Section 4
Direct, Indirect, and Cumulative Impacts of the Proposed Project and Alternatives

This section details the impacts of the New Jersey Turnpike Authority's (NJTA's) proposed Route 92 project, and the impacts of selected alternatives to the proposed project, to environmental and socioeconomic resources within the Proposed Route 92 Corridor and the Project Study Area. As discussed in Section 2, each of the alternatives proposed over the history of the Route 92 project was screened to ascertain how well it meets the project purpose and its comparative potential impact. The impact analyses for the No Action alternative, the Route 92 alternative, the phased Route 92 sub-alternative, and the US Route 1 Widening and Signal Removal alternative are presented in this section. Some of the US Route 1 alternative impacts discussion is divided into "widening only" and "widening with signal removal". This helps to segregate impacts by construction element, because a significant portion of the impacts of that alternative would be due to intersection alteration rather than the widening of US Route 1. Much of the discussion for the proposed Route 92 alternative and phased Route 92 sub-alternative was extracted from the 1994 DEIS (Harris, 1994), the revised Stream Encroachment Permit Application (Harris, 1999c), the US Army Corps of Engineers (USACE) Section 404 Permit Application and other previously submitted documents, and reviewed and updated as appropriate.

This section addresses regional and cumulative environmental impacts from the project alternatives, as well as site-specific issues. Impacts have been assessed for 18 different environmental and socioeconomic subject areas that are important in the Project Study Area. These subject areas include biological resources (e.g. wetlands and wildlife), other natural resources (e.g., water quality and hydrology), socioeconomic resources (e.g., community facilities and land use) and historic resources.

Several types of impacts are presented in Section 4. The Federal Council on Environmental Quality regulations (40 CFR 1508.8 and 1508.7) define the impacts that must be evaluated during the NEPA process. Direct impacts are those that are caused by a proposed project and occur at the same time and place. For example, the loss of wetland value and acreage from filling would be a direct impact. Indirect impacts are caused by a project, but occur later in time or are removed in distance. Induced development resulting from increased highway traffic is an example of an indirect impact. Cumulative impacts result from the incremental impact of an action when added to other past, present, and reasonably foreseeable future action that may be undertaken by any party. Economic growth in a region after increased development could be considered a cumulative impact.

4.1 No Action

The No Action alternative would have no effect on many of the impact parameters identified in the proposed Route 92 and US Route 1 Widening and Signal Removal sections (sections 4.2 and 4.3 below). Under this alternative, proposed Route 92 would not be constructed, nor would any other regional traffic network improvement be implemented as part of this project. The environmental and socioeconomic impacts that would result from the No Action alternative are described in the following sections.

4.1.1 Air Quality

An air quality modeling analysis was conducted for all alternatives selected for more detailed evaluation in this section of the DEIS. The goal of the analysis was to estimate potential regional carbon monoxide (CO), nitrogen oxide (NO_x) and volatile organic compound (VOC) emissions for each alternative. The analysis was prepared based on the procedures set forth in the Federal Highway Administration (FHWA), USEPA, and New Jersey Department of Environmental Protection (NJDEP) regulations, guidelines, and guidance documents. A discussion of the modeling results follows (refer to Appendix B for a discussion of the methodology followed in completing the analysis).

4.1.1.1 Regional Emissions Modeling

A regional emissions model was performed for the Existing Year (2001) and Horizon Year (2028). The Horizon Year evaluated the following scenarios: No Action, proposed Route 92, and US Route 1 widening improvements. The modeling was conducted with the following goals:

- Estimate the potential regional CO, NO_x, and VOC emissions;
- Determine whether or not each of the project alternatives meets USEPA transportation conformity requirements.

The estimation of the potential regional CO, NO_x, and VOC emissions was based on predicted vehicle miles traveled (VMT) along with average speeds in the study area. These data, combined with emission factor data from USEPA's Mobile Source Emissions Factor Model, MOBILE 6, were used to generate a tons-per-hour emission rate for each model scenario.

The Statewide Transportation Planning Model was used to supply the VMT and average speed data for all roadways included in the model. The data for each scenario are presented in Table 4-1.

Emission factor data were estimated for each scenario for CO, NO_x, and VOCs using MOBILE 5B. The MOBILE 5B inputs for each scenario model run are presented in Appendix B, Table 2. Table 4-2 contains the emissions factors for the Traffic Study Region.

Table 4-1
VMTs and Average Speeds in the Traffic Study Area

Year	Scenario	VMT	Avg. Speed (mph)
2001	Existing	864,883	21.1
2028	No Action	1,163,744	17.7
2028	US Route 1 Six-Lane Widening	1,158,159	18.8
2028	US Route 1 Widening and Signal Removal	1,162,800	20.0
2028	Route 92	1,152,027	21.1

Table 4-2
Final Emission Factors

Year	Scenario	VOC (g/mile)	CO (g/mile)	NO_x (g/mile)
2001	Existing	2.52	21.88	1.64
2028	No Action	1.66	21.32	1.34
2028	US Route 1 Six-Lane Widening	1.59	20.66	1.34
2028	US Route 1 Widening and Signal Removal	1.51	19.68	1.33
2028	Route 92	1.46	18.50	1.33

The resultant VOC, CO, and NO_x pollutant loadings for the 2001 and 2028 build/no action scenarios were calculated using the VMT values from Table 4-1 and the emission factors from Table 4-2. This calculation was performed by multiplying the VMT for a specific scenario by the emission factor for each pollutant and scenario. The results of these calculations are displayed in Table 4-3.

Table 4-3
Total VOC, CO, and NO_x Loadings

Year	Scenario	VOC (tons)	CO (tons)	NO_X (tons)
2001	Existing	2.40	20.85	1.56
2028	No Action	2.13	27.35	1.72
2028	US Route 1 Six-Lane Widening	2.03	26.37	1.71
2028	US Route 1 Widening and Signal Removal	1.94	25.23	1.71
2028	Route 92	1.85	23.49	1.69

Air pollution from vehicular traffic, which is severely intensified by congested conditions, would worsen under the No Action alternative. Based on traffic and air quality modeling, under the No Action alternative 2028 emission loadings for VOCs are expected to decrease by 11%, but CO emissions could increase by 31% and NO_x emissions could increase by 10% over year 2001 emissions. The improvements to the regional traffic network that are considered in the proposed Route 92 and US Route 1 Widening and Signal Removal have the effect of lessening the rise in CO and NO_x and provide for the greatest decrease in VOCs that is expected to occur over time, because of reductions that would occur in vehicle miles traveled and improvements in vehicle speeds. Therefore, if no alternative were implemented (i.e., no action was taken), the air quality in the year 2028 would be expected to be worse than if some sort of regional transportation improvements were made.

4.1.2 Transportation

Traffic congestion is currently experienced in significant portions of the existing local and regional roadway network in the study area. Under the No Action alternative, congestion would continue and would become worse in future years as population, employment, and vehicular use increase.

Under the No Action alternative vehicle hours of travel associated with trips in the region would increase, causing further delay in local and regional commutation, freight movement, and general travel. Compared to the Route 92 and US Route 1 Widening and Signal Removal alternatives, the No Action alternative exhibits the greatest increase in Vehicle Hours of Travel and Vehicle Miles Traveled in year 2028. It exhibits the lowest average network speed, attributable to extensive overloading of the capacity of the existing road system in the project area.

The No Action alternative would contribute to saturation of the existing roadway network, and significant declines in the level of service on existing roads. Increasing levels of regional through traffic, including heavy truck traffic, would be experienced on the local road system, making the affected neighborhoods less amenable to walking and bicycling and decreasing the quality of life in the area's neighborhoods.

