5.12 SECTION 6(F) AND NON-HISTORIC 4(F) LANDS

5.12.1 SECTION 6(F) LAND IMPACTS

Section 6(f) lands in the corridor, as defined and described in Section 4.12, include two small pieces of the Nehantic State Forest located between Old New London Road and Routes 82 and 85 in Salem. The full build and partial build alternatives travel to the west of, but do not contact these lands. The widening alternatives would result in some degree of fill along Route 85 at the edge of Horse Pond. Horse Pond is included in the Nehantic State Forest parcel. No impact to 6(f) land is associated with these alternatives, however, because all work would occur within the existing ConnDOT right-of-way and would not result in a permanent loss of recreational land. Impacts to Horse Pond and adjacent wetlands were considered in Section 5.6.

5.12.2 NON-HISTORIC SECTION 4(f) LAND IMPACTS

Non-historic Section 4(f) lands were defined and described in Section 4.12. None of the alternatives would result in impacts to non-historic Section 4(f) lands. Because the preferred alternative would not affect non-historic Section 4(f) resources, a Section 4(f) Evaluation was not required for these resources.

5.13 VISUAL AND AESTHETIC RESOURCES

5.13.1 VISUAL AND AESTHETIC IMPACTS

While each of the four towns expresses an individual identity with respect to local natural and manmade features and their related development patterns, all may be characterized as having relatively low population densities and a distinctly rural feeling. The town centers are described as villages, having a small, intimate scale. The commercial/ business groupings are essentially convenience services for the local population and those traveling through the area.

5.13.1.1 *Community Perceptions*: Plans of Development for all four towns describe communities that consider themselves a congregation of neighborhoods and small village centers supporting a rural-urban and rural population. Residents have chosen the southeastern region because of the rural flavor and the sense of community that many feel is not inherent in the larger urban centers within the state. The natural limitations of the environment have helped to maintain a low concentration of development throughout the general southeastern region. Town goals recognize this self-limiting development control and the importance of preserving their environment.

5.13.2 COMPARISON OF VISUAL AND AESTHETIC IMPACTS

This section analyzes and evaluates the visual and aesthetic impacts associated with each alternative.

5.13.2.1 *No Build Alternative*: Traffic volumes within the Route 82 and 85 corridor would continue to increase under the no build condition and with this increase in traffic volumes comes incentive and economic pressure to increase consumer services related to traffic volumes. Over time, the combined effects of increased traffic and growth of commercial/business within the corridor would lead to incremental degradation of the aesthetic aspects of the existing environment that the local communities consider critical to the maintenance of their current lifestyle.

5.13.2.2 *TSM Alternative*: Similar effects as described for the no build condition could be expected as a result of implementation of TSM measures only.

5.13.2.3 *TDM/Transit Alternatives*: Implementation of TDM and/or transit options would likely have no measurable impact upon aesthetics or visual quality in the corridor areas.

5.13.2.4 *Route 82 and 85 Widening Alternatives*: The primary aesthetic impacts of widening include removal of vegetation, most notably deciduous and evergreen street trees; removal or relocation of existing street-side features such as stone walls and other related elements of historic interest; cuts and fills required to accommodate the widening; and moving/demolition of selected structures, some of which have historic credentials or are recognized as having local importance. Another element of the widening, perhaps not initially perceptible, is a change in scale with respect to the new corridor width. The increase in road width, combined with the removal of existing street trees, would reduce the sense of enclosure as one transits the corridor. This change in scale would constitute a move away, visually, from the local urban-rural road experience that exists throughout segments of the corridor. Of the build alternatives, widening would affect the greatest number of parcels, up to twice that of other build alternative.

The widening would help to accommodate the anticipated increase in traffic volumes, but may also expedite the increase in commercial/business development along the corridor. As with the no build alternative, the increased activity and development density would, over time, diminish the existing urban-rural character of the Route 85 corridor.

5.13.2.5 *New Location - Full Build Alternatives*: Potential visual and aesthetic impacts vary by alternative for the routes on new location; therefore each alternative is discussed individually, below. The preferred alternative is discussed in Section 5.13.2.7.

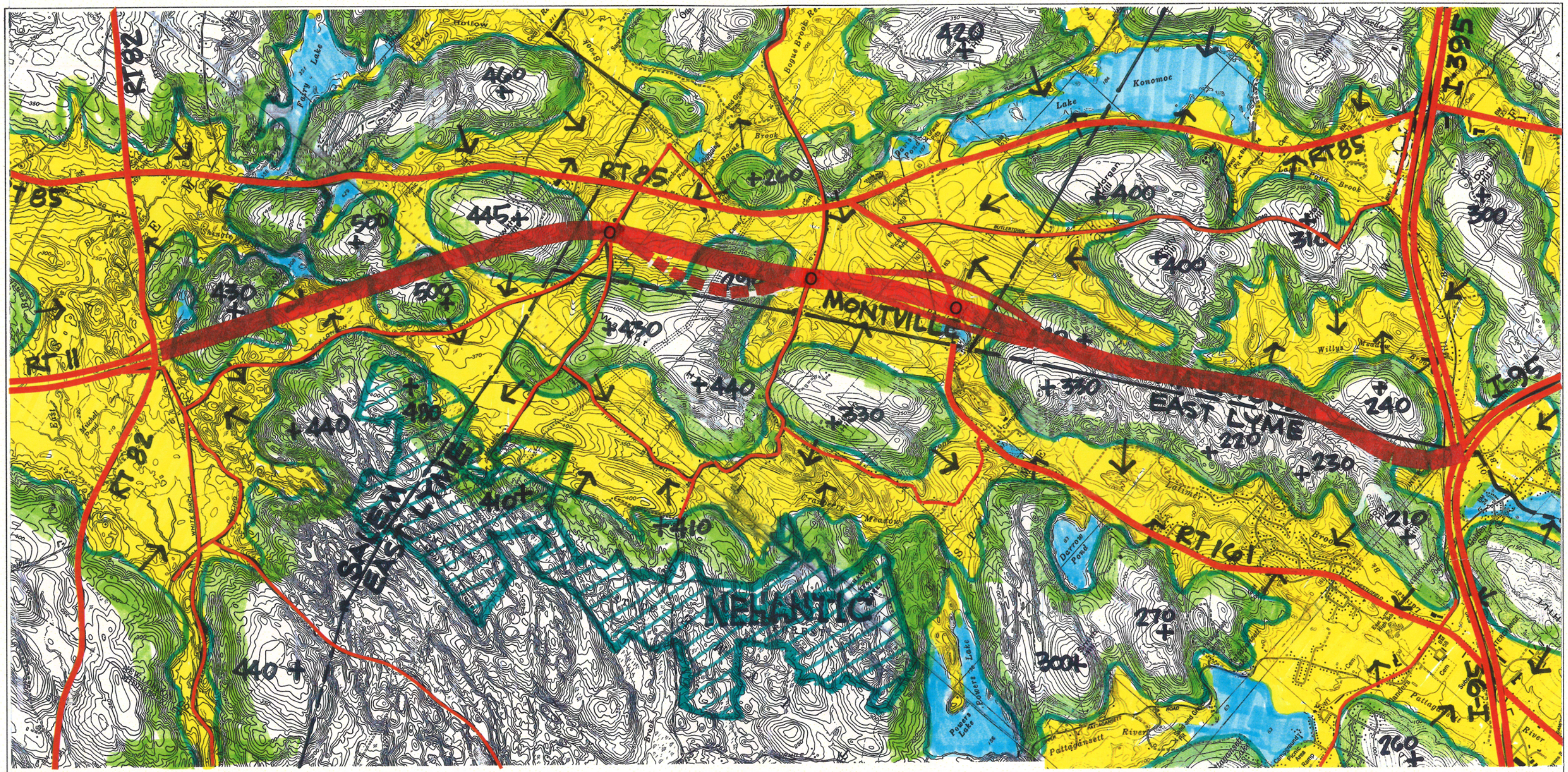
92PD Alternative: With respect to cut and fill requirements, the 92PD alternative is the least intrusive of the four full expressway alternatives. Of the four, it also has the lowest overpass elevation differentials (10 m. (32 ft.)) and, along with Alternative E, has the least number of overpasses (3) as depicted on Figure 5-20a. However, in terms of horizontal alignment, it is one of the most disruptive with respect to its close proximity to the Route 85 corridor from Salem Turnpike to Route 161. Additionally, several subdivisions would be exposed to expressway corridor views and corridor related noise. More specifically, these include: Beckwith Hill Drive, Skyline Drive, Fawn Run, Daisy Hill Drive, Pruett Place and portions of Holmes Road.

E Alternatives: Impacts associated with the E alignments, regarding cuts, fills and changes in terrain, are similar to the 92PD alternative. However, because $E_{(4)}$ and $E_{(2)}$ avoid, to a greater extent, the residential areas that would be impact by 92PD, the visual impact of the new expressway would be less pronounced for these alternatives.

F Alternatives: As the westernmost alignment, Alternative F runs generally along ridge areas (Figure 5-20b) farthest from the higher concentrations of residential development. In this context it may be considered the least disruptive of the alternatives. However, because of the ridge-related alignment, this alternative requires the second highest quantity of cuts and fills. There are 4 overpasses with one at Grassy Hill Road requiring a 13 m. (44 ft.) grade differential.

G Alternatives: Like Alternative F, the G alignment follows high ground, but in terms of general alignment, falls between F and 92PD/E while maintaining the same Route 161 interchange location as Alternative F (Figure 5-20c). However, because of the alignment shift east, the area of disruption for ramp access at Route 161 is greatest with this alternative. In terms of general disruption to the residential environment, it appears to be consistent with that of Alternative F. In this case, the Cardinal Road subdivision lies in close proximity to the alignment. Further exacerbating impacts in this general area is the 17 m. (55 ft.) elevation differential at the Grassy Hill Road overpass (1 of 4 overpasses required). The G alternatives require the greatest quantity of cut and fill, approximately 2.5 times that required for the 92PD alignment.

5.13.2.6 *New Location - Partial Build Alternatives*: The partial build alternatives, $H_{(4)}$ and $H_{(2)}$, have a total of 4 overpasses, however, unlike the 92PD, E, F and G alignments, there is no interchange at Route 161 (Figure 5-20d). Disruption of the residential environment is less than that of the 92PD and E alternatives but about the same as the G alignment, running just west of



STEEP SLOPES
TOE OF SLOPE
VALLEY FLOOR
WATER BODY
+400 SPOT ELEVATION
VIEWSHED
EXISTING TRAVELWAYS
ALTERNATIVE ALIGNMENT
O OVERPASS
U UNDERPASS

LEGEND

NOTES

STATE OF CONNECTICUT
DEPARTMENT OF TRANSPORTATION
ROUTE 82 / 85 / 11 CORRIDOR E.I.S – M.I.S.
IN THE TOWNS OF
EAST LYME, MONTVILLE, SALEM AND WATERFORD
ALTERNATIVE 1992 PD, E(4) & E(2)
VISUAL AND AESTHETIC IMPACTS

SCALE:

Figure 5-20a

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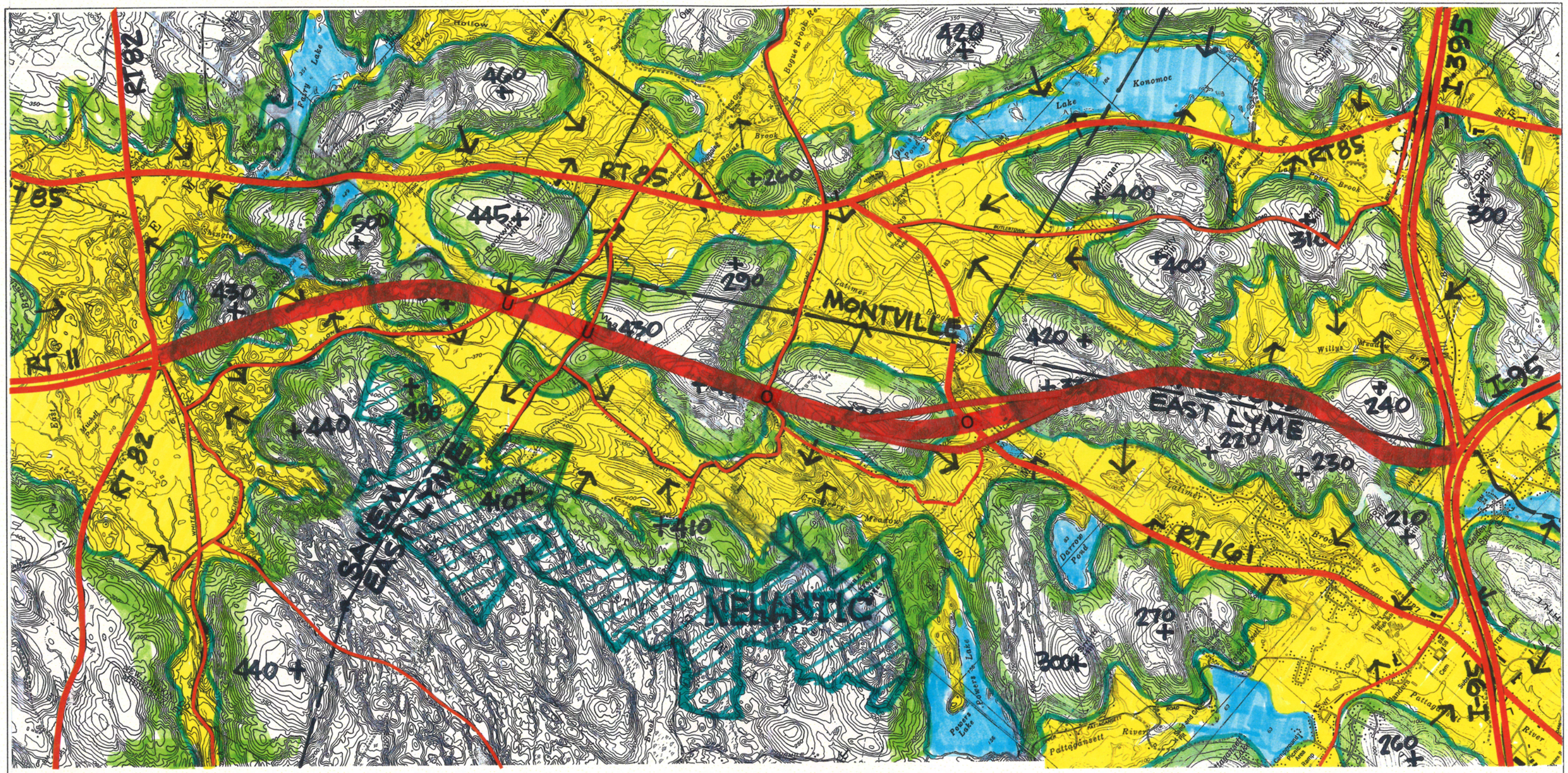

STEEP SLOPES	WATER BODY	EXISTING TRAVELWAYS	O OVERPASS
TOE OF SLOPE	+400 SPOT ELEVATION	ALTERNATIVE ALIGNMENT	U UNDERPASS
VALLEY FLOOR	VIEWSHED		

LEGEND

NOTES

STATE OF CONNECTICUT
DEPARTMENT OF TRANSPORTATION
ROUTE 82 / 85 / 11 CORRIDOR E.I.S – M.I.S.
IN THE TOWNS OF
EAST LYME, MONTVILLE, SALEM AND WATERFORD
ALTERNATIVE F(4) & F(2)
VISUAL AND AESTHETIC IMPACTS

SCALE:

Figure 5-20b

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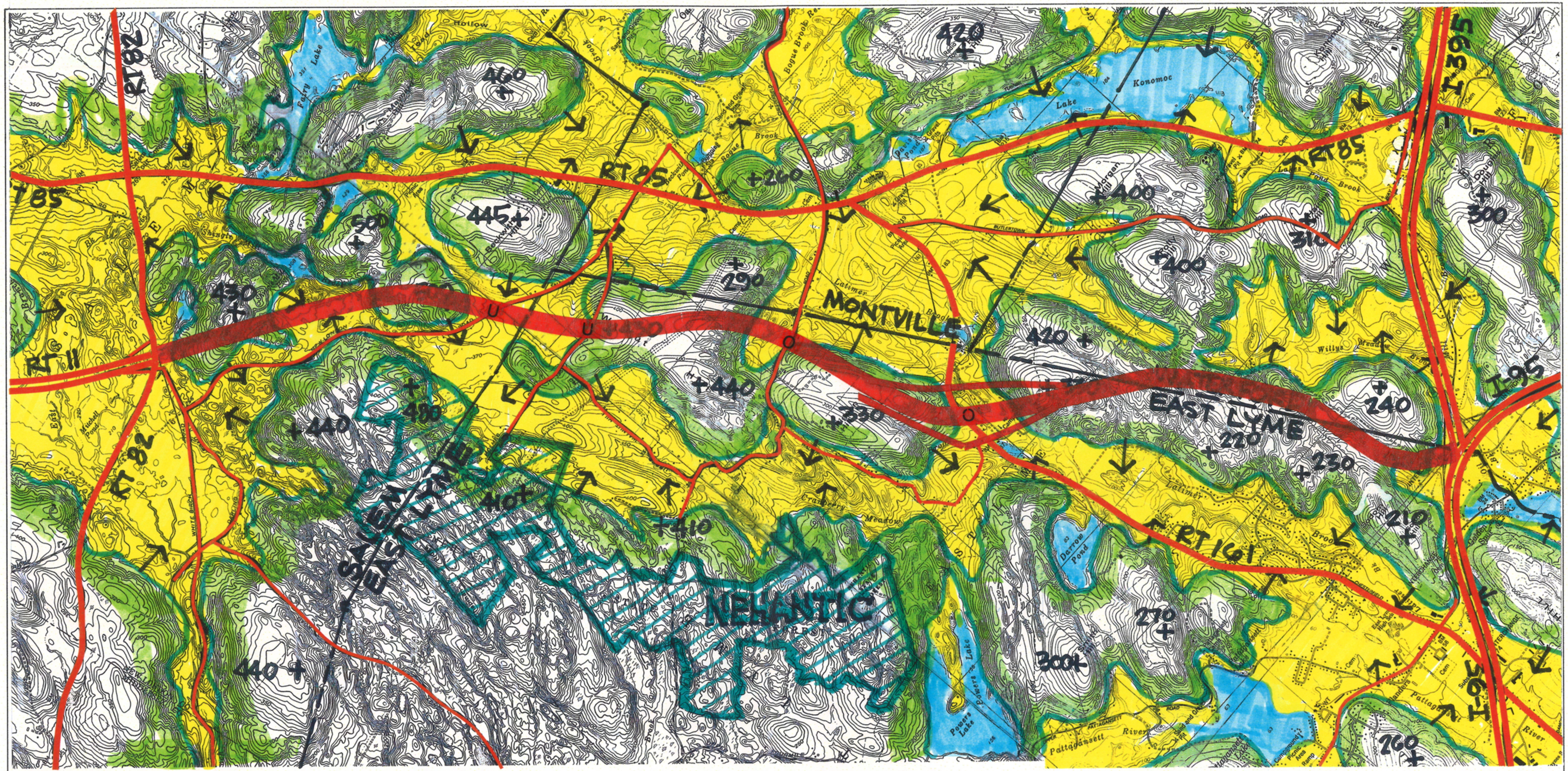

LEGEND

STEEP SLOPES	WATER BODY
TOE OF SLOPE	+400 SPOT ELEVATION
VALLEY FLOOR	VIEWSHED
EXISTING TRAVELWAYS	O OVERPASS
ALTERNATIVE ALIGNMENT	U UNDERPASS

NOTES

STATE OF CONNECTICUT
DEPARTMENT OF TRANSPORTATION
ROUTE 82 / 85 / 11 CORRIDOR E.I.S – M.I.S.
IN THE TOWNS OF
EAST LYME, MONTVILLE, SALEM AND WATERFORD
ALTERNATIVE G(4) & G(2)
VISUAL AND AESTHETIC IMPACTS

SCALE:

Figure 5-20c

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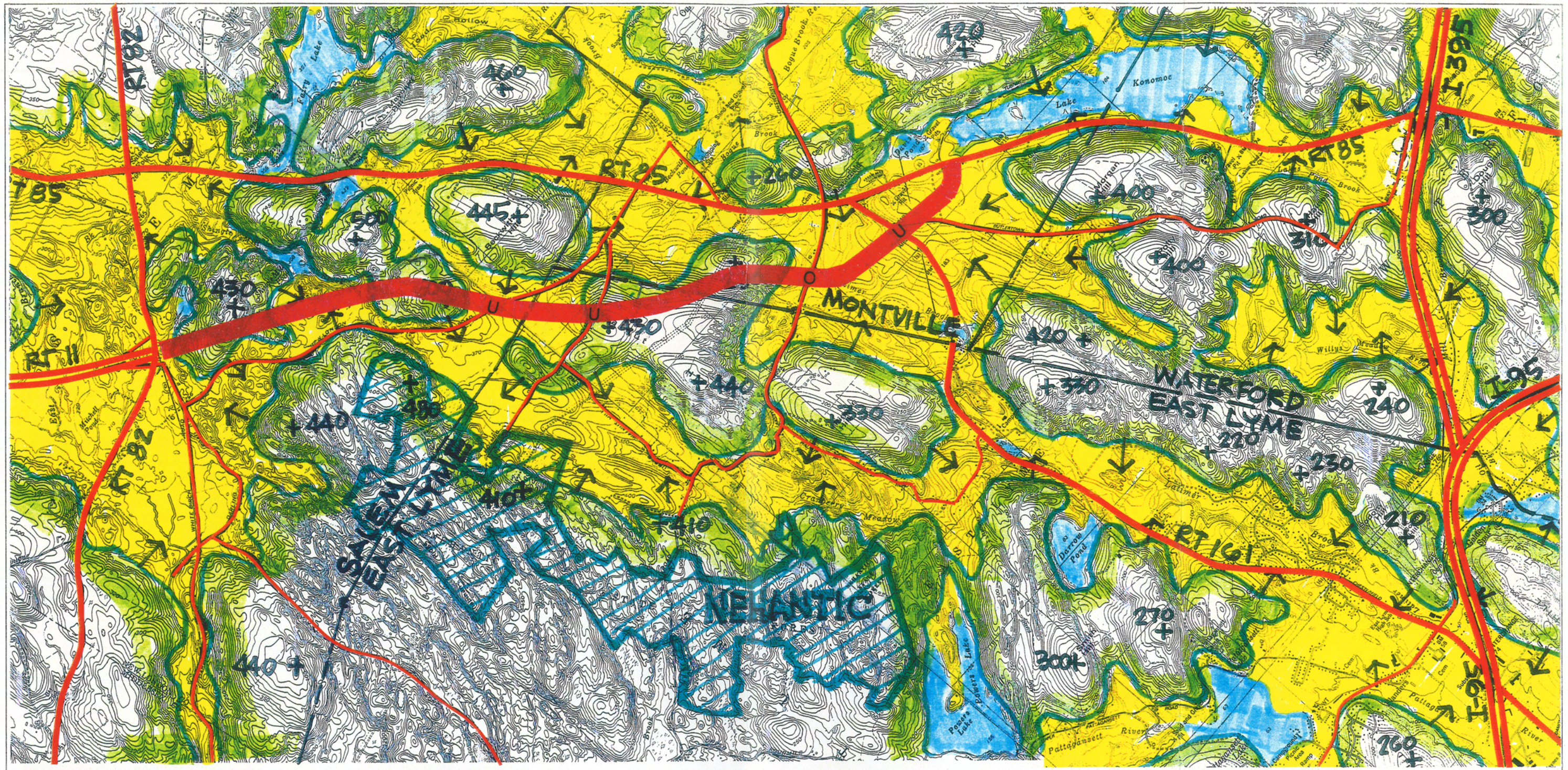

STEEP SLOPES	WATER BODY	EXISTING TRAVELWAYS	O OVERPASS
TOE OF SLOPE	+400 SPOT ELEVATION	ALTERNATIVE ALIGNMENT	U UNDERPASS
VALLEY FLOOR	VIEWSHED		

LEGEND

NOTES

STATE OF CONNECTICUT
DEPARTMENT OF TRANSPORTATION
ROUTE 82 / 85 / 11 CORRIDOR E.I.S – M.I.S.
IN THE TOWNS OF
EAST LYME, MONTVILLE, SALEM AND WATERFORD
ALTERNATIVE H(4) & H(2)
VISUAL AND AESTHETIC IMPACTS

SCALE:

Figure 5-20d

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the Pruett Place residential subdivision. Because the alignment must extend east to intersect with Route 85 at the northern end of Lake Konomoc, the right-of-way would compromise a substantial area of moderately sloping terrain. This required convergence also creates an area from Grassy Hill Road to the Route 85 intersection point that would be dominated by the impact of the expressway.

5.13.2.7 *New Location -Preferred Alternative*: Preferred alternative $E_{(4)}$m-V3 would have similar visual and aesthetic impacts as Alternative $E_{(4)}$. The magnitude of impact would be less in areas where cuts and fills are reduced and the roadway cross section is narrower. Impacts are described in detail below for each impact area.

Between Route 82 and Route 161: The visual effects of the preferred alternative would be similar to the $E_{(4)}$ alternative between Route 82 and Route 161. Views of the roadway would be most apparent at overpasses crossing local roads, interchanges, and near several residential neighborhoods.

Between Route 161 and I-395: South of Route 161, the effects of preferred alternative $E_{(4)}$m-V3 would differ from the other full build alternatives because the alignment variation is closer to residential neighborhoods along Route 161 in East Lyme. The proposed roadway in this area would be situated at topographic elevations of between 160 ft. and 250 ft. To a great extent, hills, ridges and trees would obscure views of the new roadway. However, a visual impact would occur from relatively higher elevations on several residential streets, including portions of Quailcrest Road, Grouse Circle, Catbird Lane and Goldfinch Terrace. Most of these views would be obscured by trees for much of the year. In some locations, views would only occur from second floor levels.

Distant views of the new roadway and in particular, the interchange at I-395/I-95 could occur from the numerous hilltops surrounding the corridor, particularly in winter. Views would be possible from hill slopes above 200 ft. in elevation, which face the corridor. Many of these views, however, would be screened by tree cover or blocked by other hills.

New Interchange at I-395/I-95: At the interchange of proposed Route 11 and I-395/95, the new ramps for Route 11 would be constructed above the existing interchange, thereby raising the total elevation of the structure. To understand the visual impact of the new interchange, proposed elevations of the Route 11 ramps were compared with elevations of the existing interchange and the general topography of the area. A comparison was also made of the change in total area covered by the interchange. All elevations are referenced to the National Geodetic Vertical Datum (NGVD).

- *Existing topographic elevations*: The existing interchange is situated within a zone of contrasting elevations. Rocky hills reaching elevations of more than 60 m. (200 ft.) comprise the terrain north of the interchange. The south side of the interchange drops to between 18 and 25 m. (59 and 82 ft.), and reaches sea level at the Niantic River within approximately 300 m. (985 ft.) to the south.
- *Existing interchange elevations*: The highest point on the existing interchange is the I-395 southbound ramp at 26.5 m. (87 ft.). The highest elevation on I-95 is currently 24 m. (79 ft.) on the southbound lane just north of the merge with I-395.
- *Proposed interchange elevations:* The highest point on the proposed ramps for Route 11 would be 35 m. (115 ft.) on the Route 11 southbound ramp where it crosses the proposed I-395 southbound ramp. This represents an increase in elevation of 8.5 m (28 ft.) over existing conditions. The proposed Route 11 northbound ramp would be 31.5 m (103 ft.), an increase of 5 m. (16 ft.) over the existing I-395 southbound ramp. Overall, the greatest increase in elevation would then be 8.5 m (28 ft.) over existing interchange elevations.
- *Existing and proposed interchange areas*: The total area covered by the existing interchange is 25 ha. (62 ac.), while the proposed interchange would cover an area of 55 ha. (137 ac.). This increase in area primarily occurs on the north side of the existing interchange (refer to Figures 3-12a and 3-12b).

Views from Proposed Route 11: The new roadway would traverse areas of hills, forest, field, rock outcrop, and wetland, which would all contribute to a favorable visual aesthetic for motorists. Developed areas along the proposed alignment are mainly limited to attractive rural residential neighborhoods. Heading in the southbound direction, travelers may experience vistas of the Niantic River or Long Island Sound, from points of higher elevation. Views from the roadway would be aesthetically pleasant and scenic in many locations.

5.13.3 MITIGATION MEASURES

Mitigation of adverse visual and aesthetic effects would be focused in areas where the new roadway is in proximity to residential neighborhoods. Measures that would be used to screen the roadway include land forming to create berms, minimizing clearing of existing vegetation, and planting of new trees and shrubs. Plantings would include a mix of regionally native, non-invasive evergreen and deciduous trees and shrubs, in a diversity of sizes.

5.14 HAZARDOUS WASTE / CONTAMINATED SITES

5.14.1 COMPARISON OF HAZARDOUS SITE IMPACTS

5.14.1.1 *No Build Alternative*: Selection of the no build alternative would result in little, if any, impact to hazardous waste or contaminated sites given that further substantive modification of the physical layout of the existing roadway would not occur. Impacts associated with this alternative would be limited to the potential exposure of highway construction and/or maintenance personnel to previously undetected hazardous or regulated materials or wastes encountered during routine maintenance of roadway components (i.e. catchbasins); during periodic refuse removal along road shoulders; or during isolated repairs or improvements of utilities, drainage systems, or other roadway components.

5.14.1.2 *Build Alternatives*: Potential impacts associated with the proposed build alternatives fall into two general categories:

- The potential for increased construction costs or lengthened construction schedules for either the widening or expressway alternatives should contaminated materials be encountered during construction associated with any of the alternatives; or

- The potential for construction of either the widening or expressway alternatives to impact conditions for present or future remedial actions at nearby release sites.

Little evidence of applicability of the latter scenario to this project was discovered during this preliminary assessment. An example of this type of impact would be if the installation of roadway drainage structures or utilities disrupted contaminated groundwater flow toward a treatment system. At least one leaking underground storage tank site along Route 85 exhibited signs of contaminant flow underneath the roadway (recovery wells were noted on both sides of the roadway, down gradient from a gasoline station). However, this site is located south of I-395, and no construction activities associated with any of the alternatives are proposed along this segment of Route 85.

The former impact scenario (i.e., encountering contaminated materials during construction) is more likely and should be anticipated for areas such as the Salem Four Corners and Chesterfield Four Corners intersections for the widening alternatives, and at the exit 75 interchange of I-95/I-395 for the remaining expressway alternatives, excluding the H alignment.

Potentially contaminated materials encountered during construction would be subject to regulation under the DEP's Remediation Standard Regulations (RSRs). This typically would require removing the contamination source, excavating contaminated materials, securing stockpiles of potentially contaminated material, testing and characterizing the material, and properly disposing of the materials. At Salem Four Corners and at Chesterfield, stockpiling of contaminated materials may pose a logistical problem as space in these areas is a limiting factor. Should excavation and stockpiling of contaminated materials be required, the materials would likely be transported to an off-site stockpile area, adding additional cost to the project.

In areas where the groundwater table is expected to be close to the ground surface, such as at Salem Four Corners, temporary draw down of the water table may be required during excavation. Groundwater extracted at the area of contamination would require treatment and discharge under a DEP wastewater discharge permit. Should excavation prove to not be feasible (e.g. due to existence of structures, depth of contamination plume, etc.) an alternative method of remediation would be required which could add substantial time and cost constraints to the project.

In general, the widening alternatives and the H alternatives would present the greatest risk of encountering hazardous or contaminated material during construction. The total number of identified hazardous/contamination sites per alternative transportation alignment for the build options are summarized in Table 5-66. The preferred alternative is discussed in more detail in Section 5.14.1.3.

TABLE 5-66
IDENTIFIED SITES OF POTENTIAL ENVIRONMENTAL CONCERN - COMPARISON OF ALTERNATIVES

ALTERNATIVE	REGISTERED UST SITES	LUST SITES	RELEASE SITES(1)	SOLID WASTE DISPOSAL SITES	STATE SUSPECTED SITES	RCRA NOTIFIER AND TSD FACILITIES	CERCLA SITES	TOTAL SITES
No Build	0	0	0	0	0	0	0	0
$W_{(4)}$, $W_{(4)}$m, $W_{(2)}$	8	1 (suspected)	7	1	3	0	0	20
TSM	3	0	2	0	2	0	0	7
TDM/Transit	0	0	0	0	0	0	0	0
92PD	0	0	1	1	0	0	0	2
$E_{(4)}$ and $E_{(2)}$	0	0	1	1	0	0	0	2
$F_{(4)}$ and $F_{(2)}$	0	0	1	2	0	0	0	3
$G_{(4)}$ and $G_{(2)}$	0	0	1	2	0	0	0	3
$H_{(4)}$ and $H_{(2)}$	5	0	5	3	1	0	0	14
$E_{(4)}$ m-V3 (2)	0	0	18	0	0	0	0	18

Source: New England DataMap Technology Corporation Environmental First Search

(1) Oil and chemical spills resulting from transportation accidents
(2) ConnDOT Task 110 Corridor Land Use Evaluation; 3 additional sites are of moderate risk because of current or former land uses.

UST = Underground Storage Tank
LUST = Leaking Underground Storage Tank
RCRA = Resource Conservation and Recovery Act
TSD = Hazardous Waste Treatment, Storage, or Disposal Facility
CERCLA = Comprehensive Environmental Response Compensation and Liability Act

5.14.1.3 *Preferred Alternative*: A ConnDOT Task 110 Corridor Land Use Evaluation was performed in 2002 for preferred alternative $E_{(4)}$m-V3. The objective of the Task 110 was to assess the environmental risk associated with current and former land uses in the vicinity of the alignment, and to determine the need for further evaluation. The environmental risks pertain to the potential presence of hazardous substances or other contaminated materials situated on parcels or existing state-owned rights-of-way that would be wholly or partially affected by the preferred alternative.

Current land use along the alignment is residential, commercial, industrial, agricultural, government/institutional, recreation/ open space, highway, and undeveloped land. A total of 54 parcels plus the state right-of-way at the I-395/I-95 interchange were evaluated.

Methodology

Identification of current and historic land use formed the basis for a determination of the relative risk of environmental contamination associated with each parcel that would be affected by the preferred alternative. Each affected parcel was evaluated to determine if there would be a low, moderate or high risk for encountering a release of hazardous substances or other contaminates. Recommendations for further evaluation were made, where warranted. Parcels that appeared to be relatively free of environmental concerns were assigned a low risk, and typically were not recommended for further investigation. Parcels occupied by facilities that are suspected of present or past uses of chemicals, petroleum products, or other potential contaminants were assigned a moderate risk designation. A high-risk designation was assigned to parcels that fit one or more of the following criteria:

- Parcel appeared to fit the definition of an "establishment" under the CT DEP Transfer Act C.G.S. 22a-134.
- Parcel was included on one or more state and federal environmental database inventories (e.g., a list of suspected hazardous waste sites; leaking underground storage tank sites; oil, chemical or regulated substance release sites, etc.).
- Parcel exhibited visible signs of chemical release; or evidence of on-site activities conducive to chemical release were noted or suspected.

Results

Four parcels in the study area were assigned a moderate risk, and 6 parcels and 16 spill sites identified on the state right-of-way at the I-395/I-95 interchange were assigned a high risk. Of these sites, 21 would likely be affected by the preferred alternative. These sites are listed in Table 5-67.

TABLE 5-67
POTENTIAL HAZARDOUS/CONTAMINATED AREAS
PREFERRED ALTERNATIVE $E_{(4)}$m-V3

LOCATION	FACILITY	RISK	BASIS OF RISK ASSESSMENT
Grassy Hill Road	Tillable Farmland	Moderate	Land Use
39 Silver Falls Drive	Agricultural Land	Moderate	Land Use
30 Chesterfield Road	RV Campground	Moderate	Land Use
43 Daisy Hill Drive (44 Daisy Hill Dr.)	Residence	Moderate	Spill
Near I-95 Northbound, Exit 74	Interstate	High	Spill
I-95 Southbound, Exit 75/ 74	Interstate	High	Spill
I-95 Northbound, Exit 75, under U.S. Route 1	State/ Interstate	High	Spill
I-95 Southbound, Exit 75	Interstate	High	Spill
I-95 Southbound near Exit 75	Interstate	High	Spill
Route 395 by Exit 75	Interstate	High	Spill
Near I-95 Northbound Exit 75 overpass	Interstate	High	Spill
Route I-95, Northbound, Exit 75	Interstate	High	Spill
Route 161, I-95, Exit 74	State/ Interstate	High	Spill
Route 161, I-95 DOT maintained	Allwaste, North Atlantic	High	Spill
Route 161, I-95	State/ Interstate	High	Spill
I-95 between Exit 73 & Exit 74	State/ Interstate	High	Spill
Flanders Road (undisclosed area)	State	High	Spill
I-95 Southbound/ I-395 merge	Interstate	High	Spill
I-95, Exit 80	Interstate	High	Spill
I-95 Northbound, Exit 76	Interstate	High	Spill
I-95/ I-395	Interstate	High	Spill

5.14.2 MITIGATION MEASURES

Additional surficial site investigations (ConnDOT Task 210) will be performed during the design phase of the project for areas on or adjacent to the identified moderate and high risk sites. These investigations will include surficial and subsurface soil and/or groundwater sampling to assess the potential for encountering contaminated material. A Health and Safety Plan will be prepared for the protection of on-site workers. If necessary, a remediation plan would be prepared (ConnDOT Task 310).

5.14.2.1 *Avoidance and Minimization*: The first strategy in impact mitigation is avoidance. Further investigation was provided by the Task 110 Corridor Land Use Evaluation following selection of the preferred alternative. The Task 110 was a more detailed investigation, in that it identified land use systematically

by providing a parcel-by-parcel evaluation of land use within the area of the recommended action as well as all parcels adjacent to a given alignment and those within a specified proximal distance from the alignment. It also identified ownership and provided more detail on historic land use. For properties identified during the Task 110 that appear to be parcels of environmental concern, a Task 120 Preliminary Site Evaluation would be recommended, if substantial right-of-way activity is proposed (i.e. partial or complete takings of property). Should preliminary design activities call for intrusive activities on a parcel identified as an environmental concern, then a Task 210 Surficial Site Investigation or a Task 220 Exploratory Site Investigation would be warranted. Intrusive activities that warrant Task 210 and 220 Investigations include drainage or utility relocation and improvements, structure excavations, and the removal of excavated materials from the site. By furthering the level of environmental assessment through these progressive steps, contaminated properties can be avoided or the number of contaminated sites encountered can be minimized.

5.14.2.2 *Remediation*: Mitigation of impacts to known contaminated sites could be accomplished by any one or a combination of several remediation strategies, depending on contaminant, that would be employed prior to or during road construction. Examples of typical remediation strategies include excavation of contaminated materials; installation of groundwater interceptor drains, recovery wells, or treatment wells; etc. In most cases, and if at all possible, source removal would be required. However, the applicability of these strategies to a given site cannot be determined without information provided by a detailed, site-specific hydrogeologic investigation.

Any previously undiscovered contaminated soil (controlled materials) encountered during construction would be managed according to all applicable state and federal regulations. This would be assured through the preparation of a Task 310 Remedial Management Plan (RMP) and associated construction specifications. The RMP would specify duties of the on-site engineer and contractor and procedures for handling controlled materials at each site. Health and safety information available for known contaminants would also be included in the RMP. In general, all construction activities (i.e., roadway, drainage or utility excavation) associated with this project would be conducted under a general health and safety plan. In addition, a contingency plan detailing the proper protocol for roadway construction personnel to follow in the event of a hazardous or regulated material release would be included in the RMP.

