the least disruptive of active farmlands.

All Build Alternatives will disrupt areas of active farmland, and will result in increased development pressure. However, under the No Build, Transit/TDM and TSM Alternatives, development pressure will continue even in the absence of a new roadway.

Mitigation to reduce farmland impacts includes: (1) reducing right-of-way requirements, (2) re-routing or shifting the alignments to minimize impacts, (3) maintaining or providing new or additional access to farmlands isolated by the roadway, and (4) purchase of development rights to a farmland property to avoid secondary development impacts.

4.6 HISTORIC AND ARCHEOLOGICAL RESOURCES

HISTORIC RESOURCES

Methodology

Impacts of proposed alignments on historic properties that were determined eligible for the National Register of Historic Places were evaluated at a meeting of NHDHR, Corps, NHDOT and the consultant team on April 30, 1993. Consensus determinations were made by NHDHR, NHDOT and the Corps in all cases. NHDHR/Corps Determinations of Eligibility/Effect (33 CFR Part 325 Appendix C and by incorporation, 36 CFR §800) are included in the revised Historic Resources Technical Report.

Criteria of Effect and Adverse Effect were determined based on 33 CFR Part 325 Appendix C and by incorporation, 36 CFR §800.9, which specifies the following:

Effect: *Undertaking may alter National Register-qualifying characteristics and features of location, setting or use.*

Adverse Effect: *May diminish the integrity of design, setting, materials, workmanship, feeling or association. Adverse effects include but are not limited to:*

- *physical destruction, damage, or alteration of all/part of the property*
- *isolation from or alteration of the character of the property's setting when that character contributes to the property's qualification for the National Register*
- *introduction of visual, audible, or atmospheric elements that are out of character with the property or alter its setting*
- *neglect of a property resulting in its deterioration or destruction*
- *transfer, lease, or sale of the property.*

Otherwise adverse effects may be considered not adverse:

- *when the property is of value only for potential contribution to research, and when such value can be substantially preserved through appropriate research in accordance with professional standards and guidelines*

- *when the undertaking is limited to rehabilitation of buildings and structures and is conducted in a manner that preserves the historical and architectural value of affected historic property through conforming with the* **Secretary of the Interior's Standards for Rehabilitation and Guidelines for Rehabilitating Historic Buildings**, *or*

- *when the undertaking is limited to transfer, lease, or sale of a historic property, and adequate restrictions or conditions are included to ensure preservation of the property's significant historic features.*

Impact Evaluation

Of the one already listed and sixteen individual properties and three historic districts determined eligible for the National Register, three individual properties and all three districts would be adversely affected by a number of the proposed Build Alternatives. In addition, the setting of two historic properties would be affected by all Build Alternatives, although the effect would not be adverse.

None of the Build Alternatives directly affect Benson's Wild Animal Farm Historic District on Kimball Hill Road in Hudson (Area A-28). However, the proposed construction of 9.4 acres of wetlands within the 38 acre historic portion of the 165.81 acre property would have an adverse effect on the unique and significant historic district.

Alternative 1

Alternative 1, the No Build Alternative with no physical road improvements, would have no effect on historic resources in the study area. This Alternative assumes that the existing roadway system would be maintained in its current condition, other than three committed projects scheduled to be completed by 2010: F.E. Everett Turnpike widening between Exits 3 and 7 in Nashua, the F.E. Everett Turnpike Exit 2 project, and the Camp Sargent Road Bypass in Merrimack. The potential effects of these three projects on historic resources in the project areas have already been determined and are not reiterated in this study.

Alternative 2

Alternative 2, the Transit/TDM and TSM Alternative, would be made up of a wide range of measures aimed at increasing vehicle occupancy and reducing single-occupant vehicle travel during peak periods and of low cost traffic engineering measures designed to improve traffic flow in selected problem areas. No detailed plans have been determined. Therefore, the effect of these *improvements on historic resources currently is unknown and will need to be addressed if necessary.*

Alternative 3

Alternative 3 would have adverse effects on two historic properties on N.H. Route 3A in Litchfield, the Bathalon-Hayes House (#90) and the Adams-Bergeron House (#92), and on the Jasper Poultry Farm Historic District (Area BB) on Old Derry Road in Hudson and Litchfield. Alternative 3 also would affect the setting of two historic properties in Hudson, the Asa Davis House at 101 Bush Hill Road (#23) and the Bartlett House and Office Complex at 2 Old Derry Road (#107), as would all the Build Alternatives (Alternatives 3 through 8); but the effects would not be adverse, and the properties' National Register characteristics would not be lost.

Under Alternative 3, the Bathalon-Hayes House (#90) would suffer the greatest adverse effect, due to the loss of this historically significant small-scale early 20th century poultry farm. Alternative 3 would require the acquisition of the c.1930 house, garage, two chicken coops and one outbuilding and the entire 9.8 acre parcel (due to a lack of access), causing a complete loss of setting, location and use. To the south, the Adams-Bergeron House (#92) would suffer an adverse loss of setting, feeling and association. Alternative 3 would require the acquisition of 3.8 acres of the National Register portion of the property east of the historic structures, which supply the domestic and agricultural setting of the former farm. No historic buildings would be acquired, and access to the property would be maintained.

The Jasper Poultry Farm Historic District (Area BB) would be severely impacted by Alternative 3 and suffer an adverse effect due to the loss of integrity of setting, feeling and association. Alternative 3 would require the acquisition of a wide area of right-of-way (17.1 acres), bisecting the district and destroying its historic coherence and significance. The historic district comprises 112.1 acres, on the east and west sides of Old Derry Road. Much of the land historically was used for poultry ranges and remains cleared today, establishing the district's open, rural setting. This Alternative, as well as Alternatives 4, 7 and 8, would introduce a new element within the agricultural landscape. In addition to the acquisition of 17.1 acres of land for the roadway, one contributing structure, the Crockett House (#62), would be acquired, resulting in the loss of location, design, setting, materials, workmanship, feeling and association for this structure. Although not acquired, properties #61 and #63-A could be affected by the visual, audible and atmospheric elements of the highway, which would be out of character with their historic setting, feeling and association.

In Hudson, Alternative 3, as well as all the other Build Alternatives would require the construction of an access road along the north property line of the Asa Davis House (#23), one of the town's oldest and most important historic farms. However, this right-of-way would not require the acquisition of any land from the Asa Davis property. The presence of a new access road would affect the historic property's setting, but not impair its National Register characteristics under either Criterion A or C.

All the Build Alternatives also would affect the historical setting of the Bartlett House and Office Complex (#107), due to the acquisition of 0.3 acres of land and minor grading and ditching on N.H. Route 102 at the parcel's west edge. NHDOT has already acquired the right-of-way for this part of the project, and the proposed ditching and grading would not have an adverse effect on the historic property's National Register eligibility status.

Alternative 4

Alternative 4 would follow the same route as Alternative 3 in the southern and central sections of the project area and have the effects previously noted on the Asa Davis House (#23), the Bartlett House and Office Complex (#107) and Jasper Poultry Farm Historic District (Area BB).

North of N.H. Route 102, Alternative 4 would follow a path north and south of historic properties along N.H. Route 3A in Litchfield. Road widening required along N.H. Route 3A under this Alternative would end just south of the Chase-Parker House (#76), the McQuesten-Leary House (#75) and the McQuesten-Calawa House (#73), having no effect on their National Register status.

Alternative 5

As with all Build Alternatives in the southern section of the project area, Alternative 5 would affect the setting of the Asa Davis House (#23) and the Bartlett House and Office Complex (#107), but would not impair their National Register eligibility.

In the central and northern sections of the project area, Alternative 5 would adversely affect one property already listed on the National Register and two properties that have been determined eligible: the Hills House, "Alvirne" (#106), the Bathalon-Hayes House (#90) and the Adams-Bergeron House (#92). The adverse effects on the latter two properties are comparable to those under Alternative 3: the loss of the Bathalon-Hayes House (#90), a well-preserved small-scale poultry farm, and the acquisition of 3.8 acres of land associated with *the Adams-Bergeron House (#92), would result in diminished integrity of domestic and agricultural setting, feeling and association.*

Alternative 5, as well as Alternative 6 would require the acquisition of the Hills House (#106), historically known as "Alvirne", resulting in the loss of this former summer estate. "Alvirne" was listed on the National Register of Historic Places in 1983 for its statewide architectural significance as one of the finest examples of the Shingle Style in New Hampshire. Its location in the small town of Hudson is unique; most comparable examples are found in wealthy suburbs or mountain or coastal resort communities. The building is now owned and maintained by the Hudson Historical Society.

Alternative 6

The impacts to historic properties under Alternative 6 are the same as Alternative 5, except in the northern section of the project area, where it would follow a path similar to Alternative 4 and avoid the Bathalon-Hayes House (#90) and the Adams-Bergeron House (#92) on N.H. Route 3A in Litchfield. As with Alternative 4, road widening required along N.H. Route 3A would end just south of the Chase-Parker House (#76), the McQuesten-Leary House (#75) and the McQuesten-Calawa House #73), having no effect on their National Register status.

As noted under Alternative 5, Alternative 6 would result in a more severe adverse effect, the loss of the Hills House, "Alvirne" (#106), listed on the National Register for its statewide architectural significance. As with all the Build Alternatives in the southern section of the project area, Alternative 6 would affect the setting of the Asa Davis House (#23) and the Bartlett House and Office Complex (#107), but would not impair their National Register eligibility.

Alternatives 7 and 8

The impacts of Alternatives 7 and 8 on historic properties are comparable. As with all the Build Alternatives in the southern section of the project area, Alternatives 7 and 8 would affect the setting of the Asa Davis House (#23) and the Bartlett House and Office Complex (#107), but would not impair their National Register eligibility.

Alternatives 7 and 8 would differ from the other Build Alternatives north of N.H. Route 102, where these Alternatives would follow a westerly line through the Pennichuck Water Works to intersections with the F.E. Everett Turnpike. The Pennichuck Water Works is highly significant as a pioneering modern water works complex, established in the 1850's to supply the rapidly expanding city of Nashua *with both running water and greater fire protection. The well-preserved pumping stations illustrate the evolution of pumping station technology and late 19th/early 20th century architecture, and are the most extensive complex of pumping station structures in the state.*

Alternative 7 would bisect the historic district portion of the water works, requiring the acquisition of 86.7 acres of land, diminishing the district's integrity of setting, feeling and association. Alternative 8 would divide a 54.6 acre portion of land along the eastern edge of the district boundary from the remainder of the 1090 acre historic district. Under both Alternatives, the historic physical plant would not be directly affected; the buildings' functions would not change; the buildings would remain in use, and the water works operations would be uninterrupted. No highway construction would affect the overall storage of water, although some water would be internally diverted within the system, under agreement with NHDOT.

SUMMARY OF FINDINGS

In the southern section of the project area, from the start of the project north to N.H. Route 111 in Hudson, no historic resources are adversely affected by any of the proposed Alternatives. Although each of the Build Alternatives affect the setting of two eligible properties, the Asa Davis House (#23) and the Bartlett House and Office Complex (#107), the effects are not adverse and do not impair the properties' National Register eligibility.

In the central portion of the project, between N.H. Routes 111 and 102 in Hudson and Litchfield, the six Build Alternatives would present a choice between the acquisition of the Hills House, "Alvirne" (#106), already listed on the National Register, under Alternatives 5 and 6, and the loss of the National Register eligibility of the Jasper Poultry Farm Historic District under the remaining Build Alternatives, 3, 4, 7, and 8. In both cases, National Register eligibility would be lost and mitigation measures unsatisfactory. Due to its complex massing and plan, relocation of the architecturally significant Hills House would be difficult and unlikely. Mitigation measures to screen the Jasper Poultry Farm Historic District from the visual, audible and atmospheric effects of Alternatives 3, 4, 7 and 8 could introduce an incompatible new element into the district. In addition, one contributing building in the district, the Crockett House (#62), would be acquired under Alternatives 3, 4, 7 and 8.

At the Jasper Poultry Farm Historic District (Area BB), Alternatives 7 and 8 would follow the same route as Alternatives 3 and 4, and have the same adverse effects, as noted in the discussion of Alternative 3.

Alternatives 3, 5, 7 and 8 would present further adverse effects in the northern section of the project area, leaving Alternatives 4 and 6 as the least damaging to National Register eligible properties. Alternatives 3 and 5 would require the acquisition and removal of the Bathalon-Hayes House (#90) in Litchfield and the acquisition of 3.8 acres of the Adams-Bergeron House (#92) parcel in Litchfield, although no historic contributing buildings would be acquired. As noted, the National Register eligibility of the Jasper Poultry Farm Historic District would be lost under Alternatives 3, 4, 7, and 8, whereas Alternatives 5 and 6 would require the acquisition and loss of the Hills House, "Alvirne" (#106), already listed on the National Register.

Alternatives 7 and 8 avoid adverse impacts to three individual properties (#90, #92 and #106), but would introduce adverse effects to the Pennichuck Water Works Historic District, in addition to adverse impacts to the Jasper Poultry Farm Historic District. Although Alternatives 7 and 8 would not adversely affect the historic and continuing use of the water works, both alignments would bisect the natural wooded landscape of the district, causing diminished integrity of setting, feeling and association.

Only Alternative 1, the No-Build Alternative, would avoid adverse effects to National Register historic properties in the project area. No detailed plans for Alternative 2, the Transit/TDM and TSM Alternative, have been determined; therefore, its effects on historical resources are currently unknown and would have to be addressed if necessary. All of the Build Alternatives will result in an adverse effect on the Benson's Wild Animal Farm Historic District because of wetland creation.

Mitigation

Preferred mitigation is to design or select an alignment that avoids the historic property; when this is neither prudent nor feasible, mitigation utilizes a combination of efforts to suit the individual circumstance. These efforts include documenting the adversely affected properties using HABS (Historic American Buildings Survey) standards; marketing the documented structure for relocation with priority given to relocation on the same parcel and/or within the district or area; minimizing land acquisition and maximizing the distance between the highway corridor and the historic structure; providing access as necessary to maintain existing land uses; and providing landscaping and screening to minimize visual and noise impacts.

For this project, adverse effects to historic properties would be the same for similar sections of various Alternatives. Therefore, mitigation would also be the *same. Mitigation possibilities are listed on a property by property basis, with applicable Alternatives identified.*

Eligible Historic Properties Not Affected by Construction

No mitigation measures are required for these properties

Fred Giddings House (#3)
Smith-Walch House (#50)
Jeremiah and William Hills House (#59)
Baptist Meeting House (#600A)
Greeley House (#600B)
Hudson Town House (#603)
Hudson Center School (#610)
McQuesten-Calawa House (#73)
McQuesten-Leary House (#75)
Chase-Parker House (#76)
Leary-Center House (#81)
LaBombarde Estate (#116)

Asa Davis House (#23)

Under all of the Build Alternatives an access road would be built along the northern property line of tax parcel 19/20. Because no land would be acquired and the new access road would not adversely affect the Asa Davis House's National Register eligibility, no mitigation would be required.

Hills House, "Alvirne" (#106)

Alternatives 5 and 6 would require the acquisition of the entire Hills House property, causing the loss of this historic summer estate listed on the National Register. This would have an unavoidable adverse effect on the property's location, setting and use. Mitigation measures would include documentation of the property to HABS standards and marketing the building for relocation with preservation covenants. However, the buildings' complex plan and massing would make relocation difficult and unlikely.

Bartlett House and Office Complex (#107)

Proposed mitigation measures under all the Build Alternatives would be to minimize the extent of grading and ditching along the western lot line of the property on N.H. Route 102. Although the introduction of grading and ditching *affects the historic property's setting, it does not impair its National Register eligibility.*

Bathalon-Hayes House (#90)

Alternatives 3 and 5 would require the acquisition of the Bathalon-Hayes House, resulting in the physical destruction of this National Register eligible property. The only mitigation measure available would be to document the property to HABS standards. Because this property is significant for the historic information it conveys about small scale early 20th century poultry farming under Criterion A, relocation of the house and four outbuildings would not be applicable.

Adams-Bergeron House (#92)

Under Alternatives 3 and 5, 3.8 acres of the eastern part of the eligible property would be acquired, causing an adverse effect on the property's integrity of setting, feeling and association. The contributing historic house and barn are located on the western half of the lot, fronting the Charles Bancroft Highway. Mitigation measures under Alternatives 3 and 5 would be to shield the remaining portion of the eligible property from the highway with trees, vegetation and landscaping along the highway right-of-way on the northern and western boundaries of the eligible property. No eligible buildings would be taken, and access to the property would be maintained.

Benson's Wild Animal Farm (Area A-28)

Although the Benson's Wild Animal Farm Historic District would not be affected by the routes of any of the Build Alternatives, proposed wetlands mitigation will adversely affect the district's National Register eligibility. The effects upon the historic district, which encompasses 38 acres, will involve creation of 9.4 acres of wetland. Although the wetland creation has been designed to avoid direct impacts to all contributing structures, it would result in an adverse effect on the district due to alteration of its setting. If an appropriate reuse of the district cannot be found, there could be additional adverse effects on the district's location and use, including impacts on design, materials, workmanship, feeling, and association. Appropriate mitigation measures include avoiding encroachment on historic contributing structures; documentation of contributing structures in conformance with standards of HABS; exploration of feasibility for reuse and/or alternate uses; marketing for lease or sale of the historic property, or relocation of individual structures, with preservation covenants; if no qualified response, marketing without preservation restrictions.

Jasper Poultry Farm Historic District (Area BB)

The Jasper Poultry Farm Historic District would be affected by Alternatives 3, 4, 7 and 8. Mitigation measures would include the documentation of the one acquired contributing structure, the Crockett House (#62), to the standards of HABS and marketing for relocation with preservation covenants, preferably within the district. Visual screening such as vegetation and landscaping should be provided for all contributing properties in the district, particularly properties #61 and #63-A, which flank the proposed alignments. The district is significant as a cluster of four contiguous farms on Old Derry Road. Although landscaping would partially screen individual properties from the adverse affects of the highway, it also could introduce a new element into the historic district, diminishing its integrity of setting, feeling and association.

Pennichuck Water Works (Area B-115)

Several measures have already been proposed to mitigate adverse effects under Alternatives 7 and 8 on the Pennichuck Water Works Historic District to protect its historic use. The contributing historic structures in the district, clustered near the Supply Pond and Pennichuck Brook, are already screened from the proposed alignments by the natural wooded character of the historic landscape. Alternative 7 would pass close to Bowers Dam, which was extensively rebuilt in 1990 and no longer contributes to the district's eligibility.

For Alternative 7, under agreement with the Pennichuck Water Works, the water supply to the pond from the Merrimack River would be intercepted and brought directly to the treatment plant. The highway drainage to the west of the water works would be held in swales; to the east it would be captured in a closed system. Alternative 8 would have no impact on the municipal water system; highway runoff would be carried in the right-of-way, or treated with holding ponds and wetlands to the north of the water works historic district.

No other mitigation measures to protect the district's historic location and setting would be available under Alternatives 7 and 8, except for avoidance through the choice of another Alternative.

Historic Resources Database

Adverse effects on historic resources will be mitigated according to Federal laws and requirements. The database of historic resources developed by Federal agencies for this project is available to the community, citizens and local officials and can be used to enact ordinances to protect affected resources. The material *can also be incorporated in the community master plan, to identify historical resources and preserve them for the future enrichment of the community.*

Results of Archeological Survey

The archeological survey included preliminary reconnaissance level documentation of historic archeological sites and features, areas exhibiting historic archeological site sensitivity, locations of previously recorded prehistoric sites and districts and areas exhibiting prehistoric archeological sensitivity. This included background documentary review, development of a predictive model, and field inspection. Resource significance and National Register eligibility were not determined for archeological resources within this study.

The prehistoric archeological survey resulted in the definition of two archeological districts, 13 previously recorded sites and 25 locations of prehistoric resource sensitivity. The historic archeological survey resulted in the definition of 39 sites or sensitive locations. Build Alternative alignments will affect a portion of these sites and sensitive areas.

The Circumferential Highway data can be broken down into three separate sections for more detail. The southern section runs from the Sagamore Bridge north to N.H. Route 111. The central section runs from N.H. Route 111 north to N.H. Route 102. The northern section runs from N.H. Route 102 north to the F.E. Everett Turnpike. Sensitive strata in each section are as follows:

Section	Number of Sensitive Areas	Areas by Stratum FT	FS	ST	IN	UP
Southern	4	2	0	0	2	0
Central	1	0	0	0	0	1
Northern	13	4	4	1	4	0

NOTE:
FT = located on the first Merrimack River terrace
FS = located on the second tier and juncture of first terrace
ST = located on the second tier
IN = located on interior surface water feature
UP = located in uplands

Archeological sensitivity within the study area largely coincides with the first and second Merrimack River terraces, as well as the margins of interior water features. Full Build Alternative alignments will affect 17 of the 25 areas assigned archeological sensitivity. All alternatives are likely to affect sensitive areas located on the Merrimack River terrace, on the second tier above the Merrimack River, and those associated with interior surface water features. Alternatives 7 and 8 will affect the archeologically sensitive area in the uplands. Archeologically sensitive areas will not be affected in their entirety; instead, margins or segments of individual areas may be cross-cut by alternative alignment corridors.

		Areas by Stratum				
Alt.	**Number of Sensitive Areas**	FT	FS	ST	IN	UP
3	8	4	1	1	1	1
4	8	3	1	1	2	1
5	8	4	1	1	2	0
6	8	3	1	1	3	0
7	11	3	3	0	4	1
8	11	3	3	0	4	1

A ranking of the Full Build Alternative alignments on the basis of archeological resources ranks those alignments impacting the fewest resources as the most desirable. The archeological preference for the alignments is:

Archeological Rank	**Alignment**
1	3, 4, 5, or 6
2	7 or 8

If archeological properties are found which meet National Register criteria, then either preservation in place, or the implementation of a data recovery plan consistent with the Secretary of the Interior's "Standards for Documentation" (48 FR 44754-37) and the Advisory Council on Historic Preservation's (ACHP) handbook, "Treatment of Archeological Properties," will be developed and submitted by NHDOT to the SHPO, the Corps, and the ACHP for approval.

4.7 AIR QUALITY

The air quality analysis examined the No Build and Build Alternatives in 2000 (estimated completion year), and 2010 (the design year). Full Build Alternatives were evaluated in detail.

Areawide Emissions Inventories

EPA's MOBILE4.1 program was used to estimate the emissions from motor vehicle sources on existing arterials and the proposed highway. Between 1990 and 2000, traffic volumes or vehicle-miles-traveled (or VMT's) are expected to increase. This increase, however, should be more than offset by a decrease in the exhaust emissions from the motor vehicles due to the mandatory federal motor vehicles exhaust emissions control program and the New Hampshire Inspection and Maintenance (or I/M) program in the greater Nashua area. Consequently, the estimated Nonmethane hydrocarbon (NMHC) emissions under the No Build Condition in 2000 were estimated to be lower (by approximately 31 percent) than the 1990 total. In 2000, NMHC emissions from the Build Alternatives were estimated to range from 5.91 to 5.93 tons/day. These emissions are less than the No Build emissions. NMHC emissions from the Build Alternatives are very close to one another.

The effects of the federal emissions control program and the existing I/M program will not be sufficient to offset the predicted growth in VMT between 2000 and 2010. Consequently, NMHC emissions for both the No Build and Build Alternatives are expected to increase in 2010 when compared with their 2000 counterparts. These increases will generally range around 11.7 percent for the Build Alternatives to 11.8 percent for the No Build. Emissions from each of the Build Alternatives are lower than the emissions from the No Build. The difference between the highest and the lowest emissions is very small. Because the NMHC emissions from the Build Alternatives are less than the No Build emissions in both the short- and long-term, no mitigation measures are proposed at this time. In all instances, the 2010 emissions are lower than the 1990 conditions (refer to Table 4.7-1.)

Irrespective of project alternatives, oxides of nitrogen (NOx) emissions in the study area were estimated to decrease from 1990 to 2000, but to increase from 2000 to 2010. It appears that the overall decrease in NOx emissions from motor vehicle exhaust (as a result of the mandatory federal emissions control program and the existing I/M program) will not be sufficient to offset the anticipated growth in VMT's in this area. NOx emissions from the Build Alternatives were estimated to be slightly higher than the corresponding

Table 4.7-1

ESTIMATED TOTAL NMHC, NOx, AND CO EMISSIONS - 1990, 2000, 2010

Analysis Year	Alternative Description	Emissions in Tons/Day NMHC	NOx	CO
1990	Existing Condition	8.65	8.60	48.36
2000	No Build	5.96	7.52	26.00
	Alternative 3	5.93	7.65	25.91
	Alternative 4	5.93	7.64	25.91
	Alternative 5	5.93	7.65	25.92
	Alternative 6	5.92	7.63	25.88
	Alternative 7	5.92	7.66	25.87
	Alternative 8	5.91	7.65	25.83
2010	No Build	6.67	8.61	24.63
	Alternative 3	6.63	8.75	24.37
	Alternative 4	6.62	8.74	24.37
	Alternative 5	6.63	8.75	24.37
	Alternative 6	6.62	8.73	24.35
	Alternative 7	6.62	8.77	24.30
	Alternative 8	6.61	8.75	24.27

emissions from the No Build case, ranging from 1.4 percent (for Alternative 6) to 1.8 percent (for Alternative 7). Because the increase in NOx emissions for the Build cases is small, and because the main focus of the ozone control strategy is on NMHC, no further mitigation measures are recommended for NOx at this time.

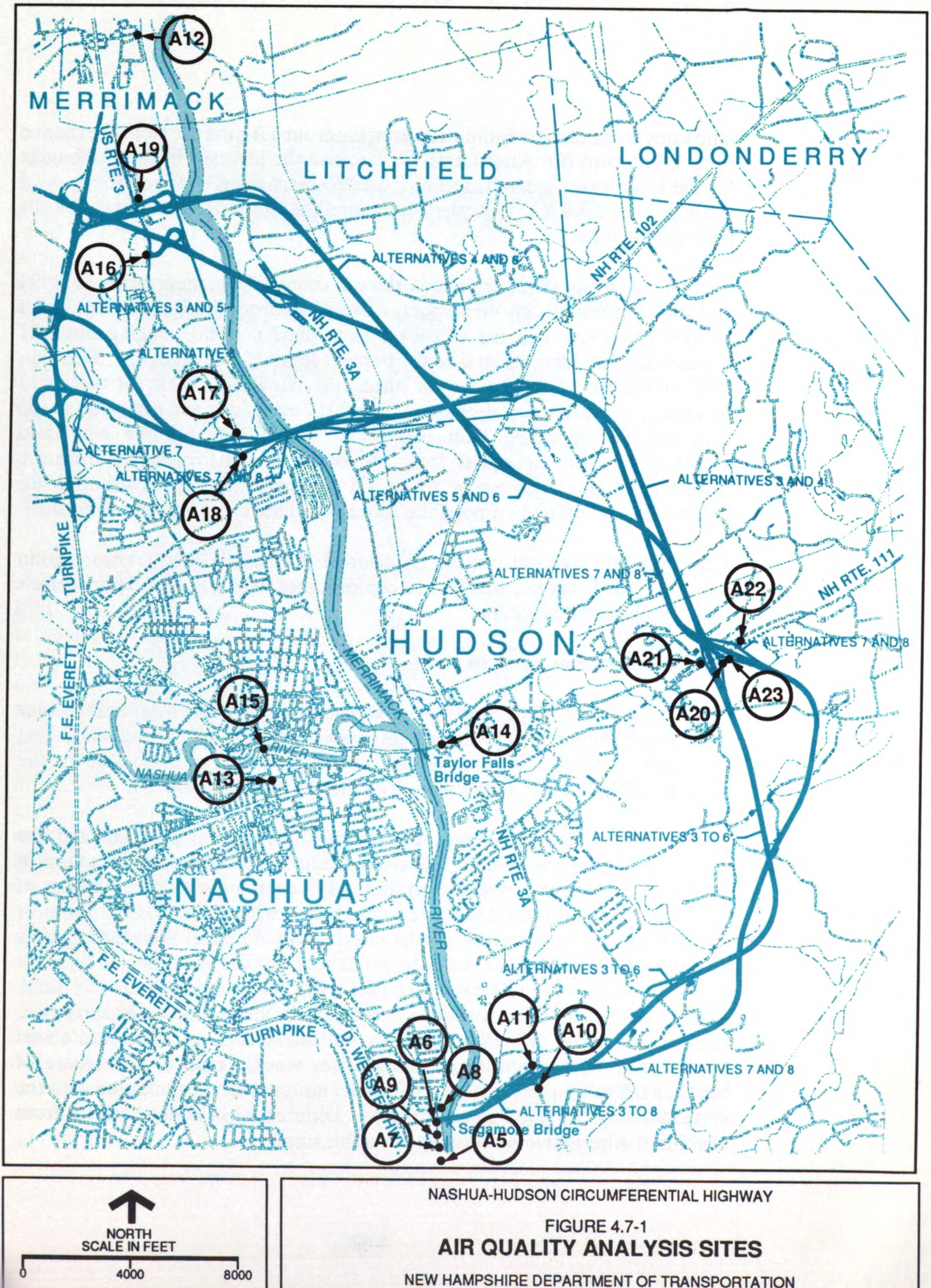
Carbon monoxide (CO) emissions show a dramatic decrease between 1990 and 2000 (approximately 46 percent). Emissions from the Build Alternatives in 2000 are lower than the emissions from the No Build, ranging from 0.7 percent less for Alternative 8 to 0.3 percent less for Alternative 5. Between 2000 and 2010, CO emissions for either the No Build or any of the Build Alternatives continue to decrease. The 2010 emissions are generally lower than the corresponding 2000 emissions. Compared with the No Build emissions in 2010, emissions from the Build Alternatives range from 1.1 percent less (for Alternative 5) to 1.5 percent less (for Alternative 8). Differences in emissions among the Build Alternatives in 2010 are very small.

The proposed highway project is included in the NRPC's Transportation Improvement Program, which is in conformance with the New Hampshire's State Implementation Plan.

CO Concentrations Analysis

EPA's CAL3QHC dispersion model was used to estimate maximum 8-hour CO concentrations at selected receptor locations. For the Nashua-Hudson study area, a total of 19 intersections or analysis sites were chosen for the detailed CO analysis. These sites are illustrated in Figure 4.7-1.

Because of the federal motor vehicle emissions control program and the existing I/M program, 8-hour CO concentrations at all receptor locations in 2000 were significantly lower than their 1990 counterparts. No violations of the 8-hour standard are anticipated anywhere - with either the No Build or any of the Build Alternatives. At the intersection of Daniel Webster Highway and Spit Brook Road (Site A.5), the Build Alternatives are expected to result in a slight increase in CO concentrations when compared with the No Build. But at a number of other locations - especially in the downtown Nashua area, such as at Library Hill (Site A.15) or the intersection of Main and Canal Streets (Site A.13) - the Build Alternatives would result in a decrease of between 0.5 to 1.5 ppm in 8-hour CO concentrations when compared with the corresponding No Build concentrations. Differences in concentrations from one Build Alternative to another are quite small.



NASHUA-HUDSON CIRCUMFERENTIAL HIGHWAY

FIGURE 4.7-1

AIR QUALITY ANALYSIS SITES

NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

The range of maximum 8-hour CO concentrations for the 1990 condition, and the No Build and Build Alternatives in 2000 and 2010 are summarized in Tables 4.7-2 and 4.7-3 for the 19 sites analyzed.

Differences in project alignments will also affect the CO concentrations because of background traffic conditions as illustrated by the maximum 8-hour concentrations at receptors at the intersection of the Circumferential Highway and U.S. Route 3. The maximum 8-hour concentrations are 4.0 ppm for Alternatives 3 and 5 (Site A.16), 4.4 ppm for Alternatives 7 and 8 (Sites A.17 and A.18), and 5.8 ppm for Alternatives 4 and 6 (Site A.19).

With either the No Build or any of the Build Alternatives, 8-hour CO concentrations in 2010 are expected to be below the 9-ppm standard everywhere. Compared with the corresponding 2000 concentrations, most 2010 CO concentrations are generally lower - but only by approximately 0.5 ppm. Differences among the Build Alternatives are not significant.

Maximum 1-hour CO concentrations were estimated from the 8-hour modeling results by the use of an inverse persistence factor. Again, because of the federal exhaust emissions control program and the existing I/M program, 1-hour CO concentrations are expected to show significant decreases in 2000 when compared with corresponding 1990 concentrations. This improvement is expected to continue into 2010 but at a slower rate. No violation of the 1-hour standard of 35 ppm is expected anywhere in 2000 or in 2010.

Because the proposed Circumferential Highway is not expected to result in creating any new violations of either the 8- or the 1-hour standards, or to exacerbate an existing violation, the proposed project is in conformance with the State Implementation Plan and the Clean Air Act Amendments of 1990 (CAAA) with respect to CO. Therefore, no further CO mitigation measures are needed at this time.

Construction Impacts

Fugitive dust emissions during construction can be mitigated with good housekeeping practices such as wetting or chemically treating exposed earth areas, covering dust-producing materials during transport, and limiting construction activities during high wind conditions. Similarly, potential adverse effects associated with traffic disruption or diversion can be mitigated with proper traffic management. With proper mitigation measures in place, therefore, short-term construction impacts should not be a problem in the study area.

Table 4.7-2

SUMMARY OF ESTIMATED MAXIMUM 8-HOUR CO CONCENTRATIONS (ppm) FOR VARIOUS STUDY AREA INTERSECTIONS - EXISTING AND YEAR 2000

Intersection Description	1990 Existing	No-Build	2000 Alternatives 3	4	5	6	7	8
1. DW Hwy & Sagamore Br.	2.8-12.9	NA	NA	NA	NA	NA	NA	NA
2. DW Hwy & Sag. Br. NHCH NB Ramps	NA	2.2-7.0	2.4-6.8	2.3-7.1	2.2-6.8	2.3-7.0	2.2-6.9	2.2-6.9
3. DW Hwy & Sag. Br. NHCH SB Ramps	NA	2.1-6.1	2.0-5.9	1.9-5.8	1.9-5.7	1.9-5.8	1.9-5.7	2.0-5.9
4. DW Hwy & Sag. Br. NHCH Ramp S	NA	1.4-3.3	1.4-3.4	1.4-3.4	1.4-3.4	1.4-3.4	1.4-3.4	1.4-3.4
5. Sag. Br. & Lowell Rd. - No Build	2.5-9.8	1.3-5.0	NA	NA	NA	NA	NA	NA
6. Sag. Br. & Lowell Rd. - Build	NA	NA	1.2-4.7	1.2-4.7	1.2-4.7	1.2-4.7	1.2-4.8	1.2-4.8
7. DW Hwy & Spit Brook Rd.	5.6-15.5	3.1-8.0	3.3-8.5	3.4-8.4	3.3-8.4	3.4-8.4	3.3-8.4	3.3-8.5
8. DW Hwy & Greeley St.	4.7-15.8	1.8-5.9	2.1-6.5	2.1-6.5	2.1-6.5	2.1-6.5	1.7-5.5	1.8-5.5
9. Main St. & Canal St.	5.9-14.5	3.1-8.4	2.9-6.6	2.9-6.6	2.9-6.6	2.9-6.6	2.9-7.5	2.9-6.8
10. Taylor Fls. Br. & Trs. 3A/102/111	5.2-15.5	2.4-6.4	2.0-5.3	2.0-5.6	2.0-5.7	2.0-5.6	1.8-4.9	1.9-5.2
11. Amherst St. & Concord St. (Library Hill)	5.3-14.1	2.5-6.5	2.4-5.9	2.4-6.1	2.4-5.9	2.4-6.1	2.4-6.0	2.3-5.9
12. NCHC Alt. #3 & 5 & Rt. 3	NA	NA	1.4-4.0	NA	1.4-4.0	NA	NA	NA
13. NCHC Alt. #7 & 8 NB Ramps & Rt. 3	NA	NA	NA	NA	NA	NA	1.3-4.4	1.3-4.3
14. NCHC Alt. #7 & 8 SB Ramps & Rt. 3	NA	NA	NA	NA	NA	NA	1.4-2.5	1.4-2.4
15. NCHC Alt. #4 & 6 & Rt. 3	NA	NA	NA	1.2-5.8	NA	1.2-5.8	NA	NA
16. NCHC Alt. 3 thru 6 NB Ramps & Rt. 111	NA	NA	1.3-4.5	1.3-4.4	1.3-4.5	1.3-4.4	NA	NA
17. NCHC Alt. 3 thru 6 SB Ramps & Rt. 111	NA	NA	1.4-3.6	1.4-3.7	1.4-3.7	1.4-3.6	NA	NA
18. NCHC Alt. 7 & 8 NB Ramps & Rt. 111	NA	NA	NA	NA	NA	NA	1.2-3.6	1.2-3.7
19. NCHC Alt. 7 & 8 SB Ramps & Rt. 111	NA	NA	NA	NA	NA	NA	1.2-3.6	1.2-3.6

NOTES:

1. Concentrations are in parts per million (ppm). The 8-hour CO standard is 9 ppm.
2. The tabular range of concentrations refer to the lowest and the highest 8-hour concentrations that were estimated for the various receptors at each intersection.
3. "NA" = this analysis site does not apply to the given alternative or the analysis year.

Table 4.7-3

SUMMARY OF ESTIMATED MAXIMUM 8-HOUR CO CONCENTRATIONS (ppm) FOR VARIOUS STUDY AREA INTERSECTIONS - YEAR 2010

Intersection Description	2010 Alternatives No-Build	3	4	5	6	7	8
1. DW Hwy & Sagamore Br.	NA	NA	NA	NA	NA	NA	NA
2. DW Hwy & Sag. Br. NHCH NB Ramps	2.2-7.3	2.3-7.6	2.3-7.8	2.3-7.6	2.4-7.8	2.3-7.6	2.3-7.6
3. DW Hwy & Sag. Br. NHCH SB Ramps	2.7-5.2	1.8-4.5	1.8-4.5	1.8-4.5	1.8-4.4	1.7-4.2	1.8-4.3
4. DW Hwy & Sag. Br. NHCH Ramp S	1.3-2.7	1.3-2.8	1.3-2.9	1.3-2.8	1.3-2.9	1.3-2.9	1.3-2.9
5. Sag. Br. & Lowell Rd. - No Build	1.4-5.3	NA	NA	NA	NA	NA	NA
6. Sag. Br. & Lowell Rd. - Build	NA	1.1-4.4	1.1-4.6	1.1-4.5	1.1-4.6	1.1-4.5	1.1-4.5
7. DW Hwy & Spit Brook Rd.	2.5-6.7	2.6-6.9	2.6-7.0	2.6-7.0	2.7-6.8	2.7-7.0	2.6-6.9
8. DW Hwy & Greeley St.	1.7-4.9	2.0-5.5	2.0-5.5	1.9-5.5	2.0-5.5	1.6-4.9	1.6-4.9
9. Main St. & Canal St.	2.9-6.7	2.7-6.0	2.7-6.0	2.4-5.2	2.5-5.7	2.2-5.0	2.4-5.3
10. Taylor Fls. Br. & Trs. 3A/102/111	2.4-6.1	1.8-4.6	1.9-4.7	1.8-4.8	1.8-4.7	1.7-4.4	1.7-4.4
11. Amherst St. & Concord St. (Library Hill)	2.4-5.9	2.2-5.5	2.2-5.7	2.2-5.4	2.2-5.6	2.1-5.1	2.1-5.4
12. NCHC Alt. #3 & 5 & Rt. 3	NA	1.3-3.4	NA	1.3-3.4	NA	NA	NA
13. NCHC Alt. #7 & 8 NB Ramps & Rt. 3	NA	NA	NA	NA	NA	1.2-3.8	1.2-3.8
14. NCHC Alt. #7 & 8 SB Ramps & Rt. 3	NA	NA	NA	NA	NA	1.3-2.2	1.3-2.3
15. NCHC Alt. #4 & 6 & Rt. 3	NA	NA	1.1-4.8	NA	1.1-4.8	NA	NA
16. NCHC Alt. 3 thru 6 NB Ramps & Rt. 111	NA	1.2-4.1	1.2-4.0	1.2-4.1	1.2-4.0	NA	NA
17. NCHC Alt. 3 thru 6 SB Ramps & Rt. 111	NA	1.4-4.0	1.4-3.9	1.4-3.9	1.4-3.9	NA	NA
18. NCHC Alt. 7 & 8 NB Ramps & Rt. 111	NA	NA	NA	NA	NA	1.1-3.1	1.1-3.1
19. NCHC Alt. 7 & 8 SB Ramps & Rt. 111	NA	NA	NA	NA	NA	1.1-3.2	1.1-3.2

NOTES:

1. Concentrations are in parts per million (ppm). The 8-hour CO standard is 9 ppm.
2. The tabular range of concentrations refer to the lowest and the highest 8-hour concentrations that were estimated for the various receptors at each intersection.
3. "NA" = this analysis site does not apply to the given alternative or the analysis year.

4.8 NOISE

Modeling Results

Noise levels at various receptor locations were estimated with FHWA's STAMINA 2.0 program for the No-Build and each of the Full Build Alternatives in the year 2010.

The results described below are based on a worst case condition, not taking into account the possible shielding of receptors by terrain, vegetation, and buildings.

No-Build. A total of 22 receptors were estimated to exceed the FHWA criteria of 67 dBA under existing conditions.

Because of the projected growth in traffic volumes, the number of receptors exceeding this criteria is expected to increase to 31 in 2010.

Build Alternatives. The number of receptors adversely impacted by noise attributed to Alternative 3 was estimated at 73. As shown in Table 4.8-1, this includes 39 receptors that would exceed the 67 dBA criteria; and 34 others that would experience noise levels greater than 15 dBA over existing conditions.

Relative to Alternative 3, Alternative 4 would result in a slightly higher number of receptors that would exceed the 67 dBA criteria, or exceed the relative criteria of greater than 15 dBA. The total number of receptors adversely affected was estimated at 88.

Alternative 5 appears to result in the least number of receptors adversely affected by the project (estimated at a total of 69), while Alternative 6 would result in approximately 83 receptors being adversely affected.

Alternatives 7 and 8 were estimated to result in a relatively higher number of residences that would experience a greater than 15 dBA increase in noise. Consequently, these two Alternatives are expected to have a relatively high number of receptors that are adversely impacted (estimated at 123 for Alternative 7 and 124 for Alternative 8).

Table 4.8-1

SUMMARY OF SENSITIVE RECEPTORS AFFECTED BY PROJECT ALTERNATIVES

Project Alternatives	ROWs[1]	Number of Receptors >67 dBA[2]		Receptors >15 dBA[3]		Total Adversely Impacted	
		w/out[4]	w/ Barriers[4]	w/out	w/ Barriers	w/out	w/ Barriers
1990							
Existing	0	22	NA	0	NA	22	NA
2010							
No Build	0	31	NA	0	NA	31	NA
Alt. 3	41	39	37	34	3	114	81
Alt. 4	51	43	37	45	5	139	93
Alt. 5	40	41	40	28	4	109	84
Alt. 6	47	44	39	39	6	130	92
Alt. 7	13	41	34	82	15	136	62
Alt. 8	16	41	34	83	15	140	65

[1]Receptors are in the right-of-way of the proposed highway alignment and will have to be relocated.

[2]Receptors experiencing hourly Leq equal to or greater than 67 dBA.

[3]Receptors expected to have an increase of greater than 15 dBA over the existing condition.

[4]Without and with noise barriers.

Mitigation Measures

Noise mitigation measures are considered for any of the receptor sites that approach or exceed the FHWA's noise abatement levels or the State's relative criterion.

In general, traffic noise impact can be alleviated by one or some combination of the following mitigation measures:

- Traffic restrictions. These could involve prohibiting trucks (especially heavy trucks) from the use of certain roads.

- Changes in the highway alignment and/or its vertical profile. These involve moving the proposed highway away from noise-sensitive sites, reducing areas with grade or using existing elevations to break the line-of-sight from the receptor to the highway.

- Soundproofing of noise-sensitive sites. These would improve the situation indoors but would offer no protection for outdoor use of the impacted sites.

- Property acquisition. Aside from property taking because the affected property is in the right-of-way, property acquisition to create a buffer zone is another method of noise abatement, if some of the other measures are not effective or practical.

- Noise barriers. These would involve erecting physical structures or earth berms to shield the affected receptor site from traffic noise.

The proposed highway will be a principal arterial intended to relieve traffic congestion on local streets in project area by diverting through traffic not destined for the Nashua-Hudson Central Business Districts. Restricting the use of this highway by certain vehicle categories would defeat its intended purpose.