4.2 Proposed Route 92 Project

4.2.1 Integrated Impacts Analysis

Through the course of preparing this EIS, several specific impact issues have been identified. These issues combine several environmental and/or socioeconomic parameters, and therefore are better addressed by an integrated discussion. Among these issues are impacts to the Devil's Brook watershed/wetland complex, impacts to the Plainsboro Preserve, impacts to historic resources, and the potential for induced development if proposed Route 92 is constructed. The following text addresses each of these impact issues.

4.2.1.1 Devil's Brook Watershed/Wetland Complex

Most wetland impacts related to the proposed Route 92 project are located within the Devil's Brook wetland complex.

The Devil's Brook watershed is flanked by a large tract of forested wetland and upland extending from just north of Dey Road in Plainsboro Township, north to where Conrail traverses east-west through Dayton. This entire forested system is approximately 1650 acres. The proposed Route 92 project would traverse the southerly portion of this forested tract, leaving 500 acres south of Route 92 and 1150 acres north of Route 92. The width of the forested tract varies from approximately 1000 feet at its narrowest point, located north of Friendship Road and east of Haypress Road, to 6000 feet at its widest point, located north of Dey Road and south of McCormack Lake. Proposed Route 92 would cross the forested tract at the narrowest feasible point for the proposed alignment. The width of the forested tract at the proposed crossing is approximately 3000 feet, although it is interrupted by a 700-foot wide upland field such that the forested width is approximately 2300 feet. Alignments crossing narrower portions of this tract would result in significant impacts to McCormack Lake or extensive disruption of developed residential communities, particularly those located north of Dey Road in Plainsboro Township.

As the proposed Route 92 project would cross the forested wetland tract, the issue of fragmentation of wildlife habitat must be addressed. The issue of fragmentation includes several concerns related to the wetlands system, including the connection of the hydrologic system, movement of wildlife throughout the system and the potential division of the larger system into distinct fragments.

In some sections of the wetland where the soil is not suitable to support the proposed highway bed, the soils would be excavated and replaced with structurally sound fill.

Fill material has the potential to act as a dam, impeding the flow of subsurface water across the wetland complex. This could result in dehydration of the wetlands down gradient and ponding of the wetlands up gradient of the fill. These changes in subsurface hydrology could adversely affect wetland habitat. Hydrologic factors affecting wetland systems include precipitation, surface water, groundwater and evapotranspiration. The forested wetlands in the Devil's Brook watershed are surface water-driven wetland systems, with the underlying soils having relatively low permeability rates. The forested wetlands have been created in areas that receive surface water during flooding events and do not immediately drain afterwards due to flat topography and low soil permeability. The low permeability soil formations suggest that subsurface hydrology interaction with the surface hydrology in the forested wetlands is limited. These forested areas provide a slow release of surface and near-surface water to adjacent water bodies due to the relatively flat nature of the wetlands and low permeability of the underlying soils. The source of water for the Devil's Brook watershed is primarily surface water from flooding events (Harris, 1997). The placement of roadway fill would lead to localized, minor surface and subsurface changes to the wetlands immediately adjacent to the roadway.

Potential impacts to the hydrology of the Devil's Brook wetlands complex would be minimized by several features of the proposed roadway design. Proposed sections of elevated roadway would provide openings under the roadway to allow for small and large surface flow along Devil's Brook such that the surface flow would reach downstream wetland complexes. The roadway bed proposed in the Devil's Brook wetlands would modify the local subsurface hydrology by replacing the substrate with more permeable material, leading to additional seepage from the roadway embankment into the wetlands, rather than acting as a dam restricting subsurface water flow. Given the limited subsurface flow due to low permeability of the existing soils, the roadbed is not expected to have major impacts to the horizontal flow of subsurface water in the wetland complex. The potential impacts to surface water from the Route 92 project would be lessened by the proposed cross-culverts under the roadway where fill is proposed, and by two bridges: one where the Amtrak Northeast Corridor rail lines cross the proposed alignment, and a second where Devil's Brook flows through the proposed alignment. These bridges, 535 and 525 feet long, would preserve the surface and subsurface flow, thus minimizing fragmentation effects to the wetland complex.

These structures would also enable the passage of reptiles, amphibians, and larger animals. The wetland system does not contain documented large mammals that require a large habitat to maintain a stable population. Existing mammal populations (deer, raccoon, etc.) would be able to migrate to either side of proposed Route 92 by crossing beneath the spanned sections of the roadway at Devil's Brook and the Amtrak Northeast Corridor. In addition, sufficient habitat exists on either side of proposed Route 92 to support these animal populations.

The proposed Route 92 project would traverse the Devil's Brook watershed and has the potential to separate the southern section of the watershed's wetlands from the main stream corridor in the northern section, with respect to both animal movement and hydrologic circulation. However, Friendship Road and the adjoining properties, which run parallel to proposed Route 92, comprise a swath of upland along part of this watershed's wetlands (refer to Figure 3-9). USGS topographic maps do not provide enough detail to determine whether Friendship Road was built on a natural ridge or whether wetlands were drained to support it and the surrounding agricultural areas; either way, it exists as an upland that separates the two wetland areas. Construction of proposed Route 92 on this upland area would cause less additional hydrologic fragmentation than constructing it in a wetland area. As discussed above, several culverts under the highway would allow passage of surface water and small animals. Larger animals (such as deer) that cannot utilize the culverts for passage have suitable habitat on either side of the proposed right-of-way.

The USFWS has expressed concern over the impacts of forest fragmentation on neotropical migrant birds. These are birds that migrate long distances from wintering grounds in the tropics of the Western Hemisphere (the New World Tropics or "Neotropics"). More than 130 neotropical migrant species breed in New Jersey, including many types of warblers and sparrows.

In part because of the presence of neotropical migrant birds, USFWS considers the wetlands in the vicinity of proposed Route 92 an Aquatic Resource of National Importance (USFWS, 1999). It has been documented that forested plots with a minimum of about 100 acres are required for the maintenance of stable populations of neotropical migrants (Galli et al., 1976). Fingers of forested land in the vicinity of McCormack Lake would be divided into smaller fragments (approximately 35 and 50 acres) by proposed Route 92; neotropical bird populations could be adversely affected in this localized area. However, the Devil's Brook forested wetland complex, consisting of about 1150 acres north of proposed Route 92 and 500 acres south of proposed Route 92 would continue to support migratory birds. Therefore, suitable habitat for neotropical migratory birds would remain in the area. Because proposed Route 92 would not create a barrier to bird migration, species success or survival would not be affected.

During and after construction, NJTA's design for proposed Route 92 aims to preserve existing drainage patterns, with any temporarily disturbed areas restored to preexisting conditions as feasible.

Concern has been noted over the placement of fill within the floodplain of Devil's Brook and its tributaries, as this may negatively affect its flood-storage function unless properly mitigated. Fill in the floodplain would reduce the flood storage capacity and flood height of the stream, and could increase flood hazards in areas beyond the Proposed Route 92 Corridor. The proposed Route 92 project, while requiring the placement of fill, would also incorporate bridges and culverts to convey the flow of Devil's Brook and its tributaries across the filled areas.

A 525-foot bridge is proposed to cross Devil's Brook and its floodplain. A second bridge, 535 feet long, is proposed to cross Amtrak's Northeast Corridor railroad tracks and a tributary to Devil's Brook. These bridges would require modification of the stream channels they cross. The proposed changes have been designed to closely resemble existing conditions, so that fish passage in these watercourses would not be significantly impacted. In addition, culverts would be installed to allow the flow of smaller tributaries and stormwater runoff courses to pass under Route 92. Because these smaller tributaries are intermittent and therefore not favorable for fish passage, design for fish passage is not required for these structures.