5.15 CONSTRUCTION ACTIVITY

5.15.1 CONSTRUCTION IMPACTS

All of the build alternatives would have short-term impacts associated with them during the construction phase. These impacts are likely to include noise, dust, sedimentation and erosion, and disruption of traffic. All control measures and BMPs utilized during construction would use the latest technologies, guidelines, and specifications and adhere to all state and federal regulations and permits.

5.15.1.1 *Noise*: All of the alternatives would produce noise resulting from construction activities. Noise resulting from construction of any of the build alternatives is expected to be a short-term impact affecting those residents living adjacent to the construction area or along the roadways traveled by the construction equipment. Noise resulting from excavation, drilling and blasting can be expected throughout the construction period. The noise resulting from these activities should not exceed 90 dBA at the nearest residence or occupied building. Any operation that exceeds this standard would cease until a different construction method can be developed which conforms to this 90 dBA limit. Alternatives $W_{(4)}$, $W_{(4)}$m and $W_{(2)}$ have many residences and businesses located within the immediate vicinity of the construction area. The expressway alternatives would impact fewer residences and businesses despite the greater amount of excavation, drilling and blasting that would be required. All methods and devices utilized to minimize impacts would be in accordance with the appropriate regulations and approval of ConnDOT.

5.15.1.2 *Air Quality*: Fugitive dust impacts can be expected throughout the construction phase for any of the build alternatives. Generally, the greater the area of disturbed earth and blasting, the larger the amount of fugitive dust produced. Based upon the assumption that the same measures would be utilized for each of the alternatives, Alternative $F_{(4)}$ would likely produce the largest quantity of fugitive dust, since it would have the largest total construction area. Mitigation for fugitive dust emissions involves curbing or eliminating its generation. Mitigation measures that will be used in site construction include wetting and stabilization to suppress dust generation, cleaning paved roads, and scheduling construction to minimize the amount and duration of exposed earth. These measures would be included in the construction contract documents. The latest edition of *Standard Specifications for Roads, Bridges and Incidental Construction for the State of Connecticut Department of Transportation*, as updated by supplemental specifications, would be utilized for design and installation of these measures.

During construction the contractor shall ensure that all motor vehicle and/or construction equipment (both on-highway and non-road) shall comply with all

pertinent state and federal regulations relative to exhaust emission controls and safety, including but not limited to the anti-idling provisions of the regulations of Connecticut State Agencies Section 22a-174-18(b)(3), which limits (with exceptions) the idling of delivery and/or dump trucks, or other equipment to three minutes during periods of non-active use.

5.15.1.3 *Water Quality*: Adverse impacts associated with erosion and sedimentation would require mitigation for any of the build alternatives. The latest approved measures to control water pollution and soil erosion would be utilized to minimize impacts. These measures typically include, but are not limited to, berms, dikes, dams, sediment basins, erosion control matting, gravel, mulches, grasses, slope drains, ditches, channels, riprap and grading. Given the amount of earthwork associated with Alternative $F_{(4)}$, this alignment would be expected to result in the greatest impact from sedimentation and erosion. The next greatest would be $G_{(4)}$, followed by $E_{(4)}$ and 92PD.

Short-term impacts resulting from construction of any of the build alternatives include a potential increase in water turbidity and the temporary changes in water color and clarity. Erosion and sediment control measures, noted above, would be effective in minimizing these impacts. There are numerous waterbodies and watercourses in the vicinity of the construction areas. These include but are not limited to Lake Konomoc, Fairy Lake, Latimer Brook, Shingle Mill Brook, Oil Mill Brook and numerous wetlands.

Although all of the build alternatives would affect surface water resources in the corridor to some extent, impacts associated with the widening alternatives, $W_{(4)}$, $W_{(4)}$m and $W_{(2)}$, are perhaps more critical since public water supply reservoirs (Fairy Lake and Lake Konomoc) could be affected. Alternatives $H_{(2)}$ and $H_{(4)}$ could also potentially affect Lake Konomoc. BMPs would be utilized as well to ensure all reasonable measures are used to maintain water quality. In order to further protect Fairy Lake and Lake Konomoc, additional temporary and permanent mitigation measures would be employed during and following construction of any of the widening alternatives or partial build expressway alternatives $H_{(4)}$ and $H_{(2)}$. During construction along Route 85, turbidity curtains could be used in waterbodies in order to help maintain the high water quality of sensitive resources. The protection of surface and subsurface water quality would be extensively coordinated with ConnDOT, DPH and DEP and incorporated into the construction documents.

Construction Runoff: During construction, treatment areas could be used as temporary sediment basins and, following completion of construction, they could be re-excavated for use as permanent retention ponds. To ensure that runoff from disturbed areas does not flow directly to the reservoir, construction of the basins could be completed prior to beginning any earthwork or clearing. All drainage within disturbed areas (the new right-of-way and limits of cuts and fills on side slopes) could be directed to the basins, conveyed either

through piping or diversion ditches/swales. Where swales are constructed to direct or divert storm flows, check dams or beams of crushed stone could be installed at appropriate intervals as specified in the *Connecticut Guidelines for Soil Erosion and Sediment Control*.

Clean runoff from non-disturbed areas within the watershed could be intercepted in ditches and allowed to flow directly to the reservoir instead of to additional sediment basins. The number and size of sediment basins that would be required to accept, contain and treat both roadway runoff and watershed runoff would require a commitment of a substantive amount of land area and result in additional tree clearing and wetland disturbances. Under existing conditions, runoff flows directly to the reservoir. This would remain essentially unchanged, however, the quality of the runoff would be improved by incorporating a series of check dams (at appropriate intervals as specified in the *Connecticut Guidelines for Soil Erosion and Sediment Control*) to slow flows and trap sediments. Construction of additional sediment basins would likely not be appropriate, given the minimal benefit that would be realized as a result of treating non-contaminated runoff. Maintaining a separate "clean" water system would ensure that the "dirty" water system does not become overburdened accepting flows that do not require added treatment prior to entering the reservoir.

ConnDOT would perform scheduled cleaning and maintenance of catch basins, wet basins and other system components. In addition, non-scheduled maintenance would be performed as required (after severe storm events, etc.) to ensure optimal system operation.

5.15.1.4 *Earthwork*: Topography throughout the corridor is severe. Large cuts and fills can be expected for any of the build alternatives on a new location. During the conceptual engineering and layout phases of alternative development, a general balancing of earthwork (cut/fill ratio) was maintained. Subsequent, more detailed design plans for a selected alternative would attempt to further refine the balance of earthwork in an attempt to minimize any borrowing or hauling of waste material off site. All suitable excavated material would be utilized on site, where permitted by the specifications and standards, to reduce the amount of material to be hauled off site in the event of a surplus of excavated materials. In the event that there is a shortage or surplus of suitable material, the contractor would be responsible for obtaining or disposing of this material in accordance with appropriate regulations. The longest of the new expressway alternatives, Alternative $F_{(4)}$, is also the alternative that would require the most substantial amount of excavation and grading; $F_{(4)}$ would likely produce the largest amount of waste material.

5.15.2 MAINTENANCE AND PROTECTION OF TRAFFIC

Short-term disruption of traffic during the construction of any of these alternatives would occur. For any of the build alternatives, a detailed Maintenance and Protection of Traffic (MPT) plan would be developed as part of the design of these alternatives to insure that traffic would be maintained at all times where possible. Sequencing of construction, detours, bypasses and crossovers are some of the measures that would be utilized where feasible to minimize any disruption to travel. These items would be coordinated with the appropriate state and local officials.

5.15.2.1 *No Build Alternative*: Spot improvements and/or maintenance that would occur under the no build scenario would generally not require a specific MPT plan; provisions for the safe passage of traffic would be developed on an activity-specific basis.

5.15.2.2 *Route 82 and 85 Widening Alternatives*: The construction associated with Alternatives $W_{(4)}$, $W_{(4)}m$ and $W_{(2)}$ would result in the greatest amount of disruption to traffic because it would be necessary for the existing roadways to remain open to traffic during most of the construction. MPT plans would be incorporated into the construction contract documents in addition to specifications concerning the maintenance of traffic. The large number of intersecting roadways along Routes 82 and 85 would probably be areas impacted the most during construction, especially the major intersections at Salem Four Corners, Routes 85 and Grassy Hill Road, and Routes 85 and 161. Access to local side streets, businesses and residences along Routes 82 and 85 would also be impacted during the construction. These impacts may include temporary delays and hindrance to access to these locations.

5.15.2.3 *TSM Alternatives*: TSM improvements would be localized and involve relatively small disturbance areas at any one time. Similar to the no build alternative, provisions for the safe passage of traffic would be developed on an activity-specific basis.

5.15.2.4 *TDM/Transit Alternatives*: Implementation of TDM initiatives or expansion of transit routes would not require construction, and therefore would not require a construction-related traffic plan.

5.15.2.5 *New Location - Full Build Alternatives and Preferred Alternative*: All of the expressway alternatives on a new location, including the preferred alternative, would generally have the least amount of disruption of traffic in the corridor in comparison to the widening alternatives. Typically, impacts can be expected at locations where the alternatives intersect with or cross over existing interstate, state and local roadways. These include but are not limited to Route 82, Salem Turnpike, Holmes Road, Grassy Hill Road, Boston Post Road, Oil

Mill Road, Route 161 and I-395/I-95. Traffic at any of these locations could be impeded for short periods of time throughout the construction phase.

Each of the new full build expressway alternatives would include the construction of interchanges at Route 82, Route 161 and at I-395/I-95. The 92PD, $E_{(4)}$, $F_{(4)}$ and $G_{(4)}$ alternatives and preferred alternative $E_{(4)}$m-V3, would have substantial improvements along I-95, including relocation, reconstruction and construction of new ramps and structures. The improvements along I-95 and the interchange of I-395/I-95/Route 11 would be identical for each of the four-lane expressway alternatives; the same amount of disruption to traffic along I-95 would be expected for these alignments, as well as for $E_{(4)}$m-V3. Alternatives $E_{(2)}$, $F_{(2)}$ and $G_{(2)}$ would also disrupt traffic along I-95 temporarily. However, the impacts to traffic on I-95 would be substantially less than those associated with Alternatives 92PD, $E_{(4)}$, $F_{(4)}$ and $G_{(4)}$ and $E_{(4)}$m-V3. No substantial improvements to I-95 would be part of the two-lane expressway options; however, connecting ramps to these alternatives to and from I-95 would be provided.

5.15.2.6 *New Location - Partial Build Alternatives*: Impacts associated with construction of the expressway portion of Alternatives $H_{(4)}$ and $H_{(2)}$ would approximate those associated with the full build expressway alternatives, however, Alternatives $H_{(4)}$ and $H_{(2)}$ would not have an interchange constructed at Route 161 and I-395 and I-95. The partial build alternatives would experience traffic impacts described for the widening alternatives in those sections of roadway where improvements would be required along Route 85. Generally, the impacts to traffic for Alternatives $H_{(4)}$ and $H_{(2)}$ would be greater than those of the other expressway alternatives on a new location but less than the widening alternatives. This difference is primarily attributable to the shorter length of construction necessary along Route 85.

5.16 UTILITY SERVICE

5.16.1 COMPARISON OF UTILITY IMPACTS

The impacts to utilities for each of the build alternatives would include, to varying degrees depending on the alternative, relocating/resetting above and below ground utilities. These impacts would be relatively minor in nature and would not pose severe problems with respect to construction of any of the alternatives, including the preferred alternative. A summary of utility impacts is presented on Table 5-68.

5.16.2.1 *No Build Alternative*: No construction activity would occur under the no build option, therefore, no existing utilities would be impacted within the study area.

FIGURE 5-68
POTENTIAL IMPACTS TO UTILITIES BY ALTERNATIVE

DESCRIPTION OF UTILITY	ALTERNATIVE															
	No Build	TSM	TDM/ Transit	$W_{(4)}$	$W_{(4)}$m	$W_{(2)}$	92PD	$E_{(4)}$	$E_{(2)}$	$F_{(4)}$	$F_{(2)}$	$G_{(4)}$	$G_{(2)}$	$H_{(4)}$	$H_{(2)}$	$E_{(4)}$m-V3
High voltage transmission lines: Northeast Utilities lines are located along I-395 in East Lyme and Waterford, and a separate set is located in Montville near Daisy Hill.							×	×	×	×	×	×	×	×	×	×
Overhead electrical lines: Overhead CL&P lines are located along the entire lengths of RT 82, 85, and 161 and all local roads.		×		×	×	×	×	×	×	×	×	×	×	×	×	×
Telecommunication lines: Overhead SNET lines and Eastern and Century cable lines (fiber optic and coaxial; some underground) are located along the entire lengths of RTS 82, 85, 161, and all local roads. TCG runs fiber optic cable along RT 82 and 85 for telecommunications for Millstone Nuclear Facility		×		×	×	×	×	×	×	×	×	×	×	×	×	×
Sanitary sewer pipes: Waterford underground sanitary sewer lines are located near the intersection of RT 85/I-395/ Industrial Dr. and at intersection of Gurley Rd and Oil Mill Rd.; East Lyme has a line along RT 161, from 305 m. (1000 ft.) north of RT 1, south				×	×	×	×	×		×		×		×	×	
Water supply: 1 main from Beckwith Pond, along RT 85 to RT 161. 3 mains from south of Lake Konomoc, along RT 85 to Cross Road. A high pressure transmission main and pump station on RT 85 between Industrial Drive and Douglas Lane; 1 main along RT 161, north to Westchester Drive.				×	×	×				×	×	×	×	×	×	
Gas Facilities: Yankee Gas Services has facilities along RT 85 from Industrial Drive, near I-395, and south.				×	×	×								×	×	

× = May require relocation and/or resetting of utility

5.16.2.2 *Route 82 and 85 Widening Alternatives*: The three widening alternatives, $W_{(4)}$, $W_{(4)}$m and $W_{(2)}$, would impact utilities at several locations along Routes 82 and 85 including residences served by local electric, telephone and cable utilities. Overhead electrical lines and telecommunication lines adjacent to existing roadways, as well as a fiber optic line located along Route 82 and Route 85, would be impacted. The impact to these utilities is limited to relocation and/or resetting the overhead and underground lines and poles.

Sanitary sewers may also be affected in the vicinity of the Route 85/I-395 intersection in Waterford, depending on the extent of construction in that area. A water supply main that runs from the Beckwith Pond Pumping Station south on Route 85 to the Route 161 intersection may need to be relocated or realigned during construction for any of the widening alternatives ($W_{(4)}$, $W_{(4)}$m, and $W_{(2)}$). Three water transmission mains located along Route 85 from south of Lake Konomoc to Cross Road, a high pressure water transmission main located along Route 85 between Industrial Drive and Douglas Lane, and a pumping station at Industrial Drive could be affected by construction activities. Gas facilities along Route 85 from Industrial Drive south through Waterford may also be impacted if construction were to occur along Route 85 in the southern part of the corridor.

5.16.2.3 *TSM Alternatives*: TSM improvements would be localized and involve relatively small disturbance areas at any one time, however, utilities would be affected in a number of areas along Routes 82 and 85. Overhead utilities in the vicinity of the proposed improvements would be temporarily and/or permanently relocated/reset. Overhead electrical lines and telecommunication lines would be impacted. Additionally, a fiber optic line along Route 82 and Route 85 would likely be impacted.

5.16.2.4 *TDM/Transit Alternatives*: The TDM/transit alternative would be unlikely to affect utilities in the corridor since it would not involve any type of construction activities.

5.16.2.5 *New Location - Full Build Alternatives*: Each of the new expressway alternatives, 92PD, $E_{(4)}$, $E_{(2)}$, $F_{(4)}$ $F_{(2)}$, $G_{(4)}$ and $G_{(2)}$, would impact overhead utilities along its alignment. Preferred alternative $E_{(4)}$m-V3 is discussed in Section 5.16.2.7. Two high voltage transmission lines would require relocation and resetting of both the lines and poles for all of the alternatives on a new location. The relocation of these high voltage lines should not result in more than a minor impact to the surrounding area. They would only require relocation/resetting for a relatively short distance to accommodate the construction associated with these alternatives.

Sanitary sewer lines along Route 161 just north of U.S. Route 1 and at the intersection of Oil Mill and Gurley Roads may require relocation with reconstruction of the I-395 interchange and improvements to I-95 for any of

the four-lane alternatives. The F and G alternatives would affect a water main in East Lyme along Route 161 south of Westchester Drive and south.

5.16.2.6 *New Location - Partial Build Alternatives*: Construction along either the $H_{(4)}$ or $H_{(2)}$ alignment would impact telecommunication and overhead electrical lines adjacent to Route 85 in the southern portion of its alignment. At each of its six road crossings along the new location portion of the alignment, this alternative would impact overhead electrical lines and telecommunication lines. The $H_{(4)}$ or $H_{(2)}$ alternatives would also require temporary and, in some areas, permanent relocation of high voltage transmission lines in the Town of Montville. Water supply mains along Route 85 south of Lake Konomoc, and gas facilities on Route 85 from Industrial Drive, south, may be affected by the Route 85 widening that would be undertaken as part of Alternative $H_{(4)}$ or $H_{(2)}$.

Gas facilities along Route 85 from Industrial Drive south through Waterford may be impacted if construction were to occur along Route 85 in the southern part of the corridor.

5.16.2.7 *Preferred Alternative*: Preferred alternative $E_{(4)}$m-V3 would impact overhead utilities along its alignment. Two high voltage transmission lines would require relocation and resetting of both the lines and poles for this alternative. The relocation of these high voltage lines should not result in more than a minor impact to the surrounding area. They would only require relocation and resetting for a relatively short distance to accommodate the construction associated with the preferred alternative.

Sanitary sewer lines along Route 161 just north of U.S. Route 1 and at the intersection of Oil Mill and Gurley Roads would not require relocation with reconstruction of the I-395 interchange and improvements to I-95 for the preferred alternative since its interchange design has been minimized.

5.16.2 MITIGATION MEASURES

Utility coordination meetings with all affected parties would be held prior to any construction to avoid any potential conflicts or impacts. Coordination would be incorporated into the design of any of the alternatives to minimize impacts and resolve potential conflicts that might arise during construction; this will be an important consideration regardless of which alternative is selected. Prior to the start of any construction activities, the contractor would be required to call 1-800-922-4455 (CALL before you DIG) to have utilities sited in construction areas.

5.17 ENERGY CONSUMPTION

5.17.1 ENERGY IMPACTS

The energy consumption impacts associated with each of the alternative alignments consider the direct consumption of energy required to construct the alternative as well as the indirect consumption of energy (gasoline equivalent) by vehicles using the alternative after construction is completed.

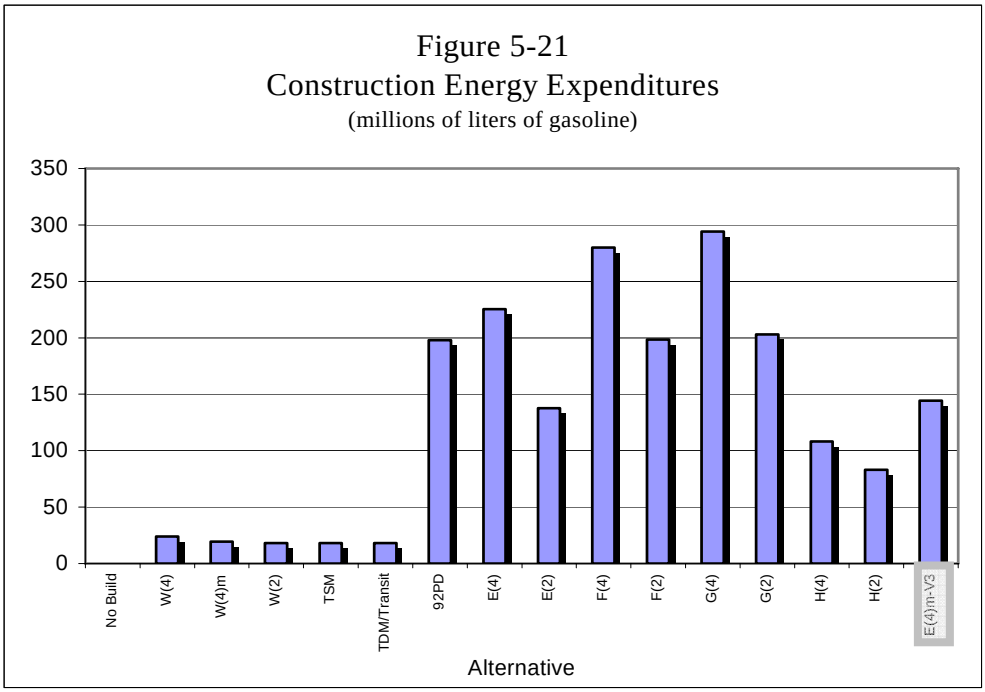
The total energy utilization for the alternatives was estimated by adding the construction energy required to build the alternative and the energy consumption by vehicles over a service period of 20 years. The sums can then be compared to that of the no build alternative to determine if the energy savings created by a decrease in VMT for the build alternatives would compensate for the energy required to construct the alternative. For example, if the total energy consumption associated with a given alternative is less than that for the no build alternative, then the vehicular energy savings would compensate for the construction energy expenditures. Conversely, if the total energy is greater than that of the no build alternative, the construction energy expenditures are not recovered over a 20-year service period.