Highway alignments have been the subject of the intensive investigation in earlier phases of this study. The Full Build Alternative alignments evaluated here represent the final choices, taking into account impacts on other environmental factors such as wetlands, and other engineering considerations.

Soundproofing of noise-impacted buildings and residences is generally not considered until all other options have been exhausted. This mitigation measure also offers no protection for outdoor use at the impacted sites.

Property acquisition to create a buffer zone, other than acquisition of those properties that fall in the right-of-way, is an option not being pursued at this time because of the large amount of land that would have to be purchased.

Noise Barriers

Because of the constraints on alternative options, the current mitigation effort focuses on constructing noise barriers between the highway and the impacted receptors.

Based on the noise analysis conducted to date, the approximate locations where noise barriers will be considered are shown in Figure 4.8-1. Some of these locations may be eliminated from consideration once more detailed information on project impacts becomes available.

Alternative 3. Nine areas were identified where noise barriers may be considered. In Figure 4.8-1, they are shown as locations 1, 2, 3, 5, 6, 8, 9, 11 and 12.

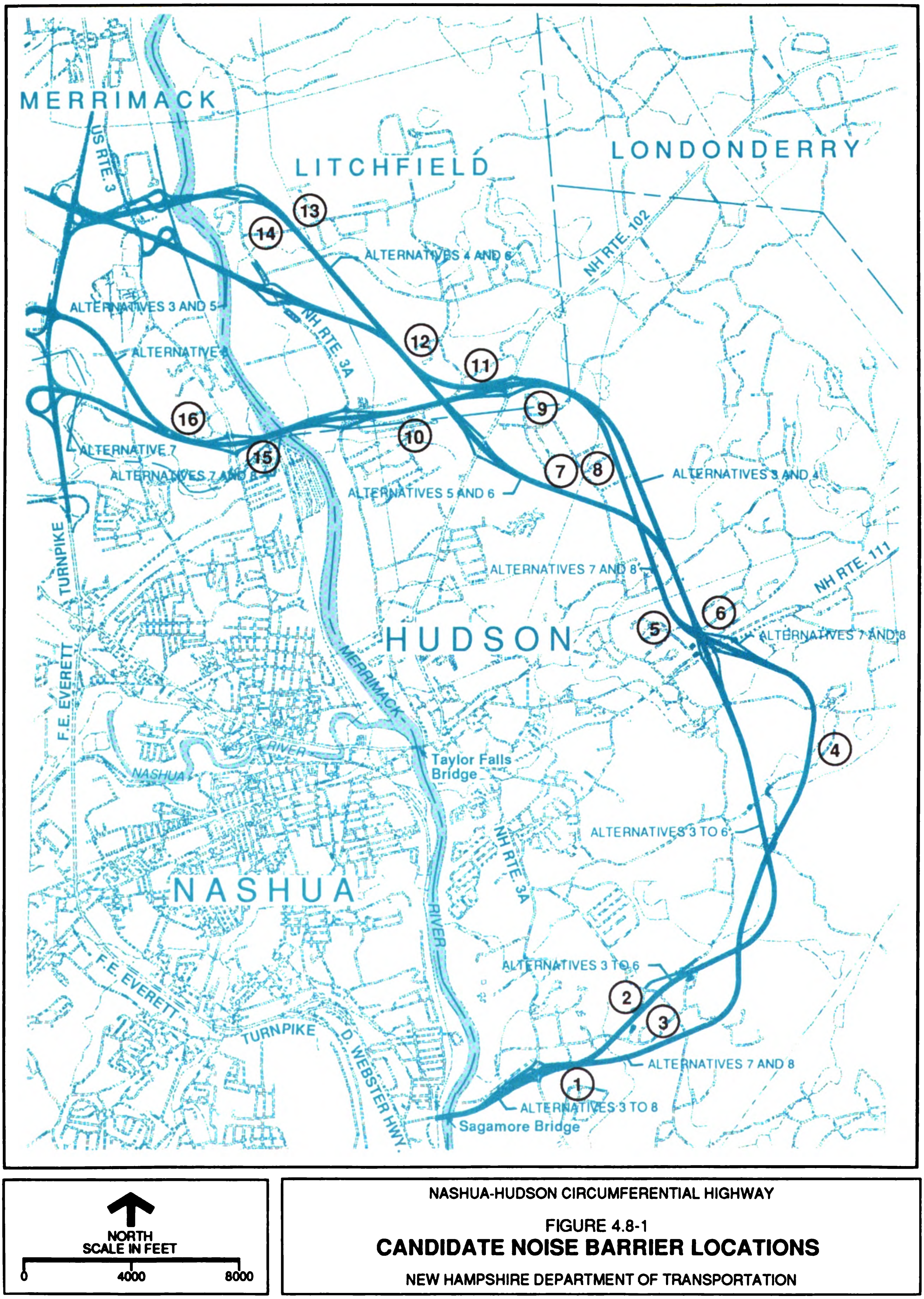
Alternative 4. Eleven areas were identified where noise barriers may be considered. They are shown as locations 1, 2, 3, 5, 6, 8, 9, 11, 12, 13, and 14.

Alternative 5. Seven areas were identified where noise barriers may be considered. They are shown as locations 1, 2, 3, 5, 6, 7 and 12.

Alternative 6. Nine areas were identified where noise barriers may be considered. They are shown as locations 1, 2, 3, 5, 6, 7, 12, 13, and 14.

Alternative 7. Ten areas were identified where noise barriers may be considered. They are shown as locations 1, 4, 5, 6, 8, 9, 10, 11, 15, and 16.

Alternative 8. Because Alternative 8 follows the same alignment as Alternative 7 for much of the corridor, the same ten areas identified in Alternative 7 for possible barrier construction are also applicable under this alternative.



NASHUA-HUDSON CIRCUMFERENTIAL HIGHWAY

FIGURE 4.8-1
CANDIDATE NOISE BARRIER LOCATIONS

NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

Construction Noise

Noise impacts from construction activities are closely related to the phase of construction and the type and placement of construction equipment at the site.

Construction noise impacts associated with this project can be mitigated by installing mufflers, enclosures and noise barriers, and by restricting construction activities to those hours which are relatively less sensitive to noise intrusions.

More exact description of the noise impact and the associated mitigation measures should be defined later on in the study process, as the construction schedule is finalized.

4.9 VISUAL AND AESTHETIC IMPACTS

Impacts to visual and aesthetic resources within the study area fall into three categories: short-term, long-term, and secondary. Short-term impacts are related to construction activities. These will be adverse as they will create sharp contrasts to the existing surroundings. Fortunately, these unavoidable impacts will be offensive to nearby residents only during this early construction phase of the project. Examples of short term impacts include right-of-way vegetation removal, cut and fill operations, stockpiling, and the general presence of heavy equipment in the area.

Long-term impacts relate to the presence and operation of the highway. These impacts are considered from two perspectives: the view of the roadway and the view from the roadway. As with any major roadway corridor through a rural area, the Nashua-Hudson Circumferential Highway would result in significant changes in the visual setting. Nearby residents would sacrifice pleasant rural scenery for a view of cleared vegetation, constant vehicular movement, headlight reflections, noise barriers, retaining walls and other roadway structures. Over time, however, the visual and aesthetic impact would diminish as vegetation would slowly soften the abruptness of the right-of-way intrusion, screening nearby residents' visual perception of the roadway.

No Build, Transit/TDM and TSM Alternatives

These alternatives would effectively preserve the visual and aesthetic quality of the existing environment. However, the implementation of the No Build Alternative would subject travelers to the sight of an increasing number of vehicles on the existing roadway network. This increased congestion would diminish the visual and aesthetic quality of the areas roadways and surroundings. The Transit/TDM and TSM Alternatives may produce a slight decrease in traffic congestion during peak periods. This would provide some aesthetic enhancement, although it would be temporary, given the population growth rate of the region.

Build Alternatives

Views from the Highway. The primarily rural character of the region would provide motorists with attractive views of the surrounding area. The elevation in eastern and southeastern Hudson would enable motorists to gain panoramic views of the region when emerging from the proposed cuts near Bush Hill Road and Kimball Hill Road. Additionally, the expansive Second Brook system and its associated wetlands could be seen from all Alternative alignments in this region. The highway would include two bridges across the

Merrimack River, thus creating additional vantage points from which to view the scenic beauty of the waterway. The undeveloped Pennichuck Reservoir and its white pine upland would provide visual pleasure to motorists if Alternative 7 or 8 is implemented.

A 36-hole golf course near the Sagamore Bridge would offer a serene view, as would the agricultural areas in southwestern Litchfield along the shores of the Merrimack River. The remaining sections of all alternative alignments traverse various residential, commercial and industrial developments with minimal visual and aesthetic qualities.

Views of the Highway. The construction and operation of the Circumferential Highway would affect water resources, forest vegetation, wetlands, hillsides, agriculture, and residential zones. These resource impacts would adversely affect the visual and aesthetic quality of the environment for residents with a direct view of the roadway. The impact would be strongest in areas where interchanges encroach on residential districts, namely in the vicinity of N.H. Routes 102, 111, and 3A. The urban character of this landscape unit is more visually compatible with new roadway development than undeveloped areas, but neighbors of the highway will find it obtrusive.

Historic Districts are also sensitive to aesthetic and visual impacts created by a roadway. The Historic Preservation Act of 1966 states that, "criteria for adverse effect include the introduction of visual elements that are out of character with the district or alter its setting." *Two historic districts that are eligible for the National Register of Historic Places may encounter adverse visual and aesthetic impacts depending on the selected alternative. The Jasper Poultry Farm Historic District will be impacted by Alternatives 3, 4, 7, and 8 and the Pennichuck Water Works Historic District will be impacted by Alternatives 7 and 8. In addition to these historic districts, the Benson's Wild Animal Farm Historic District may become impacted as a result of wetland creation included as part of the wetland mitigation plan associated with each Full Build Alternative alignment.*

Mitigation

The following is a list of techniques which may be employed to mitigate adverse visual and aesthetic impacts:

- Highway construction in staged segments.

- Curvilinear highway design - Highway design will take into account compatibility with local topography and natural features.

- Landscape screening techniques - Plantings and revegetation of cut and fill slopes, aesthetically designed stormwater renovation measures.

- Enhanced structural design - Retaining walls, bridges, noise barriers, drainage structures.

- Periodic watering during construction to minimize the spread of dust in the area.

- Proper maintenance - Litter pick-up, mowing practices, paving, and painting structures in less conspicuous earth tone colors.

- Signing and lighting techniques.

- Provide scenic vistas.

4.10 TERRESTRIAL ECOLOGY

Impacts to the terrestrial ecology will include impacts to various resources such as wetlands, wildlife, and waterbodies; all are addressed separately in this document. Other resources, addressed here, include losses of various undeveloped habitats such as forests, barren areas, fields, portions of the complex mixture of each of these habitat types, the vegetation, and unique natural communities comprising these habitats within the landscape of this project. Interwoven within these habitats is a complicated mixture of development, including high and low density residential, commercial, industrial, and municipal land uses.

Of the four unique natural community types found within the study area as identified by the New Hampshire Department of Resources and Economic Development (NHDRED), only Alternatives 4 and 6 will impact one of these natural community types. These Alternatives will each impact two wetlands in Litchfield characteristic of Inland Basin Marsh communities. These communities have been identified, evaluated in detail, and presented in the Wetlands Technical Report.

Landscape modifications will be consistent with other development modifications in the study area. Some undeveloped, "natural" communities will be altered in the vicinity of the roadway; however, none of these communities are rare or demonstrably significant. No significant losses of these habitats will occur with any of the proposed alternatives. Changes in the vegetative community will include loss of some vegetation within the impact areas of the proposed roadway, and some slight changes in species composition in the areas adjacent to the roadway.

Some local modification to terrain and soils within the impact areas of the project will occur. No significant adverse impacts to soils or geology within the study area are anticipated.

Endangered and Threatened Plant Species

No federally listed, Threatened, Endangered, or Candidate plant species have been identified within the study area, hence no impacts are anticipated.

NHDRED, Natural Heritage Inventory, has identified one state-listed, Endangered plant species as having occurred in the vicinity of one alignment. Alternatives 7 and 8, along a common alignment, cross an area identified as having an historical record of Walking Fern Spleenwort (*Camptosorus rhizophyllus*). This plant was last observed in 1939, and is believed to no longer occur in the vicinity of the alignments. No impact to this state-listed, Endangered species is anticipated.

Four state-listed, Threatened plant species have been identified as having historically occurred in the vicinity of several proposed alignments. According to NHNHI information, Burgrass (Cenchrus longispinus) *was found in 1984 near U.S. Route 3 in Merrimack and also in the general vicinity of the proposed northern interchange between alignments 3, 4, 5 and 6 with the F.E. Everett Turnpike. Another species, Blunt-leaved Milkweed,* (Asclepias amplexicaulis) *occurs near U.S. Route 3 in Merrimack. The other two state-listed Threatened plant species, River Birch* (Betula nigra) *and American Plum* (Prunus americana), *have historical records along the bank of the Merrimack River, south of the Sagamore Bridge. Burgrass was not encountered during field investigations, although a comprehensive search for this plant was not undertaken.*

All Build Alternatives, 3 through 8, will cross the river in the area immediately adjacent to the existing Sagamore Bridge; hence, some minor disturbance to the state-listed river bank species may occur. Overall, impacts to the two potential species is anticipated to be negligible, and will be readily mitigated if any of the trees are encountered. Planting similar species or transplanting young saplings of these species from any impact area to an adjacent similar habitat will be facilitated if they are encountered.

A thorough search was conducted for Blunt-leaved Milkweed in the area of historical occurrence, and no specimens were encountered. No impacts to this Threatened species are anticipated. If encountered, impacts to this plant will be mitigated by transplanting specimens to similar habitat.

4.11 WILDLIFE

If the proposed Nashua-Hudson Circumferential Highway is constructed, the impact on wildlife species and habitats would vary depending on which alternative is selected. The No Build, Transit/TDM and TSM Alternatives will not result in any additional habitat loss or modification.

Impact differences between the various Build Alternatives are not substantial; however, they are differentiated in Table 4.11-1 by several criteria: number of stream crossings, total number of wetland acres impacted, overall habitat loss, habitat fragmentation, endangered species habitat, and notable habitats that would be affected by the proposed Alternative.

As indicated by the table, Alternative 5 would likely result in the least impact to wildlife habitats and species, while Alternative 7 would likely result in the greatest impact. However, the range of impacts between Alternatives 5 and 7 is not large.

Corridor Impacts

Alternatives 3 and 5 cross the least number of streams while Alternatives 7 and 8 cross the most. These stream crossings may be considered as minor wildlife corridor disruptions and their impacts can be mitigated with bridge or culvert designs.

Wetland Habitats

Another consideration related to wildlife impacts is the impact to wetlands. Since wetlands are considered higher value wildlife habitat, wetlands impacts may be indicative of potential wildlife impacts. The least wetland acreage impact occurs with Alternative 6 (54 acres), while the greatest impact occurs with Alternative 7 (93.5 acres).

Table 4.11-1

IMPACTS ON WILDLIFE HABITATS AND SPECIES

Alt	# Stream Crossings	Wetland Acres Impacted	Number of Wetlands with Wildlife as Principal Function	Undeveloped Habitat Impacted (acres)	Notable Habitats Affected
3	13	78.2	14	511	Second Brook Wetlands Anheuser-Busch Swamp
4	14	66.6	15	527	Second Brook Wetlands Pocket Wetlands
5	13	65.6	15	513	Second Brook Wetlands Anheuser-Busch Swamp
6	14	54.0	15	529	Second Brook Wetlands Pocket Wetlands
7	18	93.5	21	641	Upper Limit Brook Second Brook Wetlands Lower Pennichuck Brook Pennichuck Reservoir
8	18	87.5	21	641	Upper Limit Brook Second Brook Wetlands Lower Pennichuck Brook

Wetlands were field evaluated for functions, including wildlife habitat. The assessment of wetlands along proposed alignments led to conclusions of principal functions. Total wetland intercepts with principal functions as wildlife habitat have been tabulated. The alternative with least intercepted wetlands with wildlife habitat as a principal function was Alternative 3 (14 wetlands) while Alternatives 7 and 8 intercepted the most wetlands with wildlife habitat as a principal function (21 wetlands).

Undeveloped Habitat Areas

Undeveloped land considered as wildlife habitat areas has been quantified and listed in Table 4.11-2. Alternatives 3, 4, 5 and 6 will impact nearly the same amount of undeveloped land, (approximately 520 acres). Alternatives 7 and 8 both impact almost 20 percent more undeveloped land (641 acres). Undeveloped land impacts cannot be considered alone, in that habitat acreages do not represent quality or value of this habitat for wildlife.

Notable Habitats

Field assessment of habitats along the proposed corridors reveals six important wildlife habitat areas. These include: (1) Second Brook wetland system, (2) Upper Limit Brook, (3) Lower Pennichuck Brook, (4) Pocket wetlands in Litchfield characteristic of basin marshes, (5) the bottom land swamp near the Anheuser-Busch plant, and (6) the Pennichuck Reservoir. Alternatives 3, 4, 5 and 6 impact only two of these habitats, while Alternative 8 impacts three and Alternative 7 impacts four habitats. Table 4.11-1 reports the notable habitats impacted by each alternative.

Fragmentation Impacts

Fragmentation impacts were considered in this study by reviewing impacts associated with roadways crossing areas of very sparse or no development. Fragmentation impacts are most noticeable and important in areas of large contiguous blocks of undeveloped natural habitat. Although undeveloped blocks of habitat have been identified for this study, these blocks can be characterized as variously disturbed, patchy suburban landscape. Fragmentation impacts associated with the proposed roadway are nearly identical between all Build Alternatives. When considering portions of alignments, some sections may be perceived as better or worse than others, depending upon perspective.

Table 4.11-2

WILDLIFE HABITAT IMPACTS
(Acres)

ALTERNATIVES	FIELDS						SURFACE WATER						BARREN/EXCAVATED						WOODLAND						TOTAL UNDEV.	DEVELOPED AREAS						TOTAL ROW
FULL BUILD Sagamore Bridge to F.E. Everett Turnpike																																
3	78.0						8.0						26.0						399.0						511.0	77.0						588.0
4		61.0						13.0						27.0						426.0					527.0		97.0					624.0
5			79.0						8.0						15.0						411.0				513.0			72.0				585.0
6				62.0						13.0						16.0						438.0			529.0				92.0			621.0
7					97.0						8.0						43.0						493.0		641.0					74.0		715.0
8						97.0						8.0						43.0						493.0	641.0						74.0	715.0
SOUTHERN SECTION Sagamore Bridge to N.H. Route 111																																
* 3	24.0						0.0						2.0						196.0						222.0	54.0						276.0
* 4		24.0						0.0						2.0						196.0					222.0		54.0					276.0
* 5			24.0						0.0						2.0						196.0				222.0			54.0				276.0
* 6				24.0						0.0						2.0						196.0			222.0				54.0			276.0
* 7					25.0						0.0						2.0						270.0		297.0					50.0		347.0
* 8						25.0						0.0						2.0						270.0	297.0						50.0	347.0
CENTRAL SECTION N.H. Route 111 to N.H. Route 102																																
* 3	15.0						1.0						23.0						86.0						125.0	9.0						134.0
* 4		15.0						1.0						23.0						86.0					125.0		9.0					134.0
* 5			16.0						1.0						12.0						98.0				127.0			4.0				131.0
* 6				16.0						1.0						12.0						98.0			127.0				4.0			131.0
* 7					11.0						0.0						39.0						110.0		160.0					17.0		177.0
* 8						11.0						0.0						39.0						110.0	160.0						17.0	177.0
NORTHERN SECTION N.H. Route 102 to F.E. Everett Turnpike																																
3	39.0						7.0						1.0						117.0						164.0	14.0						178.0
4		22.0						12.0						2.0						144.0					180.0		34.0					214.0
5			39.0						7.0						1.0						117.0				164.0			14.0				178.0
6				22.0						12.0						2.0						144.0			180.0				34.0			214.0
7					61.0						8.0						2.0						113.0		184.0					7.0		191.0
8						61.0						8.0						2.0						113.0	184.0						7.0	191.0

* Coincident alignments

Wildlife Species

The entire study area contains a typical assemblage of wildlife species for southern New Hampshire. The effects of development (urbanization) and fragmentation of the region are evidenced by the species composition. Most species occupying the study area will continue to occupy the study region even with the addition of a new roadway. Changing the existing landscape as a result of the proposed roadway will affect some local species distributions, but in context of the already changing character of the study area, these impacts will be less noticeable.

No impact to fish populations, including anadromous fish, is anticipated.

Rare, Threatened, or Endangered Species

Federal. A Biological Assessment entitled, ***Bald Eagle Impacts Associated with the Proposed Nashua-Hudson Circumferential Highway,*** *dated April 1993, was prepared by the Corps in accordance with Section 7(c) of the Endangered Species Act of 1973 (ESA), due to the presence of the endangered Bald Eagle* <u>(Haliaeetus leucocephalus)</u>, *in the area of a major Federal construction project. Bald Eagles, which winter along the Merrimack River, are the only species listed pursuant to the ESA known to be present in the Nashua-Hudson Circumferential Highway project area. No federally designated critical habitat is present.*

The Biological Assessment identified the most important resources for the Bald Eagle in the project area as the food and feeding habitat provided by the Merrimack River and its associated riparian corridor. While eagles in the project study area may forage along the entire river, the fast water (riffle) area behind the Anheuser Busch Company in Merrimack is of greatest importance. Second, several relatively large blocks of intact forest in the study area were identified that may serve as night roosting habitat for wintering eagles. However, it was not possible to document that Bald Eagles are currently utilizing any of the potential night roosts. Based on these facts, the Corps concluded the following in the Biological Assessment for the various alternatives.

1. *Alternatives 1 (No Build) and 2 (Transit/TDM and TSM) are not likely to adversely effect the Bald Eagle.*

2. *Alternatives 3 and 5 are likely to adversely affect the Bald Eagle since these alternatives cross the Merrimack River about one-half mile downstream of the most valuable feeding habitat and may influence continued utilization of it by eagles. Alternatives 3 and 5 also impact perching habitat adjacent to*

feeding areas and would fragment the largest block of contiguous potential night roost habitat present.

3. *Alternatives 4 and 6 cross the Merrimack River at the most valuable Bald Eagle feeding habitat, bisecting it. Therefore, these alternatives are likely to adversely affect the Bald Eagle.*

4. *Based on current information, Alternatives 7 and 8 do not affect important feeding, perching or roosting habitat. Therefore, these alternatives are not likely to adversely affect Bald Eagles.*

The Biological Assessment was forwarded to the FWS via a letter dated May 5, 1993 for their review and concurrence relative to its findings concerning the potential affects of the project on the Bald Eagle. The FWS concurred with the findings of the Biological Assessment as stated in a letter to the Corps dated June 2, 1993.

In addition, they stated that if Alternatives 1, 2, 7 or 8 are selected to be permitted, no further Section 7 ESA consultation need occur. However, if Alternatives 3, 4, 5 or 6 are selected, formal consultation should be initiated promptly.

State. The State of New Hampshire Fish and Game Department (NHF&G) has also designated the study area as having the occurrence of state-listed, Endangered Bald Eagles. Pennichuck Brook was designated by NHF&G as appearing "to be high quality winter habitat." NHF&G also stated there has been no monitoring of this site for eagle occurrence (Tappan, NHF&G, pers. com. 1991).

NHDRED, Natural Heritage Inventory has identified wildlife species from within the general study area that are considered rare in New Hampshire. Two reptiles (Blandings turtle and Eastern hognose snake) and two amphibians (Blue-spotted and Four-toed salamanders) were listed, but not encountered along any alignment during any field work. In all instances these herpetiles are considered globally secure. However, the Blandings turtle and Eastern hognose snake are rare in the state, while the salamanders are secure but less common in population in the state.

In consideration of state-listed rare, threatened, endangered or protected species, other than Bald Eagles mentioned above, no impacts have been identified for any alternative. Alternatives 4 and 6 may affect potential Blandings turtle habitat; however, their presence is not documented along these alignments. All Build Alternatives may encounter some habitat containing the characteristics essential to support Eastern hognose snakes, Blue-spotted salamanders and Four-toed salamanders; however, their presence is not documented along any alignment.

No other state-listed threatened or endangered species have been identified in the study area. State-listed Species of Concern have been identified as occurring or having occurred previously in the general study area, but not directly within any Build Alternative corridor.

Mitigation

Opportunities to reduce or eliminate impacts to wildlife as a result of the proposed roadway include both general and site specific recommendations. General considerations include:

- Design a roadway with minimal width, with least right-of-way requirements.

- Avoid higher value or notable habitats.

- Cross riparian habitats on bridge structure or utilize culverts to facilitate wildlife movement.

- Place culverts as required in upland areas for wildlife movement.

- Design stream channel crossings such that fish can travel freely up or down stream.

- Utilize standard Best Management Practices to protect the environment and water quality.

- Maintain wetland hydrologic characteristics to minimize ecological changes to these areas.

- Retain or place dense vegetative barriers for noise and disturbance abatement.

- Utilize fencing along roadway right-of-way to restrict wildlife movement across road surfaces.

- Enhance habitat areas for wildlife with plantings such as food sources.

- Purchase undeveloped open space as buffer for wetlands or purchase higher value habitat areas for preservation.

- Create wetlands to mitigate wetland losses and design created or enhanced wetlands to serve as valuable wildlife habitat.

Specific mitigation suggestions include:

1. Provide a bridge or culvert structure at Upper Limit Brook wetland and consider means of providing protection for this wetland.

2. Cross Second Brook wetland system with bridge or culvert crossings to allow wildlife movement along the riparian corridor.

3. Cross the Lower Pennichuck Brook on a bridge, or culvert, and minimize riparian disturbance.

4.12 WATER RESOURCES

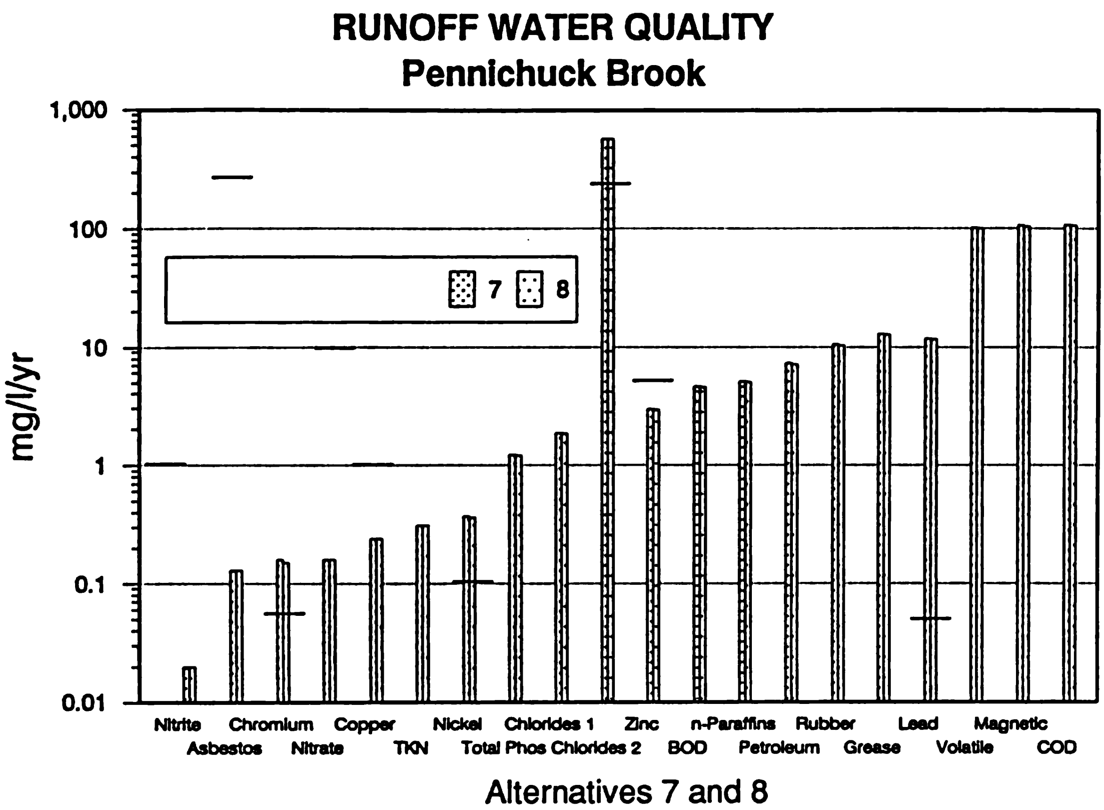
Study Area Drainage Basins

All streams and waterbodies within the study area have water quality classification B, suitable for recreational use, fish and wildlife habitat and agricultural and industrial use. Dissolved and suspended contaminants in roadway and urban runoff presently enter these waterbodies as a result of the existing land use occurring in the drainage basins. Water from the Pennichuck Brook is used to supply drinking water to the city of Nashua. The Merrimack River provides drinking water to several towns down stream in Massachusetts. These two water sources are treated before use.

Figure 3.12-1 shows the Full Build Alternative alignments passing through the drainage basins and their corresponding waterbodies which would have water quality impacted by each alignment. Alternatives 7 and 8 pass through the Pennichuck Brook drainage basin. Without mitigation, these alignments could affect the Pennichuck's water quality. Alternative 7 passes over Bowers Pond, part of Pennichuck Brook, increasing the risk of hazardous material spills directly into the waterbody.

The concentrations of various contaminants shown in Figure 4.12-1 are essentially equal for each alternative alignment. Drinking water standards for zinc, chromium, chloride, nickel and lead will be exceeded before mitigation. After mitigation the concentration of zinc will be below the standard for drinking water. These concentrations were calculated by modeling the mix of traffic generated pollutant loading onto the roadway surface with stormwater runoff from the roadway and other surfaces which will enter the highway drainage system.

The amount of contaminated runoff entering the various waterbodies will not increase by the total amount calculated because local traffic in the drainage basins exists now and will exist after an alternative alignment is constructed. Some of this local traffic will be diverted onto the Nashua-Hudson Circumferential Highway and deposit pollutants on it instead of on other roads. Therefore, this "existing" traffic will not cause an increase in pollutant concentration in stormwater. Also the diverted existing traffic will use a new facility which will incorporate stormwater renovation measures. Traffic predictions for the 2010 design year show a decrease from existing average daily traffic on most secondary roads in Hudson and Litchfield. This decrease in traffic volumes may assist in reducing traffic generated pollution effects on water quality.



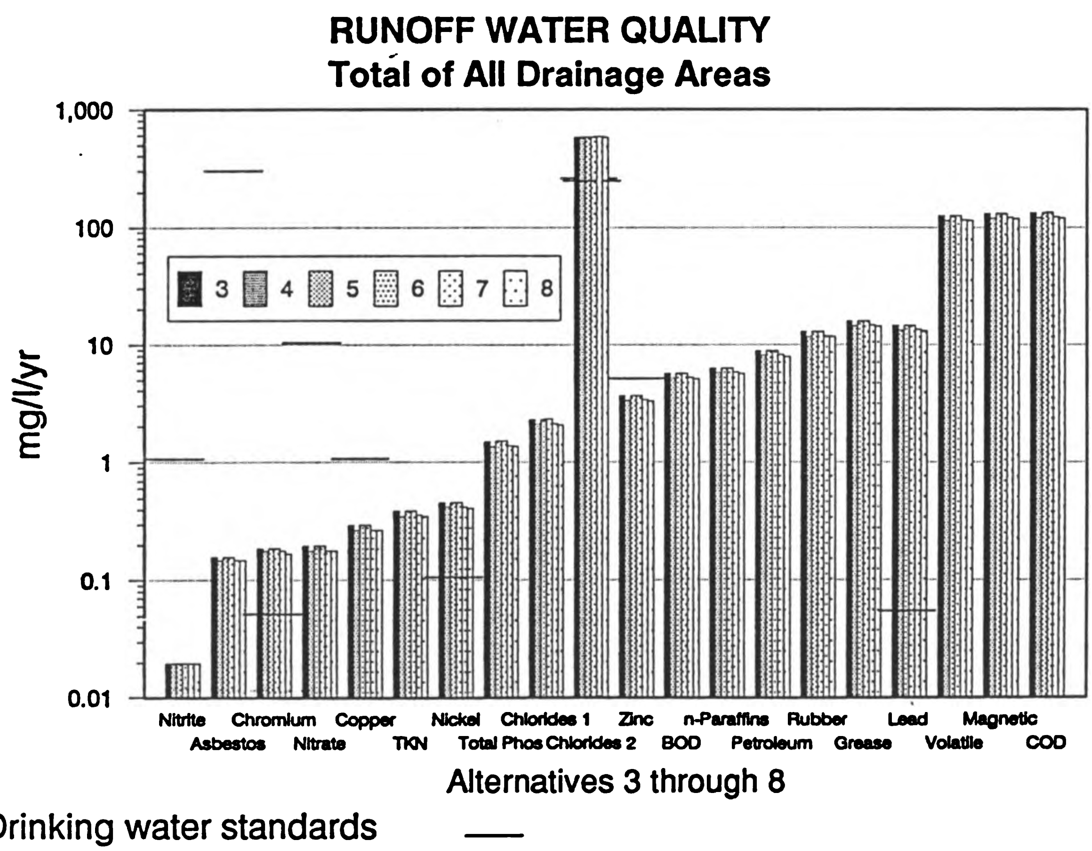


FIGURE 4.12-1

RUNOFF WATER QUALITY BY ALTERNATIVE
PENNICHUCK BROOK AND ALL DRAINAGE AREAS

The concentration of deicing salts in runoff from a constructed alignment will increase by an amount proportional to the roadway length of that alternative alignment. Roadway salting is dependent on the length and number of lanes of travelway and frequency of storms and independent of traffic volume. Alternatives 7 and 8 pass through the Pennichuck Brook. Consequently, the salinity of that water supply reservoir may increase if runoff is allowed to enter the ground or surface water of that basin.

Transportation-related spills of hazardous materials can impact water quality and other resources. Spills may occur on any of the alternative alignments as they can on any highway. The frequency of all types of spills is dependent on the length of travel route being analyzed and the amount of truck traffic which passes over that route within a given time period.

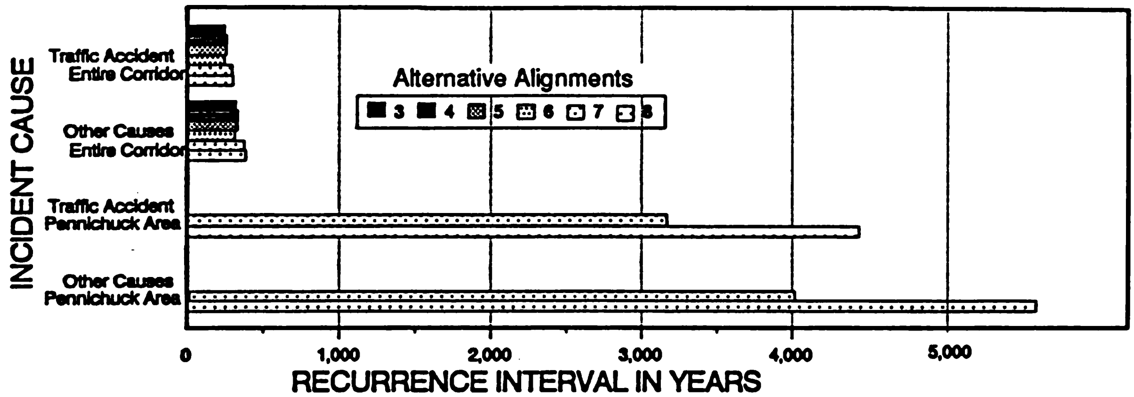
The estimated recurrence interval of all spills, severe spills and catastrophic spill incidents were calculated for truck routes through the entire lengths of the studied alternative alignments and for Alternatives 7 and 8 through the Pennichuck drainage area and for the southern, central and northern sections of each alternative alignment. The recurrence interval of spills caused by traffic accidents will be 29.6 years for Alternative 3; 30.8 years for 4; 30.5 for 5; 28.9 for 6; 34.8 for 7; and 35.3 years for Alternative 8. A catastrophic spill caused by a traffic accident impacting the Pennichuck Brook basin will occur once every 3,180 years on average if Alternative 7 is selected and once every 4,425 years if Alternative 8 is selected. (see Figure 4.12-2.)

Land use has a direct impact on water quality and other resources. Increases in land use will occur along the study corridor over time regardless of which alternative alignment is chosen, although the rate of development along the corridor will accelerate as a result of the construction. Impacts to water quality as a result of development vary by the type and location of development. Generally, increased activity will occur at the interchanges with the F.E. Everett Turnpike, U.S. Route 3, and N.H. Routes 3A, 111 and 102. Development near the northern terminus should therefore be regulated by Merrimack to protect the Pennichuck Brook.

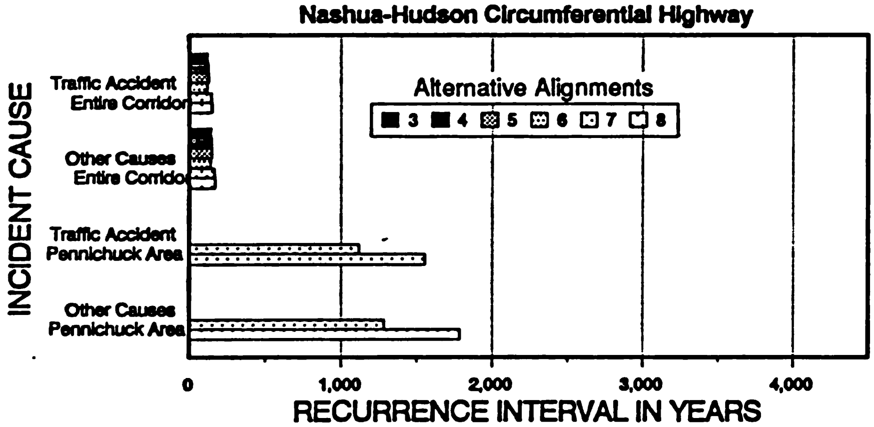
Mitigation

Direct discharge of highway runoff to waterbodies will be avoided where possible and appropriate to maintain surface and groundwater quality. The removal of suspended solids is an important factor in the renovation of

Probability of a Catastrophic
Hazardous Material Incident on the Nashua-Hudson Circumferential Highway



Probability of a Severe
Hazardous Material Incident on the Nashua-Hudson Circumferential Highway



Probability of a
Hazardous Material Incident on the Nashua-Hudson Circumferential Highway

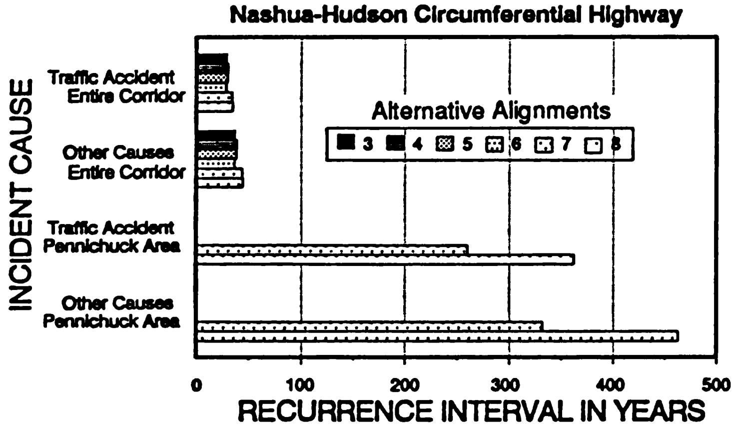


FIGURE 4.12-2

PROBABILITY OF HAZARDOUS MATERIAL INCIDENTS

ON THE NASHUA-HUDSON CIRCUMFERENTIAL HIGHWAY

(CATASTROPHIC / SEVERE)

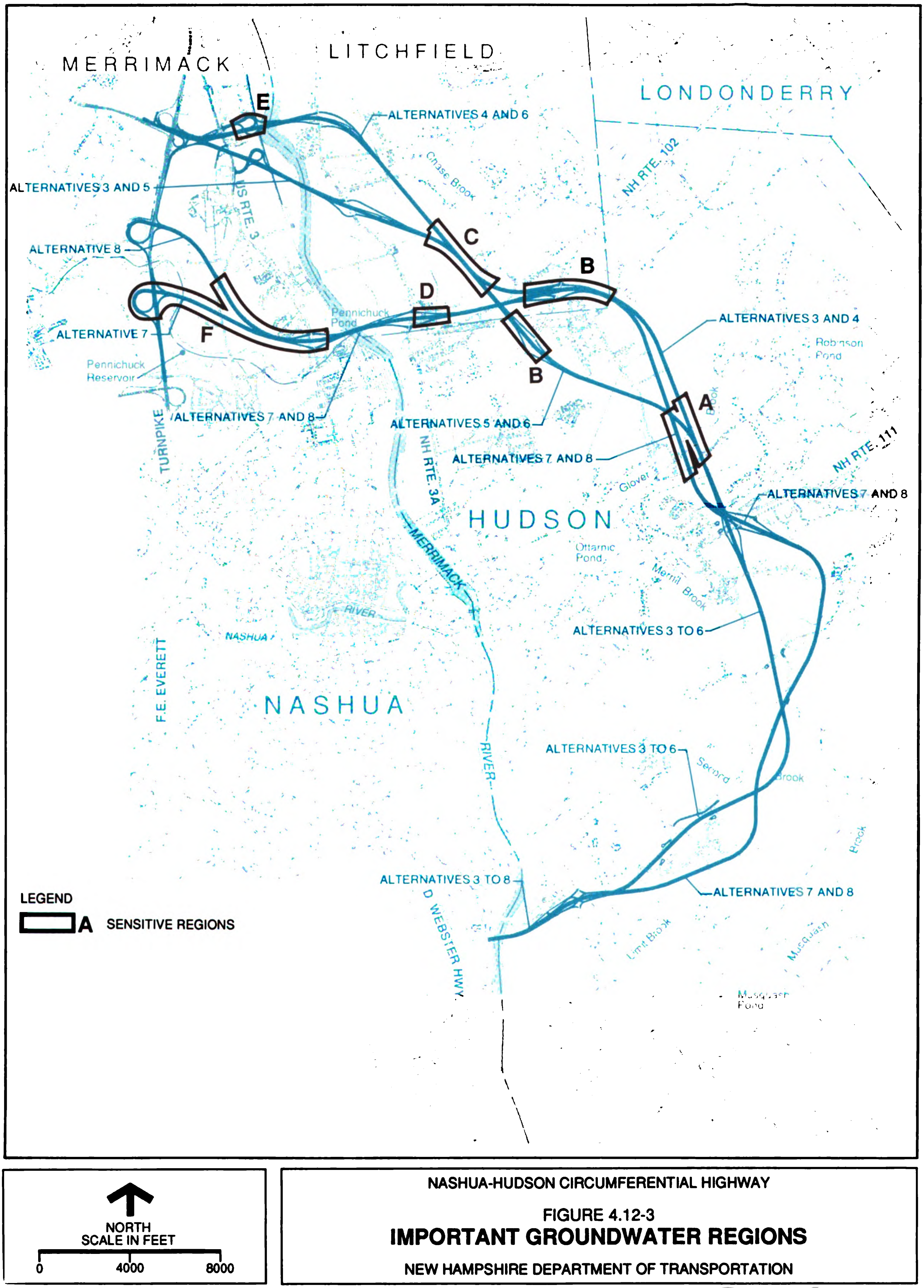
stormwater. This will be accomplished by directing discharges to vegetative controls, such as grassy drainageways, filter strips, overland flows and wetlands. Similarly, catch basin design with deep sumps and maintenance will improve water quality.

Diversion of runoff from water supply reservoirs will prevent impacts from salt and other runoff contaminants.

Wells and Aquifers

This analysis shows that all Build Alternative alignments cross substantially similar amounts of surface acres underlain by aquifers. However, an in-depth examination into the characteristics associated with these aquifer resources reveals some important differences. Similarly, all alignments are located in the vicinity of an equal number of wells, yet a closer look at individual well attributes shows some significant differences.

There are essentially six locations along a generic corridor that deserve special consideration. These are shown in Figure 4.12-3. They include, from south to north: (A) the Ottarnic Pond aquifer underlying Brox Industries; (B) the aquifer and wells in the vicinity of N.H. Route 102; (C) the high production Weinstein Well near Cutler Road in Litchfield; (D) the southwestern corner of Litchfield along N.H. Route 3A; (E) the aquifer and wellfield associated with the Anheuser-Busch property; and (F) the Pennichuck Reservoir. Table 4.12-1 identifies which alignments pass by these six areas, followed by a summation of sites per alignment.