As part of NJTA's Stream Encroachment Permit Application (revised April 1999), water surface elevations (WSEL) for the 100-year flood were computed for existing and proposed conditions at locations that would be impacted by proposed construction in each Design Section. The Federal Emergency Management Agency (FEMA) prohibits encroachment within the 100-year flood boundary that will cause an increase in flood heights of greater than 1.0 foot, and the State of New Jersey prohibits encroachment that will cause an increase greater than 0.2 feet. The model results indicate that the WSEL would not increase more than 0.2 feet at any of the upstream or downstream control points within the Devil's Brook floodplain or any tributary floodplains. The results of hydrologic modeling are discussed further in Section 4.2.3.1.2 and in the Engineer's Reports excerpts in Appendix E. In general, the hydraulic analyses show that the construction of proposed Route 92 would not have a major impact on the WSEL of the Devil's Brook or its tributaries.

NJDEP regulations (N.J.A.C. 7:13-2.14(a)(1)) limit the fill or reduction of floodplain volume below the 100-year flood to a maximum of 20 percent of the flood fringe area within the right-of-way. Two areas of proposed floodplain fill within the Devil's Brook watershed would exceed this 20 percent rule. These are located in the Devil's Brook floodplain in Design Section 2 and in the floodplain of a tributary to Devil's Brook in Design Section 3. NJTA requested exemptions from the requirement for these two areas in the Stream Encroachment Permit Application submitted to the NJDEP, revised April 1999.

Impacts to surface and groundwater quality due to highway runoff are also a concern in the Devil's Brook watershed. In the Devil's Brook floodplain east of the Amtrak Northeast Corridor (Design Section 2), use of detention basins is not feasible due to the extent of wetlands in this area. Instead, water quality mitigation is proposed in the roadway design, which would limit the one-year flow at each of the twelve discharge locations within the floodplain to 1-to-2 cubic feet per second. The water quality requirement for these low runoff volumes would be achieved by alternative BMPs, as well as low velocity sheet flow into the forested wetlands, to maintain the wetland hydrology and allow the wetlands to perform their natural water quality improvement functions.

NJTA is enhancing the stormwater management design to ensure that its proposed project does not increase flooding impacts and complies with NJDEP's recently enacted stormwater management rules. In a letter of March 18, 2004, NJTA states that "the Authority will … assure full compliance with the recent New Jersey [stormwater] regulations implemented earlier this year". Along the project corridor, a range of stormwater management approaches are proposed to improve the water quality of runoff from highway impervious surfaces.

4.2.1.2 Plainsboro Preserve

The proposed Route 92 project would pass through the northeastern corner of the Plainsboro Preserve. The presence of a highway close to the preserve could impact its value as a recreational and wildlife habitat area.

Approximately 12.5 acres of the preserve north of proposed Route 92 would be separated from the rest of the preserve. As with other parts of the Devil's Brook watershed, habitat and hydrologic fragmentation is a possible result. However, both the Devil's Brook bridge and the bridge over the Amtrak Northeast Corridor/Devil's Brook tributary would allow surface water to flow freely, maintaining some hydrologic connection between land on either side of the highway. Wildlife would also be able to travel beneath these bridges. Section 4.2.3 details the wetland, hydrology and floodplain impacts in the Devil's Brook watershed.

Adverse aesthetic impacts of proposed Route 92 would be diminished by the existing forest present over much of the preserve. Trees would act as a natural vegetative screen and reduce both noise and visual impacts of the highway, especially near McCormack Lake, where most human activity is centered. Part of the preserve is agricultural land; while this area would have less natural screening from Route 92, recreation is restricted and the habitat value is lower than in the wetland and forested areas. It should be noted that the Amtrak Northeast Corridor is adjacent to the preserve, and trains currently using the tracks create high levels of noise. Near the tracks, it is unlikely that noise from Route 92 would exceed the noise already experienced due to train activity.

Because proposed Route 92 is at the northern edge of the Plainsboro Preserve, construction- and use-related impacts would be restricted to a relatively small portion of the preserve. The project will not significantly affect the wildlife and aesthetic value of the entire property.

4.2.1.3 Historic Resources

A Phase I/Phase II cultural resources investigation performed by Hunter Research, Inc. in 1996 indicated that the proposed Route 92 project would impact two houses eligible for listing on the National Register of Historic Places on architectural grounds. These were the Van Pelt-Clark Farmstead on Perrine Road and the Dey-Bayles House on Friendship Road. However, the Van Pelt-Clark House has since been destroyed by fire and the Dey-Bayles House has been demolished.

The Village of Kingston has expressed concerns regarding the volume of traffic using the local roads, particularly truck traffic, in this historic village. With respect to proposed Route 92, the concern of Kingston residents focuses on the additional traffic that would travel to and from Route 92 on Kingston's local roads, particularly Heathcote Road. Heathcote Road is a two-lane rural roadway without shoulders, bordered by residences constructed very close to the road. Together with Ridge Road, it provides an east-west connection between US Route 1 and NJ Route 27. The Heathcote Road intersection with NJ Route 27 is the major intersection in the Village.

The network model used for this project estimates that during each peak hour, an additional 20 trucks would use Heathcote Road and the adjacent portion of Ridge Road (as compared with the No Action alternative, both directions together). This would be undesirable from safety and operation perspectives, due to tight geometry on this section of road as well as tight clearances at the intersections on Route 27. If restrictions on truck traffic and traffic calming measures such as speed humps were implemented on this road, however, the traffic impact of proposed Route 92 on Heathcote Road would be reduced.

4.2.1.4 Induced Development

Much of the open land within the Proposed Route 92 Corridor is presently zoned for residential or commercial development. Planning officials have noted that growth and development pressures exist notwithstanding the development of proposed Route 92, and much of the development that is proposed or expected would likely occur with or without proposed Route 92, because of the commercial attractiveness of the Princeton region, and the related demand for housing. The most significant direct land use impacts resulting directly from the proposed highway would be those related to conflicts with proposed or existing development within the right-of-way (Harris, 1994).

Indirect impacts are those effects that are not directly attributable to the development of the proposed Route 92 project, but occur as a secondary or spin-off effect. Indirect impacts include growth-induced impacts. In the case of Route 92, indirect land use impacts could include changes in area land use or land use trends that would not occur if the highway were not developed. Unlike direct impacts, indirect impacts occur over a period of time after a project is developed or occur in areas that are remote or removed from the site of the development. Induced development occurs when the project increases the function or attractiveness of previously undeveloped land for a particular use. In addition to a change in rate of development, a change in land use patterns might also occur.

Although proposed Route 92 would cross undeveloped lands, no direct access would be available to adjacent lands (either as frontage or via connecting local roads) because proposed Route 92 is designed as a limited access highway. For this reason, proposed Route 92 would not create opportunities for linear development along its route, and direct access to nearby undeveloped lands would only be possible in the interchange areas. There would be no interchanges along the road segment between Perrine Road and US Route 130, and thus it would not connect to local or cross streets that could provide access to new lands for development. Induced development impacts could potentially occur at the interchanges of proposed Route 92 with US Route 1, Perrine Road, US Route 130 and New Jersey Turnpike Interchange 8A. However, these interchange areas have either already been extensively developed, or are zoned for development. While the four interchanges may accelerate existing development trends for nearby parcels, Proposed Route 92 is not expected to change the final amount of development anticipated in these areas. Development in these locations remains under the jurisdiction of the municipal development review process, and occurs under the guidance of municipal Master Plans.

While NJTA has no direct control over the land development review and approval process, which is principally the jurisdiction of municipalities and counties, it recognizes that new highway development can be a significant factor in the rate and shape of growth. State agencies have affirmed their interest in collaborating closely with local communities to ensure that future development occurs in sustainable patterns.