5.17.2 CONSTRUCTION ENERGY

To determine the energy utilized during the construction of a given alternative, a construction energy factor (CEF) was used. The CEF relates the 1998 cost of the alternative to the number of kilojoules (British thermal units (BTU's)) of energy that would be consumed during construction. The cost varies between alternatives based on a number of factors such as cut/fill volumes, the length/width of the alternative, and the type and number of structures. The CEF also varies for each type of roadway project (e.g., rural freeway, rural conventional highway, rural conventional highway widening). Energy units in kilojoules were then converted to an equivalent volume measurement for gasoline. The construction energy consumption for each of the alternatives is shown in Figure 5-21.

The four-lane expressways require the most energy to construct, with Alternative $G_{(4)}$ requiring the most. Construction energy expenditures, as extrapolated from DEIS values, for the preferred alternative ($E_{(4)}$m-V3) are just above those for the $E_{(2)}$ alternative, but less than all the four-lane full build alternatives. The widening alternatives consume approximately one-tenth the energy as the four-lane expressway alternatives, and the two-lane expressway variations consume 60-70% of the energy required for the four-lane alternatives.

Figure 5-21
Construction Energy Expenditures
(millions of liters of gasoline)

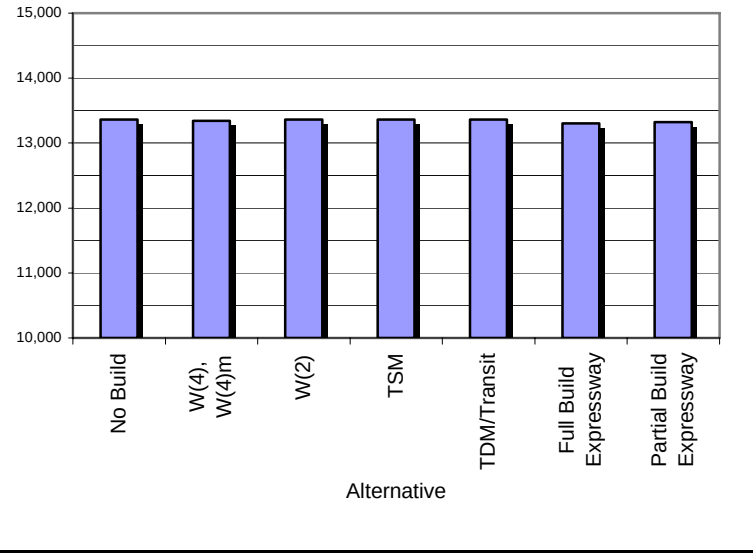


5.17.3 VEHICULAR ENERGY

The motor vehicle energy used by each alternative is influenced by the total miles and the efficiency of travel as reflected in the average speed and the conditions of travel. For each alternative, the design year VMT by roadway class was forecast at a mesoscale level over a twenty-five town area in New London and Hartford Counties. The traffic volumes for the two- and four-lane expressway variations were assumed to be the same. Speed ranges were assigned to each of the fifteen roadway classes. Fuel consumption (liters per kilometer (gallons per mile)) by speed range and roadway type was used to determine the total liters (gallons) of gasoline consumed by each alternative.

The VMTs by speed range and road type used in the energy analysis are the same as those used in the air quality analysis. The annual fuel consumption was accumulated over the 20-year study service period, assuming that VMT by speed range and road type remained constant over the service life of the alternative. This assumption is reasonable since there are two opposing trends; VMT is expected to increase over time, while fuel consumption per VMT should decrease as vehicles become more efficient. As shown in Figure 5-22, there is very little difference in vehicle energy consumption for each of the alternatives, including the preferred alternative. This is attributable to several factors including:

Figure 5-22
Vehicular Energy Usage Over 20 Years
(million liters of gasoline)



- The VMTs were collected over a large geographic area (25 towns); and

- The expressway alternatives would parallel the existing Route 85 with a very similar roadway length.

5.17.4 COMPARISON OF ALTERNATIVES

All of the build alternatives have total energy expenditures greater than that of the no build alternative. Therefore, vehicular energy savings of the build alternatives are not substantial enough to compensate for construction energy expenditures, given the following primarily factors:

- There is very little difference in VMT between the build alternatives and the no build alternative; and

- The construction costs of the build alternatives are much higher than that of the no build alternative.

For the build alternatives, the expressway alignments would be expected to consume the most total energy and the widening alternatives the least. Each alternative is described in detail in the following sections.

5.17.4.1 *No Build Alternative:* The no build alternative would not have any construction energy expenditures as no construction would occur under this alternative. Vehicular energy, and thus the total energy expenditure, is calculated to be 13.36 billion liters of gasoline over the 20-year study period.

5.17.4.2 *Routes 82 and 85 Widening Alternatives*: Construction energy utilization for the widening alternatives would range from 18 million liters of gasoline for Alternative $W_{(2)}$ to 24 million liters for Alternative $W_{(4)}$. In terms of post-construction, vehicular energy costs, Alternatives $W_{(4)}$ and $W_{(4)}$m would each utilize 13.343 billion liters of gasoline over a 20-year period. This equates to a savings of approximately 21 million liters, or 0.16%, as compared to the no build condition and is considered to be a negligible difference. Alternative $W_{(2)}$ would realize no measurable savings in vehicular energy costs as compared to the no build alternative. The total energy expenditures predicted for the widening alternatives are among the least of all build alternatives under consideration, but would still be greater than no build alternative.

5.17.4.3 *TSM Alternative*: This alternative would require very little construction energy expenditure, as compared to the other alternatives. Since this alternative is primarily spot improvements, its cost is less than other alternatives. Therefore, its energy expenditure, as related to cost, is also less than other alternatives. As for Alternative $W_{(2)}$, construction energy costs for TSM initiatives are 18 million liters of gasoline and vehicular energy costs show no measurable difference from the no build alternative.

5.17.4.4 *TDM/Transit Alternative*: Construction and vehicular energy expenditures resulting from the TDM/Transit Alternative would be the same as the $W_{(2)}$ and TSM alternatives.

5.17.4.5 *New Location - Full Build Alternatives*: Alternative $G_{(4)}$ would have the greatest construction energy expenditure of all the alternatives with 294 million liters of gasoline utilized. This alternative would expend the greatest amount of energy because it would require extensive cut and fill operations to construct the road; this would mean a greater number of construction vehicle hours of use. The $F_{(4)}$ alternative would have the second greatest construction energy expenditure of the four-lane alternatives on new location, followed by Alternative $E_{(4)}$. The 92PD alternative would have the least construction energy expenditure (198 million liters of gasoline) because this alternative has the lowest cost of the four-lane alternatives and less cut and fill would be necessary as compared to the other alignments on new location. With less cut and fill volumes, less machinery hours would be needed to build the roadway.

The two-lane, full build expressway alternatives would generally have less construction energy expenditures than the four-lane alternatives, with the exception of Alternative $G_{(2)}$, which would have a greater impact than the four-lane 92PD Alternative. Alternative $G_{(2)}$ would have the greatest

construction energy costs (203 million liters of gasoline) of the two-lane alternatives as a result of the large quantity of cut and fill that would be required along this alignment. The $E_{(2)}$ alignment would have the least expenditure with 138 million liters of gasoline utilized, while $F_{(2)}$ would have construction energy costs intermediate to $G_{(2)}$ and $E_{(2)}$.

Vehicular energy consumption for both the two- and four-lane, full build expressway alternatives is estimated to be 13.304 billion liters of gasoline over a 20-year period. This amount translates to a savings of approximately 60 million liters of gasoline, or 0.45%, relative to the no build alternative and is not considered to be a substantial improvement.

5.17.4.6 *New Location - Partial Build Alternatives*: Construction energy expenditures for the partial build expressway alternatives are intermediate to the values obtained for the full build expressway alternatives and the widening alternatives. Alternative $H_{(4)}$ would utilize 108 million liters of gasoline during construction, while $H_{(2)}$ would require 83 million liters of gasoline.

Vehicular energy usage for both the two- and four-lane partial build expressways would be 13.33 billion liters of gasoline over the 20-year study period. This equates to an energy savings of 39 million liters of gasoline, or 0.29%, over the no build condition and is viewed as a negligible difference.

5.17.4.7 *Preferred Alternative*: Preferred alternative $E_{(4)}$m-V3 would have the least construction energy expenditure of all the four-lane, full build alternatives with 144 million liters of gasoline utilized, as extrapolated from DEIS data. This alternative would expend less energy because it is a narrower roadway than the other four-lane alternatives and would require less cut and fill operations to construct the road; this would mean a lesser number of construction vehicle hours of use.

Vehicular energy consumption for the preferred alternative is estimated to be 13.304 billion liters of gasoline over a 20-year period, as extrapolated from DEIS data. This amount translates to a savings of approximately 60 million liters of gasoline, or 0.45%, relative to the no build alternative and is not considered to be a substantial improvement.

5.18 INDIRECT AND CUMULATIVE IMPACTS

Indirect and cumulative impacts were determined based on an analysis of land use, traffic patterns, municipal and regional plans, and economics. Impacts of a roadway project would affect both the local and regional environments. Analysis of indirect and cumulative impacts is inherently inexact in nature, but necessary in order to gain an understanding of "big picture" implications of a project.

Indirect impacts are defined as reasonably foreseeable indirect consequences to the environment caused by an action that occurs either later in time or not in the same location as the direct impacts. The potential indirect impact to environmental, cultural, or community resources has been assessed qualitatively. Indirect roadway impacts affecting natural and community resources were discussed in Sections 5.4, 5.6, 5.8, 5.10, 5.11 and 5.17. Indirect impacts may also occur as a result of land use changes that could be induced by new and/or improved access to the transportation network. This section explores the potential for indirect impacts from induced land use changes in the Route 82/85/11 corridor.

Cumulative impacts are defined as the total impacts to environmental resources and the socioeconomic and transportation conditions, which result from the incremental effects of the action when added to other past, present and reasonably foreseeable future actions regardless of what agency or person undertakes these actions. The determination of cumulative actions differs from indirect actions in that it focuses on the environment affected by an action rather than the type of action causing the impact. Cumulative impacts of the alternatives were examined qualitatively to determine the impacts to environmental resources, cultural and community resources, and public infrastructure when the effects of each of the alternatives are considered together with other developments and infrastructure improvements that exist or are planned.

These analyses rely heavily on discussions with town planners and plans of development for the study area towns of Salem, Montville, East Lyme and Waterford as well as the *Regional Conservation and Development Policy Guide for Southeast Connecticut*.

An updated analysis of the preferred alternative was completed in 2006 and is presented separately in Sections 5.18.7 and 5.18.8.

5.18.1 INDIRECT AND CUMULATIVE IMPACTS ON RESOURCES – LAND USE

Transportation improvements have the potential to alter existing and future land use trends depending on the type of improvement and the condition of the existing transportation system. Improvements to the transportation network usually enhance development potential locally and perhaps regionally. Travel time savings and improved roadway access to lands available for development are positive incentives to prospective tenants looking for residential, commercial and industrial development opportunities. Improved access to selected land areas via high traffic volume capacity roadways creates a variety of

development opportunities. Impacts to current zone designations for lands accessed as the result of new road construction and/or improvements to existing roads may indicate that the existing zone be considered for change to a more appropriate land use. For example, new access or improved access to existing rural residential zoned land uses may indicate that those lands are better suited for more intense development; i.e., higher density residential or commercial/business use.

Factors other than transportation facilities that are considered in development decisions include cost and availability of developable land, availability of labor and housing, suitability of the land for building, tax structures, availability of sewer and water facilities, zoning regulations and local desire for development.

Potential disadvantages of transportation improvements on development include business inequity and stress on the local infrastructure. Changes in transportation patterns can create business inequities by rerouting high volume traffic such that existing businesses experience diminished patronage.

Transportation improvements that create physical barriers (large earth cuts and fills) to development tend to inhibit road and utility expansion to specific locations where crossings can occur; e.g., bridges and overpasses.

The Route 82/85/11 study area is a currently established transportation corridor; therefore, highway improvements would not introduce a completely new development pattern. The primary responsibility for future development within the study area would reside with the individual towns. Local controls, in the form of zoning regulations and either incentives or disincentives for developers, will determine what development takes place after transportation improvements are made.

Historically, interchanges and intersections have experienced the most visible and immediate indirect impacts resulting from improvements to the transportation system. Concentrations of development tend to occur along higher volume roadways and at points of access/egress to limited access highways. If this consequence is not a part of a general plan of development, the effect on a given community may be considered adverse.

Local zoning and future plans for development will decide the land use patterns in these areas (Land Use Section 4.8). Presently, the most developed portion of the corridor lies along Routes 82, 85 and 161, especially in the vicinity of I-395 and I-95. These areas are predominately residential with clusters of commercial development at Salem Four Corners, Chesterfield, Crystal Mall, Flanders and Waterford's Business Triangle.

5.18.2 COMPARISON OF INDIRECT LAND USE IMPACTS

5.18.2.1 *No Build Alternative*: Development would continue to reflect the demand for roadside services and new housing development. Salem currently encourages development along Route 82 and at Salem Four Corners as part of an effort to

attract commercial development that would broaden the local tax base. This trend would be expected to continue. In the area of the proposed new alignments, a no build decision would likely spur additional subdivision development of undeveloped tracts of land, as has happened since the last time this corridor was studied in 1990. Such development has recently occurred in several areas; including, in Salem at Emerald Glen, and Fieldstone Farms and in East Lyme at Cardinal Road and Rocco Drive and in Montville off Route 161. Additional roads accessing Routes 82 and 85 may also continue to be constructed unless effective access management control regulations are implemented by the towns. Lack of access management in the Route 82/85 corridor, such as combined commercial driveways and frontage roads for channeling access, would contribute to increases in traffic-related problems. Attraction of development in Waterford is focused on the Business Triangle, which would still continue under the no build scenario.

Residential growth in the vicinity of the Route 82/85/11 corridor over the last 30 years has, for the most part, skirted the proposed alignment for the extension of Route 11. In recent years, as the project was perceived to be dormant, development interest revived and several homes were built within the alignment and additional proposed developments were under consideration. If the no build alternative were to be selected, it is very likely that much of the alignment would become attractive for housing development.

As increased economic development causes an increase in traffic burden, levels of transport service would drop. The Route 82/85 areas would then experience negative impacts with respect to diminished accessibility to places of business, local driveways and residential subdivisions. In time, this translates to a reduction in patronage for businesses and general degradation of quality of life for impacted residents. Development and growth would also increase demand for water, electric, gas services and increase the burden on sanitary services including on-site septic, municipal sewer and solid waste disposal.

According to Salem town officials, the lack of a direct highway link to I-95 has hampered economic development at their industrial park at the Route 11 interchange at Witchmeadow Road. This is predicted to continue if Route 11 is not extended, which is contrary to the economic goals and objectives of the town. In the meantime, the town is searching for alternatives to highway-oriented or industrial development. The area is now under consideration for age-restricted housing because of the rising trend in this type of residential development.

Without direct highway access to a Route 11 that connects to I-95, it is expected that there is a lower potential for development of the commercial land near the Route 11/Route 82 interchange. This is also not consistent with Salem's planning and development goals.

5.18.2.2 *Route 82 and 85 Widening Alternatives:* The widening alternatives would result in some minor land use changes as a result of property acquisitions associated with right-of-way requirements. Improvement of the roadway would likely attract new commercial interests, however, development in these areas would be limited by the lack of sewer and water. An additional constraint to development is that more than 5 km. (3 mi.) of frontage on Route 85, primarily in the vicinity of Lake Konomoc, is reserved for water supply protection. Acquisitions of commercial property in the Chesterfield area, particularly for the four-lane alternative, may result in restrictions to future business development because of the close proximity of the Water Resource Protection zone to the rear of the commercial lots located on the east side of Route 85. The improved roadway may encourage growth within the Light Industrial zone southeast of the junction of Route 161, however, restrictions to development are necessary here as well because this land drains into Lake Konomoc.

Increased property values (commercial/business properties) and economic incentives to provide consumer goods and services as the result of increased traffic volumes would precipitate entrepreneurial pressure to rezone existing residential properties for commercial/business use. This pressure would be particularly strong in areas where commercial parcels are lost to right-of-way acquisition. This growth could incrementally impact the natural environment.

5.18.2.3 *New Location - Full Build Alternatives*: The new interchanges proposed for the full build expressway alternatives could be expected to be the focus of induced development occurring as a result of a new highway. The following sections describe the locations of the proposed interchanges for each of the expressway alternatives and anticipated indirect land use impacts.

- Interchange at Route 82/All Expressway Alternatives: Currently an interchange with the terminus of Route 11 exists on the north side of Route 82 in Salem. The zoning designation in this area is Highway Commercial. Parcels immediately adjacent to this zone are Rural Zone B and Rural Zone A. There was very little development near the existing interchange in 1999, but development in the Highway Commercial zone has been progressing since that time. Proximity to a completed expressway may encourage growth in the commercial zones as well as the rural zones along Route 82, Darling Road or Old New London Road. The completion of Route 11 could have a positive impact on local desires to draw industrial interests to this area. Land acquisitions and/or conservation easements by the Salem Land Trust, The Nature Conservancy, the state of Connecticut, and private property owners have preserved the undeveloped condition of several large property parcels in this area (Salem Land Use GIS 2006.)

  Salem officials and planning and economic development plans indicate that the planned industrial park at the existing Witch Meadow Road exit (north of the study area) off Route 11 would be an immediate beneficiary of the new

alignment. Several commercial parcels along Route 82 would become more attractive to developers. Two of the larger parcels north of Route 82 and west of Route 85 have been preserved within the last few years by The Nature Conservancy.

- Interchange at Route 161, Montville, East Lyme and Waterford /Alternatives 92PD, $E_{(4)}$ $E_{(2)}$, $H_{(4)}$ and $H_{(2)}$:

  Montville: Zoning at this proposed intersection in Montville is Residential (RU-80) and Light Industrial, with a Commercial zone (C-1) in nearby Chesterfield and a small Open Space zone southeast of the Route 161/ Route 85 intersection. The industrial area presently contains two sand and gravel operations, where excavation is almost complete, a 19-lot industrial park along Route 85 and Butlertown Road, and several small businesses. The light industrial zone contains approximately 300 ac. and straddles the land between Route 161 and Route 85 along the northern portion of Butlertown Road. According to Montville Zoning Regulations, permitted uses would include lower impact industrial businesses, such as research and office facilities, that may be operated with on-site septic systems and water supply wells. Potential developers must document that adverse impacts would not result to watershed lands (approximately 90 ac. adjacent to Route 85) and nearby streams, most notably Latimer Brook. Since 1996, 230 ac. of this zone has been developed averaging approximately 8% per year. Based on this rate and input from town planning officials, this zone is expected to be fully developed within approximately 10 years with or without any of the alternatives.

