4.4 BIOLOGICAL DIVERSITY

The study area is located primarily within the Southeast Hills Ecoregion of Connecticut, with a small portion of the southern corridor located in the Eastern Coastal Region (Dowhan & Craig, 1976). This ecoregion is a near-coastal upland, the northern border of which lies within 48 km. (30 mi.) of Long Island Sound. It is characterized by low rolling hills, moderately broad and level upland and valley bottoms, and local areas of steep and rugged topography. Elevations in the corridor range from 165 m. (540 ft.) in the northern portion of the corridor to sea level in the southern part of the corridor. The greatest relief is found near the north and central portions of the corridor.

Climate plays an important role in shaping the biological and ecological character of the area. The mean annual temperature is approximately 9.4˚C (49˚F). The average winter temperature is -6˚C (29˚F), and the monthly mean minimum temperature is -7.5˚C (18.5˚F). The average length of the frost-free season is variable over the region, ranging from 140 days in the east to 170 days in the southern and western portions. Average seasonal snowfall accumulation is about 100 cm. (40 in.). The average summer temperature is 20.5˚C (69˚F) and the monthly mean maximum temperature during the warmest month is 27.8˚C (82˚F). The average annual precipitation is approximately 114.3 cm. (45 in.) (Dowhan & Craig, 1976).

The type, size, location and quality of water resources in the corridor are important factors influencing the localized and regional ecology. Latimer Brook, which runs in a southeast direction west of Route 85 from Montville to Niantic Bay in East Lyme, is the most important waterway within the corridor. Other brooks include Oil Mill Brook, which runs from Waterford to Niantic Bay, and Shingle Mill and Harris Brooks, which flow from Salem to the east branch of the Eight Mile River; all are designated Class A streams with substantial wildlife and fisheries resources. Shingle Mill Pond and Horse Pond are both owned and maintained by DEP. Latimer Brook is stocked annually with trout by DEP (N. Hagstrom, personal communication).

Methods of Evaluation: Initial evaluations of the biological and ecological character of the study area involved the review of scientific literature and natural resources mapping, consultation with DEP and FWS, and field investigations, which focused primarily on wetlands.

Biological field surveys were subsequently conducted at the request of EPA, FWS, ACOE and DEP between September 2004 and September 2005 to augment information on wildlife species and vegetation communities. Additional detailed information was collected on the distribution of flora and fauna, with a focus on wetland-dependent species, within the area potentially affected by preferred alternative $E_{(4)}$m-V3. Information collected during these surveys provided detailed data for the mitigation/compensation planning phase of the project.

The ACOE outlined the required surveys in a letter dated March 12, 2004 (refer to Section 7 and Agency Correspondence). They were: vegetation communities, herpetofauna (eastern ribbon snake and wood turtle), avifauna, wildlife movement, New England cottontail, Odonata

(dragonflies and damselflies), aquatic invertebrates (via stream bioassessments), and a supplemental seasonal pool study. The methods used and results were documented in the reports: *Biological Survey Report* and *Seasonal Pool Inventory and Evaluation*.

While the focus of the 2004-2005 biological surveys was wetland-dependent species, it was recognized by ConnDOT, FHWA and the cooperating agencies that additional surveys of federally listed and state listed species will be required during the design and permitting phase of the project before DEP could issue a Clean Water Act §401 Water Quality Certification or ACOE could grant a §404 permit. Surveys that were deferred included listed species of plants, upland herpetofauna, mammals (except New England cottontail), and terrestrial invertebrates.

Surveys were conducted within the corridor using widely accepted survey protocols for determining the presence of wildlife species and wildlife habitat. Special efforts were made to detect the presence of federally listed and state listed species included in DEP's *County Report for Connecticut's Endangered, Threatened, and Special Concern Species*, *New London County* (i.e., those species listed by the FWS as threatened or endangered, and those species listed by the state of Connecticut as threatened, endangered, or special concern), with a focus on wetland-dependant species. The scoping of survey protocols involved coordination with DEP and input from the ACOE, EPA, and FWS. Final decisions on survey methodology were made by the ACOE. The overall limits of the survey area were confined to undeveloped areas (e.g. habitat blocks and corridors, as defined in Section 4.4.8) within the study area, which may be directly or indirectly affected by the new roadway alignment. Surveys were limited to land where the property owner granted access permission. Surveys were performed along transects, at point locations and other locations based on specific habitat attributes. The survey sites are shown in Figure 4-17.

4.4.1 VEGETATION COVER AND COMMUNITY TYPES

Vegetation within the region varies with a number of factors, including the drainage class of the soils in a particular area, topography, hydrology, aspect, microclimates, and human influences. Depending on these variables, different plant communities may develop in separate areas; often these communities will reflect the ecological system which is found there. The primary plant communities documented within the study corridor include:

- *Mixed Oak Community* - found throughout the project area on side slopes and terraces. These areas are located most often in deeper, moist to dry soils, with scattered areas of shallow-depth-to-bedrock soils and ledge outcrops.

  Dominant species: Northern red oak (*Quercus rubra*)
  Chestnut oak (*Quercus prinus*)
  White oak (*Quercus alba*)
  Black oak (*Quercus velutina*)

- *Chestnut Oak Community* - there are several upland forest areas composed of almost homogenous stands of chestnut oak. These areas are generally located in the southern portion of the corridor, at the tops of ridges and knolls. The ridgetops where these stands occur are very dry with excessively-well drained soils, which are generally shallow-depth-to-bedrock. Associated understory species are noted below.

  Dominant species: Mountain laurel (*Kalmia latifolia*)
  Maple-leaf viburnum (*Viburnum acerfolium*)
  Huckleberry (*Gaylussacia sp*.)

- *Red Maple Community* - found primarily in wetland areas, it is the dominant forested wetland community in the corridor. It is found in poorly-drained, very-poorly drained
  and moderately-well drained soils in depressions, drainage swales, and floodplains.

  Dominant species: Red maple (*Acer rubrum*)
  Yellow birch (*Betula alleghaniensis*)
  Black gum (*Nyssa sylvatica*)
  American elm (*Ulmus americana*)

- *Maple-Ash Community* - found at the base of slopes and in uplands adjacent to wetland areas. It occurs primarily in deep moderately-well and well drained soils.

  Dominant species: Sugar maple (*Acer saccharum*)
  White ash (*Fraxinus americana*)
  Red maple (*Acer rubrum*)

- *Pine-Spruce Community* - found, within the corridor, only on watershed lands adjacent to Lake Konomoc. The dominant species in this community are white pine (*Pinus strobus*) and red spruce (*Picea rubens*), however, other species include Norway spruce (*Picea abies*) and white spruce (*Picea glauca*). There is very little understory associated with this community, especially in mature stands. Where light penetrates to the forest floor, young white pine and sugar maple saplings are common.

  Dominant species: White pine (*Pinus strobus*)
  Red spruce (*Picea rubens*)

Over 270 non-dominant vegetation species were also documented during data collection in the field. Some noteworthy tree species observed within the corridor include butternut (*Juglans cineria*), hackberry (*Celtis occidentalis*), and sweetgum (*Liquidambar styraciflua*). These trees are worthy to note since they are uncommon in the corridor.

In addition to forested communities, there are non-forested communities within the corridor which exhibit different types of vegetation and habitat. Grasslands are scattered throughout the corridor; they are generally associated with agricultural operations, but

also occur in areas where the land has recently been disturbed by human activity, such as gravel mining operations. Grasslands are common in the central portion of the corridor, however, they are relatively small compared to the forest areas.

Shrublands also occur within the corridor, generally occur in abandoned agricultural field areas in successional stages of reforestation. These areas are dominated by shrub vegetation interspersed with grasses and forbs. The dominant species include red cedar (*Juniperus virginiana*), multiflora rose (*Rosa multiflora*), Russian olive (*Elaeagnus angustifolia*), green brier (*Smilax spp*.), sweet gale (*Myrica gale*), and sweet fern (*Comptonia peregtrina*). Shrublands also include scrub-shrub wetland areas, which occur sporadically in the project area. Dominant species in this type of wetland system include highbush blueberry (*Vaccinium corrymbosum*), winterberry (*Ilex verticillata)*, speckled alder (*Alnus rugosa*), smooth alder (*Alnus serrulata*), meadow sweet (*Spirea latifolia*), steeple bush (*Spirea tomentosa*), willows (*Salix spp*.), sweet pepperbush (*Clethra alnifolia*), northern arrowwood (*Viburnum dentatum*), and buttonbush (*Cephelanthus occidentalis*).

Vegetation Classification Survey: A vegetation classification survey was conducted in the field as part of the 2004-2005 biological surveys to verify vegetation communities present within the study area. Surveys were conducted along the 16 transects that were established for the Avian Surveys (Figure 4-17). The transects traverse extensive sections of habitat blocks, identified below in Section 4.4.8, as well as other habitats. Survey classifications were conducted using *Vegetation Classification for Connecticut* (Metzler and Barrett Draft 2004), the most current vegetation classification system developed to date for the state. Communities that did not fit under this system were classified using a system developed specifically for the study area (*Biological Survey Report, 2006*).

The survey documented additional detail on the distribution of vegetation communities and corresponding natural communities observed along each transect. In general, the vegetation associations and communities documented within the survey area correspond to the more general primary community types discussed above. All of the community types originally documented were verified in the field during the 2004-2005 vegetation survey. Of the five primary plant community types, the first four were found within the alignment of preferred alternative $E_{(4)}$m-V3. Only the pine-spruce community does not occur there.

The field survey provided further refinement of the community type data. Twenty-one different vegetation associations, as described by Metzler and Barrett Draft 2004, were recorded and mapped (*Biological Survey Report, 2006*). These associations and the corresponding primary community type are provided in Table 4-30. Of these 21 communities, many were further divided into sub-associations (i.e. similar in dominant species to the community type, but differing in sub-dominant species). There were 28 sub-associations identified.

TABLE 4-30
VEGETATION COMMUNITIES DOCUMENTED IN 2004-2005 VEGETATION SURVEY

PRIMARY COMMUNITY TYPE	VEGETATION COMMUNITY TYPE 2004-2005 SURVEY [1]
Mixed Oak Community	Northern red oak/black oak/chestnut oak (chestnut oak co-dominant) Northern red oak/yellow birch Northern red oak/flowering dogwood Northern red oak/rock polypody
Chestnut Oak Community	Northern red oak/black oak/chestnut oak (chestnut oak dominant)
Red Maple Community	Red maple/skunk cabbage Red maple/highbush blueberry
Maple-Ash Community	Sugar maple/white ash/American basswood Pignut hickory/white ash Sugar maple/oak
Pine-Spruce Community	Eastern hemlock
Shrublands	Highbush blueberry Scrub/grass complex Early successional Common meadowbeauty
Grasslands	Little bluestem/poverty grass Scrub/grass complex Mowed lawn Emergent wet meadow Common reed Twig rush Woollyfruit sedge

[1] Biological Survey Report, 2006

The relative dominance of each association within the vegetation classification survey area (i.e. 16 transects) is listed in Table 4-31. Of a total of 23,260 linear m. (76,321 ft.) of transect, over 40% is dominated by the northern red oak/black oak/chestnut oak association.

TABLE 4-31
OVERALL PERCENT DOMINANCE – VEGETATION TRANSECTS 1 THROUGH 16

VEGETATION COMMUNITY TYPE[1]	PERCENT DOMINANCE
Northern red oak/black oak/chestnut oak	40.9
Northern red oak/yellow birch	17.4
Little bluestem/poverty oatgrass	7.2
Northern red oak/flowering dogwood	6.5
Red maple/skunk cabbage	5.5
Shrub/grass complex	4.8
Red maple/highbush blueberry	4.6
Early successional	2.6
Sugar maple/white ash/American basswood	2.3
Eastern hemlock	2.1
Pignut hickory/white ash	1.5
Highbush blueberry	1.3
Sugar maple/oak	1.1
Mowed lawn	0.8
Other (paved roadways)	0.3
Northern red oak/rock polypody	0.3
Emergent wet meadow	0.2
Common reed	0.2
Twigrush	0.1
Woollyfruit sedge	0.1
Common meadowbeauty	0.1
Palustrine open water/aquatic bed	0.1
Total	**100**

[1] Biological Survey Report, 2006

The survey also verified the presence of shrubland and grassland communities within the study area. The vegetation classification survey serves as a good representation and verification of vegetation communities within the entire study corridor.

A list of identified vegetation species was also compiled during the 2004-2005 vegetation classification survey, resulting in a total of 544 species of vascular plants documented along the survey transects. The survey documented more species than the original field investigations because it included a broader area of study and a more in-depth investigation of upland areas. State or federally listed species found during this vegetation classification survey were: small whorled pogonia (*Isotria medeoloides*) (federally threatened/state endangered), creeping bush-clover (*Lespedeza repens*) (state special concern), New England grape (*Vitis novae-angliae*) (state special concern), slender needlegrass (*Aristida longespica*) (state special concern), and purple milkweed (*Asclepias purpurascens*) (state special concern). Additional information on listed species is provided in Section 4.4.7.

4.4.2 FISHERIES RESOURCES

One of the largest and most important riverine systems in the area is Latimer Brook, which flows from Salem Turnpike south to Flanders, before discharging into the Niantic River. Latimer Brook exhibits many favorable characteristics of fisheries habitat such as pools, riffles, and meanders; it also has abundant cover, generally composed of vegetation, boulders/rocks, and undercut banks. Much of the brook is shaded by tree cover, however, there are a number of areas which are in full sun. The brook has been dammed at two sites within the corridor; the first is located just north of I-95 in East Lyme, where an abandoned concrete dam exists. DEP, however, has installed a fish ladder around the dam, to facilitate fish movement and migration. The second dam is located off Silver Falls Road in Montville. A concrete spillway restricts flow and creates a ponded area on the north and south sides of Route 161.

Many of the other smaller brooks within the corridor also provide fisheries habitat. These include Harris, Shingle Mill, and Fraser Brooks, which are located in the northern portion of the corridor and discharge to the eastern branch of the Eight Mile River. Also, Lakes Pond Brook and Oil Mill Brook are important fisheries resources in the southeastern portion of the project area. In addition to riverine systems, there are several lakes and ponds within the corridor which are important fisheries resources. Horse Pond and Lake Konomoc are the two major lacustrine wetlands within the corridor. Horse Pond is a DEP-owned recreation area, heavily used by fishermen. DEP has not conducted fish sampling in this pond, therefore, no data is available. Based on discussions with local fishermen, bluegill, pumpkinseed and rainbow trout have been caught there. Other species such as pickerels, bass and perch could be expected there also. In addition, water company personnel have reported that there is a land-locked population of striped bass in Lake Konomoc. DEP currently has a stocking program for Latimer Brook within the project area. Approximately 7.5 km. (4.7 mi.) of Latimer Brook area is stocked annually. Pre-season stocking includes 1,400 trout; in-season stocking includes 1,550 trout.

4.4.3 AVIAN RESOURCES

Avifauna within the corridor area is diverse due to the number of habitat types present. Habitat types such as mixed hardwoods of varying age categories, coniferous forest, grasslands, shrublands, open water, and emergent, shrub and forested wetlands can all be found within the corridor. Modified by variations in topography, climate and other factors, these habitats are even more dynamic and diverse. Many species of avifauna prefer or require certain types of habitat, while others are generalists, and are able to utilize different habitat types. Most forest habitat areas have good plant layer community structure, meaning they have representative vegetation from the tree, sapling, shrub, liana, herbaceous, and moss categories. Many of the forest areas also have abundant snags which are utilized by woodpeckers and other cavity nesters such as Black-capped Chickadee (*Poecile* [*Parus*] *atricapillus*) and White-breasted Nuthatch (*Sitta carolinensus*).

An inventory of bird species was compiled for the corridor area. This was accomplished by utilizing a number of sources such as *The Atlas of Breeding Birds of Connecticut* (Bevier 1994), the *Breeding Bird Survey*, and field observation. The *Atlas of Breeding Birds of Connecticut* was utilized to determine which species have been documented as breeders within the corridor area. According to the atlas, 84 bird species have been confirmed breeders, 22 species are probable breeders and 11 are possible breeders within the corridor, comprising a total of 117 breeding species.

Upland habitat within the corridor is composed primarily of deciduous hardwood forests which are inhabited by bird species such as the Downy (*Picoides pubescens*) and Hairy (*Picoides villosus*) woodpeckers, White-breasted Nuthatch, and Black-capped Chickadee. Other species, which prefer larger forest blocks of this habitat type, are the Ovenbird (*Seiurus aurocapillus*), Wood Thrush (*Hylocichla mustelina*), Red-eyed Vireo (*Vireo olivaceus*), Worm-eating Warbler (*Helmitheros vermivorus*), and the Scarlet Tanager (*Piranga olivacea*). Also, an uncommon and local migratory breeder in Connecticut, the Cerulean Warbler (*Dendroica cerulea*), prefers this type of habitat (Ellison, 1994). All of the species listed above were observed within the corridor during this study.

Red maple forests are common in the corridor. These areas, generally associated with wetlands, tend to be inhabited by different species than upland hardwood forests. The understory of red maple forests is quite different from the northern hardwood forests, thereby providing different food and cover opportunities. Species such as the Louisiana Waterthrush (*Seiurus motacilla*), Eastern Screech-owl (*Megascops* [*Otus*] *asio*), Downy and Hairy woodpeckers, Tree Swallow (*Tachycineta bicolor*), Black-capped Chickadee, Carolina Wren (*Thyrothorus ludovicianus*), Veery (*Catharus fuscescens*), Gray Catbird (*Dumetella carolinensis*), Warbling Vireo (*Vireo gilvus*), Yellow Warbler (*Dendroica petechia*), American Goldfinch (*Carduelis tristis*) and Common Yellowthroat (*Geothlypis trichas*) are common to this habitat. The Red-shouldered Hawk (*Buteo lineatus*), Hooded Warbler (*Wilsonia citrina*), and White-eyed Vireo (*Vireo griseus*) are three uncommon species observed in red maple wetlands within the corridor.

Common grassland/shrubland species included the Turkey Vulture (*Cathartes aura*), Red-tailed Hawk (*Buteo jamaicensis*), Killdeer (*Charadrius vociferus*), American Woodcock (*Scolopax minor*), Northern Rough-winged Swallow (*Stelgidopteryx serripennis*), Bank Swallow (*Riparia riparia*), Northern Mockingbird (*Mimus polyglottus*), Blue-winged Warbler (*Vermivora pinus*), Field Sparrow (*Spizella pusilla*), and Song Sparrow (*Melospiza melodia*). The Savannah Sparrow (*Passerculus sandwichensis*), a state species of concern, was observed within the corridor in early spring. This bird was most likely a migrant.

Some other types of specialized habitat in the corridor are emergent and open water wetlands. These areas tend to be inhabited by Mallards (*Anus platyrhynchos*), Black Duck (*Anus rubripes*), Swamp Sparrow (*Melospiza georgiana*), Canada Goose (*Branta*

canadensis), Red-winged Blackbird (*Agelaius phoeniceus*), and Common Grackle (*Quiscalus quiscula*). These habitats are unique, providing areas of ponded water and different emergent and submergent native plant species that provide food and cover. Additionally, there are a number of beaver impoundments within the corridor, which provide many snags for cavity nesters of open areas such as the Tree Swallow and Eastern Bluebird (*Sialis sialis*).

There are a number of species within the corridor that prefer large blocks of unfragmented forest land for successful breeding. The large forest blocks greatly reduce the amount of predation on these sensitive species. Predators such as the Brown-headed Cowbird (*Molothrus ater*) tend to occur in higher numbers at the edges of large forest blocks and are less common deeper within the blocks. Because of this, many species, such as the Cerulean Warbler, Scarlet Tanager, Wood Thrush, Ovenbird, and Hooded Warbler, experience more successful breeding deep within the forest blocks.

Habitats which support migrating species are important because they provide temporary food and cover. This allows the birds to rest in a safe area and to replenish their food stores, which they will need to complete the trip to summer breeding grounds.

Avian Surveys: Seasonal avian surveys were conducted as part of the biological field surveys between September 2004 and September 2005. These field studies were intended to determine the presence and overall distribution of bird species across the survey area, with a focus on federal and Connecticut listed species.

Surveys were conducted by competent observers on 16 transects and 12 point locations in early-mid spring, late spring, and summer (Figure 4-17). Four additional transects were surveyed in June for Whip-poor-will (*Caprimulgus vociferous*) and two winter transect surveys were performed for Short-eared Owl (*Asio flammeau*). The surveys documented 144 species over the three survey seasons. The comprehensive tally included a mixture of winter residents, spring migrants, summer breeders, and summer residents. The results of the seasonal surveys, and additional observations made during field surveys of other taxa, documented the changes in the avian communities with season. The forest interior bird species identified in the scientific literature to be resident within southeastern Connecticut forests were also detected within the survey area as a result of this effort. Comparing the total number of bird species detected within each habitat block (described below in Section 4.4.8), or survey location representative of a specific habitat, forest Habitat Block Nos. 2 and 4 had the highest percentage of forest interior bird species throughout the three survey seasons. A majority of the bird population detected during the breeding season was composed of neotropical migrant species.

4.4.4 MAMMALIAN RESOURCES

The study corridor exhibits many of the mammal species commonly found in the southeastern part of the state. Mammals within the corridor were inventoried based on

field observation and by consultation with federal, state, and local agencies, as well as a comprehensive literature search. According to DeGraaf and Rudis (1987), 45 species of wildlife may occur within the geographical range that includes the project area. With only a few exceptions, most of the mammals found in forests tend to be generalists in terms of forest type; fewer generalists are found among the birds and herpetofauna. Many of the species which may occur in the corridor can be found in all types of deciduous and coniferous forests. However, some species, such as the Virginia opossum (*Didelphis virginiana*), eastern (*Sylvilagus floridanus*) and New England (*Sylvilagus transitionalis*) cottontails, beaver (*Castor canadensis*), white footed mouse (*Peromyscus leucopus*), woodland jumping mouse (*Napaeozapus insignis*), and raccoon (*Procyon lotor*), prefer deciduous cover over coniferous cover, but many are found in all habitats. Only the red squirrel (*Tamiasciurus hudsonicus*) and deer mouse (*Peromyscus maniculatus*) prefer coniferous forests.

Grasslands and shrublands within the corridor provide habitat for species such as the eastern mole (*Scalopus aquaticus*), eastern cottontail, woodchuck (*Marmota monax*), white-footed mouse, meadow vole (*Microtus pennsylvanicus*), meadow jumping mouse (*Zapus hudsonius*), red fox (*Vulpes vulpes*), ermine (*Mustela erminea*) and striped skunk (*Mephitis mephitis*). Wetland areas are preferred habitat for species such as the water shrew (*Sorax palustris*), northern short-tailed shrew (*Blarina brevicauda*), New England cottontail, beaver, muskrat (*Ondatra zibethicus*), raccoon, mink (*Mustela vison*), and river otter (*Lutra canadensis*).

Mammalian Surveys: The 2004-2005 biological surveys included the identification of wildlife movement corridors along the preferred alignment $E_{(4)}$m-V3. Surveys for mammal tracks and other signs (scat, tree and shrub markings, bedding areas, trails, etc.) were conducted in winter and spring, and collectively resulted in the documentation of 16 mammalian species (Table 4-22), including bobcat and fisher, two top predators, both of which were identified via tracks within the two large contiguous forest habitat blocks (see Section 4.4.8). Signs of black bear (claw marks) were also observed. Bats were observed in various habitats although specific surveys were not conducted. A member of the vespertines, little brown bat (*Myotis lucifugus*), was identified.

The winter and spring survey efforts served to identify and further define movement locations across the proposed alignment and within all habitats. Movement corridors were identified for river otter, mink, red fox and white-tailed deer. It was found that coyote, gray fox, fisher, and bobcat did not necessarily use distinct corridors but instead may move in more stochastic movements while actively searching for food. White-tailed deer were found to use corridors in some areas, while in other areas their movements appeared to be more stochastic. Distinct deer corridors were noted at a number of

TABLE 4-32
MAMMAL SPECIES FOUND WITHIN THE CORRIDOR SURVEY AREA

ORDER/Family/Species

INSECTIVORA

Talpidae
- Eastern mole (*Scalopus aquaticus*)

CHIROPTERA

Vespertilionidae
- Unidentified bat (vespertine spp.)

LAGOMORPHA

Leporidae
- Eastern cottontail (*Sylvilagus floridanus*)
- New England cottontail (*Sylvilagus transitionalis*)

RODENTIA

Sciuridae
- Eastern chipmunk (*Tamias striatus*)
- Gray squirrel (*Sciurus carolinensis*)
- Red squirrel (*Tamiasciurus hudsonicus*)

Castoridae
- Beaver (*Castor canadensis*)

Muridae
- White-footed mouse (*Peromyscus leucopus*)
- Muskrat (*Ondatra zibethicus*)

Dipodidae
- Woodland jumping mouse (*Napeozapus insignis*)

CARNIVORA

Canidae
- Coyote (*Canis latrans*)
- Red fox (*Vulpes vulpes*)
- Gray fox (*Urocyon cinereoargenteus*)

Ursidae
- Black bear (*Ursus americanus*)

Procyonidae
- Raccoon (*Ursus americanus*)

Mustelidae
- Fisher (*Martes pennanti*)
- Long-tailed weasel (*Mustela frenata*)
- Mink (*Mustela vison*)
- River Otter (*Lontra canadensis*)

Felidae
- Bobcat (*Lynx rufus*)

locations along the alignment, many times found along man-made features such as woodland trails, power line easements and along property boundary survey traverses. In some but not all areas, white-tailed deer corridors corresponded to locations where structures (e.g. bridges, culverts) facilitating the movement of other wildlife species have been incorporated in the roadway conceptual design.

Other animals exhibited movements along distinct habitat, topographic, or hydrologic features. Examples include the river otter (movement along the Shingle Mill beaver flowage), mink (movement along a tributary to Shingle Mill Brook), and red fox (movement along the shrubland ecotone within a power line easement).

Targeted surveys were also conducted for New England cottontail in 2004-2005. Mitochondrial DNA testing was utilized to confirm the presence of this species at two locations along the preferred alignment corridor (the power line in Montville and the rock cut on the unfinished section of Route 11 south of Route 82), while at a third potential location the testing was inconclusive. The habitat at all three locations was created by past human disturbance and consists of deciduous cover containing a high woody stem count density in the shrub layer.

4.4.5 REPTILIAN/AMPHIBIAN RESOURCES

Reptiles and amphibians (herpetofauna) were investigated within the study area concurrently with wetland and upland documentation. Field investigations for herpetofauna consisted primarily of direct observation, but also included hand capture, log-rolling, and searching under rocks and debris. Reports from local, state and federal agencies as well as local residents have also been considered in developing a herpetofauna inventory for the corridor area. According to Klemens (1993), 17 amphibian and 19 reptilian species may occur within the study corridor. During field investigations, nine amphibian species were observed and eight reptilian species were observed. Amphibian species tended to be more common in or near wetland areas, since many amphibian species utilize wetlands for breeding purposes.