The western end of proposed Route 92, including the US Route 1 and Perrine Road interchanges, would be constructed in an area of South Brunswick designated for office parks on the Land Use Plan Map in the 2001 South Brunswick Master Plan. The central portion of proposed Route 92, where there would be no interchanges, would pass through an area designated for rural residential use on the 2001 map. The eastern end of proposed Route 92, including the US Route 130 interchange and the South Brunswick portion of NJ Turnpike Interchange 8A, is in an area designated for general industrial development on the 2001 land use map.

The areas in South Brunswick where proposed Route 92 might potentially stimulate development—the interchange areas--are areas the Township has designated for commercial and industrial development because of the proximity of these lands to US Route 1 and the extensive office development that currently exists in this area (between US Route 1 and the Northeast Corridor railway). Thus, Proposed Route 92 could stimulate development in areas where South Brunswick has planned for commercial and industrial development to occur.

The area in South Brunswick where Route 92 would have no interchanges, and would therefore have little potential to stimulate development, is an area South Brunswick has designated for relatively sparse development. Although proposed Route 92 would cross undeveloped lands (in the central section), no direct access would be available to adjacent lands (either as frontage or via connecting local roads) because proposed Route 92 is designed as a limited access highway. For this reason, proposed Route 92 would not create opportunities for linear development along its route, and direct access to nearby undeveloped lands would only be possible in the interchange areas. There would be no interchanges along the road segment between Perrine Road and US Route 130, and thus it would not connect to local or cross streets that provide access to new lands for development.

East of Perrine Road, proposed Route 92 would pass through the northern portion of Plainsboro Township. In this part of Plainsboro, Route 92 would pass through the northern end of the Plainsboro Preserve, designated for open space and conservation on the Land Use Plan Map in the Plainsboro Master Plan, last revised in 2000. The remainder of the Plainsboro section of proposed Route 92 would pass through undeveloped property designated for low-density residential development. The Plainsboro Master Plan states that proposed Route 92 is "a priority for the Township," and that the Township supports Route 92 and "encourages [its] timely implementation."

In South Brunswick Township, the proposed Route 92 project may result in indirect impacts to farmland. Farmland areas adjacent to the Perrine Road interchange may be removed from agricultural use and converted to more intensive industrial and office park uses. In Monroe Township, indirect impacts could be experienced in currently open areas in the Township. Monroe Township planning officials have indicated that areas are available for development; however, induced development might overstress local roads and infrastructure (Harris, 1994).

Plainsboro has fairly stringent land use controls that do not allow for development without adequate access to roadways and public facilities. Plainsboro officials have indicated that although the pace of new development could be accelerated if Route 92 were constructed, no new development or shift in development patterns is expected as a result of the proposed highway (Harris, 1994).

According to the 1994 DEIS, area township planners have indicated that factors other than the proposed Route 92 will determine the region's future development potential. These factors include the national economy, the land supply suitable for development and the capacity of the housing and labor markets to absorb additional demand. In addition, the type and extent of development that will occur in each area is controlled to a great extent by each township's zoning ordinance. Much of the area that would be traversed by the proposed Route 92 project is low-density residential, which would preclude the development of commercial uses along Route 92, even if it were not a limited-access highway. In areas that are commercially zoned (generally near the interchanges), each township's zoning ordinance dictates the density and type of development that can occur. Recent and proposed development in the area indicates that development will occur with or without proposed Route 92. As a result, indirect land use impacts are expected to be minimal.

4.2.2 Topography, Geology and Soils

4.2.2.1 Topography

Because the topography of the area is generally flat, significant topographic constraints to construction do not exist. The absence of major bedrock outcrops, excessively steep hills, mountains and severe land depressions would reduce the cut and fill requirements for road construction. The cut and fill operations required for grading of proposed Route 92 should not result in harsh contrasts to the existing landscape. Construction would require substantially more fill than cut, especially between Perrine Road and US

Route 130. Construction between US Route 130 and the New Jersey Turnpike would not be expected to require substantial amounts of cut and fill activities. Clean, usable material excavated for the proposed road would be utilized as fill where suitable. In addition, clean fill would have to be imported for grading. Impacts to geology and soils resulting from earth disturbances are addressed in Sections 4.2.2.2 and 4.2.2.3.

4.2.2.2 Geology

The Project Study Area contains no unique geologic features or economically significant geologic formations. Existing quarries in the region are outside the study area. Excavation for proposed Route 92 would be most extensive for the roadway section between Schalks Crossing Road and Perrine Road, within the Stockton Formation. The remainder of proposed Route 92 would require predominantly fill operations with minimal, isolated areas of excavation required. In areas within the study area where the depth to bedrock is shallow, blasting operations could be necessary.

Certain geologic formations may contain iron sulfide minerals known as "acid-producing deposits" that, when exposed to oxygen, oxidize and produce sulfuric acid. This acid increases the solubility of metals to the extent that these metals may represent a toxic source to aquatic life, vegetation, and potable water supplies. According to the *Technical Manual for Stream Encroachment*, the Magothy and Raritan geologic formations of the Coastal Plain physiographic province sometimes contain substantial acid-producing deposits. Construction of proposed Route 92 would require excavation within the Magothy and Raritan Formations; therefore, it is important to note the possibility of exposing acid-producing deposits to oxygen so that appropriate mitigation could be implemented if necessary.

As discussed in Section 3.2.2.1, 10 of 30 soil samples tested in the laboratory showed evidence of containing acid-producing minerals. One sample came from Design Section 1 (between the New Jersey Turnpike and the proposed toll plaza), while the remaining nine came from Design Section 2 (between the proposed toll plaza and the Amtrak Northeast Corridor). In Design Section 2, excavation would be relatively minor and fill operations would be more substantial. In that area, the risk of exposure of acid-producing deposits would not be as great.

4.2.2.3 Soils

The major anticipated impact to soils would be erosion of soil particles. One soil erosion problem occurs when downstream water features become laden with sediment, degrading water quality. Sediment from soil erosion also tends to obstruct natural and manmade drainage structures and channels.

Construction activities increase the amount of soil exposed to flowing water, increasing the extent of soil erosion leading to adverse impacts of nearby surface water features. To minimize impacts, soil erosion control guidelines and mitigation would be adhered to in accordance with New Jersey's *Standards for Soil Erosion and Sediment Control*.

The resistance of a soil to erosion depends upon the composition of the particles that make up the soil, the presence or absence of vegetative cover, and slope steepness. Sandy soils on steep slopes with minimal vegetative cover, such as a sand dune, are highly susceptible to erosion. Conversely, clayey silts with binding particles found on gentle to level slopes with significant vegetative cover, such as a forested wetland, are less susceptible to erosion. In accordance with the USDA Natural Resources Conservation Service classifications, all soil types are designated an erosion factor, K, that predicts an area's annual rate of soil loss by sheet and rill erosion. These estimated factors are based on the percentage of silt, sand and organic matter and on soil structure and permeability. K-factor values between 0.17 and 0.24 indicate low erodibility, 0.28 to 0.37 indicate medium erodibility, and 0.43 to 0.49 indicate high erodibility.

Table 4-4 lists each soil anticipated to be disturbed for the construction of proposed Route 92 and its K-factor. A majority of the soils that would be impacted by construction of proposed Route 92 are characterized by a K of 0.28, representing soils of medium erodibility. The rest of the soils are characterized by K-factor values of 0.24, 0.37, 0.43 and 0.49. Only 10 of the 42 soil types have K values indicating they are highly erodible.