NASHUA-HUDSON CIRCUMFERENTIAL HIGHWAY

FIGURE 4.12-3
IMPORTANT GROUNDWATER REGIONS

NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

Table 4.12-1

ALIGNMENTS IN RELATION TO IMPORTANT GROUNDWATER REGIONS

Alignments	Sites
3,4,5,6,7,8	Brox/Ottarnic Pond Aquifer
3,4,5,6,7,8	NH Route 102 Aquifer and Wells
3,4,5,6	Weinstein Well
7,8	Southwest Litchfield along NH Route 3A
7,8	Pennichuck Reservoir
4 and 6	Anheuser Busch Aquifer and Wellfield

Alignment	Number of Sites
3	3
4	4
5	3
6	4
7	4
8	4

Although Alternatives 7 and 8 pass near four of these identified sites, and directly impact four wells, two of which service Olson's Mobile Home Park, these corridors are presumed to have the least overall impact on groundwater resources, especially if recommended Best Management Practices are instituted. The main constraint for Build Alternative alignments 3 through 6 is their proximity to the Weinstein Well, the major public groundwater supply in the region. The Pennichuck Reservoir, the major surface water supply, is crossed by Alternative 7. But, when considering groundwater impacts, the other alignments are of greater concern, especially with regard to potential spills. Alternatives 7 and 8 directly impact wells associated with Olson's Mobile Home Park, but the owners are planning to drill a new well in the northeast corner of their property. This well will provide high quality groundwater once again to the residents of the park.

All alignments cross the extensive recharge area associated with the Ottarnic Pond Aquifer near Brox Industries. Impacts here are seen as negligible primarily because of the poor quality of the existing groundwater contained within the aquifer. All Build Alternative alignments are designed to cross N.H. Route 102 between Alvirne High School and the Tabernacle Baptist Church. Many wells occupy this area and may be impacted to differing degrees as stated in the "Wells and Aquifers" Technical Report, but to differentiate which alignment is better in this region is difficult. There are nine wells in the vicinity of N.H. Route 102. Of these wells, only one non-community well will be directly impacted by Alternatives 5 and 6. The other wells may be indirectly impacted by highway runoff. Final design mitigation measures in this area should greatly minimize any adverse impacts no matter which alignment is chosen.

Alternatives 4 and 6 cross an area underlain by the aquifer associated with the Anheuser-Busch property as well as encroach upon the extensive wellfield situated in this resource. Protective measures here will involve the diversion of runoff away from the area. In this way, untreated runoff will not be allowed the opportunity to infiltrate the ground surface in the immediate vicinity of the aquifer.

Considering Alternatives 7 and 8, on the western side of the Merrimack River, Alternative 8 would be the alignment of least impact with respect to groundwater. This is because it does not cross the Pennichuck Reservoir and its associated aquifer. Instead, the alignment is designed to diverge from Alternative 7 just prior to crossing the reservoir and travel up and around the reservoir to the north where it ultimately connects with the F.E. Everett Turnpike.

Mitigation

The construction and subsequent operation of the Circumferential Highway may contribute to the degradation of groundwater quality in the region if it does not incorporate Best Management Practices (BMP's). This fact, coupled with the heavy reliance on groundwater in south-central New Hampshire, strongly supports the need to include BMP's into highway design as a measure to prevent groundwater degradation. There are many different forms of water quality BMP's ranging from standard construction procedures to actual landscape design features. The following list of mitigation measures represents general concepts or designs which may be implemented to mitigate adverse impacts. Numerous others exist but the following represent adequate measures which can and have been proven effective.

A site-specific discussion of recommended mitigation techniques and BMP's can be found in the Technical Report entitled "Wells and Aquifers."

- Strict adherence to existing regulations and construction guidelines.

- Drainage systems designed to maintain a minimum of 1 ft/sec flow velocity so as to decrease the potential for direct infiltration into groundwater supplies. Also, the system design should function to renovate runoff water quality.

  a) Where grades allow for a 1 ft/sec flow velocity, vegetated drainage swales can be used. These serve to renovate stormwater quality as it is diverted away from a sensitive area.

  b) If 1 ft/sec cannot be sustained, then swales lined with impervious materials (clay, synthetic geotextiles) should be used.

- Spill gates (such as a simple pile of soil) should be designed within the drainage system to act as a makeshift barrier in the event of a spill.

- Grassy buffers.

- Standard catch basins.

- As an ultimate protection measure, a closed drainage system with operation and maintenance plans. This may be warranted in an area such as the Pennichuck Reservoir.

- Detention ponds.

- Fueling/changing pads utilized in construction sites located within potential aquifer recharge zones.

- Calibrated sanding equipment and employees trained in the proper application of road salt.

4.13 FLOODPLAINS

Development within a 100-year floodplain is regulated by Federal, State, and Local laws which have been formulated primarily as an attempt to reduce the risk of property damage and loss of life due to flooding. Executive Order 11988 (Federal Register 42:101, May 24, 1977) requires all federal agencies to avoid construction within a 100-year floodplain unless no other practicable alternatives exist.

For the purpose of this FEIS, 100-year floodplains were examined regarding potential impacts related to the construction and operation of the Circumferential Highway. Additionally, suggested mitigation techniques are provided to allow for the construction of this roadway, while reducing impacts to a minimum. The objective is to maintain existing floodplain storage capacity after the construction of the roadway has been completed. Local zoning regulations have been promulgated that outline land use and construction controls designed to reduce the level and impacts of flooding in compliance with standards established by the Federal Insurance Administration. These regulations are necessary in order for a locality to qualify for the National Flood Insurance Program. Permits for roadway construction within these regulated floodplain areas may be obtained if no significant increase in water surface elevation results from final roadway design.

No Build, Transit/TDM and TSM Alternatives

The implementation of the No Build, Transit/TDM or TSM Alternatives will have no impact on the existing floodplain resources in the study area.

Build Alternative Alignments

Each Build Alternative alignment crosses an area identified as a 100-year floodplain at some point along the corridor. Table 4.13-1 depicts impacted 100-year floodplain acreage associated with each alternative alignment and also identifies the watercourse to which each floodplain is connected.

Short-term impacts may result from construction activity in or near a 100-year floodplain. Earthwork, especially that involved in the construction of the Merrimack River crossings, is probably the most intrusive activity. This may temporarily destabilize the ground and change erosion and runoff patterns. Other short-term impacts include removal of vegetative cover, grading, and wetland disruption, all leading to increased silt laden runoff to drains and nearby watercourses.

Table 4.13-1

100 YEAR FLOODPLAIN IMPACTS

Alternatives	Watercourse	100 Year Floodplain Impacts per Watercourse (Acres)	100 Year Floodplain Total Impacts Per Alignments (Acres)
3	Merrimack River	6.0	6.3
	Second Brook	.3	
4	Merrimack River	4.4	7.3
	Second Brook	0.3	
	Chase Brook	2.6	
5	Merrimack River	6.0	6.3
	Second Brook	0.3	
6	Merrimack River	4.4	7.3
	Second Brook	0.3	
	Chase Brook	2.6	
7	Merrimack River	0.7	12.8
	Unnamed Stream	2.7	
	Second Brook	4.0	
	Pennichuck Brook	5.4	
8	Merrimack River	0.7	12.1
	Unnamed Stream	2.7	
	Second Brook	4.0	
	Pennichuck Brook	4.7	

Sediment and erosion control BMP's are an integral part of the NHDOT's Standard Specifications for Road and Bridge Construction (1990). These BMP's will minimize any adverse impacts created during the construction phase of the project.

The most significant concerns regarding development in a designated floodplain are the loss of storage capacity and an increase in water surface elevations. The placement of fill or structures in a 100-year floodplain reduces the flood carrying capacity, thus increasing the flood heights and channel velocities of streams and rivers as well as increasing flood hazards beyond the actual encroachment. In all instances involving smaller streams, the loss of existing storage capacity in the immediate area of the crossing is anticipated, albeit minimal. Extensive networks of ponds and wetlands located adjacent and downstream of the crossings (especially Second Brook and Chase Brook) will more than adequately compensate for the loss of flood storage capacity resulting from the encroachment of the 100-year floodplain. The roadway will be designed with culverts capable of passing a 100-year flood without substantial increases in flood heights.

The creation of impervious surfaces and the destruction of natural detention basins (wetlands) within a drainage basin can result in an increase in runoff and hence an increase in peak flow. However, since the increases in impervious area relative to the total drainage area of each basin crossed is minimal, a substantial increase in peak flows is not expected.

Alternatives 4 and 6 appear to affect a large portion of the 100-year floodplain just south of the Anheuser Busch factory based on the placement of the proposed interchange with U.S. Route 3. However, given the lay of the land and the location of an active rail-line, the interchange will have to be elevated above the land surface as an extension of the bridge. This will drastically reduce the amount of floodplain acres affected, as fill will only be required along 4.4 acres along the fringe of the floodplain. Minimal flood storage capacity will be lost and impacts to water surface elevations as a result of this interchange can be quantified using the "HEC-2" hydraulic analysis.

No substantial impacts related to the Merrimack River bridges are anticipated because design criteria requires adequate hydraulic capacity for bridges. A "HEC-2" Water Surface Profile analysis was conducted in 1989 to predict the effect that proposed Circumferential Highway bridges would have on the water surface profile. The 50-year flood is the design storm and the 10, 100, and 500-year floods were also analyzed. The backwater produced by the two bridges would be 0, 0.01, 0.03, and 0.04 feet for the 10, 50, 100, and 500-year floods. The 500-year flood is not contained within the channel, but the other floods will remain within the river banks. The present bridge designs are of similar style and are predicted to have similar impacts.

Fill will be placed at either end of the bridges, resulting in a reduction of storage capacity of the floodplain in this region. However, this reduction in storage capacity is extremely minimal when one considers the substantial flood storage capacity provided by five Corps dams to the north along the Merrimack River as well as the extensive floodplain associated with the entire river. This loss of storage capacity can be easily mitigated by the excavation of an area large enough to replace the storage capacity lost by the addition of the fill. Impacts to hydrology and floodplains will be mitigated through appropriate engineering design and proper application of erosion and sediment control measures.

4.14 WETLANDS

An overview and comparison of wetland impacts for each of the Build Alternatives is represented in Figure 4.14-1. These data reflect both hydric soil and National Wetland Inventory (NWI) delineated wetland areas. All wetlands were field visited; adjustments to the digitized mapping were made based on field observations. An unknown percentage of these hydric areas will not meet the three-parameter federal requirements for wetlands. Slight offsets in the digitized NWI and hydric information, and recent land use changes tend to artificially increase wetland impact quantifications. It is expected that the figures derived from actual field delineations along a final alignment may vary from those reported here. The shading in Figure 4.14-1 indicates areas where individual alignments share a similar route, and therefore have identical wetland impacts.

In terms of acreage, Alternative 6 has the least wetland impact (54.0 acres) while Alternative 7 has the greatest (93.5 acres). Alternatives 3 and 4 impact the fewest number of discrete wetlands (28), and Alternative 7 impacts the most (45). Alternatives 3, 5, and 8 impact the fewest number of key wetlands (4), and Alternative 7 impacts the most (6).

The following is a ranking of Alternative alignments (from best to worst) for each of these categories:

Rank	Wetland Acreage Impacted	# of Discrete Wetlands Impacted	# of Key Wetlands Impacted
1	Alt. 6	Alt. 3,4	Alt. 3,5,8
2	Alt. 5	Alt. 5,6	Alt. 4,6
3	Alt. 4	Alt. 8	Alt. 7
4	Alt. 3	Alt. 7	
5	Alt. 8		
6	Alt. 7		

The NWI classifications are used to indicate relative amounts of wetland impact by type. Impacts associated with the various wetland classes are represented in Figure 4.14-2. Since these classifications are defined by the NWI mapping, areas of hydric soil are not included in these quantifications. All six Build Alternative alignments impact more palustrine forested habitat than any other wetland class. This is consistent with the predominance of wooded wetland habitat found in the study area. Alternative 7 and 8 impact a disproportionately higher amount of palustrine forested wetland than the other four Build Alternative alignments. This may be attributed to the

ALTERNATIVES	Wetland Acres Impacted	Number of Discrete Wetlands Impacted	Number of Key Wetlands Impacted
FULL BUILD Sagamore Bridge to F.E. Everett			
Alt. 3	78.2	28	4
Alt. 4	66.6	28	5
Alt. 5	65.6	34	4
Alt. 6	54.0	34	5
Alt. 7	93.5	45	6
Alt. 8	87.5	43	4
NORTHERN SECTION N.H. Route 102 to F.E. Everett Turnpike			
Alt. 3	44.5	7	1
Alt. 4	32.9	7	2
Alt. 5	38.0	7	1
Alt. 6	26.4	7	2
Alt. 7	31.6	13	3
Alt. 8	25.6	11	1
CENTRAL SECTION N.H. Route 111 to N.H. Route 102			
* { Alt. 3	16.4	4	0
Alt. 4	16.4	4	0
* { Alt. 5	10.3	10	0
Alt. 6	10.3	10	0
* { Alt. 7	17.1	8	0
Alt. 8	17.1	8	0
SOUTHERN SECTION Sagamore Bridge to N.H. Route 111			
* { Alt. 3	17.3	17	3
Alt. 4	17.3	17	3
Alt. 5	17.3	17	3
Alt. 6	17.3	17	3
* { Alt. 7	44.8	24	3
Alt. 8	44.8	24	3

* Coincident Alignments

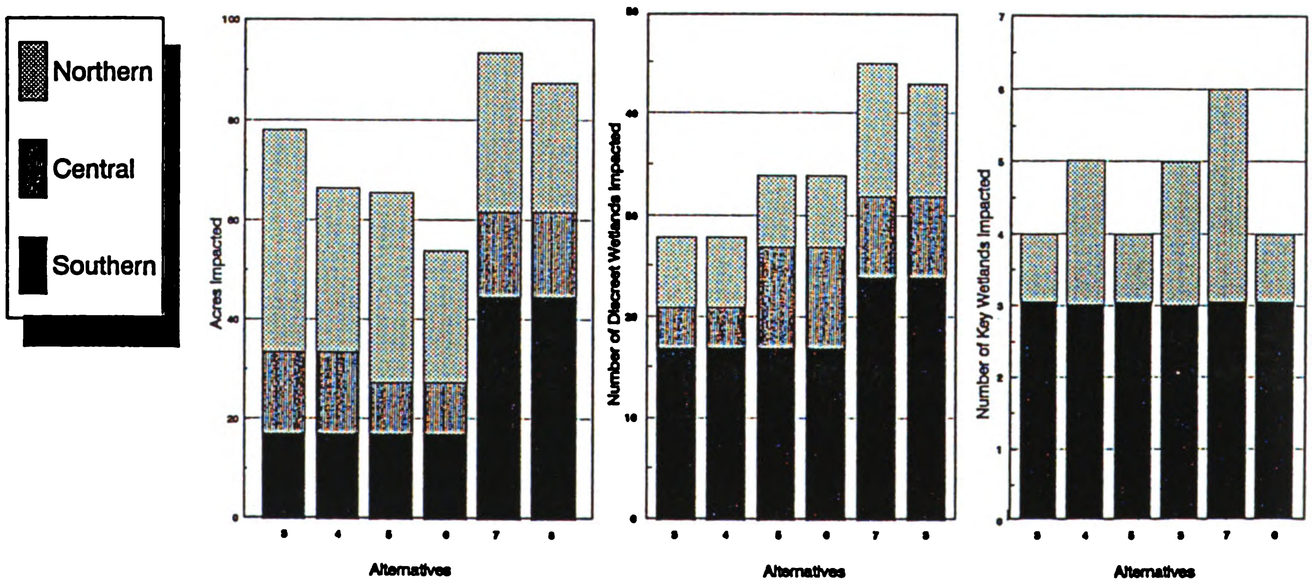


FIGURE 4.14-1
OVERVIEW OF WETLAND IMPACTS
(BASED ON NWI AND HYDRIC SOILS)

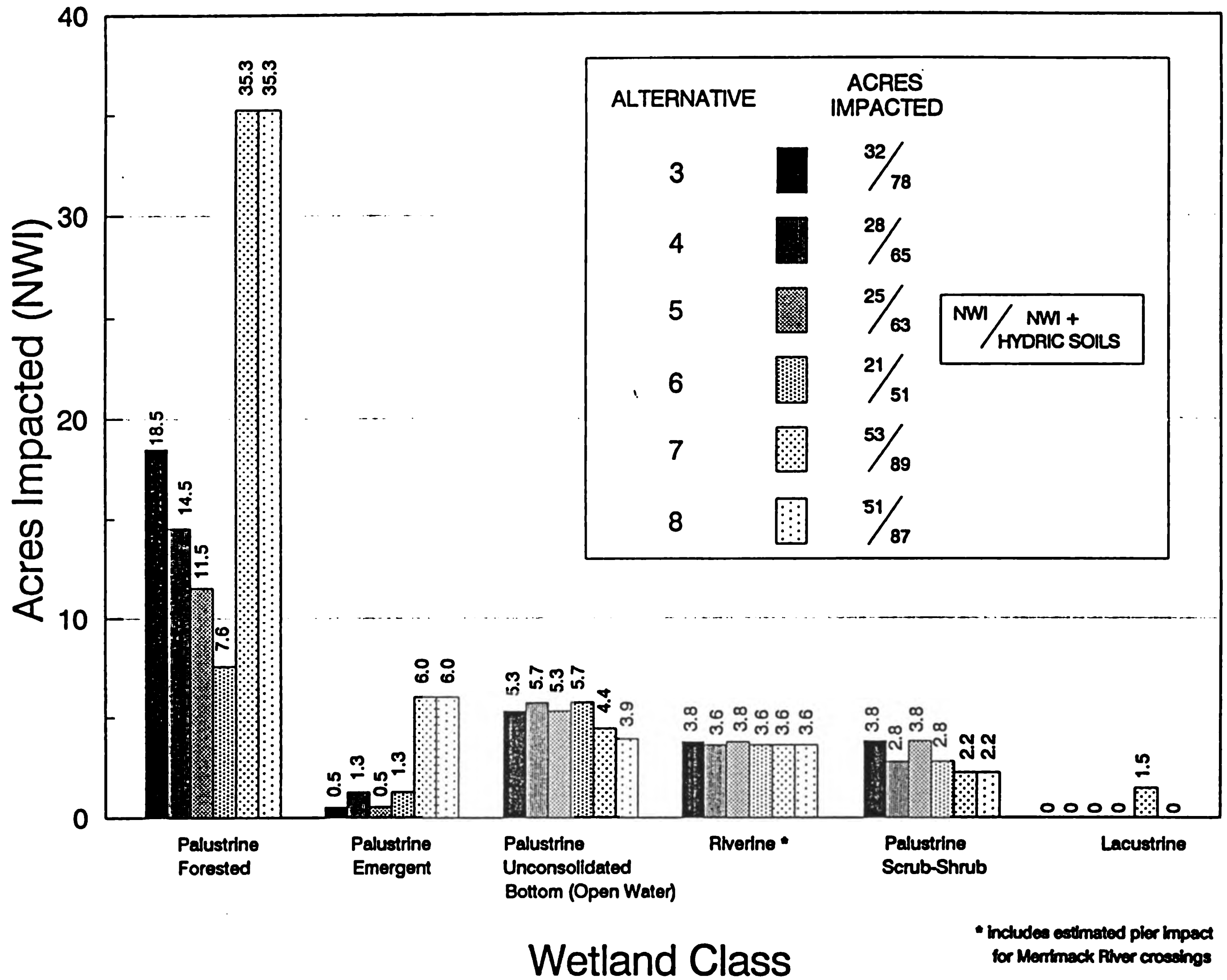


FIGURE 4.14-2
WETLAND ACRES IMPACTED BY WETLAND CLASS

previous efforts by the state of New Hampshire to purchase right-of-way along the Alternative 7 (B/C) corridor. The arrested land development brought on by State acquisition of this corridor may account for the predominance of forested habitat that is being impacted by Alternatives 7 and 8, while no such arrest of development was applied to other corridors. Except for palustrine emergent and lacustrine, all other wetland types are more evenly impacted by each of the Alternative alignments. Crossings of the Merrimack River and Chase Brook account for the riverine impact, while the Pennichuck Reservoir represents the only lacustrine impact.

As part of the evaluation process, determinations of Principal Valuable Functions (PVF) were made for each of the 65 evaluated NWI wetlands. The PVF is the function, or functions, which are most dominant, or most important, based on the overall wetland evaluation. In Figure 4.14-3, PVFs are related to acres of impact for each Alternative alignment. These quantifications represent impact to NWI and associated hydric soil wetlands.

A small number of impacted hydric soils had no NWI association. These areas were not evaluated, but their impact is accounted for under the category of "UNE", or unevaluated hydric soils. (Refer to Figure 3.14-1 for the location of these unevaluated sites.) The large Pipestone soil complex south of Page Road in Litchfield accounts for most of the unevaluated soil acreage. This explains the disproportionately high acreage of unevaluated hydric soil impact (UNE) in the northern section of the study area for Alternatives 3, 4, 5, and 6.

For all Alternative alignments, the wildlife PVF is associated with the highest acreage impact. As with the wetland class impact, the disproportionately large amount of impact to wildlife function along Alternatives 7 and 8 appears to reflect the State's acquisition of sections of the Alternative 7 (B/C) right-of-way.

Mitigation

Wetland mitigation is accomplished in three steps (Corps 1989): first, through avoidance of wetland habitats, second, by the minimization of impacts, and finally by the compensation for unavoidable losses through wetland restoration and creation. Avoidance occurs during the initial selection of alignment locations and minimization of wetland impacts occurs through specific roadway design. After avoidance and minimization of impacts have been addressed, unavoidable wetland losses are offset through restoration of degraded wetland sites and creation of new ones. The Corps guidelines for replacement of wetland habitats are based on a minimum ratio of 1:1.

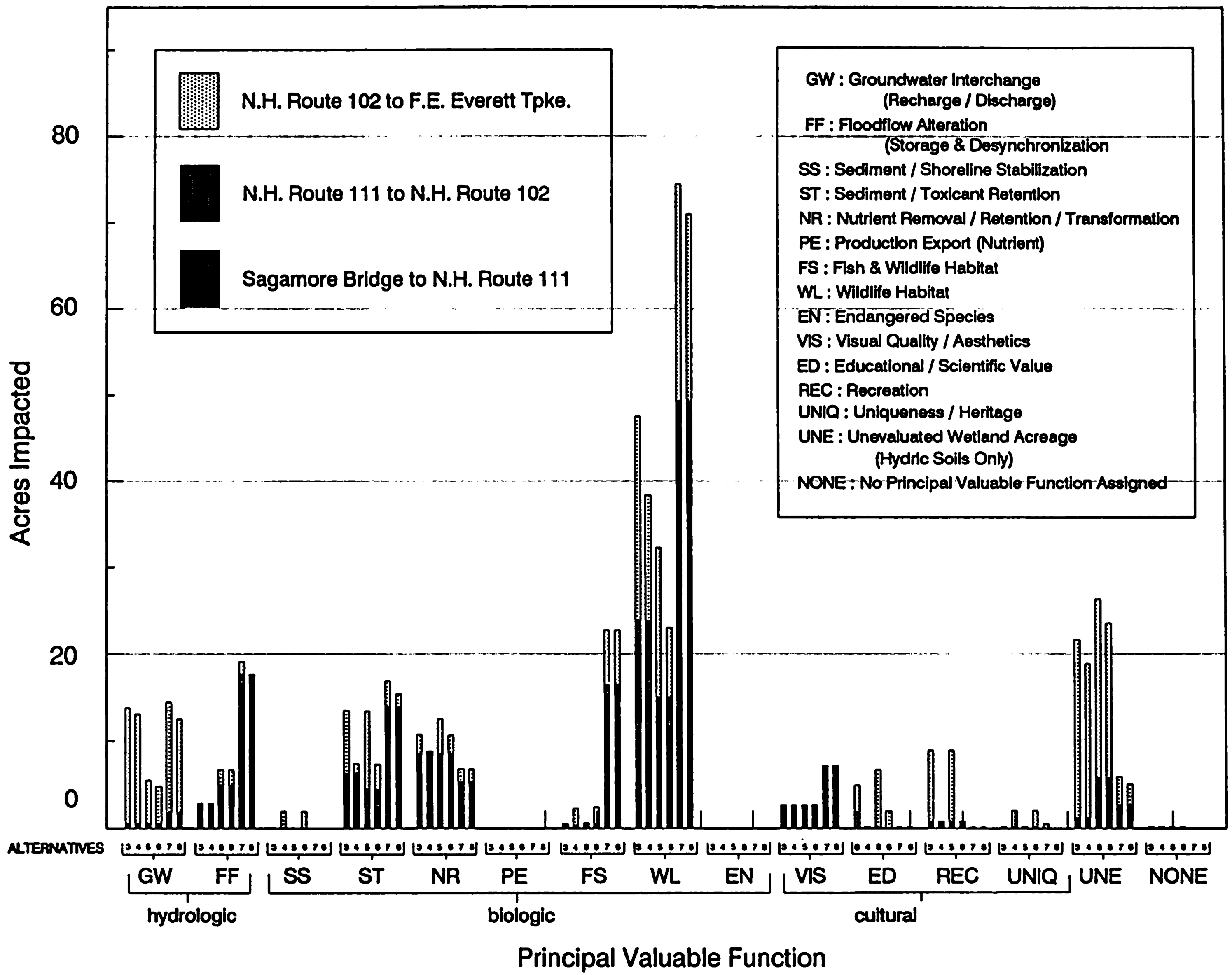


FIGURE 4.14-3
WETLAND ACRES IMPACTED BY PRINCIPAL VALUABLE FUNCTION

Six sites were initially identified as potential compensatory mitigation areas. These sites were chosen for their potential to offset the losses incurred by the construction of a Build Alternative. (Locations of these sites are shown in Figure 4.14-4.) Further investigation revealed that two of the six potential sites did not comply with compensation requirements. (These two sites are indicated by brackets.) The remaining sites have potential to meet the specific function-value and acreage goals needed to offset potential losses incurred by the Circumferential Highway. The sites are:

Site 1: Bensons Property, Kimball Hill Road and Bush Hill Road, Hudson. (Mitigation potential: approximately 60 acres.)

[Site 2:] Former pond behind Oliver Drive in Hudson.

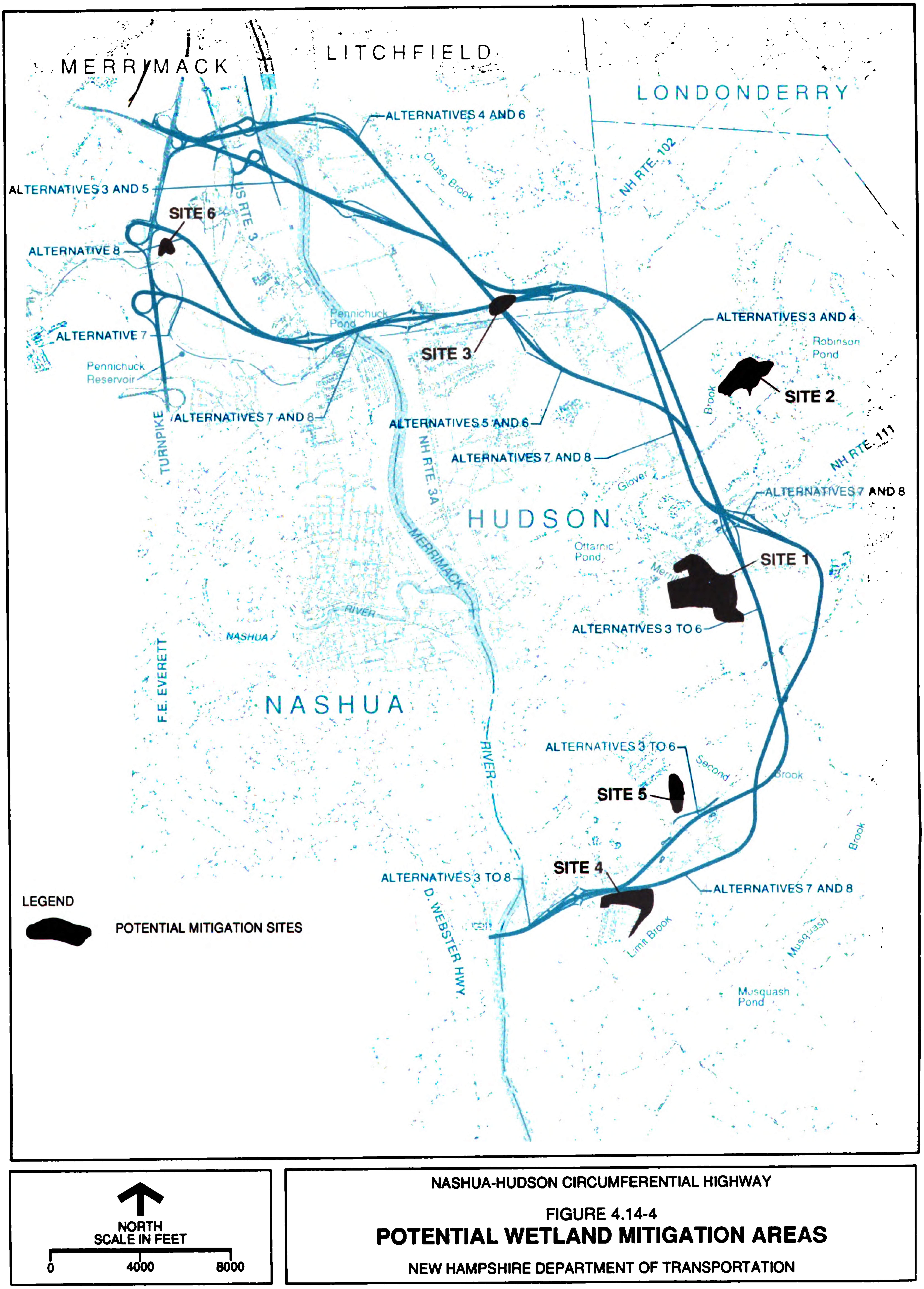
Site 3: Sand pit and adjacent disturbed fields south of Cutler Road, behind Alvirne High School, near the Litchfield-Hudson town line. (Mitigation potential: approximately ten acres.)

[Site 4:] Blackberry Run, proposed development site in southern Hudson.

Site 5: Disturbed area adjacent to the old town dump, Burns Hill Road, in southern Hudson. (Mitigation potential: approximately one acre.)

Site 6: Disturbed area located north of the Pennichuck Reservoir and east of the F.E. Everett Turnpike near proposed Exit 9. (Mitigation potential: approximately two to five acres.)

Based on preliminary investigations, the Benson's Property appears to have the greatest potential to satisfy wetland compensation requirements for the Circumferential Highway. Nine groundwater monitoring wells were installed in various locations at this site in April and May 1992. Since then, data on groundwater depths have been collected on a monthly basis. Preliminary assessments have been undertaken to determine the feasibility of creating and restoring wetlands at this site (Figure 4-14.5). Groundwater monitoring wells have recently been installed at Sites #3 and #6 as well. Thorough evaluations of the sites listed above, the investigation of additional sites, and close coordination with reviewing agencies remains as an ongoing task.



NASHUA-HUDSON CIRCUMFERENTIAL HIGHWAY

FIGURE 4.14-4

POTENTIAL WETLAND MITIGATION AREAS

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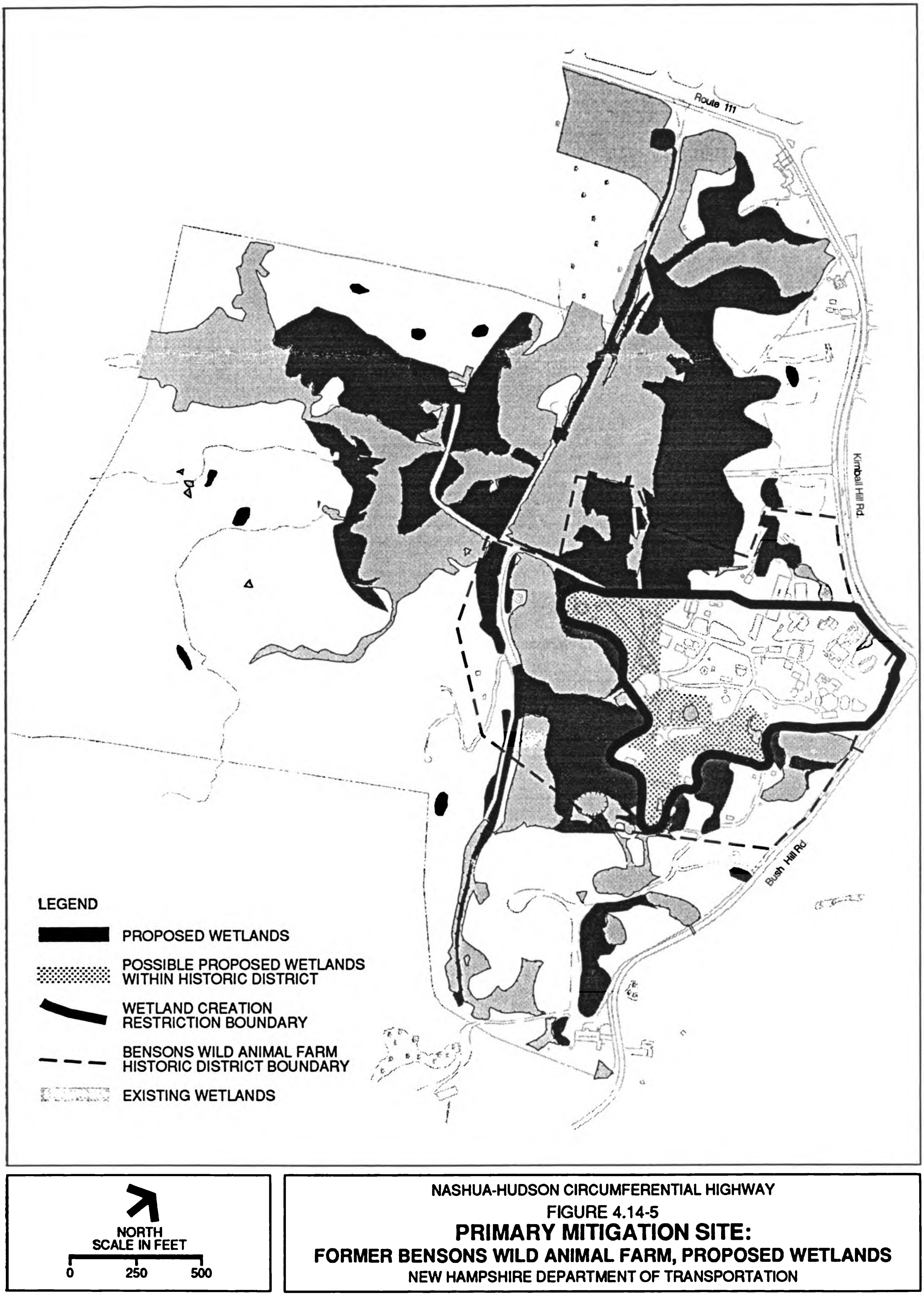


NASHUA-HUDSON CIRCUMFERENTIAL HIGHWAY

FIGURE 4.14-5

PRIMARY MITIGATION SITE:

FORMER BENSONS WILD ANIMAL FARM, PROPOSED WETLANDS

NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

4.15 WATERBODY MODIFICATIONS

The Build Alternatives will traverse several perennial and intermittent streams, the Merrimack River, and unnamed open waterbodies, such as ponds. Important streams in the study area are Limit, Second, Merrill, Glover, Chase and Pennichuck Brooks. The Merrimack is the receiving river for all drainages within the study area. Several unnamed streams, tributaries to the aforementioned brooks, are also crossed by all Build Alternatives. Table 4.15-1 lists Alternatives and watercourse crossings. The No Build, Transit/TDM and TSM Alternatives will have no direct impacts associated with stream crossings.

Highway crossings over the Merrimack River and Bowers Pond of the Pennichuck Reservoir will be made by bridge. All other crossings will be made by utilizing culverts. No major rechannelization will occur other than excavation to construct the culverts and bridge piers. Stream crossings will create a loss of habitat for some aquatic organisms and fish species. An incremental loss of stream habitat approximating 300 linear feet per crossing is anticipated. The placing of culverts or fill in stream crossings will temporarily increase turbidity and sedimentation in the stream. Construction of piers for the bridges over the Merrimack River, for all Build Alternatives, and over Bowers Pond for Alternative 7 may cause some short-term increase in turbidity and sedimentation (See Section 4.22, Construction Impacts).

All major drainages, such as the aforementioned brooks, and some of the unnamed tributaries to these brooks, have been traversed by previously constructed roadway crossings. These existing crossings utilize pipes, culverts and bridges with no significant impact to the watercourse. No significant change to any stream ecology, hydrology or hydraulics is anticipated by using properly designed and constructed bridge or culvert crossings.

Open waterbodies along the Build Alternatives, such as farm ponds and sedimentation ponds, will be filled within the footprint of the impact areas. Culverts and pipes will be installed as appropriate to maintain proper hydrological and hydraulic characteristics.

Modification in topography, removal of vegetation, construction of highway lanes and secondary development could change the direction and volume and chemical composition of surface water runoff to streams. Forest clearing may release increased nutrients to streams. Exposing streams to additional sunlight and new runoff may cause some minor temperature increases and changes to smaller watercourses.

Table 4.15-1

WATERBODY MODIFICATIONS BY ALTERNATIVE

Alternative	Unnamed Streams Intermittent	Unnamed Streams Perennial	Named Streams Perennial	Total Streams	River Crossings	Total Crossings	Open Waterbodies
3	4	5	Limit Brook Second Brook Merrill Brook Glover Brook Chase Brook	14	Merrimack River (2)	16	2 Farm ponds 1 Sedimentation Pond
4	4	6	Limit Brook Second Brook Merrill Brook Glover Brook Chase Brook	15	Merrimack River (2)	17	3 Farm ponds 2 Pocket Wetlands 1 Sedimentation Pond
5	5	5	Limit Brook Second Brook Merrill Brook Glover Brook Chase Brook	15	Merrimack River (2)	17	2 Farm ponds 4 Sedimentation Ponds
6	5	6	Limit Brook Second Brook Merrill Brook Glover Brook Chase Brook	16	Merrimack River (2)	18	3 Farm ponds 2 Pocket Wetlands 4 Sedimentation Ponds
7	6	6	Limit Brook Second Brook Merrill Brook Glover Brook Pennichuck Brook	17	Merrimack River (2)	19	1 Bowers Pond of Pennichuck Reservoir 1 Pond 2 Sedimentation Ponds
8	6	6	Limit Brook Second Brook Merrill Brook Glover Brook Pennichuck Brook	17	Merrimack River (2)	19	1 Pond 2 Sedimentation Ponds

Temperature increases, in conjunction with increased nutrients, may promote increased or accelerated algal growth. Excessive algal growth or an algal bloom have a detrimental effect on some stream biota. The impact is expected to be minor, since all streams are presently traversed by multiple roadways and also collect runoff from developed lands.

4.16 WILD AND SCENIC RIVERS

No Wild and Scenic Rivers are located within the Nashua-Hudson Circumferential Highway study area. Thus, Wild and Scenic Rivers are not considered in this document.

4.17 ENVIRONMENTAL RISK SITES

The No Build, Transit/TDM and TSM Alternatives will not impact any of the environmental risk sites, as these alternatives do not include any construction outside of the existing roadways. The Full Build Alternative alignments will impact environmental risk sites as summarized:

Build Alternative 3 - five sites, Nos. 21, 46, 47, 61, and 63.
Build Alternative 4 - four sites, Nos. 21, 46, 47, and 63.
Build Alternative 5 - five sites, Nos. 21, 46, 47, 61, and 63.
Build Alternative 6 - four sites, Nos. 21, 46, 47, and 63.
Build Alternative 7 - two sites, Nos. 46 and 47.
Build Alternative 8 - two sites, Nos. 46 and 47.

Without performing a field survey, it is impossible to locate the environmental risk site precisely on the property listings. It must therefore be assumed that an impact to a property, or site, will directly impact the material/ materials producing the environmental risk status. The sites impacted by the Build Alternatives are shown in Figure 4.17-1 and listed below.

Site No. 21, 4 Gregory Street, contains asbestos. This site is located, for the most part, within the proposed right-of-way of the impacting Build Alternative(s).

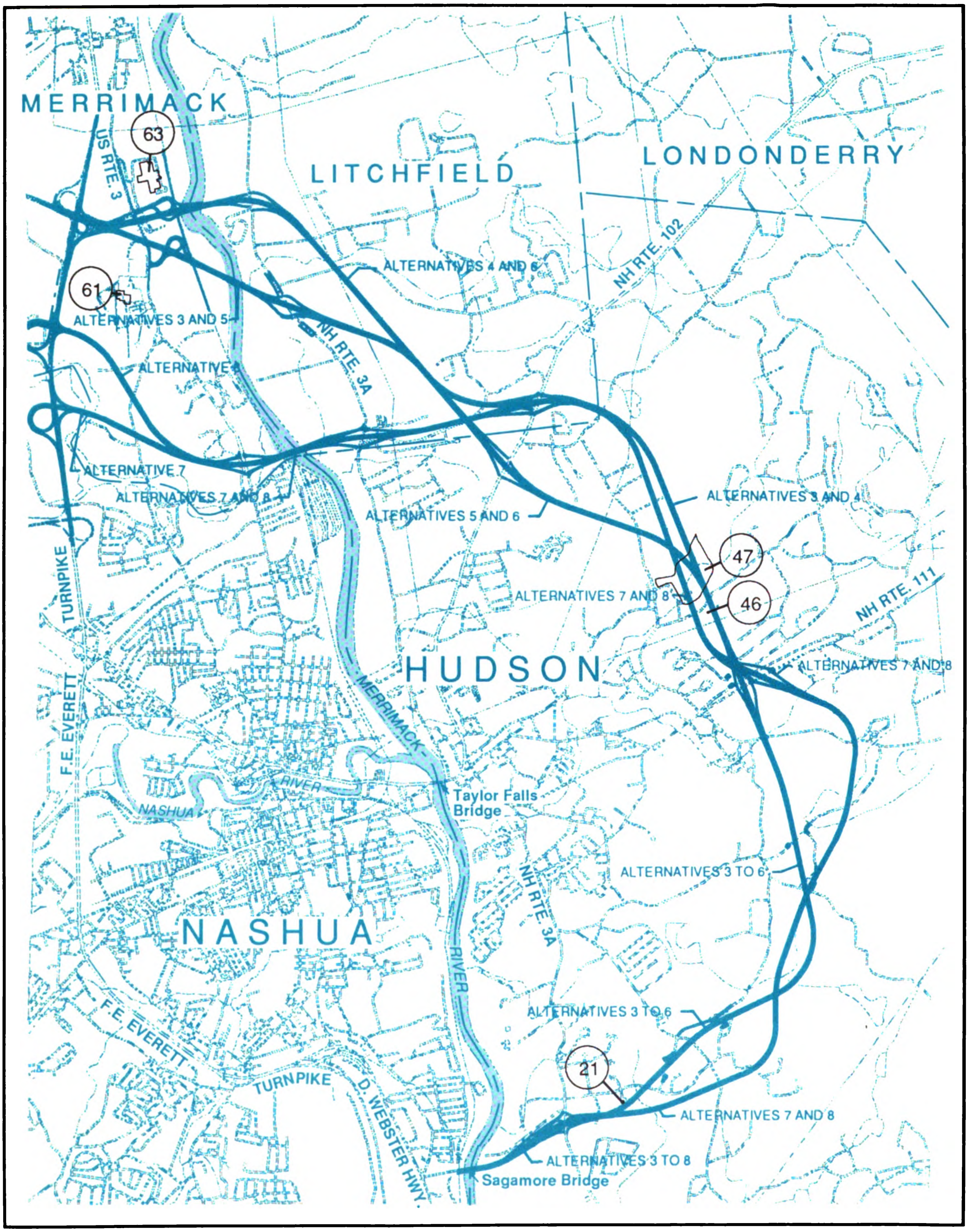
Site No. 46, Hudson Paving, Inc., contains underground storage tanks. This site is located, for the most part, within the proposed right-of-way of the impacting Build Alternative(s).