Virtually all of the amphibian species that may occur in the corridor either prefer, or utilize to some extent, forested red maple wetlands. Some of the more common species observed in the corridor include the red-spotted newt (*Notophthalmus v. viridescens*), red-backed salamander (*Plethodon cinereus*), bull frog (*Rana catesbeiana*), green frog (*Rana clamitans melanota*), pickerel frog (*Rana palustris*), wood frog (*Rana sylvatica*), spring peeper (*Hyla c. crucifer*), and American toad (*Bufo a. americanus*). Many of these amphibians utilize temporary pools (vernal pools) or woodland ponds for breeding. The advantage of using temporary ponds for breeding is the absence of predators such as fish and most turtles. There are a number of wetlands in the corridor which have been identified as vernal pool habitat.

Reptile species were found in a variety of habitats. The northern water snake *(Nerodia s. sipendon*), eastern garter snake (*Thamnophis s. sirtalis*), spotted (*Clemmys guttata*), snapping (*Chelydra s. serpentina*), and eastern painted (*Chrysemys p. picta*) turtles were observed in a number of open water and emergent wetlands in the corridor. Species such as the eastern milk snake (*Lampropeltis t. triangulum*), northern black racer (*Coluber c. constrictor*), and northern ringneck snake (*Diadophis punctatus edwardsii*) were found in dryer upland areas.

Herpetofauna Surveys: Herpetofauna surveys conducted as part of the 2004-2005 biological survey focused on two state listed wetland species – eastern ribbon snake (*Thamnophis s. sauritus*) and wood turtle (*Glyptemys insculpta*). All species encountered in the field were recorded. Survey area limits included the footprint of the preferred alternative E(4)m-V3 alignment, and the area within 230 m. (750 ft.) from the edge of disturbance on each side of the proposed roadway. Areas within the 230 m. (750 ft.) area that are currently developed were not surveyed.

Transect surveys bisected the following habitat types: lowland riparian areas bordered by floodplain, woodland, or meadows; swift, clear pebble-bottomed streams; meandering sand or organic substrate streams; beaver impoundments; and wooded swamps – all habitats known to be frequented by the target species (Klemens, 1993). Nine survey transects (1 through 9, Figure 4-17) were located along major streams that bisect or are proximal to the preferred alignment. The survey area also included the adjacent riparian corridor. Further detail on methodology is provided in the *Biological Survey Report*.

In total, 26 herpetofaunal species were encountered within the survey area. The surveys added nine observed herpetofauna species for the study area in addition to the 17 previously observed. The 26 species are listed in Table 4-33. Two state special concern species, the eastern ribbon snake and the eastern box turtle (*Terrapene c. carolina*) were confirmed as residents of the survey area. The eastern ribbon snake was found in wetlands associated with Latimer Brook that are outside of the $E_{(4)}$m-V3 alignment direct impact area, and along Shingle Mill Brook proximal to where the alignment crosses the drainage. The eastern box turtle was encountered near lower Pember Road, outside of the anticipated impact area of the preferred alternative, but within the area of impact of the other new location full build alternatives. A possible nesting site for the wood turtle, a state species of special concern, was encountered along Latimer Brook outside and upstream of the $E_{(4)}$m-V3 alignment direct impact area. Section 4.4.7 provides further detail regarding these listed species within the corridor.

4.4.6 WILDLIFE SPECIES/COMMUNITY DIVERSITY

The study corridor exhibits good wildlife species and community diversity. Due to the expanse of the study area, many types of communities and habitats are represented; consequently, high numbers of species were expected. The actual numbers of species

TABLE 4-33
HERPETOFAUNA FOUND WITHIN THE CORRIDOR SURVEY AREA

ORDER/Family/Species

CAUDATA

Ambystomatidae
- Marbled salamander (*Ambystoma opacum*)
- Spotted salamander (*Ambystoma maculatum*)

Salamandridae
- Red-spotted newt (*Notophthalmus v. viridescens*)

Plethodontidae
- Northern dusky salamander (*Desmognathus fuscus*)
- Northern redback salamander (*Plethodon cinereus*)
- Four-toed salamander (*Hemidactylium scutatum*)
- Northern two-lined salamander (*Eurycea bislineata*)

ANURA

Bufonidae
- Eastern American toad (*Bufo a. americanus*)

Hylidae
- Northern spring peeper (*Pseudacris c. crucifer*)
- Gray treefrog (*Hyla versicolor*)

Ranidae
- Bullfrog (*Rana catesbeiana*)
- Green frog (*Rana clamitans melanota*)
- Wood frog (*Rana sylvatica*)
- Pickerel frog (*Rana palustris*)

TESTUDINES

Chelydridae
- Common snapping turtle (*Chelydra s. serpentina*)

Emydidae
- Spotted turtle (*Clemmys guttata*)
- Eastern painted turtle (*Chrysemys picta*)
- Eastern box turtle (*Terrapene c. carolina)*

SQUAMATA (SUBORDER SERPENTES)

Colubridae
- Northern water snake (*Nerodia s. sipedon*)
- Garter snake (*Thamnophis sirtalis*)
- Eastern ribbon snake (*Thamnophis sauritus*)
- Northern ringneck snake (*Diadophis punctatus*)
- Northern black racer (*Coluber c. constrictor*)
- Black rat snake (*Elaphe o. obsoleta*)
- Eastern milk snake (*Lampropeltis t. triangulum*)
- Northern brown snake (*Storeria d. dekayi*)

reported during field investigations in the study area have been moderate to high. Because the study area is located in two ecoregions, both influence the species and community diversity. These two influences were observed in the field through the documentation of vegetation and wildlife species. For example, the American holly (*Ilex opaca*), sweetgum (*Liquidambar styraciflua*), white-eyed vireo (*Vireo griseus*), and double-crested cormorant (*Phalacrocorax auritus*) are generally associated with coastal areas in the state, and are less common as one moves away from the coast. As would be expected, these four species were observed in the southern portion of the corridor, but not in the northern portion.

Most of the initial field investigations took place during only a short period of time, from the late winter of 1997 to mid summer of 1998. Field observations have been referenced in addition to a number of existing information sources identified through literature searches and correspondence with local, state, federal, academic and public sources. Field inventories conducted during this study may be affected by a number of natural phenomena such as natural wildlife population fluctuations resulting from climate, seasonal weather and/or man-made conditions, inconsistent use of areas by wildlife, or species which are difficult to observe. All of these factors have been considered while assessing habitat types and quality so that wildlife species are not discounted or underestimated.

Biological field surveys conducted between September 2004 and September 2005 resulted in the collection of more detailed information on the distribution of flora and fauna and biodiversity.

Vegetation Species/Community Diversity: Twenty-one vegetation communities were documented within the corridor. Many of these were further divided into a total of 28 sub-associations (i.e. similar in dominant species to the community type, but differing in sub-dominant species). Community type diversity within the corridor is low to moderate, with over 65% of the community types dominated by oak forests. Of this, over 40% is dominated by a single community type, the Northern red oak/black oak/chestnut oak community (Table 4-31). The study area is unremarkable in terms of species and habitat diversity as compared with other parts of the southeast region and the state. Exceptions are several areas containing listed species, and other vegetation communities with a potential for harboring listed species, which include, the twigrush, woollyfruit sedge, common meadowbeauty, pignut hickory—white ash, and emergent wet meadow associations.

During the 2004-2005 field survey, a total of 544 vegetation species were documented. Based on the size of the area surveyed, 544 species represents low to moderate species diversity.

Avian Species Diversity: A high proportion of the bird community in deciduous forests is typically composed of migratory species (DeGraaf et al., 1991). Therefore, it was not

surprising that a high proportion of the species in the breeding bird communities of the survey areas were found to be migratory species as well. The results of the surveys conducted in March/April 2005 and in May 2005 documented the movement of spring migrants through the survey areas. Species diversity was lowest during the winter, highest during the spring surveys, and then reduced again by summer. Although population densities were not estimated, the total bird population is expected to be highest during the peak of spring and fall migrations, and during late summer when the habitats are infused with juveniles born that year. These findings are similar to those reported in the preliminary results of the migratory bird stopover survey conducted for the Silvio O. Conte National Wildlife Refuge System, which includes the nearby Connecticut River watershed (www.science. smith.edu/stopoverbirds).

Herpetofauna Species Diversity: Twenty-six herpetofaunal species were identitied during the 2004-2005 survey, belonging to four orders and nine families, indicating good diversity within the corridor. A complete list of all species found during the surveys was provided in Table 4-33 (Section 4.4.5). The study area is within the known range and occupied habitat types of the worm snake, smooth green snake, eastern hognose snake, musk turtle, Fowler's toad, and northern copperhead snake, however these species were not observed. A possible nesting site for wood turtle was found in the study, but this species was not confirmed.

Aquatic Invertebrate Species/Community Diversity:

Benthic Macroinvertebrates

Benthic macroinvertebrate sampling was conducted during stream bioassessments performed for the 2004-2005 surveys. Ten streams, representing both high and low order streams and tributaries within the watersheds of the study area, were sampled. The results showed that these streams support diverse communities of macroinvertebrates that are indicative of good to excellent water quality. Using the benthic macroinvertebrate community as an indicator, the streams sampled meet the following DEP Class A criteria for this community:

- A wide variety of macroinvertebrate taxa were present.
- All functional feeding groups were well represented.
- Presence and productivity of aquatic species was not limited except by natural conditions, permitted flow regulation, or irreversible cultural impacts.
- Water quality was apparently sufficient to sustain a diverse benthic macroinvertebrate community of native species.
- Taxa within the orders Ephemeroptera, Plecoptera and Trichoptera (EPT) were well represented.

Odonata (Dragonflies and Damselflies)

Odonata surveys were also performed in 2004-2005. Sixty species of Odonata were identified, including one state threatened dragonfly, the tiger spiketail (*Cordulegaster erronea*). The greatest species diversity of Odonata was seen at or around the Shingle Mill Brook system, where 25 species were identified. The tiger spiketail was found along a tributary to Latimer Brook, south of Silver Falls, where larvae of this species were also found in stream bioassessment samples.

Two county records of brook snaketail (*Ophiogomphus aspersus*) and Maine snaketail (*O. mainensis*) were made during the surveys. These dragonflies, which are not listed by DEP as special concern, threatened, or endangered, were found in Latimer Brook in Montville. One state threatened butterfly, the frosted elfin (*Callophrys irus*), was also encountered during the Odonata surveys along the rock cut at the existing terminus of Route 11.

4.4.7 THREATENED AND ENDANGERED SPECIES

A number of endangered, threatened, and special concern species ("listed species") have been identified within the corridor by federal, state, and local agencies, as well as by field investigations. Correspondence with federal and state agencies revealed that seven protected species may occur in the corridor. Initial field investigations conducted in 1998 revealed three additional species listed at the time as state species of special concern. Information on federal and state threatened and endangered species obtained through agency consultation and initial fieldwork was augmented during the evaluation of preferred alternative $E_{(4)}$m-V3 and during the 2004-2005 biological surveys. In keeping with state mandate that requires periodic revisions of Connecticut's listed species, DEP revised the list of Connecticut's endangered, threatened, and special concern species in 2004. The revisions affected the status of some of the species observed or expected to occur within the project area. Likewise, federal designations of some rare species have changed since initial fieldwork commenced in 1998. Initial and current findings related to state and federally listed species are discussed below.

4.4.7.1 *Federally listed Species:* The FWS has indicated that there are federally threatened and/or endangered species that may occur in the project area. The American Peregrine Falcon (*Falco peregrinus anatum*) and the Bald Eagle (*Haliaeetus leucocephalus*) are transient species, which may be present during migration (FWS correspondence March 1998). Water company personnel indicated that Bald Eagles were observed during the winter of 1997-98 at Lake Konomoc, which is now likely an annual migratory stopover site for this species.

The Peregrine Falcon was formerly listed as threatened but was delisted on August 25, 1999. Recovered species that are delisted in response to a successful recovery program (such is the case with the Peregrine Falcon) are subjected to a monitoring period to assess the status of the population after delisting. The Bald Eagle was proposed for delisting in February 2006 with a public comment period on the delisting open until May 17, 2006. On July 9, 2007 the FWS published a final rule in the Federal Register, effective August 8, 2007, officially removing the Bald Eagle in the lower 48 states from the federal list of endangered and threatened wildlife. Both the Bald Eagle and Peregrine Falcon remain state endangered species.

The small whorled pogonia (*Isotria medeoloides*) is listed as a federally threatened and state endangered species, and is known to occur in New London County. DEP includes this plant on listed species reports for all counties in Connecticut. FWS announced on January 26, 2007, that the small whorled pogonia would undergo a 5-year review and solicited comments on this species (Federal Register (FR) Volume 72, Number 18). The 5-year review process is used to ensure that the listing classification of a particular species is accurate. Four stems of this species, which may represent three or four individual plants, were found during the vegetation classification surveys on Transect 1 at the edge of the survey area outside the area of potential impacts of the alternatives.

According to the Center for Plant Conservation (2007), small whorled pogonia plants may remain dormant underground for several years. Plants that are dormant more than three years have a smaller probability for regrowth. A single plant may have multiple stems, but it typically does not reproduce vegetatively. The primary method of reproduction is by seed. Plants typically produce only one flower and do not necessarily flower annually. Flowering occurs from about mid-May to mid-June, with the flowers apparently lasting only a few days to two weeks.

This species likes acidic soils in dry to mesic second-growth forests, either deciduous or deciduous-coniferous dominated (Naturserve 2007). It typically is found in an open herb layer or occasionally in dense ferns, moderate to light shrub layer, and relatively open canopy. Small-whorled pogonia populations tend to occur on soils ranging from dry-mesic to wet-mesic. Drought stress may periodically occur and cause premature initiation of dormancy.

The American chaffseed (*Schwalbia americana*) is a federally endangered species with historic records in the state (FWS correspondence March 1998), but is noted as "believed extirpated" by DEP (DEP 2004). The bog turtle (*Clemmys muhlenbergii*) is listed as federally threatened and state

endangered, however, this species is only found in Litchfield and Fairfield Counties.

The Cerulean Warbler, which was detected in the study area as a migrant, was recently the subject of a 12-month finding on a petition to list the species as threatened under the federal Endangered Species Act (ESA) of 1973, as amended (FWS correspondence January 2003). The FWS concluded that the petitioned action was not warranted (FR Volume 71 70717-70733 December 6, 2006.)

The New England cottontail is a candidate mammal species under consideration for inclusion on the FWS ESA list of endangered and threatened wildlife and plants, according to a Candidate Notice of Review (FR 71 53755-53835 published September 12, 2006), and is therefore potentially subject to listing at some future time. This species was found to be present in the study area (see Section 4.4.4).

The status of small whorled pogonia and New England cottontail will be monitored during the design, permitting, and construction phases of the project. Any action(s), including possible Section 7 consultation under the ESA, that are determined to be necessary as a result of changes to the FWS or DEP lists and/or the identification of listed species within the project limits will be conducted as required by federal and/or state law or regulation.

4.4.7.2 *State listed Species:* The DEP Natural Diversity Data Base (NDDB) identified three areas which are critical habitat for state protected species within the project area. Horse Pond, located west of Route 85, south of the intersection of Routes 82 and 85, supports a population of Small's Yellow-Eyed Grass (*Xyris smalliana*), a state endangered plant species. Horse Pond is a man-made resource owned and maintained by DEP. The status of Small's yellow-eyed grass was not affected by the 2004 revision to the list of Connecticut's endangered, threatened, and special concern species.

Another area identified by DEP is the Silver Falls area, located near Route 161. The DEP has an historic report of American Chaffseed (*Schwalbia americana*) at a "dry gravelly bank three miles north of Flanders." Historic records of this federally endangered species are known from the project area. This species is listed by DEP as "believed extirpated" and therefore is assigned a special concern status designation. The status of American Chaffseed was not affected by the revision to the list of Connecticut's endangered, threatened, and special concern species in 2004.

The third area identified by the DEP NDDB as formerly harboring a rare species is "Latimer Brook." The area formerly supported a population of

Thread-leaf Sundew (*Drosera filiformis*). Initial consultation with DEP in February and August 1998 identified this insectivorous plant as an endangered species in Connecticut that was currently proposed for reclassification as a species of state special concern (historic). The reclassification was proposed by the DEP NDDB at that time because their staff was unable to relocate the plant in the field at the site where it was formerly known to occur. In the 1998 revision to the list of Connecticut's endangered, threatened, and special concern species, the thread-leaf sundew was listed as "believed extirpated" and therefore was assigned a special concern status designation. The status of thread-leaf sundew was not affected by the 2004 revision.

The DEP NDDB also reported that the state special concern bird species, Whip-poor-will, occurs in the corridor study area (DEP correspondence February 2002). Surveys for this species were conducted during the 2004-2005 biological surveys (refer to Section 4.4.3).

A single sweet gum (*Liquidambar styraciflua*) individual was identified in an area along Route 85 in Waterford, adjacent to Lake Konomoc, during initial studies. This species is listed as state special concern for native populations only (DEP, 2004). Due to the location of the individual in a previously human-manipulated landscape and its proximity to a spruce plantation and Route 85 (an old heavily traveled road), we believe this individual is not naturally occurring and was likely planted or inadvertently seeded. No other individuals were detected along any of the other alternative alignments. This species has not been detected since that time and was not encountered during the 2004-2005 field surveys.

In addition to the species identified by DEP above, three other species of concern were observed in the field during initial field work in 1998. They are the Red-shouldered Hawk (*Buteo lineatus*), Savannah Sparrow (*Passerculus sandwichensis*), and Brown Thrasher (*Toxostoma rufum*). Of these, the Red-shouldered Hawk and Brown Thrasher were observed in early summer, while the Savannah Sparrow was observed in early spring. Based on the time of year of the sightings, it is probable that the hawk and thrasher are residents, and the sparrow was a migrant. With the 2004 DEP revision of listed species, Red-shouldered Hawk was no longer state listed, and both the Brown Thrasher and Savannah Sparrow remained as special concern species.

The 2004-2005 surveys confirmed or reconfirmed the presence of 23 listed species within the survey area, including two federally listed and two species that were under review for federal listing. The species and the general locations where they were detected are provided in Table 4-34.

TABLE 4-34
LISTED SPECIES DETECTED DURING BIOLOGICAL SURVEYS 2004-2005

SCIENTIFIC NAME	COMMON NAME	FEDERAL/STATE LISTING CATEGORY[1]	LOCATION
PLANTS			
Isotria medeoloides	Small whorled pogonia	Federal threatened/ state endangered	Transect 1
Lespedeza repens,	Creeping bush-clover	State special concern	Transect 16
Vitis novae-angliae	New England grape	State special concern	Transect 10
Aristida longespica	Slender needlegrass	State special concern	Transects 10 and 16
Asclepias purpurascens	Purple milkweed	State special concern	Old New London Road (west side)
INVERTEBRATES			
Callophrys irus	Frosted Elfin	State threatened	Transect 16
Cordulegaster erronea	Tiger Spiketail	State threatened	Transect 4
Margaritifera margaritifera	Eastern Pearlshell	State special concern	Fraser Brook
HERPETOFAUNA			
Terrapene c. carolina	Eastern Box Turtle	State special concern	Transect 2
Thamnophis s. sauritus	Eastern Ribbon Snake	State special concern	Transect 9
BIRDS			
Ardea alba	Great Egret	State threatened	Banning Cove, Niantic Bay
Accipiter striatus	Sharp-shinned Hawk	State endangered	Habitat Block No. 2 (Station 14 +120)
Caprimulgus vociferous	Whip-poor-will	State special concern	Habitat Block No. 2 (reported by resident)
Circus cyaneus	Northern Harrier	State endangered	Transect 16
Corvus corax	Common Raven	State special concern	Habitat Block Nos. 1 and 2
Dendroica cerulea	Cerulean Warbler	Federal review finding – listing not warranted	Habitat Block No. 2
Dolichonyx oryzivorus	Bobolink	State special concern	Grassy Hill Road
Egretta thula	Snowy Egret	State threatened	Banning Cove, Niantic Bay
Falco sparverius	American Kestrel	State threatened	Private Farm east of Route 161
Gavia immer	Common Loon	State special concern	Flyover
Haliaeetus leucocephalus	Bald Eagle	State endangered Federal threatened[2]	Flyover
Parula americana	Northern Parula	State special concern	Habitat Block No. 2 and between 4 and 5
Toxostoma rufum	Brown Thrasher	State special concern	Western edge of Habitat Block No. 2 and Transect 16
MAMMALS			
Sylvilagus transitionalis	New England Cottontail	Federal ESA candidate	Transects 16 and 10

[1] FWS, DEP 2004 [2] Delisted, effective August 8, 2007

4.4.8 HABITATS

A species habitat is the physical and biotic environment where it is adapted to live and which contains all its survival needs. It includes, but is not limited to, land and water area, physical structure and topography, flora, fauna, climate, human activity, and the quality and chemical content of soil, water, and air. Examples of important (i.e., rare and with restricted distribution in the state) biologic habitats include old-growth forests, sand plains, and cedar swamps (Dowhan and Craig, 1976). Species that require very specialized types of habitat, such as a white cedar swamp, can be especially vulnerable to habitat changes and/or modifications. During colonial times, much of the area in the corridor had been cleared of its forest for farmland, charcoaling, timber, and pasture. Since that time many farms have become inactive, and the forest areas have grown again into mature forest ecosystems. Farm and pasture land, which has more recently become inactive, has turned into old-field habitat characterized by grass areas with scattered early-succession vegetative species. Other types of habitat include forested wetlands, scrub-shrub wetlands, emergent wetlands, open water, floodplains, and pine plantations.

4.4.8.1 *Wetlands as an Important Habitat Feature:* Wetlands within the study corridor range from forested red maple wetlands to scrub-shrub and emergent wetland areas. Watercourses and open water are quite diverse within the corridor, ranging from intermittent streams to large lakes. As described in Section 4.6 of this document, the majority of wetland areas within the corridor are forested wetlands, while scrub-shrub and emergent wetlands are less common. In many cases, riverine areas are associated with forested wetlands, increasing the wildlife value of those systems. Forested wetlands not only provide specialized wetland functions for wildlife, but also provide an extension of unfragmented upland forest areas adjacent to them. Scrub-shrub and emergent wetlands are more open and are preferred by some species of wildlife over forested wetlands.

Many of the wetland areas within the corridor function as wildlife habitat, while some wetland areas have very low wildlife habitat function. Generally, wetland areas that did not have any wildlife habitat functions were either small in size, had low diversity, were previously disturbed by man, or were located near "built" areas. Wetlands which do function as wildlife habitat are generally large in size and more isolated from man-made disturbances.

4.4.8.2 *Forest Blocks:* Forest areas are utilized by many types of wildlife. Some species use forest areas in conjunction with other habitat types, while others are dependent on forest areas for breeding and feeding. Of the forest dependent types of wildlife, birds seem to be the most prevalent, with some species requiring large tracks of undisturbed forest for successful breeding. In an attempt to document areas which are the most important habitats to

forest dependent species, unfragmented forest blocks have been delineated within the corridor.

There have been number of recent studies on the size of forest blocks required for successful breeding of certain "area-sensitive" avian species. Based on the research of a number of leading experts in the field, forest blocks greater than 100 ha. (247 ac.) in size tend to be a more important habitat feature than blocks of lesser size (Askins, et. al.,1987; Freemark, 1988; Lovejoy, et. al., 1986; Askins, personal comm). This document considers blocks of between 50 and 200 ha. (125 and 500 ac.) in size as having moderate value for forest interior species, and blocks greater than 200 ha. (500 ac.) as having high value for these species. The moderate value blocks support fairly successful breeding avian species and are also important for other vertebrate organisms such as amphibians (Rosenburg and Raphael, 1986). Blocks larger than 200 ha. (500 ac.) generally have higher success rates for avian breeders than do the smaller blocks, however, blocks larger than 300 ha. (740 ac.) may have additional habitat value for raptor species (Wilcove, et. al., 1986), such as the Red-Shouldered Hawk found within the project area in Forest Block No. 2.

Unfragmented forest habitat blocks were delineated based primarily on aerial photographs and field investigations. Recent December 1997 aerial photographs were used to identify areas of developed and undeveloped land. Next, it was determined whether the undeveloped areas were forested or non-forested, as only the forested areas would be considered unfragmented forest habitat. To do this, the aerial photographs were interpreted and field-verified as to forest types including deciduous forest, coniferous forest, mixed forest, and forested wetlands. Also, LANDSAT imagery (DEP, 1990) was used as additional verification for interpretations.

All information was then checked against the aerial photographs and field verified. Once this was done, it was determined which forested areas had a width/diameter of more than 500 m. (1,600 ft.). This task was accomplished by first delineating all the forested upland and wetland areas within the corridor. Then, forest areas of a width/diameter greater than 500 m. (1,640 ft.) were delineated as forest blocks, while all other areas less than 500 m. (1,640 ft.) in width/diameter were not delineated. As a final step, the aerial photographs were scrutinized for smaller breaks in the canopy or small inclusions of development in the forest area such as power line easements, roadways, and isolated residential lots. In Askins (1990), unfragmented blocks were separated from each other by a break in tree canopy 10 m. (33 ft.) or more wide.

The end result was the delineation of unfragmented forest habitat blocks, as shown in Figure 4-18. Once these forest blocks were delineated, areas were

obtained for each block. All blocks with areas greater than 200 ha. (500 ac.) were delineated with a solid line, while all blocks with areas between 51 and 200 ha. (125 and 500 ac.) were delineated with dashed lines. Forest blocks greater than 200 ha. (500 ac.) are considered important habitat features for forest-dependent species, while blocks between 51 and 200 ha. (125 and 500 ac.) in size are considered of moderate significance for forest-dependent species. There were two unfragmented forest blocks with areas greater than 200 ha. (500 ac.) and four blocks with areas between 51 and 200 ha. (125 ac. and 500 ac.) as noted in Table 4-35.

TABLE 4-35
UNFRAGMENTED FOREST HABITAT BLOCKS

BLOCK NUMBER	BLOCK SIZE	NOTABLE HABITAT
1	271 ha. (671 ac.)	yes
2	835 ha. (2,065 ac.)	yes
3	94 ha. (233 ac.)	no
4	52 ha. (130 ac.)	no
5	167 ha. (413 ac.)	no
6	77 ha. (190 ac.)	no

Source: Maguire Group, Inc.

The 2004-2005 biological surveys identified forest interior species and area-intensive species that occupy the larger forest blocks bisected by the preferred alternative alignment. Forest interior species are those that find suitable habitat within the interior of contiguous forest lands and avoid edge habitats. Area-intensive species are those that require large, extensive areas as suitable habitat. Examples of forest interior species noted within the unfragmented forest habitat blocks within the study area include but are not limited to the following: broad-winged hawk, pileated woodpecker, Acadian flycatcher, brown creeper, black-throated green warbler, ovenbird, Louisiana waterthrush Canada warbler, and scarlet tanager. Examples of area-sensitive wildlife inhabiting the unfragmented forest habitat blocks within the study area include black bear, fisher, bobcat, and mink.