US Route 1 to Perrine Road – The Proposed Route 92 Corridor between US Route 1 and Perrine Road consists of Nixon and Nixon Variant soils, which have K-factor values of 0.28 (low erodibility). This area consists of active farmland, vegetated fields and scattered woodland, representing adequate vegetative cover for soil stabilization. Slopes in this area are for the most part level to gentle at zero to 2 percent.

Perrine Road to US Route 130 – The Proposed Route 92 Corridor between Perrine Road and US Route 130 consists largely of Fallsington and Woodstown soils and, to a lesser extent, of Nixon and Sassafras soils. The soils all have a K-factor of 0.28, representing soils with a low erodibility rating. The proposed alignment near Friendship Road would disturb some farmland, grassed fields and minimal forested lands. The alluvial deposits associated with many of the streams in the Devil's Brook watershed represent a source of erosion, as these deposits would be easily transported downstream during construction activities.

US Route 130 to the New Jersey Turnpike – The Proposed Route 92 Corridor between US Route 130 and the New Jersey Turnpike consists of Sassafras and Mattapex soils, characterized by slow to medium runoff and low to medium erodibility ratings. Soil erosion is not expected to represent a significant adverse impact for the construction of proposed Route 92 in the urbanized area between US Route 130 and the New Jersey Turnpike.

Table 4-4
Soil K-Factor Listing

Soil	Erosion K-Factor	Soil	Erosion K-Factor
At	0.17	NaB	0.28
ChA	0.49	NfA	0.28
ChB	0.49	NfB	0.28
DnC	0.2	NGA	0.28
Ek	0.43	PhD	0.20
EvB	0.17	PM	-
Fb	0.28	PN	-
Fd	0.28	ReA	0.43
HeA	0.2	Rh	0.43
HmA	0.28	Ro	0.43
HU	Variable	SaB	0.28
KeA	0.37	SaC	0.28
KeB	0.37	SgB	0.24
KfA	0.43	SgC	0.24
LnA	0.43	SlA	0.28
LnB	0.43	SlB	0.28
LUA	0.43	UB	-
MeA	0.37	UC	-
MeB	0.37	UL	-
MgA	0.37	Wa	0.43
MgB	0.37	WdB	0.28
MoA	0.32	WkA	0.28
MsB	0.28	WlA	0.28
Mu	0.28	WlB	0.28
NaA	0.28		

Source: Soil Survey of Middlesex County, New Jersey, USDA, 1987.

4.2.3 Natural Resources

4.2.3.1 Surface Water

4.2.3.1.1 Waterways, Streams, and Lakes

The impacts to existing surface water bodies for the proposed Route 92 project are expected to be minimal, as bridge crossings would be constructed for major stream crossings, and appropriately sized culverts constructed for minor crossings. In addition, stormwater Best Management Practices will be used to improve the quality of stormwater runoff before discharge to adjacent waterways and wetlands. Approximately 0.45 acres of open water would be permanently impacted by fill if the project were constructed.

The creation of seven linear miles of impervious surfaces would result in increased stormwater runoff rates compared to pre-development conditions. Approximately 100 acres of impervious surface would be created by this project, resulting in an equivalent loss of recharge area. If uncontrolled, the stormwater from proposed Route 92 could carry significant amounts of vehicle-related contaminants from the roadway into surface and groundwater resources. In addition, increased runoff can exacerbate flooding during rain events. Detention of stormwater runoff and subsequent controlled discharge into receiving waters has been shown to reduce the rate of runoff into surrounding water bodies and to improve the quality of such runoff. Various state, county and regional agencies have set forth stormwater management regulations with which the proposed Route 92 project would have to comply. Refer to Section 5.3.3 for a discussion of the proposed stormwater management plan.

4.2.3.1.2 Floodplains

Development within floodplains is regulated at the federal level by Floodplain Management Executive Order 11988 and at the state level by the Flood Hazard Area Control Act (N.J.S.A. 58:16A-50 et seq.) and Flood Hazard Area Control regulations (N.J.A.C. 7:13-1.1 et seq.). The placement of fill within a floodplain results in adverse impacts to the function of the floodplain including a reduction of the flood storage capacity of the stream, an increase in the flood height of the stream and an increase in flood hazards extending to areas beyond the disturbed area itself. The construction of the proposed Route 92 project would result in floodplain takings of Heathcote, Devil's and Shallow Brooks within the Millstone River watershed. Table 4-5 provides a summary of regulated activities within each floodplain.

NJDEP Stream encroachment permits would be required for construction of the proposed Route 92 stream crossings of Heathcote Brook, Devil's Brook, Shallow Brook and/or various smaller tributaries associated with these brooks. The proposed Route 92 project would require widening of an existing culvert in Shallow Brook, construction of a new culvert in Shallow Brook, a bridge over Devil's Brook, cross culverts to convey flows of tributaries to Devil's Brook, a bridge over a tributary to Devil's Brook and the Amtrak Northeast Corridor, and replacement of culverts across a tributary to Heathcote Brook at US Route 1 and at Ridge Road. All bridges and culverts would have to be designed and sized to maintain the natural drainage patterns within the Proposed Route 92 Corridor. Details of each of the bridges and culverts listed above, as well as impacts to the floodplain hydraulics and hydrology, are discussed in the Engineer's Reports for each Design Section of Route 92, submitted as part of the Stream Encroachment Permit Application and reproduced in Appendix E.

FEMA prohibits encroachment within the 100-year flood boundary that will cause an increase in flood heights of greater than 1.0 foot. The State of New Jersey prohibits encroachment within the flood hazard area that will cause an increase in flood heights of greater than 0.2 feet. As part of the Stream Encroachment Permit Application (revised April 1999), NJTA modeled water surface elevations (WSEL) resulting from the 100-year

Table 4-5
Regulated Activities in Design Sections 1, 2 and 3 of the NJTA-Preferred Alignment

Watercourse	**Section 1**	**Section 2**	**Section 3**
Devils Brook	-Non-regulated construction activities outside 100-year floodplain of non-delineated watercourse	-Bridge construction -Two channel realignments -Retaining walls	
Devils Brook Floodplain		-Stormwater outfalls/cross-culvert -Fill in floodplain	-Fill in floodplain -Stormwater outfalls
Tributaries to Devils Brook		-SMBs 2B and 2E and their outfall structures -Culvert crossing -Retaining walls	-Bridge crossing -Riprap placement -Retaining walls
Tributary to Shallow Brook	-SMB-1D and outfall structure -SMB-1E and outfall structure -140 linear foot pipe extension -Fill in floodplain		
Tributary 'A' to Shallow Brook	-Culvert placement -Fill in floodplain		
Heathcote Brook			-Fill in floodplain -Replacement of storm sewer (720' pipe placement)
Tributary to Heathcote Brook			-Replacement of pipe crossing under U.S. Route 1 -Headwalls and outfall structures for SMB-3A, 3B and 3C -Replacement of pipe crossing under Ridge Road -Various utility crossings

flood were computed for existing and proposed conditions at locations that would be impacted by proposed construction in each design section. Hydraulic computations were performed using the USACE HEC-2 Water Surface Profiles software.

For Design Section 1, WSEL did not increase more than 0.2 feet at any of the upstream or downstream control points for the proposed culvert extension, proposed culvert replacement and proposed installation of two stormwater management basins (SMBs) within the floodplain. For Design Section 2, WSEL did not increase more than 0.2 feet at any of the upstream or downstream control points for the proposed bridge crossing of Devil's Brook, the relocation of a tributary to Devil's Brook, a proposed culvert at Station 544+20, and SMB 2B and 2E's outfalls. For Design Section 3, WSEL did not increase more than 0.2 feet at any of the downstream control points for the proposed bridge crossing of Devil's Brook or the proposed US Route 1 stormwater runoff conveyance system. However, the higher roadway crown line at the barrier curb opening in the US Route 1/Ridge Road intersection yielded a higher WSEL for the proposed conditions that impacts the upstream water elevation. The results of hydrologic modeling are discussed in detail in the Engineer's Reports in Appendix E.