Site No. 47, Brox Industries and Brox Paving Materials, Inc., contain underground storage tanks. This site is directly affected by the impacting Build Alternative(s) and is subject to both an earth cut and a fill section.

Site No. 61, Lockheed Sanders, Inc., contains underground storage tanks. This site covers a vast land area and is susceptible to being directly and significantly impacted by the Build Alternative(s).

Site No. 63, Anheuser-Busch, Inc., contains underground injection control, discharging benign wastewaters not requiring a groundwater permit. This site covers a vast land area and is susceptible to being directly and significantly impacted by the Build Alternative(s).

All of the Build Alternative alignments impact environmental risk sites. However, Alternatives 7 and 8 impact the fewest sites.



NORTH
SCALE IN FEET
0 4000 8000

NASHUA-HUDSON CIRCUMFERENTIAL HIGHWAY

FIGURE 4.17-1
POTENTIAL IMPACTED RISK SITES

NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

4.18 COASTAL BARRIERS

No Coastal Barriers are located within the Nashua-Hudson Circumferential Highway Study area. Thus, Coastal Barriers are not considered in this document.

4.19 COASTAL ZONES

No Coastal Zones are located within the Nashua-Hudson Circumferential Highway Study area. Thus, Coastal Zones are not considered in this document.

4.20 ENERGY

The energy impacts for the Candidate Build Alternative alignments require evaluation of the direct consumption of energy by vehicles using the alternative and the indirect consumption of energy needed to construct that alternative. This analysis considers the total energy consumed by each alternative over a 20-year service life.

Motive Energy

The energy used by motor vehicles on each alternative is influenced by the total miles of travel and the efficiency of travel as reflected in the average speed of travel and the conditions of travel. For each alternative, the Design Year Vehicle Miles of Travel (VMT) by speed range was forecasted. These forecasts were further refined to determine expressway and non-expressway (arterial) VMT by speed range. The Transit/TDM and TSM Alternatives' design year VMT is approximately equal to the No Build Alternative. Fuel consumption (gallons per mile) by speed range and arterial type were used to determine the total gallons of gasoline consumed as a consequence of the predicted traffic on each alternative.

The VMT's by speed range and road type used in the energy analysis are the same as those utilized in the air quality analysis of this FEIS. The annual fuel consumption was accumulated over the assumed 20-year service life, assuming that VMT by speed range and road type remained constant over the service life of the alternative. The results are reported in Part A of Table 4.20-1. As can be seen in Table 4.20-1, Alternative 8 consumes the least motive energy over the 20-year service period, when compared to all of the study alternatives. The No Build 2010 alternative consumes the most motive energy of all alternatives considered because it has the highest VMT and the least efficient operating conditions. As is discussed in the section on air quality impacts, the Build Alternatives alignments have similar traffic operating characteristics from the perspective of air emissions and energy utilization.

Construction Energy

In order to determine energy utilized in the construction of an alternative, a construction energy factor (CEF) was used. This CEF relates the number of British Thermal Units (BTU's) of energy consumed to the 1991 cost of the project. The CEF used here is $1.00 of construction cost results in an expenditure of 12,879.58 BTU's. The BTU's are converted to equivalent gallons of gasoline by equating 125,000 BTU's to a gallon of gasoline. The results are reported in Part B of Table 4.20-1. The No Build Alternative requires no construction energy. The Build Alternatives require a minimum equivalent of 18.2 million gallons of gasoline for Alternative 5, to a maximum equivalent of 19.1 million gallons of gasoline for Alternative 8.

Total Energy Utilization Over a 20-Year Service Period

Over the 20-year service period, the direct motive energy required by vehicles which travel the roadway network greatly exceeds the indirect energy utilization for the construction of Build Alternatives. In the case of the Build Alternatives, roughly 98 percent of the total energy used over the 20-year service period is for motive energy. As a result, the No Build Transit/TDM and TSM 2010 Alternatives require more energy than the Full Build Alternatives. The Transit/TDM and TSM Alternative and No Build Alternative require roughly 3.5 to 4 percent more energy over the 20-year service period because of the higher number of vehicle miles traveled.

The Full Build Alternatives differ by .5 percent in their use of energy over the 20-year service period.

Table 4.20-1

ENERGY USE BY CANDIDATE ALTERNATIVES (VEHICULAR USE AND CONSTRUCTION)

	ALTERNATIVE NO BUILD–1990		ALTERNATIVE 1 and 2 - NO BUILD and TRANSIT/TDM/TSM 2010		ALTERNATIVE 3 BUILD		ALTERNATIVE 4 BUILD	
	VMT (1) miles/year Cost $M	ENERGY gallons/ year	VMT (1) miles/year Cost $M	ENERGY gallons/ year	VMT (1) miles/year Cost $M	ENERGY gallons/ year	VMT (1) miles/year Cost $M	ENERGY gallons/ year
Part A VEHICULAR USAGE								
EXPRESSWAY								
Total Freeway VMT & Energy	766,528	23,906	1,443,300	45,013	1,717,750	50,461	1,717,606	50,456
ARTERIALS								
Total Arterial VMT & Energy	2,549,167	79,502	4,024,248	125,506	3,798,368	111,581	3,803,387	111,729
Sub–Total VMT & Energy(daily)		103,408		170,518		162,042		162,185
Sub–Total VMT & Energy(20 years)		754,875,846		1,244,782,744		1,182,905,026		1,183,950,446
Part B CONSTRUCTION USAGE								
Construction Cost in $M & Energy in Gallons of Gasoline	0	0	0	0	$180	18,546,595	$183	18,855,705
TOTAL ALTERNATIVE ENERGY USE (20 years)		754,875,846		1,244,782,744		1,201,451,621		1,202,806,151

	ALTERNATIVE 5 BUILD		ALTERNATIVE 6 BUILD		ALTERNATIVE 7 BUILD		ALTERNATIVE 8 BUILD	
	VMT (1) miles/year Cost $M	ENERGY gallons/ year	VMT (1) miles/year Cost $M	ENERGY gallons/ year	VMT (1) miles/year Cost $M	ENERGY gallons/ year	VMT (1) miles/year Cost $M	ENERGY gallons/ year
Part A VEHICULAR USAGE								
EXPRESSWAY								
Total Freeway VMT & Energy	1,716,094	50,412	1,714,912	50,377	1,716,880	50,435	1,710,777	50,256
ARTERIALS								
Total Arterial VMT & Energy	3,804,390	111,758	3,806,780	111,828	3,788,195	111,282	3,786,301	111,227
Sub–Total VMT & Energy(daily)		162,170		162,206		161,717		161,482
Sub–Total VMT & Energy(20 years)		1,183,841,294		1,184,100,343		1,180,536,908		1,178,821,989
Part B CONSTRUCTION USAGE								
Construction Cost in $M & Energy in Gallons of Gasoline	$177	18,237,485	$181	18,649,632	$183	18,855,705	$185	19,061,778
TOTAL ALTERNATIVE ENERGY USE (20 years)		1,202,078,779		1,202,749,975		1,199,392,613		1,197,883,768

1. VMT – Average Vehicle Miles of Travel (daily)

4.21 CONSIDERATIONS RELATING TO PEDESTRIANS AND BICYCLISTS

As shown in Figure 3.1-3 in Chapter 3, there are several existing walkways/bikeways in the project area, and an extensive network of pedestrian and bicycle facilities planned in the region.

A walkway is planned at the Sagamore Bridge, linking Nashua and Hudson.

While walkways and bike paths will be taken into consideration in the design of the Circumferential Highway, the State can expend funds for these facilities within the highway right-of-way only if they connect to existing trails.

Regarding a pedestrian walkway on the proposed northern Merrimack River bridge, requested by the Town of Litchfield, such a walkway will be provided if the town has constructed a trail leading to the bridge at the time the NHDOT is preparing for construction of the bridge.

4.22 CONSTRUCTION IMPACTS

During the period of construction of a Build Alternative, several impacts, unique to the construction phase, will be experienced in the study area. Many of these impacts have already been discussed in the previous sections of this chapter.

There are several impacts that are common to all Full Build Alternatives. The mobilization and demobilization of construction equipment to and from the various construction sites will have to be accomplished using the existing highways, arterials, ramps, and local collector roads.

The maintenance and protection of traffic during construction will be a prime consideration at the northern terminus with the F. E. Everett Turnpike, the southern terminus area surrounding the Sagamore Bridge, and at the interchanges with U.S. Route 3, N.H. Routes 3A, 102, and 111 for the length of the construction period. Maintenance and protection of traffic plans for these interchanges as well as intersections with secondary roads will be required by the general construction contractor to assure the safe and reasonably uninterrupted travel of vehicles through the area of construction.

Alternative 7 will cross Bowers Pond, a portion of the Pennichuck water supply. The construction of the bridge spanning Bowers Pond will involve land disturbance on the east and west banks, possibly increasing the turbidity of the water. A structure type study will be done to determine the best pier and span configuration to protect the water supply. The bridge should have no intermediate piers or as few as possible constructed in the pond to limit sediment disturbance and minimize spill potential.

The impacts to the air quality and noise of the study area during the period of construction will be of equal magnitude for all Full Build Alternatives. However, if the general construction contractor should decide to have the structural steel of the bridges superstructure painted in the field, as opposed to in the shop, this will introduce additional noise during the painting process, as well as additional air pollutants from the painting process.

Impacts to the environment during construction may also include an increase in sediments in runoff, turbidity, fuel or oil spills, all of which may impact an aquifer or surrounding waters. Blasting in bedrock may alter groundwater flow patterns and volumes, resulting in improvement or deterioration of water quality and yield from wells in the area. This effect is difficult to predict even by the most experienced geologists and groundwater hydrologists. Overall, no significant impact to public water supplies is anticipated. Accelerated erosion and sedimentation caused by land-disturbing activities during construction is the major short term impact.

In addition to soil erosion and sedimentation, there are other potential pollutants associated with construction activities including gasoline, oils, grease, paints, cements, and solvents, and other contaminants. Non-toxic materials such as paper, cardboard, and wood are potential pollutants if they are washed into the drainage system in large quantities.

Some loss of vegetation may result in the wetlands lying adjacent to construction areas. These areas will not result in permanent loss and will re-generate.

The construction of bridges over the Merrimack River at the northern and southern termini of all alternative alignments will involve setting cofferdams for the construction of piers. Water is removed from within the cofferdams to facilitate excavation to footing level and the construction of the pier. The pumping of water from inside the cofferdam to outside will not impact the waterbodies to any measurable degree. Disturbance of other sediments surrounding the cofferdams is not expected to occur. Construction equipment for pier construction, may be at risk of spillage of hazardous materials such as oil and gasoline directly in the waterbody.

The various construction permits that will be required for this project may have requirements which dictate specific construction techniques, construction constraints, time periods and maximum allowable increases in turbidity in which to implement these requirements.

Mitigation. The following goals will be part of construction specification preparation to minimize potential impacts due to roadway construction:

- Construction specifications and selection of bridge construction methods will insure protection of the Pennichuck Brook public water supply.

- Plans for maintenance and protection of traffic will assume safe and reasonably uninterrupted travel of vehicles throughout the area of construction.

- Construction methods will be consistent with State and Federal regulations on noise, air quality and water management.

- Construction activities will be in compliance with the latest BMP's for the protection of the environment.

- Coordination with appropriate agencies will be defined to assure proper utility relocation.

- State and Federal regulations in siting and construction of utilities requiring relocation will be specified.

- Wetland restoration will be specified where possible.

- Work areas will be minimized to reduce impact on nearby vegetation.

- Placing temporary fencing along the boundary of work areas will be specified to keep equipment and traffic out of these areas.

- Stringent erosion and sedimentation control measures will be specified to minimize loss of soil.

- Phased stabilization of disturbed work areas by revegetation or surface treatment will be specified to reduce erosion.

- The use and size of blasting charges in bedrock will be minimized to limit potential bedrock aquifer disturbance.

- All construction undertaken shall be consistent with NHDOT's Standard Specifications for Road and Bridge Construction, 1990.

- Control measures and practices to limit sediment pollution are specified in "Best Management Practices for Erosion and Sediment Control" (FHWA and Corps).

- Good housekeeping practices will be specified as the best means by which nonpoint source pollution on the site will be controlled.

- Proper erosion and sedimentation control measures will be maintained to minimize groundwater contamination potential, and reduce the risk of recharge areas becoming silted, which would otherwise result in reduced replenishment in the vicinity.

4.23 SECONDARY AND CUMULATIVE DEVELOPMENT

The most significant contribution of the Nashua-Hudson Circumferential Highway to secondary and cumulative effects on regional development is the part it will play in the evolution of land development patterns. It must be recognized that such an evolution is only marginally predictable because its constituent elements result from changing societal priorities.

Although we all intuitively recognize the complexity of secondary and cumulative impacts (Bank 1991), it is nonetheless defined here in order to assure the reader's common understanding of the methods used in this analysis.

> *Secondary effects* (i.e., impacts) are those which are "caused by an action and are later in time or further removed in distance but are still reasonably foreseeable" (40 CFR 1508.8), such as a new shopping center attracted to the near vicinity of an intersection created by a new highway project.

> *Cumulative effects* are those "impacts which result from the incremental consequences of an action when added to other past and reasonably foreseeable future actions" (40 CFR 1508.7), such as the incremental growth and increased governmental complexity of a region influenced by the accumulated secondary effects of a project within the context of all other interrelated effects of all other relevant projects.

It is evident from these two definitions that secondary and cumulative impacts are essentially inseparable. There is a continuum of impacts which develop both temporally as well as spatially.

Secondary impacts related to the Circumferential Highway are also influenced by other existing and future projects planned for the region.

4.23.1 Analysis Model

This analysis investigates the location and density of present and predicted future residential and industrial developments (i.e., cumulative development) within the study area as influenced by the Circumferential Highway. The analysis hinges on information contained in accepted Official Plans of Development, Transportation Implementation Plans (TIP's), and socio-economic analyses conducted in the region. (See Section 4.3, Socio-Economics, of this FEIS.) This planning information is utilized as the basis to predict anticipated development pressures on delineated community units (i.e., traffic zones) within the region as a consequence of the highway. The analysis involves calculating the anticipated housing density and anticipated density of non-residential building space (in square feet of industrial space) for each zone. This is done by first determining the amount of buildable land in each zone, excluding non-buildable land (e.g., wetlands and water bodies), and then applying the appropriate equation listed below.

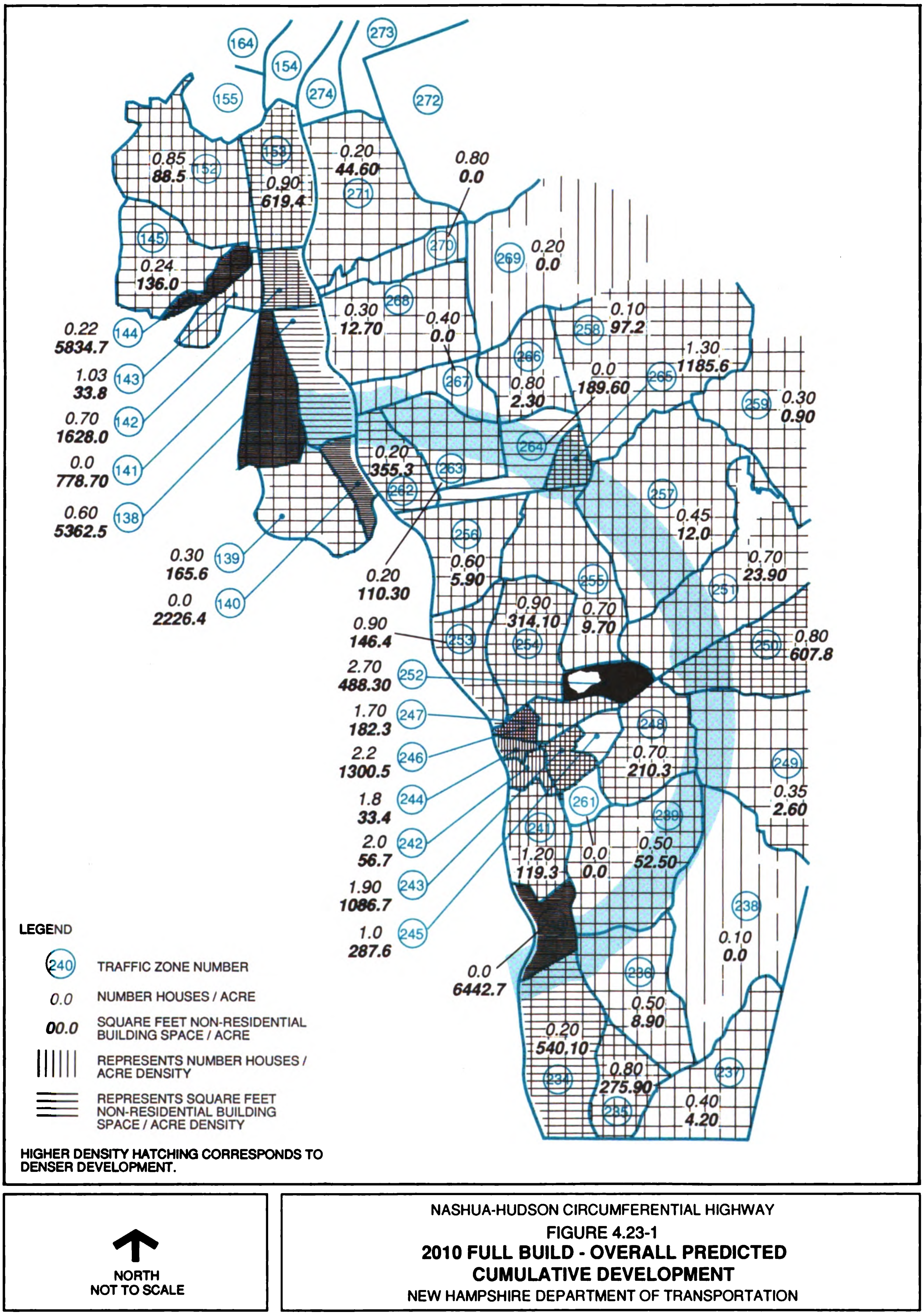
Number of Houses/Buildable Land Area = Housing Density (Eq. 1)

S.F. of Non-residential Space/Buildable Land Area = Non-residential Density (Eq. 2)

Calculations of the relative densities for each zone (1) at the present time, (2) in the year 2010 in the absence of the Circumferential Highway (No Build), and (3) in the year 2010 including the influence of the Circumferential Highway (Build), provides the basis for determining the contribution made by the Circumferential Highway to anticipated cumulative development effect on the study area. The arithmetic difference in development densities between Build 2010 (overall predicted cumulative development effect, shown in Figure 4.23-1) and No Build 2010 (predicted cumulative development effect in the absence of the highway, shown in Figure 4.23-2), represents the best estimate of the highway's contribution to cumulative development effects in the region (Figure 4.23-3.) This calculation is defined by the following equation:

Overall Predicted Cumulative Development Effect	**-**	**Predicted Cumulative Development Effect in the Absence of the Circumferential Highway**	**=**	**Circumferential Highway's Predicted Contribution to the Cumulative Development Effect**	(Eq. 3)

Based on the analysis, residential developments are predicted to double in most of the area along the length of the limited access highway. In analysis zones one tier removed, housing density increase is anticipated to be slight. Significant increases in square footage of non-residential building space are predicted for analysis zones located near proposed highway interchanges with N.H. Routes 3A, 111, 102, U.S. Route 3, and the F.E. Everett Turnpike. These increases are an obvious consequence of increased access provided to these areas by the highway and are, therefore, most appropriately categorized as secondary development impacts.



NASHUA-HUDSON CIRCUMFERENTIAL HIGHWAY

FIGURE 4.23-1

2010 FULL BUILD - OVERALL PREDICTED CUMULATIVE DEVELOPMENT

NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

4.23.2 Development Patterns

Hudson. Under the Build Alternative, Hudson is expected to add 2,676 housing units and approximately 698,000 square feet of nonresidential development by the year 2010. An estimated 260,000 square feet of the total is expected to be developed in traffic zones 234 and 240, which would be related to the interchange at N.H. Route 3A South (Lowell Road) near the Sagamore Bridge. In fact, partly in anticipation of the new highway, Wal-Mart Stores have invested several million dollars in a new facility at the southwest corner of the intersection to locate a large discount department store.

Further commercial/industrial expansion in Hudson is anticipated at the existing industrial park and business zone located near the interchange at N.H. Route 111. Because of better access and visibility from the highway, the park is more likely to attract users, thus increasing the value of land and improvements and speeding buildout. However, this interchange is also expected to spur the development of new commercial/industrial areas to the west of the existing park along N.H. Route 111. An estimated 133,000 square feet of additional nonresidential building space could be developed in the area identified as traffic zone 248.

From a residential standpoint, the majority of new housing units are expected in the more rural outlying portions of Hudson, as opposed to within the urban core area. A significant amount of these units are expected to be concentrated in the vicinity of the N.H. Route 111 interchange. Approximately 52 percent of the total units are expected to be constructed north of N.H. Route 111, with fewer units being built in the southern part of town due to the lesser amount of developable land area.

At the intersection with N.H. Route 102, neither of the two interchange locations being considered are expected to add much additional development to Hudson's nonresidential property base.

Litchfield. In Litchfield, a significant amount of strip retail and commercial uses is expected, expanding on these already prevalent uses in Hudson and Londonderry. The advent of the highway will increase the demand for retail shopping centers, fast food, service-oriented office spaces, etc. An estimated 170,000 square feet of commercial uses are projected in this portion of Litchfield.

In total, approximately 356,000 square feet of nonresidential building space is expected to be developed in Litchfield over the next 20 years, because the town has recently rezoned a significant amount of land area for commercial and industrial uses. The amount of nonresidential development may be decreased to some extent if the northernmost interchange alternative for N.H. Route 3A is selected. However, since the land in that immediate area is not zoned for commercial uses, the remaining two interchange alternatives would not be expected to differ in their potential impact on projected nonresidential growth.

In Litchfield, the Build Alternative is projected to generate approximately 340 additional housing units over the next 20 years. The southernmost traffic zones (262 through 271) are expected to receive the majority of the projected housing growth. However, selection of the northernmost interchange at N.H. Route 3A may push some of the projected residential growth into additional traffic zones within Litchfield.

Merrimack. In Merrimack, the Build Alternative is projected to add an additional 633 housing units and approximately 3.8 million square feet of commercial/industrial building space over the next 20 years. These secondary impacts are expected to be restricted to those traffic zones adjacent to the F.E. Everett Turnpike and U.S. Route 3, from the town center area in the north, to the Nashua town line in the south. Because Merrimack already has good highway access from the Turnpike, and a well-established industrial area, the creation of a new interchange at any of the proposed locations is not expected to affect a large geographic portion of the town. A good portion of the projected nonresidential development is anticipated to be generated by the expansion of existing businesses and industries.

Build vs. No Build. The primary difference between the Build and No Build Alternatives, relates to the timing of, as opposed to the overall magnitude of, projected levels of growth. This reflects the fact that, as a growth center for New Hampshire, the City of Nashua and the surrounding region absorbed a large percentage of the State's boom growth that occurred during the mid-1980's. As the economy begins its rebound during the decade of the 1990's, the Nashua region is again expected to attract significant growth. The question then becomes, where in the region will this development be located?

If, as the economy begins to expand again, the Circumferential Highway is not under construction, or expected to be constructed, one of two things may happen. Development will occur initially at those locations that already have superior highway access. As these sites are developed, less desirable locations will then be sought if regional demand is still strong. Therefore, the growth projected under the Build scenario may still eventually be attained, but under the No Build scenario, those growth levels are not expected to be reached within the next 20 years.

Because commercial/industrial development would be expected to decrease by about 1.4 million square feet as compared to the Build scenario, the number of additional housing units needed will decrease accordingly. However, regional growth will still generate the need for more housing units, even if nonresidential growth is reduced. For Hudson, Litchfield, and Merrimack as a whole under the No Build scenario, the number of additional housing units constructed would range from 1,460 to 2,189 over the next 20 years. How the units are distributed throughout the towns is not expected to vary from the patterns discussed under the Build scenario.

The effects of the No Build scenario on commercial and industrial development are expected to be more pronounced, as well as more site-specific. The increases in nonresidential development projected under the Build scenario are largely predicated on the creation of new interchanges. The loss of these interchanges under No Build will diminish improved accessibility at these locations resulting in a corresponding decrease in value.

Litchfield would be expected to receive only 20 percent of its Build growth projection, because it presently has poor access to its commercial/industrial areas. Merrimack, however, would still be likely to receive 80 percent of its projected nonresidential development due to its existing highway access and well established, upscale industrial park areas. Hudson's commercial/industrial growth would probably range between 50 percent and 80 percent of Build projections, because, while the town has established development areas, they are less desirable than a location in Merrimack. In addition, traffic projections for N.H. Routes 111 and 3A south suggest that levels of service on those roadways will be significantly reduced by the year 2010, thus diminishing accessibility and location desirability.

Total additional nonresidential development for the study area under the No Build scenario is projected to be approximately 3.4 million square feet over the next 20 years. That figure represents a decrease of over 1.4 million square feet from that projected for the Build Alternatives.

4.23.3 Resource Impacts

Overlay analyses have been conducted to investigate potential natural and cultural resource impacts resulting from the anticipated increase in development attributed to the highway. The map (Figure 4.23-3) depicting predicted development within designated zones (community units) is overlaid on maps highlighting natural resources in the study area. In zones where significant increases in development and significant resources coincide, potential impacts are likely. Water resources, wetlands, wildlife, and farmlands are examples of natural resources of concern in respect to secondary/cumulative impacts and were therefore considered in detail. Effects on the aesthetic and visual characteristics of the region are also discussed as are potential impacts to ambient air quality, ambient noise levels and historic districts.

Impacts on terrestrial ecology and floodplains were not analyzed in detail. Figure 4.23-3 can, however, be used as an overlay on these resources to predict how and where development pressures impact them. Impacts to Public/6(f) Lands and Institutional Resources by development pressures will be dealt with by the appropriate municipalities, as the need arises.

Mitigation of these potential impacts is discussed with respect to existing Federal, State, and local environmental regulations. Proper enforcement of these regulations will result in directing development away from sensitive resources, thus ensuring their ultimate regulation and appropriate protection.

Farmlands. Development of new roadways and infrastructure will increase access to areas currently not developed or minimally developed. Over time, this increased access will help stimulate development in these areas. Therefore, with the construction of the proposed roadway, development pressures will increase on the remaining active and potential farmlands. Construction of interchanges in the vicinity of farmland will further increase the attractiveness for development.

Farmlands in the region have experienced development pressure over the past few decades. Farms, being open land often with little wetland area, are most attractive to development. With this in mind, it is safe to conclude that several farmland areas adjacent to the proposed roadway will experience increased development pressures. Often, to increase the tax base, municipalities facilitate zoning changes to particularly accommodate industrial development of an area. Economic difficulties, taxes, attractiveness of land sale monies and logistical difficulties in operating a farm in developable areas further influence farm closings and their non-farm development.

In both the No Build and Build Alternatives, the results indicate highest non-residential development increases occurring north and adjacent to N.H Route 111 in Hudson, in Litchfield west and adjacent to N.H. Route 3A and south and adjacent to N.H. Route 102, and between U.S. Route 3 and the F.E. Everett Turnpike in Merrimack. In Litchfield between N.H. Route 3A and the Merrimack River the magnitude of anticipated growth in the Build and No Build cases is almost ten times greater with the new roadway. This potential development is in an area of active Prime farmland soils.

Another location of anticipated non-residential growth occurs along the south side of N.H. Route 102 in Litchfield near Cutler Road. This area is designated as Statewide Important farmland, but is currently not actively farmed.

Most attractive for development is open land adjacent to easily accessed, well traveled roadways near future growth centers. However, the nature of the Circumferential Highway is such that it should result in little secondary development outside the immediate study area. New roadways connecting towns or urban areas with little direct access are more likely to result in major secondary development.

Historic Resources. Historic Districts are also sensitive to cumulative impacts associated with increased development, especially in terms of adverse visual and aesthetic effects. The Historic Preservation Act of 1966 states that, "criteria for adverse effect include the introduction of visual elements that are out of character with the district or alter its setting." Based on the predicted development maps, *Historic Districts that are eligible for the National Register of Historic Places and that may be impacted include the Jasper Poultry Farm Historic District along Old Derry Road in Hudson and Litchfield, the Pennichuck Water Works Historic District in southern Merrimack, and the Benson's Wild Animal Farm Historic District in central Hudson. Their eligibility* for inclusion means that these districts are protected by the Historic Preservation Act. Thus, the likelihood that these areas will be impacted by increased development is small, assuming the Act and local zoning regulations are enforced.

Air and Noise. With increased development comes an increase in the amount of noise and air pollution to a degree which depends on the location and type of development. Ambient noise and air quality conditions that exist in 1992 will undoubtedly change in the future as a direct consequence of increased development in the region. However, this change is impossible to predict with certainty without knowing the specific nature of the development (in particular, industry) that is attracted to the region. This report presents anticipated residential and non-residential increases for delineated traffic analysis zones as a consequence of the Circumferential Highway and other regional transportation improvements. The extent to which these anticipated developments affect ambient air and noise quality conditions is unknown at this time. Federal, State, and local administrations will determine the nature and type of development that will be allowed in a particular area under existing regulations. In this way, conformity to existing guidelines will be achieved and ultimate air and noise pollution reduction goals will be controlled.

Visual Impacts and Aesthetics. Cumulative development pressures, as a consequence of the Circumferential Highway and other regional activities, may result in alteration of the primary rural character of the study area. This change will be most noticeable in the vicinity of proposed interchanges, where commercial, industrial, and residential developments are predicted to steadily increase over time. Those areas include traffic zones where the proposed highway intersects N.H. Route 3A and N.H. Route 102 along the Hudson/Litchfield border, N.H. Route 111 in Hudson, and an area just northeast of the Pennichuck Reservoir near U.S. Route 3 in Merrimack. The induced mixed land use is diverse as a unit, but may eventually become the most prevalent landscape type in the region. This slow change towards uniformity decreases the visual and aesthetic character of the landscape. Local zoning is the key to directing development pressures so as to not interfere with the overall character of study area towns.

Wildlife. Development of new roadways and infrastructure will increase access to areas currently not developed or minimally developed. Over time, this increased access will help stimulate development in these areas. Therefore, with the construction of the proposed roadway, development pressures will increase on the remaining undeveloped land considered as wildlife habitat. Construction of interchanges will further increase the attractiveness of development in the immediate vicinity.

The residential development of areas considered as wildlife habitat can influence the species composition and abundance. Sparse residential development throughout a once contiguous undeveloped area affects the nature of the habitat by introducing human and other disturbances. Physical changes in habitat edge, landscape, habitat composition, and introduction of non-native predators (dogs, cats, etc.) can affect existing wildlife.

For wildlife, the highest value areas are those intact large tracts of undeveloped woodlands, interspersed with wetlands. In the study area, all habitats have had some form of disturbance to these once natural areas. Secondary roadways cross every habitat block, and many residences have been built in the "woods" off these roads. The results of this disturbance are evidenced by the absence of some species and a lower overall species diversity in the study area.

Some residential developments are much higher density subdivisions. This type of development virtually eliminates that area as wildlife habitat. Concentrated or cluster development may be better for wildlife than the continued fragmentation and infiltration by sparse development. However, this higher density development can act as a "barrier", separating wildlife habitats.

Often, to encourage an increased tax base, municipalities facilitate zoning changes to particularly accommodate industrial development of an area. Commercial and industrial developments tend to concentrate near major roadways and are less defuse than residential areas. These roadways provide the mechanism that transports products and people to and from these areas. From this perspective, industrial and commercial development, typically concentrating along larger roadways, may have less impact on wildlife resources. Other factors which are difficult to predict include increased indirect impacts such as increased wildlife mortalities with heavy roadway usage.

In both the Build and the No Build Alternatives, the results indicate highest non-residential development increases occurring adjacent N.H. Route 111 in Hudson (Habitat Blocks 3 and 4), in Litchfield west and adjacent to N.H. Route 3A (Block 6), south and adjacent to N.H. Route 102 (Block 4), and between U.S. Route 3 and the F.E. Everett Turnpike in Merrimack (Block 12). In Litchfield between N.H. Route 3A and the Merrimack River the magnitude of anticipated growth in the Build and No Build cases is ten times greater with the new roadway. This potential development in Block 6 is in an area actively farmed.

Another location of anticipated non-residential growth occurs along the south side of N.H. Route 102 in Litchfield near Cutler Road. This area is the western edge of habitat Block 4, in an area occupied mostly by fields.

Projected residential growth is much more evenly distributed throughout the study area. Generally the areas of highest anticipated residential growth occur at the same locations as non-residential. One portion of habitat Block 2 is expected to have four times the housing units built within it. Even without a new roadway, there will be continued development in these areas. Construction of a new roadway would accelerate the development by improving access.

Secondary development impacts are more attributable to a specific project than the overall cumulative impacts of all developments and projects. Modeling reveals under any Build Alternative, the secondary impacts are similar, with some site-specific variations. Relative to notable wildlife habitats, the area near the pocket wetlands, including the Inland Basin Marshes of Litchfield, will experience more development pressure than any other Notable Habitat Areas.

Other land, outside the immediate study area and in other towns, is expected to be influenced by the development of a new roadway. Exact locations and extent of this secondary development are not possible to predict; however, it is expected to be considerably less than in the immediate study area.

Water Resources/Drainage Basins. Land use has a direct impact on water quality. New housing and commercial development will occur along the study corridor over time, with or without the Circumferential Highway and will impact water quality through increase runoff and induced contaminant loading. It is not possible to forecast and quantify the exact amounts of increased impacts, only that there will be an increase.

Additional housing causes an increase in runoff due to added impervious surfaces as well as increasing the contaminant loading on the land. However, it appears that residential land use typically generates less pollution than other urban uses.

Existing wetlands act to purify runoff from the land in its present state. When wetlands are taken, their water quality improvement capabilities will be lost. This assumes that the water needed improvement. This indirect impact can be avoided by replacing the wetland in kind and in the same general area. It is assumed that existing land use controls at the local and state levels will protect wetland resources. Sensitivity to, and protection of the stormwater renovation capacity of wetlands and water courses will minimize the cumulative impacts in the region.

Local planning and zoning agencies should be aware of changes in land demand caused by the construction of a chosen alternative alignment. The identification of areas presumed to see increased development allows planners and environmentalists the ability to prepare for potential impacts in advance. This is best accomplished through altering existing zoning regulations in order to take into account the demand for development near the highway corridor and at the above mentioned interchanges. Zoning regulations may need to be revised to protect the environment from the demand for development near the highway corridor. Development near the northern terminus should be regulated by Merrimack to protect the Pennichuck Brook water supply.

A common impact attributable to increased development is the acceleration of the natural eutrophication process. This occurs as a result of increased nutrient loading into a surface water. Septic systems are a common source of excess nutrients associated with residential development. During periods of heavy rains, poorly designed septic systems tend to overflow and malfunction. Nutrients, mainly nitrogen, leech out of these systems and find their way into nearby surface waters. Fertilizers are also a major source of nutrient loading associated with increased residential development. Homeowners who use excessive fertilizers, herbicides, and pesticides on their lawns and gardens increase the likelihood that these nutrients and chemicals will become mobilized and enter surface and groundwater. Additional impacts associated with increased development include increased surface water runoff, peak flows, and sedimentation. In addition to the herbicides and pesticides already mentioned, industry-specific hazardous chemicals may also enter surface waters as a result of accidental spills or intentional violations. To safeguard against these problems, zoning and environmental officials should seriously consider the developmental potential of this zone and prepare for related impacts before they occur.

Water Resources/Wells and Aquifers. In order to make predictions as to secondary impacts, existing and probable future land use zones must be identified that exhibit potential threats to either the quality or quantity of water resources. These impacts could be attributed to the density of development, siting of structures or materials, or high risk activities related to specific land use practices.

With respect to potential development threats on existing and potential groundwater supplies, the area along the Hudson/Litchfield border holds the most sensitivity. This area is underlain by a substantial aquifer deposit and is also home to the Southern New Hampshire Water Company's Weinstein Well, a supply that pumps one million gallons per day and currently serves 4,500 individuals. The traffic zones within this area are anticipated to experience a notable increase in square footage of non-residential building space and residential development - in particular, zones 264 and 265, located along N.H. Route 102 slightly to the east of the Weinstein Well, and zone 263, which contains the well. It is a well known fact that groundwater degradation is a nearly inevitable consequence of increased economic growth, increased land use, and industrial development. For example, increased pesticide and herbicide use is directly related to an increase in residential development. Likewise, the potential for hazardous materials managing to migrate into the groundwater is increased with industrial developments.

Increases in development will be most pronounced at and near interchanges where the proposed Circumferential Highway alignments intersect or connect to the regional arterial roadways, namely N.H. Route 111, N.H. Route 3A, N.H. Route 102, and the F.E. Everett Turnpike.

Of these interchanges, N.H. Route 3A and N.H. Route 102 pose the most concern in terms of potential future groundwater impacts. This is because these areas are underlain by stratified drift deposits that currently provide nearby residents with a potable water supply. Build projections for industrial and commercial development is estimated to be five times greater than the No-Build projections for these interchanges. Aquifer protection efforts and growth are in many instances incompatible (Magnuson, 1983). However, the identification of areas presumed to see increased development allows planners and environmentalists the ability to prepare for potential impacts in advance. This is best accomplished through altering existing zoning regulations and creation of Aquifer Protection Districts (as in Merrimack) that regulate against certain types of development. In this way, high risk land use practices can be directed to areas where groundwater resources are not utilized for a public water supply.

The demand for clean, safe drinking water will also increase as a direct consequence of the overall 10 percent acceleration in development predicted for the study area. Outlying sections of Hudson, which rely on groundwater obtained from limited bedrock aquifer supplies, may have to receive water piped from the town's water system in the future. This is because the supply obtained from the bedrock aquifers may not be able to meet future demand. Elsewhere in the study area, increased demand on the Southern New Hampshire Water Company, the Pennichuck Water Works, and the Merrimack Village District may result in a restructuring of water supply services in the future.

The best approach in protecting potential groundwater resources from contamination from residential development is through the implementation of Wellhead Protection Programs, Aquifer Protection Programs, homeowner education, and rezoning. Furthermore, once development has taken place, engineering measures designed to protect groundwater resources can be applied.

Wetlands. Development induced by the construction and operation of the Circumferential Highway and other planned transportation improvements will result in increased pressures on wetland habitats. The following is a list of key wetlands identified along the proposed Build Alternatives and the associated development changes predicted from the construction of a Circumferential Highway:

Key Wetland	Predicted Changes in # Houses/Acre	Predicted Changes in Sq. Ft. Non-Res. Building Space/Acre
AC4	0.1	0.0
BC2	0.1	0.0
BC5	0.1	0.0
Alt. BC1	0.1	0.0
DF4	0.1	0.0
EF2	0.1	0.0
NM1	0.1	88.2
LO1	0.1	88.2
HI7	0.0	0.0
IJ1	0.0	0.0
IJ2	0.0	0.0
MP3	0.3	587.4

As is to be expected, wetlands around potential interchanges (at N.H. Routes 3, 3A, 102 and 111) should experience the greatest development pressures. The area around wetland MP3 (Exit 10 in Merrimack) is targeted for a large increase in non-residential development, as is the area between N.H. Route 3A and the Merrimack River in southern Litchfield, the area adjacent to N.H. Route 102 near the Hudson-Litchfield town line, and the area adjacent to N.H. Route 3A near the Sagamore Bridge. The land adjacent to the N.H. Route 111 interchange is expected to experience slight increases in both residential and non-residential development as a result of the Circumferential Highway.

Wetlands in no-growth zones under the secondary development predictions (such as HI7, IJ1 and IJ2) are expected to experience both residential and non-residential development pressures if all projects in the region are completed.

Since wetlands are currently protected by law, the degree and type of wetland impact due to secondary and cumulative effects will depend on the regulatory measures currently in place. Assuming general trends do not reverse dramatically, it can be expected that local commissions will continue to implement current wetland regulations, and continue to develop increasingly protective policies to ensure continued protection and management of wetland resources. The town of Hudson's 1990 Conservation Commission Plan suggests that a town-wide wetland evaluation and subsequent designation of prime wetland habitats be done as a supplemental protection mechanism. Wetlands designated as prime areas will require closer examination of impacts (Hudson, 1990). The town of Merrimack is currently coordinating a town-wide inventory and evaluation of its wetland resources (Cathy Doyle, Chairwoman Merrimack Conservation Commission personal communication, 1992).

Environmental Risk Sites. Environmental risk sites are predominantly associated with standing structures. However, should secondary and cumulative development pressures encourage a reuse or redevelopment on the site of an environmental risk, Federal, State, and local regulations stipulate that the site be cleaned up prior to any reconstruction/reuse activity.

Impacts on Nashua. The cumulative impacts of this project on Nashua are far-reaching and of vital importance to the viability and responsiveness of the city to a changing economy and commerce. Yet, the project has virtually no structural involvement within the city limits of Nashua. Therefore, there are no direct impacts. Cumulative impacts, as a reflection of regional development and its incremental consequence, relate most directly to reduced congestion on existing bridges and streets in and near the Central Business District.

It is helpful, in assessing potential impacts in Nashua, to examine cumulative impacts resulting from the construction of new highways which relieve traffic in other communities. By doing so, a model can be constructed to predict the anticipated results in Nashua. In particular, work by the Maguire Group (1990) examined the impacts of limited access highways which bypass a population center, similar, in many respects, to the relationship which Nashua has with the proposed Circumferential Highway. In the Maguire study, it is clear that relief of traffic congestion by limited access highway construction does not significantly alter land use patterns and trends.

Limited access by-pass highways are meant to divert through traffic away from a pre-existing and congested corridor. As a cumulative consequence, stable business and residential activity is supported over the long range of 20 to 30 years. As previously mentioned, development along such a limited access corridor is generally limited to areas near interchanges.

By definition, the objective of diverting **through traffic** serves to relieve a road of vehicles whose destination is elsewhere. Therefore, the residual traffic moving between origins and destinations is less impeded by extraneous through traffic. With respect to the CBD of Nashua, the existing roadway system will, therefore, offer improved levels of service. This benefit is quantified in the Traffic and Transportation Technical Report (revised August 1993).

From the perspective of cumulative land use changes associated with highway intersections, Nashua will contend with no interference with its development. Virtually no land is taken by the proposed Circumferential Highway. Yet access to Nashua is increased by adding two new crossings of the Merrimack River, one parallel to the existing Sagamore Bridge, and a new crossing north of Nashua.

4.23.4 Mitigation

Zoning is the principal tool available to manage land use and development. It is a low-cost, effective mechanism employed for the purpose of promoting the health, safety, and welfare of a community. Existing regulations included in a town's zoning ordinance provide direct and indirect protection of natural and cultural resources that are contained within a town's boundaries.

Zoning commissions in the City of Nashua, and the Towns of Hudson, Litchfield, and Merrimack can review their respective ordinances and Master Plans of Development in order to quantify and evaluate the potential changes attributable to the limited access highway.

By doing so, resource protection measures included in the town's zoning ordinance can be enforced in areas where they are judged to be most necessary. These areas may include, for example, critical habitats, open space, conservation lands, prime wetlands, valuable drinking water aquifers, and unfragmented forest blocks. The analysis "flags" traffic zones predicted to experience a significant increase in development.

In addition to the zoning districts outlined above, each town's Conservation Commission must take a role in the identification of natural resources in need of protection. An inventory of those resources considered valuable from an ecological standpoint should be conducted and the results documented. This inventory should focus on those areas identified within the framework of this analysis as being most likely to encounter cumulative impacts as a consequence of future development. The enforcement of regulations designed to protect these resources should, however, be the first and foremost responsibility of these commissions at the local level of government.

In addition to local controls outlined in a town's zoning ordinance or conservation plan, many Federal and State environmental regulations exist which provide direct and indirect protection of natural and cultural resources.

Representative Federal regulations include the Clean Water Act, Safe Drinking Water Act, Endangered Species Act, Resource Conservation and Recovery Act, and the Clean Air Act. These regulations are administered by Federal Agencies such as the Corps, the EPA, and the FWS.

Representative State regulations include the New Hampshire Safe Drinking Water Act (NH RSA 485), Fill and Dredge Act (NH RSA 482-A), New Hampshire Endangered Species Conservation Act (NH RSA 212-A), and the New Hampshire Air Pollution Control Act (NH RSA 125-C). These regulations are administered by State Agencies such as the New Hampshire Wetlands Board, New Hampshire Water Supply and Pollution Control Division of the Department of Environmental Services, and the New Hampshire Fish and Game Department.