Also noted during the biological surveys was that Habitat Blocks No. 1 and 2 have been impacted in several areas by proximity to existing and new subdivisions, logging, clear cutting, recreational uses (e.g. hunting, all terrain vehicles) and forest roads.

4.4.8.3 *Grassland Blocks:* Grassland blocks were analyzed for the corridor using a similar method as for the unfragmented forest blocks. Grasslands were delineated based on 1997 aerial photographs and field verification. Once the areas were delineated, areas with a width/diameter of 500 m. (1,640 ft.) or greater were delineated.

Of these areas, however, none were greater than 200 ha. (500 ac.). Therefore, using these criteria, no noteworthy grasslands blocks (i.e., extensive, unfragmented blocks that currently provide suitable breeding habitat to robust populations of obligate grassland fauna of conservation concern) exist within the corridor. The majority of the grassland areas within the corridor are located within the central portion of the corridor near Route 85, Grassy Hill Road, Salem Turnpike, Holmes Road, and Walnut Hill Road.

During the 2004-2005 biological surveys, bobolinks exhibiting breeding behavior were noted within a grassland block adjacent to Grassy Hill Road. This grassland block is used to provide forage hay for livestock. Since the field is dominated by cool-season grasses, it is likely harvested by mid-June of most years, which is too early in the season to allow bobolinks adequate time to fledge their young. Therefore, this site is a suspected ecological "sink" for this species of conservation concern.

4.4.8.4 *Wildlife Corridors:* In addition to forest blocks and grassland blocks, landscape level wildlife corridors were also identified within the project area (Figure 4-18). Wildlife corridors are primarily forested areas that are 100 m. (330 ft.) wide, or greater. They connect two or more forest blocks, facilitating movement of wildlife between the blocks. This is important so wildlife is able to move freely between feeding and bedding areas and different habitat types, such as wetlands, forests, and field edges. Corridors also allow wildlife to respond to human pressures such as development and logging activities by providing safe corridors for re-distribution of individuals.

Additional data regarding wildlife movement was collected during the 2004-2005 biological field surveys. Surveys for vertebrate tracks, signs, and movement patterns found along the $E_{(4)}$m-V3 alignment were conducted to identify vertebrate species that exist within the survey area, and to determine the extent to which the proposed roadway might disrupt paths of wildlife movement.

The majority of the animal tracks and signs encountered along the alignment did not necessarily indicate use of distinct corridors and likely represent more stochastic movements or active searches for food resources throughout the habitat blocks in which they were detected. Examples include coyote, gray fox, fisher, and bobcat. Bobcat tracks were also noted following deer

tracks within an area of high white-tailed deer activity between alignment survey stations 21+320 and 21+600. Wild turkey tracks were often found in association with deer tracks. Turkey likely follow deer herds to access the ground beneath the snow where deer have scraped in search of food.

Distinct corridors, where multiple deer appear to travel the same paths, were noted at a number of locations along the survey corridor. Many times these corridors were found along man-made features that offered a path of least resistance through dense shrub understory or steep topography. For instance, signs of deer travel were frequently noted along the northbound and southbound barrels of the existing rock cut for the unfinished section of Route 11 at the northern limits of the alignment, oriented down the center of the ROW. In areas where gaps in the autumn olive and dense intermixed understory occur in the rock cut, deer tracks would frequently veer off of the alignment and proceed through the shrub gaps. Other examples where deer followed manmade corridors were at woodland trails in Habitat Block No. 2 (west of Pember Road), the two power line easements that bisect the corridor, and along a survey traverse that cut through a dense stand of laurel in the vicinity of station 13+340. Other animals exhibited movements along distinct habitat, topographic, or hydrologic features. Examples include the river otter (movement along the Shingle Mill beaver flowage), mink (movement along an unnamed tributary to Shingle Mill Brook), and red fox (movement noted along the shrubland ecotone within the power line easement).

4.5 TOPOGRAPHY, GEOLOGY AND SURFACE/GROUNDWATER RESOURCES

4.5.1 TOPOGRAPHY

In the corridor, rough terrain with steep wooded slopes and narrow valleys is found in Salem, Montville and northern East Lyme along the East Lyme/Waterford town line. To the south, the landscape moderates with the approach of the coastal plain of Waterford and East Lyme in the vicinity of Niantic Bay and nearby Long Island Sound.

The varied topography in the Route 82/85/11 study area corridor generally reflects the underlying bedrock geology as well as alternating hill and valley terrain of the glaciated Northeast region. In the corridor, rough terrain with steep wooded slopes and narrow valleys is found in Salem, Montville and northern East Lyme along the East Lyme/ Waterford town line. Areas with poorly drained and/or shallow to bedrock soils or steep slopes tend to be the less developed areas in the towns. To the south, the landscape moderates with the approach of the coastal plain of Waterford and East Lyme in the vicinity of Niantic Bay and Long Island Sound.

The following more specifically describes the study area. All elevational information is referenced to National Geodetic Vertical Datum (NGVD) 1929.

4.5.1.1 *Route 82 and Route 85 Vicinity*: At the northern end of the corridor, Route 82 runs in a northeasterly direction across generally flat terrain of a valley and floodplain and wetland areas associated with Harris Brook to the intersection with Route 85 at Salem Four Corners. The elevation of Route 82 in the study area ranges from approximately 73 to 88 m. (240 to 290 ft). From Salem Four Corners, Route 85 trends southeasterly, ascending to approximately elevation 134 m. (440 ft.) at Horse Pond where it bisects two hills (162± m. (530± ft.)).

Route 85 maintains a relatively level course to the intersection with Beckwith Hill Drive (116± m. (380± ft.)), then descends along the east side of Beckwith Hill to the Latimer Brook floodplain (52± m. (170± ft.)) and follows along terraces of Latimer Brook to Chesterfield Four Corners. Route 85 climbs a small hill near the intersection of Route 161 and maintains a fairly level course between the foot of Morgan Hill and west shore of Lake Konomoc. South of Lake Konomoc, Route 85 follows along the gradually sloping topography of the southeastern Connecticut coast between hills and along streams such as Lakes Pond Brook and Jordan Brook.

4.5.1.2 *Route 11 Expressway Alternatives Vicinity*: Major topographic features of the corridor west of Route 85 include the varied terrain of the Shingle Mill Brook area in Salem. To the west of the brook, this area is characterized by numerous small promontories with elevations of between 107 and 137 m. (350 and 450 ft.) that exhibit shallow depths to bedrock. Wetland areas are interspersed in swales among the hills. Shingle Mill Brook is bound to the

east by three larger hills aligned in a north-south direction, with peak elevations of more than 152 m. (500 ft.). Land surrounding Shingle Mill Pond, which lies in series with the brook, is part of the Nehantic State Forest. A larger, contiguous wetland area is located between the three aforementioned hills and Beckwith Hill (elevation 134 m. (440 ft.)) to the east. The rough, irregular terrain of Nehantic State Forest in Salem and East Lyme bounds the study area to the west.

Walnut Hill, located between Holmes Road and Grassy Hill Road in East Lyme has a peak elevation of approximately 134 m. (440 ft.); it slopes steeply to the south and more gradually to the east towards the Latimer Brook floodplain in Montville. Pigeon Hill (elevation 98 m. (320 ft.)) forms the primary topographic feature south of Grassy Hill Road to Route 161 in East Lyme. The two north-south trending hills comprising Pigeon Hill are overlain by thick till deposits. Small, unnamed perennial and intermittent stream tributaries of Cranberry Meadow and Latimer Brooks drain between the hills.

South of Route 161 to I-395 along the East Lyme/Waterford town line, the terrain is very hilly and irregular with areas of exposed bedrock; consequently, land remains largely undeveloped in this region. Several intermittent and perennial streams and wetlands channel water from the hillsides. Peaks of hills are generally higher in the northern section and tend to decrease at the south end of the corridor in the vicinity of Sodom Hill, just north of the I-395/I-95 interchange. In East Lyme, steep slopes on the west sides of these hills descend to the flat floodplain of Latimer Brook. East of this steep terrain in Waterford lay streams and associated wetlands of Willys Meadow Brook, a tributary of Oil Mill Brook. Both Latimer and Oil Mill Brooks discharge their flows to the upper reaches of Niantic Bay.

4.5.2 GEOLOGY

Surficial Geology: The corridor study area is characterized by a surficial covering of glacial till and stratified sand and gravel; soils within the corridor have formed in glacial till, deposits of stratified sand and gravel, and alluvium. These glaciofluvial, sand and gravel units are capable of storing and yielding enough water to be considered aquifers.

Bedrock Geology: The bedrock of this area consists primarily of units of volcanic and sedimentary origin. The resultant bedrock types are gneisses and schists with intrusions of granite and pegmatite. Prominent structural features in the corridor contributing to its many ridges and valleys are the Honey Hill fault, Montville dome, Hunts Brook syncline and the Lyme dome.

The major formations within the corridor, as mapped by the State Geological and Natural History Survey of Connecticut (Hamburg Quadrangle 1966, Montville Quadrangle 1967,

Niantic Quadrangle 1967), are as follows, generally described as they appear in a north-south direction:

- *Brimfield and Tatnic Hill Formations* (believed to be equivalent) - Present north of the corridor, running in an east-west direction along the Honey Hill Fault, located approximately 1.6 km. (1 mi.) northwest of the terminus of Route 11. This formation is noted, herein, due to surface water contamination that occurred following construction of the first section of Route 11. These formations are predominately biotite-schists containing a small percentage of accessory iron sulfides (pyrite or pyrrhotite). The Brimfield schists were used to construct a rock embankment along the shoreline of Witch Meadow Lake in Salem. It is believed that leachate from the rocks induced a drastic drop in the pH of the lake causing the lake to become uninhabitable for fish (Kaseoru 1980). This is thought to have been a temporary condition with no lasting adverse effects.
- *Plainfield Formation* - Metasedimentary quartz schist, quartzite and gneiss. Some quartzites of this formation are identified as "locally pyritic." Units of this type are found near Grassy Hill and the East Lyme-Montville town line; in the vicinity of Route 161 and Butlertown Road east of Silver Falls; east of Route 161 running north-south, along the East Lyme town line (outcrops of nodular granite are exposed in this area); and the east side of Pigeon Hill. These units would be traversed by all of the new expressway alternatives.
- *Sterling Plutonic Group* - Consisting of granite-gneiss.
- *Mamacoke Formation* - Metasedimentary rocks consisting of gneiss, calc-silicates, and schists that are located along Shingle Mill Brook and east to Fairy Lake.
- *Ivoryton Group* - Plagioclase-gneisses of volcanic origin.
- *Brimfield/Tatnic Hill Formation of the Hunts Brook Syncline* - This formation is a higher metamorphic grade, but considered equivalent to the formation near the Honey Hill fault. The Hunts Brook syncline runs through the study area near Holmes Road and east across Route 85 to Beckwith Pond. It is not as exposed as the northerly formation, where outcrops occur along the Eight Mile River in Devil's Hopyard State Park. The formation crosses Route 85 again at the I-395 Interchange and continues southwest, passing the I-395/95 interchange and continuing into the Niantic River.
- *Monson Gneiss* - Located near the I-95/395.
- *New London Gneiss* - Crossed by Route 85 in the vicinity of Kenyon Road.

Neither the Brimfield/Tatnic Hill formation of the Hunts Brook Syncline nor the Plainfield formation is believed to contain the problematic units that are present in the northerly formation (Stone, Warzecha).

4.5.3 SURFACE WATER

The project corridor is located principally within the Southeast Coast major watershed, with a small section in the northern portion of the project corridor located in the Connecticut River Basin watershed.

The Southeast Coast watershed covers an area of approximately 207 square (sq.) km (80 sq. mi.), extending from Fairy Lake and Mill Pond in Salem south to the headwaters of the Niantic River located in East Lyme. Within this large watershed, smaller watersheds can be delineated for each of the major tributary streams. In the project corridor, surface water flows southerly toward the Niantic River. The principal subregional drainage basins in the corridor area are the Latimer Brook and Oil Mill Brook basins. Table 4-36 presents a summary of the major streams and drainage areas within the project corridor. Figure 4-19 shows the major drainage basins in the project corridor and Figure 4-20 illustrates the subregional drainage basins.

TABLE 4-36
WATERSHEDS WITHIN PROJECT CORRIDOR

SUBREGIONAL DRAINAGE BASIN	WATERSHED AREA	MAJOR DRAINAGE BASIN
Harris Brook	1,596 ha. (3,943 ac.)	Connecticut River
East Branch Eight Mile River	3,229 ha. (7,980 ac.)	Connecticut River
Latimer Brook	4,594 ha. (11,353 ac.)	Southeast Coast
Oil Mill Brook	1,349 ha. (3,333 ac.)	Southeast Coast
Niantic River	1,888 ha. (4,666 ac.)	Southeast Coast
Jordan Brook	1,945 ha. (4,807 ac.)	Southeast Coast

Source: Maguire Group/DEP Natural Resources Center

The section of the project corridor within the Connecticut River Basin is located at the northernmost end of the corridor. The Harris Brook watershed flows in a northerly direction in the vicinity of Salem Four Corners and the East Branch Eight Mile River watershed flows westerly near the Route 11 and Route 82 interchange.

4.5.4 GROUNDWATER HYDROLOGY

Groundwater is present beneath the surface of the earth in voids within rock fractures and between soil particles. Aquifers are evaluated on the basis of void spaces. The more important aquifers are those that have the most void space since they can store and produce the largest volumes of water. The type of soil material and the depth of soil material directly determines the amount of void space. Bedrock aquifers yield water from fractures in the rock and are generally only suitable for low volume domestic or commercial supplies. Deposits which consist of layers of sand, gravel, silt and clays are termed stratified drift deposits. The shape, arrangement and uniformity of soil particles within deposits influence the quantity of water that can be stored. Material deposits consisting of uniformly sized particles usually provide the greater amount of void space for water storage. In aquifers, the depth of material below the water table and above the base of the aquifer is referred to as saturated thickness. The base of the aquifer, in most cases, is an impermeable material such as bedrock or till. The greater the depth of the material, the more space in the material to store water.

Aquifer deposits within the study corridor were identified and evaluated by DEP in cooperation with the U.S. Geological Survey (USGS). The most important of these stratified drift deposits are those whose material composition and depth have potential for high water yields. Figure 4-21 shows the location of aquifer deposits, Level B aquifer protection zones, and local aquifer protection zones.

The most productive aquifers are located along the major streams and the adjacent wetland areas. These aquifers are coarse-grained stratified drift deposits which have a water-saturated depth of over 3 m. (10 ft.). The coarse-grained stratified drift deposits occur primarily along Latimer Brook. In the northern section of the project corridor, a coarse-grained stratified drift deposit is located south of Barnes Reservoir extending southerly along Latimer Brook for about 1.2 km. (0.7 mi.) to Beckwith Pond. This stratified drift deposit continues southwesterly along Latimer Brook for just over 1.6 km. (1 mi.), crossing under Route 85 and ending just south of Grassy Hill Road. At the intersection of Walnut Hill Road and Route 161 in East Lyme, an area of coarse-grained stratified drift is located along Latimer Brook extending in a southerly direction for about 16 km (10 mi.) ending at I-395.

Coarse-grained stratified drift deposits are also located along the northern and southern boundaries of Lake Konomoc. The deposits south of Lake Konomoc extend along Lake Ponds Brook in a southerly direction for about 1.6 km. (1 mi.) ending at I-395.

Surficial materials over the remainder of the project corridor consist of till deposits. Till deposits are a mixture of sand, silt and clay and course fragments. These deposits have a much lower capability of storing water and thus generally have low water yield rates. The till deposits in the project corridor have a water saturation depth of less than 3 m. (10 ft.) and include areas of exposed bedrock. In many areas, the till has been removed exposing relatively large areas of bedrock or large boulders.

4.5.5 WATER QUALITY

This section describes water quality in the project corridor with particular attention to the pollutants which are found in highway runoff. Highway runoff pollutants originate from operating vehicles and from atmospheric deposition. A variety of constituents can be generated by these sources including nutrients, heavy metals, oil and grease. The amount of these constituents can be affected by traffic characteristics, highway design, climate and land use. Highway pollutants can accumulate on highway surfaces, median areas and adjoining rights of way. Table 4-37 lists typical highway runoff constituents and their sources.

Under Connecticut's Water Quality Standards (CGS §22a-426) standards for water quality within the state have been established by the Commissioner of Environmental Protection. Water Quality Classifications, based on Water Quality Standards, have been established which designate uses for both surface and groundwater sources. There are five general classifications, as follows:

Latimer Brook and Lakes Pond Brook are both classified as A. This designation indicates that the water is suitable for fish and wildlife habitat; recreational uses; agricultural and industrial supply uses; and has the potential of being used as a drinking water supply source.

- Class AA - These waters are the highest quality and are currently being used or are potentially acceptable for drinking water supply uses without treatment.
- Class A - These waters can be used for potential drinking water supply, habitat for fish and wildlife, and agricultural and industrial supply purposes.
- Class B - These waters are acceptable for swimming and other recreational uses, and for fish and wildlife habitat, and are presumed not suitable for human consumption without treatment.
- Class C - These waters present water quality conditions that preclude the full attainment of one or more designated uses for Class B waters some or all of the time. Class C water quality conditions are usually correctable through the implementation of a comprehensive water quality management program to control point and non-point sources of pollution.

- Class D - These waters present water quality conditions that persistently preclude the attainment of one or more designated uses for Class B waters some or all of the time. One or more designated uses for Class B waters are not being achieved most or all of the time, and the sources of pollution are not readily correctable.

TABLE 4-37
HIGHWAY RUNOFF CONSTITUENTS AND THEIR PRIMARY SOURCES

CONSTITUENTS	PRIMARY SOURCE (S)
Particulates	Pavement wear; vehicle; atmosphere; sand
Nitrogen; Phosphorous	Atmosphere; roadway fertilizer application
Lead	Leaded gasoline (1) (auto exhaust); tire wear (lead oxide filler material); lubricating oil and grease
Zinc	Tire wear (filler material); motor oil (stabilizing additive); grease
Iron	Auto body rust; steel highway structures (guard rails etc.); moving engine parts
Copper	Metal plating; bearing/bushing wear; brake lining wear; moving engine parts; fungicides and insecticides
Cadmium	Tire wear (filler material); insecticide application
Chromium	Metal plating; moving engine parts; brake lining wear;
Nickel	Diesel fuel; gasoline exhaust; lubricating oil; metal plating; bushing wear; brake lining wear; asphalt paving
Manganese	Moving engine parts
Sodium/Calcium Chlorides	Deicing salts
Sulphates	Roadway beds; fuel; deicing salts
Petroleum	Spills; leaks of motor lubricants; antifreeze and hydraulic fluids; asphalt surface leachate

Source: *Sources and Migration of Highway Pollutants*, Kobriger, 1984
(1) Existing only; new sources of lead would not included leaded gasoline as it is no longer used

4.5.5.1 *Surface Water Quality*: The major surface waterbodies within the project corridor have been classified for water quality. Lake Konomoc and Beckwith Pond are classified as AA. This classification designates the water sources as existing or proposed drinking water supplies. Both of these surface

waterbodies are drinking water sources for the City of New London and Towns of Waterford and Montville. Latimer Brook and Lakes Pond Brook are both classified as Class A. This designation indicates that the water is suitable for fish and wildlife habitat, recreational uses, agricultural and industrial supply uses, and could potentially be developed as a future drinking water supply source. All other surface water resources in the project corridor, which do not have a specific designation, are considered Class A, according to DEP.

Limited surface water quality sampling has been conducted within the project corridor (Figure 4-22). Surface water quality data for Latimer Brook was obtained from *Connecticut Water Resources Bulletin No. 16* (Cervione, Grossman, Thomas, 1968). This data is compared to water quality standards to determine if Latimer Brook is meeting its classification.

A numerical water quality standard stipulates the concentration of a particular pollutant which is allowable in a waterbody in order to protect the designated use. Criteria values for the protection of aquatic life are developed by EPA as the maximum one-hour average with a three-year return period. The aquatic life criteria have been included in Connecticut's water quality standards as numerical water quality criteria for chemical constituents (DEP, 1996). Latimer Brook's Class A designation means that it has the potential to be used as a drinking water source. The federal Safe Drinking Water Act (SDWA) established drinking water standards which, in turn, establish maximum contaminant levels (MCL) for organic and inorganic chemicals known to be toxic and for microbiological parameters known to cause ailments. The SDWA also established a secondary standard called a recommended contaminant level (RCL) for those parameters that do not cause chronic or toxic health impacts but contribute to the taste and visual quality of the water.

Based on the above-referenced data for those parameters tested, Latimer Brook in the project corridor meets Class AA water quality criteria and several of the secondary standards. The concentrations of iron and manganese levels in Latimer Brook exceeded the RCL for drinking water. For manganese, the concentration was 0.05 mg/l and for iron, 0.3 mg/l. Iron and manganese are common in waters in Connecticut. These substances do not cause health concerns but contribute to metallic taste and discolored water which can stain clothes, cooking utensils and plumbing fixtures.

In 1993, DEP Fisheries Division sampled a limited number of chemical parameters. The parameters included dissolved oxygen, pH, conductivity, and alkalinity. The pH readings of 6.9 and 7.1 were higher than the pH results obtained from the 1968 samples. Although these pH levels were slightly

higher, minor fluctuations in pH are not unusual. This variation does not represent a major change in the pH level of Latimer Brook and is still within drinking water contaminant standards and the aquatic criteria.

Stream bioassessments were conducted in the corridor during the 2004-2005 biological surveys using the EPA Rapid Bioassessment Protocols (Barbour et al.) Stream sampling and visual habitat assessments were performed at 10 sites in the study area; including Oil Mill Brook, Gurley Brook (tributary to Niantic River), seven sites on Latimer Brook and its tributaries, and Shingle Mill Brook (Figure 4-17).

Measurements were taken of important physical parameters (e.g. stream morphology, water quality, etc.). Qualitative assessments evaluated habitat characteristics including substrate, riparian vegetation, frequency of riffles or bends, bank stability, channel flow, and velocity. Sampling of stream substrate for benthic macroinvertebrates was conducted to further evaluate stream ecology and quality.

The stream bioassessment data, which were reported in detail in the *Biological Survey Report*, showed that all of the sites evaluated represent minimally impaired streams with aquatic habitats favorable for supporting benthic communities that are sensitive to pollution and disturbance. The data showed that the representative streams evaluated in the survey meet DEP criteria for benthic invertebrates that inhabit lotic (flowing) Class A waters, as follows: a wide variety of macroinvertebrate taxa are present; all functional feeding groups are well represented; presence and productivity of aquatic species is not limited except by natural conditions, permitted flow regulation, or irreversible cultural impacts; water quality is apparently sufficient to sustain a diverse macroinvertebrate community of native species; and EPT taxa are well represented (DEP 1997).

Readings for pH on Latimer Brook at Site 8, slightly upstream from the DEP 1993 sample site, were 6.75 and 6.9. Water quality was excellent, as measured by the Hilsenhoff Biotic Index (Hilsenhoff 1987) at Oil Mill Brook, Gurley Brook, and three tributaries to Latimer Book (sites 4, 6 and 9). Shingle Mill Brook reported lower macroinvertebrate diversity and lower water quality as compared with the other stream sites. This is attributed to an ongoing change in stream characteristics from a lotic system to a more lentic (still) environment. Beavers are building dams on the stream, which are creating a series of step pools that obstruct flow.

4.5.5.2 *Groundwater Quality*: Groundwater sources within the corridor area have also been classified by DEP for water quality. The groundwater quality classification system uses the same type of designations and standards as used

for surface waters (preceded with the letter "G"). Most of the land area northeast of Route 85 is over groundwater with Class GAA identification. This classification is for existing or potential public water supply areas and hydraulically connected to a surface waterbody which is used as a public drinking water supply source. Groundwater associated with the surface water supply watershed for the City of New London and towns of Waterford and Montville is designated Class GAA.

All other groundwater resources in the project corridor that do not have a specific designation are considered to be Class GA. GA groundwater is in areas of existing or potential private water supply and is assumed to be suitable for drinking water. DEP notes that the area at Salem Four Corners, although designated a Class GA groundwater area, may not be currently meeting that standard.

Groundwater quality data was obtained from *Connecticut Water Resources Bulletin No. 16* (Cervione, Grossman, Thomas, 1968). Two groundwater wells generally located within the project corridor were tested for certain water quality parameters. These data were compared to drinking water quality standards since the Class GA designations assumed the groundwater to be suitable for drinking water. Based on the limited data available, the groundwater in the project corridor meets Class GA water quality criteria for most parameters. The only value that was exceeded was for iron.

4.5.6 DRINKING WATER SUPPLY SYSTEMS

The project corridor includes surface and ground water resources used for public drinking water supply; specifically, the area northeast of Route 85 includes surface water reservoirs and ground water wells that provide drinking water to community water systems. Community water supply resources and systems in the study area are shown on Figure 4-22 and summarized in Table 4-38.

PSG New London Utilities (PSGNLU, formerly called New London Water and Water Pollution Control Authority) operates the water system which serves the entire City of New London, most of the Town of Waterford and portions. The PSGNLU system has established interconnections with the Ridgewood Park Independent Water System in Waterford and the Town of Montville Municipal Water system in Uncasville. PSGNLU supplies water to these systems averaging about 0.10 million gallons per day (mgd). The 1997 average daily demand for the existing water system was 5.4 mgd with a future projected demand of about 6.3 mgd.

Overall, about 27% of the PSGNLU water demand goes to residential users. Another 29% is pumped to commercial users and multi-family residences; 14% to industrial users; and about 6% to institutional users (WWPCA, 1990).

PSGNLU relies entirely on surface water supplies located within the project corridor including Fairy Lake, Bogue Brook Reservoir, Barnes Reservoir, Beckwith Pond, Davis Pond, Great Swamp, and Lake Konomoc. The three upstream reservoirs, Fairy Lake, Bogue Brook Reservoir and Barnes Reservoir, are interconnected by open channels which flow into Beckwith Pond. In case of an emergency water shortage, PSGNLU may divert water from Bond Reservoir, located north of Fairy Lake. A diversion pumping station at Beckwith Pond pumps the pond water into the 51 cm. (20 in.) diameter supply main which brings the water to Lake Konomoc. Water from Davis Pond flows directly into the northwest end of Lake Konomoc. The Great Swamp Diversion Pumping Station is located adjacent to the north shore of Lake Konomoc and pumps water into Lake Konomoc.

A potential groundwater well site, known as the Polly Brook well site, is located on the southwest side of Route 85 in Waterford approximately 730 m. (2,400 ft.) southeast of the Lake Konomoc spillway. PSGNLU currently has no plans to develop this well for water supply use because of its low yield (0.3 mgd) and need for treatment prior to distribution; however, the well is treated as an existing public water supply resource as it has the potential to serve as such in the future, should the need arise. Another potential water supply source (shown on Figure 4-21) was identified in East Lyme just west of Powers Lake (SCCOG, 1997). In addition, in April 1998, PSGNLU applied to DEP for a diversion permit to divert water from Hunts Brook to Lake Konomoc during high flow periods; the application is pending.