  The village of Chesterfield is located along Route 85 at the junction of Route 161 within two miles of the proposed interchange. The village is currently a mix of residential, a fire station, and traffic-oriented commercial establishments such as a hotel. The loss of traffic volume on Route 85, especially beach traffic, would reduce drive-by business, which may result in a loss of business. Proximity to a highway interchange may stimulate interest in new development. Since much of the land in the village is already developed, most new development would take the form of reuse, which may have a beneficial effect on the aging village. Town planning officials also advised that development in Chesterfield would continue to be constrained by wetlands, floodplain, steep slopes and the lack of sanitary sewer and water service.

  Access to the limited access expressway may spur increased development of roadside and emergency services in this location. The proximity of the Water Resource Protection zone, however, would constrain development.

  In recent years, much of the residential land along Route 161 in Montville has been developed. Since publication of the DEIS in 1999, several homes have been constructed in the area, some of which are within or adjacent to the proposed roadway alignment.

East Lyme: As in Montville, much of the residential land along Route 161 in East Lyme has been developed. Zoning of undeveloped land in this area is one acre rural residential. An existing subdivision consisting of one-half acres lots is present along Route 161, but zoning regulation revisions will not allow it to be expanded further. It is reasonable to foresee continued development of residential land regardless of the completion of Route 11. High property values, lack of sewer and water, and environmental constraints have discouraged large-scale residential development in this area and have encouraged large lot development. This trend will continue with or without the extension of Route 11.

Two large parcels of land comprise a special use zone on the east side of Route 161 south of Silver Falls Road in East Lyme. Currently, a church and campground/RV park occupy this land. Future development may occur on the undeveloped portion of the land, which could include commercial establishments like a motel or recreation facility. East Lyme's Zoning Regulations dictate a coverage maximum of no more than 10 % on a 20-ac. lot (or a 10-ac. lot for elderly housing). Additional constraints include Latimer Brook and its adjacent floodplain and steep slopes present on the easterly portion of the zone.

Waterford: Land in proximity to the proposed interchange at Route 161 is situated within Waterford's lowest density residential district, the RU-120 (three acre) zone in the northwest corner of town. This area is characterized by development constraints including lack of access, wetlands, steep slopes and lack of sewer or water services. Much of the area is registered as "forest land" under the Connecticut Public Act 490 (PA 490) program. Under this program, a certificate is issued pursuant to Connecticut General Statutes 12-107a-d for a period of 10 years during which time a qualifying property may be assessed at a reduced value if the land remains forest.

- Interchange at Route 161, East Lyme/Alternatives $F_{(4)}$, $F_{(2)}$, $G_{(4)}$ and $G_{(2)}$: This interchange would be located on Route 161, northeast of Walnut Hill Road. Zoning in this location is Rural Residential (RU-40) and Special Use (a campground and church currently occupy this zone). Zoning adjacent to these areas includes Rural Residential (RU-80) to the northwest, Residential (R-20) south on Route 161, and a local aquifer protection district (Figure 4-21).

  Because this interchange is located less than one mile from the interchange of the other new expressway alternatives, development under this interchange scenario would be the same as described above.

  Areas west of Route 161 present development constraints including the State Forest, steep slopes and many streams and lakes. Areas to the south,

including Flanders, are already developing as higher density residential and commercial zones and would continue to do so as they are strongly influenced by proximity to I-395, I-95 and U.S. Route 1. The Route 11 interchange would likely strengthen commercial development potential but traffic volume, and therefore attractiveness to developers, in this location is expected to increase with or without the completion of Route 11 (Section 5.1). Particularly in light of the presence of Latimer Brook and the aquifer protection district along Route 161, pressure for commercial development to move north of the present commercial district because of the Route 11 interchange appears limited.

- Interchange at Witch Meadow Road/existing Route 11/All Expressway Alternatives: Land adjacent to the existing Route 11 interchange at Witch Meadow Road is designated highway commercial and industrial. A sand and gravel operation is currently located there. According to Salem town officials, the lack of a direct highway link to I-95 has hampered development in these designated commercial zones. The extent of future development in this area will also continue to be constrained by the lack of sewer and water infrastructure and other utilities, and a strong emphasis on protection of water resources.

  According to town representatives, development impacts resulting from the completion of Route 11 would likely complement planned patterns of development more so than those of the widening alternatives.

5.18.3 INDIRECT AND CUMULATIVE IMPACTS ON RESOURCES - BIOLOGICAL DIVERSITY

Biological resources within and outside of the study area may be impacted by induced development as a consequence of the new expressway alternatives. It should be noted, however, that development is currently ongoing and is expected to continue regardless of the roadway alternative selected. As noted in Section 5.4.1.2, Connecticut biologists, the late Drs. Goodwin and Niering, provided their observations on the adverse effects of residential zoning and "suburban sprawl" within the corridor on wildlife habitat and species of concern.

Wildlife would be affected by loss of habitat, fragmentation of landscape, disturbance, and through water and habitat quality degradation. Development occurring within the study area would affect the six identified habitat blocks as well as areas outside the study area, most notably the Nehantic State Forest. The main tract of the State Forest lies along the western edge of the study area.

As discussed in Section 5.4, all alternatives would contribute some impact to unfragmented forest blocks and to the variety of wildlife dependant upon this habitat. The new expressway alignments would impact the greatest amount of habitat, however, because access to the new highway would be limited, indirect highway-induced development would be concentrated near the interchanges. Primary disturbance introduced by the new

roadway, such as alteration of vegetative communities, stress induced disease, and introduction of alien species, may overlap with areas disturbed by induced development resulting in further fragmentation of habitat blocks. This incremental degradation of habitat contributes to the cumulative loss of wildlife habitat currently experienced statewide.

Impacts to the forest cover along the widening alternatives would be minimal (Section 5.4.1). Many forested areas along the existing Route 82/85 roadway already exhibit signs of impact from disturbance, most notably, the colonization of alien species. However, development associated with a widening may increase impact on unfragmented forest Habitat Blocks Nos. 1 and 2 (Figure 4-18). For example, residential subdivisions constructed along Route 85 have displaced native grassland birds and amphibians (Drs. Goodwin and Niering).

Impacts experienced by fisheries resources resulting from implementation of any of the roadway alternatives could be magnified in areas of highway-related development. Streams degraded by the presence of additional pavement or culverts suffer a reduction in ability to sustain healthy fish populations. Latimer Brook is of particular concern in this corridor because of its central presence and use as a cold water fishery resource. A decline or loss in this resource could result in an economic impact to area businesses that rely on the patronage of sport fisherman.

5.18.4 INDIRECT AND CUMULATIVE IMPACTS ON RESOURCES - WETLANDS AND WATER RESOURCES

State, federal and local regulations that are in place to protect wetlands and water resources would have an effect on reducing the potential direct impacts on these resources associated with induced development. Typically, wetlands and watercourses would be better protected than other resources that are not specifically preserved by statute and/or regulation. There could, however, be a number of indirect impacts to wetlands and water resources within the corridor as a result of induced development.

One of the foremost indirect impacts would stem from the additional discharge of stormwater into adjacent watercourses and drainage swales from new streets or driveways. The increase in impervious surfaces associated with roadway installation could increase the volume of stormwater discharging to wetlands during storm events as a result of decreased infiltration rates and times of concentration. Increased volumes of water would tend to induce erosion and sedimentation. In addition, pollutant loadings in wetlands and watercourses could also increase. Potential pollutants include sediment, bacteria, trace metals, oil and grease, fertilizers, pesticides and increased BOD and COD (Schueler 1987). While the building of a state highway requires that strict measures are taken to prevent such pollutants from reaching water resources, local building regulations are not necessarily as stringent, and there is virtually no regulation of suburban lawn maintenance. In addition to pollutant inputs, water temperatures could be increased in wetland areas which are permanently devoid of tree cover (i.e. adjacent lawns).

Another indirect impact to water resources, which is related to the cumulative increase in impervious surface, is the reduction in groundwater recharge. The new impervious surfaces would retain rainwater and discharge that water to drainageways, thereby reducing the volume of water infiltrating into upland areas. As a result, local groundwater levels could be reduced, affecting wetland and watercourse levels as well as water supply areas. Reduced streamflows could occur during prolonged dry periods (Schueler 1987). As a result of the potential hydrologic and chemical indirect impacts to wetlands and watercourses, fisheries and wildlife might also be impacted. Excavation of the landscape, particularly near wetlands and wells, may facilitate movement of groundwater out of the soil stratum, thereby altering groundwater dynamics resulting in draining of wetlands and drying of wells.

5.18.5 INDIRECT AND CUMULATIVE IMPACTS ON RESOURCES - FLOODPLAINS

Each of the roadway alternatives is expected to impact floodplain areas to some degree. Impacted areas are small in size and compensatory mitigation measures would greatly reduce the seriousness of each impact. However, the cumulative effect of highway projects and local development may result in the alteration of flood channelization and storage. Areas of particular concern in the study area would be near Salem Four Corners (Harris Brook), which would be affected by the widening alternatives and any areas along Latimer Brook where indirect development is likely. All alternatives cross Latimer Brook floodplain areas at some point (Figure 4-27). Such areas with development potential include Beckwith Hill Drive and Chesterfield on Route 85 and Pruett Place, Cardinal Road and Walnut Hill Road near Route 161. Another critical floodplain area susceptible to cumulative floodplain impacts is around the proposed Route 11/I-95/I-395 interchange. Care must be taken by local zoning commissions to enlist input from FEMA to ensure that new development does not affect flood storage capacity in the floodplain areas.

5.18.6 INDIRECT AND CUMULATIVE IMPACTS ON RESOURCES - FARMLANDS

The most substantial indirect impact on prime farmland is its increased attractiveness to developers resulting from enhanced access to the roadway network. Farmland is already under development pressure in the study area because of its inherent nature as prime buildable land because of its gentler slopes, relative lack of ledge and well drained soils. Therefore, under the no build alternative, continued loss of farmland to development would continue in the absence of preservation measures.

With implementation of either the Route 82/85 widening or expressway alternatives on a new location, any farmlands not required for highway right-of-way would be subjected to non-farm development pressure, especially if a large tract of land is truncated leaving inaccessible or excessively small parcels. Such a situation could occur with any of the expressway alternatives. Prime farmland currently cultivated or used as horse pasture, located just west of the current terminus of Route 11 (just outside the study area), would come under development pressure with an improved highway system, particularly a new expressway. This horse farm is now protected from development by the Salem Land Trust

through a conservation easement (pers. communication D. Bingham). Parcels along Route 82 in the immediate vicinity of Route 11 are already zoned Highway Commercial, and those to the west are zoned for three-acre residential development.

5.18.7 INDIRECT IMPACTS OF THE PREFERRED ALTERNATIVE

This analysis was completed in 2006 using currently available guidance documents for analyzing indirect impacts from induced growth, including: National Cooperative Highway Research Program's Desk Reference for Estimating the Indirect Effects of Proposed Transportation Projects (2002); National Cooperative Highway Research Program Report 466 (2002); and Center for Transportation and the Environment (CTE) National Teleconference (TC-31) (2004); Executive Order 13274 Indirect and Cumulative Impacts Work Group Baseline Report, March 2005; and FHWA Interim Guidance: Questions and Answers Regarding the Consideration of Indirect and Cumulative Impacts in the NEPA Process, January 2003.

The method used in the analysis was qualitative inference drawn from available policy data and interviews with local officials, town planners, wetland officers, the SCCOG, SECTER, conservation commissions, private developers and real estate experts. Quantitative analysis was performed for indirect impacts using GIS and available data from the federal, state, and local governments as well as the regional planning office. Details of the analysis were documented in a draft technical report and copies were distributed to persons interviewed for review and comment. A final report was prepared, *Technical Report – Induced Growth Analysis for the Preferred Alternative, July 2007.*

The potential for development to be induced by the preferred alternative, the extension of Route 11 as a limited access roadway on new location, was explored further. This analysis involved answering the question: would the preferred alternative induce industrial, commercial or residential development that would otherwise not happen under the present and future condition without the project? Where induced growth and development could be attributed to the preferred alternative, potential impacts to the environment from that development were assessed.

For the purpose of considering areas of potential induced development, the study area was defined as the four corridor towns—Salem, Montville, East Lyme and Waterford, and also Colchester, East Haddam, Groton, and New London. These towns were selected because they either have direct access to existing and proposed sections of Route 11, or would be the most likely to be affected by the project. These towns comprise the core of the Route 11 commuteshed. Groton, New London, and to a lesser extent Waterford represent the major workplace destinations. The town of Lyme was also considered for inclusion in the study area, but was eliminated after analysis of travel patterns and consultations with the town concluded that indirect effects would not occur there.

To assess the potential for development induced by the preferred alternative, the study area was characterized to establish baseline data from which to compare the build and no build

scenarios. Data were collected on current trends in population, housing, employment, and economics. The study area was considered within the context of the transportation network and the environmental resources presented in the preceding sections of this document.

5.18.7.1 *Demographic and Economic Baseline Trends*: Between 1980 and 1990, the Southeastern Region grew in population by 6.5%. In the following 10 years, the region experienced a shift in population rather than an increase in population, which grew by only 1% between 1990 and 2000. The region experienced an average annual increase of 0.4% between 1980 and 2000 while the suburban and rural towns grew by between 1% and 3%. According to the 2000 Census, the urban centers of Groton and New London experienced a decrease in total population, whereas, suburban (Colchester, East Lyme, Montville and Waterford) and rural towns (Salem and East Haddam) experienced an increase of an average of 18%, and another 5% in the next four years. From 1990 to 2000, the largest percentage increases were experienced in Colchester (33%) and East Haddam (25%); this continued the next four years at 6% and 9%, respectively. The numbers reflect the ongoing statewide and nationwide trend of people moving out of cities into outlying areas. New residents are attracted to a perceived higher quality of life in these suburban and rural areas, while still being able to remain in proximity to urban employment centers.

The migration of the region's population from the urban centers to the suburbs in the 1990s is also reflected in the construction of new housing units. The number of housing units stayed relatively the same, or even decreased, in the urban areas in part due to limited land availability for new development and relatively small investments in redevelopment. Conversely, the suburban and rural towns of the region experienced high growth in housing. All six towns had a 19% average increase in housing units, while in comparison, the region experienced a total increase of 6% and there was only a 5% increase statewide.

Because of future increases in population and continued out-migration from cities, the rural and suburban towns of the region, including the study area towns, will continue to experience pressure to increase available housing units. Therefore, aside from possible economic influences, such as a major reduction or expansion of the work force in the region, the current respective residential growth rates would likely remain at or near current levels through 2010. Real estate professionals contacted in the study area have indicated that most home sellers and buyers tend to stay in the same town because they are satisfied with the quality of life. Typically, these sellers and buyers are looking to "upgrade" and move into a bigger home.

According to the 2000 Census, the work place destinations for most of the commuting workforce (over 16 not working at home) of the eight towns in the study area were Groton (27%), New London (17%), Waterford (10%), and Montville (5%), correlating with the major employers of the region (refer to Section 4.10.3). The majority of commuters from the eight towns traveling to

Groton and New London originated in Groton, New London, Waterford, Montville and East Lyme, and the majority of commuters into Waterford originated in Waterford. The census showed that most working residents of the four corridor towns that work out of town typically travel between 20 and 34 minutes to the Groton, New London and Waterford area. In the towns north of the corridor, Colchester and East Haddam, most commuters are currently traveling between 30 and 39 minutes or 35 and 59 minutes respectively, to the Hartford area and Middletown.

According to the *Regional Transportation Plan for Southeastern Connecticut 2004-2005* (SCCOG 2004), the portion of land area in the Southeastern Region developed for commercial uses grew an average of 3.5% per year between 1980 and 2000 (from approximately 2,200 to 3,700 ac.). This growth rate has fluctuated each decade since 1960 between about 2% and 4% per year, with the highest rate occurring in the 1980's. Industrial land uses grew an average of 2% per year between 1980 and 2000, fluctuating between zero and 6% per year since 1960. The most growth occurred between 1970 and 1990. Between 1990 and 2000 commercial and industrial growth slowed substantially with the decline in the defense industry, but is expected to recover and increase in the next two decades

In the Southeastern Region, transportation infrastructure, including the completion of Route 11, is noted in economic development plans as one of the strategic goals for strengthening and diversifying the region's economy. The project would help support development of shoreline tourist attractions, waterfront attractions, the New London Multi-modal Transportation Center, trucking distribution from the state pier, and redevelopment of brownfields in the New London area. It would offer a means to accommodate an anticipated labor demand to support this development by providing a safer and more efficient route for bus transit between the Greater Hartford area and the New London/Groton area.

Locally, commercial and industrial business activities have typically occupied a small percentage of land in the eight study area communities. Zoning in these towns includes less than 6% of total land area as commercial or business (with the exception of the urban town of New London with over 18% zoned commercial) and less than 4% as industrial. The most recent plans of development, dated between 1997 and 2002, indicate that approximately 3% or less of land in each town is being used for commercial activities and less than 2% is developed for industrial. New London, however, has 6.8% of commercial land developed and the town of Groton has 3% of a total of 4% of industrial land already developed. These numbers suggest that, overall, about half of the industrial and commercial zoned land in the rural and suburban towns of the study area had yet to be developed as of 2002; although, since that time period on site observations and 2004 aerial photography have shown that some of this land has been developed.

Development of commercial and industrial land is considered critical to these towns for economic development and the generation of tax revenue to support town services and employment opportunities. For this reason, the towns promote this type of development and sometimes offer tax incentives to attract commercial and industrial businesses. Under favorable economic conditions, improved access to a community could bring business development by improving its desirability to developers, which in turn could increase economic development opportunities and give towns the potential to increase their tax bases.

Developers of commercial property in the study area stated in interviews that a highway interchange alone does not create demand for commercial development because most commercial development follows population increase rather than highway construction. The potential for highway-oriented development is limited in areas with a low-density population, such as the study area's suburban and rural towns.

5.18.7.2 *Induced Development Potential*: The potential for induced development with the preferred alternative was evaluated and compared with potential development under the no build alternative. Reviews of town planning documents and interviews with planning, zoning, and economic development officials, real estate professionals and developers were undertaken to define the factors influencing development within the study area. These factors were considered in light of local and regional trends along with input collected in the interview process.

Residential Growth – Preferred Alternative

The factors identified that influence home buying decisions in the study area were: relative affordability, quality of life (in this case rural, small-town character was most often cited), accessibility to employment centers and the trend of movement to the suburbs, especially among the baby boom generation. The factors identified in home construction decisions were: land availability and suitability (i.e., minimum buildable acreage, dry land, and level topography), road frontage, accessibility to highways, utilities (sanitary sewer, water, and electric), quality of setting, and cost. The only factor influencing residential development throughout the study area that may be affected by the preferred alternative versus the no build alternative is accessibility to highways; therefore, this factor was examined in detail.

Residential growth may occur in areas where a transportation improvement creates new access to a rural area or reduces commute time to employment centers. The study area is already accessible through the existing transportation network so commute time reduction was the focus of this analysis. To explore this potential relative to the extension of Route 11, travel speeds through the

corridor (Section 4.1) were used to make a generalized comparison of travel times for the existing roadway and for the proposed new section of Route 11. The overall reduction in travel time on the new 8.5-mile section of roadway, as compared with a comparable 9.3-mile route under the no build alternative, was estimated to range from 2 to 8 minutes under future conditions depending on actual speeds.

For the four towns of the Route 11 corridor, Salem, Montville, East Lyme and Waterford, the travel timesavings of between 2 and 8 minutes would not significantly affect the typical commute time or destination. As discussed above, most working residents that work out of town typically travel between 20 and 34 minutes to the Groton, New London and Waterford area. Although the convenience and safety of the drive would improve through the elimination of traffic lights and turning vehicles on the new section of Route 11, commute times would remain within this typical time range.

In the towns north of the corridor, Colchester and East Haddam, most commuters are currently traveling between 30 and 39 minutes or 35 and 59 minutes respectively, to the Hartford area and Middletown. Since the average commute time in Connecticut is 23.7 minutes, according to ConnDOT's *Connecticut Census Review, March, 2005*, factors other than drive time to work must be contributing to the robust housing growth in these towns. Interviews with town planners, real estate professionals and reviews of planning documents confirm this assertion. The area is an attractive place to live because of quality of life, availability of land, relative affordability and existing access to major employment centers.