Land use agencies responsible for the management of natural resources should be made aware by this EIS of the increased pressures predicted by the analyses. Additionally, they should verify that controls are in place and are properly enforced. The enforcement of these regulations at the local level is a vital task, and is an absolute necessity in the ultimate protection of natural and cultural resources.

NOTE: Refer to Section 2.4.2, Summary of Alternative 9 Impacts for a complete analysis of the environmental consequences associated with Alternative 9.

4.24 COMPLIANCE REQUIREMENTS

Implementation of this project, regardless of which alternative is selected as the least environmentally damaging practicable alternative (LEDPA), will require several permits and certifications or technical reviews at various Federal and State levels of jurisdiction. As lead agency, the Corps has determined under NEPA that an EIS is required for this project.

Discussed below is a summary of some compliance requirements required for the implementation of this project.

***The National Environmental Policy Act (NEPA)** is the basic national charter for protection of the environment. It establishes policy, sets goals and provides means for carrying out the policy. In addition, it requires that reasonable alternatives be evaluated and that environmental information be available to public officials and citizens before decisions are made and before actions are taken. This EIS is the required documentation for these purposes. NEPA regulations governing the Department of the Army's regulatory activities are found in 33 CFR Part 325 Appendix B.*

***Section 404 of the Clean Water Act** authorizes the Corps to regulate the discharge of dredged or fill materials into waters of the United States. A permit is required.*

***Section 401 of the Clean Water Act** requires applicants to obtain a certification or waiver from the State water pollution control agency to discharge dredged and fill materials. NHDOT must apply to the New Hampshire Department of Environmental Services Water Supply and Pollution Control Division and Wetlands Board regarding this certification. This certification process will require coordination at a level of project design which allows site specific stormwater renovation considerations in light of final right-of-way definition.*

***The 404(b)(1) Guidelines** prepared by EPA in consultation with the Corps are the Federal environmental regulations for evaluating the filling of waters and wetlands. They are designed to avoid unnecessary filling of waters and wetlands. The guidelines prohibit discharges:*

- *where LEDPA's exist;*
- *which result in violations of State or Federal Water Quality Standards, the Endangered Species Act, or the Marine Sanctuaries Act;*

- *which cause or contribute to significant degradation of waters or wetlands;*

- *if all appropriate and practical mitigation has not been taken.*

Compliance with the guidelines is required before a 404 permit can be issued.

***Section 10 of the Rivers and Harbors Act** authorizes the Corps to regulate certain structures or work in or affecting navigable waters of the United States. The Merrimack River in New Hampshire is a navigable water of the United States, therefore a permit is required from the Corps to perform work in this waterway.*

***The Fish and Wildlife Coordination Act** requires that any federal agency that proposes to control or modify any body of water must first consult with the FWS and the National Marine Fisheries Service (NMFS) as appropriate. Both agencies have been consulted on this project. The FWS is a cooperating agency on this EIS. The NMFS has been consulted concerning anadramous fish within the Merrimack River.*

***Section 106 of the National Historic Preservation Act** requires that federal agencies afford full consideration of impacts to historic properties; 33 CFR Part 325 Appendix C establishes the procedures for the Corps to follow in its regulatory program to comply with the Act. The regulations require coordination with the SHPO, the ACHP, as well as the development of Memorandums of Agreement (MOA's) for properties listed in the National Register of Historic Places or eligible for such listing that will be adversely affected by an action. The Corps has been coordinating with the NHDHR throughout the EIS process. MOA's will be required for any of the alternatives, and must be included as conditions of the 404 permit.*

***The Endangered Species Act** requires that federal agencies, in consultation with the FWS and the NMFS use their authorities in furtherance of its purposes by carrying out programs for the conservation of endangered or threatened species, and by taking such action necessary to ensure that any action authorized, funded, or carried out by the agency is not likely to jeopardize the continued existence of such endangered or threatened species or result in the destruction or adverse modification of habitat of such species which is determined by the Secretary of the Interior or Commerce, as appropriate, to be critical. The Corps completed a Biological Assessment for the Bald Eagle on this project in compliance with the Act. The Corps concluded that Alternatives 1, 2, 7 and 8 would have no adverse impacts to the Bald Eagle, whereas Alternatives 3, 4, 5 and 6 would be likely to adversely affect the Bald Eagle. Formal consultation will be necessary with the FWS if Alternative 3, 4, 5 or 6 is selected as the LEDPA.*

Section 6(f) of the Land and Water Conservation Act (LAWCON), as amended, requires that property acquired or developed with LAWCON assistance is retained and used for public outdoor recreational use. Any property so acquired or developed shall not be wholly or partly converted to other than public outdoor recreational uses without the approval of the director of the U.S. Department of the Interior.

No lands within any of proposed alignments have been found to be classified as falling under this federal jurisdiction. Therefore, this regulation is not expected to apply.

***Executive Order 11988** requires that the Corps avoid authorizing floodplain development whenever practicable alternatives exist outside the floodplain. If there are no such practicable alternatives, the Corps shall consider, as a means of mitigation, alternatives within the floodplain which will lessen any significant adverse impact to the floodplain.*

The Corps is required to employ the eight-step decision-process outlined in Further Advice on Executive Order 11988 Floodplain Management prior to filling a floodplain.

***National Pollution Discharge Elimination System Permit.** Under jurisdiction of the Clean Water Act of 1972, as amended (Section 402 33 U.S.C. 1251 et seq.) it is anticipated that the New Hampshire Department of Environmental Services will have in place a new procedure to administer this regulation. That procedure is expected to require that proposed projects seek an NPDES permit in order to ensure water quality protection.*

Compliance by this project with those procedures will be initiated once the Corps issues a permit and as soon as NPDES permit procedures are in effect.

***Hazardous Materials Regulations.** The applicability of hazardous materials regulations and the implementation of compliance procedures associated with the various hazardous materials regulations (both federal and state) will begin with a preliminary site assessment on any risk site implicated in the identification of the LEDPA. Compliance will be concluded as part of the final permit process in advance of project construction as directed and controlled by applicable regulations.*

State permits and coordination specific to State requirements include the following:

Inland Wetlands and Water Courses. ***Inland Wetlands and Water Courses.*** *The State of New Hampshire Department of Environmental Services, Wetlands Board will require a full review of all findings of fact relative to the identification and functional value of those wetland and surface water resources which may be directly or indirectly impacted by this proposed project. As a cooperating state agency, the Wetlands Board will process an application once the project is into design of a specific alignment. The process will be consistent with New Hampshire RSA 482-A and regulatory procedures in Chapter WT100 through WT800.*

River Protection. *The project crosses the Merrimack River within the jurisdictional boundaries of the New Hampshire Rivers Management and Protection Program, administrated by the Department of Environmental Services. Early coordination with that Department will be required on this aspect of project implementation once a final alignment is defined for the project.*

Aquifer Protection. *Coordination of the project with the New Hampshire Department of Environmental Services, Water Quality Division Well Management Bureau will be required to insure appropriate groundwater protection. This will be initiated simultaneous with the state coordination activities defined above.*

Historic Preservation. *Refer to the discussion on Section 106 of the National Historic Preservation Act. The SHPO has been an integral part of the Corps Section 106 coordination, including National Register Eligibility Determinations, effects determinations, as well as being signatory's to the MOA's.*

4.25 ADVERSE ENVIRONMENTAL EFFECTS THAT CANNOT BE AVOIDED

There are short-term adverse impacts associated with all Build Alternatives, none of which result in significantly different magnitudes. These short-term impacts include disruption of traffic patterns, the imposition of construction traffic on the existing roads, construction noise, fugitive dust, erosion and sedimentation, "housekeeping" requirements and all other associated nuisance factors which occur during the construction of a major transportation facility.

All such factors are minimized to a permitted and tolerable level by the imposition of construction specifications. Contract specifications dictate methods and constraints which must be followed in order to control project implementation during the construction period. As part of construction contracts, they are enforced by Construction Management personnel responsible to certify that contract conditions, which include permit constraints, are being fully and effectively implemented.

Long-term impacts relate to changes in land use which are defined in the Socio-economic Impacts Technical Report, and resource impacts to air quality, the noise environment, water quality, wetland impacts, and wildlife and habitat impacts. These are defined and quantified to the extent possible in each of the technical reports which are part of this EIS. Their avoidance, mitigation, and compensation is dealt with elsewhere in this EIS in the appropriate, impact specific sections.

With respect to a consideration of the No Build Alternative, it leads to considering associated unavoidable adverse impacts. In that sense, simple developmental or anti-developmental strategies are bad substitutes for resource stewardship. Lack of action, by choosing to do nothing, disrupts the orderly stewardship advocated by the fundamental environmental laws of the United States. That disruption is created when the body politic is obstructed from following its consensus to choose plans to manage human and natural resources. Inaction, (i.e., the No Build) is virtually always a worse choice than action because inaction usually leads to disorder, lack of direction, and consequential bureaucratic lethargy.

The No Build Alternative would allow worsening traffic congestion, air quality degradation, and associated adverse impacts to continue. Control of land use would be weakened by lack of support of the regional and State plans of development which recognize the Nashua-Hudson Circumferential Highway as a significant part of the transportation infrastructure of the region.

Most importantly, the No Build Alternative removes an opportunity for focused resource management from the region. Consequential short term impacts resulting from selecting the No Build Alternative will be those now present. They all relate to significant traffic congestion and restricted access to east-west vehicular movement in the region.

Long term adverse effects resulting from selecting the No Build Alternative are indeterminate because in the absence of managing resources, disorder follows and the consequences are especially illusive to predict since no plan exists to enable confident development of a predictive model.

4.26 RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

Environmental impacts associated with any and all of the proposed Build Alternatives will result in short and long-term impact relationships which are fundamentally similar in kind and magnitude. The Highway Methodology guided this environmental impact assessment. It is a procedure promulgated by the U.S. Army Corps of Engineers, New England Division and requires that all significant short and long-term environmental relationships created by project alternatives be quantified in light of the (1) avoidance, (2) minimization and (3) compensation of unavoidable impacts on resources. In addition to wetlands, wildlife, air quality, water, farmland, and historical/ archeological factors, quantified resources include options of societal land use and development. Those commitments are represented by secondary and cumulative developments anticipated as a consequence of implementation of any of the Build Alternatives.

The differences between Build Alternatives are quantified and assessed in the resource specific sections of this EIS. Full documentation of the methods and interpretation of conducting their assessments are documented in the technical reports which are a part here of. The Highway Methodology provides a basis on which the choice of one alternative over another is aided. However, the choice is expected to be difficult because each potential choice, except No. 7 (the original BC state preferred alignment) was derived by filtering choices through a winnowing of adverse impact (1) avoidance, (2) minimization, and (3) compensation.

The surviving Phase II alternatives are close to one another in overall impacts. Each is based on planning which recognizes traffic requirements within the content of present and future land use. In that sense, and coupled with environmentally sound design and construction management practices cited elsewhere in this EIS, short-term impacts and use of resources are evaluated. Those alternatives are all consistent with the conservative maintenance and enhancement of long-term productivity of the study area in particular, and the state and region, in general.

In summary, the long-term enhancement of the efficiency of the study area roadway system would occur at the expense of short-term construction impacts on nearby residents. Those short-term effects would include localized noise, air and water pollution and traffic delays. Based on standard environmental specifications made part of construction contracts as directed by this EIS, they would not have a lasting impact on the environment.

Short-term gains to the local economy would occur during construction resulting from hiring local firms and labor, and local services and supplies.

Long-term relief of traffic congestion in the Central Business Districts of Nashua and Hudson, and increases in cross river access to those municipal activity centers, answer the basic project purpose.

Based on its significant contribution to the long-term objects of regional and local plans of development, the proposed Nashua-Hudson Circumferential Highway project is consistent with the maintenance and enhancement of long-term productivity of the known local, regional, and State plans of development.

4.27 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

All Build Alternatives involve comparable commitments of land for new highway construction. The specific quantification of this measure of impact is reported in the socio-economic technical report, summarized in Sections 4.2 and 4.3 of this chapter and detailed in the technical report which is part hereof.

As a project-specific overview, implementation of the proposed highway requires the commitment of a wide range of natural, physical, human and fiscal resources, most of which are irretrievable but reversible. For example, land used in the construction "footprint" is irreversible for the life of the project. Obviously, if a greater need arises for its use, or if the highway is no longer needed, the land can be converted (i.e., reverted) to other uses, albeit very improbable that such an eventuality could come to pass.

Large amounts of fossil fuels, labor, and construction materials, such as cement, aggregate, and bituminous material, will be invested. Large amounts of labor and natural resources are needed to fabricate construction materials. Once used, these materials are essentially gone from the reuse cycle. Project implementation will also expend irretrievable state funds. However, that financial investment returns not only tolls from facility users, but also generates returns to the economy derived from positive socio-economic impacts of secondary or cumulative contributions of the project. One such example is the support which Build Alternatives provide adjacent municipalities in expanding their infrastructure. This will accelerate land use in those areas defined in the socio-economic and secondary/cumulative development analyses of this EIS.

The displacement of buildings and residents can result in a loss of these resources. However, replacement housing is available and only loss of structures is essentially irretrievable. State policies provide relocation procedures to protect affected residents and provide a means by which they can remain in the community.

The loss of tax revenues from private land taken for highway use would result in an irretrievable loss to the local economy while enabling, accelerating, or redistributing land use and associated local taxes as quantified in the socio-economic sections of this EIS.

The commitment of this required broad array of resources is advocated in this proposed project based on the concept that the human society in the immediate area, State, and region will benefit from the improved quality of this piece of a transportation infrastructure planned for and anticipated over a period of many years. Benefits anticipated include (1) improved accessibility; (2) improved safety; (3) time savings; and (4) availability of high quality highway transportation service to the Nashua-Hudson business districts, the region, and the State.

Chapter 5
Community and Agency Coordination

Chapter 5
COMMUNITY AND AGENCY COORDINATION

This section summarizes agency and public involvement during the planning phases of the Nashua-Hudson Circumferential Highway Project. Copies of Notice of Intents, published in the Federal Register, and other pertinent correspondence and information are included in Appendix B.

5.1 PUBLIC MEETINGS

Several public meetings have been held since the Corps published the Notice of Intent to produce a Revised Draft Environmental Impact Statement. The first meeting, a formal Scoping Meeting, was held on June 28, 1990, at the Nashua City Hall. This evening session was attended by approximately 70 people, including agency representatives as well as citizen groups and individuals. After the history and status of the project were presented, the meeting was opened to comments and questions.

Preliminary alternatives were presented at the second meeting, a Public Information Meeting, held on April 10, 1991, at Alvirne High School in Hudson. Approximately 200 people attended. As with the previous meeting, questions and comments were solicited.

The majority of comments dealt with the locations of specific alternates, especially for the alignment north of NH Route 111. Some general issues raised included the following:

- Most commenters agreed with the need for the project. Some felt that the Transit/TDM and TSM Alternative had not been given enough consideration and questioned the wisdom of spending public funds on a highway, considering the existing economic climate.

- Several residents from Litchfield expressed opposition to the more northerly routes, citing traffic on NH Route 3A (already too heavy), and the feeling that the highway would "cut the town in half" if either of those routes were chosen.

- The fact that zoning regulations in some of the affected towns had been developed and/or changed to accommodate the 1984 BC alignment should be taken into consideration.

- Pedestrian/bicycle lanes should be provided on both new bridge crossings of the Merrimack River.

- Toll diversion should be considered.

A third meeting, a Public Information Meeting, was held on July 6, 1992, at Alvirne High School in Hudson. Approximately 300 people attended this meeting and had the opportunity to view displays showing the Phase II alternative alignments in conjunction with the mapped resource data. After the status of the project was presented, the meeting was opened to comments and questions.

Some general issues raised included the following:

- Several residents discussed the need for toll facilities, the traffic diversion that may result, and the necessity of paying a toll to travel from Hudson to Nashua and vice-versa. Some residents questioned the absence of federal funds on the project.

- Alternatives 7 and 8 received support, due to a majority of the right-of-way already having been purchased. Alternative 8 was the preferred of the two, as it avoids crossing the Pennichuck ponds.

- Most commentors agreed on the need for the project and stated their impatience in waiting for the commencement of construction.

- Pedestrian/bicycle access at the northern routes across the Merrimack River.

- The purchase of Benson's Animal Park as a means of providing mitigation for wetland impacts.

- The need for more information on the Transit/TDM and TSM Alternatives.

A project mailing list was developed from these meetings. Before the selection of the six Full Build Alternatives carried forward to the DEIS, a mailing was prepared and information distributed. This mailing presented the project status and offered a means to comment on the preliminary alternatives.

The DEIS was distributed in October 1992. A reconvened Public Hearing was held on January 4, 1993 at Hudson Memorial School. Comments received at and subsequent to this hearing were included as part of the official record and can be found in their entirety in Volume II of this FEIS.

5.2 AGENCY COORDINATION

At an interagency meeting on April 26, 1990, the Corps agreed to act as the lead federal agency on this project and discussed the need for a revised DEIS. The Notice of Intent to produce a revised DEIS was published in the Federal Register, Vol. 55, No. 100 on May 23, 1990. (See Appendix B)

On May 10, 1990, the Corps sent letters to the United States Environmental Protection Agency (EPA), Fish and Wildlife Service (FWS), Soil Conservation Service (SCS), and the Federal Highway Administration (FHWA) to formally request that they be cooperating agencies for this project. A positive response was received from the EPA, FWS, and the SCS. Copies of the Corps request and agency responses are included in Appendix B.

A Scoping Meeting was held on June 28, 1990, at Nashua City Hall. In addition to the lead and cooperating federal agencies, also represented at this meeting were the FHWA, the Federal Emergency Management Agency (FEMA), the New Hampshire Department of Transportation, New Hampshire Department of Environmental Services, New Hampshire Division of Historical Resources, and the Nashua Regional Planning Commission. Other attendees included representatives of the City of Nashua, the Pennichuck Water Corporation, the New Hampshire Land Conservation Investment Program, New Hampshire Sierra Club, and The Telegraph (a local newspaper). Written and oral comments were received.

Interagency meetings were held on October 18, 1990, and February 20, 1991. The purpose of these meetings was to brief the agencies on the development of alternative alignments and receive concurrence on how many and which alternatives needed to be considered. All cooperating agencies were present at these meetings. At the February 20 meeting, agreement was reached on the 33 preliminary alternative alignments.

On June 5, 1991, an interagency meeting was held at the Waltham office of the Corps for the purpose of eliminating the least desirable of the 33 preliminary alignments, leaving a minimum of four alignments to be carried forward to the DEIS. All cooperating agencies were in attendance. Concurrence was reached on six alignments, including the 1984 BC alignment and its altered alignment BC-K. It was agreed at this meeting that the Corps, EPA, and SCS representatives would make a field visit to the site to clarify the extent of wetlands in the Northern Segment. This meeting took place on November 18, 1991.

Several informal meetings with representatives of individual agencies took place during the intervals between these large interagency meetings. The purpose of these smaller meetings was to keep the cooperating agencies apprised of progress made in quantifying impacts and proposed methods of presenting the information. As comments were received, methods were modified so that agency concerns were addressed. A listing of these meetings follows, with a more detailed description provided for the interagency meetings:

July 18, 1991: A meeting was held at NHDOT with representatives of the Departments of Transportation and Environmental Services, the Corps, EPA, FWS, and FHWA to discuss wetland evaluations.

August 29, 1991: A meeting was held at the office of the Audubon Society of New Hampshire with representatives of the Society, EPA, and FWS to discuss proposed methodology for evaluating wetland functions, wildlife and vegetative resources.

August 30, 1991: A meeting was held at EPA with NHDOT and Subconsultant KM Chng to review the scope and approach for the air quality and noise analyses of the EIS.

September 20, 1991: A meeting was held at the Corps with the EPA, FWS, FHWA, NHDOT, and KM Chng to discuss the proposed modeling protocol for air quality and noise analysis.

September 27, 1991: A meeting was held in Hudson with the EPA, FWS, and the NH Audubon Society to demonstrate the wetland function evaluation technique developed in accordance with the directives of the Corps.

February 14, 1992: A meeting was held in Concord (New Hampshire) with the Corps, EPA, FWS, and NHDOT to discuss wetland mitigation.

Subsequent to the October 1992 publication of the DEIS and January 4, 1993 Public Hearing, several meetings were held to discuss and clarify issues that were raised at the Public Hearing. These meetings were part of the coordination involved in the preparation of this FEIS.

OVERALL COORDINATION MEETINGS

Date	Location	Purpose
5/9/90	Waltham, MA	Kick-off Meeting
5/16/90	Concord, NH	Collect File Data
6/13/90	Boston, MA	EPA Coordination
6/28/90	Nashua, NH	Public Scoping Meeting
7/11/90	Waltham, MA	Corps Coordination
7/13/90	Waltham, MA	Corps Coordination
7/23/90	Lowell, MA	EPA Coordination
7/23/90	Waltham, MA	Corps Coordination
8/6/90	Concord, NH	DOT Coordination
8/6/90	Concord, NH	FWS Coordination
8/16/90	Concord, NH	DOT Coordination
9/16/90	Waltham, MA	Corps Coordination
9/18/90	Waltham, MA	Corps Coordination
10/4/90	Concord, NH	Agencies Coordination
10/10/90	Concord, NH	DOT Coordination
10/10/90	Durham, NH	RKG Coordination
10/18/90	Waltham, MA	Corps Coordination
10/23/90	Concord, NH	DOT Coordination
10/23/90	Waltham, NH	Corps Coordination
10/26/90	Concord, NH	DOT Coordination
11/1/90	Concord, NH	DOT Coordination
11/2/90	Boston, MA	EPA Coordination
11/3/90	Concord, NH	DOT Coordination
11/7/90	Boston, MA	EPA Coordination
12/5/90	Concord, NH	DOT Coordination
12/5/90	Waltham, MA	DOT Coordination
12/19/90	Boston, MA	EPA Coordination
12/28/90	Concord, NH	DOT Coordination
1/22/91	Concord, NH	DOT Coordination
2/1/91	Waltham, MA	Corps Coordination
2/13/91	Concord, NH	USFWS Coordination
2/13/91	Concord, NH	SHPO Coordination
2/20/91	Boston, MA	Out Selc. Agency Coord.
3/7/91	Concord, NH	DOT Coordination
4/10/91	Hudson, NH	Public Information Meeting
5/8/91	Waltham, MA	Corps Coordination
5/15/91	Boston, MA	EPA Coordination
5/16/91	Concord, NH	FWS Coordination
5/16/91	Waltham, MA	Corps Coordination
5/17/91	Waltham, MA	Corps Coordination
5/24/91	Concord, NH	DOT Coordination
5/31/91	Concord, NH	DOT Coordination
6/5/91	Waltham, MA	Corps Coordination
6/17/91	Waltham, MA	Corps Coordination
6/17/91	Concord, NH	DOT Coordination

Date	Location	Purpose
7/2/91	Boston, MA	EPA Coordination
7/10/91	Concord, NH	DOT Coordination
7/18/91	Concord, NH	Wetland Evaluations
7/29/91	Concord, NH	FWS/DOT/TSM
8/2/91	Waltham, MA	Corps Coordination
8/14/91	Concord, NH	DOT Coordination
8/14/91	Waltham, MA	Corps Coordination
8/29/91	Concord, NH	Environmental Evaluations
8/30/91	Boston, MA	EPA Coordination
9/6/91	Boston, MA	MCE-Air/Noise
9/20/91	Waltham, MA	Agency Air/Noise
9/23/91	Concord, NH	DOT Wetland
9/24/91	Boston, MA	EPA Coordination
9/27/91	Hudson, NH	Agency Coordination - Wetlands
10/2/91	Concord, NH	DOT Wetland
10/11/91	Waltham, MA	Corps Coordination
10/18/91	Waltham, MA	Corps Coordination
11/1/91	Waltham, MA	Corps Coordination
11/7/91	Hudson, NH	Town Engineer - Project Update
11/18/91	Hudson, NH	Conservation Commission
11/18/91	Waltham, MA	Corps Coordination
11/25/91	Concord, NH	DOT Coordination
12/2/91	Concord, NH	DOT Traffic
12/20/91	Waltham, MA	Corps Coordination
1/16/92	Concord, NH	USFWS Coordination - Wildlife
1/16/92	Concord, NH	NH Nat. Heritage Inv. Coordination
1/31/92	Boston, MA	Air/Noise Coordination
2/4/92	Boston, MA	EPA,Corps,NHDOT - Partial Builds
2/14/92	Concord, NH	EPA,NHDOT - Partial Builds
3/3/92	Boston, MA	Water Quality Mitigation
5/8/92	Concord, NH	DOT Coordination
5/15/92	Concord, NH	DOT Coordination
6/2/92	Waltham, MA	Corps Coordination
7/1/92	Waltham, MA	Corps Coordination
7/6/92	Hudson, NH	Public Information Meeting
7/16/92	Concord, NH	Coordination w/NHDOT, Corps
7/21/92	Nashua/Merrimack, NH	Discussion on Bald Eagles w/NH Audubon
7/30/92	Hudson, NH	Coordination w/Arch. Subconsultant
8/7/92	Concord, NH	EIS Coord. w/NHDOT, Corps

TRAFFIC MEETINGS

Date	Location	Purpose
1/4/91	Concord, NH	DOT Traffic
1/17/91	Concord, NH	DOT Traffic/Coordination
2/1/91	Nashua, NH	NRPC
6/5/91	Waltham, MA	Agency Coordination

Date	Location	Purpose
6/21/91	Nashua, NH	NRPC
9/6/91	Cambridge, MA	Air/Noise Coordination

Date	Location	Purpose
9/13/91	Cambridge, MA	Air/Noise Coordination
9/20/91	Waltham, MA	Agency Air/Noise
10/18/91	Waltham, MA	Agency Air/Noise
12/2/91	Concord, NH	DOT Traffic
1/16/92	Nashua, NH	NRPC

WETLAND ASSESSMENT/MITIGATION MEETINGS

Date	Location	Purpose
11/7/90	Boston, MA	EPA Coordination
5/15/91	Boston, MA	EPA Coordination
7/18/91	Concord, NH	Agency Coordination
8/29/91	Concord, NH	NH Audubon Coordination
9/18/91	Hudson, NH	Corps Field Meeting/Demonstration
9/27/91	Hudson, NH	Agency Field Meeting/Demonstration
10/1/91	Hudson, NH	Agency Field Meeting/Demonstration
10/2/91	Concord, NH	Corps Coordination
10/23/91	Hudson, NH	Town Engineer - Informational
10/23/91	Hudson, NH	Alvirne H.S. - Informational
11/1/91	Waltham, MA	Agency Coordination
11/18/91	Hudson, NH	Agency Field Meeting - NWI/SCS
11/18/91	Hudson, NH	Conservation Com. - Informational
12/20/91	Waltham, MA	Corps Coordination - Mitigation
1/2/92	Concord, NH	Corps Coordination - Mitigation
1/22/92	Hudson, NH	Hudson, Litchfield, DOT Coord. - Mitigation
2/10/92	Hudson, NH	Hudson, Litchfield, DOT Coord. - Mitigation
2/14/92	Concord, NH	Agency Coordination - Comp./Mit.
3/13/92	Concord, NH	DOT Coordination - Compensation
3/24/92	Merrimack, NH	Merrimack Conservation Comm. Compensation
5/14/92	Hudson, NH	Agency Coordination at Bensons - Corps, EPA, NHDOT, Hudson Conservation Commission, F&WS
5/29/92	Hudson, NH	Mitigation Discussion at Bensons

AIR/NOISE MEETINGS

Date	Location	Purpose
8/30/91	Boston, MA	EPA Coordination
9/6/91	Cambridge, MA	Traffic Coordination
9/13/91	Cambridge, MA	Traffic Coordination
9/20/91	Waltham, MA	Agencies Air/Noise
9/24/91	Boston, MA	EPA Coordination

Date	Location	Purpose
1/31/92	Boston, MA	EPA Coordination
6/24/92	Concord, NH	Review of Air TR w/DOT

ARCHEOLOGICAL/HISTORICAL RESOURCES MEETINGS

Date	Location	Purpose
10/10/90	Concord, NH	NH Historical Coordination
10/18/90	Waltham, MA	Agency Coordination
2/13/91	Concord, NH	NH Historical Coordination
2/20/91	Boston, MA	Agency Coordination
3/7/91	Concord, NH	Agency Coordination
5/1/91	Concord, NH	NH Historical Coordination
5/14/91	Concord, NH	NH Historical Coordination
5/31/91	Concord, NH	NH Historical Coordination
6/5/91	Waltham, MA	Agency Coordination
10/15/91	Concord, NH	NH Historical Coordination
5/5/92	Concord, NH	NH Historical Coordination
6/3/92	Concord, NH	Review of Hist/Arch TR w/DOT, NH HRC

SOCIOECONOMICS/LAND USE MEETINGS

Date	Location	Purpose
4/10/91	Hudson, NH	Public Meeting
5/13/91	Nashua, NH	Pennichuck Corporation
5/13/91	Hudson, NH	Lockheed/Sanders
5/13/91	Nashua, NH	Kollsman Instruments
5/14/91	Nashua, NH	Tamposi Company
5/15/91	Nashua, NH	Gutierrez Company
5/16/91	Merrimack, NH	Nashua Corporation
5/20/91	Hudson, NH	Digital Equipment Corporation
5/22/91	Merrimack, NH	Anheuser-Busch
5/28/91	Nashua, NH	NRPC
5/28/91	Nashua, NH	R.G. Bramley Associates
5/29/91	Hudson, NH	Brox Industries

Date	Location	Purpose
May/June	Hudson, NH	Hudson Planning Director
6/4/91	Nashua, NH	The Nash Group
6/5/91	Waltham, NH	Agency Coordination
9/30/91	Nashua, NH	Sanders Corporation
4/17/92	Concord, NH	Review of Socio. TR w/DOT

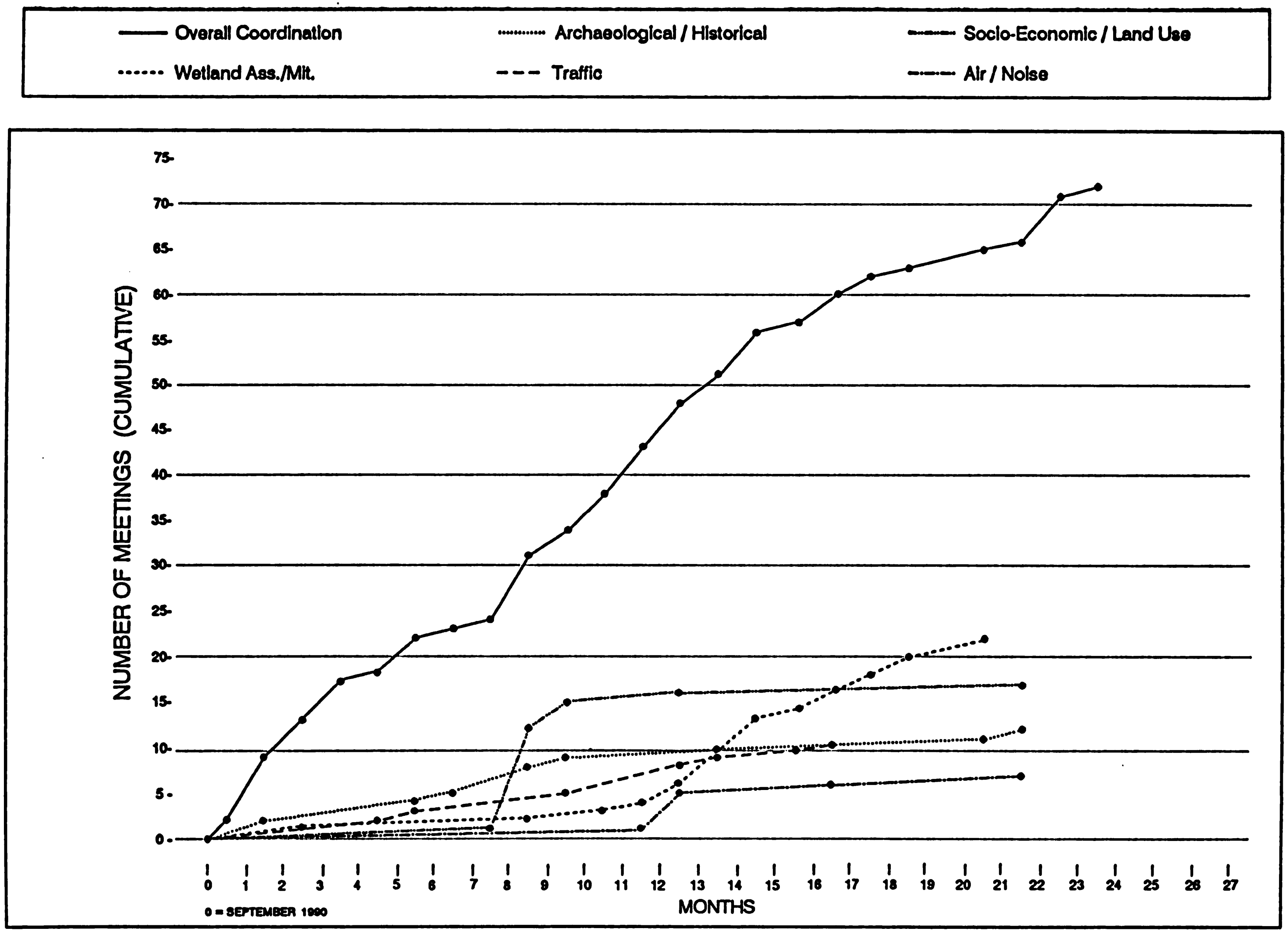


FIGURE 5.2-1
PROJECT MEETINGS ATTENDED
NASHUA-HUDSON CIRCUMFERENTIAL HIGHWAY EIS

Chapter 6
List of Preparers

Chapter 6
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Chapter 7
Distribution of Final Environmental Impact Statement

Chapter 7
DISTRIBUTION OF FINAL ENVIRONMENTAL IMPACT STATEMENT

The Environmental Impact Statement and Technical reports are available for inspection at:

U.S. Army Corps of Engineers, Waltham, MA
U.S. Environmental Protection Agency, Boston, MA
U.S. Fish and Wildlife Service, Concord, NH
U.S. Soil Conservation Service, Milford, NH
New Hampshire Department of Transportation, Concord, NH
New Hampshire Department of Environmental Services, Concord, NH
New Hampshire Department of Resources and Economic Development, Concord, NH
Nashua Town Hall
Merrimack Town Hall
Litchfield Town Hall
Hudson Town Hall
Nashua Regional Planning Agency, Nashua, NH

In addition, a copy of the FEIS will be sent to each individual that provided substantive comments on the DEIS.

Environmental Impact Statements are available for inspection at the following libraries:

State - NEW HAMPSHIRE STATE LIBRARY, 20 Park Street, Concord, 03301. Telephone: 603-271-2394. State Librarian, Kendall Wiggin, Assistant State Librarian, Matthew J. Higgins.

Merrimack - MERRIMACK PUBLIC LIBRARY, Daniel Webster Highway, 03054. Telephone: 603-424-5021. Director, Elizabeth Levy; Reference, Dianne Hathoway; Technical Service, Joyce Puriton.

Nashua - NASHUA PUBLIC LIBRARY, Two Court Street, 03060. Telephone: 603-594-3412. Director, Robert C. Frost; Assistant Director, Clare M. Ackroyd; Reference and On-Line Service, Nancy Grant.

Hudson - HILLS MEMORIAL LIBRARY, 18 Library Street, 03051. Telephone: 603-886-6030. Librarian, Susan DuFault; Assistant Librarian, Gail St. Cyr.

Litchfield - LITCHFIELD PUBLIC LIBRARY, 269 Charles Bancroft Highway 03051. Telephone: 603-424-4044. Director, Claudia Danielson.

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Appendices

APPENDIX A

FEDERAL HIGHWAY ADMINISTRATION REVIEW

Bob DeSanto

U. S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
REGION ONE
279 PLEASANT STREET, ROOM 204
CONCORD, NEW HAMPSHIRE 03301

September 22, 1992

IN REPLY REFER TO:

Mr. William F. Lawless, P.E.
Chief, Regulatory Division
Operations Directorate
US Army Corps of Engineers
424 Trapelo Road
Waltham, MA 02154

In response to your August 18, 1992 request, we have conducted a review of the MINUTP traffic model and the traffic projections generated from it for the Nashua Circumferential project. We received the assistance of Patrick DeCorla-Souza of our Headquarters Office, Planning Support Branch. Mr. DeCorla-Souza is very familiar with the MINUTP model and has had previous experience in its use at the Metropolitan Planning Organization level.

After prior review of the back-up documentation on the model and project traffic projections, Mr. DeCorla-Souza and Mr. O'Donnell of my staff met on September 10, 1992 with the following individuals:

Greg Lantos, Nashua Regional Planning Commission
Bob Lyford, NHDOT Bureau of Planning
Bob DeSanto, Parsons DeLeuw, Inc.
Tim White, Parsons DeLeuw, Inc.

This meeting was used to clarify any questions about the methodology used in the model and to determine whether the assumptions used and resulting projections were reasonable.

Although several suggestions surfaced from the review for future model updates, it was concluded that such adjustments would not significantly influence this project and that the 2010 traffic projections appear reasonable. Mr. DeCorla-Souza has provided the enclosed September 17, 1992 memorandum documenting his findings in detail. We are also enclosing a copy of a September 11, 1992 from Mr. Lantos responding to a few issues raised by Mr. DeCorla-Souza and a copy of Mr. O'Donnell's September 18 memorandum documenting the September 10 session.

After satisfying ourselves that the traffic projections were reasonable, we evaluated several project alternatives, because of your concern about partial build options meeting the project purpose and need. We understand this purpose and need to be to relieve congestion to the downtown Nashua and Hudson areas by providing additional crossings of the Merrimack River. We compared the various alternatives to the Existing 1990 Volumes. We used Full Build Alternative 3 as representative of options which tie in at Exit 10 and Full Build Alternative 8 as representative of options which tie in at Exit 9.

Our conclusions are as follows:

1. The Full Build Alternatives meet the project purpose and need. Substantially increased volumes of traffic remain on the south at Daniel Webster Highway and Spit Brook Road and to a certain extent on the north at US 3. However, this occurs under all build scenarios and appears to be beyond the defined purpose of the project.

2. The Partial Build to NH 111 Alternative does not improve the congestion at the Taylors Falls Bridge, the Nashua approaches and the NH 102 approach on the Hudson side. In addition, it increases volumes at the Sagamore Bridge crossing over the Full Build Alternatives. At 64,700 vehicles per day and with the close proximity of the interchanges combined with a toll facility, this link should operate at a poor level of service. This alternative also impacts Greeley Street (2-lane, local road) by redirecting about 10,000 additional vehicles daily to use it as a connector to NH 102. Thus, this alternative does not appear to meet the project purpose and need.

3. The Partial Build to NH 102 Alternative provides some relief to the Hudson approaches, however, it does not relieve the Taylors Falls Bridge or the Nashua approaches. Additionally, it draws even more traffic (68,500 vehicles per day) to the Sagamore Bridge. Thus, it is concluded that it does not appear to meet the project purpose and need.

4. The Partial Build Turnpike South to NH 102 Alternative provides slightly less relief to the Taylors Falls Bridge as compared to the Full Build Option, but does improve upon the existing conditions. It also relieves the Nashua approach to NH 101-A. However, it does not improve the current congestion on the Nashua approach to NH 111 and the NH 102 and NH 3-A approaches in Hudson. Also, about 9,000 additional vehicles would be crossing daily at the existing 2-lane Sagamore Bridge. An additional 9,000 vehicles would also use Greeley Street as a connector to NH 111. Thus, it is concluded that it does not appear to meet the project purpose and need.

5. The Partial Build Without NH 111 to NH 102 Alternative provides relief to the Taylors Falls Bridge and the Nashua approaches but not to the Hudson approaches. Also, from a transportation systems planning perspective, this option is unsatisfactory and would likely only forestall the need to close the gap between NH 111 and NH 102. The added pressure on Greeley Street (+12,000 vehicles per day) would be unacceptable to local officials. Thus, this alternative does not appear to meet the project purpose and need.

The deficient links are highlighted on the enclosed figures.

We have discussed the results of this review with Mr. Killoy and Ms. Flieger. They asked us to attend your September 23, 1992 interagency meeting and we plan to do so.

We hope that this information is helpful in your deliberations during the preparation of the Draft Environmental Impact Statement.

Sincerely yours,

Gerald L. Eller, P.E.
Division Administrator

Enclosures
WFOD/dsl
File: M-5229( )
cc: Greg Lantos, NRPC w/enc.
Bill Hauser, Environment
Bob Greer, Dir. Proj. Dev.
Bob Lyford, Planning w/enc.
Rod Cyr, Design w/enc.
Patrick DeCorla-Souza, HEP-22 w/enc.
Dan Reagan, HRA-01
Bob DeSanto, Parsons DeLeuw, Inc. w/enc.

U.S. Department of Transportation

Federal Highway Administration

Memorandum

Subject: Nashua Circumferential
Traffic Projection Methodology

Date: September 18, 1992

From: W.F. O'Donnell
Area Engineer
Concord, New Hampshire 03301

Reply to Attn. of:

To: Files

At the request of the Army Corps of Engineers (ACOE), Patrick De Corla-Souza of our Headquarters Planning Support Branch and I met with the following individuals to review the MINUTP Model for the Nashua region and the Nashua Circumferential (NC) traffic projection methodology on September 10, 1992:

Greg Lantos, Nashua Regional Planning Commission
Bob Lyford, NHDOT Bureau of Planning
Bob DeSanto, Parsons DeLeuw, Inc.
Tim White, Parsons DeLeuw, Inc.

Mr. DeCorla-Souza had been provided with back-up documentation on the model and project traffic projections for review prior to the meeting.

The NRPC uses the MINUTP Model as a part of their planning activities within the Region and had developed the land use and socio-economic data to input the model. Using the various build/no-build scenarios provided by Parsons DeLeuw, the NRPC provided traffic projections for the Nashua Circumferential project.

The ACOE is the Federal lead agency on this project and had requested our review of the traffic modeling and projections in recognition of our special expertise in this area.

The session began with a general discussion of the model and project information. We discussed the purpose and need of the project with Mr. DeSanto. It is described in the EIS as providing congestion relief to the downtown Nashua and Hudson areas (as depicted on the study documents) by providing additional crossings of the Merrimack River.

The NRPC has recently updated their Regional Model, using MINUTP software, while Parsons DeLeuw was working on the NC project. Therefore, both activities were accomplished simultaneously. The consultant's traffic specialists provided some technical assistance to the NRPC in this effort.

Annual growth trends of about 2% of dwelling units were used, which is consistent with the long-term growth of the Region. Growth in the last 10 years in the Nashua area were about 5% annually.

The same development factors for the No Build Alternative were used as for the Build Alternatives. The NRPC and consultant feel that most of the projected development will occur even without the

NC. Local planning and zoning changes have been set in motion in its anticipation. Walmart and Sam's Warehouse are examples of recent large development sites. Mr. Lantos feels that once these businesses decide to build in the Nashua area based on market analysis, the only issue is where it would be located. Mr. DeCorla-Souza generally agreed with that position, feeling that it could affect the individual zones but not the overall regional projections.

We asked for the latest information available from the NH Office of State Planning to compare their population growth projections for the region with the Model's growth rates. Unfortunately, the latest data is from a May 1987 Study. It predicted the following:

Town	1990	2010	% Change
Population			
Nashua	89,228	145,694	+63%
Hudson	19,987	29,055	+45%
Households			
Nashua	35,179	64,452	+83%
Hudson	6,577	10,715	+63%

Also, population data from OSP for the entire Nashua Regional Planning Commission boundaries, including rural communities to west, show a 36.9% increase from 1970 to 1980 and 26.8% increase from 1980 to 1989.

Mr. DeCorla-Souza noted that he had calculated the vehicle miles traveled daily per household and found that it was about 55 now versus about 65 in the future. He believes this is reasonable because of future residential development further outside of CBD where car ownership is higher and distances traveled are greater. He pointed out that some could criticize this because they do not believe that the development would occur with the No-Build. However, because of the affluence of this area and available land, it is likely to occur even with the No-Build.