Lake Konomoc serves as the principal storage reservoir of the PSGNLU system. Lake Konomoc is located in Montville and Waterford along Lakes Pond Brook, which is a tributary to the Niantic River. It is located along the east side of Route 85, extending for a distance of about 3.2 km (2 mi.). The reservoir has a storage capacity of 4,596 million liters (1,216 million gallons) and a surface area of 116 ha. (286 ac.) at the spillway elevation. The chute spillway has its crest at elevation 57 m. (186 ft.) NGVD. The top of dam is at an elevation of 58 m. (191 ft.) and the lowest intake at Lake Konomoc is a 76 cm. (30 in.) pipe at a centerline elevation of 51 m. (166 ft.).

TABLE 4-38
PUBLIC WATER SUPPLY SYSTEMS

OPERATOR	LOCATION	SOURCE	POPULATION SERVED	WATER QUALITY / COMMENTS
COMMUNITY WATER SYSTEMS				
PSG New London Utilities	Route 85, Salem/Montville/ Waterford	Surface water impoundments including Lake Konomoc, Fairy Lake, Bogue Brook, Barnes Reservoir, Beckwith Pond, Davis Pond, and Great Swamp	Entire City of New London, most of Town of Waterford, some sales to Montville (1990 population for New London and Waterford 42,700) (Roald Haestad Inc. 1991)	High quality (DPH files)
Crystal Lake Condominium Assoc.	End of Horse Pond Road, Salem	7 bedrock wells comprising 5 separate systems	184 residents in 74 units: 40 one bedroom, 32 two-bedroom, 2 three-bedroom	Routine detections of total coliform bacteria in all 5 systems; exceedances of lead, copper, and radiological standards; low pH; new water system planned (DPH 1998)
Deer Run	Deer Run, Montville	1 bedrock well	53 residents in 18 cottages and 1 three-family home	Good-meets DPH standards (DPH 1997)
NON-TRANSIENT NON-COMMUNITY PUBLIC WATER SUPPLY				
Salem Market Place	Northeast Corner of Salem Four Corners, Salem	1 bedrock well; approx. 50 ft. from Route 85	15 businesses with 25 employees and 50 customers	Good-meets DPH standards (DPH 1996)
The Colonial Center	Northeast of Salem Four Corners on Route 82, Salem	1 bedrock well in parking lot near Route 82	15 residents in 10 one-bedroom apartments, 30 employees in 5 businesses	Meets DPH standards; low levels of carbon tetrachloride present below DEP standards (DPH 1998)
Salem Town Center	Southwest corner of Salem Four Corners, Salem	2 bedrock wells	14 businesses with 25 employees and 100 customers	Methyl tertiary butyl ether (MTBE) detected above DEP limit in well #1; MTBE below DEP limit in well #2; DPH recommended abandoning well #1 (DPH 1998)
Salem Country Gardens	Route 85, Salem	2 bedrock wells; primary well located approx. 6 m. (20 ft.) from Route 85; additional bedrock well located on-site used for irrigation (Mr. Burnett, 6/22/98)	40 employees, 125 customers	Satisfactory-occasional detections of Total Coliform Bacteria and low pH (DPH 1993)

SOURCE: DPH Water Supplies Section Files

Fairy Lake, which is the major most northern reservoir in the PSGNLU system is also located near Route 85. Fairy Lake is located in Salem along Latimer Brook. The lake has a storage capacity of approximately 888 million liters (235 million gallons) and a surface area of 49 ha. (121 ac.). Water from Fairy Lake Dam passing over the spillway or through the 30 cm. (12 in.) outlet flows downstream to Mill Pond and then to Barnes Reservoir. Mill Pond and Barnes Reservoir are located about 0.8 and 1.3 km (0.5 and 0.8 mi), respectively, northeast of Route 85.

Beckwith Pond, located about 0.3 km. (0.2 mi.) from Route 85, is a small pond, which serves as an intake pool for the Beckwith Pond Diversion Pumping Station. It is located in Montville, along Latimer Brook and is downstream of Barnes Reservoir. Bogue Brook, carrying flows from Bogue Brook Reservoir, confluences with Latimer Brook at this location. The pond (elevation 46 m. (150 ft.)) has a storage capacity of 7.6 million liters (2.0 million gallons) and a surface area of 1.5 ha. (3.7 ac.).

The PSGNLU monitors various raw water quality parameters at Lake Konomoc. They are required to sample inorganic chemicals every three years for a variety of parameters, some of which are pollutants generally associated with roadway runoff. Based on available data, Lake Konomoc currently meets Class AA water quality criteria for most parameters. The only value that was exceeded was for copper for the aquatic life criteria. There was no exceedance of the drinking water standards.

4.5.7 PUBLIC WATER SUPPLY WATERSHED LANDS

The New London Water Department owns several parcels in the Route 82/85/11 corridor that contain not only the surface reservoirs but also the adjoining watershed lands of the New London, Waterford and Montville water supplies. The adjacent undeveloped land serves as a buffer to these sensitive resources. In 1980, the State Department of Public Health (DPH) promulgated regulations relating to the establishment of criteria and performance standards for the classification of water company lands, and DPH review of disposition and use of such lands. The legislative purpose of these regulations is to limit disposal of water company lands for development purposes.

Nine parcels owned by the City of New London and managed by PSGNLU have frontage on Route 85 and could be affected by any of the proposed road widening scenarios (Alternatives $W_{(4)}$, $W_{(4)}$m, and $W_{(2)}$) as well as partial build Alternatives $H_{(4)}$ and $H_{(2)}$.

Public water supply reservoirs including Fairy Lake in Salem; Bogue Brook Reservoir, Beckwith Pond, and Davis Pond in Montville; the Polly Brook well in Waterford and Lake Konomoc in Montville and Waterford are located in the corridor proximal to Route 85. Public water supply watershed lands are designated as Class I, Class II or Class III resource areas for regulatory and environmental protection purposes. DPH will not grant

permission for a change of use of Class I or Class II watershed lands unless it is demonstrated that such change will not adversely affect the present and future purity and adequacy of the public drinking water supply.

Class I watershed lands are defined as land owned by a water company which is:

(1) Within 76 m. (250 ft.) of high water of a reservoir or 30 m. (100 ft.) of a watercourse;

(2) Within the areas along watercourses which are covered by any of the critical components of a streambelt;

(3) With slopes 15% or greater without significant interception by wetlands, swales and natural depression between the slopes and the watercourses;

(4) Within 61 m. (200 ft.) of groundwater wells;

(5) A direct recharge area or aquifer outcrop now in use or available for use; or

(6) An area with shallow depth to bedrock, 20 inches or less, or poorly drained or very poorly drained soils as defined by the NRCS that is contiguous to land described in Sections (3) or (4) above and that extends to the top of the slope above the receiving watercourse.

Class II watershed lands are defined as land owned by a water company which is:

(1) On a public drinking supply watershed which is not included in the Class I designation; or

(2) Completely off a public drinking supply watershed and which is within 46 m. (150 ft.) of a distribution reservoir or a first-order stream tributary to a distribution reservoir.

Class I and II water company lands owned by the City of New London and located within 915 m. (3,000 ft.) of Route 85 are shown in Figure 4-21. Class I lands are primarily located adjacent to surface water impoundments such as Fairy Lake and Lake Konomoc. At Fairy Lake, Class I designated water company lands extend for approximately 482 m. (1,580 ft.) along the east side of Route 85. At its closest point, Fairy Lake is located approximately 12 m. (40 ft.) east of Route 85.

In the central part of the corridor, the parcel containing Beckwith Pond is designated as Class I water company land. This parcel is located approximately 245 m. (800 ft.) east of Route 85 on Beckwith Road. In addition, a small, 232 sq. m. (2,500 sq. ft.) parcel owned by the water company is also located on Beckwith Road approximately 50 m. (165 ft.) east of Route 85 and is designated as Class II land. Near the southern end of the corridor, Class I water company lands associated with Davis Pond are located approximately 90 m. (100 ft.) east of Route 85. A small parcel owned by the water company at the intersection of Route 85 and Turner Road contains approximately 12 m. (40 ft.) of frontage on Route 85 and is designated as Class I land.

Adjacent to the west shore of Lake Konomoc, the primary public water supply reservoir, water company-owned land extends for approximately 3.2 km. (2 mi.) along the east side of Route 85. Of this, approximately 2.4 km. (1.5 mi.) of frontage on Route 85 is classified as Class I land, and 0.8 km. (0.5 mi.) is designated Class II land.

On the west side of Route 85 in the vicinity of Lake Konomoc, Class I water company land includes approximately 1.6 km. (1 mi.) of frontage, while Class II land comprises only 12 m. (40 ft.) of frontage. South of Lake Konomoc, an additional 53 m. (175 ft.) of Class I water company land is located along the west side of Route 85 on the parcel containing the proposed Polly Brook well.

4.6 WETLAND RESOURCES

4.6.1 WETLAND IDENTIFICATION AND MAPPING

Preliminary identification of wetland resources was achieved through use of secondary information sources including ConnDOT mapping depicting wetlands delineated under prior studies, soil mapping from the Natural Resources Conservation Service (NRCS) and aerial photographs. GIS soils mapping was prepared based on hydric soils and alluvial soils marked over standard USGS quadrangle maps.

All mapped areas were then examined in the field. Following field reconnaissance, the GIS maps were modified using aerial photographs and field observations to identify wetland areas, which are either more extensive or less extensive than identified by the soils map. During field reconnaissance, consideration was given to those areas which may qualify as wetlands based on *either* the ACOE three-parameter approach to defining wetlands (*ACOE Wetland Delineation Manual*, 1987) or Connecticut's soils-based wetland definition (Connecticut Inland Wetlands and Watercourses Act) in accordance with DEP jurisdictional criteria. In most instances within the study area, there does not appear to be a great dissimilarity between the state and federal jurisdictional boundaries. Wetland areas which have been disturbed, filled, or developed since the publication of the soils maps were also identified.

The function and value of wetlands in the study corridor have been documented using the *ACOE Highway Methodology Workbook Supplement* (ACOE, 1995). This methodology is used to assess the functions and values provided by each wetland area, and to identify appropriate avoidance and minimization techniques that can be applied to the various alternatives to reduce impacts to wetlands as much as practicable. The Highway Methodology is a method for integrating the NEPA process with ACOE's Section 404(b)(1) permit process (see Section 6). The outcome of this process is the development of the LEDPA. The LEDPA is the alternative, which substantially meets the project purpose and need while resulting in the least adverse impact on wetlands.

4.6.2 Field Verification of Wetland Systems and Functions and Values

Function and value assessments were conducted for all wetlands in the study corridor that would be potentially impacted by the alternatives. Documentation for each area included completing a "Wetland Function-Value Evaluation Form" which is designed to lead the evaluator toward a conclusion as to which functions and values the particular wetland area provides. Documentation for each wetland includes:

- a color photograph of the wetland area (with reference ID number);
- full vegetation and wildlife species lists for the area;
- a field sketch of the wetland area, with localized site features;
- Global Positioning System (GPS) coordinates (latitude/longitude) to facilitate mapping;
- adjacent land uses;
- whether there has been human influence;
- whether it is a wildlife corridor or habitat island;
- whether there is a contiguous undeveloped buffer zone present;
- whether the wetland is a separate hydrologic system and, if not, where it lies in the drainage basin; and
- how many tributaries contribute to the wetland.

Principal functions and values of each wetland were determined based on the *ACOE Highway Methodology* list of "considerations/qualifiers." If a particular consideration or qualifier applies to the wetland, it is evidence that a particular function or value occurs in that wetland; the more qualifiers that apply, the more likely the function or value occurs. The 13 principal functions and values are listed and briefly described below in Table 4-39.

Field assessment of project area wetlands and determinations of wetland functions and values for the DEIS alternatives were primarily qualitative in nature (typical for a DEIS

TABLE 4-39
13 PRIMARY WETLAND FUNCTION AND VALUE CATEGORIES

FUNCTION/VALUE	DESCRIPTION
Groundwater Recharge/Discharge	Considers the wetland's potential to serve as a groundwater recharge/ discharge area, based on interaction between wetlands and aquifers
Floodflow Alteration (Storage and Desynchronization)	Considers the wetland's effectiveness in reducing flood damage by floodwater retention and gradual release; adding to the stability of the wetland ecological system or its buffering characteristics; and providing social/economic value relative to erosion and flooding
Fish and Shellfish Habitat	Considers the effectiveness of seasonal or permanent watercourses in sustaining fish and shellfish habitat
Sediment/Toxicant/ Pathogen Retention	Considers the wetland's ability to reduce contaminant concentrations in surface water and/or to prevent degradation of water quality; relates to the wetland's effectiveness in trapping sediments, toxicants, or pathogens in runoff from surrounding uplands/upstream eroding areas
Nutrient Removal, Retention and Transformation	Considers the wetland's effectiveness in trapping nutrients in runoff from surrounding uplands or contiguous wetlands, and the ability to process nutrients, preventing eutrophication of surface waters (ponds, lakes, streams, rivers, estuaries) and/or excess nutrients in aquifers
Production Export	Considers the wetland's effectiveness in producing food or usable products for man or other living organisms
Sediment/Shoreline Stabilization	Considers the wetland's effectiveness in stabilizing stream banks and shorelines against erosion
Wildlife Habitat	Considers the wetland's effectiveness in providing habitat for various species (resident or migrating) typically associated with wetlands/edges
Recreation (Consumptive and Non-consumptive)(1)	Considers the wetland/watercourse's suitability to provide recreational opportunities such as hiking, canoeing, boating, fishing, hunting and other active or passive recreational activities.
Educational and/or Scientific Value	Considers the wetland's suitability as an "outdoor classroom" site or location for scientific study or research
Uniqueness/Heritage	Considers special wetland values; these may include critical habitat for endangered species, important archaeological sites, overall health and appearance, role in the ecological system of the area, or relative importance as a representative wetland class for this geographic location. This category considers wetland attributes which make the wetland clearly a valuable resource relative to aspects of the public health, recreation and habitat diversity
Visual Quality/Aesthetics	Considers the wetland's visual/aesthetic quality or usefulness
Threatened or Endangered Species Habitat	Considers the wetland's effectiveness in supporting rare, threatened or endangered species or habitats

Source: ACOE *Highway Methodology Workbook Supplement, 1995*

(1)Consumptive opportunities consume or diminish the plants, animals, or other resources that are intrinsic to the wetland. Non-consumptive opportunities do not consume or diminish these resources.

level of analysis) and were based, primarily, on the professional judgment of the evaluators. The only quantitative data described for this evaluation were preliminary wetland area impact calculations (see Section 5) and distances to nearby development. A more detailed, precise quantitative evaluation was undertaken for the preferred alternative; results are reported in Section 5.

As a quality assurance measure, the wetland evaluations were conducted by two teams, each with a team leader and one or two assistants. The same team leaders were utilized throughout the course of the evaluation. Four assistants worked in rotation between the teams. This was done in an effort to assure consistency in analytical methods, qualitative judgments and documentation throughout the project area. Periodically, the two team leaders worked together to ensure that the two approaches to the evaluations were consistent.

4.6.3 DESCRIPTION OF CORRIDOR AREA WETLAND RESOURCES

The wetland systems evaluated and documented, herein, are specific localized wetland areas along the proposed alternative alignments. Wetlands throughout the entire corridor area, and adjoining areas, are shown on the generalized mapping (Figure 4-23); the wetlands depicted were compiled from both primary and secondary sources. Three generalized wetland classification categories are represented within the corridor:

- *Lacustrine*: Wetlands and deepwater areas located in naturally-occurring topographic depressions, or dammed rivers or streams. They lack trees, shrubs, and persistent emergents with greater than 30% areal coverage, and are generally greater than 8 ha. (20 ac.) in size. There are three lacustrine systems located within the study corridor, Lake Konomoc, Horse Pond and Fairy Lake. All three of these lakes are the result of construction of dams and/or dikes. Lake Konomoc and Fairy Lake, are surface water supply sources; Horse pond is maintained by DEP as a recreation area.

- *Riverine*: Wetlands and deepwater habitats occurring within a channel. There are numerous riverine systems within the study area, most consisting of smaller upper and intermittent riverine systems, however, larger riverine systems are present as well. Latimer Brook, Oil Mill Brook and Harris Brook constitute the larger riverine systems in the corridor.

- *Palustrine*: Non-tidal wetlands dominated by trees, shrubs, emergents, mosses, and/or lichens. They may also include areas without vegetation, where they are smaller than 8 ha. (20 ac.), lack active wave-formed or bedrock shoreline features, and have a water depth of less than 2 m. (6.6 ft) at the deepest part of the basin. This is the dominant wetland category within the study corridor. It is composed of a number of sub-categories, including the following seven found in the corridor:

- POW Open Water
- PEM Emergent
- PSS Scrub-shrub
- PFO Forested
- PSS/EM Scrub-shrub/emergent
- PFO/SS Forested/scrub-shrub
- PFO/EM Forested/emergent

Wetlands composed of two or more categories or sub-categories are termed "complexes." In general, wetlands in the corridor are part of one of the three large wetland complexes, the Harris Brook, Latimer Brook and Oil Mill Brook complexes, which are described below.

- *The Harris Brook Complex*: The Harris Brook complex, which also includes the Shingle Mill Brook and Fraser Brook systems, is located in the northern portion of the corridor. Harris Brook flows from the northeast of Salem Four Corners, west under Route 85, south under Route 82, then north under Route 82, and finally west under the existing Route 11 expressway before draining into the East Branch of the Eight Mile River. This system is predominantly forested wetlands associated with the river systems. There are, however, some areas of scrub-shrub wetland. In particular, there is a large scrub-shrub wetland located northeast of Salem Four Corners. The Harris Brook complex exhibits all of the 13 functions and values noted in the ACOE methodology. The more prominent functions and values include floodwater alteration, wildlife habitat, fisheries habitat, sediment/toxicant removal, and groundwater discharge.

- *The Latimer Brook Complex*: The Latimer Brook complex is a very diverse system constituting the largest overall wetland acreage within the study corridor. This complex exhibits all of the 13 functions and values listed under the ACOE methodology, including endangered species. It includes a well-developed riverine system, lacustrine systems, and extensive palustrine systems. Latimer Brook flows south into the study corridor under Route 85, north of Chesterfield Center. It then flows southeast, crossing Grassy Hill Road and Route 161. From this point, the brook flows parallel to Route 161 into the Flanders area, where it then flows south under I-95 and into the Niantic River. Just before the brook flows under I-95, it flows over an old rock dam; a DEP maintained fish ladder is located to the east of the rock dam. Associated with Latimer Brook are expansive floodplain areas, as well as numerous upper tributaries throughout the central and southern sections of the study corridor.

- *The Oil Mill Brook Complex*: The Oil Mill Brook wetland complex is located in the southeast portion of the study corridor. This complex is composed predominantly of forested wetlands, however, there are some small areas of scrub-shrub and emergent wetlands. The single largest wetland feature in this complex is Lake Konomoc, located in the upper portion of the Oil Mill Brook Sub-Regional Watershed. This complex exhibits 12 of the 13 ACOE functions; all except endangered species habitat. The predominant functions are

fish/shellfish habitat, floodflow alteration, sediment/toxicant retention, and production export. Oil Mill Brook flows into the corridor from the southeast corner of the corridor, near Butlertown and Way Hill Road. Also contributing to Oil Mill Brook is Lakes Pond Brook which flows from Lake Konomoc and receives flow from Polly Brook.

The majority of the wetland areas within the study corridor are deciduous forested wetlands, which are characterized by deciduous vegetation 6.2 m (20 ft) or taller. The forested wetlands within the corridor tend to be comprised of medium-aged to mature trees, with well-developed shrub and herbaceous layers. Forested wetlands occur along riverine systems and within upland groundwater seeps, depressions, and drainageways. Although most forested wetlands within the corridor are dominated by red maple, there is still some variation in vegetative species between these individual areas. This is likely due to differences in hydrology, soil type, nutrients, and human influences.

The common functions associated with scrub-shrub wetlands within the corridor were found to be wildlife habitat; nutrient removal and transformation; sediment/ toxicant retention; floodflow alteration; and production export... scrub-shrub wetlands are unique from other wetland types in that they support species found in both emergent and forested wetlands, since they are a transition wetland between the two.

Forested wetlands have a number of functions and values associated with them that other wetland types do not have. Since many of the forested wetland areas within the corridor occur along rivers and streams and in floodplain areas, many of the functions associated with riverine systems, such as fish/shellfish habitat, floodflow alteration, and production export, were documented. Some of the forested wetland areas occur in upland depressions, were water is not channelized, and moves very slowly or remains stagnant. In these areas, other functions such as nutrient removal and sediment/toxicant retention were more prevalent.

Forested wetlands are unique from a wildlife habitat perspective due to the abundance of tree cover. Trees are essential habitat in that they provide food, nesting holes, and safety from predators. Additionally, trees are essential habitat for most types of birds, who use trees for feeding, nesting, safety from predators, roosting, and cover. Forested wetlands also protect watercourses by shading them from the sun, thereby maintaining cooler water temperatures which area preferred by some fish species, such as trout.

Some forested wetlands in the corridor have potential value for recreation; however, since many of these areas are located on privately-owned or non-access lands, they are not readily usable. Recreation opportunities in the corridor are primarily limited to public lands.

Scrub-shrub wetlands were the next most commonly found wetland type within the corridor. These wetlands tend to occur in areas of deeper water, such as in depressions and along the edges of lakes, ponds, and meandering rivers. These wetlands are dominated by woody vegetation less than 6.2 m (20 ft) in height. The common functions associated with scrub-shrub wetlands within the corridor were found to be wildlife habitat; nutrient removal and transformation; sediment/toxicant retention; floodflow alteration; and production export. Since most of the scrub-shrub wetlands within the corridor occur in flat areas and in depressions with diffuse water flow, functions similar to those associated with ponded areas were commonly documented. With respect to wildlife habitat, scrub-shrub wetlands are unique from other wetland types in that they support species found in both emergent and forested wetlands, since they are a transition wetland between the two. Scrub-shrub wetlands also provide habitat for a number of species which prefer shrub vegetation over forest or emergent types.

The scrub-shrub wetlands in the corridor exhibit a number of wetland values in addition to the functions discussed above. Recreation is an important value for some scrub-shrub wetlands in the corridor; however, like the forested wetlands many of these areas are located on privately-owned or other non-access lands. Scrub-shrub wetlands generally have more educational/scientific value in the corridor since they are more dynamic than forested wetlands, and generally have greater species diversity and abundance, although access is sometimes difficult due to high water levels. They also tend to have higher uniqueness/heritage value than forested wetlands since they are not as abundant in the corridor.

Less common than scrub-shrub wetlands in the corridor, emergent wetlands occur in only a few areas where naturally ponded water is present year-round. Many times, wet meadows are produced by human influence such as mowing and grazing of livestock in emergent wetland areas. The most common functions associated with emergent wetlands within the corridor were found to be wildlife habitat, nutrient removal/transformation, sediment/toxicant retention, floodflow alteration, and production export. Because emergent wetlands occur in flat areas and depressions with diffuse water flow, water velocities are very slow, and long water retention times are common. Functions such as nutrient removal/ transformation, sediment/toxicant retention are partially dependent on long water retention times. Some emergent wetland areas occur along the edges of meandering watercourses, were water flow is channelized, but moves very slowly. In these areas, other functions such as fish habitat, sediment/shoreline stabilization, and floodflow alteration become more prevalent. Also, the shores of lakes and ponds are commonly bordered by emergent wetland areas which provide shoreline stabilization from wave action, as well as spawning habitat and cover for many fish, amphibian, reptile and invertebrate pond species of wildlife. Emergent wetlands also provide habitat for a number of species that prefer herbaceous vegetation over forest or shrub types. One emergent wetland within the corridor was reported to have endangered species habitat.

4.6.3.1 *Notable Wetland Areas*: During the documentation of wetland areas within the study corridor, eight wetland areas were observed to have a particularly unique or representative character or quality; these wetlands are considered to be notable wetlands. The term "notable wetlands" has been used to describe those areas that are especially interesting and/or less common resources; the term does not denote or imply any regulatory status other than that applied to all wetlands under state and federal regulations. Wetlands were considered notable when one or both of the following conditions were observed:

- The wetland was of particularly high quality, is representative of a unique habitat type or exhibits unique habitat characteristics generally not found within the region.
- The wetland had exceptionally high functions and values and, in this respect, may be differentiated from surrounding habitats.

Each of the eight notable wetlands found in the corridor is listed and described below; Figure 4-24 depicts the locations of these areas.

(1) *Harris Brook System*: This is a large and wide wetland system located near the intersection of Route 82 and 85 within the Harris Brook sub-regional watershed. It receives flow primarily from Harris Brook, Fraser Brook, and Shingle Mill Brook. This system is of particular importance due to its floodflow alteration and wildlife functions. During flood events, this wetland detains large amounts of water and protects the Salem Four Corner commercial area as well as Routes 82 and 85. Due to its large size and variable wetland types, which include forested, scrub-shrub, emergent and open water habitats, it is important to wetland dependent wildlife species.

(2) *Shingle Mill Brook System*: This is a large wetland system located in the northern portion of the study corridor. It is primarily a POW and PEM, with smaller areas of PSS. This area exhibits all of the 13 functions and values under the *ACOE Highway Methodology.* It is an active beaver impoundment with abundant snags and nesting holes. Numerous vegetation species as well as species of birds, herpetofauna and mammals have been recorded at the site. It is considered notable due to its high vegetation and wildlife diversity. The wetland has five tributaries and is surrounded by a contiguous upland forest area, except for a short portion, which is bordered by Salem Turnpike.

(3) *Horse Pond*: This wetland is located just west of Route 85, approximately 2 km. (1.2 mi.) south of the Salem Four Corners. Horse Pond is owned and maintained by DEP as part of the Nehantic State Forest system. It is a man-made pond, with a small weir dam located in its southeast corner. The pond is heavily used by fisherman, who can fish from its shores, launch a canoe, or utilize a handicap-accessible fishing platform. The pond has no official boat launch; however, small craft can be used. Horse Pond is stocked annually, and has a healthy fish population. In addition to its recreational use, the pond is important habitat for wildlife.

(4) *Latimer Brook*: This wetland is a large riverine system which flows through the southern half of the corridor. It crosses under Route 85 into the study corridor near Daisy Hill Drive in Montville, and continues south into the Niantic River. This is a functionally important wetland system and has local significance due to its aesthetic value and recreational use, especially by fisherman. It acts as a wetland wildlife corridor through the project area, which is a safe haven for many types of wetland dependent wildlife. Also, a portion of Latimer Brook in Montville, has been identified as a critical habitat area for a state-endangered plant species.