In general, the hydraulic analyses show that the construction of proposed Route 92 would not have a major impact on the WSEL of the affected brooks and tributaries, with the exception of the tributary to Heathcote Brook crossed by US Route 1. However, the modeling indicated that the excessive increase in WSEL for this tributary only occurred when the proposed conditions were modeled with the regulatory flood of 74 cfs (as prescribed in N.J.A.C. 7:13-2.3), and not when modeled with the 100-year flood of 50 cfs.

Proposed Route 92 would involve construction of bridges for major stream crossings and appropriately designed and sized culverts for minor stream crossings. NJDEP regulations require that any new or modified channel of a watercourse be designed and constructed so that during low flow conditions, the water depth is at least as deep as the existing channel (N.J.A.C. 7:13-3.6(c)1). The bridge crossings over Devil's Brook and one of its tributaries in Design Section 2 would require modification of the main channel of the brook as well as a diversion channel. The proposed modifications have been designed to closely resemble existing conditions, so fish passage in these watercourses would suffer minimal adverse impact. All other proposed culverts would be built in intermittent streams where conditions for fish passage are not favorable; therefore, design of fish passage is not required in these structures.

For major streams, bridge heights were established on the basis of preliminary hydraulic estimates, taking into account allowable increases in headwater depth caused by the bridge construction. The bridge lengths were based on spanning the entire floodway, allowing the natural stream cross-section to pass under the bridge.

NJDEP regulations (N.J.A.C. 7:13-2.14(a)1) limit the fill or reduction of floodplain volume below the 100-year flood to a maximum of 20 percent of the flood fringe area within the right-of-way. Three of the proposed floodplain takings or net fills within the

Proposed Route 92 Corridor exceed this 20-percent rule; these are located in the Devil's Brook floodplain and an unnamed tributary's floodplain in Design Section 2 and in the floodplain of a tributary to Devil's Brook in Design Section 3. In the revised Stream Encroachment Permit Application submitted to NJDEP in April 1999, NJTA requested exemptions from the 20-percent rule for design sections 2 and 3.

4.2.3.1.3 Water Quality

As roadway construction would include a bridge over Devil's Brook, a bridge over a tributary to Devil's Brook, and culverts in several watercourses, the potential for adverse impacts to these water bodies was assessed. Impacts to the waterways in the region may originate from three distinct activities associated with the construction of the proposed roadway:

- Bridge and Roadway Construction – soil erosion and stream sedimentation.
- Vehicular Traffic – deposition of vehicular-related pollutants on highway surfaces
- Application of Deicing Material – deposition of salts and sand on highway surfaces.

The types of pollution that could result from these activities are further described below.

Sediment/Particulate Matter – Sediment is one of the most harmful pollutants transported by stormwater. Sediment is predominately soil particles that have eroded from uplands as a result of natural processes or deliberate land disturbance during development. Sediment washes off the land and can build up in lakes and clog drainage ditches, culverts, natural watercourses and man-made features. Increased sediment loading can have impacts to the flora and fauna of water bodies including, but not limited to, the following:

- Sediment particles can accumulate on plants and fish, limiting respiration and leading to mortality.
- Increased sediment can limit sunlight penetration in lakes and ponds, decreasing photosynthetic capabilities of the macrophytic and algal communities.
- Excessive sediment build-up can lead to transformation of shallow water ponds to emergent wetlands, eliminating various aquatic organisms that require permanent standing water.
- Suffocation of benthic communities by sediment accumulation.
- Alteration of the benthic substrate.

Initial clearing and grading operations during construction would expose much of the surface soil, leaving it vulnerable to erosion by wind and water. As a result, pollutant export during construction is typically high. Adequate soil erosion controls would be required at the site, so that large quantities of sediment are not transported to receiving waters (see Section 5.2.1).

Petroleum Hydrocarbons – Oil and grease contain a diversity of hydrocarbon compounds that can be damaging to the environment. The major source of hydrocarbons is from the leakage of oil and other lubricating agents related to automobile and truck use. Hydrocarbon levels are generally highest in areas near parking lots, concentrated roadway networks and service stations. Once hydrocarbons are introduced to a water source, they are quickly adsorbed and absorbed by sediment and particulate matter and can accumulate at the bottom of lakes and streams, causing adverse impacts to the benthic community. Petroleum hydrocarbons biodegrade in an aerobic environment, but at a very slow rate.

Metals – Highway runoff is known to include metals such as lead, zinc, iron, copper, chromium, cadmium and nickel. Automobiles account for a significant portion of these metal contaminants. If metal levels exceed the acceptable standards for a water supply, the safety of public health and aquatic biota is at risk. Metals may naturally occur in the soil, but can be introduced into the environment by way of automobile use, industrial runoff or atmospheric deposition.

Solids/Floatables – Solids and floatable materials are defined as floating or suspended debris generally including bottles, cans, newspapers, plastic containers, and plastic and paper bags. As these pollutants are large, they are generally a surface water pollutant concern and are not capable of infiltrating the groundwater table. Solids and floatables are primarily an aesthetic concern because they litter the aquascape without posing serious health threats to humans. These materials can pose a hazard to wildlife, however.

Nutrients – Phosphorus and nitrogen are two common nutrients found in highway runoff. Phosphorus occurs in various forms of phosphates, including orthophosphates (PO_4), polyphosphates (polymers of phosphoric acid), and organically bound phosphates. Likewise, nitrogen occurs in gaseous forms such as ammonia (NH_3), ammonium (NH_4^+), nitrite (NO_2^-) and nitrate (NO_3^-). Typically, undeveloped land generates few nutrients, agricultural and low to moderate density residential land generates more nutrients, and land uses consisting of commercial, industrial and high-density residential development generate significantly higher nutrient levels. The sources of these nutrients are extensive, including use of fertilizers high in nitrogen and phosphorus, manure from livestock and pet droppings, soaps and detergents, sewage effluent and septic system leachate from domestic and urban sources. The results of increased nutrient levels in the hydrologic system include eutrophication of surface water features. Eutrophication is defined as an over-enrichment of waters by nutrients resulting in a dominance of algal and plant growth.

Pathogens – Pathogens are common contaminants in stormwater. Bacterial and viral forms of pathogens are found in the intestinal tracts of humans and warm-blooded animals and are excreted with fecal wastes. The sources of pathogens include fecal wastes from livestock operations, domestic pets, concentrated wildlife populations, sewage effluent and septic system leachate.

Pesticides – Pesticides including insecticides, herbicides, rodenticides and fumigants are toxic substances deliberately introduced into the environment for agricultural purposes and maintenance of residential and commercial properties. Pesticides in stormwater runoff are carried from application sites by dissolution or binding to particulate matter carried by the runoff. These pesticides can enter surface water and percolate into the groundwater table. They can affect animals and humans either indirectly through the food chain or directly upon contact with the skin.

Road Salt – Road salts are typically used on roadways in the winter to minimize hazardous conditions on roads, as they are a low cost substance for melting snow and ice. Road salt is composed predominately of sodium chloride, which has the potential to degrade natural resources such as vegetation, surface and groundwater quality and aquatic ecosystems.