The information suggests that the effective decrease in travel time afforded by the new 8.5-mile section would not be a substantial catalyst for new residential growth. The factors identified through the document review and interview process that will continue to be the strongest influence on residential growth are quality of life, availability of land, relative affordability, existing access to major employment centers and the ongoing trend of movement to the suburbs. Because of the continuing growth in residential development within the corridor described above, and the lack of commute time reduction incentives, it is not expected that the extension of Route 11 would induce residential development that would not occur otherwise or change projected rates of population or housing growth within the study area.

Residential Growth – No Build Alternative

Because of future increases in population and continued out-migration from cities, the rural and suburban towns of the region, including the study area towns, will continue to experience pressure to increase available housing units under the no build alternative. It is projected that population in these towns will increase by between 1% and 2% per year through 2010 (SCCOG 2004). Therefore, aside

from possible economic influences, such as a major reduction or expansion of the work force in the region, residential growth rates would likely remain at or near current levels through 2010.

Residential growth in the vicinity of the Route 82/85/11 corridor over the last 10 years has, for the most part, skirted the proposed alignment for the extension of Route 11. In recent years, however, several homes were built within the alignment. It is reasonable to foresee land in this area becoming more attractive for development under the no build scenario.

Commercial and Industrial Growth – Preferred Alternative

The factors identified that affect commercial and industrial growth in the study area are population density (higher density favors commercial), presence of other commercial and industrial development, mining resources (e.g. sand, gravel, etc.), and traffic volume. Providing economic conditions are favorable, commercial and industrial development activities are projected to benefit from improved access to major transportation routes and regional centers of commercial and industrial activity with the preferred alternative. These benefits include visibility and ease of access to the highway network for travelers and heavy vehicles.

New interchanges proposed with the Route 11 extension would likely result in an increase in development of the existing commercial and industrial zones because of the connection that Route 11 would provide between Route 2 and I-95. This type of development typically occurs within a one-mile radius and/or two miles along an arterial approaching an interchange (NCHRP 466). In some cases, this influence is experienced up to five miles along an arterial, but in this corridor anything beyond two miles falls under the influence of other major roadways (e.g. Route 2, Route 9, I-395, I-95, etc.). The interchange analysis area included commercial and industrial zones within a one-mile radius and two miles along arterials leading to/from the interchanges.

The interchanges with potential for induced development, as discussed above, are Witch Meadow Road (north of Route 82) and Route 82 (upgrade of a partial to a full interchange) in Salem, and Route 161 in Montville. A full interchange is already present on the existing section of Route 11 at Witch Meadow Road. This interchange was included in the analysis because the town of Salem is actively promoting development of industrial land near the interchange and town officials feel strongly that the extension of Route 11 would stimulate development there. The existing interchange north of Witch Meadow Road at Lake Hayward Road in Colchester and the I-95/I-395/U.S. Route 1 interchange in East Lyme and Waterford were also analyzed for induced growth potential. The results of the analysis concluded that these interchanges are the sites of ongoing and planned development related to their locations near town villages and high-volume highways and will develop with or without Route 11.

An assessment of the potential for residential zones to be rezoned to commercial or industrial was also performed and, as with preceding analyses, involved discussions with town planning, zoning and economic development officials and reviews of plans of conservation and development and past activities of municipalities. It was concluded that rezoning for economic development in proximity to proposed or existing Route 11 interchanges is not expected to occur as a result of the extension of Route 11.

Commercial and Industrial Growth – No Build Alternative

As a comparison, the effect of the no build alternative was evaluated for potential commercial and industrial growth that could occur at the interchanges without the extension of Route 11. Presuming economic conditions remain constant, the existing growth rate at all interchanges would be unaffected.

5.18.7.3 *Quantitative Analysis of Commercial and Industrial Development*: To assess potential acres of land that could be induced to develop, a quantitative analysis of developable land was performed. Methods included mapping of commercial and industrial zones within a one-mile radius and two miles along arterials at each of the three interchanges with potential for Route 11-induced development. This analysis presumes the previous conclusion that zoning designations would not change in these interchange areas. Existing zoning at each of the interchanges was described in Section 5.18.2.3 for the other full build alternatives.

GIS data layers of generalized zoning, obtained from the SCCOG in 2006, formed the basis for the analysis. Total acres within each zoning category were compiled for the three interchanges. The GIS data from the SCCOG and environmental resources described in the preceding sections were used to determine the total acres of potentially developable commercial and industrial land within the analysis area. The process consisted of the following steps:

Step 1: Calculate total acreage by zoning classification within the one-mile radius and two miles along arterials approaching interchange.

Step 2: Subtract acres containing limitations for commercial and industrial development. The special use zone in East Lyme was considered commercial. Land zoned for residential use was considered a development limitation because, as discussed above, development of residential land would not be induced by the project. Development limitations are as follows:

- Existing Roadways
- Existing and Proposed Route 11 right-of-way
- Proposed Route 11 right-of-way excess property takings
- State-owned land
- State forest

- Water company land
- Dedicated open space
- Land currently developed
- Residentially zoned land
- Land with the following environmental constraints

  - 100-year floodplain
  - wetlands
  - steep slopes (over 15%)
  - shallow to bedrock soils

Step 3: The potential development areas and overlays of property parcels and aerial photos were reviewed with town planning and zoning officials to determine areas viable for development. Land not considered developable due to size, existing or planned land use and/or location were eliminated. Other individual lot conformances (e.g. setbacks) were not considered in this process.

Step 4: Remaining land is the approximate net acreage of developable land where interchange-induced commercial and industrial development could potentially occur. The results showed that 167 ac. of commercial and 178 ac. of industrial land are developable.

Because most highway-oriented commercial and industrial growth would be largely influenced by regional economic factors, it was assumed that most of the commercial development of the 167 ac. would occur at the average annual regional growth rate of 4% and industrial development of 178 ac. at 2% annually through the project forecast year of 2020. An exception is 70 ac. of light industrial land in Montville, which based on current rates of development is projected to grow at 8% annually. The extension of Route 11 may provide an advantage for the towns to compete with other towns in the region for this growth. With this overall rate of growth as a basis for development, each interchange was analyzed, with input from town planning and zoning officials, for individual qualities that would promote a faster or slower rate of development, with or without the preferred alternative.

The results of the interchange analysis are summarized in Table 5-69. The table provides the average annual rate of development estimated for each land use zone. It is estimated that 216 ac. of commercial and industrial development could occur with the preferred alternative by 2020 as compared with 146 ac. or more with the no build alternative, for a total of 70 ac. of induced development estimated for the preferred alternative.

TABLE 5-69
POTENTIAL COMMERCIAL AND INDUSTRIAL DEVELOPMENT

TOWN	INTERCHANGE	ZONING DESIGNATION	ACRES	ESTIMATED ACRES OF NEW DEVELOPMENT BY ALTERNATIVE	
				Preferred	**No Build**
				Average annual rate[1] (by 2020)	Average Annual rate[1] (by 2020)
Salem	Witchmeadow Road	Industrial	108	2 (30)	2 (30)
Salem	Witchmeadow Road	Commercial	65	2.6 (39)[2]	0
Salem	Route 82	Highway Commercial	14	0.9 (14)[2]	0.3 (5)
Salem	Route 82	Village Commercial	48	2 (30)	2 (30)
Montville	Route 161	Light Industrial	70	6 (70)[3]	6 (70)[3]
Montville	Route 161	Commercial	18	0.7 (11)	0.7 (11)
East Lyme	Route 161	Special Use	22	1.5 (22)[2]	0
TOTAL			**345**	**14.4 (216)**	**9.7 (146)**
TOTAL ESTIMATED INDUCED ACRES BY 2020			**--**	**4.7 (70)**	

Note: This analysis does not consider individual lot conformances.
[1] Average 4% annually commercial; 2% annually industrial (total through project planning year (2020)).
[2] Projected to be induced at higher than annual rate.
[3] This zone has developed at an average rate of 8% annually since its inception in 1996 (estimated build-out by 2016).

5.18.7.4 *Potential Environmental Impacts from Development*: Potential development of 70 ac. of commercial and industrial land induced by the preferred alternative could have impacts on the environment that would be considered indirect impacts of the roadway project. Those impacts cannot be precisely predicted, but reasonable estimates were made using the data presented above and consultations with town planners, zoning and wetlands officials. The no build scenario was also assessed for comparison.

Indirect Environmental Impacts – Preferred Alternative

Development of 70 ac. of commercial and industrial land near the interchanges that could be induced by the extension of Route 11 may result in impacts to the following environmental resource categories:

Traffic and Transportation: New commercial/industrial business would generate additional traffic on the major arterials. The corridor traffic analysis provided in Sections 4.1 and 5.1 used a travel demand model that accounted for future growth projected for 2020. This growth also includes projections for economic development. Because of the limitations on the size of allowable development in

the interchange study areas, the traffic produced is not expected to exceed growth projections. The preferred alternative was designed to increase safety and capacity in the corridor and accommodate the resulting future traffic volumes.

The extension of Route 11 would provide a safer, more efficient link between the New London and Hartford areas. This, in combination with other incentives, is predicted to increase use of Bradley International Airport by residents of Southeastern Connecticut. Likewise, it may attract travelers to the New London multi-modal transportation center from the Hartford area.

Biological Diversity: Of 70 ac. of potential induced development land area, 30 ac. are located in habitat blocks delineated within the Route 11 corridor. Eight acres are located in Habitat Block No. 1 in Salem and are expected to be induced by the preferred alternative. Twenty-two acres in East Lyme are within Habitat Block No. 2. It is important to note that the undeveloped industrial and commercial zones in the corridor are located at the edges of the habitat blocks and are not considered by the towns to be land that should be preserved.

Water Resources: Development of commercial and industrial zones would occur in proximity to streams at all three interchanges. These are Witch Meadow Brook and Harris Brook in the East Branch Eight Mile River watershed, and tributaries to Latimer Brook in the Latimer Brook watershed. Direct impacts to surface waters can be minimized or avoided through the local environmental permitting processes. This development would not occur in proximity to the important public water supply resources along Route 85. This would be a beneficial effect of the preferred alternative.

Wetlands: Wetland impacts would be largely avoided during the local environmental permitting process for commercial and industrial development in Salem, Montville and East Lyme. However, local authorities could possibly permit a small amount of wetland impact. Based upon data collected for the five-year period between 2000 and 2005, the towns allowed an average of 0.05 ac. of direct wetland alteration (e.g. fill) per permit for commercial and industrial development. The town of Salem did not allow any wetland alterations for commercial development. Montville generally allowed an average of 0.05 ac. per permit for 10 permits, with one exception of 0.5 ac. on a large parcel in the Route 85 light industrial zone. This impact required mitigation for full replacement. The town of East Lyme allowed an average of 0.1 ac. per permit for three commercial and industrial permits with full mitigation required.

Assuming most induced interchange development takes place at an average rate of 5 ac. per year (Table 5-69), this would require approximately two inland wetlands permits per year, based on the average size (3-10 ac.) of commercial/industrial developments in the last five-year period. Therefore, it is estimated that average wetland alterations could be 0.1 ac. per year attributable to development near the proposed Route 11 interchanges. The total amount of

wetland affected through the project planning year 2020 would then be about 1.5 ac. For the five parcels in Salem and one in East Lyme that are projected to develop more rapidly, it is estimated that 0.1 additional acres of wetland impact may be permitted based on town averages (0 in Salem and 0.1 in East Lyme). This increases the total to 1.6 ac. Based on town records, it is expected that any impacts would be mitigated in the form of wetland restoration, creation or enhancement.

Land Use: The estimated induced commercial and industrial development would comply with existing zoning, plans of development and economic development plans.

Farmland: An estimated 17.5 acre land area within the potentially developable area in the industrial zone on Butlertown Road in Montville is considered prime farmland, i.e., land consisting of prime or statewide important farmland soils that is currently being farmed or is available for farming. Farming is an allowed use in this zone; however, development of this parcel for a use other than agriculture would result in the loss of this farmland. As discussed previously (Sections 5.18.2.3, 5.18.7.3 and Table 5-69), this industrial land is susceptible to development with or without the preferred alternative and was not included in the induced development area.

Socioeconomic: Estimated development is consistent with town plans of conservation and development and economic development plans and is considered a positive socioeconomic impact. According to consultations with local businesses and developers, impacts on existing businesses along Routes 82 and 85 may vary. Some businesses may experience a loss of drive-by business, while other locally oriented businesses could benefit from a decrease in congestion on Route 85. Losses may be mitigated through implementation of directional signage and advertising.

The development of new businesses is not expected to have a significant effect on employment or population. The type of development permitted is for smaller scale, less intensive uses and should not generate a level of new jobs that would affect the projected population growth rate.

Archaeological Resources: The Route 11 corridor was determined to have moderate to high sensitivity for archaeological resources in undeveloped areas and along some parts of Route 85. It is reasonable to assume that undeveloped areas in the vicinity of the interchanges would have a similar sensitivity, and have the potential to contain archaeological resources. The town's permitting processes incorporate historical resources review and, in some cases, recovery programs that would help to minimize and/or mitigate any disturbance.

Indirect Environmental Impacts – No Build Alternative

Commercial and industrial development of the areas analyzed that is expected to occur under the no build scenario may result in the following impacts:

Traffic and Transportation: Future increases in traffic were incorporated into the travel demand model used to project 2020 traffic volumes in Sections 4.1 and 5.1. The traffic analysis predicted increasing congestion on the existing Route 82 and Route 85 corridor as a result, which may have the indirect effect of encouraging new commercial development along Route 85. However, for certain business more traffic congestion may discourage some customers and result in business losses.

Biodiversity: Information gathered in interviews suggests that development of residential lands has historically been suppressed in areas within or near the proposed alignment for the Route 11 extension. Gradually, some of these areas are being developed. Judging from trends in patterns of residential development, and after discussions with local residents, it is reasonable to foresee an eventual expansion of residential neighborhoods near the proposed alignment under the no build scenario. These areas include east of Route 161 in East Lyme and Waterford, between Route 161 and Grassy Hill Road in East Lyme and Montville and east of Old New London Road in Salem. This type of development within existing unfragmented forest habitat would not incorporate the mitigation measures proposed with the roadway project.

Water Resources: Development of commercial and industrial zones that would eventually occur over time (potentially as residential development) under the no build alternative would be in proximity to streams, Witchmeadow Brook, Harris Brook, and tributaries to Latimer Brook. Additional development would be likely along Route 85, which may adversely affect important Class I and II watershed lands and the Fairy Lake and Lake Konomoc reservoirs.

Wetlands: Development of residential, commercial and industrial zones would eventually occur over time under the no build alternative. Impacts to wetlands, including federal jurisdictional resources, would be largely avoided during the local permitting process. However, a small amount of wetland alteration may be permitted. Based on data collected for the period 2000-2005, the corridor towns typically permit an average of 0.1 ac. of inland wetland alteration for residential inland wetlands permits and 0.05 ac. for commercial and industrial.

Land Use: Development of areas near existing or proposed Route 11 interchanges currently zoned for commercial and industrial uses has progressed, but in some cases is not occurring according to town plans of conservation and development or economic development for various reasons. The town of Salem attributes hampered development in these zones to the Route 11 project not being

completed, which has had an adverse economic impact on the town. The no build alternative would have less of an impact at the Route 161 interchange area in Montville. The no build alternative may encourage more commercial development along Route 85 from Salem to Waterford. The town of Waterford could consider development along Route 85 in the aquifer protection zone or vicinity of Lake Konomoc (Figure 4-20) an adverse impact of the no build alternative.

Farmland: The industrial zone in Montville contains 17.5 ac. of prime farmland off Butlertown Road. This land may eventually be impacted by future development with or without the preferred alternative. Farming is an allowed use in the industrial zone.

Socioeconomic: After struggles in attracting commercial or industrial developers, the town of Salem is considering variances for underutilized industrial properties to allow development for alternative uses such as age-restricted residential development. This type of development involves a more intensive use with less of an economic return (tax revenue or jobs). The generation of residential rather than commercial/industrial development would result in an adverse economic impact on the town and a more intensive use of natural resources. The no build alternative would not have adverse economic impacts on the other towns because plans of development for the proposed Route 161 interchange area do not rely on the extension of Route 11.

Archaeological Resources: The Route 11 corridor was determined to have moderate to high sensitivity for archaeological resources in undeveloped areas and along some parts of Route 85. It is reasonable to assume that undeveloped areas would have a similar sensitivity, and would have the potential to contain archaeological resources. The town's permitting processes incorporate historical resources review and, in some cases, recovery programs that would help to minimize and/or mitigate any disturbance.

5.18.8 Cumulative Impacts of the Preferred Alternative

To fully understand the impacts of the proposed project on the natural and human resources in the Route 82/85/11 corridor, direct impacts on the environment of the study area from the proposed roadway right-of-way of the preferred alternative must be considered along with indirect impacts of the roadway including indirect impacts from potential induced development (Section 5.18.7), when added to the effects of other projects or actions. These potential cumulative impacts were evaluated. Cumulative impacts were defined at the beginning of Section 5.18.

The goal of a cumulative effects analysis is to inform decision makers evaluating projects individually as to the changes in characteristics and trends of an area from the combined effects of incremental actions. "Other actions" can include not only actions of the sponsoring

agency related or unrelated to the subject project, but also actions by other governmental agencies, private citizens and corporations.

5.18.8.1 *Cumulative Impacts Analysis Scoping and Methods*: Scoping for the analysis of all project impacts began in 1998 upon initiation of the EIS process and has continued throughout the various project phases. The scoping process is described in detail in Section 7. Meetings were held with the corridor towns, Salem, Montville, East Lyme and Waterford, and eight meetings of the AC were held between November 1997 and September 1998. Five meetings of the AC were also held after publication of the DEIS. In addition, consultations with town officials to discuss comments received on the DEIS and to collect additional data regarding indirect and cumulative impacts took place on several occasions between 2002 and 2006.

This analysis utilized currently available guidance documents[2], data drawn from other analyses presented in this FEIS, and information gathered during interviews with local municipal and environmental planners. The following steps were performed:

1. Definition of the cumulative impacts analysis study area and timeframe.
2. Identification of the environmental resources of concern for cumulative impacts.
3. Summary of direct and indirect impacts of the preferred alternative.
4. Summary of direct and indirect impacts of the no build alternative.
5. Identification of other past, present, and reasonably foreseeable future actions or projects impacting those resources; analysis and description of the impacts.
6. Determination of the potential cumulative impacts of the preferred alternative and other actions. Comparison with the no build alternative.

5.18.8.2 *Cumulative Impacts Analysis Study Area and Timeframe*: For the purpose of considering areas of cumulative impacts, the study area was the Route 11 corridor study area and the area of direct and indirect impacts of the preferred alternative within the four corridor towns—Salem, Montville, East Lyme and Waterford (Figure 1-2). Also considered were potential cumulative watershed impacts extending beyond the study corridor.

The time period considered in this evaluation was 1970 to 2020, which encompasses the construction of the existing section of Route 11 in 1970 and the future project planning year, 2020. Prior to 1970, historical disturbance to the natural environment in the Route 11 corridor consisted primarily of the following dispersed activities: farming, rock quarrying, sand and gravel mining, residential and commercial development, and public roads.

[2] *Consideration of Cumulative Impacts in EPA Review of NEPA Documents*, EPA 1999; National Cooperative Highway Research Program Report 466, *Desk Reference for Estimating the Indirect Effects of Proposed Transportation Projects,* 2002; FHWA *Interim Guidance: Questions and Answers Regarding Indirect and Cumulative Impact Considerations in the NEPA Process*, January 31, 2003; CTE National Teleconference (TC-31), 2004; Executive Order 13274 Indirect and Cumulative Impacts Work Group Draft Baseline Report, March 2005.