(5) *Grassy Hill Wet Meadow*: This is a wet meadow wetland located directly south of Grassy Hill Road near the 92PD alignment. This wetland area is unique, as only two other wet meadow wetlands were found within the study corridor. This fringe wetland is associated with Latimer Brook, which flows across an active hay field. The wetland exhibited good vegetative and wildlife diversity. Ducks, swallows, and other open wetland bird life were observed at the wetland. In addition, the wetland has a high aesthetic value, and is a picturesque scene.

(6) *Wetland PD-12A*: Wetland PD-12A is a narrow wetland area located in the southern portion of the corridor, just west of the 92PD alignment. This forested wetland is located at the base a steep ridge, where groundwater discharges and forms seep areas. Although the wetland is not large in area, it is located within a large upland forest block with few wetland areas nearby. Because of this, the wetland is a type of "habitat island" where wetland dependent species may congregate. During the field visit to the wetland, it was found that amphibian life is abundant. Numerous red-spotted newts were found, as well as wood frogs, red-backed salamanders, and American toads. The wetland is surrounded by a large undeveloped buffer zone of upland forest. This wetland has high values for wildlife.

(7) *Lake Konomoc:* This is a large man-made lake, owned by the New London Water Department, located east of Route 85, and north of I-395. The lake is of local and regional significance since it is one of the primary surface water sources for the area. It provides water for 100% of the population in New London and 70% of Waterford's population, some 42,700 people total, based on 1990 data. The New London Water Department also sells water to the Millstone Power Plant in Waterford, and the town of Montville.

(8) *Wetland PD-30*: Wetland PD-30 is a large wetland area located in the southern portion of the corridor, just east of the 92PD alignment. This wetland occurs within a valley formed by rolling topography; it drains to the southwest. The southwest end of the wetland, located near Pember Road, has been dammed, creating a ponded area with sections of scrub-shrub and emergent wetlands. Because the wetland is relatively expansive, and located within a large forest block, it provides valuable habitat for many types of wetland and upland species. Species observed within the wetland include the red-winged blackbird, common grackle, Canada goose, hooded warbler, and bullfrog. The wetland is surrounded by a large undeveloped buffer for much of its border, with the exception of an active, rural residence adjacent to the ponded area. This wetland exhibited 12 of the 13 ACOE functions and values for wetland areas.

4.6.3.2 *Tidal Wetlands*: Although most of the wetlands throughout the project area are inland (freshwater) wetlands, there is a small area of tidal wetland that could be impacted, either directly or indirectly if any of the full build expressway alternatives are implemented. Construction of the Route 11 interchange at I-95/I-395, proposed as part of the 92PD, $E_{(4)}$, $E_{(2)}$, $F_{(4)}$, $F_{(2)}$, $G_{(4)}$ and $G_{(2)}$ alignments, would occur in the vicinity of the coastal boundary, as designated under the state's Coastal Area Management (CAM) Act. Oil Mill Brook and Willys Meadow Brook converge at the proposed interchange area and then flow into the Niantic River, which is a tidally influenced navigable waterbody. The northern extent of the coastal boundary and regulated tidal wetlands is approximately 300 m. (1,000 ft.) from the proposed interchange (Figure 4-25).

Regardless of proximity of possible construction to the coastal boundary and/or wetlands, Montville, East Lyme and Waterford are considered coastal towns (as defined by CGS §22a-94). A coastal zone consistency review, therefore, may be required at the discretion of the state Office of Long Island Sound Programs (OLISP) even though activities may be located outside the designated tidal wetland areas or coastal boundary.

4.6.3.3 *Seasonal Pools:* Inventories and evaluations of seasonal pools were conducted in 2002 and 2005. The 2002 inventory was performed along the preferred alternative alignment, 155 m. (500 ft.) on either side of the area of disturbance (i.e., cut and fill limits). The 2005 inventory was conducted as part of the 2004-2005 biological field surveys (discussed in Section 4.4) along 16 transects located throughout the study area also used for the avian surveys (refer to Figure 4-17). Because of the rolling terrain and glacial till surface characteristics of the corridor, seasonal pools were found to be scattered throughout the study area. In total, 33 seasonal pools were inventoried during the 2002 and 2005 studies. Their locations are depicted in Figure 4-26.

Seasonal pools were located, evaluated, and species inventories were conducted. The studies were carried out based on the current scientific literature pertaining to seasonal (i.e., vernal) pool ecology. During the 2002 inventory, the boundaries of all seasonal pool areas identified were field located using a sub-meter Trimble GPS unit. Pools were delineated by the edge of free-standing water at the time of sampling. Representatives from the ACOE, FWS and ConnDOT were present on a number of field survey sessions during the seasonal pool inventory. Approximate boundaries were mapped during the 2005 survey using GPS coordinates and topographic features.

Seasonal pools were evaluated based on their hydrology, vegetation, upland habitat area, and species composition. The assessment included inspection and sampling to determine if visual evidence of seasonal pool characteristics were evident. The following physical characteristics must be met for an area to be considered a seasonal pool in Connecticut (Donahue, no date):

- presence of standing water for at least two months during the growing season,
- occurrence within a confined depression or basin, lacking a permanent outlet stream,
- absence of fisheries, and
- exhibits the potential to dry out in most years, usually by late summer.

Benthic grab samples of detritus were collected from the bottom of the pool, using trout nets, to determine benthic fauna composition. Man hours of sampling were recorded for each pool. Grab samples were also collected from the surface of the pools in order to determine which species were present or likely to be present in the upper water columns. Trout nets, plastic containers, and glass bottles were used to collect sub-surface and surface samples.

Visual observations were also made from the shore and within each pool. All species heard, seen or captured during sampling were recorded. Identification was made to the lowest taxonomic classification possible. For vertebrates, this

usually resulted in identification to species level. For invertebrates, identification was usually made to the order, suborder, or sometimes to the family level.

Upland habitat areas surrounding the pool (within 150 m. (492 ft.) of the pool edge) were also characterized by noting the species of dominant vegetation in each of the major vegetation layers, and by noting presence of adult herpetofauna. Based on available literature, ambystomid species generally travel up to 150 m. (492 ft.) from breeding pools to their upland habitat areas. According to Stone (1992) and Raymond and Hardy (1991), impacts to the upland buffer within 150 m. (492 ft.) of a seasonal pool may have measurable impacts on obligate species. Also, Semlitsch (1981) determined that adult male ambystomatid salamanders migrate between 100 m. (328 ft.) and 300 m. (984 ft.) between the breeding pool and their upland sites.

Detailed information, including figures depicting the specific locations of identified seasonal pools is documented in the report, *Seasonal Pool Inventory and Evaluation*.

4.7 FLOODPLAINS AND FLOODWAYS

4.7.1 EXISTING 100-YEAR FLOOD BOUNDARY

Floodplains are areas adjacent to rivers, streams and surface waterbodies, which are susceptible to flooding during periods of excessive water runoff. During normal stream flow, water is carried within the channel; in times of high runoff, water overflows its banks and spills into the floodplain.

Figure 4-27 shows the floodplain areas associated with the major watercourses in the project corridor. The limits of the designated 100-year floodplain are based on the Flood Insurance Rate Maps (FIRM) prepared by the Federal Emergency Management Agency (FEMA) for the communities of Salem, East Lyme, Montville, and Waterford (FIRM, 1982, 1995).

The 100-year floodplain includes all the land area that would be flooded during a 100-year storm event. A 100-year flood is a base flood that has a one percent chance of occurring in any given year. Over a long period of time, such a flood is projected to occur once every 100 years on the average. The 100-year flood boundary, or the 100-year floodplain, is the area identified for development restrictions. There can be no increase in the base flood elevations due to the proposed project. Thus, it must be ensured that hydraulic conveyance for the 100-year flood is maintained.

Within the project corridor, floodplains are found adjacent to most large watercourses... The largest floodplains within the project corridor are those associated with the sections of Latimer Brook in Montville and East Lyme and a section of Shingle Mill Brook in Salem.

Within the project corridor, floodplains are found adjacent to most large watercourses. The floodplains are generally located in wetland areas adjacent to the surface waterbodies. The largest floodplains within the project corridor are those associated with the sections of Latimer Brook in Montville and East Lyme and a section of Shingle Mill Brook in Salem.

A large floodplain is located at the intersection of Route 82 and Route 85 (Salem Four Corners). This floodplain, associated with Harris Brook, extends a distance of 300 m.(1,000 ft.) easterly from the brook to Route 85 and about 500 m.(1,600 ft.) northwesterly along Route 85 from Route 82. In Montville, Latimer Brook crosses Route 85. The floodplain in this area along Route 85 is about 300 m. (1,000 ft.) in width. From Route 85 to Route 161, the floodplain along Latimer Brook is about 120 m.(400 ft.) in width with larger areas located north and south of Grassy Hill Road. The Latimer Brook floodplain is generally narrow within East Lyme except in the area around Darrow Pond where the floodplain broadens to about 80 m.(250 ft.) in width.

4.8 LAND USE AND COMMUNITY CHARACTERISTICS

4.8.1 REGIONAL CONTEXT

The four-town study area (Salem, East Lyme, Montville and Waterford) commonly referred to as being a part of the Southeast Regional constituency, has a history, as do most Connecticut towns, rooted in agriculture. However, as with many of the smaller towns that pepper the eastern half of the state, the Southeast Region has maintained a rural character despite the pressures for growth that have influenced many other areas to become hubs for concentrated development. Reasons for this characteristic slow rate of growth are essentially geographical, and to a great extent physiographical. Over time, residents have come to cherish the many life style qualities that attend rural living and today, the area continues to attract new residents who are seeking the same.

As the state transportation system has grown and increased in efficiency, living in the Southeast Region and commuting to work in the larger city centers has become more feasible. This, in effect, has been helping to move these towns from a strictly rural context toward more suburban type community profiles. This is evidenced by the slow but steady incursion of discrete residential subdivisions into formerly undeveloped portions of the landscape. Of the four-town study area, the change is more accelerated in the towns of Montville and Waterford due to their juxtaposition to major transportation corridors, employment and coastal attractions.

...the Southeast Region has maintained a rural character despite the pressures for growth that have influenced many other areas to become hubs for concentrated development. Reasons for this characteristic slow rate of growth are essentially geographical, and to a great extent physiographical. Over time, residents have come to cherish the many life style qualities that attend rural living and today, the area continues to attract new residents who are seeking the same.

The traditional seasonal influx of regional visitors from the north and west seeking the recreational offerings of the Connecticut coast are now being supplemented by in-state and out-of-state year round visitors traveling to the Mohegan Sun casino, off Route 2a in Montville, and Foxwoods casino, off Route 2 in Ledyard (Figure 1-1). Clearly, the region is becoming more oriented as a recreation and entertainment venue. This combined with the normal pressures for growth cyclically tied to the general economy, are primary forces that are influencing the changes to land use in the Southeast Region. Progressively increasing burdens on local transportation networks, infrastructure, community services and the environment are prompting residents to react to what is perceived as an escalation of personal taxes and potential change in their quality of life.

Local efforts to gain some measure of control over growth patterns have manifested themselves in the basic development guidelines that are common to most municipalities; zoning, subdivision and wetland/ conservation regulations and local sanitary and water authority policies. Typical of the four town policies to help maintain "rural" quality of life objectives, promote neighborhood cohesiveness and protect the environment is a reliance on the large lot residential subdivision and related residential density controls. This is supplemented by limiting new road construction and infrastructure networks; functional placement of community services and commercial and industrial uses; and exploration of mechanisms to increase open space through public and private commitments.

4.8.2 LAND USE BY TOWN

The following is a discussion of each of the four towns in the study area with respect to specific land uses common to all. Local zoning for each town is shown on Figure 4-28.

4.8.2.1 *Town of Salem*: Incorporated in 1819, Salem is the northern-most town in the four-town group that comprises the study area. Salem is unique in that the last completed segment of Route 11 penetrates a portion of the town with the last interchange terminating on Route 82. The local land use impacts of the completed portion of Route 11 are evident in some of the new businesses that have grown in locations convenient to the Route 11 corridor points of access.

Physiography: The town has a landscape that may be characterized as a typically glaciated topography with many hills and valleys. Rainfall is channeled creating myriad small streams and pocketed in the flatter terrain as ponds and wetlands. Slopes in excess of 20% cover over 28% of the town

area; wetlands include over 20% of the land area. Soils are relatively shallow to bedrock in many areas with frequent appearance of ledge. The restrictive nature of the topography and wetlands is further limited by the effects of seasonally high water tables and flooding. Largely as a result of these restrictions, the town is only 14% developed with the majority of the built-up areas occurring in linear concentrations along local roads.

Residential Development: At 63% occupancy of the developed lands, residential land uses comprise the majority of development in Salem (Table 4-40). Residential land use categories include single and multi-family uses; single family use associated with farmlands (6% of total land area) is a relatively small category which continues to decline. There are no major concentrations of the town population, rather it is scattered throughout the town and is, for the most part, directly accessed from the local road network. More recently there has been some increased "suburban" type growth occurring as small subdivisions.

The 1980-1990 housing growth rate of 40% has slowed since 1990 reflecting the generally slower rate of population growth that is affecting all communities statewide. However, it has been determined that the completion of the last Route 11 segment in the early 1970s was an important factor in the 1980s rate of growth (on record as the fastest in the state for the 1980-1990 period).

Commercial Development: As with the residential market response to Route 11, commercial growth experienced its greatest increase as a direct result of improved access to Routes 82 and 85 via the terminal Route 11 interchange on Route 82. The construction of new businesses along Route 82 and at the intersection of Routes 82/85 occurring since the completion of the last Route 11 segment was considered to be the greatest period of commercial growth in the history of the Town of Salem. Most of the balance of the commercial market is scattered north along Route 85 and in the Salem Four Corners and Heilwield Corner areas; the entire commercial land use representing only about 2% of the developed area in town. The commercial/retail market consists mostly of convenience-type stores. Town residents travel to neighboring towns where more extensive shopping venues are offered.

Industrial Development: Industrial land uses in Salem fall into three basic categories: manufacturing/processing, excavation and junkyards. Industrial uses are generally small in scale and scattered, with the greatest concentration of "I" zoned lands occurring adjacent to the Route 11 corridor in the vicinity of the interchange with Witch Meadow Road. Industrial land use represents about 4% of the developed land area in town.

TABLE 4-40
EXISTING LAND USE BY TOWN

LAND USE	SALEM		MONTVILLE		EAST LYME		WATERFORD	
	AREA	PERCENT	AREA	PERCENT	AREA	PERCENT	AREA	PERCENT
Residential	666 ha. (1,644 ac.)	8.6%	1,036 ha. (2,559 ac.)	9.1%	1,624 ha. (4,011 ac.)	17.1%	1,494 ha. (3,689 ac.)	17.3%
Commercial	22 ha. (54 ac.)	0.3%	230 ha. (569 ac.)	1.9%	133 ha. [(1)] (328 ac.)	1.4% [(1)]	475 ha. [(2)] (1,173 ac.)	5.5% [(2)]
Industrial	38 ha. (93 ac.)	0.5%	74 ha. (183 ac.)	0.6%	NOT AVAILABLE	NOT AVAILABLE	118 ha. (292 ac.)	1.4%
Government/ Institutional	15 ha. (36 ac.)	0.2%	56 ha. (139 ac.)	0.5%	1,624 ha. (4,011 ac.)	17.1%	210 ha. (518 ac.)	2.4%
Transportation/ Communication	246 ha. (608 ac.)	3.2%	NOT AVAILABLE	NOT AVAILABLE	446 ha. (1,102 ac.)	4.7%	577 ha. (1,424 ac.)	6.7%
Recreation/ Open Space	704 ha. (1,740 ac.)	9.1%	960 ha. (2,370 ac.)	8.5%	997 ha. (2,463 ac.)	10.5%	1,121 ha. (2,768 ac.)	13.0%
Agricultural	508 ha. (1,256 ac.)	6.6%	410 ha. (1,013 ac.)	3.6%	NOT AVAILABLE	NOT AVAILABLE	NOT AVAILABLE	NOT AVAILABLE
Undeveloped	5,510 ha. (13,609 ac.)	71.5%	8,513 ha. (21,027 ac.)	75.8%	4,672 ha. (11,539 ac.)	49.2%	4,619 ha. (11,409 ac.)	53.7%
Total	7,708 ha. (19,040 ac.)	100%	11,279 ha. (27,860 ac.)	100%	9,532 ha. (23,454 ac.)	100%	8,614 ha. (21,273 ac.)	100%

Source: Town Plans of Development
[(1)] Figure represents both commercial and industrial land.
[(2)] Figure includes 243 ha. (600 ac.) of land designated for public utilities and transmission lines.

Open Space: Salem Open Space, defined as land presently owned or managed for purposes of resource protection, occupies about 6% of the total town land area and includes town-owned properties, the New London water supply lands and the Nehantic State Forest Parcel.

Government and Community Facilities (local/state/federal): The Salem Town Offices and Town Garage are centrally placed within the community on town owned lands identified as the "Town Center Area." This is an area defined along both sides of the segment of Route 85 between the intersections of Morgan and Round Hill Roads, the centerpiece of which is the Town Green. The general area is also on the National Register of Historic Districts (CT Historical Commission). The greater portion of Gardner Lake (DEP-owned waterbody) is within the Salem town boundary. Salem considers Gardner Lake a "unique" resource and "the town's most important natural asset." Approximately 20% of the Nehantic State Forest is within town boundaries at the southerly edge of the municipality.

Police protection is provided by a full-time resident state trooper and two full-time constables housed within the town office building. Fire protection is provided by two local volunteer companies; the Salem Volunteer Fire Company on Route 85 and the Gardner Lake Volunteer Fire Company on Route 354. The two local companies are supplemented by the Chesterfield Fire Company located in Montville providing cooperative service to cover the southeastern areas of Salem. The town maintains one ambulance garaged at the Gardner Lake Firehouse. Emergency medical needs are supplemented by the First Responder System, which constitutes a group of trained volunteers living in various parts of town and responding to calls in their personal vehicles with special emergency kits.

Solid waste is handled at a local transfer station since closure of the landfill in 1994. Sanitary wastes (liquid) are handled exclusively by individual septic systems; there is no central sewer system in place.

Institutional Facilities: The Salem Elementary School located in the Town Center off Route 85, is the town's only school (K-8). High school students are bussed to adjacent towns; most attend the East Lyme High School. Elementary school health needs are administered by a school nurse on staff with the Board of Education. All other town health services are provided by the Visiting Nurse Association of Southeast Connecticut, together with Waterford, East Lyme and other shoreline towns. The Salem Congregational Church and Town Cemetery are located on Route 85 in the Town Center Area.

Recreational Facilities: Recreation facilities and programs are managed by the Salem Recreation Commission and include school-related indoor and outdoor facilities, athletic fields on town-owned lands, Gardner Lake Park, boat launch, and camp grounds. Recreational land uses occupy about 6% of the developed land area.

SALEM CONSERVATION AND DEVELOPMENT GOALS

- Preserve Salem's rural character and natural resources.
- Encourage preservation of agricultural character.
- Protect and preserve historic and archaeological resources.
- Assist in expansion of existing businesses and encourage businesses compatible with rural character of Salem.
- Provide appropriate and affordable community services.
- Town Center and Town Green should remain center of municipal activity.
- Provide safe and convenient roadway access.
- Complete Route 11
- Town roads should reflect rural character of community.
- Encourage bikeways, trails and pedestrian facilities and networks.
- Encourage balance of housing, including affordable housing, tied to ability of land to support housing development.
- Ensure accessibility to houses by emergency vehicles.

Source: Plan of Conservation and Development, Salem, Connecticut, adopted February 12, 2002.

Transportation: Salem roads are classified in four categories: limited access highway (Route 11), two-lane arterial (Routes 82, 85 and 354), collector and local access roads. With the exception of Route 11, most roads do not meet current standards with respect to required shoulders, sight distance and gradient, but are reasonably well maintained. Substantial increases in traffic along the Route 85 corridor from the intersection with Route 82 south has resulted in diminished LOS locally and higher accident rates. The town is not pursuing the construction of any new local roads at this time, but has voiced strong local support for the completion of Route 11. Salem considers Route 11 the single most important asset for attracting economic activity.

Undeveloped Lands: Representing 72% of the total town land area, this area includes all lands not previously categorized. These lands are defined as privately-owned undeveloped woodland. Almost one-third of this area is registered under the state forested lands statute, Public Act (PA) 490 (25-ac. minimum forested plots may be registered with the state as existing undeveloped tracts. These lands are subject to reduced tax rates.)

Water Supply: Town wells servicing municipal properties (i.e., Town Hall, Salem School, etc.) and private wells provide water supply for Salem residents. Two large water supply watersheds are defined; one to the north (364 ha. (900 ac.)) supplying the Deep River Reservoir, the sole source of water for the City of Norwich, and one to the south (about 770 ha. (1,900 ac.)) that drains into Fairy Lake and Barnes Reservoir serving the New London system. Additionally, there are several aquifers that have been identified both within and outside the watershed boundaries.

Municipal Controls (zoning, subdivision, wetlands, infrastructure policy): The Salem Zoning and Subdivision Regulations (November 8, 1960; update April 15, 1998) are the primary land use control mechanism for development in the town. These regulations are supplemented by Inland Wetland Regulations and related local authority procedural and design standards. The regulations are administered through Planning and Zoning Commission, Zoning Board of Appeals, Inland Wetlands/Conservation Commission and the Recreation Commission. Salem is regarded as a non-urban municipality. Maintenance of this characterization is accomplished through controlled housing density. Subdivision regulations permit smaller lot sizes within well-defined development criteria.

To facilitate development opportunities in areas otherwise unsuitable for conventional single family applications due to topographic and/or environmental limitations, the zoning regulations provide for Rural Cluster Development (RCD) which allows placement of single family homes in close proximity on small lots (20,000 sq. ft. min.) within a large subdivision tract that maintains commonly owned land that is at least 70% of the overall subdivision parcel designated to remain as open space. Another device for purposes of minimizing development impacts is the allowance to construct dead end access roads to a maximum length of 457 m. (1,500 feet).

4.8.2.2 *Town of Montville*: Settled in 1786, Montville is the oldest municipality of the four-town study group. Geographically positioned with the Thames River extending along the entire length of the town's eastern boundary, having multiple access points to I-395 and being home to the Mohegan Sun Casino, Montville is able to offer a dynamic land use mix to existing and prospective residents. Much of the town's growth and activity (approximately 26% of total land area) is concentrated along the Route 32 local corridor where superior access to and from I-395 provides a favorable environment for business. However, the uncompleted Route 11 currently directs a growing traffic volume south through the Route 85 corridor to I-95 and I-395. As a result, Montville residents in this southwest corner of the town are experiencing a growing degradation of access levels of service and safety.

Physiography: Like Salem, Montville's landscape defines its development opportunities given the limitations of slope, wetlands, bedrock and flood hazards. In regard to the study area, while the Route 85 corridor terrain is relatively flat to moderately sloping, the road progresses through an area that is bordered by extensive wetlands and through water supply lands. Slopes in excess of 20% cover approximately 20% of the land area; wetlands and watercourses cover approximately 25% of the total land area. The developed area of the town presently totals approximately 12% of the total land area.

Residential Development: At 74% (1,036 ha. (2,559 ac.)) occupancy of the developed lands, residential land uses comprise the majority of the development in Montville (Table 4-25). Residential densities are categorized as low, medium and high density; being predominantly low and medium density residential. The town's most marked growth rate occurred in the 1960s decade, but has weakened over time, and is now experiencing a relatively slow rate of growth. Typical of the Southeast Region development pattern, residential land uses are scattered along the local road network with the greater portion of residents locating east of I-395 and north of Horton Cove. Two exceptions are the major developments at Montville Manor and Oakdale Heights. Residential development along the Route 85 corridor is low density with most homes directly accessing Route 85.

Commercial Development: With the noteworthy exception of the Mohegan Sun Casino, commercial growth has been slow to moderate with no apparent trends. Commercial businesses are scattered with no major concentration, although the majority of commercial development occurs along the Route 32 corridor. Commercial land uses comprise approximately 5% of the developed land, however, in context with residential development, its share has been decreasing since the late 1970s. With the exception of local convenience-type businesses in the vicinity of the Route 85 and Chesterfield Road intersection, the Route 85 corridor is predominantly residential land use with some light industrial zoned lands.

Industrial Development: As with commercial development, the growth of industrial land uses has been slow and has not kept pace with the rate of residential growth. Comprising over 17% of the developed land area, industrial uses far exceed commercial uses (excepting the Mohegan Sun Casino enterprise). Uses include manufacturing, warehousing, junkyards, sand/gravel excavation (almost 12% of the total 17%), Connecticut Light and Power Company and the town landfill area. Changes in industry have generally taken place within existing buildings with few new structures being constructed. Within the Route 82/85/11 corridor area, light industrially zoned lands occur east of Route 161 and south along Route 85 including two excavation operations.

Open Space: Montville includes its recreation properties within its open space land total thereby comprising approximately 8.5% of the total land area (as compared to residential, commercial and industrial comprising 10%, 0.5% and 0.7% of the total land area respectively). "Reserve" open space includes Nature Conservancy properties along Route 82/Lynch Hill Road, City of Norwich owned lands at Stoney Brook Reservoir, New London owned lands at Lake Konomoc, Bogue Brook and Barnes Reservoirs, and the town conservation area on Chesterfield Road. Unreserved open space would include agricultural lands which occupy approximately 3.5% of the total land area and have been experiencing a slight decline over the past three decades.

MONTVILLE COMPREHENSIVE DEVELOPMENT GOALS

- Provide for residential development at densities and in areas compatible with economic, social, transportation, and environmental objectives of the plan.
- Achieve a land use design which adds to the economic viability of the town by way of efficient use of public and municipal utilities, provision of sufficient amounts of land for commercial, industrial, and residential development, and sound environmental planning.
- Achieve a more balanced residential population density distribution in developing areas, and in areas serviced or to be serviced by public and municipal utilities.
- Enhance the quality of the environment and natural resources.
- Preserve areas of historic and cultural significance.
- Locate individual land use sectors in a manner that serves the needs of the town and all its residents in accordance with the transportation system's capabilities.
- Establish an efficient and coordinated transportation system to serve the needs of the Town of Montville.
- Enhance prospects for open space and recreation in the Town of Montville.

Source: Montville Plan of Development, updated 1996.

Government and Community Facilities: Municipal facilities are centered in Uncasville and Montville concentrated along the Route 163 and Maple Avenue corridor. There are no community facilities located within the study area.

Public Services, Police/Fire Protection: Public sewerage is concentrated along the Routes 163 and 32 corridors, the areas of greatest concentrated development and potential for future growth. Future expansion of the system will continue to be based on serving new development within these corridors and, to a limited extent, for the purposes of solving septic problems in environmentally sensitive areas. Sewer expansion programs have typically been designed to solve small lot/high population density groundwater pollution problems and have been limited in areas that have been designated to be maintained as low density development and reserve open space. This includes much of the area within the Route 82/85/11 corridor.