The NRPC had used origin-destination surveys and home interviews to establish total external-internal trip production but did not have similar data to adjust external-internal trip attractions. Mr. DeCorla-Souza suggested reviewing this data and calibrating it. Mr. Lantos provided further information on this (see September 11, 1992 memo for Mr. Lantos).

We then discussed the NRPC's June 1991 Model Development Report:

- Adjustments of about 20% upward were made to the daily vehicle trip rates per dwelling unit from the home interview surveys because surveys often did not include return trips or other family members' responses were missing. Mr. DeCorla-Souza suggested that Mr. Lantos make a comparison with other urban areas, such as Manchester, of total trips per population or dwelling units to see how the growth rates compared (see Mr. Lantos's September 11 memo).

- The toll penalties applied seem to be slightly high when treated as a cost/hour. Mr. Lantos indicated that he tried several iterations until the traffic projection on the toll

facilities seemed reasonable. If they were high, there could be a slightly reduced attraction to the Circumferential and the F.E. Everett Turnpike.

- A special generator was added to the NH 3-A in Litchfield because of the many trips between Litchfield and Manchester rather than Nashua. Mr. Lantos indicated that it was not practical to treat Manchester as an internal zone and this generator serves to produce a certain number of trips on 3-A. Mr. DeCorla-Souza indicated that this approach was not traditional and he would prefer to see an appropriate external station.

  Messrs. Lyford and Lantos noted that there are Statewide efforts being made to coordinate the RPCs traffic models between regions (particularly Manchester, Nashua, and Salem).

- I noted that the percentage variations at the two existing crossings of the Merrimack River shown in the Model Development Report as 11.9% should actually be 6.6%. Mr. Lantos concurred.

- A factor of 0.92 was used by NRPC to adjust for actual axle counts (passenger car equivalents) to ADTs and Parsons-DeLeuw used a 10% factor to generate DHVs from the ADT data for design purposes. Mr. DeCorla-Souza pointed out that each type of facility would have different percentages of non-automobile usage. He would prefer that individual adjustments be made rather than region wide. Mr. Lyford pointed out that the 10% factor is consistent with data from the State's permanent traffic stations.

We also reviewed the NRPC's Land Use Data Report, dated May 1991:

- Mr. DeCorla-Souza pointed out that household size is decreasing over time and in the future it could be reduced based upon studies.

- I questioned the very high future employment projections (+7493) shown for zones 43, 45, 47, and 48 in southern Nashua. Mr. Lantos agreed that they may be optimistic given the current economic conditions. They are based upon input from local planners. The areas in question are near the Massachusetts State line and Exit 1 and easterly to the Merrimack River. They would likely influence traffic figures for the Daniel Webster Highway, Spit Brook Road and the F.E. Everett Turnpike the most.

- I questioned the high housing unit forecasts for zones 79 and 80 (+5877) in southwestern Nashua. Mr. Lantos explained that the Halls Corner Housing Development (3,400 units) has been approved by the City for that area and is awaiting better market conditions and financing. He feels that these figures are achievable within the 20-year time frame.

- I also questioned the high employment projections (+6047) for zones 137 and 138 in Merrimack near the Industrial Interchange along the F.E. Everett Turnpike. Mr. Lantos feels that these projections are also optimistic even the under the current economic conditions. They are based on projections for local planners considering vacant land and zoning. However, they would likely influence the F.E. Everett Turnpike, Camp

Sargent Road and US Route 3 roadways the most.

It was agreed that all of the above discussions have some influence on the predictions produced by the model and that future adjustments in the model might be appropriate. However, it was agreed that the 2010 projections for the NC project were reasonable and that these variations would not influence project decision making.

We then reviewed the traffic projections for the various NC scenarios. These included:

- Existing 1990 volumes
- No Build 2010 volumes
- Alternative 3 Full Build 2010 volumes *
- Alternative 8 Full Build 2010 volumes **
- Partial Build to NH 111, 2010 volumes
- Partial Build to NH 102, 2010 volumes
- Partial Build Turnpike South to NH 102, 2010 volumes
- Partial Build w/o NH 111 to NH 102, 2010 volumes

* Represents typical example of full build circumferential which ties in at Exit 10 in Merrimack.

** Represents typical example of full build circumferential which ties in at Exit 9 in Merrimack.

The various 2010 Build Alternatives were compared to the Existing 1990 Volumes to determine which alternatives appeared to meet the project purpose and need; i.e., provide congestion relief to downtown Nashua and Hudson by providing additional crossings of the Merrimack River. The following conclusions were drawn:

1. The Full Build Alternatives meet the project purpose and need. Substantially increased volumes of traffic remain on the south at Daniel Webster Highway and Spit Brook Road and to a certain extent on the north at US 3. However, this occurs under all build scenarios and appears to be beyond the defined purpose of the project.

2. The Partial Build to NH 111 Alternative does not improve the congestion at the Taylors Falls Bridge, the Nashua approaches and the NH 102 approach on the Hudson side. In addition, it increases volumes at the Sagamore Bridge crossing vehicles over the Full Build Alternatives. At 64,700 vehicles per day and with the close proximity of the interchanges combined with a toll facility, this link should operate at a poor level of service. This alternative also impacts Greeley Street (2-lane, local raod) by redirecting about 10,000 additional vehicles daily to use it as a connector to NH 102). Thus, this alternative does not appear to meet the project purpose and need.

3. The Partial Build to NH 102 Alternative provides some relief to the Hudson approaches, however, it does not relieve the Taylors Falls Bridge or the Nashua approaches. Additionally, it draws even more traffic (68,500 vehicles per day) to the Sagamore Bridge. Thus, it is concluded that it does not appear to meet the project purpose and need.

4. The Partial Build Turnpike South to NH 102 Alternative provides slightly less relief to

the Taylors Falls Bridge as compared to the Full Build Option, but does improve upon the existing conditions. It also relieves the Nashua approach to NH 101-A. However, it does not improve the current congestion on the Nashua approach to NH 111 and the NH 102 and NH 3-A approaches in Hudson. Also, about 9,000 additional vehicles would be crossing daily at the existing 2-lane Sagamore Bridge. An additional 9,000 vehicles would also use Greeley Street as a connector to NH 111. Thus, it is concluded that it does not appear to meet the project purpose and need.

5. The Partial Build Without NH 111 to NH 102 Alternative provides relief to the Taylors Falls Bridge and the Nashua approaches but not to the Hudson approaches. Also, from a transportation systems planning perspective, this option is unsatisfactory and would likely only forestall the need to close the gap between NH 111 and NH 102. The added pressure on Greeley Street (+12,000 vehicles per day) would be unacceptable to local officials. Thus, alternative does not appear to meet the project purpose and need.

Following our review, Messrs. DeCorla-Souza, Lyford and I met with Dave Killoy and Terry Flieger of the ACOE to brief them on our findings. We discussed the results and agreed to respond formally in writing. The ACOE has scheduled an interagency meeting on the project for September 23, 1992 and asked us to attend.

Mr. DeCorla-Souza will provide a memo documenting his finding on the model and our meetings.

WFOD/dsl
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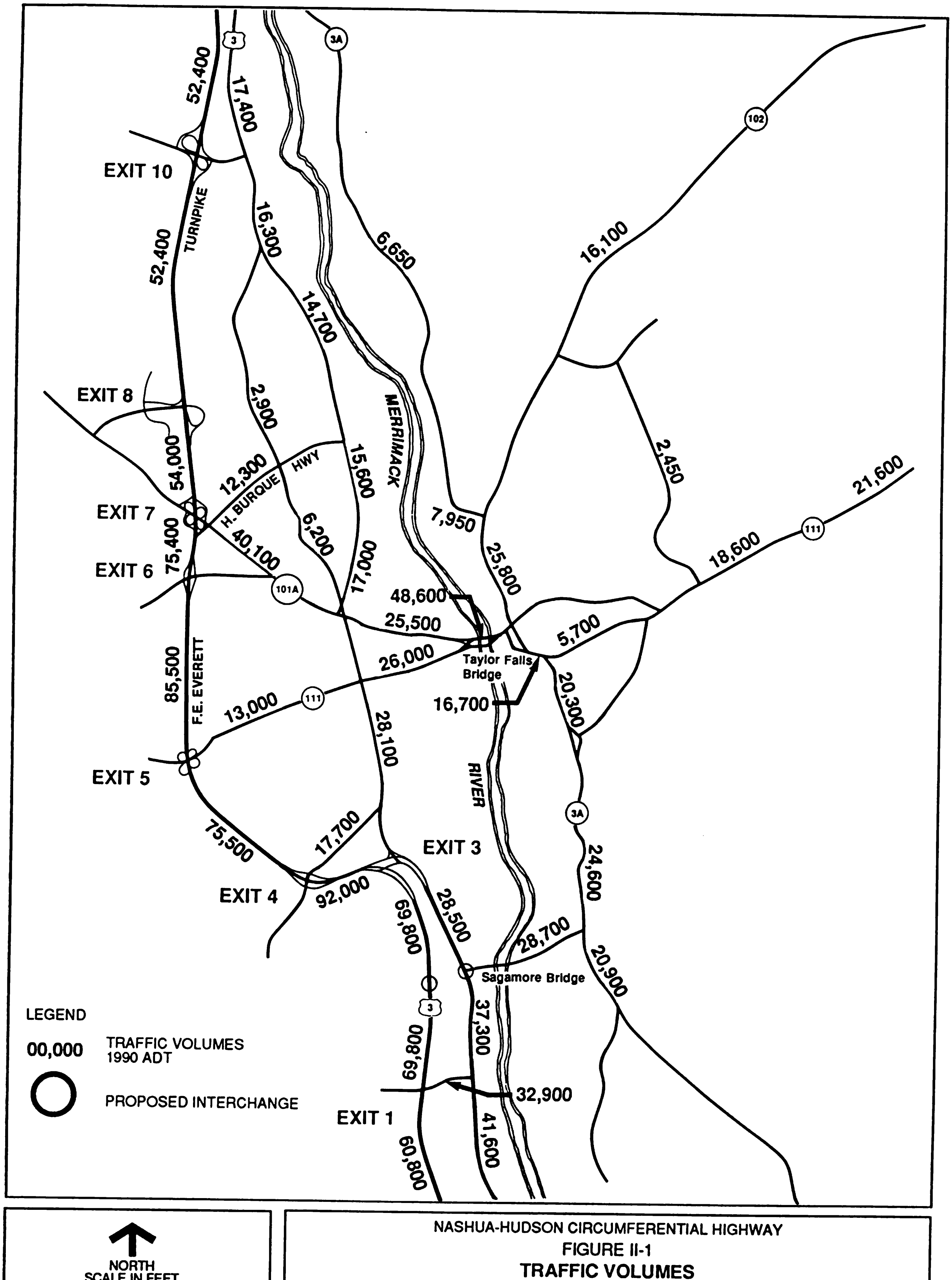


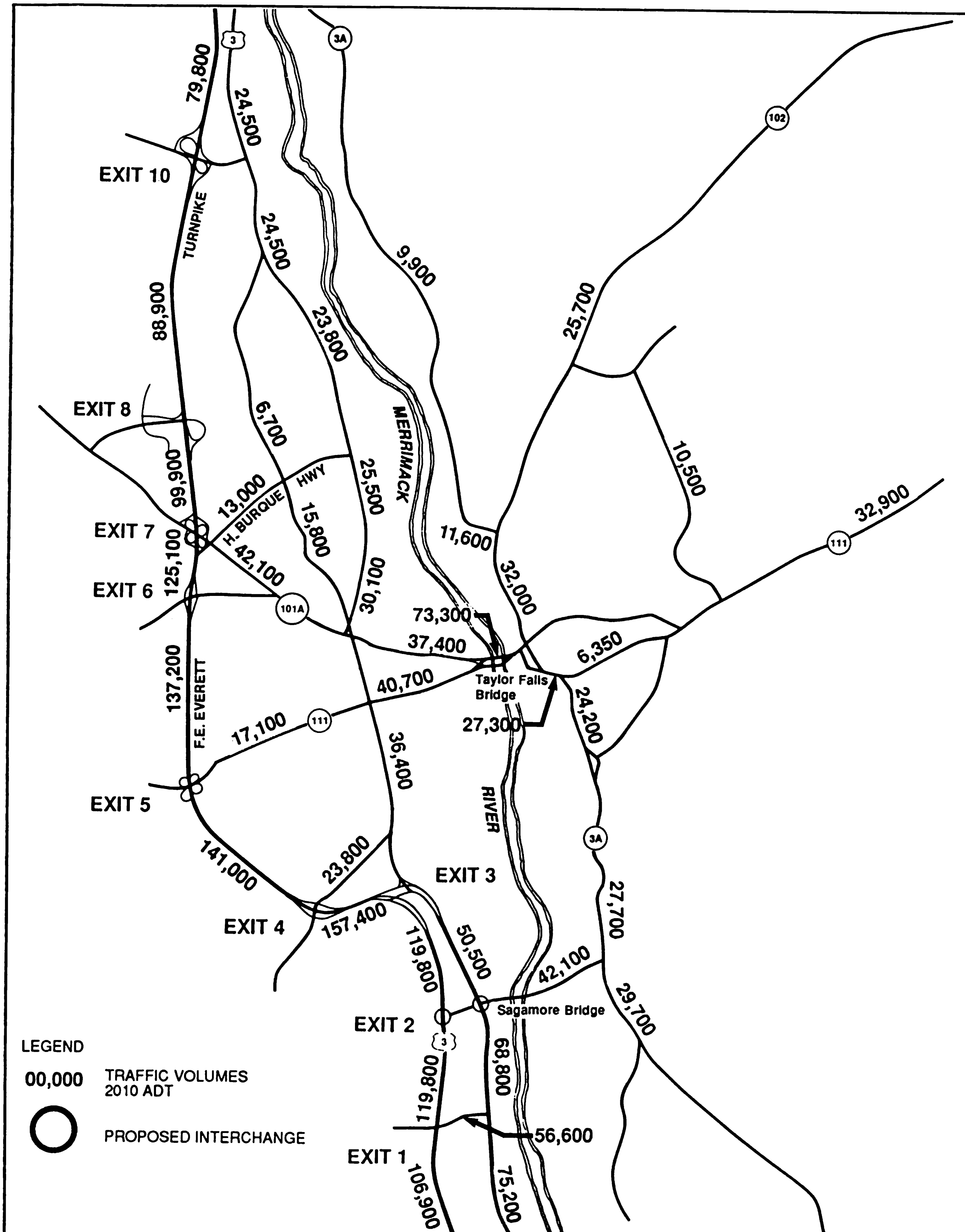
NASHUA-HUDSON CIRCUMFERENTIAL HIGHWAY

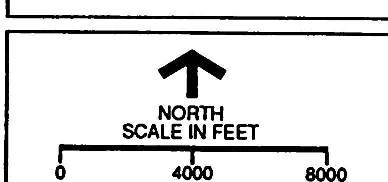
FIGURE II-1

TRAFFIC VOLUMES

EXISTING - 1990

NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION





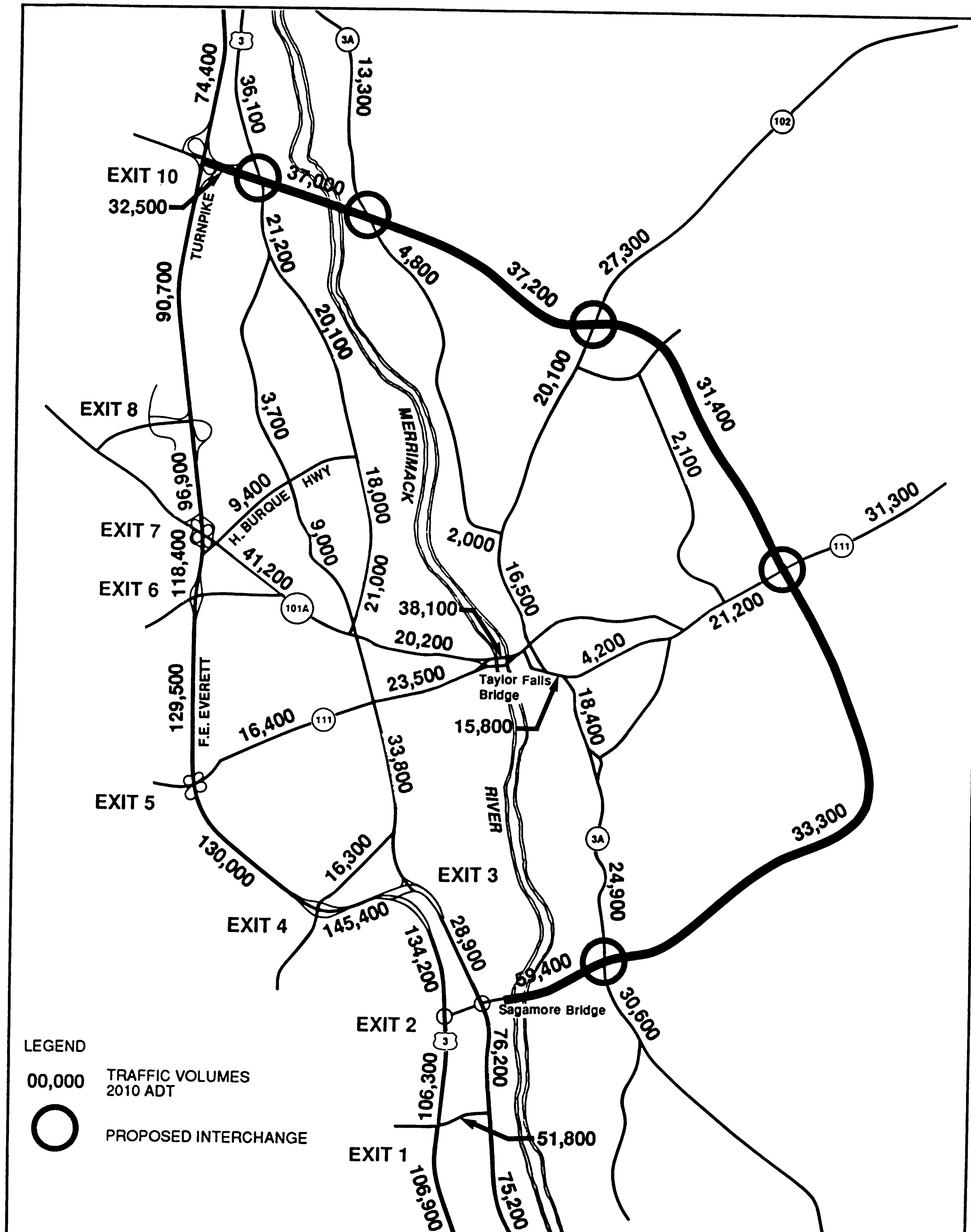
NASHUA-HUDSON CIRCUMFERENTIAL HIGHWAY

FIGURE III-4

TRAFFIC VOLUMES

NO BUILD - 2010

NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION



NORTH
SCALE IN FEET
0 4000 8000

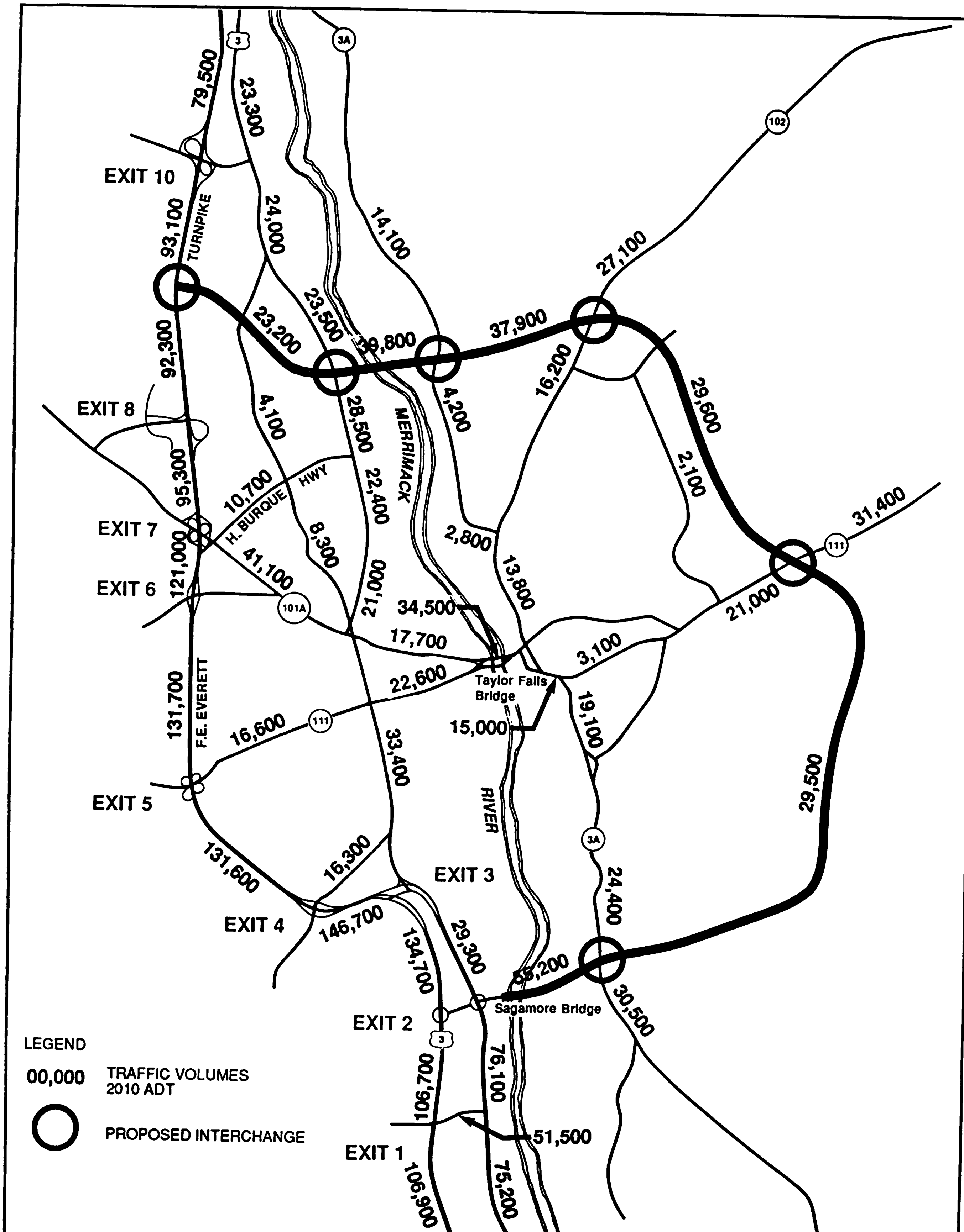
NASHUA-HUDSON CIRCUMFERENTIAL HIGHWAY

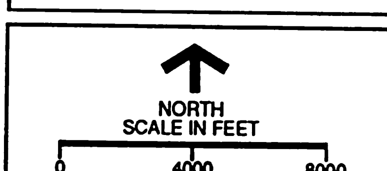
FIGURE III-5

TRAFFIC VOLUMES

ALTERNATIVE 3

NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION





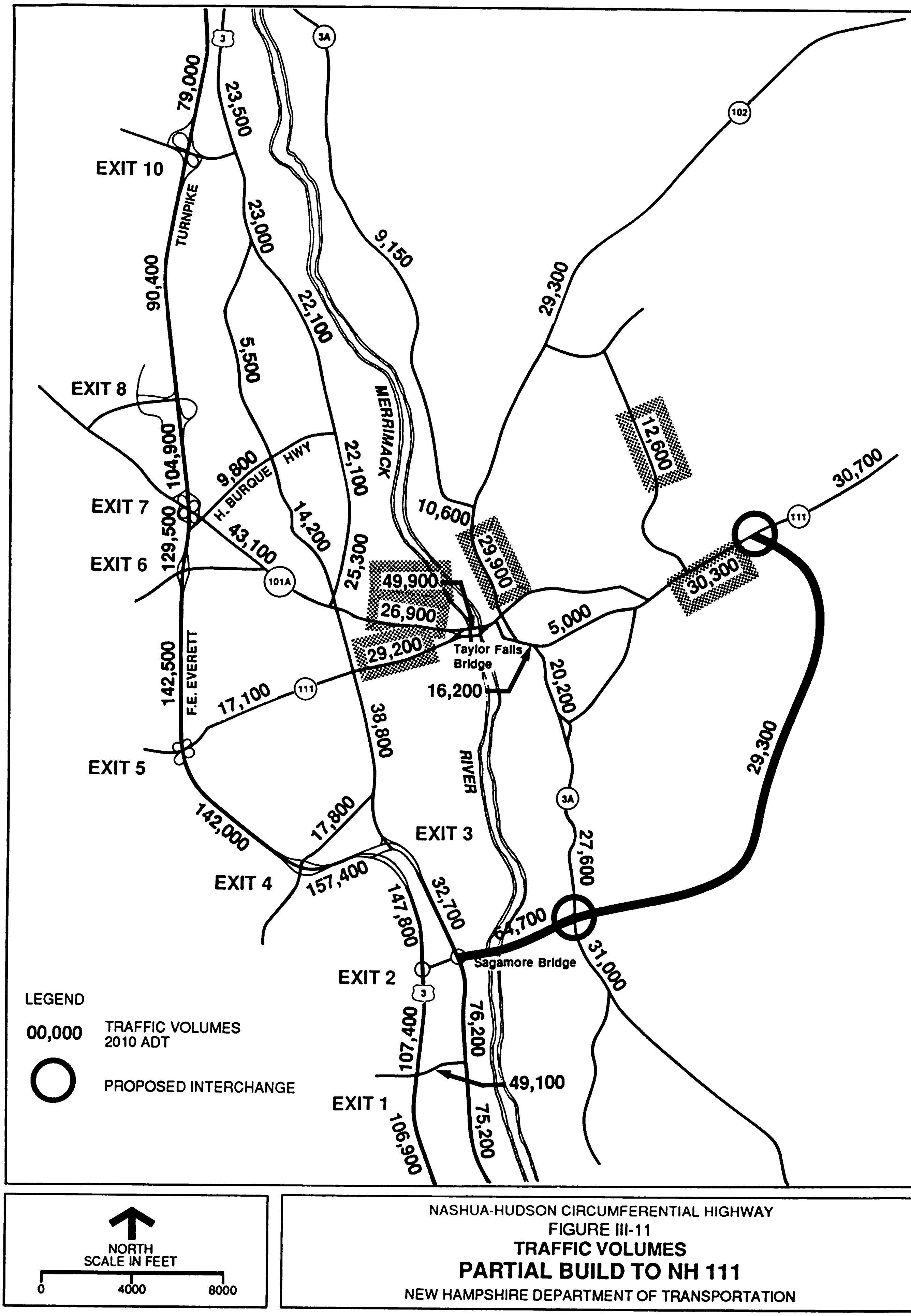
NASHUA-HUDSON CIRCUMFERENTIAL HIGHWAY

FIGURE III-10

TRAFFIC VOLUMES

ALTERNATIVE 8

NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION



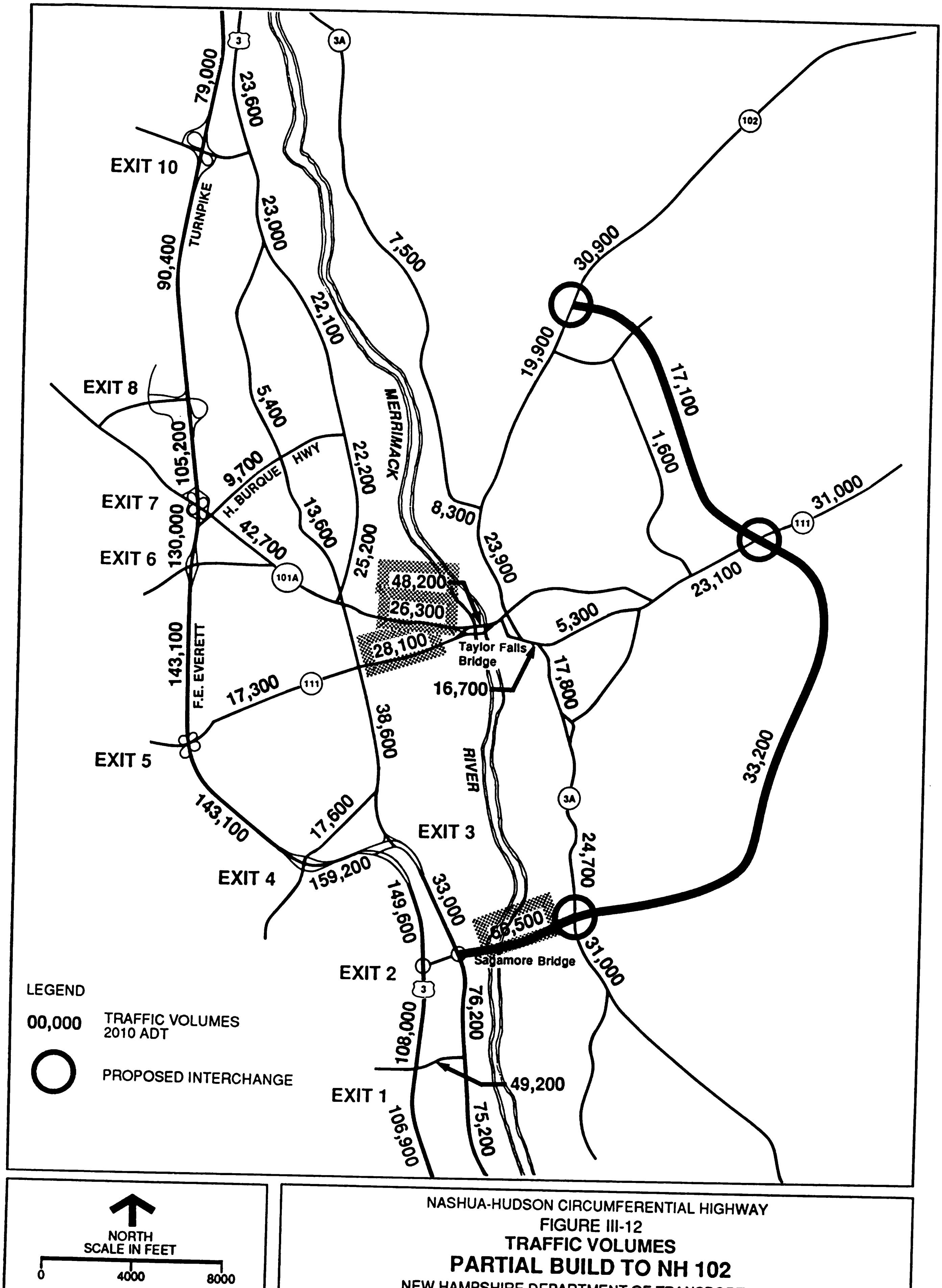
NASHUA-HUDSON CIRCUMFERENTIAL HIGHWAY

FIGURE III-11

TRAFFIC VOLUMES

PARTIAL BUILD TO NH 111

NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION



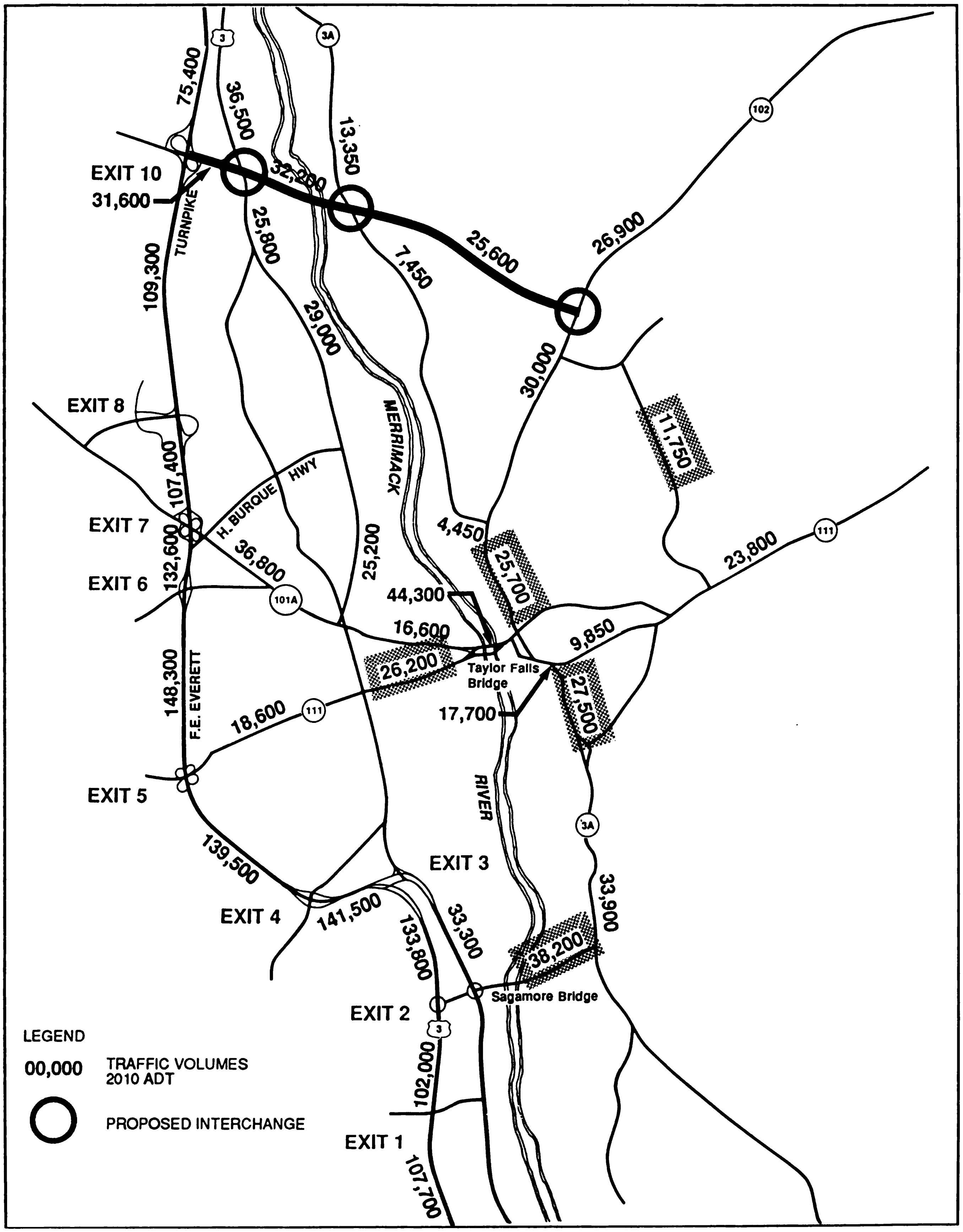
NASHUA-HUDSON CIRCUMFERENTIAL HIGHWAY

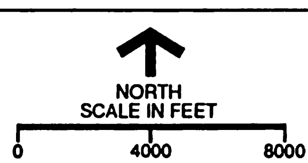
FIGURE III-12

TRAFFIC VOLUMES

PARTIAL BUILD TO NH 102

NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION





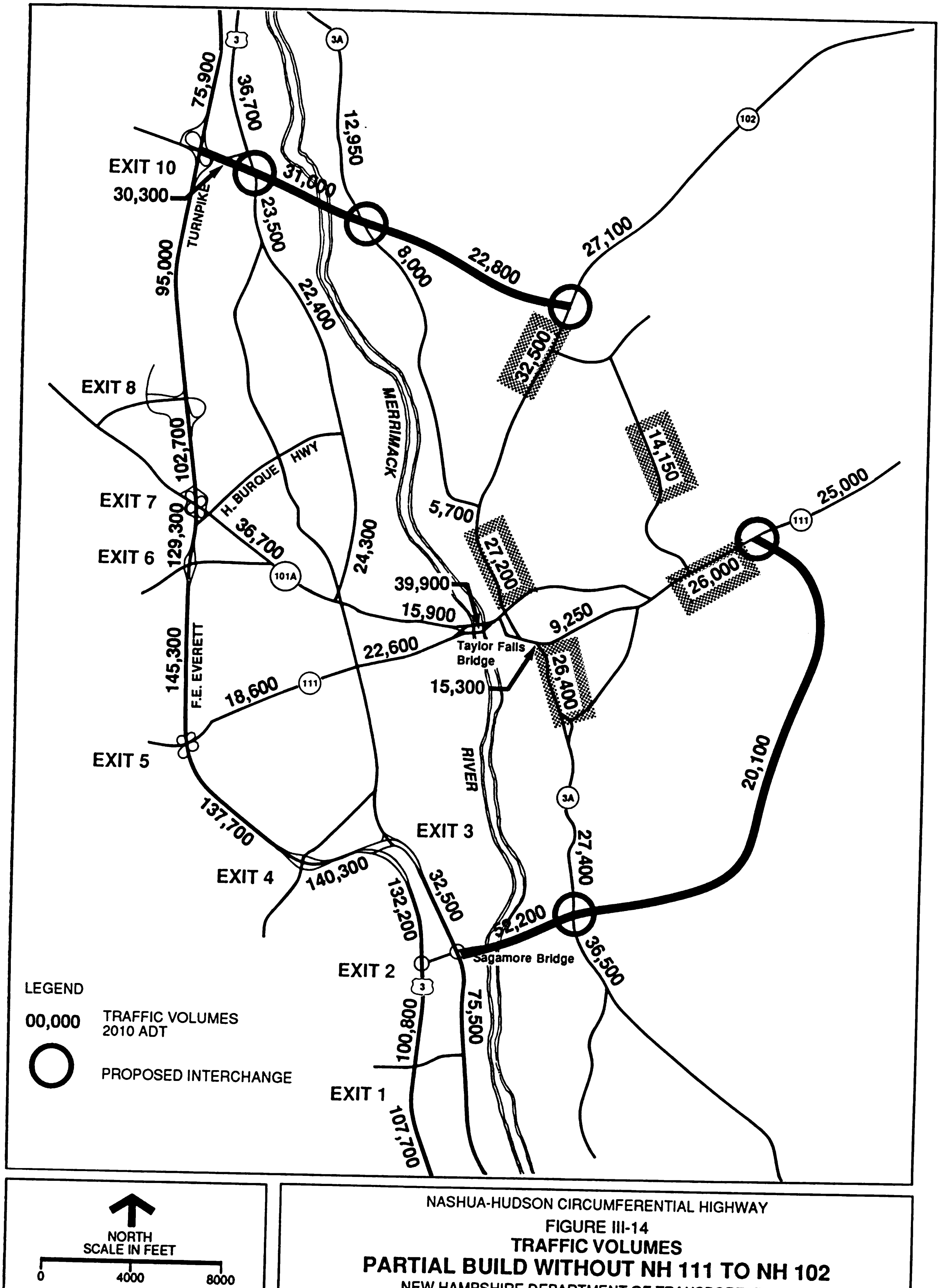
NASHUA-HUDSON CIRCUMFERENTIAL HIGHWAY

FIGURE III-13

TRAFFIC VOLUMES

PARTIAL BUILD, TURNPIKE SOUTH TO NH 102

NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION



NASHUA-HUDSON CIRCUMFERENTIAL HIGHWAY

FIGURE III-14

TRAFFIC VOLUMES

PARTIAL BUILD WITHOUT NH 111 TO NH 102

NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

Memorandum

U.S. Department of Transportation
Federal Highway Administration

Subject: **INFORMATION:** NCH Circumferential Route Study Review

Date: SEP 17 1992

From: Community Planner

Reply to Attn. of: HEP-22

To: Mr. William O'Donnell
New Hampshire Division (HEC-NH)
Concord, New Hampshire

This memo documents the results of our review of the traffic projections for the Nashua Hudson Circumferential Highway (NCH) project, per the request from William Lawless of the New England Division, Corps of Engineers.

The traffic projections were developed by Parsons DeLeuw, Inc. using a MINUTP travel demand forecasting model and future year 2010 land use and SOCIO-economic projections developed by the Nashua Regional Planning Commission (NRPC). The purpose of our review was to determine (1) whether the models used were valid; (2) whether the future year 2010 model inputs were reasonable; and (3) whether model forecasts for 2010 were appropriately refined to account for base year model errors.

Based on my review and our discussions with representatives from NRPC and Parsons DeLeuw, Inc. on September 10 at the NRPC offices, I have concluded that the 2010 traffic projections made for the NCH project are reasonable. My conclusion is based on the following separate findings:

1. The MINUTP models used for the analysis are valid and adequate for use for the purpose of projecting future traffic volumes within the Nashua transportation study area. As discussed later in this memo, enhancements and fine-tuning of the model can be considered concurrent with future updates of the model proposed by NRPC. However, the current level of accuracy of the model is adequate for the NCH project study.

2. Overall growth in land use development forecasted by NRPC for the year 2010 is reasonable. Growth in dwelling units over the 20 year period 1990-2010 is forecasted to be 41.5%, while employment growth is forecasted to slightly exceed 50%. While separate projections of population growth have not been made by NRPC, population growth would be much less than 41.5%, since household size continues to decrease in Nashua as in other urban areas. The 20-year growth projected by NRPC appears to be conservative in comparison

with the historical (10-year) population growth of 25% from 1980 to 1990 based on Census data. Since the most important model input affecting the magnitude of traffic on regional highway facilities is the amount of land use growth, the traffic estimates on regional facilities should be reasonable. As discussed later in this memo, however, we have some concern about the share of total regional growth allocated to specific traffic analysis zones; however, any adjustments to the share of growth allocated to those zones are not anticipated to significantly affect traffic estimates on regional facilities.

3. Traffic forecasts from MINUTP have been appropriately adjusted to account for differences between MINUTP estimates and traffic counts in the base year.

The purpose and need of the NCH project is to relieve congestion in the Nashua and Hudson CBDs by reducing traffic volumes below current heavily congested traffic levels on certain facilities. Based on our review of the refined traffic forecasts for the several alternatives (including no build, full build and partial build alternatives) developed by Parson DeLeuw, Inc., the purpose and need for the project appear to be achieved by the full build alternatives. While the partial build alternatives which provide the northerly crossing of the Merrimac River relieve traffic on Taylor's Falls Bridge and the Nashua CBD, high levels of congestion on local facilities in Hudson would remain.

We now turn to some specific comments on the model and the land use forecasts. These comments are intended for consideration by NRPC in future model updates and analyses. We do not feel that the comments need to be addressed in the context of the NCH project.

Model comments: The NRPC should consider the following in future model updates:

1. Introduction of household size as an independent variable in the trip production models. Also, overall trip rates per dwelling unit or per person should be compared with similar urban areas such as Manchester.

2. Calibrate External - Internal trip attraction rates by balancing total E-I trip attractions across the region with total E-I trip productions derived by aggregating E-I trips at all cordon line stations obtained from the cordon line survey.

3. Compare trip lengths and distances output from the MINUTP gravity model with data from similar urban areas and with Census work trip data for Nashua, to assess whether adjustment of gravity model friction factors would be appropriate.

4. Consider representing the E-I attractions to Manchester along NH route 3A in Litchfield through estimates of E-I attractions at the appropriate external station, instead of the current method which involves representing Manchester as an internal traffic zone.

5. Review the need for continuing the current practice of forecasting passenger car equivalents (PCEs) instead of average daily traffic (ADTs) through the model. Currently, a uniform conversion factor (0.92) is used to convert from PCEs to ADTs, irrespective of class of facility, which may be inappropriate. Also, the current documentation of the model does not describe this significant variation from traditional modeling practice, and model results are therefore prone to misinterpretation.

6. In future validation efforts, screenlines to be used for model checking should be more carefully drawn to assure that traffic moving primarily in homogeneous directions is captured. The map of screenlines displayed in the current model documentation is unclear.

Land Use Comments: In future analyses, NRPC should consider the following:

1. Travel demand models such as MINUTP assume a fixed land use input. These models are not designed to forecast changes in land use which may occur due to performance of the transportation system. While models have been developed in a very small number of urban areas in the U.S. to predict the transportation/land use interaction, the models are very complex and data hungry, and would be far too costly to develop for the Nashua area. However, the question that may be asked with respect to the "no build" alternative for the NCH project is: Would the shares of growth allocated to traffic zones in the vicinity of the circumferential route still apply if the proposed road were abandoned? If shifts would occur, where would growth forecasted for those zones shift to? These questions are difficult to answer without transportation/land use models, but NRPC could nevertheless attempt to assess the sensitivity of traffic estimates for "no build" alternatives to possible shifts in land development patterns. In the case of the NCH project, it is clear that any shifts in growth from the vicinity of an abandoned circumferential route would gravitate towards existing highway facilities, further congesting them above the levels suggested by the "no build" traffic forecasts produced by the MINUTP model with "fixed" land use growth in the urban fringe.