As areas become more urbanized, impervious pavement is placed on formerly natural lands. Much of this pavement is treated with road salt during the winter months, resulting in large amounts of sodium chloride entering streams, wetlands, ponds and lakes. During precipitation, much of the salt applied to proposed Route 92 would be transported by stormwater runoff into detention/retention basins, and eventually into streams and wetlands within the Millstone River watershed. The influx of sodium chloride into freshwater systems like the Millstone River watershed, if not controlled and mitigated, can produce widespread damage to the aquatic environment. Plants and animals living in this environment cannot tolerate the elevated salt levels and eventually die off. Influx of stormwater runoff containing high concentrations of sodium chloride into a lake or pond can inhibit the natural mixing of a lake, vital to lake oxygenation and survival of organisms. These effects can be most intensive in the summer when evaporation rates are high and there is less water in the lake to dilute any sodium chloride that has not yet been flushed from the lake.

In addition to contaminating surface water resources, sodium chloride at high levels can kill roadside vegetation and tends to corrode bridges, roads, and stormwater management devices.

Pollutant Loads of Highway Generated Runoff

Roadway-associated pollutant loading was estimated using the *Predictive Procedure for Determining Pollutant Characteristics of Highway Runoff– Constituents of Highway Runoff* developed by the Federal Highway Administration (FHWA). This model was used to estimate the amount of roadway-associated pollutant loading that would occur in the subbasins located adjacent to the Proposed Route 92 Corridor. Seventeen constituents were examined using this model for Devil's Brook, Heathcote Brook and Shallow Brook.

Input Requirements
The above-referenced predictive model calculates quantities of pollutants based on empirical equations, highway type and runoff rate. Input requirements for model operation include the following:

- Average Daily Traffic (ADT) for proposed Route 92:
  2028 build conditions – 41,000 vehicles
  This assumes that the 2-way peak hour volume estimates (roughly 4000 vehicles in the morning and 3000 vehicles in the afternoon, as modeled by Urbitran) represent 17% of the ADT

- Type of site:
  Type I – All paved, bridge or overpass
  Type II – Paved and unpaved with curbs and inlets along paved areas
  Type III – rural sites with flush shoulders, grassy ditch conveyance to inlets

  For the purposes of this model, Type II was assumed for proposed Route 92

- Site length in miles from one end of the drainage area to the other end:
  Heathcote Brook – 0.5 miles
  Devil's Brook – 4.9 miles
  Shallow Brook – 1.3 miles

- Rainfall Record:
  Rainfall data was collected by Harris for a similar analysis included in the 1994 DEIS. Data for a ten-year period (1975-1985) was analyzed to determine mean values. Rainfall patterns in 1977 most closely represented these mean values, and therefore that year was selected as the typical rain year. Rainfall data for 1977 used includes number of rainfall events, month/day/year of each event, rainfall in inches for each event, duration of each rainfall and dry days prior to each rainfall. The average of each of these parameters from a total of 98 storm events in 1977 was used.

Model Operation
The following steps were completed to arrive at the pollutant load characteristics of the stormwater runoff generated by proposed Route 92. Pollutant loads were determined for a total of 17 contaminants for the year 2028, which represents the projected completion of the project plus 20 years.

- Runoff Volume for Type II Highway:
  $Q = R^{1.369} DD^{-0.0858}(0.470)$ where Q = runoff (in)
  R = rainfall (in)
  DD = dry days to last rainfall

  The average rainfall was 0.34 inches; the number of dry days ranged from 1 to 19 – an average of 10 was used.

$Q = (0.34^{1.369})(10^{-0.0858})(0.470)$
Q = 0.088 inches of runoff for the average rainfall event

- Runoff Rate for Type II Highway:

  Dry days ≥ 10
  FD = 1.06 RD + 1.79 where FD = runoff duration (hr)
  RD = rainfall duration (hr)

  The average rainfall duration was 6 hours.

  FD = 1.06(6) + 1.79
  FD = 8.15 hours

  Average Runoff Rate (r):

  r = Q/FD
  r = 0.088/8.15
  r = 0.0108 inches/hour

- Runoff Quality:

  $K_1 = ADT^{0.89}(0.007)$ where K_1 = pollutant accumulation rate (lb/mi-day)
  ADT = average daily traffic for the year 2028

  $K_1 = (41000^{0.89})(0.007)$
  K_1 = 89.2 lb/mi-day

  The calculated K_1 is used to predict the load of total solids on the highway surface at the start of the model storm.

  $P = P_o + (K_1 \times HL \times T)$ where P = pollutant level after build-up (lb)
  P_o = initial surface pollutant load (lb)
  K_1 = pollutant accumulation rate (lb/mi-day)
  HL = highway length (mi)
  T = time of accumulation (days; 20 days max)

  P was estimated for the "best case" and the "worst case." The "best case" assumed no initial surface pollutant load ($P_o = 0$), as if the model storm was to occur 10 days after a large rainstorm event that washed all pollutants off the highway surface. The "worst case" assumed that the time of accumulation for the initial surface pollutant load included an additional 20 days prior to the 10 days assumed in the "best case." The additional 20 days is the maximum allowed by the model.

  Best Case Model:

  Heathcote Brook Subbasin
  P = 0 + (89.2 x 0.5 x 10)
  P = 446 lbs total solids on the roadway at the start of the model storm

Devil's Brook Subbasin
P = 0 + (89.2 x 4.9 x 10)
P = 4372 lbs total solids on the roadway at the start of the model storm
Shallow Brook Subbasin
P = 0 + (89.2 x 1.3 x 10)
P = 1160 lbs total solids on the roadway at the start of the model storm

Worst Case Model:

Heathcote Brook Subbasin
P_o = (89.2 x 0.5 x 20)
P_o = 892 lbs initial total solids
P = 892 + (89.2 x 0.5 x 10)
P = 1338 lbs total solids on the roadway at the start of the model storm

Devil's Brook Subbasin
P_o = (89.2 x 4.9 x 20)
P_o = 8744 lbs initial total solids
P = 8744 + (89.2 x 4.9 x 10)
P = 13,116 lbs total solids on the roadway at the start of the model storm

Shallow Brook Subbasin
P_o = (89.2 x 1.3 x 20)
P_o = 2320 lbs initial total solids
P = 2320 + (89.2 x 1.3 x 10)
P = 3480 lbs total solids on the roadway at the start of the model storm

- Wash-off During Model Storm:

$P_D = P(1 - e^{-K_2 r})$ where
P_D = pollutant load (total solids) discharged (lb)
P = pollutant load at storm start (lb)
K_2 = wash-off coefficient (6.5 for Type II highway)
r = average runoff rate (in/hr)

Best Case Model:

Heathcote Brook Subbasin
$P_D = 446(1 - e^{-(6.5)(0.0108)})$
P_D = 30 lbs total solids discharged

Devil's Brook Subbasin
$P_D = 4372(1 - e^{-(6.5)(0.0108)})$
P_D = 297 lbs total solids discharged

Shallow Brook Subbasin
$P_D = 1160(1 - e^{-(6.5)(0.0108)})$
P_D = 79 lbs total solids discharged

Worst Case Model:

Heathcote Brook Subbasin
$P_D = 1338(1 - e^{-(6.5)(0.0108)})$
P_D = 91 lbs total solids discharged

Devil's Brook Subbasin
$P_D = 13{,}115(1 - e^{-(6.5)(0.0108)})$
P_D = 890 lbs total solids discharged

Shallow Brook Subbasin
$P_D = 3480(1 - e^{-(6.5)(0.0108)})$
P_D = 236 lbs total solids discharged

If a second round of modeling is to be performed, the initial load is calculated by subtracting the discharge from the initial pollutant load.

Pollutant load discharged (pounds of total solids) for each subbasin was then inserted into constituent equations provided for seventeen pollutants typical of highway-generated runoff to estimate each pollutant load. Table 4-6 provides the constituent equations for each pollutant. Tables 4-7, 4-8, and 4-9 provide total pollutant load estimates during an average storm event for the Heathcote Brook, Devil's Brook, and Shallow Brook subbasins, for both best case and worst case models.