5.18.8.3 *Cumulative Impacts Environmental Resources Summary*: The natural and human resources of concern are those estimated to be susceptible to the most critical direct and indirect impacts (both beneficial and adverse). These are: traffic and transportation, biodiversity, wetlands, water resources, farmland, socioeconomics, and historic and archaeological resources.

The area of impact of preferred alternative E(4)m-V3 features several high-quality natural and cultural resources that may be susceptible to cumulative impacts. These were described in detail in Section 4. The natural resources of particular concern that were identified during the scoping process were watersheds (wetlands and watercourses), public water supplies, forest habitat blocks, state or federally listed species of plants and animals, farmland, and historic and archaeological resources. As part of the National Highway System and emergency evacuation routes, the Route 82/85/11 corridor itself is an important human resource.

Wetland resources include three large, high-value wetland complexes: Harris Brook, Latimer Brook and Oil Mill Brook. Watersheds include the Harris Brook and East Branch Eight Mile River subregional watersheds, which comprise the northerly section of the study area and flow to the Eight Mile River. The majority of the study area is within the Latimer Brook watershed and parts of the Oil Mill Brook and Niantic River watersheds, which drain to the Niantic River. Watershed management plans have been completed recently for both the Eight Mile River and Niantic River watersheds.[3] The Eight Mile River is under study for possible designation as a National Wild and Scenic River; the National Park Service released a Study Report for public comment in October 2006 recommending Congressional designation. The Niantic River is an impaired coastal waterbody for which planning has been initiated to restore water quality and associated habitat characteristics.

The Route 82/85/11 corridor contains surface and ground water resources used for public drinking water supply. Lake Konomoc serves as the principal storage reservoir of the New London Water Company system. It is located along the east side of Route 85 in Montville and Waterford, extending for a distance of about 2 miles. Class I and II watershed lands are located in Salem along Fairy Lake and in Montville and Waterford along Lake Konomoc and Lakes Pond Brook.

Habitat blocks in the corridor, containing the greatest level of biodiversity, consist of two large unfragmented forest blocks of greater than 200 ha. (500 ac.) and three small forest blocks of between 51 and 200 ha. (125 and 500 ac.). Habitat Block No. 2 comprises much of the southern portion of the corridor and is the most valuable with over 835 ha. (2,065 ac.).

[3] Eightmile River Watershed Management Plan Draft October 2005; Niantic River Watershed Protection Plan Draft 8/14/06.

Twenty-three species of plants and animals listed as state special concern, threatened or endangered, including two federally threatened and one federal candidate for listing, were identified in the study area.

Habitat Block No. 2 is also the site of the highest concentration of identified archaeological resources in the study area, most notably the Wolf Pit Hills potential archaeological district. The study area was determined to have a moderate to high sensitivity for archaeological resources.

More than 330 ha. (800 ac.) of prime farmland were identified within or adjacent to the study area.

5.18.8.4 *Summary of Direct and Indirect Impacts:* Direct impacts on these resources that would result from construction of the preferred alternative are listed in Table 5-70. Also listed in the table are indirect impacts associated with both the new roadway and as a result of potential induced commercial and industrial development in the vicinity of the new interchanges (Section 5.18.7).

Direct and indirect impacts estimated to result with the no build alternative are listed in Table 5-71.

5.18.8.5 *Past, Present and Reasonably Foreseeable Future Projects*: Past, present and reasonably foreseeable future projects, in addition to the Route 82/85/11 corridor project, occurring within the study area that have impacted or have the potential to contribute to cumulative impacts on the resources of concern are listed in Table 5-72, along with the estimated impacts. Many of the projects listed vary in size and location. These projects have either occurred or are reasonably foreseeable, but vary in the availability of environmental impact data, or are not defined such that resource impacts can be quantified. Therefore, this analysis presents a general qualitative assessment of the types of impacts.

TABLE 5-70
SUMMARY OF DIRECT AND INDIRECT IMPACTS OF THE PREFERRED ALTERNATIVE

	DIRECT IMPACT[1] $E_{(4)}M$-V3	INDIRECT IMPACT [1] $E_{(4)}M$-V3
TRAFFIC AND TRANSPORTATION	Improved safety and capacity on Routes 82 and 85 and I-95. Changes in traffic patterns at proposed interchange for Route 11/I-95/I-395/U.S. Route 1.	Additional traffic generated by induced commercial and industrial development would be accommodated by the preferred alternative.
BIODIVERSITY ***Upland and Aquatic Habitat***	57 ha. (141 ac.) of total right of way impact in 2 large and 3 small forest habitat blocks Fragmentation of the five habitat blocks. Increased incidents of vehicle collisions with animals.	381 biodiversity units or equivalent of 539 ac. of high-value habitat affected.[2] 30 ac. induced development potential within commercial/industrial zones near interchange areas within two large habitat block Nos. 1&2. Forest interior species vulnerable to increased edge effects causing reduced breeding success, predation and invasive species. State listed bird Brown Thrasher (special concern) may be impacted in induced development area.
Wildlife	9 listed species (including 1 FWS candidate); 8 occur in early successional, grassland habitat, or shrubland habitats and 1 in aquatic habitat. (1 was found in shrubland within Habitat Block No. 1 and 1 was found in a stream within Habitat Block No. 2; all others were outside habitat blocks).	Stormwater runoff impacts (pollutants, sedimentation, thermal) on aquatic life without appropriate mitigation.
WETLANDS	6.7 ha. (16.6 ac.) right of way impact (fill, excavation and/or bridge piers within roadway footprint or side slopes), including 4 seasonal pools; watersheds affected: East Branch Eight Mile River, Harris Brook, Latimer Brook, Oil Mill Brook, Niantic River	Indirect wetland impacts include alteration of hydrology, stormwater runoff impacts, and introduction of invasive species. Upland habitat around 28 seasonal pools may be impacted by roadway right of way. Potential for approx. 1.6 ac. of wetlands impacts (fill, stream crossings) by induced development in vicinity of Salem and Montville interchanges[3]; watersheds affected: East Branch Eight Mile River, Harris Brook, Latimer Brook
WATERCOURSES	Direct watercourse impacts include stream crossings in the Harris Brook, Latimer Brook, and Oil Mill Brook stream systems. Most stream impacts avoided by extended bridges, however, some small bridge pier impacts occur.	Indirect watercourse impacts from roadway right of way, without appropriate mitigation, include alteration of hydrology, stormwater runoff impacts, channelization of streams, and invasive species. Impacts may occur in the East Branch Eight Mile River, Harris Brook, Latimer Brook, Oil Mill Brook, Niantic River watersheds. Potential induced development may occur near the Witchmeadow Brook, Harris Brook and Latimer Brook stream systems.
PRIME FARMLAND	3.4 ha. (8.4 ac.) right-of-way impact	None
SOCIOECONOMIC	Total taking of 11 homes and 6 land parcels, plus partial takings from 33 parcels; loss of tax revenue for acquired properties	Increased tax revenues from planned commercial/ industrial development
HISTORIC AND ARCHAEOLOGICAL RESOURCES	16 sites, including sites within the Wolf Pit Hills potential archaeological district	Reduced effects on Wolf Pit Hills potential archaeological district with Route 11 blocking further encroachment of residential from the west. Possible adverse impacts to archaeological sites in induced commercial/ industrial zones.

[1] As assessed in Section 5.
[2] Determined by CAPS analysis (UMASS 2004)
[3] Based upon potential induced acres and average wetland permit (Section 5.18.7)

TABLE 5-71
SUMMARY OF DIRECT AND INDIRECT IMPACTS OF THE NO BUILD ALTERNATIVE

RESOURCE	DIRECT IMPACT[(1)] NO BUILD	INDIRECT IMPACT NO BUILD
TRAFFIC AND TRANSPORTATION	Increased deficiencies in safety and capacity on Routes 82 and 85 and I-95. Decreasing efficiency of evacuation routes from the shoreline.	Increased public frustration with traffic congestion within the community. Reduced quality of life for residents living and traveling along the existing corridor.
BIODIVERSITY ***Upland and Aquatic Habitat and Wildlife***	Increased incidents of vehicle collisions with animals with increase in traffic volume on Routes 82 and 85; decrease in wildlife distribution frequency.	Potential impacts from development within area proposed, or previously acquired, for the Route 11 extension alignment that could become available for other development.
WETLANDS	None	Increased stormwater impacts to wetlands along Routes 82 and 85 with increase in traffic volume. Potential impacts from development within area proposed, or previously acquired, for the Route 11 extension alignment that could become available for other development.
WATERCOURSES	None	Increased stormwater impacts to watercourses along Routes 82 and 85 with increase in traffic volume. Traffic increase would occur in proximity to important water supply resources, and in the absence of improved water quality protection measures (e.g. drainage system upgrades), may adversely impact those resources. Commercial and industrial development along Route 85 induced by the no build alternative may adversely affect public water supply resources.
PRIME FARMLAND	None	None
SOCIOECONOMIC	Loss of potential tax revenues for Salem from planned commercial/ industrial development at Witchmeadow Road and Route 82 under no build alternative	None
HISTORIC AND ARCHAEOLOGICAL RESOURCES	Uncertain opportunity for preservation within the Wolf Pit Hills potential archaeological district	Increased potential for adverse impacts on Wolf Pit Hills potential archaeological district from encroachment of residential development from the west.

[(1)] As assessed in Section 5.

TABLE 5-72
PAST, PRESENT AND FUTURE PROJECTS AND ASSOCIATED ENVIRONMENTAL IMPACTS

PROJECT OR ACTION	ENVIRONMENTAL IMPACT
PAST PROJECTS	
Route 11: existing section between Route 2 and Route 82	Wetland fill and watercourse crossing impacts within East Branch Eight Mile River subregional watershed; impacts to farmland, forest, wetlands and wildlife habitat, land use changes: commercial/ industrial zoning; traffic reduction on Route 85 between Routes 2 and 82.
Local economic development initiatives: development in commercial and industrial zones in proximity to highway network (Routes 82, 85, 161, 11).	Direct and indirect wetland/watercourse impacts to Harris Brook, Latimer Brook and Oil Mill Brook subregional watersheds. Impacts to farmland, forest and wildlife habitat.
Residential subdivision development in vicinity of: Route 85, Salem Route 161, Montville Route 161, East Lyme	Wetland/watercourse impact to East Branch Eight Mile River, Harris Brook and Latimer Brook watersheds. Wildlife habitat encroachment, fragmentation, and edge impacts in forest north of Route 82 and Habitat block Nos. 1 and 2; increased traffic congestion and accidents with added access points to arterial roadways; conversion of prime farmland to residential
PRESENT PROJECTS	
Route 82 and 85 Safety Improvements	Improves roadway safety; minor wetland impacts
I-95 Cross Road interchange improvement	Improves traffic circulation and access to business triangle commercial area.
Industrial park development on Route 85 and Butlertown Road, Montville	Wetland/watercourse impacts in Latimer Brook and Oil Mill Brook watersheds; encroachment on Habitat Block 2; added access drive on Route 85; potential for adverse effects on archaeological resources
Residential subdivision development Rocco Drive, East Lyme	Wetland/watercourse impacts to Latimer Brook. Edge impacts in Habitat Block 2; potential effects on archaeological resources; mitigation was required
Golf course with residential development, Upper Walnut Hill Road in East Lyme and Montville	Wetland/watercourse impact in Latimer Brook watershed; eliminates Habitat Block 4 and associated wildlife corridors; substantially reduces Habitat Block 5; potentially impacts state species of special concern habitat in power line right-of-way; potential for adverse effects on prime farmland and archaeological resources.
Logging and clear cutting is several areas within Habitat Block #2	Reduces area of forest block; increases edge effects.
Residential subdivision between Routes 11 and 85 in Colchester at Salem town line.	Potential wetland/watercourse impacts to East Branch Eight Mile River watershed.
FUTURE PROJECTS	
Commercial development at East Lyme's Flanders Village (intersection of U.S. Route 1 and Route 161), Waterford's business triangle (area between Route 85 and I-95), and along Route 85. . Disposition of 142 ac. ConnDOT-owned parcel in Waterford business triangle.	Potential for adverse wetland/watercourse impacts to Latimer Brook, Oil Mill Brook, Jordan Brook and Niantic River watersheds; potential for adverse water quality impacts to public water supply resources; potential for adverse effects on prime farmland and archaeological resources. Under preferred alternative or no build—either preservation (transfer to DEP) or development (sale to town or private entity), or development as a municipal water supply. Parcel contains Jordan Brook and an aquifer protection area.

TABLE 5-72
PAST, PRESENT AND FUTURE PROJECTS AND ASSOCIATED ENVIRONMENTAL IMPACTS

PROJECT OR ACTION	ENVIRONMENTAL IMPACT
FUTURE PROJECTS – contd.	
Development of remaining buildable land (approximately 70 ac.) in Montville industrial zone on Route 85/Route 161/ Butlertown Road.	Potential for adverse impacts to wetlands /watercourses within Latimer Brook watershed, forest in Habitat Block No. 2 (70 ac.), prime farmland (17.5 ac.) and archaeological resources.
Residential development in the vicinity of Route 161 on Walnut Hill Road, Mostowy Road and Goldfinch Terrace in East Lyme and West Road in north Salem between Routes 11 and 85.	Potential for adverse impacts to wetlands/watercourses within Harris Brook, Latimer Brook, East Branch Eight Mile River, Oil Mill Brook, and Niantic River watersheds. Habitat encroachment, fragmentation, and edge impacts in Habitat Blocks Nos. 2 and 6; potential for adverse effects on archaeological resources
Expansion of Campground for recreational vehicles on Route 161	Vegetation clearing and limited grading along eastern shore of Latimer Brook; potential for adverse riparian habitat and watercourse impacts, but permit would require protections of same.
Colchester business development at Route 2, 11, Lake Hayward Road area	Potential for adverse impacts to wetlands/watercourses within Meadow Brook subregional drainage basin. Does not impact resources within the study area.
Regional economic development initiatives – tourism and entertainment	Development throughout the region of designated economic development zones and associated beneficial fiscal impacts and adverse environmental impacts (e.g. regional loss of habitat, increased demand on energy and water resources, etc.); job retention/creation; sustained quality of life
Possible long-term alternative sourcing of water supply by East Lyme from regional water systems.	Would allow continued development of land according to existing zoning.

5.18.8.6 *Cumulative Impacts*: The potential cumulative impacts on the resources of the study area, when the impacts from other projects (Table 5-72) are considered along with those of preferred alternative $E_{(4)}$m-V3 (Table 5-70), are summarized in Table 5-73. These cumulative impacts are also compared with the no build alternative (Table 5-71).

Past development has encroached on habitat within the corridor and contributes to existing impacts. Habitat fragmentation also occurred along the existing section of Route 11 in north Salem, within the Eight Mile River Watershed. Information collected from the Salem Land Trust (D. Bingham pers. comm.) and data documented for a study of the Eight Mile River Watershed suggests that this habitat continues to function well in that area. Connecticut biologists, Drs. Goodwin and Niering provided comments supporting this observation (see Sections 5.4.12 and 5.6.3). The presence of bridges and oversized culverts and relatively low level of development all may have contributed to mitigating the adverse effects of the highway. Several large parcels with high biodiversity and watershed protection value adjacent to Route 11 have been preserved in this area by the Salem Land Trust, State of Connecticut and The Nature Conservancy (e.g. Walden Preserve).

Further encroachment on habitat blocks, especially with residential development that can spread out over a wide area, will increase edge effects. These effects include the introduction and/or spreading of invasive vegetation,

TABLE 5-73
POTENTIAL CUMULATIVE IMPACTS

RESOURCE	CUMULATIVE IMPACT – PREFERRED ALTERNATIVE	CUMULATIVE IMPACT – NO BUILD ALTERNATIVE
TRAFFIC AND TRANSPORTATION	Improvement in safety and capacity on Routes 82 and 85 and I-95 between interchanges 74 (Route 161) and 81 (Cross Road). Improvement in evacuation routes. Cumulative effects may exacerbate existing traffic congestion in the Cross Road/U.S. Route 1 residential area in Waterford due to the elimination of Interchange 75 and diversion to Interchange 81.	Increasing congestion and safety problems on Routes 82 and 85 and I-95 between interchanges 74 (Route 161) and 81 (Cross Road). Decrease in efficiency of evacuation routes. Existing traffic congestion in Cross Road/U.S. Route 1 residential area in Waterford would continue to increase with development of the nearby commercial/industrial business triangle.
BIODIVERSITY		
Upland and Aquatic Habitat	Reduction in size and/or encroachment on habitat blocks will increase edge effects – introduction and/or spreading of invasive vegetation, increased predation, reduction in the size of each block with a concomitant loss of forest interior and habitat connectivity. Habitat Block 1 projected to be reduced from a large block to a small block; reduction in size of Habitat Blocks 2 and 3; loss of Habitat Block 4 and associated habitat corridors; Habitat block 5 may be reduced by half and loss of associated wildlife corridor. Future residential development will impact Habitat Block 6.	Cumulative impacts would be similar to preferred alternative. Habitat Block 1 was reduced by residential development and may be reduced further by future residential development; reduction in size of Habitat Block 2; no impacts identified for Habitat Block 3; loss of Habitat Block 4 and associated habitat corridors; Habitat block 5 may be reduced by half and loss of associated wildlife corridor. Future residential development will impact Habitat Block 6.
Wildlife	Habitat block fragmentation may affect forest interior species and those requiring large territories, which become more vulnerable to increased edge effects and loss of habitat connectivity. This may increase the threat to the sustainability of species populations and potential metapopulations(1). No specific cumulative threats to state or federally listed species were identified.	Same as preferred alternative.
WETLANDS	The combination of projects is likely to cumulatively affect wetlands, including seasonal pools, by direct impacts (e.g., fill, excavation, or bridge piers) and indirect impacts (e.g., alteration of hydrology, stormwater runoff, and introduction of invasive species) in the watersheds of the study area, particularly Latimer Brook. This watershed and the others in the study area continue to retain a high value despite past effects. Because of permitting and mitigation requirements, cumulative impacts are not expected to significantly degrade the high water quality that currently exists.	Cumulative impacts to wetlands include indirect effects (stormwater runoff) from increased traffic volumes on Routes 82 and 85 and direct impacts (e.g., fill, excavation, structures, etc) and indirect impacts (e.g., alteration of hydrology, stormwater runoff, and introduction of invasive species) from other projects in the watersheds of the study area, particularly Latimer Brook.

TABLE 5-73
POTENTIAL CUMULATIVE IMPACTS -contd.

RESOURCE	CUMULATIVE IMPACT – PREFERRED ALTERNATIVE	CUMULATIVE IMPACT – NO BUILD ALTERNATIVE
WATERCOURSES	Increased impervious surfaces, with the new roadway and other development, contributing additional stormwater runoff, physical alterations, sedimentation, and pollutants would occur in the East Branch Eight Mile River, Harris Brook, Latimer Brook, Oil Mill Brook and Niantic River subregional watersheds without appropriate protections. Most of the cumulative impact would occur in the Latimer Brook watershed. Because of permitting and mitigation requirements for the protection of water resources, cumulative impacts are not expected to degrade the high water quality and Class A designations that currently exist.	Same as preferred alternative, but without new roadway impervious surface. However, future build out scenarios may include development and added impervious surfaces within the proposed right-of-way for the preferred alternative under the no build. Additional commercial and industrial development may be induced along Route 85 under the no build, which may have an adverse impact on water quality of watercourses and public water supply resources in that area.
PRIME FARMLAND	The impact to prime farmland of the study area, through its conversion to non-farming uses, is small with the preferred alternative (8.5 ac. of direct impact and no indirect impact) when compared to the ongoing and foreseeable future impacts from residential and other development.	The impact to prime farmland of the study area, through its conversion to non-farming uses, is ongoing and future impacts from residential and other development are foreseeable.
SOCIOECONOMIC	Planned local and regional economic development and employment retention/creation to meet regional economic development strategies and balance the increased demand for services generated by residential development.	Regional economic development strategies, which include improvements in the transportation system for the Route 82/85/11 corridor, would not be met.
HISTORIC AND ARCHAEOLOGICAL RESOURCES	Cumulative impacts on archaeological resources are probable because of the moderate to high sensitivity of much of the study area. Potential disturbance of archaeological sites is regulated by the local permitting process in areas known to be sensitive. Appropriate evaluation and recovery is performed where necessary. Mitigation for the preferred alternative includes documentation and preservation of archaeological resources.	The no build will not directly affect archaeological resources. It may indirectly increase the potential for adverse effects on the Wolf Pit Hills potential archaeological district by allowing encroachment of residential development from the west. Cumulative impacts on archaeological resources are probable because of the moderate to high sensitivity of much of the study area. Potential disturbance of archaeological sites is regulated by the local permitting process in areas known to be sensitive. Appropriate evaluation and recovery is performed where necessary. Preservation through mitigation for the preferred alternative would not occur, however.