2. The NRPC forecasts of development in a few traffic zones appear to be high. It appears that the forecasts were compiled from submittals by local planners, but consensus among the planners from the various jurisdictions was not sought. The NRPC should consider a consensus approach to develop regional forecasts and allocate growth among jurisdictions and traffic zones, to avoid what appears to be unbalanced growth projections in some cases.

Patrick DeCorla-Souza

Patrick DeCorla-Souza

MEMORANDUM

TO: Bill O'Donnell, FHWA
FROM: Gregg Lantos, NRPC
SUBJECT: NRPC Traffic Estimates for Circumferential Hwy. EIS
DATE: September 11, 1992

NASHUA REGIONAL PLANNING COMMISSION P.O. BOX 847 115 MAIN STREET NASHUA, NEW HAMPSHIRE 03061 (603) 883-0366

This memo provides the following responses to the issues raised by FHWA at yesterday's meeting regarding NRPC's traffic analysis for Circumferential Highway alternatives:

- Estimating the external-internal percentages for each attraction trip purpose was not based upon known rates, but rather upon general assumptions with subsequent minor adjustments to achieve calibration at the external cordon stations. As we discussed at the meeting, we have precise data relative to internal-external percentages on the trip production side, due to obtaining this data in the home interview survey. However, we recognized that obtaining this degree of specific data on the trip attraction side would be nearly impossible. It would involve: 1) surveying customers at many shopping areas in the region in order to achieve a a balanced sample (for example, the Pheasant Lane Mall has a very high rate of external-internal generation, while a newsstand in downtown Nashua has very little); 2) employees at their workplaces; and 3) households, with respect to trips made to their homes by persons not living there (in many cases they will not know the origins of such visitors).

  From general assumptions made on the attraction side made during the first model run (25% E-I for home-based work attractions, 20% for the other two categories), adjustments were made to bring the model counts at the external cordon stations closer to the actual ground counts. This degree of fine-tuning, though, was relatively minor. However, we would have had a much more difficult time in achieving calibration at these locations had we not had solid data for the internal-external productions.

  In addition to the fact that individual cordon station ground counts are closely matched by the model, the totals produced by the trip generation model also closely match the aggregate totals. The sum of all cordon station counts is 264,700. Less the approximate 15,200 external through trips leaves a total of 249,500 trips that should be reflected in the model internal-external or external-internal totals. The sum of the model I-E trips (107,000) and E-I trips (121,000) is 228,000, a figure which is 8.4% below the actual figure. This indicates that the model trip generation closely represents travel patterns into and out of the study area.

4.47

- I contacted Southern NH Planning Commission to provide a comparison of their models trip generation vs. the NATS model. As the table below shows, the two study areas are quite comparable. In the Manchester area a total of 705,700 daily vehicle trips are generated for the population of 157,685, producing a per capita vehicle trip rate of 705,700. This is just somewhat higher than the Nashua area per capita rate of 4.16. It should be noted, also, that these trip totals include the external trips that pass through the study area without stopping. Because Manchester has more expressways passing through its study area (I-93 and I-293/Route 101), it has a substantially higher number of trips included in the total that are not generated by the study area. By excluding the external through trips for both study areas, the difference between the per capita trip rates would be even less. In any event, it is evident that the NRPC did not overestimate the trip generation rate for its area by upwardly adjusting the home interview survey household vehicle trip rate.

NATS Area	Population	Manchester Area	Population
Nashua	79,662	Manchester	99,332
Merrimack	22,156	Auburn	4,085
Hollis	5,705	Bedford	12,563
Hudson	19,530	Londonderry	19,781
Amherst	9,068	Hooksett	7,303
Litchfield	5,516	Goffstown	14,621
Milford	11,795		157,685
TOTAL	153,432		
Total Traffic Model Vehicle Trips (Includes Ext. thru)	638,500		705,700
Veh. Trips per Capita	4.16		4.47

- The New Hampshire Office of State Planning has not updated their population projections produced in 1987.

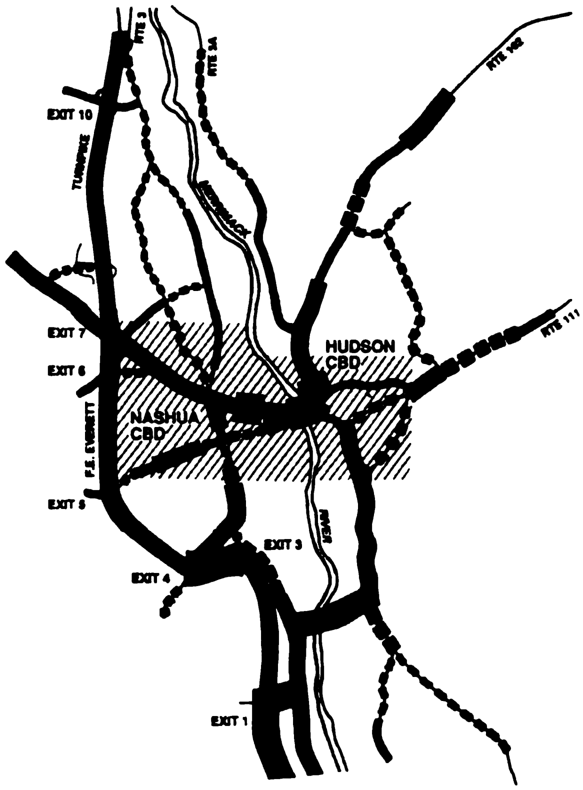
cc: Patrick DeCorla-Souza, FHWA

#300b-12

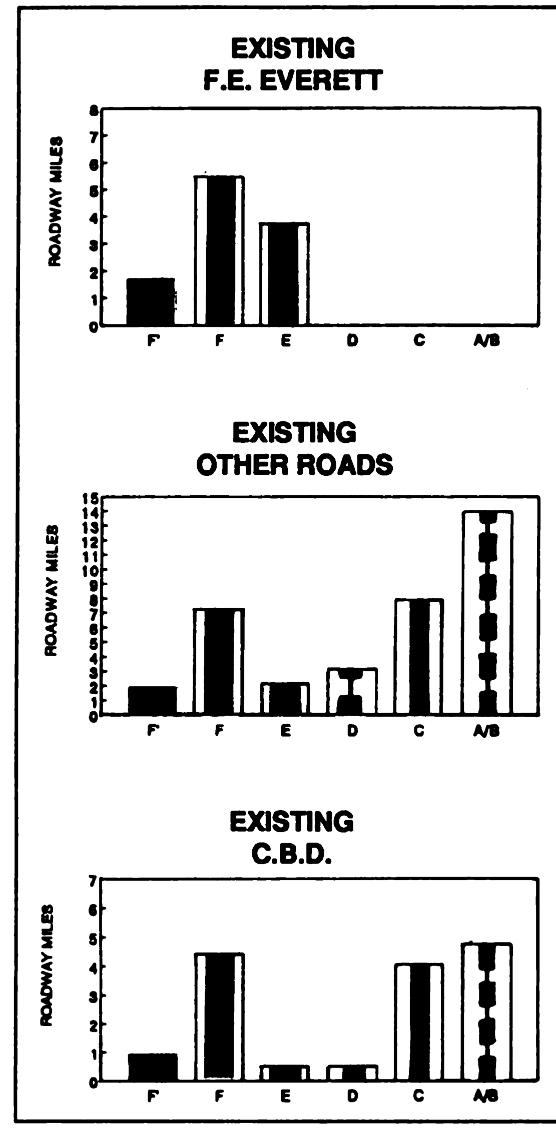
LEVEL OF SERVICE BY ALTERNATIVES

The following eight pages represent LOS differences between No Build, Full Build, Partial Build and Transit/TDM Alternatives, compared with existing 1990 estimates. The data and its derivation are identical to that provided in Figure 2-6 on page 2-17 of the DEIS.

As shown in the following LOS tables, the Full Build Alternatives would provide a 22 percent improvement in Combined LOS °F + F + E in the Central Business District consistent with the project purpose. The Partial Build and Transit/TDM Alternatives would result in a substantial worsening of Levels of Service and thereby do not meet the project purpose. Further, in areas surrounding the Central Business District, the Full Build Alternatives would result in significantly better Levels of Service than the Partial Build and Transit/TDM Alternatives. When benefits are compared to construction costs, the Partial Build Alternatives do not provide reasonable justification as viable options. In many areas, the Partial Build and Transit/TDM Alternatives are little better than the No Build Alternative.



EXISTING - 1990

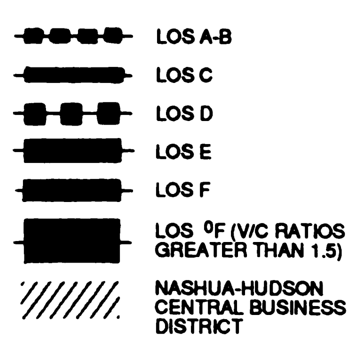


LEVEL OF SERVICE

TRAFFIC NETWORK		LEVEL OF SERVICE ROADWAY MILES						% CHANGE *
		F'	F	E	D	C	A/B	
1990	F. E. E.	1.7	5.5	3.8	0	0	0	BASE
EXISTING	OTHER	1.8	7.2	2.1	3.1	7.8	14	LINE
	C. B. D.	0.9	4.4	0.5	0.5	4	4.7	DATA
2010	F. E. E.	3.9	4.4	2.7	0	0	0	0%
NO BUILD	OTHER	8.5	7.8	3.5	2	8.4	5.8	-78%
	C. B. D.	2.5	6.2	0.2	1	1.7	3.4	-53%
2010	F. E. E.	1.7	7.2	1.3	0.8	0	0	7%
FULL BUILD	OTHER	3.1	6.4	3.1	4.4	4.6	14.4	-14%
	C. B. D.	0	2.8	1.7	1.3	4.7	4.5	22%
2010	F. E. E.	4.8	6.2	0	0	0	0	0%
PARTIAL BUILD	OTHER	4.4	11.4	2.1	5.7	3.8	8.6	-61%
F.E.E. SOUTH TO 102	C. B. D.	1.2	6.2	0.5	1.1	2.8	3.2	-36%
2010	F. E. E.	3.6	7.4	0	0	0	0	0%
PARTIAL BUILD	OTHER	4.3	9.3	1.1	4.4	7.4	9.5	-32%
F.E.E. NORTH TO 102	C. B. D.	1.1	5.1	0	1.4	4	3.4	-7%
2010	F. E. E.	4.8	4	2.2	0	0	0	0%
PARTIAL BUILD	OTHER	4.3	14.3	2.5	3.7	5.8	5.4	-90%
F.E.E. NORTH TO 111	C. B. D.	2.3	4.9	0.7	0.5	3.4	3.2	-36%
2010	F. E. E.	4.8	6.2	0	0	0	0	0%
PARTIAL BUILD	OTHER	3.4	13.9	1.9	4.8	3.6	8.4	-73%
WITHOUT 111 TO 102	C. B. D.	1.2	5.8	0	1.5	3	3.5	-21%
2010	F. E. E.	2.1	5.6	3.2	0	0	0	1%
TRANSIT/TDM	OTHER	7	10.6	1.1	1.7	10	5.5	-68%
	C. B. D.	3.5	5	0.2	1.4	1.5	3.2	-50%

* PERCENT CHANGE BETWEEN 2010 COMBINED LEVELS OF SERVICE F'+ F + E AND EXISTING 1990 LOS PROJECTIONS. ALL PROJECTIONS ARE BASED ON VOLUME / CAPACITY (v/c) RATIOS.

LEGEND

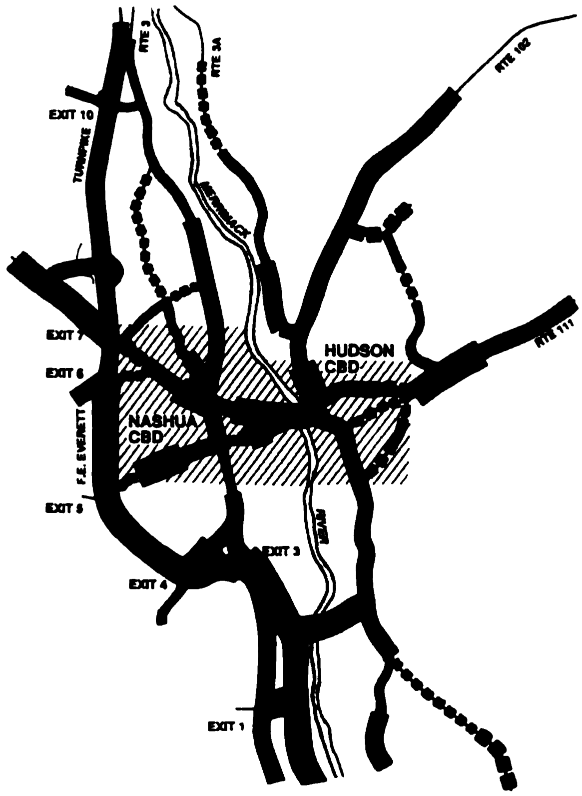


NORTH
NOT TO SCALE

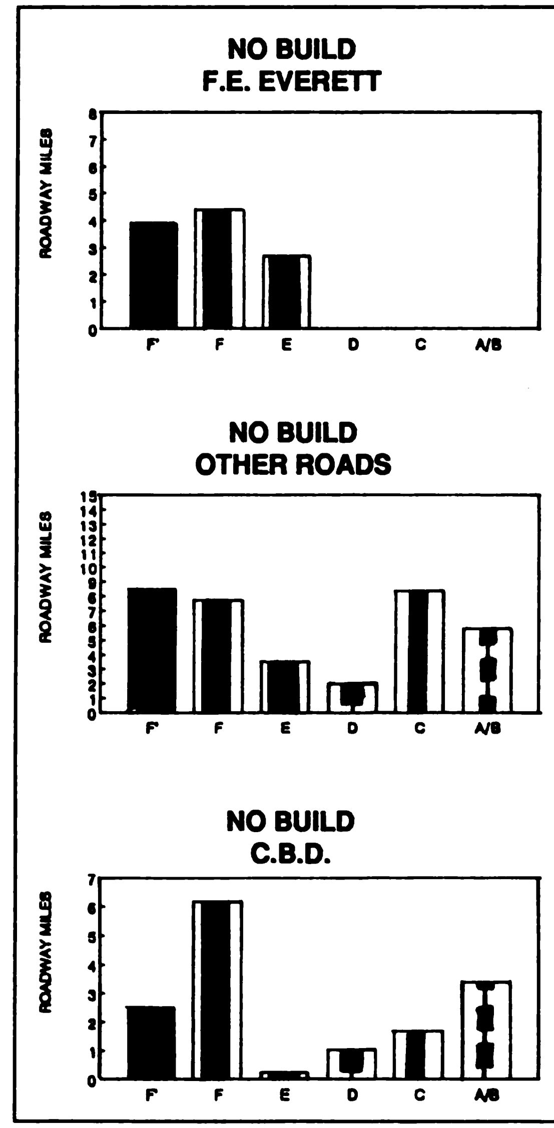
NASHUA-HUDSON CIRCUMFERENTIAL HIGHWAY

LEVEL OF SERVICE
1990 - EXISTING

NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION



NO BUILD - 2010

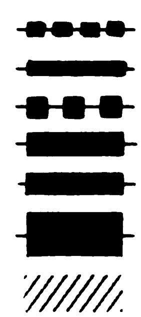


LEVEL OF SERVICE

TRAFFIC NETWORK		LEVEL OF SERVICE ROADWAY MILES						% CHANGE *
		F'	F	E	D	C	A/B	
1990	F. E. E.	1.7	5.5	3.8	0	0	0	BASE
EXISTING	OTHER	1.8	7.2	2.1	3.1	7.8	14	LINE
	C. B. D.	0.9	4.4	0.5	0.5	4	4.7	DATA
2010	F. E. E.	3.9	4.4	2.7	0	0	0	0%
NO BUILD	OTHER	8.5	7.8	3.5	2	8.4	5.8	-78%
	C. B. D.	2.5	6.2	0.2	1	1.7	3.4	-53%
2010	F. E. E.	1.7	7.2	1.3	0.8	0	0	7%
FULL BUILD	OTHER	3.1	6.4	3.1	4.4	4.6	14.4	-14%
	C. B. D.	0	2.8	1.7	1.3	4.7	4.5	22%
2010	F. E. E.	4.8	6.2	0	0	0	0	0%
PARTIAL BUILD	OTHER	4.4	11.4	2.1	5.7	3.8	8.6	-61%
F.E.E. SOUTH TO 102	C. B. D.	1.2	6.2	0.5	1.1	2.8	3.2	-36%
2010	F. E. E.	3.6	7.4	0	0	0	0	0%
PARTIAL BUILD	OTHER	4.3	9.3	1.1	4.4	7.4	9.5	-32%
F.E.E. NORTH TO 102	C. B. D.	1.1	5.1	0	1.4	4	3.4	-7%
2010	F. E. E.	4.8	4	2.2	0	0	0	0%
PARTIAL BUILD	OTHER	4.3	14.3	2.5	3.7	5.8	5.4	-90%
F.E.E. NORTH TO 111	C. B. D.	2.3	4.9	0.7	0.5	3.4	3.2	-36%
2010	F. E. E.	4.8	6.2	0	0	0	0	0%
PARTIAL BUILD	OTHER	3.4	13.9	1.9	4.8	3.6	8.4	-73%
WITHOUT 111 TO 102	C. B. D.	1.2	5.8	0	1.5	3	3.5	-21%
2010	F. E. E.	2.1	5.6	3.2	0	0	0	1%
TRANSIT/TDM	OTHER	7	10.6	1.1	1.7	10	5.5	-68%
	C. B. D.	3.5	5	0.2	1.4	1.5	3.2	-50%

* PERCENT CHANGE BETWEEN 2010 COMBINED LEVELS OF SERVICE F'+ F + E AND EXISTING 1990 LOS PROJECTIONS. ALL PROJECTIONS ARE BASED ON VOLUME / CAPACITY (v/c) RATIOS.

LEGEND



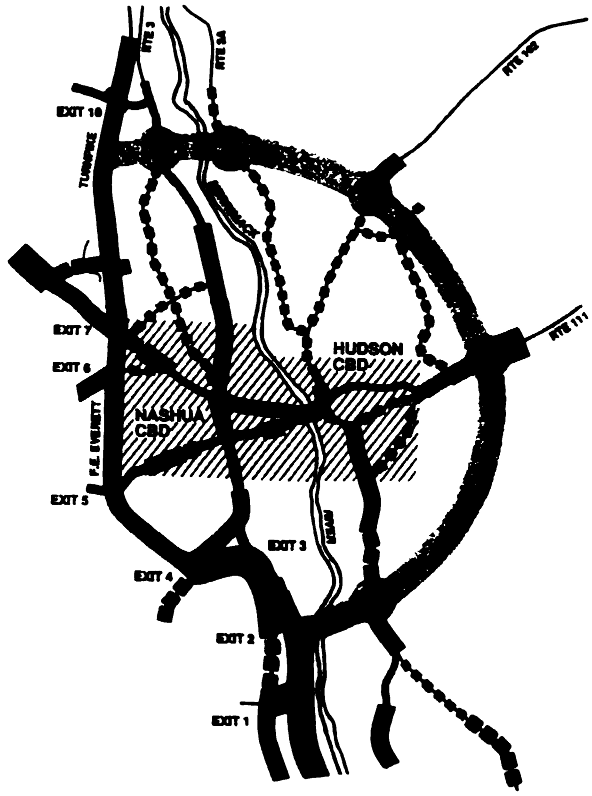
LOS A-B
LOS C
LOS D
LOS E
LOS F
LOS 0F (V/C RATIOS GREATER THAN 1.5)
NASHUA-HUDSON CENTRAL BUSINESS DISTRICT

NORTH
NOT TO SCALE

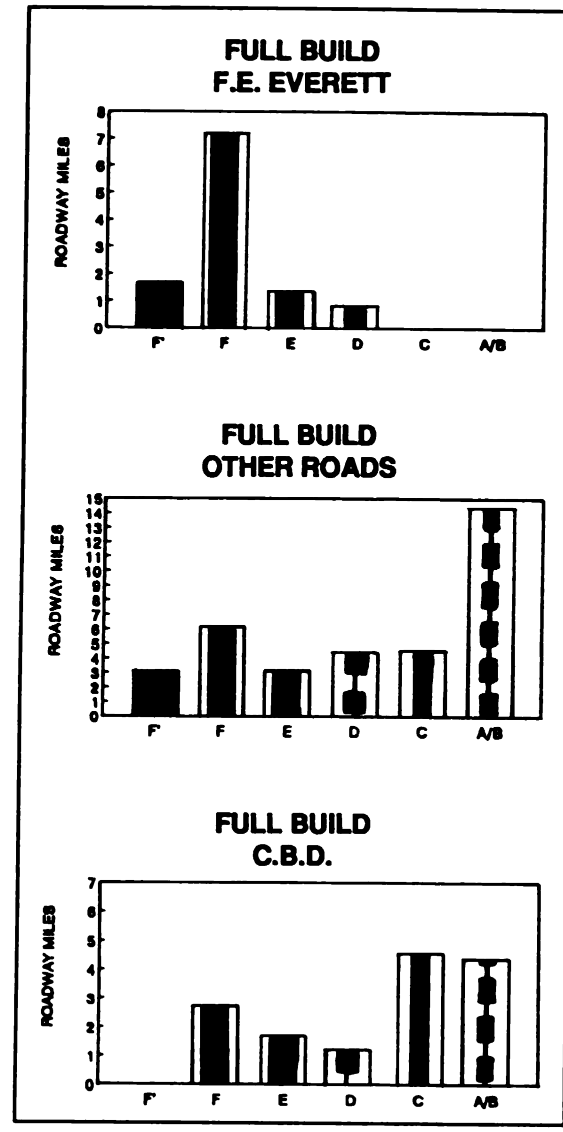
NASHUA-HUDSON CIRCUMFERENTIAL HIGHWAY

LEVEL OF SERVICE
2010 - NO BUILD

NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION



FULL BUILD - 2010



LEVEL OF SERVICE

TRAFFIC NETWORK		LEVEL OF SERVICE ROADWAY MILES F'	F	E	D	C	A/B	% CHANGE *
1990	F. E. E.	1.7	5.5	3.8	0	0	0	BASE
EXISTING	OTHER	1.8	7.2	2.1	3.1	7.8	14	LINE
	C. B. D.	0.9	4.4	0.5	0.5	4	4.7	DATA
2010	F. E. E.	3.9	4.4	2.7	0	0	0	0%
NO BUILD	OTHER	8.5	7.8	3.5	2	8.4	5.8	-78%
	C. B. D.	2.5	6.2	0.2	1	1.7	3.4	-53%
2010	F. E. E.	1.7	7.2	1.3	0.8	0	0	7%
FULL BUILD	OTHER	3.1	6.4	3.1	4.4	4.6	14.4	-14%
	C. B. D.	0	2.8	1.7	1.3	4.7	4.5	22%
2010	F. E. E.	4.8	6.2	0	0	0	0	0%
PARTIAL BUILD	OTHER	4.4	11.4	2.1	5.7	3.8	8.6	-61%
F.E.E. SOUTH TO 102	C. B. D.	1.2	6.2	0.5	1.1	2.8	3.2	-36%
2010	F. E. E.	3.6	7.4	0	0	0	0	0%
PARTIAL BUILD	OTHER	4.3	9.3	1.1	4.4	7.4	9.5	-32%
F.E.E. NORTH TO 102	C. B. D.	1.1	5.1	0	1.4	4	3.4	-7%
2010	F. E. E.	4.8	4	2.2	0	0	0	0%
PARTIAL BUILD	OTHER	4.3	14.3	2.5	3.7	5.8	5.4	-90%
F.E.E. NORTH TO 111	C. B. D.	2.3	4.9	0.7	0.5	3.4	3.2	-36%
2010	F. E. E.	4.8	6.2	0	0	0	0	0%
PARTIAL BUILD	OTHER	3.4	13.9	1.9	4.8	3.6	8.4	-73%
WITHOUT 111 TO 102	C. B. D.	1.2	5.8	0	1.5	3	3.5	-21%
2010	F. E. E.	2.1	5.6	3.2	0	0	0	1%
TRANSIT/TDM	OTHER	7	10.6	1.1	1.7	10	5.5	-68%
	C. B. D.	3.5	5	0.2	1.4	1.5	3.2	-50%

* PERCENT CHANGE BETWEEN 2010 COMBINED LEVELS OF SERVICE F'+ F + E AND EXISTING 1990 LOS PROJECTIONS. ALL PROJECTIONS ARE BASED ON VOLUME / CAPACITY (v/c) RATIOS.

LEGEND

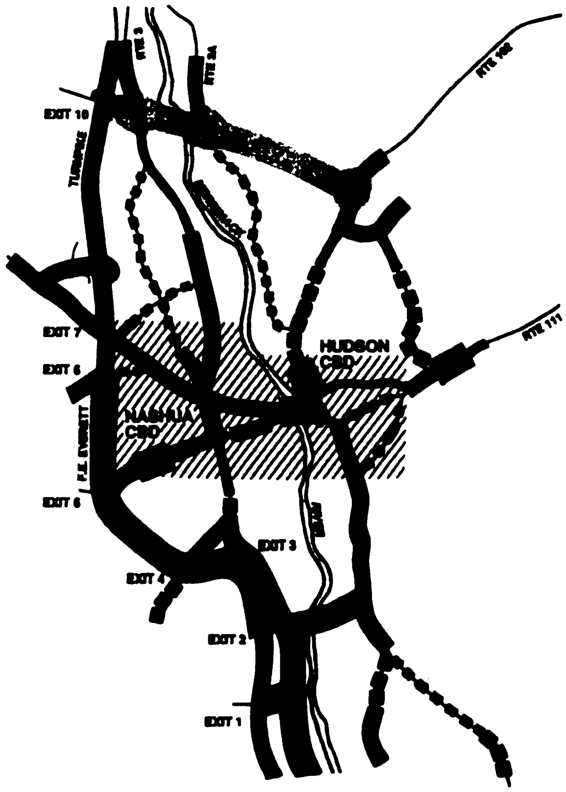
- LOS A-B
- LOS C
- LOS D
- LOS E
- LOS F
- LOS 0F (V/C RATIOS GREATER THAN 1.5)
- NASHUA-HUDSON CENTRAL BUSINESS DISTRICT

NORTH
NOT TO SCALE

NASHUA-HUDSON CIRCUMFERENTIAL HIGHWAY

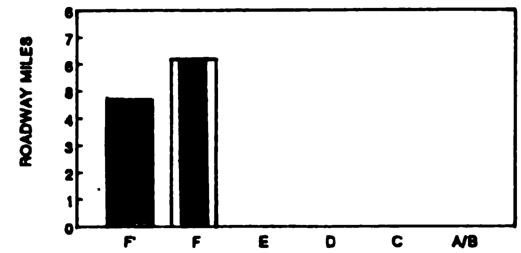
LEVEL OF SERVICE
2010 - FULL BUILD

NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

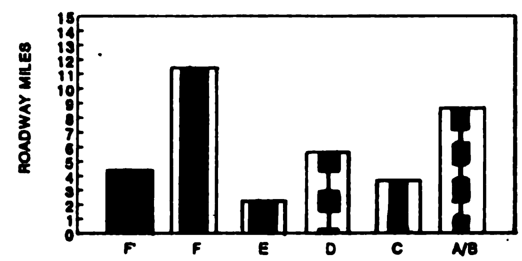


PARTIAL BUILD
TURNPIKE SOUTH TO NH 102

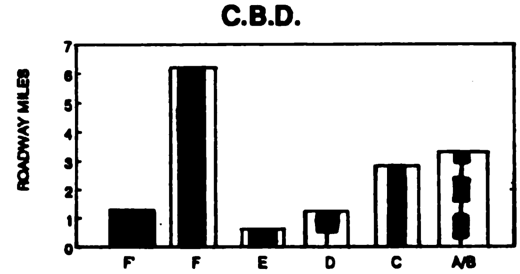
F.E.E. SOUTH TO 102
F.E. EVERETT



F.E.E. SOUTH TO 102
OTHER ROADS



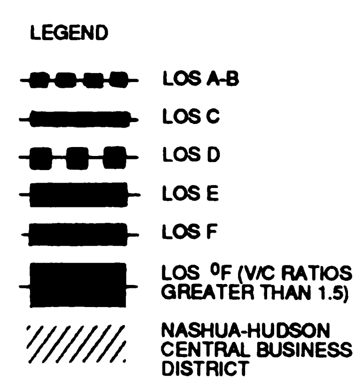
F.E.E. SOUTH TO 102
C.B.D.



LEVEL OF SERVICE

TRAFFIC NETWORK		LEVEL OF SERVICE ROADWAY MILES						% CHANGE *
		F'	F	E	D	C	A/B	
1990	F. E. E.	1.7	5.5	3.8	0	0	0	BASE
EXISTING	OTHER	1.8	7.2	2.1	3.1	7.8	14	LINE
	C. B. D.	0.9	4.4	0.5	0.5	4	4.7	DATA
2010	F. E. E.	3.9	4.4	2.7	0	0	0	0%
NO BUILD	OTHER	8.5	7.8	3.5	2	8.4	5.8	-78%
	C. B. D.	2.5	6.2	0.2	1	1.7	3.4	-53%
2010	F. E. E.	1.7	7.2	1.3	0.8	0	0	7%
FULL BUILD	OTHER	3.1	6.4	3.1	4.4	4.6	14.4	-14%
	C. B. D.	0	2.8	1.7	1.3	4.7	4.5	22%
2010	F. E. E.	4.8	6.2	0	0	0	0	0%
PARTIAL BUILD	OTHER	4.4	11.4	2.1	5.7	3.8	8.6	-61%
F.E.E. SOUTH TO 102	C. B. D.	1.2	6.2	0.5	1.1	2.8	3.2	-36%
2010	F. E. E.	3.6	7.4	0	0	0	0	0%
PARTIAL BUILD	OTHER	4.3	9.3	1.1	4.4	7.4	9.5	-32%
F.E.E. NORTH TO 102	C. B. D.	1.1	5.1	0	1.4	4	3.4	-7%
2010	F. E. E.	4.8	4	2.2	0	0	0	0%
PARTIAL BUILD	OTHER	4.3	14.3	2.5	3.7	5.8	5.4	-90%
F.E.E. NORTH TO 111	C. B. D.	2.3	4.9	0.7	0.5	3.4	3.2	-36%
2010	F. E. E.	4.8	6.2	0	0	0	0	0%
PARTIAL BUILD	OTHER	3.4	13.9	1.9	4.8	3.6	8.4	-73%
WITHOUT 111 TO 102	C. B. D.	1.2	5.8	0	1.5	3	3.5	-21%
2010	F. E. E.	2.1	5.6	3.2	0	0	0	1%
TRANSIT/TDM	OTHER	7	10.6	1.1	1.7	10	5.5	-68%
	C. B. D.	3.5	5	0.2	1.4	1.5	3.2	-50%

* PERCENT CHANGE BETWEEN 2010 COMBINED LEVELS OF SERVICE F'+ F + E AND EXISTING 1990 LOS PROJECTIONS. ALL PROJECTIONS ARE BASED ON VOLUME / CAPACITY (v/c) RATIOS.

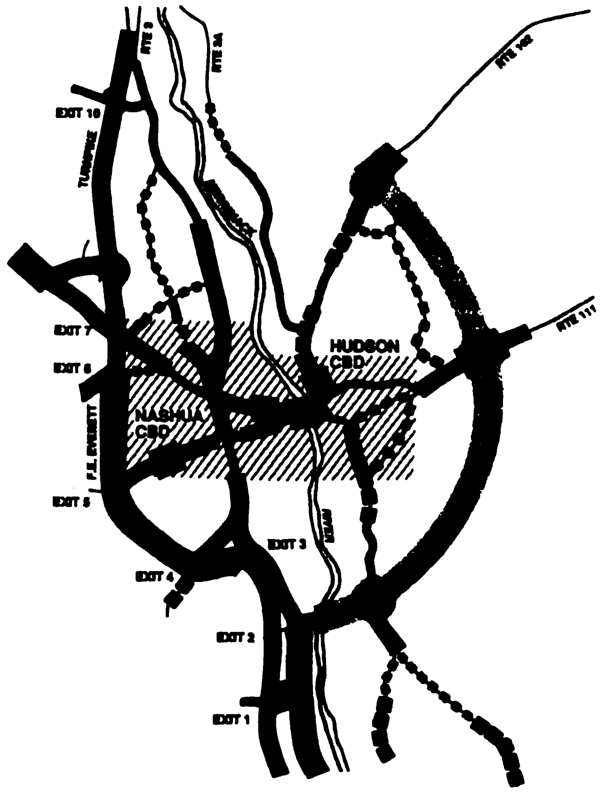


NORTH
NOT TO SCALE

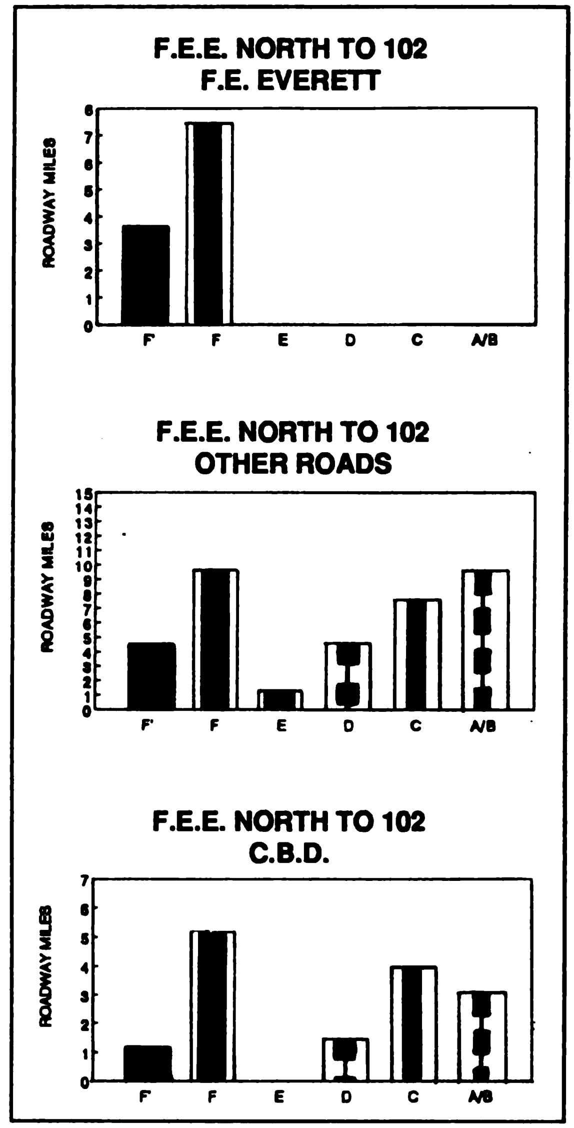
NASHUA-HUDSON CIRCUMFERENTIAL HIGHWAY

LEVEL OF SERVICE
2010 PARTIAL BUILD F.E.E. SOUTH TO NH 102

NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION



PARTIAL BUILD TO NH 102



LEVEL OF SERVICE

TRAFFIC NETWORK		LEVEL OF SERVICE ROADWAY MILES						% CHANGE *
		F'	F	E	D	C	A/B	
1990	F. E. E.	1.7	5.5	3.8	0	0	0	BASE
EXISTING	OTHER	1.8	7.2	2.1	3.1	7.8	14	LINE
	C. B. D.	0.9	4.4	0.5	0.5	4	4.7	DATA
2010	F. E. E.	3.9	4.4	2.7	0	0	0	0%
NO BUILD	OTHER	8.5	7.8	3.5	2	8.4	5.8	-78%
	C. B. D.	2.5	6.2	0.2	1	1.7	3.4	-53%
2010	F. E. E.	1.7	7.2	1.3	0.8	0	0	7%
FULL BUILD	OTHER	3.1	6.4	3.1	4.4	4.6	14.4	-14%
	C. B. D.	0	2.8	1.7	1.3	4.7	4.5	22%
2010	F. E. E.	4.8	6.2	0	0	0	0	0%
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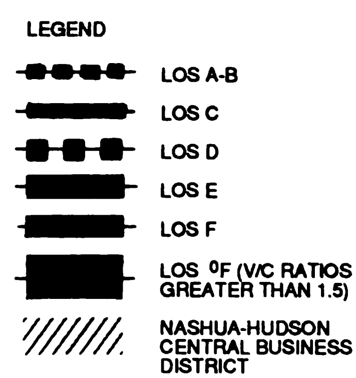
PARTIAL BUILD	OTHER	4.3	9.3	1.1	4.4	7.4	9.5	-32%
F.E.E. NORTH TO 102	C. B. D.	1.1	5.1	0	1.4	4	3.4	-7%
2010	F. E. E.	4.8	4	2.2	0	0	0	0%
PARTIAL BUILD	OTHER	4.3	14.3	2.5	3.7	5.8	5.4	-90%
F.E.E. NORTH TO 111	C. B. D.	2.3	4.9	0.7	0.5	3.4	3.2	-36%
2010	F. E. E.	4.8	6.2	0	0	0	0	0%
PARTIAL BUILD	OTHER	3.4	13.9	1.9	4.8	3.6	8.4	-73%
WITHOUT 111 TO 102	C. B. D.	1.2	5.8	0	1.5	3	3.5	-21%
2010	F. E. E.	2.1	5.6	3.2	0	0	0	1%
TRANSIT/TDM	OTHER	7	10.6	1.1	1.7	10	5.5	-68%
	C. B. D.	3.5	5	0.2	1.4	1.5	3.2	-50%

* PERCENT CHANGE BETWEEN 2010 COMBINED LEVELS OF SERVICE F'+ F + E AND EXISTING 1990 LOS PROJECTIONS. ALL PROJECTIONS ARE BASED ON VOLUME / CAPACITY (v/c) RATIOS.



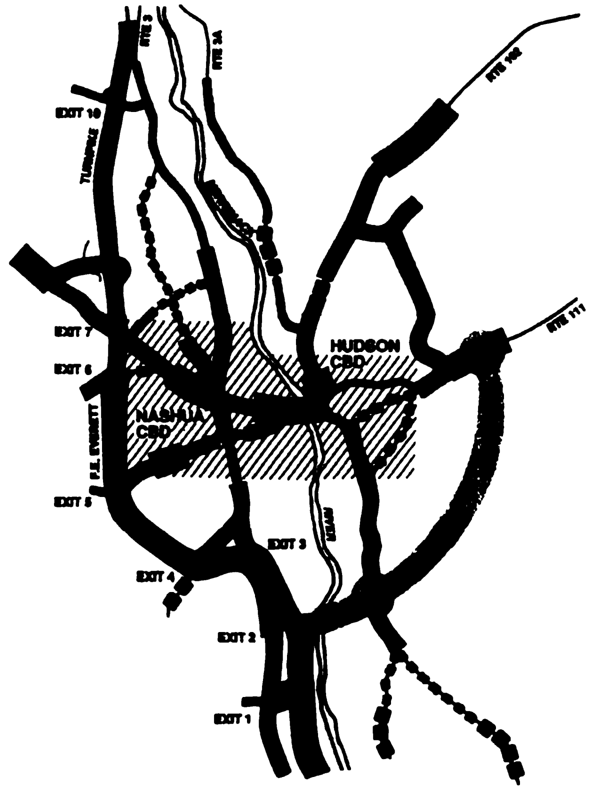
NORTH
NOT TO SCALE

NASHUA-HUDSON CIRCUMFERENTIAL HIGHWAY

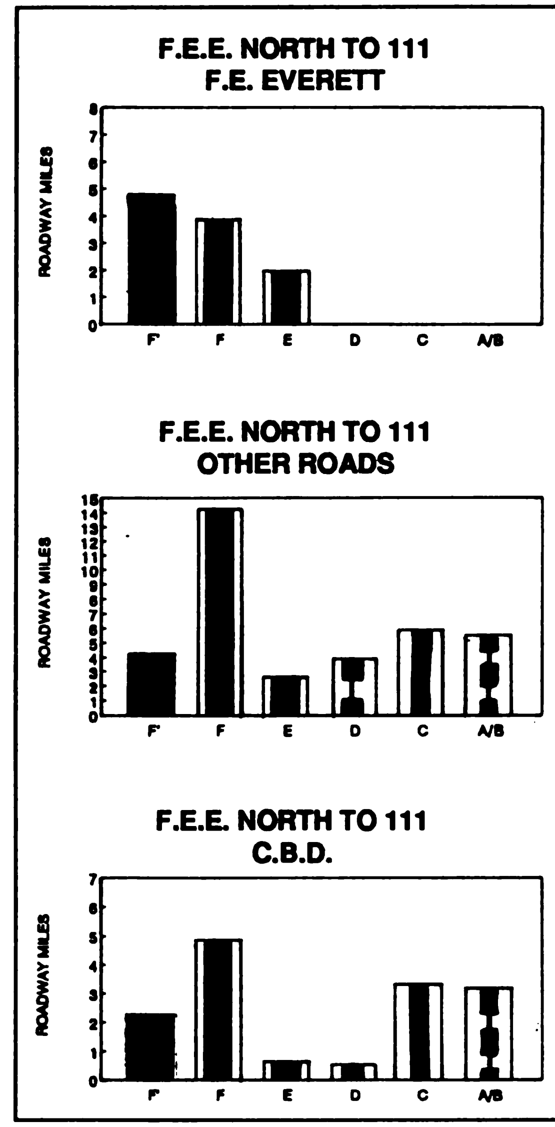
LEVEL OF SERVICE

2010 PARTIAL BUILD F.E.E. NORTH TO NH 102

NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION



PARTIAL BUILD TO NH 111



LEVEL OF SERVICE

TRAFFIC NETWORK		LEVEL OF SERVICE ROADWAY MILES F'	F	E	D	C	A/B	% CHANGE *
1990	F. E. E.	1.7	5.5	3.8	0	0	0	BASE
EXISTING	OTHER	1.8	7.2	2.1	3.1	7.8	14	LINE
	C. B. D.	0.9	4.4	0.5	0.5	4	4.7	DATA
2010	F. E. E.	3.9	4.4	2.7	0	0	0	0%
NO BUILD	OTHER	8.5	7.8	3.5	2	8.4	5.8	-78%
	C. B. D.	2.5	6.2	0.2	1	1.7	3.4	-53%
2010	F. E. E.	1.7	7.2	1.3	0.8	0	0	7%
FULL BUILD	OTHER	3.1	6.4	3.1	4.4	4.6	14.4	-14%
	C. B. D.	0	2.8	1.7	1.3	4.7	4.5	22%
2010	F. E. E.	4.8	6.2	0	0	0	0	0%
PARTIAL BUILD	OTHER	4.4	11.4	2.1	5.7	3.8	8.6	-61%
F.E.E. SOUTH TO 102	C. B. D.	1.2	6.2	0.5	1.1	2.8	3.2	-36%
2010	F. E. E.	3.6	7.4	0	0	0	0	0%
PARTIAL BUILD	OTHER	4.3	9.3	1.1	4.4	7.4	9.5	-32%
F.E.E. NORTH TO 102	C. B. D.	1.1	5.1	0	1.4	4	3.4	-7%
2010	F. E. E.	4.8	4	2.2	0	0	0	0%
PARTIAL BUILD	OTHER	4.3	14.3	2.5	3.7	5.8	5.4	-90%
F.E.E. NORTH TO 111	C. B. D.	2.3	4.9	0.7	0.5	3.4	3.2	-36%
2010	F. E. E.	4.8	6.2	0	0	0	0	0%
PARTIAL BUILD	OTHER	3.4	13.9	1.9	4.8	3.6	8.4	-73%
WITHOUT 111 TO 102	C. B. D.	1.2	5.8	0	1.5	3	3.5	-21%
2010	F. E. E.	2.1	5.6	3.2	0	0	0	1%
TRANSIT/TDM	OTHER	7	10.6	1.1	1.7	10	5.5	-68%
	C. B. D.	3.5	5	0.2	1.4	1.5	3.2	-50%

* PERCENT CHANGE BETWEEN 2010 COMBINED LEVELS OF SERVICE F'+ F + E AND EXISTING 1990 LOS PROJECTIONS. ALL PROJECTIONS ARE BASED ON VOLUME / CAPACITY (v/c) RATIOS.