Institutional Facilities: The 1990s decade has seen a marked increase in high school enrollments, and expansion programs have been implemented to accommodate the upward trend. Conversely, decreasing primary school enrollments, due to the general decrease in birth rates, have caused the total school enrollment to drop steadily since 1972. School capacities appeared to

be adequate to meet anticipated needs until the year 2000. A school renovation and expansion program was initiated in 2002. School facilities are generally centrally located and outside the study area. Church and cemetery land uses are located throughout Montville. Three historic cemeteries are located along Route 85.

Recreational Facilities: Recreation facilities and open space areas comprise approximately 8.5% of the total town land area. The majority of the active recreational land uses are located throughout the northerly two-thirds of the town. The Route 85 corridor constitutes the southerly boundary of a large natural open space system that is comprised of the Bogue Brook and Barnes Reservoirs, town conservation areas, Great Swamp, Lake Konomoc and the related New London-owned lands.

Transportation: Montville town roads are classified as interstate route, principal state route, major local street, secondary local street and minor local street. Planned reclassification will modify this group to expressways, arterials, collectors, and local streets. Routes 85 and 161 are considered arterials functioning as high volume roadways serving collector roads and connecting important destinations within the town as well as neighboring towns and major transportation corridors (I-95/I-395). Chesterfield Road is considered a collector functioning to carry moderate volumes of traffic serving local road networks and connecting important locations principally within the town. Many residences are directly accessed from roadways that were initially local in character and use but later became arterials and collectors to meet the evolving transportation demands of the towns and their regions. Current traffic patterns along the Route 85 and 161 north-south corridors have created deficiencies on both roads.

Undeveloped Lands: Representing about 75% of the total land area, this area represents all lands not previously categorized. These lands are defined as privately-owned undeveloped lands.

Coastal Management: Considered a special area of concern with respect to the many impacts and influences of the Thames River, the area between Route 32 and Montville's easterly boundary continues to receive attention with respect to future growth potential and contingent impacts. Business, community and recreational destinations along the river corridor for travelers from the north and west are accessible via Routes 11, 82, 85 and I-395.

Water Supply: Many residential land uses depend on private on-site well resources. The more concentrated areas of development are serviced by a combination of community and municipal small water systems; water resources for these systems are a combination of wells and reservoirs. The Bogue Brook and Barnes Reservoirs and Lake Konomoc service portions of Montville. All lands bordering the eastern boundary of the Route 85 corridor are zoned WRP-160 (Water Resource Protection R-160 District). This has been identified as an area that is currently functioning as an important water source and has the potential to yield a reliable water supply over the long term. Development in this area is limited to low density single family residential, farm and recreational uses. Local policies in this regard limit clearing of natural vegetative cover and filling. Also, public sewers are to be constructed only as needed to correct existing pollution problems (not to foster new development at increased densities).

Municipal Controls: Land use control is effected through the implementation of the local Zoning (1996) and Subdivision Regulations, supplemented by the Inland Wetland Regulations and related local authority procedural and design standards. The local commissions/authorities charged with administering and enforcing these regulations include: the Planning and Zoning, Inland Wetlands, Conservation and Parks and Recreation Commission, Zoning Board of Appeals, Flood and Erosion Control Board, and the Water and Water Pollution Control Authority. With the exception of the Route 32 corridor, Montville is zoned as a non-urban municipality. Of the developed acreage, over 75% is zoned for residential use with the majority requiring a 2-3 ac. minimum lot size. A substantial area zoned WRP-160 requires minimum 4-ac. lots. Zoning controls, in combination with limited public sewers, maintain large portions of the town area as rural and suburban in character. Zoning controls for the study area present a mixed use opportunity of medium density residential, limited areas of medium density commercial, light industrial and a majority of the lands WRP-160.

4.8.2.3 *East Lyme*: Settled in 1839, East Lyme is the youngest municipality of the four-town study group. With approximately one-half of its eastern boundary and entire southern boundary bordered by the Niantic River and Long Island

Sound respectively, East Lyme is essentially a coastal community that has long been associated with beach recreation opportunities. Over time the town has developed (50% of total land area) in a pattern that is characterized as having three distinct areas: the northern area which is generally rural, the central area which is characteristically suburban and the southern area which may be described as older urban type development related to Niantic Bay and Long Island Sound, comprising 60%, 25% and 15% of the total land area respectively. East Lyme growth patterns have and continue to be heavily impacted by I-95 and I-395 and the Amtrak northeast rail corridor.

EAST LYME PLAN OF CONSERVATION AND DEVELOPMENT GOALS

- To maintain the predominantly residential character of the Town.
- To ensure that development meets high standards of quality.
- To manage East Lyme's natural resources wisely.
- To provide the quality and range of municipal services and facilities desired by the townspeople while maintaining an affordable tax burden.
- To establish a coordinated, cooperative system of land use decision-making.
- To promote wise use of land in the coastal area, which recognizes the importance of the Town's coastal resources and existing water-dependent uses.
- To provide for the safe and convenient movement of people through the development of a planned circulation system which serves local traffic, through traffic, and pedestrian movement.

Source: East Lyme Plan of Conservation and Development, 1999

Physiography: The town's development patterns mirror the natural limitations posed by the steeper terrain, more extensive wetlands and shallow to bedrock conditions throughout the northern two thirds of the town as contrasted to the more accessible, generally flatter terrain in the central and southern one-third of the town. The southern area, which has experienced the majority of development, is also some of the most environmentally sensitive land given its coastal proximity and groundwater conditions. The study area transits the eastern portion of the northern area where the frequency and size of wetland groups and waterbodies is somewhat less than in the areas to the west. However, the pattern of slopes and valleys is relatively consistent throughout the entire northern area.

Residential Development: At over 20% of the developed land, residential land uses are approximately equal in coverage to institutional lands, the other prominent land use. In keeping with the physiographic limitations, residential densities are rural in the northern area, more suburban in the central area with some higher concentrations within the village of East Lyme, and suburban to urban concentrations of dwelling units along the coast and in the village of Niantic. The housing stock, like the population, continues to grow at rates that exceed towns to the immediate north due in large part to the impact of the I-95/I-395 corridor and the aspect of coastal recreation and vacation environment. Residential densities throughout the study area are generally rural with the exception of some higher densities along the Route 161 corridor.

Commercial Development: Commercial development is a combination of small-scale traditional convenience business serving some of the older medium- and high-density residential areas that are predominant in the southern area and village centers, marine related businesses, tourist accommodations and the more intensive commercial development associated with major transportation corridors. Both Niantic and Flanders have undergone a continuous commercial growth rate with Flanders experiencing the most rapid pace because its close proximity to I-95/Route 1/I-395 interchanges. Commercially-zoned lands in the Route 82/85/11 study area occur at the proposed Route 11 interchange with I-95/I-395.

Industrial Development: Light industry is primarily confined to two industrial parks, one off Flanders Road and the other in the southwest end of the town adjacent to I-95. The Flanders Road park is in the vicinity of the proposed Route 11 interchange at I-395 and I-95.

Open Space: East Lyme identifies their open space as state-owned (Nehantic and Rocky Neck State Parks) and town-owned (Plant's Dam, Maplewood Drive Property, and Grouse Circle lands). The state lands include recreation facilities; the town lands are undeveloped. The Grouse Circle lands (20 ha. (50 ac.)) are located in the northern area of town, east of Route 161 and extending to the Town of Waterford corporate boundary (Grouse Circle open space falls within the corridor study area).

The Nehantic State Forest (486 ha. (1200 ac.)) is located in the northern area of the town, and Rocky Neck State Park (227 ha. (562 ac.)) is located in the southern area of the town. Together, these two public open space holdings represent approximately 10% of the total town land area. The Nehantic State Forest occupies a large linear area running north and south to the west of the study area.

Government and Community Facilities: The Town Hall is located in the village of Niantic; the Town Garage is located just north of the village on Route 161. State facilities include the Nehantic and Rocky Neck State Parks.

Fire Protection and related emergency services are provided by the Emergency Operations Center and Flanders Fire Headquarters located in the village of East Lyme, the Niantic Fire Headquarters in the village of Niantic and Niantic Fire Station No. 2 on Route 156, south of Bride Lake. Police Protection is headquartered in the Town Hall in the village of Niantic. Plans for many of these facilities call for expansion of existing facilities or involve the construction of new buildings. There are no plans for construction of new community facilities within the Route 82/85/11 study area.

The East Lyme sanitary landfill facility is located in an old quarry area off Roxbury Road, south of I-95. Landfill capacity is almost depleted and the town has been seeking a solution to future waste disposal needs that focuses on regional alternatives. Under the management of the East Lyme Water and Sewer Department, the town is in a multi-phased process of constructing pipe and pumping facilities to carry sanitary wastes to the New London sewage treatment plant.

Institutional Facilities: Unique to East Lyme is the relatively large portion of low intensity institutional lands (1,623 ha. (4,010 ac.)). These lands include:

- State Farm Correctional Facility, located near Bride Lake, south of I-95
- Stone Ranch Military (National Guard) Reservation, north of I-95 along the town's western boundary and extending into the northern area to meet the southerly boundary of the Nehantic State Forest
- The Yale Property, located in the northern area of town near the Nehantic State Forest
- Public Education Facilities include the L.B.Haynes School and Junior High School located on Society Road, south of I-95, and the Flanders School and High School located on Chesterfield Road in the village of East Lyme, north of I-95. At this time, there is no anticipation of the need for the expansion of the existing system.

Recreational Facilities: Town-owned lands offering public recreation facilities include the following: McCook Point Park, Veterans Memorial Park, Bride Brook Park, the Junior High and Haynes School and Smith Harris Tract, the Flanders School and High School and the Niantic Center School. All facilities are outside the Route 82/85/11 corridor study area.

Transportation: East Lyme town roads are classified as expressways, arterials, collectors, rural collectors and local roads. Route 161, which penetrates the Route 82/85/11 study area, is considered an arterial, functioning as a high volume roadway serving collector streets and connecting important destinations within the town as well as neighboring towns and major transportation corridors (I-95). Route 161 is also an important traffic corridor linking Route 85 in Montville to Route 1, I-95 and the villages of East Lyme and Niantic. Route 161 also services the rural collectors, Walnut Hill and Upper Walnut Hill Roads and Grassy Hill Road, all of which are within the Route 82/85/11 study area.

The East Lyme Traffic Improvement Program has identified several specific roadways for improvement, which have been categorized as first, second or third Priority objectives. Route 161, Grassy Hill Road and Upper Walnut Hill

Road are prioritized first, second and third respectively. As a first priority issue, Route 161 has been identified as the highest volume local road in East Lyme and considered among the most congested routes in the region. The basic problem of reduced traffic capacity has been attributed to a combination of too many signalized intersections and too many uncontrolled access points to roadside commercial interests. Proposed solutions include selected widening and safety improvements.

Undeveloped Lands: Approximately 50% of the total town area (54 sq. km. (21 sq. mi.)) is undeveloped. These lands consist of privately held acreage that remains as open space and currently zoned for future development.

Coastal Zone: East Lyme is designated as one of the state's coastal towns. Resources within the coastal boundary and land areas regulated under the CAM program have special value for users and as a natural resource. This area is in proximity to the area proposed for a Route 11/I-395/I-95 interchange under the 92PD, E, F and G alternatives.

Water Supply: The East Lyme Water and Sewer Department services are concentrated in the higher density development areas within the town. Future water system improvement plans include expansion of the distribution system, remaining confined to areas of relatively intense development. Properties within the Route 82/85/11 corridor study area are serviced by private on-site wells.

East Lyme has a well-established water resource management plan in effect. At least four major aquifers have been identified and are considered a first priority protection issue. Steps to help insure preservation of aquifer integrity have included town purchase of related lands and the rezoning of lands within the aquifer boundaries permitting only low density development and limited alternative development with special control regulations (refer to Figure 4-21). Within the Route 82/85/11 corridor study area, a portion of the largest aquifer bifurcates at the Route 1/I-95 intersection and continues north along the easterly side of Route 161 to the intersection with Walnut Hill Road.

Municipal Controls: Land use control is effected through the implementation of the local Zoning (amended through 1998) and Subdivision Regulations, supplemented by the Inland Wetland Regulations and related local authority procedural and design standards. The local commissions/authorities charged with administering and enforcing these regulations include the following commissions: Planning, Zoning, Zoning Board of Appeals, Conservation, Parks and Recreation and Water and Sewer.

East Lyme is classified as a suburban community based upon the average population density; the population is concentrated in the central and southern areas of the town. The physiographic and environmental restrictions imposed on the northern area combined with the presence of the major water supply resources and large tracts of reserve open space have discouraged intense development, and town controls will maintain this area as a rural environment.

4.8.2.4 *Waterford:* Settled in 1801, Waterford has the largest land area and population of the four-town study group. Waterford is especially unique to the other three towns with respect to the great extent of its coastal exposure, relationship to the major transportation corridors and its juxtaposition to the City of New London. Being in more of a "hub" location, Waterford has been able to attract some of the larger commercial business generators (Crystal Mall). The presence of the Millstone Power Plant has provided the town with the seventh largest tax base in the state (per capita basis). This has enabled Waterford to provide a wide range of community services and the funds to maintain them. Considered a suburban community, most of the population is concentrated in coastal related villages. Today Waterford is about 46% developed; the remaining 54% is undeveloped, consisting of private lands that are either uncommitted or registered under PA 490. Waterford seeks to preserve the portions of the town that still retain a rural character.

Physiography: As a primarily coastal community, the greatest portions of the town lands are associated with the more moderately sloping terrain that is characteristic of shoreline communities along the northeast coast. Lands in the northerly 25% of the town, away from the coastal environment of the Sound and Niantic and Thames Rivers, exhibit some of the steeper slopes and valley areas, representative of the other three towns within the study area. In regard to the study area, lands in and around the interchange of Route 11 with I-95 and I-395 proposed for the full build alternatives are moderately sloped and affected by adjacent wetland and the coastal zone of the Niantic River.

Residential Development: Waterford is considered a suburban community with over 37% of the developed land committed to residential use. Residential densities are categorized as multi-family, village residential, medium density, low density and lowest density. Waterford has developed around the major transportation routes and coastal opportunities and attractions such that the greatest concentrations of people are located south of the I-95 corridor and north along the Thames River corridor. The majority of low density development occurs to the north of I-395. Within the Route 82/85/11 corridor study area, residential lands are zoned for minimum three ac. lots, the lowest density category.

Commercial Development: Commercial development occupies approximately 13% of the developed lands (6% of total land area). Commercially zoned land uses are generally confined to the U.S. Route 1 corridor, portions of the I-395 corridor and within the "Business Triangle", an area defined by I-95, I-395, and Route 85. Within the Route 82/85/11 corridor study area, commercial land uses are confined to acreage south of I-395 at the intersection of Route 85. Waterford considers their commercial base to be reasonably balanced at this time and would prefer to focus on the upgrading of the existing inventory rather than encouraging additional growth. Such new commercial development that is likely to occur will be directed to opportunities within the "Business Triangle."

WATERFORD GOALS AND POLICIES

- Preserve individual village identities and the rural and semi-rural character of the town through the use of greenbelts to define areas and by adopting standards to address building and site design to enhance the overall character of Waterford.
- Preserve, protect, and enhance the environmental quality of important natural and biological resources including fresh water resources and key scenic vistas.
- Preserve, protect, and enhance coastal waterbodies, wetlands, and fragile shoreline environment as one of the unique and defining characteristics of Waterford.
- Provide for adequate open space to meet present and future needs by establishing a coordinated open space/greenbelt system and a comprehensive trail system in Waterford, by setting aside funds to acquire open space, and by encouraging private ownership of open space.
- Encourage a variety of appropriate housing types and densities to meeting different housing needs and desires of Waterford's residents; guide design/location of multi-family development.
- Promote economic development and balanced growth in order to foster local employment opportunities, maintain a favorable tax base, encouraging compatible economic development and direct business growth to the Business Triangle, and guiding the design of non-residential developments
- Provide adequate community services and facilities and a range of recreational opportunities to meet residents' needs.
- Provide for the safe and efficient movement of persons and goods through and within the Town while balancing the needs of pedestrians, bicyclists, vehicles, and transit with community character and environmental impacts.

(Continued on next page)

Industrial Development: Industrial lands account for approximately 2% of the developed area (less than 1% of the total land area). Current zoning concentrates industrial land uses in the south, primarily at the site of the Millstone Power Plant. Another area is concentrated around the Amtrak Northeast Corridor, and the largest area is located within the "Business Triangle." Within the Route 85 corridor and Route 82/85/11 study area, industrial park zoned land is located north of and adjacent to the I-395 corridor at the Route 85 interchange. Waterford would like to expand this tax base by modifying the existing zones to increase industrial land use within the "Business Triangle" and all along the southerly portion of the I-95 corridor.

Open Space: The town regards approximately 13% of their land area as preserved open space, with over half of this area being in the public domain. In terms of preserved open space versus vacant lands, this percentage is comparable to the amounts of designated open space found in other communities in the state's southeastern region. The town resident consensus

is that more open space should be set aside both as undeveloped space and for public park use. Currently, 1,120 ha. (2,768 ac.) is designated open space; of the total land area, 7.7% is public land (parks, etc.), 0.6% is held in land trusts or conservation easements and 4.6% is private open space or cemeteries. The Waterford Plan of Preservation, Conservation and Development (effective October 1, 1998) proposes that additional open space be acquired by the town with the objective of combining existing and future open space lands in combination with easements in such a manner as to create a contiguous system of public access open space. This system would be developed to support passive recreation opportunities such as hiking and bike trails.

WATERFORD GOALS AND POLICIES (CONTINUED)

- Provide adequate infrastructure for community needs including the development of new water supply sources in the near future and the placement of sewers where needed and appropriate.
- Establish a design review process to preserve and protect the most important elements of Waterford's community character.
- Preserve the historical, archaeological, and cultural features that contribute to the character and uniqueness of Waterford.
- Continue to work cooperatively with other municipalities and regional planning agencies in areas of common interest.
- Maintain local regulations and enforcement procedures to implement the Plan of Preservation, Conservation & Development.
- Undertake detailed studies of important areas in Waterford including ... major road corridors such as Routes 1, 32, and 85.
- Implement the recommendations of the Plan and other programs that encourage the most appropriate development of Waterford.

Source: Town of Waterford, Plan of Preservation, Conservation & Development, 1998.

Government and Community Facilities: The Waterford Town Hall is within the civic triangle which is located along U.S. Route 1 near the easterly boundary of town. Millstone Power Plant is a quasi-public facility.

Most of the town's community services are located within the civic triangle, an area bounded by U.S. Route 1, Rope Ferry Road and Avery Lane. Facilities at that location include the Town Hall, Library, Community Services Building, Historical Society, Police and Public Safety Complex and the Post Office. Fire protection is provided by the Goshen Fire Station in the south, the Jordan Fire Station in the south-central town area, the Oswegatchie Station on U.S. Route 1 along the westerly town boundary, the Cohanzie Fire Station in the east-central portion of town and the Quaker Hill Station in the northeast quadrant of town. The Public Works Facility is located in the north-central part of town along Route 85just south of the I-395 interchange. Future growth needs will continue to rely on the existing facilities.

At this time the town landfill is still viable and available to the community to handle solid waste through the transfer station located in the southeast quadrant of the town. Looking ahead to the eventual closure of the landfill, current plans include the movement of the transfer station to the Business Triangle just north of I-95 to be serviced by private contractor. Recent sewer

installations have brought public sewers to most areas of town covering about 80% of all areas south of I-395. Sewerage north of I-395 has not been encouraged in order to minimize concentrated growth. Sewage treatment is provided by the City of New London.

Institutional Facilities: As with the other community services and facilities, all schools are located south of the I-395 corridor. School capacities are considered adequate for the near term (Waterford 1998). As most of the school sites have limited potential for expansion due to site and/or building restrictions, the potential for construction of new facilities on adjacent lands or on new sites is a consideration. New sites would logically be pursued in areas south of the I-395 corridor where most of the town development has occurred. There are no existing or planned institutional facilities located in areas that will be directly impacted by the Route 82/85/11 alternatives.

Recreation Facilities: The town is well served by an extensive array of facilities that are all located to the south of the I-395 corridor. Planned future facilities are associated with the natural resources of Miller's Pond and Smith Cove; both located south of I-395. There are no existing or proposed recreation facilities located to the north of I-395 that would be directly impacted by any of the proposed Route 82/85/11 alternatives.

Transportation: Existing road classifications include local, collector, arterial and interstate or limited access highway. With the exception of proposed specific improvements to increase capacity and access on selected arterials and segments of I-95, most local road improvements are safety related at particular intersections and turn lanes. Waterford is intent on maintaining a neighborhood scale to their travelways and maintaining a balanced hierarchy within the town transportation system. Specific to the Route 82/85/11 corridor alternatives is the town's desire to implement traffic safety improvements to Route 85 north of I-395 and to complete Route 11 from Salem to the I-395/I-95 interchange. These improvements are considered important to the encouragement of development and the general economy as well critical to the safety of the users.

Undeveloped Lands: Undeveloped lands or vacant lands currently uncommitted or registered under the PA 490 program, are defined as all lands not classified as designated open space. Most of these undesignated open space lands are privately owned and comprise approximately 53% of the total land area; about 31% 2,645 ha.(6,535 ac.) being vacant/uncommitted and 23% (1,973 ha. (4,874 ac.)) PA 490 lands (minimum 5-acre tracts of undeveloped or farm lands enrolled in the PA 490 reduced tax assessment for lands committed over a defined period of time.).

Coastal Zone: Waterford is designated as one of the state's coastal towns. Resources within the coastal boundary and land areas regulated under the CAM program have special value for users and as a natural resource. This area is in proximity to the area proposed for a Route 11/I-395/I-95 interchange under the 92PD, E, F and G alternatives.

Water Supply: Community water service extends throughout most areas of town. Most of the public supply comes from the New London-owned and PSGNLU-controlled Lake Konomoc reservoir. Looking to the future, the town is considering the benefits of creating a regional water supply system.

Municipal Controls: As with the other communities, land use control is effected primarily through Zoning and Subdivision Regulations, augmented by Inland Wetland Regulations and the local authority procedural and design standards. These controls are implemented within growth guidelines provided within the town's Plan of Conservation and Development. Public improvements are further controlled by the fiscal parameters of the local capital improvements program. Administration of the established land use controls and interpretation of planning guidelines is provided through town staff and the various commissions and authorities charged with that responsibility.

Waterford considers itself a rural urban community with areas of higher residential concentration that are generally referred to as neighborhoods or village residential areas. The greatest concentration of the population occurs to the south of the I-395 corridor with over 60% of the developed areas south of I-95. Areas directly impacted by the Route 82/85/11 corridor alternatives are zoned RU-120, the lowest density use in town.

4.9 FARMLAND RESOURCES

The NRCS has developed criteria for important farmlands; these include soils designated as "Prime, Unique or Additional Farmlands of Statewide Importance." Farmlands may also be classified as locally important. The agricultural soils are categorized according to their relative ability to support farming.

In Connecticut, there are no Unique Farmland soils. Prime farmlands, which are designated based on soils characteristics, are high quality lands best suited to producing food, feed, fibers, forage and oilseed crops. The Additional Farmlands of Statewide Importance cover land that is almost considered prime land but may be wetter or have steeper slopes. Sites with either of these soil classifications may be actively farmed, fallow, forested or developed. Farmland soils are classified based on physical characteristics, rather than current land use. Areas meeting the

criteria of farmland soils may or may not be presently farmed. In contrast, Prime Farmlands are distinguished from the prime and statewide important soils classifications in that Prime Farmlands include only those areas with qualifying soil types that are presently cultivated or are undeveloped and have the potential to be farmed in the future. Prime Farmlands are delineated in order to identify areas with irreplaceable crop production potential that may be candidates for preservation.

4.9.1 DESIGNATION OF IMPORTANT FARMLAND RESOURCES

Figure 4-29a shows soils classified by DEP and NRCS as prime and of statewide importance for farming. As stated above, in order for prime or statewide important soils to be classified as Prime Farmland, the land must be available for farming. Areas that may be considered Prime Farmland are those not yet developed, or committed for development, in a way that would preclude their use for farming.

4-29b illustrates Designated Prime Farmland in the Route 82/85/11 corridor. Areas were designated based upon review of aerial photos (dated December 1997) and field verification of land uses in areas containing qualifying soils. Development potential was determined through review of zoning regulations and discussions with town planners for each study area town. Parcels for which development is proposed or is likely were eliminated. More than 800 acres of Prime Farmland were identified within or adjacent to the corridor study area.

In all four study area towns there is a clear interest in preserving the rural quality of the northern portion of the corridor. The Town of Salem maintains a specific land use category for "Agricultural" land within which cropland, pasture and open fields are included. Agricultural land represents 6% of the total town area, and according to the Plan of Development of Salem dated 1991, this is a land use category deserving preservation. It is important to note, however, that current town zoning does not prevent development of this land for uses other than farming.

Areas of Prime Farmland within or abutting the study area in Salem are as follows: northwest and southwest of the current terminus of Route 11 along Route 82; near the northwest corner of Salem Four Corners (junction of Routes 82 and 85) along Route 82; on Route 85 at Salem Country Gardens; and off Forsyth and Old New London Roads. Parcels on Route 82 are predominately zoned for business and those in other areas are zoned rural residential. Several of these areas are utilized for corn or garden products or are old field. Farmland west of Route 11 on or near Route 82 is currently preserved under a special farmland tax class, however, these arrangements are not permanent. These areas are predominately used as hay fields and pasture. The Connecticut Dairy Industry Council includes Salem Valley Farms, Inc. in their *Connecticut Dairy Farms* brochure. This farm is located on Darling Road near the present terminus of Route 11, just outside the study area.

Montville includes agricultural land within the "Unreserved Open Space" zone, which comprised a total of 3.5% of all land in Montville as of 1985. These lands are not necessarily protected for agricultural use. Farmlands occur as old fields near Beckwith Pond on the east side of Route 85; forest land north and south of Grassy Hill Road between Route 85 and the East Lyme town line; wet meadow near the southeast corner of Salem Turnpike Road and Route 85; and cultivated fields along Butlertown Road.

Much of Montville within the study area is classified as a "Water Resource Protection" area. Farmland soils are present around Lake Konomoc, however these lands have not been designated Prime Farmland due to the remote possibility of their use for that purpose, given the needs associated with protection of the water supply in this region.

Prime Farmlands in East Lyme occur along the western edge of the Nehantic State Forest from Holmes Road south to Grassy Hill Road, from Grassy Hill Road south to Route 161 and in two areas along Route 161 between Darrow Pond and Route 1. These areas are classified as existing open space, proposed open space or low density residential. Much of this acreage is covered by fields including fallow fields, hay fields and horse pasture. Along Holmes Road an area of undeveloped forest occurs. Emerald Island Farm is located on the south side of Grassy Hill Road, west of Walnut Hill Road.