(1) Metapopulations consist of a group of spatially separated populations of the same species, which are sustained by and interact through patterns of gene flow, immigration and emigration.

increased predation on forest interior species, and reduction in the size of each block with a concomitant loss of forest interior and habitat connectivity.

Habitat block fragmentation impacts of the preferred alternative are estimated as follows:

HABITAT BLOCK NO.	CUMULATIVE IMPACT
1	Reduced from a large to small habitat block by the cumulative effect of new residential development and the preferred alternative
2	Edge effects and reduction in area from encroaching residential and commercial development and the preferred alternative, but would remain a large habitat block.
3	Reduced in size with increased edge effects with preferred alternative; no other projects identified.
4	Habitat block and associated wildlife corridors potentially eliminated by golf course; a portion of fragmentation attributed to preferred alternative.
5	Fragmented by preferred alternative, but remains a viable block. However, would be reduced by half with proposed golf course.
6	Not impacted by preferred alternative; future residential development may substantially reduce the habitat block.

While preferred alternative $E_{(4)}$m-V3 contributes to habitat fragmentation in Habitat Blocks Nos. 1, 2, 3, 4 and 5, most habitat loss would be due to residential or golf course development. Because of the number of bridges proposed in the conceptual roadway plan, habitat connectivity would be maintained after construction of the Route 11 roadway. The alignment would essentially block further spread of residential development from the west into Habitat Block No. 2, as opposed to allowing it to continue with the no build alternative. Logging and clear cutting are already occurring there. Habitat Block No. 6, which is not affected by the roadway alignment, would be reduced in size by future residential development along Walnut Hill Road.

Forest interior species and those requiring large territories (e.g. bobcat, fisher, and various species of birds) become more vulnerable to increased edge effects with encroachment and forest fragmentation. Although this increases the stress on these species populations and potential metapopulations, no impacts were identified that would be detrimental to the status of any species in this region or the state.

Through wetland protection, conservation and stormwater management regulations, wetlands and watercourses within the study area have proven resilient thus far to the effects of past projects and continue to exhibit high water quality. Despite the advent of more stringent stormwater management requirements, the foreseeable future cumulative impact scenario may potentially be some reduction in water quality in the Latimer Brook watershed. This eventuality is likely with or without Route 11 as development occurs along Latimer Brook and its tributaries. However considering

regulatory protections, there is no reason to believe that the surface and groundwaters of the study area would not retain Class A water quality characteristics.

Unlike the no build alternative, increased traffic volumes and induced commercial and industrial development would not occur in proximity to, and therefore would not have the potential to adversely affect, important public water supply resources along Route 85.

Impact avoidance and minimization techniques to be used in the construction of the Route 11 extension would reduce the unavoidable loss or impairment of these resources and therefore the cumulative environmental impact. The new roadway would be subject to stringent regulatory compliance, permitting and mitigation requirements. New residential developments in the study area are also subject to these regulations. Although an average of .04 ha (0.1 ac.) of wetland alteration (i.e. direct fill, excavation, structures, etc.) is typically permitted with a residential development project in the study area towns, a buffer for valuable wetlands and streams, such as Latimer Brook, is typically required. This helps to mitigate overall watershed impacts. Extra protections may be instituted in the near future as a result of the watershed management plan recommendations for the Eight Mile River and Niantic River watersheds.

Cumulative impacts on archaeological resources are probable because of the moderate to high sensitivity of much of the study area. There is a potential for archaeological resources to be encountered throughout the study area during development activities. These impacts would be minimized and mitigated by federal, state and local permitting processes. As part of mitigation for the preferred alternative, archaeological sites of the potential Wolf Pit Hills Archaeological District will be documented and preserved through provisions of the MOA with the SHPO.

Local preservation protections would help to minimize potential cumulative impacts on archaeological resources. The towns of East Lyme and Waterford require archaeological surveys for certain development activities within areas of known sensitivity, and with the assistance of the state archaeologist, require avoidance, documentation, and/or recovery of artifacts if archaeological sites are encountered. The town of Salem refers projects under permit review to the state archaeologist if they are located in areas mapped by the state as sensitive for archaeological sites.

Conclusion

The findings of this analysis suggest that while some resources may be adversely impacted, the cumulative impacts would not be detrimental to the viability of the resources of concern. Loss of biodiversity through habitat block impacts is the most adverse cumulative threat to important resources of the study area. Planning for

habitat preservation through conservation and controls on development at the local level and through project mitigation for the preferred alternative would provide some compensation for these losses.

Persons Consulted

The following people were consulted and provided input for this analysis:

MUNICIPAL

Town of Salem
Mary Ann Chinnati, Town Planner, Inland Wetlands Officer
Larry Reitz, First Selectman
Richard Asafaylo, Economic Dev. Commission
David Bingham, Salem Land Trust, Planning and Zoning Commission

Town of Montville
Marcia Vlaun, Town Planner
Colleen Bezanson, Wetlands Officer/Asst.Planner

Town of East Lyme
Meg Parulis, Director of Planning
William Mulholland, Zoning Official
Keith Haden, Conservation Officer

Town of Waterford
Tom Wagner, Planning Director
Maureen FitzGerald, Wetlands Officer/Environmental Planner

Town of East Haddam
Bradley Parker, First Selectman
Jim Ventres, Land Use Office

Town of Colchester
Chris Beauchemin, Town Planner
Gary Goeschel II, Asst. Planner and Zoning Enforcement Officer
Alicia Watson, Wetlands Enforcement Officer

Town of Groton
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City of New London
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Town of Lyme
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REGIONAL

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Anthony Irving, Chairman
Eight Mile River Study Commission

Damon Hearne
National Park Service Project Manager
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PRIVATE BUSINESS

John Lombardi, Developer
Lombardi Inside/Out

Henry Resnikoff, Developer
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Karl Frey, Developer
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Eastern CT Association of Realtors

Gem Marshall
Prudential Realty, Colchester Sales Office

Linda Davis
REMAX Realty, Groton

5.18.9 MITIGATION MEASURES

Planning for habitat preservation through conservation and controls on development at the local level, and through project mitigation for the preferred alternative (see Compensation and Mitigation Framework) would provide compensation for indirect and cumulative impacts.

A comparison with the existing section of Route 11, which traverses the Eight Mile River Watershed, shows that preservation and/or conservation easements in combination with water quality protection measures outlined in the Compensation and Mitigation Framework, can mitigate the indirect and cumulative effects of the proposed extension of Route 11. According to comments provided in 1999 by the late Drs. Goodwin and Niering, the potential exists for the preferred alternative to actually improve future conditions as compared with the no build alternative (Section 5.6.3).

Management of land use and development is the single most important tool that may be used by individual towns in order to minimize the adverse impacts associated with roadway construction, and take advantage of the positive impacts that result from transportation improvements. The future landscape and environmental health of each community will be determined by the planning and zoning decisions made today.

As reflected in the plans of development of Salem, Montville, East Lyme and Waterford, natural and cultural resources are a recognized and important part of these communities. Zoning regulations are already in place that attempt to control growth and induce specific types of development, however, incremental development is proceeding. Local commissions may reconsider their plans of development after a transportation alternative is chosen in order to ensure that growth occurs in a way that is complementary to the future vision of their town.

5.19 SUMMARY OF IMPACTS

The determination of which alternative was advanced as the preferred alternative in the FEIS was predicated upon the results of further investigation of historical/archaeological resources and flexibility of design standards, as noted in Sections 3.3.7 and 3.4. Because the process of further screening and elimination of unsuitable alternatives resulted in the selection of a full build expressway alternative as the preferred alternative, more detailed archaeological investigations were undertaken, with a focus on the Wolf Pit Hills area, in accordance with SHPO directives.

The preferred alternative was examined in greater detail with respect to options to further reduce impacts through flexibility of design standards. This resulted in minimization of

impacts to wetlands, wetland-dependant biota, habitat blocks, high-yield aquifer, floodplain, prime farmland, property, and historic and archaeological resources.

An additional traffic analysis was undertaken in 2002 for the interchange at I-95/I-395/U.S. Route 1 for the preferred alternative to determine the effects of potential lane and ramp configurations on traffic flow in this area. Results showed that the final interchange concept and proposed intersection improvements would allow necessary movements between these roadways while also correcting existing deficiencies on I-95 in this area. The final interchange concept also reduced impacts to wetlands as compared with the other four lane full build alternatives.

Further quantitative analysis of indirect impacts of the preferred alternative resulted in estimates of acres of indirect impacts to wetlands and wildlife habitat and indirect impacts projected from project-induced development. A more in-depth study of cumulative impacts was also undertaken. The findings suggested that while some resources may be adversely impacted, the cumulative impacts would not be detrimental to the viability of the resources of concern. Loss of biodiversity through habitat block impacts is the most adverse cumulative threat to important resources of the study area.

A summary matrix that quantifies several of the impacts associated with the various alternatives and the preferred alternative is presented in Table 5-74.

TABLE 5-74 COMPARISON MATRIX: OVERVIEW OF IMPACTS BY ALTERNATIVE

PROPOSED ALTERNATIVE	WETLANDS	NUMBER OF HABITAT BLOCKS	HABITAT BLOCK AREA	CLASS I & II LANDS	HIGH YIELD AQUIFERS	LISTED[1] SPECIES 2004-2005 SURVEY	PRIME FARMLAND	FLOODPLAINS	HISTORIC/ ARCHAEOLOGICAL	STRUCTURES POTENTIALLY AFFECTED	AIR QUALITY *MICROSCALE ANALYSIS/ MESOSCALE ANALYSIS	NUMBER OF NOISE RECEPTORS EXCEEDING CRITERIA[2]	POTENTIAL/KNOWN HAZARDOUS WASTE/ CONTAMINATED SITES	COST[4] (MILLIONS)
Preferred Alternative ***(Data based on 2000-2005 impact minimization studies, FEIS analyses and mitigation planning studies for the preferred alternative)***														
$E_{(4)}$m-V3	**6.7 ha (16.6 ac)**	**>200 ha - 2 50-200 ha - 3**	**56.9 ha (140.6 ac)**	**None**	**0.68 ha (1.7 ac)**	**9**	**3.4 ha (8.4 ac)**	**1.17 ha (2.9 ac)**	**None/ Yes**	**11 dwellings**	*No CO violations/ VOC & CO < No Build NO_x > No Build	**1**	**21 [3]**	**$843 to $924**
Alternatives	*(Data based on 1999 Draft EIS impact analysis for 15 alternatives)*													
No Build	None	None	None	None	None	None	None	None	None/ None	None	*No CO violations	4	None	None
$W_{(4)}$	2.07 ha (5.12 ac)	>200 ha - 2 50-200 ha - 0	1.8 ha (4.4 ac)	I - 2.99 ha (7.39 ac) II- 0.52 ha (1.28 ac)	3.5 ha (8.7 ac)	1	0.32 ha (0.78 ac)	1.6 ha (3.9 ac)	11 properties/ Yes	32 dwellings 7 commercial 1 institutional	*No CO violations/ VOC & CO < No Build NO_x < No Build	4	20	$41.0
$W_{(4)}$m	1.52 ha (3.77 ac)	>200 ha - 2 50-200 ha - 0	1.4 ha (3.5 ac)	I - 2.47 ha (6.06 ac) II- 0.44 ha (1.09 ac)	1.8 ha (4.3 ac)	1	0.26 ha (0.65ac)	1.1 ha (2.7 ac)	11 properties/ Yes	27 dwellings 7 commercial 1 institutional	*No CO violations/ VOC & CO < No Build NO_x < No Build	4	20	$33.0
$W_{(2)}$	1.37 ha (3.37 ac)	>200 ha - 2 50-200 ha - 0	1.2 ha (3.0 ac)	I - 2.42 ha (5.96 ac) II- 0.46 ha (1.15 ac)	1.3 ha (3.3 ac)	1	0.18 ha (0.45 ac)	1.0 ha (2.4 ac)	11 properties/ Yes	17 dwellings 3 commercial	*No CO violations/ VOC & CO = No Build NO_x = No Build	4	20	$31.1
TSM	0.26 ha (0.65 ac)	None	None	None	0.2 ha (0.5 ac)	None	0.12 ha (0.3 ac)	0.2 ha (0.5 ac)	None/ None	2 dwellings 3 commercial 2 institutional	*No CO violations/ VOC & CO = No Build NO_x = No Build	4	7	$1.7
TDM/Transit	None	None	None	None	None	None	None	None	None/ None	None	*No CO violations/ VOC & CO = No Build NO_x = No Build	4	None	$1.4[5]
92PD	14.17 ha (35.01 ac)	>200 ha - 2 50-200 ha - 2	59.2 ha (146.2 ac)	None	1.6 ha (4.1 ac)	9	6.32 ha (15.61 ac)	2.7 ha (6.6 ac)	1 properties/ Yes	31 dwellings 16 commercial	*No CO violations/ VOC & CO < No Build NO_x > No Build	7	2	$255.6
$E_{(4)}$	14.27 ha (35.26 ac)	>200 ha - 2 50-200 ha - 3	63.8 ha (157.6 ac)	None	1.4 ha (3.5 ac)	9	6.32 ha (15.61 ac)	2.3 ha (5.6 ac)	1 properties/ Yes	22 dwellings 16 commercial	*No CO violations/ VOC & CO < No Build NO_x > No Build	7	2	$255.2
$E_{(2)}$	7.89 ha (19.50 ac)	>200 ha - 2 50-200 ha - 3	47.5 ha (117.3 ac)	None	0.5 ha (1.1 ac)	9	5.93 ha (14.65 ac)	1.2 ha (3.0 ac)	None/ Yes	13 dwellings	*No CO violations/ VOC & CO < No Build NO_x > No Build	7	2	$154.7
$F_{(4)}$	11.62 ha (28.72 ac)	>200 ha - 2 50-200 ha - 4	68.3 ha (168.7 ac)	None	1.9 ha (4.6 ac)	8	34.49 ha (85.23 ac)	1.8 ha (4.5 ac)	2 properties/ Yes	29 dwellings 16 commercial 2 institutional	*No CO violations/ VOC & CO < No Build NO_x > No Build	7	3	$329.7
$F_{(2)}$	6.21 ha (15.35 ac)	>200 ha - 2 50-200 ha - 4	51.6 ha (127.5 ac)	None	0.8 ha (2.1 ac)	8	30.55 ha (75.48 ac)	0.7 ha (1.6 ac)	1 properties/ Yes	16 dwellings 2 institutional	*No CO violations/ VOC & CO < No Build NO_x > No Build	7	3	$213.1
$G_{(4)}$	13.23 ha (32.69 ac)	>200 ha - 2 50-200 ha - 4	68.3 ha (168.7 ac)	None	2.9 ha (7.2 ac)	8	25.58 ha (63.19 ac)	2.3 ha (5.8 ac)	3 properties/ Yes	38 dwellings 16 commercial 2 institutional	*No CO violations/ VOC & CO < No Build NO_x > No Build	7	3	$344.8
$G_{(2)}$	7.93 ha (19.59 ac)	>200 ha - 2 50-200 ha - 4	51.6 ha (127.5 ac)	None	1.1 ha (2.6 ac)	8	21.21 ha (52.40 ac)	1.0 ha (2.4 ac)	2 properties/ Yes	24 dwellings 2 institutional	*No CO violations/ VOC & CO < No Build NO_x > No Build	7	3	$224.6
$H_{(4)}$	4.40 ha (10.87 ac)	>200 ha - 2 50-200 ha - 3	38.1 ha (94.1 ac)	I - 2.98 ha (7.36 ac) II- 0.52 ha (1.28 ac)	3.0 ha (7.3 ac)	8	16.73 ha (41.35 ac)	1.2 ha (3.0 ac)	4 properties/ Yes	28 dwellings 1 commercial	*No CO violations/ VOC & CO < No Build NO_x > No Build	8	14	$113.6
$H_{(2)}$	3.0 ha (7.41 ac)	>200 ha - 2 50-200 ha - 3	28.8 ha (71.1 ac)	I - 2.41 ha (5.95 ac) II- 0.46 ha (1.15 ac)	1.0 ha (2.5 ac)	8	7.40 ha (18.28 ac)	0.6 ha (1.5 ac)	4 properties/ Yes	20 dwellings	*No CO violations/ VOC & CO < No Build NO_x > No Build	8	14	$81.9

1 = State or federal endangered, threatened, special concern or candidate species identified during the 2004-2005 biological surveys. Note: Surveys were not conducted for portions of the W, E, F, G and H alternatives.
2 = Does not include the number of receptors already exceeding criteria (NAC) under existing conditions
3 = Identified through a detailed Corridor Land Use Evaluation for the preferred alternative (includes low, moderate and high risk sites)
4 =Construction cost including estimated ROW acquisition costs; Alternatives in 1999 dollars; Preferred alternative E(4)m-V3 in 2013 year of expenditure dollars
5 = Cost of implementation for Route W only

5.20 Relationship between Local Short-term Uses of Man's Environment and the Maintenance and Enhancement of Long-term Productivity

Adverse impacts of the preferred alternative that would be experienced locally include effects on, and/or use of, noise levels, vegetation, wildlife, threatened and special concern species, earth cuts and fills, watercourses and wetlands, floodplains, private property, farmland, archaeological resources, visual and aesthetic quality, and the short-term impacts associated with construction. Impacts to these resources would occur with any of the build alternatives to varying degrees. A comprehensive mitigation and compensation plan will reduce the net overall adverse impact of the project.

The beneficial effects of the preferred alternative outweigh the net adverse consequences. Benefits include improvements to traffic and transportation, emergency management, local, regional and state economies, visual and aesthetics (on Route 85 and from the new roadway), and hazardous contamination site cleanup.

Traffic congestion and poor levels of service would be alleviated in the corridor on Routes 82 and 85 by the diversion of through traffic to the Route 11 extension. This would also reduce the number of turning conflicts that contribute to vehicular collisions, thereby improving safety.

The preferred alternative would support local and regional economic development plans by improving access to existing commercial and industrial zones and improving the highway linkage between regional destinations in the Hartford and the New London areas (e.g. Bradley International Airport, State Pier New London). Temporary, short-term employment and business opportunities would be created by the construction of the roadway.

The project is an important component of local, regional and state transportation plans, plans of conservation and development, and economic development plans. The local short-term impacts and use of resources for the preferred alternative is therefore consistent with the maintenance and enhancement of long-term productivity for the local area, the region and the state.

5.21 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

The preferred alternative will result in an irreversible and irretrievable use of vegetation, wildlife habitat, threatened and special concern species habitat, private land, wetlands, floodplain, farmland, archaeological resources, and visual and aesthetic quality. It will also require a substantial commitment of state and federal funds for construction and maintenance that is not retrievable. All of the build alternatives would require the use of these resources to varying degrees.

Considerable amounts of fossil fuels, labor, and highway construction materials such as cement, aggregate, and bituminous material would be expended. Additionally, large amounts of labor, energy, and natural resources would be used in the fabrication and preparation of construction materials. These materials are generally not retrievable. However, they are not in short supply and their use will not have an adverse effect upon continued availability of these resources.

The commitment of these resources is based on the concept that local, regional, and state residents will benefit by the improved quality of the transportation system. These benefits will consist of improved safety and capacity to meet existing and future travel demands and accessibility to the Southeastern Connecticut region. It is anticipated that these benefits will outweigh the commitment of resources.