LEGEND

- LOS A-B
- LOS C
- LOS D
- LOS E
- LOS F
- LOS F' (V/C RATIOS GREATER THAN 1.5)
- NASHUA-HUDSON CENTRAL BUSINESS DISTRICT

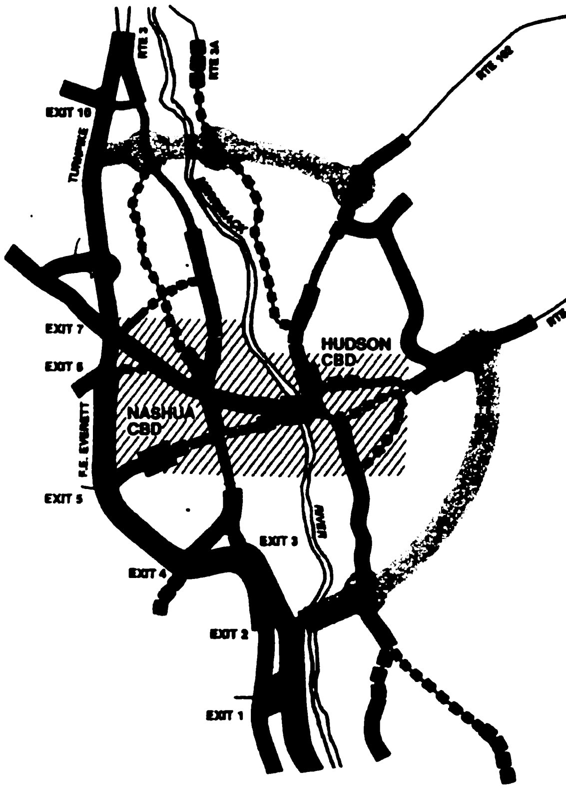
NORTH
NOT TO SCALE

NASHUA-HUDSON CIRCUMFERENTIAL HIGHWAY

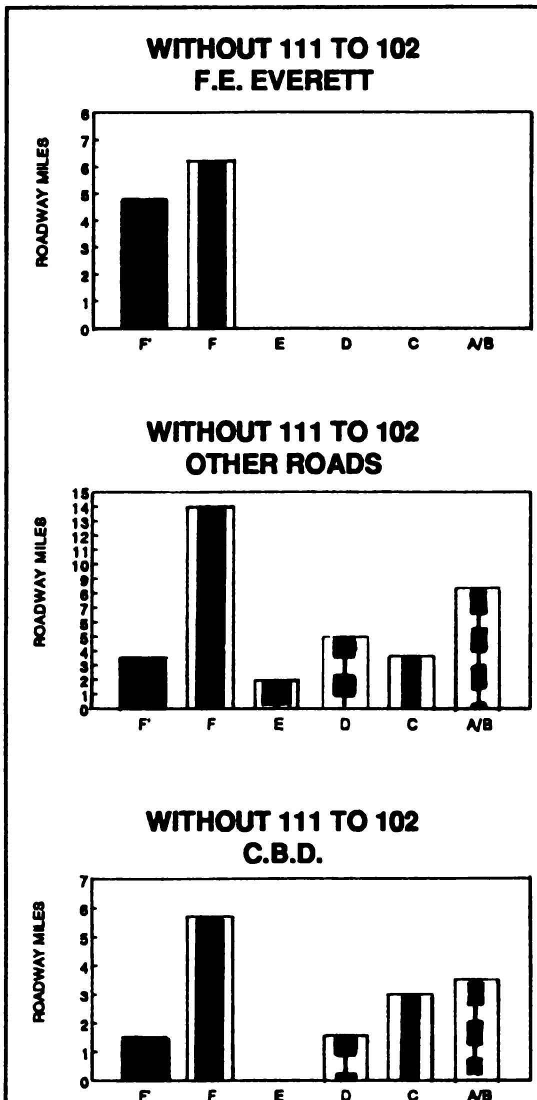
LEVEL OF SERVICE

2010 PARTIAL BUILD F.E.E. NORTH TO NH 111

NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION



**PARTIAL BUILD
WITHOUT NH 111 TO NH 102**



LEVEL OF SERVICE

TRAFFIC NETWORK		LEVEL OF SERVICE ROADWAY MILES						% CHANGE *
		F'	F	E	D	C	A/B	
1990	F.E.E.	1.7	5.5	3.8	0	0	0	BASE
EXISTING	OTHER	1.8	7.2	2.1	3.1	7.8	14	LINE
	C.B.D.	0.9	4.4	0.5	0.5	4	4.7	DATA
2010	F.E.E.	3.9	4.4	2.7	0	0	0	0%
NO BUILD	OTHER	8.5	7.8	3.5	2	8.4	5.8	-78%
	C.B.D.	2.5	6.2	0.2	1	1.7	3.4	-53%
2010	F.E.E.	1.7	7.2	1.3	0.8	0	0	7%
FULL BUILD	OTHER	3.1	6.4	3.1	4.4	4.6	14.4	-14%
	C.B.D.	0	2.8	1.7	1.3	4.7	4.5	22%
2010	F.E.E.	4.8	6.2	0	0	0	0	0%
PARTIAL BUILD	OTHER	4.4	11.4	2.1	5.7	3.8	8.6	-61%
F.E.E. SOUTH TO 102	C.B.D.	1.2	6.2	0.5	1.1	2.8	3.2	-36%
2010	F.E.E.	3.6	7.4	0	0	0	0	0%
PARTIAL BUILD	OTHER	4.3	9.3	1.1	4.4	7.4	9.5	-32%
F.E.E. NORTH TO 102	C.B.D.	1.1	5.1	0	1.4	4	3.4	-7%
2010	F.E.E.	4.8	4	2.2	0	0	0	0%
PARTIAL BUILD	OTHER	4.3	14.3	2.5	3.7	5.8	5.4	-90%
F.E.E. NORTH TO 111	C.B.D.	2.3	4.9	0.7	0.5	3.4	3.2	-36%
2010	**F.E.E.**	**4.8**	**6.2**	**0**	**0**	**0**	**0**	**0%**
PARTIAL BUILD	**OTHER**	**3.4**	**13.9**	**1.9**	**4.8**	**3.6**	**8.4**	**-73%**
WITHOUT 111 TO 102	**C.B.D.**	**1.2**	**5.8**	**0**	**1.5**	**3**	**3.5**	**-21%**
2010	F.E.E.	2.1	5.6	3.2	0	0	0	1%
TRANSIT/TDM	OTHER	7	10.6	1.1	1.7	10	5.5	-68%
	C.B.D.	3.5	5	0.2	1.4	1.5	3.2	-50%

* PERCENT CHANGE BETWEEN 2010 COMBINED LEVELS OF SERVICE F'+ F + E AND EXISTING 1990 LOS PROJECTIONS. ALL PROJECTIONS ARE BASED ON VOLUME / CAPACITY (v/c) RATIOS.

LEGEND

- LOS A-B
- LOS C
- LOS D
- LOS E
- LOS F
- LOS 0F (V/C RATIOS GREATER THAN 1.5)
- NASHUA-HUDSON CENTRAL BUSINESS DISTRICT

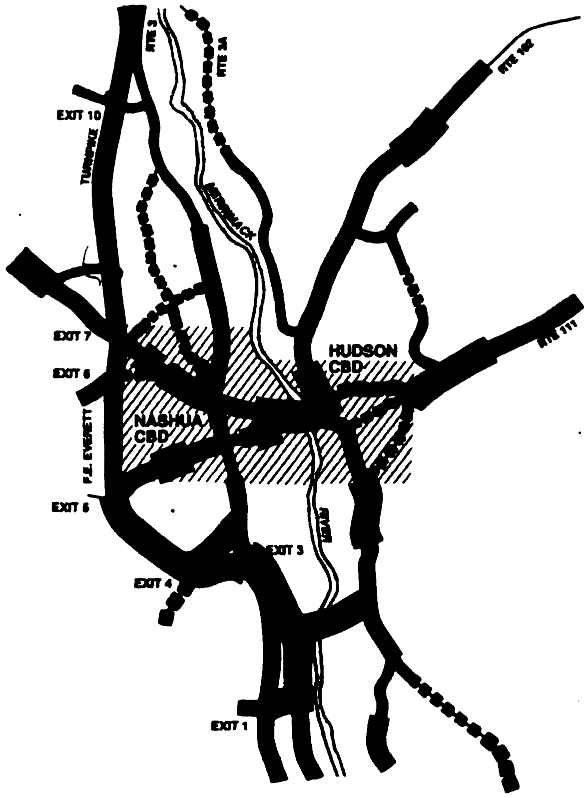
NORTH
NOT TO SCALE

NASHUA-HUDSON CIRCUMFERENTIAL HIGHWAY

LEVEL OF SERVICE

2010 PARTIAL BUILD WITHOUT NH 111 TO NH 102

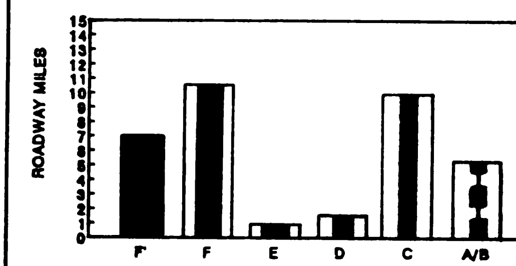
NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION



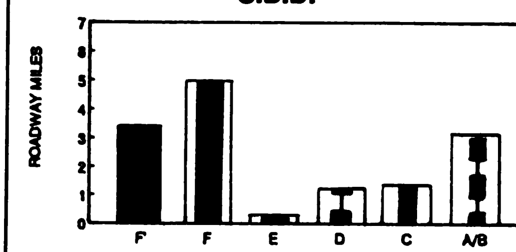
TRANSIT / TDM - 2010

TRANSIT / TDM
F.E. EVERETT

TRANSIT / TDM
OTHER ROADS



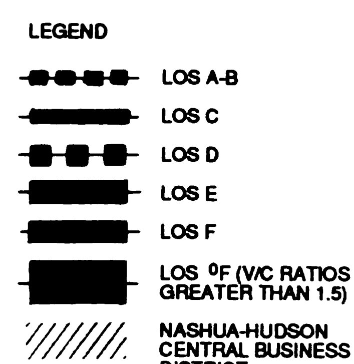
TRANSIT / TDM
C.B.D.



LEVEL OF SERVICE

TRAFFIC NETWORK		LEVEL OF SERVICE ROADWAY MILES						% CHANGE *
		F'	F	E	D	C	A/B	
1990 EXISTING	F. E. E.	1.7	5.5	3.8	0	0	0	BASE
	OTHER	1.8	7.2	2.1	3.1	7.8	14	LINE
	C. B. D.	0.9	4.4	0.5	0.5	4	4.7	DATA
2010 NO BUILD	F. E. E.	3.9	4.4	2.7	0	0	0	0%
	OTHER	8.5	7.8	3.5	2	8.4	5.8	-78%
	C. B. D.	2.5	6.2	0.2	1	1.7	3.4	-53%
2010 FULL BUILD	F. E. E.	1.7	7.2	1.3	0.8	0	0	7%
	OTHER	3.1	6.4	3.1	4.4	4.6	14.4	-14%
	C. B. D.	0	2.8	1.7	1.3	4.7	4.5	22%
2010 PARTIAL BUILD	F. E. E.	4.8	6.2	0	0	0	0	0%
	OTHER	4.4	11.4	2.1	5.7	3.8	8.6	-61%
F.E.E. SOUTH TO 102	C. B. D.	1.2	6.2	0.5	1.1	2.8	3.2	-36%
2010 PARTIAL BUILD	F. E. E.	3.6	7.4	0	0	0	0	0%
	OTHER	4.3	9.3	1.1	4.4	7.4	9.5	-32%
F.E.E. NORTH TO 102	C. B. D.	1.1	5.1	0	1.4	4	3.4	-7%
2010 PARTIAL BUILD	F. E. E.	4.8	4	2.2	0	0	0	0%
	OTHER	4.3	14.3	2.5	3.7	5.8	5.4	-90%
F.E.E. NORTH TO 111	C. B. D.	2.3	4.9	0.7	0.5	3.4	3.2	-36%
2010 PARTIAL BUILD	F. E. E.	4.8	6.2	0	0	0	0	0%
	OTHER	3.4	13.9	1.9	4.8	3.6	8.4	-73%
WITHOUT 111 TO 102	C. B. D.	1.2	5.8	0	1.5	3	3.5	-21%
2010 TRANSIT/TDM	F. E. E.	2.1	5.6	3.2	0	0	0	1%
	OTHER	7	10.6	1.1	1.7	10	5.5	-68%
	C. B. D.	3.5	5	0.2	1.4	1.5	3.2	-60%

* PERCENT CHANGE BETWEEN 2010 COMBINED LEVELS OF SERVICE F'+ F + E AND EXISTING 1990 LOS PROJECTIONS. ALL PROJECTIONS ARE BASED ON VOLUME / CAPACITY (v/c) RATIOS.



NORTH
NOT TO SCALE

NASHUA-HUDSON CIRCUMFERENTIAL HIGHWAY

LEVEL OF SERVICE

TRANSIT / TDM - 2010

NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

APPENDIX B

AGENCY COORDINATION LETTERS

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02254-9149

REPLY TO
ATTENTION OF

May 10, 1990

Operations Directorate
Regulatory Division

Ms. Elizabeth Higgins Congram
Assistant Director for Environmental Review
Office of Government Relations and Environmental Review
Environmental Protection Agency- Region 1 (RGR-2203)
John F. Kennedy Federal Building
Boston, Massachusetts 02203

Dear Ms. Higgins Congram:

We have recently decided it will be necessary to do an Environmental Impact Statement on the New Hampshire Department of Transportation Nashua Circumferential Highway project.

In as much as your agency has expertise in the areas likely to be effected, we would like to request your participation in the development of the Environmental Impact Statement.

We anticipate publishing a Notice of Intent to do a revised Draft Environmental Impact Statement in the Federal Register on May 25, 1990, and hope to have a public scoping meeting on June 28, 1990.

Please notify me in writing, of your response to this request at your earliest convenience.

If you have any questions, please feel free to call me at 617-647-8320, or Mr. Richard Roach, the Senior Project Manager in charge of the study, at 617-647-8211.

Sincerely,

V. L. Andreliunas
Chief Operations Directorate

Copies Furnished:

Mr. Gorden Beckett, Supervisor
U.S. Department of the Interior
Fish and Wildlife Service - Ecological Services
Ralph Pill Marketplace - 4th Floor
22 Bridge Street
Concord, New Hampshire 03301-4901

Mr. Vincent F. Schimmoller
Division Administrator
U. S. Department of Transportation
Federal Highway Administration
55 Pleasant Street
Concord, NH 03301

Mr. David L. Mussulman
State Conservationist
U.S. Department of Agriculture
Soil Conservation Service
Federal Building
Durham, NH 03824

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION I
J.F. KENNEDY FEDERAL BUILDING, BOSTON, MASSACHUSETTS 02203-2211

May 15, 1990

V. L. Andreliunas
Chief
Operations Directorate
Regulatory Division
U.S. Army Corps of Engineers
424 Trapelo Road
Waltham, MA 02554-9149

Dear Mr. Andreliunas:

Thank you for your May 10, 1990 letter in which you requested EPA's participation in the development of the new Environmental Impact Statement for the New Hampshire Department of Transportation's proposed Nashua Circumferential Highway. Based on discussions with your staff at the May 9 meeting, we understand that the Corps would like EPA to serve as a "cooperating agency."

We would be pleased to serve as a "cooperating agency" in this effort. We agree, based on discussions on May 9, that EPA's role during the development of the EIS will be to review preliminary draft NEPA documents and provide technical assistance based on EPA's areas of jurisdiction and expertise. We further understand that the Corps is not requesting that EPA be responsible for drafting parts of the EIS. Also, as you know, EPA's status as a "cooperating agency" does not affect our independent responsibilities under either Section 309 of the Clean Air Act or Section 404 of the Clean Water Act.

We appreciate the Corps' decision to require this EIS as the project raises issues of substantial concern to EPA relative to NEPA requirements and public water supply and wetland impacts. Our February 28, 1985 comments (copies of which we have provided to the Corps) on the Federal Highway Administration's original Draft EIS for this project describe these concerns in greater detail.

We look forward to working with the Corps, NHDOT, and their consultants throughout the NEPA process for this project. If you agree with EPA's "cooperating agency" role as described above, we suggest that this letter serve as our "cooperating agency" agreement. Feel free to contact me at 617/565-3422 if you have

any questions.

Sincerely,

Elizabeth Higgins Congram

Elizabeth Higgins Congram
Assistant Director for Environmental Review
Office of Government Relations and Environmental Review

cc:

Wallace E. Stickney, Commissioner, NHDOT

United States Department of Agriculture
Soil Conservation Service
Federal Building
Durham, New Hampshire 03824

May 30, 1990

Mr. V. L. Andreliunas, Chief Operations Directorate
Department of the Army, Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02254-9149

Dear Mr. Andreliunas:

This is in response to your letter of May 10, 1990 concerning the public scoping meeting for the New Hampshire Department of Transportation Nashua Circumferential Highway project. Mr. Thomas Chrisenton, our District Conservationist for Hillsborough County, will be able to attend on that day. Please notify Mr. Chrisenton and me of the time and place when it is set.

Sincerely,

David L. Mussulman

David L. Mussulman
State Conservationist

cc: T. G. Chrisenton, District Conservationist, SCS, Chappell Professional Center, Route 13 South, Milford, New Hampshire 03055-9605

United States Department of the Interior

FISH AND WILDLIFE SERVICE
400 RALPH PILL MARKETPLACE
22 BRIDGE STREET
CONCORD, NEW HAMPSHIRE 03301-4901

May 23, 1990

V. L. Andreliunas
Department of the Army
New England Division, Corps of Engineers
244 Trapelo Road
Waltham, MA 02254-9149

Dear Mr. Andreliunas:

This letter is in response to your May 10, 1990 request for our participation in the development of an Environmental Impact Statement on the New Hampshire Department of Transportation Nashua Circumferential Highway Project. We will be happy to act as a cooperating agency within our area of expertise and participate in the scoping and review process of the project, subject to staff and budget limitations.

We commend your decision to require a revised Draft Environmental Impact Statement for this project.

Sincerely yours,

Vernon B. Lang
Acting Supervisor
New England Field Office

U. S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
REGION ONE

FEDERAL BUILDING
55 PLEASANT STREET, ROOM 219
CONCORD, NEW HAMPSHIRE 03301

Rec'd from RP 10/12/9. SB

May 30, 1990
IN REPLY REFER TO:

Mr. V. L. Andreliunas
Chief Operations Directorate
Department of the Army
New England Division, Corps of Engineers
424 Trapelo Road
Waltham, MA 02254-9149

Subject: Nashua Circumferential

Dear Mr. Andreliunas:

We have reviewed your May 10, 1990 request to participate in the development of an environmental impact statement (EIS) for the Nashua Circumferential with some concern.

As you are aware, this proposal began as a Federally-aided effort because the NHDOT intended to use Federal funds for its construction. As the Federal lead agency, we followed the Council of Environmental Quality's (CEQ) Regulations in the preparation of a Draft EIS, including the Notice of Intent and Scoping Processes. Our staff has expended many hours over several years on the preparation of this document. We believe that the Draft EIS is an acceptable document, and in accordance with CEQ's Regulations at 1500.5 entitled "Reducing Delays" and 1506.3 "Adoption", we believe the Corps could have adopted it.

Additionally, following completion of the Draft EIS, the NHDOT determined that in order to schedule construction within a reasonable time frame, they would have to utilize toll financing rather than Federal funds. Subsequently, they withdrew their request for Federal-aid highway funds for the project. Since your agency became involved as a Federal lead agency, we have asked the NHDOT if they foresee the potential use of Federal funds on the Circumferential and they have responded negatively. Thus, we find it somewhat difficult to approach active involvement on this project. Additionally, we believe that the expertise needed for the preparation of the document for a highway project, as well as the engineering resources, are readily available at the NHDOT.

-more-

However, we do recognize that the emphasis on wetland avoidance has increased in the last five years since the draft was released and the procedures, which must be successfully followed to get a Section 404 permit, have become complex. Also, there are several projects currently under study in New Hampshire, where we both need to work together to find reasonable solutions to transportation needs. In the interest of better interagency cooperation, we are willing to accept a role of limited participation. We agree to review and comment on highway-related aspects of the project (i.e., design features, operations, geometrics, safety, etc.), however, we do not intend to participate in regularly scheduled meetings or detailed dialogue on non-highway issues.

We recognize that there are serious social-economic community-wide problems with some alternative corridors, which we have previously considered. We do not intend to play a future role in these trade-offs, but believe the Corps needs to adequately weigh these matters with their wetland protection goals in order to comply with the intent of the National Environmental Policy Act.

Please provide us with further notice of the upcoming scoping meeting.

Sincerely yours,

V.F. Schimmoller

Vincent F. Schimmoller
Division Administrator

4054.15 /13

[illegible] statements with the committee at the time and in the manner permitted by the committee. The ASB Administrative Officer, Sally Warner, may be contacted for further information at (202) 695-0781/0782.

Sally A. Warner,

Administrative Officer, Army Science Board.

[FR Doc. 90-11884 Filed 5-22-90; 8:45 am]

BILLING CODE 3710-08-M

Corps of Engineers

To Prepare a Draft Environmental Impact Statement (DEIS) for the Proposed Arts Park La Within the Sepulveda Flood Control Basin; Los Angeles, CA

AGENCY: Corps of Engineers, DOD.

ACTION: Notice of Intent to Prepare Draft Environmental Impact Statement (DEIS).

SUMMARY:

1. Study Alternatives

The Cultural Foundation, a nonprofit Corporation, proposes the construction of the Arts Park LA on a 60 acre site within the Sepulveda Flood Control Basin. The Arts Park will serve as a multi-cultural and multi-discipline cultural center to serve the residents of the San Fernando Valley in Los Angeles County. Corps of Engineers approval is required for this use.

The Arts Park is proposed to consist of several facilities consistent with the multi-cultural theme of the center. Facilities proposed include a Performing Arts Center, Performance Glen and Grove, Arts Park Center, Childrens Center for the Arts, Natural History Museum, Lakeside Food Pavillion, Media Education Center, Founders Grove, Artists Outdoor Workshops and a water reclamation facility. Additionally, paved parking for 600 cars is proposed.

Several Alternatives to the Applicants Proposed Action are possible. These include:

a. No Action Alternative

The No Action alternatives involves the construction of no Arts Park related facilities on Federal lands.

b. Construction of Entire Facility in Another Location

This set of alternatives involves the construction of the entire proposed Arts Park facilities in an other location within the San Fernando Valley. Potential alternative sites include Hansen Dam Flood Control Basin, Warner Center, Van Nuys Civic Center, Pierce College, and California State University, Northridge. Other potential sites may be identified during the scoping process.

c. Construction of Same Project Components at Alternative Sites

This alternative involves the construction of a portion of the Arts Park (most-probably the Performing Arts Center) at an alternative location within or outside of the Sepulveda Basin.

d. Construction of a Reduced Sized Project in the Sepulveda Basin

This set of alternatives involve the construction of a reduced intensity Arts Park at the Sepulveda Basin. This alternative could range from a construction of the Performance Glen and Grove only to a construction complex nearly as intense as the Applicant's proposed project.

e. Alternative Designs

This alternative involves the development of the facilities proposed for Arts Park on the proposed site, but using different designs and facility placements.

A detailed alternatives analysis and screening analysis will be an integral portion of the EIS.

2. Scoping Process

A key issue of the EIS will be the identification and analysis of alternatives to the Applicant's Proposed Project. This analysis will include sites both within the Sepulveda Basin and at other locations as well as alternative projects at the proposed site.

Other key environmental issues include:

a. Impact to other existing or potential recreational opportunities at the site and surrounding areas of the Sepulveda Flood Control Basin.

b. Traffic, air quality and noise impacts associated with the construction and operation of the facility.

c. Potential impact to wildlife using the site and adjoining areas.

d. Potential aesthetic impacts.

e. Potential impact on public services and utilities.

3. A scoping meeting is planned at the Reserve Center Drill Hall, Naval and Marine Corps Reserve Center in Lake Balboa Park near the Sepulveda Flood Control Basin on Tuesday, April 24, 1990 at 2 to 5 p.m. and at 7 to 9:30 p.m.

4. Publication of Draft EIS

The Draft EIS is scheduled to be available for public review in May 1990.

ADDRESSES: Questions concerning the proposed action, its alternatives, the Draft EIS and public scoping should be addressed to: Ms. Sheila Murphy, Environmental Resources Branch, Army Corps of Engineers, 300 North Los Angeles Street, Los Angeles, California 90053, (213) 894-5695.

Dated: April 30, 1990.

Charles S. Thomas,

Colonel, Corps of Engineers, District Engineer.

[FR Doc. 90-11940 Filed 5-22-90; 8:45 am]

BILLING CODE 3710-KF-M

Environmental Statements; Availability, etc.; Circumferential Highway Project, NH

The New England Division of the Army Corps of Engineers announces its intent to prepare a Draft Environmental Impact Statement (DEIS) for the New Hampshire Department of Transportation (DOT) Circumferential Highway Project—Nashua, Hudson, Litchfield and Merrimack, New Hampshire. The Corps of Engineers will be evaluating a permit application for the proposed work under section 404 of the Clean Water Act.

AGENCY: New England Division, U.S. Army Corps of Engineers, Department of Defense (DOD).

ACTION: Notice of Intent to Prepare a Draft Environmental Impact Statement (DEIS).

SUMMARY: The Nashua-Hudson region of southern New Hampshire is experiencing rapid population and economic growth which necessitates the expansion of the region's highway system. The construction of a circumferential highway around Nashua is proposed to provide relief for existing and projected highway capacity deficiencies and to enhance traffic flow in the area. Various social, economic and environmental impacts will occur with each of the applicant's alternatives. Because the Army Corps of Engineers will have to decide whether and under what circumstances to grant a Federal permit for the proposed work, we have decided to prepare an EIS to aid in agency decisionmaking and to assure compliance with the National Environmental Policy Act (NEPA).

The Federal Highway Administration (FWA) prepared a DEIS dated 1984. In 1988, the New Hampshire Department of Transportation (DOT) withdrew the project from Federal funding and became the project proponent. Due to the time elapsed since release of the DEIS, potential changes in transportation patterns, Federal environmental policy changes and the

Title: Nashua - Hudson

availability of additional alternative information, a new DEIS will be released to assure major issues have been identified.

SUPPLEMENTARY INFORMATION:

1. *Proposed Action:* The project proposed by the applicant is a 12 mile long, 4-lane limited access perimeter highway. It is to be built on a new alignment located primarily east of Nashua forming a semi-circle around the city. Various alternative alignments begin in the vicinity of Exit 2 of the F.E. Everett Turnpike in south Nashua circling east, north, and then west through Hudson and Litchfield, recrossing the Merrimack River and returning to the Everett Turnpike in Merrimack or North Nashua.

2. *Alternatives:* Various alignment alternatives are being considered to reduce traffic to the area's primary highway, the F.E. Everett Turnpike. In addition to these capital improvement alignments, a No Action and Transportation System Management (TSM) Alternative are also being considered. The New Hampshire DOT conducted engineering studies that separate the highway into a Southern and Northern Segment.

The Southern Segment—One Southern Segment alternative would require construction on 379 acres in Nashua and Hudson, including 44.4 acres of wetlands. An analysis of this and other alignments for the southern corridor will be included as alternatives in the DEIS.

The Northern Segment—Alternative corridors are being evaluated for the Northern Segment. All corridor alternatives impact lands in Hudson, Litchfield and Merrimack. Additional alternatives may be proposed for analysis in the DEIS by the scoping process.

No Action Alternative—Under the No Action Alternative, traffic will continue to use the existing street and highway network.

The TSM Alternative—The purpose of the TSM Alternative is to encourage maximum utilization and energy efficiency of the existing transportation system by increasing its passenger capacity, without implementing capital-intensive construction projects.

3. *Scoping Process:* Public meetings were conducted by the U.S. Department of Transportation, Federal Highway Administration and the State of New Hampshire Department of Transportation to introduce the project and solicit comments, during the period March 1987 to September 1988. The Corps of Engineers has held a preliminary coordination meeting with Federal and State agencies to identify issues of concern.

The Environmental Protection Agency has indicated it will accept Cooperating Agency status for this study. Additional requests will be sent to the following agencies to accept Cooperating Agency status for this study:

U.S. Department of Interior—Fish and Wildlife Service
U.S. Department of Agriculture—Soil Conservation Service
U.S. Department of Transportation—Federal Highway Administration

The DEIS will analyze the potential social, economic, and environmental impacts to the region resulting from the proposed project such as impacts to wetlands, water quality, wildlife, increased residential and commercial development and historic and archaeological resources. Construction and operational phase impacts will be considered, as well as cumulative and secondary impacts.

4. *Scoping Meeting:* The Corps plans to hold an EIS Scoping Meeting on the evening of June 28, 1990 at the Nashua City Hall Auditorium. All interested agencies, organizations and publics are invited to attend this meeting. Sufficient local notification will be provided.

5. *Availability:* It is anticipated that the DEIS would be made available for review in November, 1990. The FEIS on this permit action is anticipated in the spring of 1991.

Address: Questions about the proposed action and DEIS can be answered by Mr. Richard Roach, Senior Project Manager, New England Division, Corps of Engineers, 424 Trapelo Road, Waltham, MA 02254–9149. Phone: 617–647–8211.

Dated: May 11, 1990.

Vyto L. Andreliunas,

Director of Operations.

[FR Doc. 90–11941 Filed 5–22–90; 8:45 am]

BILLING CODE 3710–24–M

DEPARTMENT OF EDUCATION

DEPARTMENT OF STATE

DEPARTMENT OF JUSTICE

Nondiscrimination in Federally-Assisted Programs; Enforcement Coordination Agreements Between State and Justice Departments

ACTION: Agreement between the Department of State and the Department of Education to delegate certain civil rights compliance responsibilities for educational institutions.

A. Purpose

Section 1–207 of Executive Order 12250 authorizes the Attorney General to initiate cooperative programs among Federal agencies responsible for enforcing title VI of the Civil Rights Act of 1964, title IX of the Education Amendments of 1972, as amended, section 504 of the Rehabilitation Act of 1973, as amended, and similar provisions of Federal law prohibiting discrimination on the basis of race, color, national origin, sex, handicap, or religion in programs or activities receiving Federal financial assistance.

This agreement will promote consistent and coordinated enforcement of covered nondiscrimination provisions, as required in the Coordination of Enforcement of Nondiscrimination in Federally Assisted Programs (28 CFR §§ 42.401–42.415), increase the efficiency of compliance activity, and reduce burdens on recipients, beneficiaries, and Federal agencies by consolidating compliance responsibilities, by eliminating duplication in civil rights reviews and data requirements, and by promoting consistent application of enforcement standards.

B. Delegation

By this agreement the Department of State designates the Department of Education as the agency responsible for specific civil rights compliance duties, as enumerated below, with respect to educational institutions. Responsibility for the following covered nondiscrimination provisions is delegated:

1. Title VI of the Civil Rights Act of 1964 (42 U.S.C. 2000d to 2000d–4); and

2. Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S.C. § 794).

This agreement specifies the duties to be performed by each agency. It does not alter the requirements of the joint Department of Justice/Equal Employment Opportunity Commission (EEOC) regulation concerning procedures for handling complaints of employment discrimination filed against recipients of Federal financial assistance. 28 CFR §§ 42.601–42.613; 29 CFR 1691.1–1–1697.13, 48 Federal Register 3570 (January 25, 1983). Complaints covered by that regulation filed with a delegating agency against a recipient of Federal financial assistance solely alleging employment discrimination against an individual are to be referred directly to the EEOC by the delegating agency.

and Other Resources Reforestation. Northen Spotted Owl Habitat Conservation Area 0-10, Willamette National Forest, Oakridge Ranger District, Lane County, OR, Due: December 28, 1992, Contact: Terri Jones (503) 782-2291.

EIS No. 920435, Draft EIS, FHW, TN, I-40 Reconstruction, I-40/I-240 Directional (Midtown) Interchange to TN-300 Interchange, Funding and Possible COE 404 Permit, Shelby County, TN, Due: December 28, 1992, Contact: Dennis C. Cook (615) 736-5394.

EIS No. 920436, Draft EIS, BOP, SC, Edgefield Low Security Federal Correctional Institution, Construction, Operation and Site Selection, Edgefield County, SC, Due: December 28, 1992, Contact: Patricia K. Sledge (202) 514-6470.

EIS No. 920437, Draft EIS, SCS, ND, Belfield Watershed Protection and Flood Prevention Plan, Funding and Section 404 Permit, City of Belfield, Billings and Stark Counties, ND, Due: January 08, 1993, Contact: Ronnie L. Clark (701) 250-4421.

EIS No. 920438, Draft EIS, FHW, SC, Cooper River Bridges Replacement Project, Grace Memorial/Silas N. Pearman Bridges on US 17 over Cooper River and Town Creek, Funding, COE Section 10/404 Permits and CGD Permit, Charleston County, SC, Due: January 11, 1993, Contact: Kenneth Myer (803) 253-3881.

EIS No. 920439, Draft EIS, BOP, WA, Yakima River Basin Fisheries Project, Construction, Operation and Maintenance, Funding, COE Section 10/404 Permits and NPDES Permit, Yakima Indian Nation, WA, Due: December 28, 1992, Contact: Kenneth Ward (503) 230-5373.

920440 *EIS No. 920440*, Revised Draft EIS, COE, NH, Nashua-Hudson Circumferential Highway Improvements, Approval, Town of Hudson, Litchfield, Merrimack and Nashua, Hillsborough County, NH, Due: December 28, 1992, Contact: Col. Brink Miller (617) 647-8336.

EIS No. 920441, Draft EIS, COE, MS, Abiaca Creek Watershed Project, Demonstration Erosion Control Project, Implementation, Sediment and Flood Control Measures, Yazoo Basin, Mathews Brake National Wildlife Refuge, Carroll, Holmes and Leflore Counties, MS, Due: December 31, 1992, Contact: Wendell King (601) 631-5967.

EIS No. 920442, Draft Supplement, FHW, MD, MD-100 Highway Improvements, MD-104 to I-95, Updated Improvement concerning Wetland Avoidance and Minimization Options, Funding and COE Section 404 Permit, Howard County, MD, Due: December 28, 1992, Contact: David Lawton (410) 962-4440.

EIS No. 920443, Final EIS, UAF, AR, Eaker Air Force Base Disposal and Reuse, Implementation, Mississippi County, AR, Due: December 14, 1992, Contact: Lt. Col. Gary Baumgartel (210) 536-3869.

EIS No. 920444, Final EIS, USA, LA, England Air Force Base Disposal and Reuse, Implementation, Rapides Parish, LA, Due: December 14, 1992, Contact: Lt. Col. Gary Baumgartel (512) 536-3869.

Dated: November 9, 1992.

Marshall Cain,

Senior Legal Advisor, Office of Federal Activities.

[FR Doc. 92-27580 Filed 11-12-92; 8:45 am]

BILLING CODE 6560-50-M

[FRL-4533-8]

Ella Warehouse Drums Site; Proposed Settlement

AGENCY: Environmental Protection Agency.

ACTION: Notice of proposed settlement.

SUMMARY: Under section 122(h) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), the Environmental Protection Agency (EPA) has agreed to settle claims for past response costs at the Ella Warehouse Drums Site, Houston, Harris County, Texas, with North Loop West Industrial Park, a general partnership, and its partners, Mr. Roy C. Hairston and Ms. Betty N. Ferguson. EPA will consider public comments on the proposed settlement for thirty (30) days. EPA may withdraw from or modify the proposed settlement, should comments disclose facts or considerations which indicate the proposed settlement is inappropriate, improper or inadequate. Copies of the proposed settlement are available from: Mr. Anthony Robledo IV, telephone (214) 655-6670, Cost Recovery Section, Hazardous Waste Management Division, U.S. EPA, Region 6, 1445 Ross Avenue, Dallas, Texas 75202-2733. Written comments may be submitted to the person above by thirty (30) days from the date of publication.

Dated: November 3, 1992.

Joe D. Winkle,

Acting Regional Administrator.

[FR Doc. 92-27546 Filed 11-12-92; 8:45 am]

BILLING CODE 6560-50-M

[OPPTS-44592; FRL-4174-4]

TSCA Chemical Testing; Receipt of Test Data

AGENCY: Environmental Protection Agency (EPA).

ACTION: Notice.

SUMMARY: This notice announces the receipt of test data on dibenzo-para-dioxins/dibenzofurans: tetrabromobisphenol-A (CAS No. 79-94-7) and allyl ether of tetrabromobisphenol-A (CAS No. 25327-89-3), submitted pursuant to a final test rule. Test data were also submitted for 4-vinylcyclohexene (4-VCH) (CAS No. 100-40-3) and mesityl oxide (MO) (CAS No. 141-79-7) pursuant to a testing consent order. All data were submitted under the Toxic Substances Control Act (TSCA). Publication of this notice is in compliance with section 4(d) of TSCA.

FOR FURTHER INFORMATION CONTACT: Susan B. Hazen, Director, Environmental Assistance Division (TS-799), Office of Pollution Prevention and Toxics, Environmental Protection Agency, Rm. E-543B, 401 M St., SW., Washington, DC 20460, (202) 554-1404, TDD (202) 554-0551.

SUPPLEMENTARY INFORMATION: Section 4(d) of TSCA requires EPA to publish a notice in the Federal Register reporting the receipt of test data submitted pursuant to test rules promulgated under section 4(a) within 15 days after it is received. Under 40 CFR 790.60, all TSCA section 4 consent orders must contain a statement that results of testing conducted pursuant to these testing consent orders will be announced to the public in accordance with section 4(d).

I. Test Data Submissions

Test data for tetrabromobisphenol-A were submitted by Ameribrom, Inc., and Ethyl Corporation pursuant to a test rule at 40 CFR Part 766. They were received by EPA on August 14 and August 26, 1992. The submissions describe the determination of polybrominated dibenzo-p-dioxins and dibenzofurans by high-resolution gas chromatography/medium high resolution mass spectrometry in tetrabromobisphenol-A. These chemical analyses are required by this test rule

Test data for allyl ether of tetrabromobisphenol-A were submitted by Great Lakes Chemical Corporation pursuant to a test rule at 40 CFR Part 766. They were received by EPA on August 10, 1992. The submission describes the determination of polybrominated dibenzo-p-dioxins and dibenzofurans by high-resolution gas

Channel Transit Project, Boylston Station to the World Trade Center, Funding, MA. Due: January 04, 1993. Contact: Mary Beth Mello (617) 494-2444.

EIS No. 920453, DRAFT SUPPLEMENT, FHW, WV, VA, Appalachian Corridor Construction, Elkins, WV to I-81 in VA, Updated Information concerning Legislative, Procedural and Project Surrounding Changes, Funding, Possible Section 10, 404 and CGD Permits and Right-of-Way Acquisition, several Counties, WV and VA. Due: January 25, 1993. Contact: Billy R. Higginbotham (304) 558-3093.

Amended Notices

EIS No. 920406, DRAFT EIS, AFS, AK, Central Prince of Wales Ketchikan Pulp Long-Term Timber Sale, Implementation, Tongass National Forest, Prince of Wales Island, AK. Due: December 14, 1992. Contact: David Arrasmith (907) 225-3101.

920440 *EIS No. 920440*, REVISED DRAFT EIS, COE, NH, Nashua-Hudson Circumferential Highway Improvements, Approval, Towns of Hudson, Litchfield, Merrimack and Nashua, Hillsborough County, NH. Due: January 11, 1993. Contact: Col. Brink Miller (617) 647-8336. Published FR-11-13-92—Review period extended.

Dated: November 17, 1992.

William D. Dickerson,

Deputy Director, Office of Federal Activities.

[FR Doc. 92-28271 Filed 11-19-92; 8:45 am]

BILLING CODE 6560-50-M

[ER-FRL-4536-4]

Intent to Prepare a Supplemental Environmental Impact Statement (SEIS) on Effluent Discharges From Oil and Gas Operations to Territorial Waters of the United States in the Central and Western Gulf of Mexico

AGENCY: U.S. Environmental Protection Agency (EPA).

ACTION: Proposed issuance of a new source National Pollutant Discharge Elimination System (NPDES) general permit for effluent discharges from oil and gas operations in the central and western Gulf of Mexico.

PURPOSE: EPA has determined that the issuance of the NPDES general permit represents a major Federal action that may significantly affect the quality of the human environment. Therefore, a SDEIS will be prepared to assess the potential environmental consequences of EPA's permit action.

SUMMARY: The Minerals Management Service (MMS), Gulf of Mexico Outer Continental Shelf (OCS) Region, and the EPA, Region 6, are cooperating agencies pursuant to the Council on Environmental Quality's (CEQ) regulations on the MMS's EIS for oil and gas lease sales in the central and western Gulf of Mexico (areas #142 and #143). The EPA's proposal to issue a NPDES general permit for oil and gas operations in the central and western Gulf will be evaluated in a SEIS which adopts those portions of the MMS's EIS meeting the standards for adequacy under the CEQ's regulations.

ALTERNATIVES: The EPA, Region 6, may issue or deny the NPDES general permit.

FOR FURTHER INFORMATION OR TO BE PLACED ON THE SEIS MAILING LIST: Contact Mr. Norm Thomas, U.S. EPA (6E-F), 1445 Ross Avenue, Dallas, Texas 75202-2733. Telephone: 214-655-2260.

ESTIMATED RELEASE DATE OF SUPPLEMENTAL DRAFT EIS: January, 1993.

RESPONSIBLE OFFICIAL: B. J. Wynne, Regional Administrator

Dated: November 12, 1992.

Richard E. Sanderson,

Director, Office of Federal Activities.

[FR Doc. 92-28273 Filed 11-19-92; 8:45 am]

BILLING CODE 6560-50-M

[FRL-4536-9]

Proposed Settlement Under Section 122(g) of the Comprehensive Environmental Response, Compensation and Liability Act; In re H. Brown Company, Inc.

AGENCY: Environmental Protection Agency.

ACTION: Request for public comment.

SUMMARY: Notice of *De Minimis* Settlement: In accordance with section 122(i)(1) of the Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended (CERCLA), notice is hereby given of a proposed administrative settlement concerning the remedial action at the H. Brown Superfund Site Walker, Kent County, Michigan. The agreement was proposed by EPA Region V on July 8, 1992. Subject to review by the public pursuant to this Notice, the agreement was approved by the United States Department of Justice on November 16, 1992.

DATES: Comments must be provided on or before December 21, 1992.

ADDRESSES: Comments should be addressed to the Docket Clerk, U.S. Environmental Protection Agency, Region V, 77 West Jackson Boulevard, Chicago, Illinois, 60604-3590, and should refer to: In Re H. Brown Superfund Site in Walker, Michigan.

FOR FURTHER INFORMATION CONTACT: Ceil Price, U.S. Environmental Protection Agency, Office of Enforcement, Superfund Division, 401 M Street, SW., Washington, DC 20460 ((202) 260-3840).

SUPPLEMENTARY INFORMATION: The 139 signatories will pay a total of $642,814 in settlement payments for the remediation under the agreement, subject to the contingency that EPA may elect not to complete the settlement based on matters brought to its attention during the public comment period established by this Notice. This amount will reimburse EPA for a portion of its past response costs at the H. Brown Superfund Site.

EPA is entering into this agreement under the authority of section 122(g) and 107 of CERCLA. Section 122(g) authorizes early settlements with *de minimis* parties to allow them to resolve their liabilities at Superfund sites without incurring substantial transaction costs. Under this authority, the agreement proposes to settle with parties for the remediation at the H. Brown Superfund Site who are responsible for less than 0.1% percent of the total volume of waste sent to the site between 1962 and 1981. The proposed settlement reflects and was agreed to based on, conditions as known to the parties as of July 8, 1992. Settling Parties will be required to pay their volumetric share of the government's past response costs and the estimated future response costs for the remediation at the Site. Settling parties will also be required to pay a settlement premium of 1.0 (i.e., a 2.0 multiplier) of the estimated future response costs for the remediation, based on the potential for cost overruns in implementing the remedy, based on the fact the remedy was not chosen at the time the settlement was entered into, and based on the potential for remedy failure. In exchange, Settling Parties will receive a complete release from further civil or administrative liabilities for the remediation at the Site. The settlement, as it is now proposed, includes several minor adjustments to the identity of settling parties and the volumetric shares of settling parties, which were made after the proposal was sent to all eligible parties on July 8, 1992, in response to additional information provided by those parties. In addition, the settlement makes certain allowances for those parties that demonstrated an inability to pay defense.