The Town of Waterford encourages designation of undeveloped land under PA 490 which may be classified as farm, forest or open space and for which a lower tax rate is assessed. Some farmland soils have been classified as such. Areas delineated as Prime Farmland in the Waterford study area are located west of Route 85 near Lake Konomoc, south of Lake Konomoc along Route 85 and several areas within or adjacent to the Business Triangle. These areas are predominately forested. There is a tree farm along Oil Mill Road and a horse farm along Way Hill Road.

4.10 SOCIOECONOMIC ENVIRONMENT

There have been no significant changes in trends within the Route 82/85/11 corridor towns in population, income, employment, real estate, or environmental justice from the information presented herein. Recent analysis using the 2000 Census shows that, in general, rates of growth in population and housing in the four corridor towns were somewhat higher than projections originally reported using the 1990 Census. Where additional or updated information has been collected, and is pertinent to this analysis, the information has been added or previous information updated.

4.10.1 POPULATION TRENDS

The following is a discussion of each of the four towns in the study area with respect to recorded population trends, based on available data from the 1990 and 2000 censuses, updated to reflect information from the local municipalities, SCCOG, and OPM.

4.10.1.1 *Town of Salem*: The 1980 to 1990 decade recorded Salem as having the fastest growth rate in Connecticut with a 41.8% increase in total population. This growth rate decreased to 16.6% between 1990 and 2000 (US Census 2000) and is projected to grow 19% by 2010 (CERC 2006). National trends in birth rate increases and decreases account for some changes in population growth over the decades; however, Salem has and continues to experience a population increase resulting from a pattern of in-migration. Indications are that Salem represents an attractive choice for residence for those seeking a more rural lifestyle. With a population of approximately 110 persons per 2.59 sq. km. (1 sq. mi.) (1990 census data), Salem's population density ranks lowest of the four-town study area. The residents tend to be concentrated along the local roads and evenly distributed throughout the town.

4.10.1.2 *Town of Montville*: The 1980 to 1990 decade recorded Montville as having a growth rate of only 1.3%. This growth rate increased to 11.2% between 1990 and 2000 (US Census 2000) and is projected to grow about 6.5% by 2010 (CERC 2006). Reasons for the past slow rate of growth are difficult to define. General consensus seems to cite a combination of impacts including declining birth rates and the decrease in the defense industry employment base. The advent of the Native American economic growth factor (Mohegan Sun and Foxwoods Casinos) has skewed the future population projections for the southeastern region. With a population of approximately 378 persons per 2.59 sq. km. (1 sq. mi.) (1990 census data), Montville's population density ranks as the second highest of the four-town study area. Because of the natural and imposed environmental restrictions affecting areas adjacent to the Route 82/85/11 corridor, residential development occurs in greater concentrations in the northerly and eastern portions of the town.

4.10.1.3 *Town of Waterford*: The 1980 to 1990 decade recorded Waterford as having a growth rate of about 0.05%, which increased to 6.8% between 1990 and 2000 (US Census 2000). The growth rate is projected to be 11% by 2010 (CERC 2006). Waterford has a much larger aged population, which at this time, is forecasted to continue to increase up through the year 2020. However, it is anticipated that eventually the maturing residents may leave the community, precipitating a population shift toward a young adult increase. With a population of approximately 404 persons per 2.59 sq. km. (1 sq. mi.) (1990 census data), Waterford's population density ranks highest of the four-town study area. Limited local road networks and environmental constraints

combine with the impacts of high volume transportation corridors (Route 1, I-95 and I-395) to minimize opportunities and discourage residential growth in the northwestern portions of town. The greater concentration of the population occurs south of I-95 to the town coastal boundary.

4.10.1.4 *Town of East Lyme*: The 1980 to 1990 decade recorded East Lyme as having a growth rate of over 10%. This growth rate increased to 20% between 1990 and 2000 (US Census 2000). From the year 2000, the growth rate is projected to be 5% by 2010 (CERC 2006). As with other towns in the southeast region, population rates of increase have fallen off from the numbers experienced through the 1960s-1970s. However, East Lyme continues to grow at a rate that is consistent with most other communities along the southeastern Connecticut coast. With a population of approximately 365 persons per 2.59 sq. km. (1 sq. mi.) (1990 census), East Lyme's population density ranks second lowest of the four-town study area. With much of the northern area of town occupied by state and other private tracts of undeveloped lands, the greater population is concentrated in the central portion of the town around I-95 and south to the coastal boundary.

4.10.2 INCOME

Despite notable changes in the state's manufacturing sector, Connecticut has kept pace with the rate of increased personal income at the national growth level. In 1996, per capita personal income for the state was 37.4% higher than the United States average. Table 4-41 provides nominal per capita summaries for the state, New London County and the four-town study area.

TABLE 4-41
PER CAPITA INCOME SUMMARY

GEOGRAPHIC AREA	INCOME (AS AVERAGE PER CAPITA)	INCOME (AS PERCENT OF STATE AVERAGE)	TOWN RANK [1]
Connecticut	$33,875	-	-
New London County	$28,931	85.4%	-
Salem	$32,614	96.3%	71
Montville	$26,520	78.3%	129
East Lyme	$34,571	102.1%	61
Waterford	$33,813	99.8%	63

Source: CT Dept. of Economic and Community Development (DECD) (www.ct.gov/ecd/cwp) 1996
[1] This statistic shows how the corridor towns rank in per capita income relative to all 169 towns in the state. A ranking of 1 indicates the town with the highest per capita income.

4.10.3 EMPLOYMENT

The New London Labor Market Area (NLLMA) encompasses several towns in the southeastern region of the state and includes the four-town study area. The April 1998 unemployment index for the NLLMA was at 4.3%, down from the April 1997 index of 5.3% (CT Department of Labor) (Table 4-42). Connecticut, in general, has experienced a substantial industry transformation over the last decade. The relatively recent recession in the aerospace and defense industries has given way to a more diversified economy.

TABLE 4-42
EMPLOYMENT STATISTICS

GEOGRAPHIC AREA	LABOR FORCE	EMPLOYED	UNEMPLOYED	UNEMPLOYMENT RATE (%)
Connecticut	1,716,100	1,652,400	63,700	3.7
New London LMA	138,470	132,381	6,089	4.4
Salem	2,119	2,030	89	4.2
Montville	10,003	9,551	452	4.5
East Lyme	9,358	9,063	295	3.2
Waterford	10,339	9,979	360	3.5

Source: DECD (Internet site... state.ct.us.ecd) Department of Labor May 1998 data

Manufacturing, which has been declining steadily since the 1950s, now represents under 18% of the state's economy. It is anticipated that manufacturing employment will continue to decline well into the next decade. Part of this is due to increased efficiencies realized through the application of advanced technologies. In its place service industries and, more specific to the four-town study area, entertainment and tourism are filling the void left by the diminished defense industry. The Mashantucket Pequot and Mohegan Native American economies have already dramatically affected southeastern Connecticut, and the potential for additional related economic development in this area appears substantial. Supplementing the rise in service and entertainment is the increase in exported goods. Given this scenario, the potential for economic and residential growth throughout the southeastern region appears to be very good.

According to the Southeastern Connecticut Enterprise Region (SECTER) and SCCOG, *Comprehensive Economic Development Strategy for Southeastern Connecticut 2004*, the major employers of the region in 1990 were the Naval Submarine Base and General Dynamics Electric Boat, both in Groton, and along with contractors and subcontractors, provided about 37,000 high paying jobs. Over the next ten years, defense downsizing

resulted in the elimination of nearly 17,000 defense-industry jobs, while the tourism and entertainment industry emerged as the region's fastest growing employer. By 2004, Foxwoods and Mohegan Sun casinos provided over 20,000 new jobs. Overall, the five largest employers account for 36% of the total New London County employment: Naval Submarine Base, General Dynamics Electric Boat, Pfizer Pharmaceuticals, Foxwoods Casino and Mohegan Sun Casino (not ranked).

4.10.4 Real Estate (Housing) Trends by Town

All four towns have substantial acreage that is undeveloped, much of which is currently zoned for residential use. All of the towns rely, to varying degrees, on private septic systems to handle sanitary waste discharge. Salem, in particular, has no public sewerage. Residential land use represents the large majority of the developed lands in the four-town study area, and all town plans of conservation and development support the maintenance of this trend. Given the high cost of expanding local infrastructures, environmental concerns about the capacity of the land to accept on-site sewage disposal and general desire to maintain their rural residential identities, all four towns have established goals that will help them plan their future growth to accommodate local expectations and financial and physical constraints.

Land use policies common to all four towns include: controlling higher density growth and subdivision developments in rural areas by limiting the infrastructure network (sewerage and water), encouragement of cluster housing and affordable housing where appropriate and establishment of large-lot residential zones in areas where land capacity to accept on-site sewage disposal is restrictive and as other environmental concerns may dictate.

Table 4-43 illustrates existing residential coverage as a percentage of developed land by town and the potential for future growth within the context of the "undeveloped" land areas. Table 4-44 illustrates housing activity from 1990 to 2004 in the four town study area as compared with the region and the state.

TABLE 4-43
DEVELOPED LAND BY TOWN

TOWN	PERCENT OF SPECIFIC LAND USE CATEGORY			
	UNDEVELOPED	OTHER [1]	DEVELOPED	RESIDENTIAL[2]
Salem	72	14	14	63
Montville	75	12	13	74
East Lyme	49	10	41	42
Waterford	54	13	33	65

Source: DECD (Internet site... state.ct.us.ecd) May 1998
[1] Includes recreation areas, dedicated open space and other public lands
[2] Residential land use as a percent of developed land

TABLE 4-44
HOUSING ACTIVITY BY TOWN

TOWN	1990-2000		2000-2004	
	NEW UNITS	% CHANGE	NEW UNITS	% CHANGE
Salem	410	32.9	115	6.9
Montville	522	8.3	272	4.0
East Lyme	687	10.1	270	3.6
Waterford	629	8.5	201	2.5
Southeastern Region	5,578	5.8	3,665	3.6
Connecticut	59,858	4.5	21,251	1.5

Sources: SCCOG April 2002 (for 1990 and 2000 housing units) and DECD 2005 (for 2004 housing units)

4.10.4.1 *Town of Salem*: In the 1980-1990 decade, Salem experienced one of the highest growth rates in the state increasing the housing stock by almost 40%. Between 1990 and 2000, housing units in Salem grew by 32.9% (SCCOG 2002); the rate slowed to 6.9% from 2000 to 2004 (DECD 2005). Residential median sales prices in 1990 were $161,500, 27% higher than the regional median sales price of $127,000. The higher sales price margin is generally considered to be largely attributable to Salem's proximity to the completed

portion of Route 11 (i.e., the improved accessibility of the labor markets to the north). By 2004, the median sales price was $224,250, which increased at a rate slightly lower than experienced throughout New London County and statewide. Salem is predominantly single family residential representing about 88% of the housing stock. Future town goals include the advancement of community efforts to provide affordable housing stock for first time homebuyers in an effort to infuse the community with a healthy range of age groups and to assist elderly residents on fixed incomes.

Within the Route 11 corridor study area, with the exception of a few small acreage commercial/business and RA parcels (1 acre residential) related to the Route 85 corridor, the balance of the land is zoned rural residential.

4.10.4.2 *Town of Montville*: Housing growth has been slow through the 1980-1990 decade and continues at a relatively slow pace. Between 1990 and 2000, housing units grew by 8.3% (SCCOG 2002), and continued at that moderate rate through 2004 (DECD 2005). Residential median sales prices in 1990 were $122,450 more than $4,000 below the median sales price for the region. In 2004, the median sales price was $194,000, only $1,000 below the region. In an effort to promote more residential development in the western portion of the town, infrastructure facilities were extended along existing collector roads. Given the economic growth related to the Mohegan Sun and Foxwoods Casinos, it is anticipated that Montville will benefit from the overflow impacts of the entertainment industry.

Within the Route 11 corridor study area, zoning is a mix of residential and other land uses. Residential uses occupy the majority of the land with an equal balance of 1 and 2 acre lot zones.

4.10.4.3 *Town of Waterford*: Housing units grew by moderate rate of 8.5% between 1990 and 2000 (SCCOG 2002) and continued at a slightly slower pace through 2004 (DECD 2005). The median sales price was $215,000 in 2004. The greatest concentration of residentially developed area occurs to the south of I-95 where the majority of the land is zoned for low - medium density. The balance of the low, medium and village residential zoned lands occur in the town northeast quadrant, south of I-395 and north of Route 85. Within the Route 11 corridor study area, a portion of the lands bounded by I-95, I-395 and Route 85 are zoned for "lowest" density residential, as are all residential lands north of I-395.

4.10.4.4 *Town of East Lyme*: Between 1990 and 2000, housing units grew by 10.1% (SCCOG 2002), and continued at a slightly slower rate through 2004 (DECD 2004). The median sales price was $268,000 in 2004, which represents the highest increase in price (99%) of the study area towns between 2000 and

2004 (DECD 2005). With a large portion of the northern one-third of town lands dedicated to state-owned, privately held undeveloped tracts and institutional uses, the majority of building activity takes place in the central and southern areas of town. In addition to those future growth controls and policies common to the four-town area, East Lyme is pursuing a zone revision program that will work to better direct the development of special permit high intensity uses and prohibit commercial land uses within the rural residential zoned areas of town. Within the Route 11 corridor study area, with the exception of two special use zoned parcels and a commercial area adjacent to I-95, the balance of the land is zoned residential. Lands immediately accessible from Route 161 and Butlertown Road are zoned for ½-acre and 1-acre lots, and the balance of the land is zoned rural residential.

4.10.5 ENVIRONMENTAL JUSTICE

Environmental justice goals focus on ensuring that minority, disadvantaged or low income sectors of the population would not be disproportionately affected by a proposed action. The term environmental justice is applied to the aspect of age, income and ethnicity of a population. Specifically, as defined in Executive Order 12898, no federally funded projects may be implemented in such a way that the impacts would result in disproportionately high and adverse effects on minority and low income populations.

Factors relating to environmental justice were evaluated based on ethnicity, per capita income and age-comparative data on a town and census Block No. basis. The specific census Block Nos. were chosen based on their proximity to the corridor study area. Portions of Block Nos. 68, 83, 93, 104 and 107 are within the study area (Figure 4-30). Per capita income for each town is similar to the statewide average, as indicated on Table 4-45; there were no specific low income areas noted in the study area. Population, age distribution and ethnic backgrounds for each town are shown on Table 4-45.

TABLE 4-45
POPULATION AND RACE/ETHNIC CHARACTERISTICS BY TOWN

	POPULATION (HISTORIC AND PROJECTED)					
TOWN	1990	1995	2000[1]	2005[2]	2010[3]	2015
Salem	3,310	3,620	3,858	4,230	4,599	I.N.A.
Montville	16,673	16,900	18,546	19,211	19,756	I.N.A.
Waterford	17,930	17,880	19,152	20,249	21,276	I.N.A.
East Lyme	15,340	15,420	18,118	18,610	18,934	I.N.A.

	POPULATION (AGE DISTRIBUTION, BASED ON 1995 DATA)					
TOWN	0-4 (M · F)	5-14 (M · F)	15-34 (M · F)	34-49 (M · F)	50-64 (M · F)	65+ (M · F)
Salem	9% · 8%	20% · 18%	21% · 24%	30% · 30%	14% · 12%	6% · 8%
Montville	6% · 6%	14% · 13%	31% · 28%	25% · 24%	15% · 16%	10% · 13%
Waterford	6% · 5%	12% · 11%	23% · 20%	24% · 22%	18% · 17%	18% · 24%
East Lyme	6% · 6%	14% · 12%	27% · 26%	25% · 26%	17% · 17%	11% · 14%

	RACE/ETHNICITY					
TOWN	WHITE	BLACK	ASIAN PACIFIC	NATIVE AMERICAN	OTHER	HISPANIC ORIGIN*
Salem	3,229	28	32	9	12	40
Montville	15,666	468	239	149	151	435
Waterford	17,194	372	250	55	59	310
East Lyme	14,437	543	213	49	98	365

[1] Actual 2000 Census (CERC Town profile 2006) [2] Estimate CERC Town Profile 2006
[3] Projected (CERC Town profile 2006)
I.N.A. = Information Not Available *may be of any race

4.11 HISTORIC, CULTURAL AND ARCHAEOLOGICAL RESOURCES

4.11.1 OVERALL HISTORIC CONTEXT

The corridor area has historically been, and remains, one of the least densely settled areas of Connecticut. Much of the terrain consists either of steep slopes or extensive marsh, and so the project area has not been as conducive to agriculture as have areas of broad upland ridges or alluvial valleys. Most of the project area lies inland from the Thames and Niantic rivers, watercourses that provided fishing and commercial opportunities in their immediate vicinity. Moreover, none of the streams provided sufficient waterpower to attract industry beyond the numerous saw, grist, fulling, linseed oil, and other small-scale mills associated with the agricultural economy. Exploitation of hardwood resources occurred in the 18th and 19th centuries, including charcoal making, lumbering, and tanning.

Market agriculture in the 18th century was undertaken by large landowners with the labor of enslaved Africans/African Americans. Although small subsistence family farmsteads were the norm throughout the project area, as in most of colonial Connecticut, a notable exception was the plantation-scale farming of the Browne family. Begun in 1718 by Col. Samuel Browne (1699-1731), the family's holdings included nearly 13,000 acres worth £171,150 in 1779, at which time the property, including numerous slaves, was confiscated because of the Tory activities of grandson William Browne (1737-1802). The family's holdings were concentrated near the present juncture of East Lyme, Montville, and Salem and, because of their immense size, must be assumed to be traversed by the study corridor. Reported sites associated with the plantation lie to the north and west of the corridor study area.

In the early 19th century, the improvement of certain roads as turnpikes engendered some commercial development in the form of taverns and general stores, particularly at small crossroad villages such as Chesterfield in Montville. Present-day Route 85 was part of the Hartford and New London Turnpike, chartered by the General Assembly in 1800. It was joined at Salem Four Corners by two other turnpike roads along the course of present-day Route 82: the Salem and Hamburg Turnpike (1824) and the Norwich and Salem Turnpike (1827). In addition to some limited commercial opportunities, the turnpikes probably helped the larger farmers in the area raise some crops for distant markets. Otherwise, economic activity from European settlement to the present has mostly been generalized agriculture.

Based upon this capsule historic context for the study area, the following types of historic resources can be expected, either as standing resources or potential historic archaeological sites:

- scattered farmsteads from the 18th and 19th centuries, including both dwellings and agricultural outbuildings
- meetinghouses, district schools, and cemeteries that served groups of families in their immediate locality
- former stores and taverns along turnpike roads and at crossroads
- historic landscape features such as stone walls lining the roads and small bridges over streams
- small-scale industrial enterprise

Because of the long period of population stagnation and decline in the 19th century, it is likely that many farmhouses, barns, and other resources have long ago disappeared and must be addressed as archaeological potentials. This is most notably the case of Pember Road, an old highway, shown on current USGS maps as dashed lines that ran west of and approximately parallel to Route 85 in Waterford. Historical maps indicate a number of homesteads and a cemetery in this now nearly inaccessible woodland. Throughout the project area, 19th century maps show many more buildings, including schools, stores, and meetinghouses than exist today and there were numerous small sawmills, gristmills, and similar enterprises on many of the streams.

Another uncommon aspect of the area is the numerous isolated hilltop farmsteads. Two of these that date back to the 18th century have been previously inventoried. In several other cases, however, the roads leading to possibly similar sites are posted and were not accessible.

4.11.2 HISTORIC ARCHITECTURAL RESOURCE SURVEY

4.11.2.1 *Record Document Research:* Prior to conducting field investigations, a wide range of documentary, graphic, artifact, and informant sources were consulted including:

- historic maps, atlases, photographs, and aerial photographs held by the Connecticut State Library, Yale University, the University of Connecticut, local historical societies, or knowledgeable individuals;
- site files, cultural resource management reports, and other archaeological site reports held by the Connecticut Historical Commission (CHC) or State of Connecticut;
- published and unpublished sources on local and/or site history;
- published and unpublished sources on project area soils, geology and hydrology;

- State Historic Preservation Office (SHPO)-sponsored townwide architectural inventories of Montville, Waterford and a portion of East Lyme;
- artifact collections and/or photographs; and
- historians, archaeologists, and property owners as available and appropriate.

4.11.2.2 *Field Investigations*: The entire study area, as accessible from public roads, was inspected in the field. Each public road crossing of the cross-country alignments was investigated for possible historic resources in or near the alignment, and the entire portion of Routes 82 and 85 contained within the study area was investigated. Photographs were taken of resources that appeared to be at least 50 years old and had some characteristics that might make them eligible for the National Register of Historic Places (NRHP).

4.11.2.3 *Summary of Investigations:* Twenty-five NRHP-eligible historic resources and four non-eligible cemeteries were identified within the study area, and are listed in Table 4-46. The locations of these properties are shown on Figure 4-31. The determination of eligibility was made after professional review of the corridor and in consultation with SHPO in accordance with Advisory Council on Historic Preservation procedures pursuant to 36 CFR 800 and Section 4(f) of the 1966 Department of Transportation Act. The ultimate decision regarding eligibility for listing will be made jointly by FHWA and SHPO. In the event of a disagreement, the Keeper of the NRHP will make the final determination.

Historic cemeteries were evaluated in accordance with *"Guidelines for Evaluating and Registering Cemeteries and Burial Places"* (National Park Service, 1992). Cemeteries may be eligible for the NRHP under special criteria which recognizes the qualities of age, distinctive design features, and association with historic events, such as early settlement. Since significance may be at the national, state, or local level, even small cemeteries may qualify if they have significance for their particular localities. Such is the case with sites in this corridor identified as T, V, BB, HH and OO. Cemeteries in the study area that lack community-wide significance are not considered eligible. Nevertheless, these properties do represent cultural resources that fall under state regulations (CT General Statute Section 10-388) regarding burials and human remains. There are four such properties included in Table 4-46 and on Figure 4-31 (Sites I, X, MM, TT).

In addition to resources presented in Table 4-46, other structures were noted as having some historical interest, even though they are not eligible for the NRHP largely because of alterations. These properties are listed below.

- Route 82**,** Salem: Bridge No. 2511, concrete slab, 1924, paneled railing
- Route 82, Salem: Bridge No. 2512, concrete slab, 1925, paneled railing
- Corner of Routes 82 and 85, Salem: Salem Country Store, mid 19th century building
- 406 New London Road, Salem: house and barn, mid to late 19th century
- Grassy Hill Road, Montville: bridge, 1940: Concrete structure exhibiting balustered railing
- 947 Grassy Hill Road, Montville: barn, c.1930: Early 20th-century agricultural outbuilding
- 984 Grassy Hill Road, Montville: house, 18th century
- Route 161, Montville: bridge No. 272, concrete slab, 1930, paneled railing
- 1830 Route 85, Montville: c. 1830 house with granite foundation
- 1781 Route 85, Montville: 18th century house with central chimney
- 1588 Route 85, Montville: 19th century house made into a store/gas station c 1920
- 1461 Route 85, Montville: c. 1860 house with 2 ½ stories
- 41 Grassy Hill Road, East Lyme: house and farm buildings, c.1870
- Route 161, East Lyme: bridge No. 2723: concrete slab, 1930, paneled railing
- 1077 Hartford Turnpike, Waterford: Holt House, c.1780
- 1216 Hartford Turnpike, Waterford: Avery Morgan House, Shoemaker's residence.

TABLE 4-46
HISTORIC ARCHITECTURAL RESOURCES

SITE I.D.	LOCATION	DESCRIPTION	NRHP STATUS
E	484 Old New London Road, Salem	House, c.1800**:** Clapboarded, 2 ½ stories with 1 ½-story ell, main part faces southeast. Five-bay facade, 1 bay deep, simple Federal-style pilasters on doorway, 6-over-9 sash. Setting of woods, fields, stone walls. Garage, possibly made over from old barn, 3 bays.	Eligible
H	15 Grassy Hill Road, East Lyme	House, c.1865: Vernacular/Italianate style, 2 ½ stories, clapboards, 6-over-6 sash, paired round-arched attic windows, doorframe with crosset and scroll decorations.	Eligible
I	Grassy Hill Road, East Lyme	Holmes Cemetery: Although on posted land and therefore not possible to be located precisely, the Hale Index lists this cemetery as at the rear of the "James Hatt farm," within a few hundred feet of alignment H. Not National Register eligible, but is protected under CT General Statues Section 10-388.	Not eligible
J	44 Gurley Road, Waterford	House, c.1870: No particular style, 1 ½ stories, clapboarded.	Eligible as part of historic district
K	46 Gurley Road, Waterford	House, c.1770: 1 ½ stories, five-bay facade, clapboards. Altered with porch and dormers.	Eligible as part of historic district
L	54 Gurley Road, Waterford	House, c.1790: 1 ½ stories, gambrel roof, clapboards	Eligible as part of historic district
M	31 Oil Mill Road, Waterford	D. W. Stanton House, c.1844: Greek Revival style, hip roof, 2 stories, clapboarded. Oil mill owner.	Eligible as part of historic district
N	9 Shingle Mill Road (corner of Route 82)	House, c.1800: 2 ½ stories with 1 ½-story ell, sided, brick end chimneys, 6-over-6 sash, c.1870 Italianate arched panel door and ogee arch entry surround. Small board-sided barn at rear.	Eligible
O	Route 82 opp. Shingle Mill Road	Barn, c.1850, Three-bay clapboarded barn, set amidst fields and stone walls, probably originally associated with the house across the road, 9 Shingle Mill Road	Eligible as part of N

TABLE 4-46
HISTORIC ARCHITECTURAL RESOURCES

SITE I.D.	LOCATION	DESCRIPTION	NRHP STATUS
S	509 New London Road, Salem	Elijah Ransom House, 1784: 2 1/2-story, sided but little impact on appearance, central brick chimney, transomed and pilastered entry. Barn and other outbuildings. Surrounded by field and stone walls.	Eligible
T	New London Road, Salem,	Raymond Cemetery: mid 19th-century, gateposts, stone wall; stone obelisk and zinc urn monuments. Sits far back from road, south of Elijah Ransom House.	Eligible
U	Route 85, Montville	Latimer Farm: An 18th-century dwelling and agricultural outbuildings on a lane to the west of Route 85. Stone walls and stone gate posts on Route 85.	Eligible (under consideration)
V	Route 85, Montville	DeWolf/Latimer/St John Ukranian Cemetery: A burying ground notable for its early to mid 19th century monuments and early 20th-century Ukranian Orthodox monuments, reflecting the changing ethnic make-up of the Connecticut countryside.	Eligible
W	889 Chesterfield Road (corner of Route 85), Montville.	House, 18th century: Five-bay facade, 2 1/2 stories, stone center chimney, some 12-pane sash; composition siding	Eligible
X	Just north of 1621 Route 85, Montville	Gilbert cemetery: A small mid-19th century family burying ground. Not National Register eligible, but is protected under CT General Statues Section 10-388.	Not eligible
BB	Route 85 and Route 161, Montville	Chesterfield cemetery: Community cemetery documenting long-term settlement of its locale. Many notable 18th and 19th century monuments, including one to a soldier killed in battle.	Eligible
DD	1394 Route 85, Montville.	Greek Revival-style house, c.1840: 2 stories, 3-bay gable-end facade, entry with original paneled door, pilasters, transom; paneled pilasters at corners, partial cornice, return. Modernized with c.1930 windows and siding. Board-sided barns and other outbuildings.	Eligible
FF	1214 Hartford Turnpike, Waterford	E. F. Morgan Store, c.1855: Two stories, bracketed cornice over storefront. One of few remaining historic commercial buildings on Route 85.	Eligible
HH	1135 Hartford Turnpike,	Lake Pond Cemetery: Early to mid-19th-century monuments give this burying ground	Eligible

TABLE 4-46
HISTORIC ARCHITECTURAL RESOURCES

SITE I.D.	LOCATION	DESCRIPTION	NRHP STATUS
	Waterford	local historical and cultural significance. Includes a pipe-rail fence.	
KK	Salem Turnpike, Montville	Stone slab bridge, c.1850: This small stone bridge, a two-unit culvert of approx. 4' span each, lies 700 west of Route 85 and 1,000 feet east of Alignment E. The load-bearing lintels rest on stones cut as corbels, creating a slight arched effect.	Eligible
LL	Silver Falls Road, Montville, at East Lyme town line	Latimer saw and grist mill site, c.1732: Includes mill pond, dam, foundation remains, grist mill stone.	Eligible
MM	East of Route 161and 2,000 feet west of the intersection of Alignments F, G and E	Family cemetery: Hale Index East Lyme No. 19. Not National Register eligible, but is protected under CT General Statues Section 10-388.	Not eligible
NN	21 Gurley Road, Waterford	Waller House, 1691: Because of the early date attributed to the house and its one-time use as the town almshouse, any encroachment on the property also has implications for historical archaeology.	Eligible
OO	End of Gurley Road , directly adjacent to north-bound lanes of I-95	Riverhead Cemetery: Contains a small number of notable 18th-century stones, as well as a larger assortment of early 19th-century and Victorian markers and therefore may be eligible as a local array of typical funerary art. Also known as Gurley Burying Ground.	Eligible
PP	24 Gurley Road, East Lyme	House, c.1830	Eligible
QQ	25 Gurley Road, East Lyme	House, c.1760	Eligible
RR	Day Road, Montville	House near corner of Route 85, c1780 clapboarded exterior, central chimney, scenic rural setting. Good example of early Connecticut house architecture.	Eligible
SS	Route 85, Waterford	Waterford Speedbowl, 1951, recalls popular culture of 1950s.	Eligible
TT	Route 1/I95, East Lyme	Taber Cemetery, 19th-century family cemetery, Route 1, East Lyme	Not eligible

- 1144 Hartford Turnpike, Waterford: Lake Pond Baptist Church, 1842 Greek-Revival style,

- 1107 Hartford Turnpike, Waterford: Daniel Caulkins House c.1800

- 44 Boston Post Road, East Lyme: c. 1870 vernacular house

- 46 Boston Post Road, East Lyme: c 1870 vernacular house

4.11.3 ARCHAEOLOGICAL RESOURCE SURVEY

4.11.3.1 *Field Investigations*: Each build alternative was walked over and visually inspected for cultural and environmental features related to archaeological potential. These features include those suggesting low archaeological potential, such as obvious ground disturbance and very poorly drained soils, and those suggesting moderate to high potential, such as undisturbed well-drained areas near a fresh water source. The walkover data were synthesized and used to stratify the alternatives into zones of no-to-low archaeological potential and moderate-to-high potential. Limited subsurface testing was then conducted to confirm or refine the stratification and to locate archaeological sites. The testing took the form of small shovel test pits excavated at 10- to 20-m. (33-66 ft.) intervals (10 m. along cross-country alternatives and 20 m. along existing roadway alternatives). A sufficient number of sample pits has been obtained to make sound, reasonable estimates of archaeological sensitivity and impacts. Historic period cemeteries are not included as archaeological sites here, but were identified in the architectural survey section.

4.11.3.2 *Summary of Investigations*: The level of archaeological sensitivity, as determined for each build alternative, is depicted in Figure 4-31 and described below.

92PD and E Alternatives: All but the extreme northern end of these relatively undisturbed cross-country alignments have moderate to high archaeological potential. Twenty-five prehistoric sites have been identified to date; over 100 are predicted. Sites have been found in situations conventionally believed to have low archaeological potential, thus very little of the 92PD or E alternatives is considered prehistorically nonsensitive. Data collected to date indicate the area was the focus of repeated re-occupation by prehistoric groups, one explanation for the high site density.

Historic period archaeological resources along the 92PD and E alignments are fewer overall, with the exception of the portion in Waterford which runs parallel with Pember Road, the focus of the abandoned community of Butlertown (also referred to as Wolf Pit Village). The precise boundaries of this community are not firmly known but are estimated to overlap at least in part with the 92PD/E alignment (Figure 4-31). At least 14 archaeological components of this village and a cemetery have been identified, and many more sites are believed to exist.

Additionally, there may be intact archaeological components associated with the historic structures and cemeteries noted in the architectural survey.

F, G and H Alternatives: All but very small portions of these cross-country alignments have moderate to high archaeological potential, with particularly high sensitivity for prehistoric sites. Like the 92PD and E alignments, these alignments are overland routes through relatively undeveloped areas where disturbance is minimal. Alternatives F, G and H are believed to contain the same high number of prehistoric sites, in the range of approximately 100 sites.

Historic period archaeological potential is lower than prehistoric primarily because major portions of the alternatives do not follow old roads, with the exception of the 1.5-mile-long portion at the southern end where Alignments F and G merge with the 92PD/E route at Pember Road (Figure 4-31). This common alternate leg crosses into Butlertown, an area of very high archaeological potential. Another noteworthy exception occurs where Alternative H merges with and follows Route 85 from south of the junction of Route 161 to the intersection of I-395.

There may also be intact archaeological components associated with the historic structures and cemeteries noted in the architectural survey.

Intersection of Alternatives 92PD, E, F, and G with I-395/I-95: This intersection contains the 1691 Waller House, and a cluster of 18th- and early 19th-century standing structures that make up a potential National Register historic district. These structures likely have important archaeological components. Archaeological remains of mills have been identified in the area, and these potentially important sites should be considered contributors to the district's significance.

Widening Alternatives: Nearly 75% of these alternatives have low archaeological potential (Figure 4-31); these areas have been so disturbed that no intact archaeological remains are likely. The remaining 25%, however, is surprisingly sensitive for both prehistoric and historic period sites. More than

20 archaeological sites were found close to the pavement edge in the current right-of-way on Route 85. Some of the sites are apparently associated with standing historic structures identified in the architectural survey. Potential archaeological remains may also be associated with the c. 1800 house at 9 Shingle Mill Road on the corner of Route 82. Archaeological potential increases commensurately with the width of each alternative.

Preferred Alternative $E_{(4)}$m-V3: The reconnaissance archaeological survey, partially completed in 1998 as part of evaluations for the DEIS alternatives, was completed during 2002 for the area that would be affected by the preferred alternative. For survey purposes, the area was defined as a 60 m.-(200 ft.) wide corridor based on the centerline and proposed right-of-way of the preferred alternative, the ramp and lane alignments at the two proposed interchanges (Route 11 with I-95 and I-395 and Route 1, and Route 11 with Route 161), and three areas that are proposed for the construction of new wetlands to mitigate the loss of wetlands that would ensue from the construction of the proposed highway. Property access issues prevented walk-over assessment and testing of some areas, but it is estimated that 80% of the project area was investigated. The untested areas can be assumed to be about as productive of archaeological resources as tested areas; the mitigation measures proposed for the project provide for study of the untested and inaccessible areas (see Section 5).

The reconnaissance survey included the excavation of 1,992 test pits, placed at 15 m. intervals (49 ft.), and identified 40 archaeological sites within the project area. The sites include 28 prehistoric period sites, five historic period sites, and seven sites with both prehistoric and historic components. No historic archaeological sites were discovered in the tested footprint in the vicinity of the Browne farmstead.

Intensive survey investigations at the 40 sites were conducted in 2002 to determine if identified sites ought to be considered as eligible for inclusion in the NRHP and if their significance was chiefly for their information value. The site-specific investigations involved the excavation of test pits at 5 m. (16 ft.) intervals across each site area within project limits; a total of 2,358 test pits and two one-meter-square units were excavated in the intensive survey.

The 2002 work also included intensified background research in order to better identify the boundaries of the collection of sites identified as Wolf Pit Village the area between Butlertown Road and Route 161 at the southern end of the project area, through which all of the new-location alternatives pass.

A large number of foundations, animal pens, charcoal mounds, and remnants of tanning and bark mills was identified in a 1996 town-wide archaeological survey; seven related sites were identified in the survey of the preferred

alternative. The historical background and archaeological research substantiates the conclusion that, collectively, the sites and landscape features in the undeveloped portions of this area constitute a National Register-eligible archaeological district. Designated the potential Wolf Pit Hills Archaeological District, this entity contains at least 31 individually significant archaeological sites and is a collectively eligible resource. The boundary of the potential district is shown in Figure 4-32. Extensive undocumented cultural landscape features such as stone walls are also part of the district.

As a result of the Intensive Survey, a total of 16 archaeological sites were identified as eligible for inclusion in the NRHP (Table 4-47). Of these, nine are prehistoric sites consisting of concentrations of lithic flakes and/or projectile points. Seven are historic sites, and include charcoal mounds, dam and mill remains, and domestic farmstead complexes. All seven historic sites are contributing resources within the potential Wolf Pit Hills Archaeological District.

TABLE 4-47
NRHP ELIGIBLE ARCHAEOLOGICAL SITES

SITE NUMBER	TOWN	DESCRIPTION	LOCATION
45-25	East Lyme	Prehistoric: Woodland period site and possibly Late Archaic component	$E_{(4)}$m-V3 right-of-way
45-28 *	East Lyme	Historic: 18th/19th-century domestic site	$E_{(4)}$m-V3 right-of-way
45-29	East Lyme	Prehistoric: Archaic period rock shelter site	$E_{(4)}$m-V3 right-of-way
45-37	East Lyme	Prehistoric: Late Archaic period site	$E_{(4)}$m-V3 right-of-way
45-39 *	East Lyme	Historic: 18th/19th-century domestic (house) site	$E_{(4)}$m-V3 right-of-way
45-42 *	East Lyme	Historic: 18th/19th-century domestic site	$E_{(4)}$m-V3 right-of-way
45-43 *	East Lyme	Historic: charcoal mounds	$E_{(4)}$m-V3 right-of-way
45-48 *	East Lyme	Historic: 18th/19th-century domestic site	$E_{(4)}$m-V3 right-of-way
45-49 *	East Lyme	Historic: gristmill site, stone dam	Near fish ladder / dam
86-24	Montville	Prehistoric: Terminal Archaic period site	$E_{(4)}$m-V3 right-of-way
121-8	Salem	Prehistoric: Late Archaic period site w/features	$E_{(4)}$m-V3 right-of-way
121-10	Salem	Prehistoric: Middle Archaic period site	$E_{(4)}$m-V3 right-of-way
121-22	Salem	Prehistoric: Middle Archaic to Woodland period site	$E_{(4)}$m-V3 right-of-way
152-108	Waterford	Prehistoric: probable Late Archaic site	$E_{(4)}$m-V3 right-of-way
152-129	Waterford	Prehistoric: Late Archaic to Late Woodland site w/features	$E_{(4)}$m-V3 right-of-way
152-134 *	Waterford	Historic: Remains of stone dam and raceway	$E_{(4)}$m-V3 right-of-way

* Contributing resources within the potential Wolf Pit Hills Archaeological District

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

4.12.1 SECTION 6(F) LANDS

Section 6(f) of the Land and Water Conservation Fund Act (LWCFA) states that any lands purchased or developed with LWCFA federal funds cannot be "converted" to another use for purposes inconsistent with the Act without being replaced with other land that is of equal use and value to the land proposed for conversion.

There are publicly-owned open space and recreational lands within the corridor area, however, use of such lands will not be required in association with any of the alternatives. Two fragments of the Nehantic State Forest, encompassing a total of 54 ha. (134 ac.) lie in Salem between Old New London Road and Route 85. One piece surrounds and includes Horse Pond. The majority of the 1,537 ha. (3,798 ac.) forest lies west of the corridor study area and covers portions of Salem, East Lyme and a small part of Lyme. The forest provides passive recreational opportunity; no facilities are provided.

Other lands defined as Section 6(f) lands have been identified within the four-town area; however, of these areas, none are located within the study area:

SALEM

- *Town Recreation Area*: an approximately 31 ha. (77 ac.) area located on Round Hill Road just east of the Town Hall

- *Nehantic State Forest*: the northerly portion of this forest extends into the southerly end of the town area

MONTVILLE

- *Camp Oakdale*: located along the northerly town border

EAST LYME

- *Nehantic State Forest*: located in the northern area of the town and west of the Route 11 corridor study area

- *Rocky Neck State Park*: located along the southwestern coastal area

- *Bridebrook Park*: located in the southwestern area of town, south of I-95 and Bride Lake

WATERFORD

- *Camp Harkness*: located at Harkness Memorial Park
- *Harkness Memorial Park*: located along the southeastern coastal area
- *Stenger Farm*: an approximately 38 ha. (95 ac.) area located just north of U.S. Route 1 and east of Clark Lane

4.12.2 NON-HISTORIC SECTION 4(F) LANDS

Section 4(f) of the 1966 Federal Aid and Highway Act requires that special efforts be made to protect any public park, recreation area or wildlife/waterfowl refuge property from adverse impacts resulting from any DOT project. The law states that the Secretary of Transportation may not approve the use of such lands unless a determination has been made that (1) there is no prudent and feasible alternative to using that land, and (2) the project includes all possible planning to minimize harm to the resource being affected by the use.

The list of non-historic Section 4(f) lands for the four-town area is identical to the listing above for Section 6(f) lands. There are no sites located in the immediate corridor study area; therefore, a Section 4(f) evaluation was not necessary.

4.13 VISUAL AND AESTHETIC RESOURCES

The Route 11 corridor study area is typically characteristic of glaciated terrain with its long, narrow valleys defined by north-south elongated, steeply sloped land forms punctuated with boulders and ledge outcrops. Elevation differentials between valley floors and adjacent hilltops range from 30 m. (100 ft.) to over 76 m. (250 ft.) providing a sense of intimate scale and spatial variety to the landscape (Figure 4-33).

Because of the hilly landscape, viewsheds tend to be limited with respect to distant views and peripheral expanse. Rather, sight lines tend to be channeled by the landform and tree lines, focusing attention on the immediate landscape. Watershed patterns create a myriad network of small streams. Flat areas and pockets in the valleys collect water to form wetlands, marshes and ponds. The generally wooded landscape is relieved by occasional meadows and discrete areas of residential development. All of these physical characteristics combine to provide a great aesthetic in the variety of visual experience for both visitors and residents.

4.13.1 ROUTE 82 (ROUTE 11 INTERCHANGE TO THE ROUTE 82/85 INTERSECTION)

The Route 82 segment between Route 11 and Route 85 is brief, providing a relatively conventional transient experience for the driver with respect to road alignment and visual variety. Route 82 has been improved in the vicinity of the Route 11 interchange and the landscape cleared, creating an environment that is well-suited for non-residential uses. Current zoning permits mixed commercial and business uses; a land use that is generally compatible with interchange locations. A limited interval of residentially zoned land is followed by the commercial/business uses at the intersection of Route 82/85.

4.13.2 SALEM FOUR CORNERS (ROUTE 82/ROUTE 85 INTERSECTION)

The mix of architectural styles and age of the existing buildings reflects the evolution of this small commercial center. Structures range from single to two story buildings exhibiting a mix of wood and masonry construction types; none being dominant. Despite the pleasant village scale, the apparent lack of architectural cohesiveness combines with a relatively undefined landscape to diminish the overall visual aesthetic.

4.13.3 ROUTE 85 CORRIDOR (ROUTE 82/85 INTERSECTION TO ROUTE 85/I-95 INTERCHANGE)

The Route 85 corridor may be described as a series of four distinct areas defined by nodes, i.e., road intersections or road segments. The road segments were selected based on a perceived homogeneous character peculiar to each experience.

4.13.3.1 *Segment A (Route 82/85 Intersection to Route 85/161 Intersection)*: Anchored by commercial land uses at each end of the road segments, this portion of the corridor appears to provide the most unity (essentially all residential) and visual stimulation in terms of land use and landscape. The corridor is well-defined on either side by rising land forms and/or treed lots and tree lines. Occasional meadows and waterbodies (Fairy Lake and Horse Pond) provide special interest and counterpoint against the wooded hillsides. Residences provide interesting variety as a mix of old and contemporary structures, some sited with substantial setbacks and others in close proximity to the roadside.

4.13.3.2 *Route 85/161 and Route 85/Chesterfield Road Intersections*: Architecturally more cohesive and with better defined landscapes, these commercially zoned intersections present a more aesthetic appearance than the others along the Route 85 corridor.

4.13.3.3 *Segment B (Route 85/161 Intersection to the I-395 Interchange):* This segment is dominated by the visual impact of Lake Konomoc. As a transient experience, the traveler's attention is directed to the lake by rising land forms along the westerly roadway boundary. The sometimes difficult transitional aspect of mixed land uses (light industrial and residential) is, to an extent,

mitigated by the low density of development. This is a result of development restrictions imposed by the water resource protection regulations which govern the majority of the land area associated with this road segment.

4.13.3.4 *Route 85/I-395 Interchange:* This juncture is clearly perceived as a point of departure. Depending on direction of travel, one is either north-bound and entering a distinctly local community ambience or south-bound and experiencing the transition from two-lane to four-lane roadway, cleared landscape and land uses that are non-residential.

4.13.4 Route 82/85/11 Corridor Study Area Local Roads

The local road network is comprised of relatively narrow paved roads that traverse the major valleys throughout the study area. For the most part, roads are aligned along the toes of slope at the base of the hill formations. With the exception of two or three "special use" areas, the corridor lands are zoned residential (1-acre minimum) lots with houses located along the local collector roads and on secondary roads accessing valleys and higher elevations. The primary aesthetic is related to the intimate scale and rural quality of the general environment. Most vistas along the roads are forested landscapes; there are also a few active farmland areas, providing an alternate type of scenery.

4.14 Hazardous Waste / Contaminated Sites

A preliminary hazardous waste assessment was undertaken within the Route 82/85/11 corridor area to determine the potential for encountering hazardous or contaminated sites in the event that construction were to begin on any of the project alternatives. The following summarizes the investigation's objectives:

- To minimize or reduce the risk of exposure of highway and other agency personnel to toxic and hazardous chemicals during highway construction or roadway improvement activity;

- To avoid or minimize the environmental liability associated with property transfer during the acquisition of land and to prevent or minimize litigation against highway agency staff and third parties; and

- To avoid the additional costs associated with highway redesign, remediation, permitting or planning delays, should contaminated sites be encountered during roadway construction or improvement activity.

4.14.1 EVALUATION METHODOLOGY

Data collection began with a computer database review of existing and historic land uses. Following the data collection, a cursory property inspection (i.e., windshield survey) was conducted from public roadways to verify the information obtained from the computer databases and to screen for the presence of previously undiscovered or unreported potential risk sites within the project area.

4.14.1.1 *Environmental Records Review*: A review of state and federal environmental regulatory agency records was conducted within the project limits using New England Data Map Technology Corporation's Environmental FirstSearch™ Review software systems. This record review included a search of the following federal regulatory databases:

- National Priority List (NPL) database, maintained by EPA, of sites investigated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) that were determined to pose an immediate threat to human health and the environment;
- Comprehensive Environmental Response, Compensation, and Liability Act Information System (CERCLIS) inventory of sites now or formerly subject to CERCLA investigation (i.e. "Superfund" sites);
- Environmental Response Notification System (ERNS) Database of uncontrolled chemical or regulated material release or disposal sites that have warranted EPA response or investigation; and
- Resource, Conservation, and Recovery Act (RCRA) Notifiers inventory of sites that have registered with the EPA under the Act as a hazardous waste generator or as a hazardous waste treatment, storage, or disposal facility (TSDF).

The following state databases were included in the NEDMTC Environmental FirstSearch™ review:

- State List inventory of suspected hazardous waste sites investigated by DEP's Waste Engineering and Enforcement Division;
- Records of DEP-registered underground storage tank (UST) sites;
- Records DEP-registered leaking underground storage tank (LUST) sites;

- Active solid waste landfills on file with DEP; and

- Spills 1990: an inventory of oil or chemical spills reported to the DEP Oil and Chemical Spills Unit from 1990 to July 1, 1997.

4.14.1.2 *Windshield Survey*: Properties along the transportation alignment alternatives were observed for signs of hazardous or regulated materials releases, potential sources of release, or land use practices typically associated with a release. Windshield survey observations of private properties were conducted from within the vehicle and from public roadways. Windshield surveys of commercial properties open to public access were typically conducted from within the vehicle but from parking areas, driveways or adjacent roadways. Access to private property was typically not available. For those properties that contained on-site buildings, the inspection was typically limited to the visible exterior portions of the building as viewed from the roadways or other vantage points. Therefore, all potential areas of environmental concern located on a given parcel may not have been detected or identified.

4.14.2 Identification of Potentially Hazardous Land Uses - Current and Former

Historic land use data was obtained from city directories and included within the Connecticut State Archives History and Genealogy Section Collection. For Montville, the years from 1966 to 1979 were included in the collection; the Waterford directory collection ranged from 1955 to 1988. No directories were available for the towns of East Lyme or Salem.

Various commercial facilities within the project area, and especially along Route 85, are listed in the directories with the distribution of these facilities clustered at major intersections (e.g., the Route 85/161 intersection in Chesterfield). The predominant land use for parcels outside the major road intersections consisted of combined agricultural or residential land use, or remained undeveloped.

Limited industrial land use was noted or suspected within the project limits. EDR Sanborn, Inc. reported no Sanborn Fire Insurance Map coverage for the project area. A lack of Sanborn Mapping coverage is usually a good indication of the lack of industrial or commercial land use for the area within the time frame investigated.

Many of the former agricultural areas along the existing major roadways within the project limits have either succeeded to forest or have been developed for residential or commercial use. Commercial use at major road intersections within the project area has increased over time. Based on a review of the Montville business directories, much of the commercial property that exists today at Chesterfield (a gasoline filling station, automotive repair facility, and general store), has operated similarly since at least the mid-1960s.

The majority of the commercial properties in the corridor area under study are south of I-395. As expected, the majority of the properties that are known or suspected to be associated with a moderate to high risk of contamination are clustered in these areas. Other areas zoned and developed recently for industrial or commercial use, occur in Montville in the vicinity of Route 161 and Butlertown Road, and at Enterprise Drive, located near the Montville-Waterford town line.

4.14.3 IDENTIFICATION OF POTENTIALLY HAZARDOUS SITES

Sites identified as potentially hazardous or contaminated are summarized below with reference to the specific alternatives. The general location of the sites is shown, graphically, in Figure 4-34.

4.14.3.1 *No Build Alternative*: All currently known parcels of environmental concern along the existing roadways represent the list of potential concern sites to be considered during routine roadway maintenance within the project limits.

4.14.3.2 *Widening Alternatives*: Areas of potential environmental concern identified along the existing Route 85 include five registered UST sites, one potential leaking underground storage tank site, six oil or chemical release sites, and three DEP identified suspected hazardous waste sites. No known CERCLA (Superfund) sites and no RCRA Notifiers of hazardous waste generation were identified along this alternative. However, one Superfund site and numerous RCRA and DEP Suspected Hazardous Waste Sites exist along the segment of Route 85 from I-395 south to I-95.

Some of the specific areas along Routes 82 and 85 that may potentially be termed hazardous or contaminated, are noted as follows:

- At Salem Four Corners, a former release of gasoline from an, as yet, undetermined source has resulted in contamination of groundwater in the area. As a result, methyl tertiary butyl ether (MTBE), a gasoline component, was detected in a drinking water supply well on a commercial parcel at this intersection.

- A commercial parcel at Salem Four Corners has had a history of septic problems due to the shallow groundwater table at this location.

- From Salem Four Corners, south on Route 85 to Grassy Hill Road and Chesterfield Road, few known or suspected sites of environmental concern were observed or discovered during the preliminary assessment.

- At the intersection of Routes 85 and 161 in Chesterfield, numerous sites of environmental concern are clustered in close proximity to the existing edge of road. These include a state-suspected oil spill, two registered UST sites, and a commercial land use (automotive repair) typically associated with a high risk of environmental impact. This intersection is also the site of a traffic accident that involved a tanker and dump truck collision which caused the subsequent release of 30,280 l. (8,000 gal.) of gasoline to the ground and a nearby watercourse.

- Isolated sites of potential environmental concern were identified along Route 85 south of Chesterfield and increasing in frequency and density closer to I-395. A possible oil spill and illegal discharge of solvents to the ground was inspected by a DEP officer but the release was not confirmed.

- Registered UST sites are located adjacent to Route 85 in the vicinity of the Montville - Waterford town line and at the south end of Lake Konomoc at the pump station. Further south are various commercial and professional office facilities and an automobile racetrack along the west side of Route 85. An industrial park lies east of and upgradient to Route 85 at this location. This industrial park has been the site of past hazardous or regulated materials releases.

- South of I-395, commercial land usage along Route 85 includes an insect extermination company, a construction company, a municipal complex, a motel, a printing company, a gasoline service station, an abandoned commercial building, a professional office building, and high-density commercial retail facilities in the vicinity of the Crystal Mall. Also along this segment is a CERCLA site, a RCRA hazardous waste generator site, three LUST sites, numerous oil and chemical release sites, and numerous registered UST sites.

4.14.3.3 *New Expressway Alternatives*: Potential hazard areas noted within the alignment segments common to all of the expressway alternatives are noted below along with two alternative-specific areas of concern. No specific risk sites have been identified to date in the vicinity of the overland routes.

- The terminus of Route 11 was identified as an area of apparent unpermitted solid waste disposal. Construction debris, appliances, green waste, and other debris were observed on the ground and the area also bore evidence of heavy target practice.

- Interchange 75 at I-95 has had numerous oil and chemical releases related to transportation accidents; the potential for encountering chemical release sites exists at this location. Since 1990, five transportation-related releases of hazardous or regulated materials have been reported along I-95 in the vicinity of this interchange.

- Where alternative alignment G intersects with Route 161 in East Lyme near Silver Falls Road, a state spill site was identified. Five gallons of gasoline were reportedly released to the soil and surface water adjacent to Route 161. The spill was contained and removed, however, the case remains open.

- Alternative alignment H would cross Route 161 in the vicinity of Butlertown Road. Commercial land uses in this area include a well drilling company, a metal blade sharpening business, an electrical contractor, a welding and fabrication business, and a crane and heavy equipment repair company. Some by-products associated with these commercial activities are associated with potential environmental concerns.