The estimated pollutant loads from proposed Route 92 will be reduced by a range of stormwater Best Management Practices that will be implemented adjacent to the roadway. Pollutants will be reduced in highway discharges to water bodies by stormwater management controls.

Summary

Construction, operation and maintenance of proposed Route 92 would result in the generation of stormwater runoff from the road surface into receiving surface waters. It is likely that this stormwater runoff would carry with it some or all of the pollution described above. Implementation of stormwater management practices will be required along the length of proposed Route 92 to mitigate potential water quality impacts, and as surface water flows downstream through wetlands, watercourses and floodplains, it would be further filtered by plants, and by microorganisms present in the soil and water that are capable of breaking down pollutants. In addition to pollution carried by stormwater runoff, pollution of surface and groundwater resources by other means is possible. During highway construction and operation, accidental spills of fuel products and toxic materials would be possible.

Refer to Section 5.3.3 and the Engineer's Reports in Appendix E for details on the proposed stormwater best management practices.

Table 4-6
FHWA Runoff Model Constituent Equations

Parameter	Equation
Suspended Solids (SS)	0.63TS - 188
Volatile Suspended Solids (VSS)	0.152TS + 13.5
Total Volatile Solids (TVS)	0.263TS + 243
Total Kjeldahl Nitrogen (TKN)	5.46×10^{-3}TS + 1.28
Biochemical Oxygen Demand (BOD)	3.0×10^{-2}TS + 28.3
Total Organic Carbon (TOC)	5.6×10^{-2}TS + 25.2
Chemical Oxygen Demand (COD)	0.193TS + 275.3
Total Nitrate (TN)	1.3×10^{-3}TS + 0.713
Total Phosphate (TPO_4)	2.25×10^{-3}TS - 0.32
Chloride (Cl)	0.042TS + 87
Lead (Pb)	1.02×10^{-3}TS + 0.04
Zinc (Zn)	5.84×10^{-4}TS + 0.103
Iron (Fe)	1.96×10^{-2}TS - 5.0
Copper (Cu)	3.16×10^{-4}TS + 0.064
Cadmium (Cd)	4.16×10^{-5}TS + 0.021
Chromium (Cr)	4.3×10^{-5}TS + 0.036
Mercury (Hg)	2.44×10^{-6}TS + 1.006×10^{-6}

Table 4-7
FHWA Runoff Modeling Results - Heathcote Brook Subbasin

Parameter	Amount Discharged During an Average Storm Event, Assuming No Initial Pollutant Load (lb)	Amount Discharged Durijg an Average Storm Event, Assuming 20-Day Pollutant Buildup (lb)
Suspended Solids (SS)	0	0
Volatile Suspended Solids (VSS)	18.1	27.3
Total Volatile Solids (TVS)	251.0	266.9
Total Kjeldahl Nitrogen (TKN)	1.4	1.8
Biochemical Oxygen Demand (BOD)	29.2	31.0
Total Organic Carbon (TOC)	26.9	30.3
Chemical Oxygen Demand (COD)	281.1	292.8
Total Nitrate (TN)	0.8	0.8
Total Phosphate (TPO_4)	0	0
Chloride (Cl)	88.3	90.8
Lead (Pb)	0.1	0.1
Zinc (Zn)	0.1	0.2
Iron (Fe)	0	0
Copper (Cu)	0.1	0.1
Cadmium (Cd)	0.02	0.02
Chromium (Cr)	0.04	0.04
Mercury (Hg)	0.0001	0.0002

Table 4-8
FHWA Runoff Modeling Results - Devil's Brook

Parameter	Amount Discharged During an Average Storm Event, Assuming No Initial Pollutant Load (lb)	Amount Discharged Durijg an Average Storm Event, Assuming 20-Day Pollutant Buildup (lb)
Suspended Solids (SS)	0	372.6
Volatile Suspended Solids (VSS)	58.6	148.7
Total Volatile Solids (TVS)	321.0	477.0
Total Kjeldahl Nitrogen (TKN)	2.9	6.1
Biochemical Oxygen Demand (BOD)	37.2	55.0
Total Organic Carbon (TOC)	41.8	75.0
Chemical Oxygen Demand (COD)	332.5	447.0
Total Nitrate (TN)	1.1	1.9
Total Phosphate (TPO_4)	0.3	1.7
Chloride (Cl)	99.5	124.4
Lead (Pb)	0.3	0.9
Zinc (Zn)	0.3	0.6
Iron (Fe)	0.8	12.4
Copper (Cu)	0.2	0.3
Cadmium (Cd)	0.03	0.1
Chromium (Cr)	0.05	0.1
Mercury (Hg)	0.001	0.002

Table 4-9
FHWA Runoff Modeling Results - Shallow Brook Subbasin

Parameter	Amount Discharged During an Average Storm Event, Assuming No Initial Pollutant Load (lb)	Amount Discharged Durijg an Average Storm Event, Assuming 20-Day Pollutant Buildup (lb)
Suspended Solids (SS)	0	0
Volatile Suspended Solids (VSS)	25.5	49.4
Total Volatile Solids (TVS)	263.7	305.1
Total Kjeldahl Nitrogen (TKN)	1.7	2.6
Biochemical Oxygen Demand (BOD)	30.7	35.4
Total Organic Carbon (TOC)	29.6	38.4
Chemical Oxygen Demand (COD)	290.5	320.9
Total Nitrate (TN)	0.8	1.0
Total Phosphate (TPO_4)	0	0.2
Chloride (Cl)	90.3	96.9
Lead (Pb)	0.1	0.3
Zinc (Zn)	0.1	0.2
Iron (Fe)	0	0
Copper (Cu)	0.1	0.1
Cadmium (Cd)	0.02	0.03
Chromium (Cr)	0.04	0.05
Mercury (Hg)	0.0002	0.0006

4.2.3.2 Groundwater

4.2.3.2.1 Aquifers/Aquifer Recharge in Project Area

The construction of the proposed Route 92 project would generate stormwater runoff containing various pollutants as described in Section 4.2.3.1.3. These pollutants include nutrients, petroleum hydrocarbons, sediments, floatables, pathogens, pesticides, metals, and road salts. The likelihood of these pollutants entering the groundwater table is dependent upon the permeability and structure of the overlying soils. As described in Section 3.3.2.1, most of the Proposed Route 92 Corridor is characterized by a moderate vulnerability to groundwater contamination resulting from moderate transmissivity rates. No soils in the Proposed Route 92 Corridor are designated as hydrologic group A, defined as soils with a high rate of water transmission. All of the soils in the Proposed Route 92 Corridor are hydrologic group B, C or D, representing moderate, slow and very slow rates of water transmission, respectively. Due to the lack of soils with high transmission rates, infiltration of contaminated stormwater runoff generated by proposed Route 92 should not pose an adverse threat to groundwater quality. Many pollutants would be taken up by plants, adsorbed by sediments and soil, or broken down by microorganisms in the soil before they reach the groundwater table.

Aquifer recharge is also highly dependent upon the permeability of overlying geologic formations. The more permeable a geologic formation, the greater the recharge to the aquifer. Increased development leads to a decrease in pervious surfaces by the placement of impervious pavement. This results in a reduction of surface area through which aquifer recharge can be conducted. Construction of proposed Route 92 would result in a loss of approximately 100 acres of pervious land, reducing this surface area through which an aquifer can be recharged. The Proposed Route 92 Corridor is largely composed of geologic units characterized by fine sand and silt deposits of medium permeability. The uppermost geologic units in the remainder of the Proposed Route 92 Corridor are characterized by fractured bedrock of low permeability. The proposed Route 92 project could represent a minor impact to aquifer recharge, as there would be a loss of 100 acres of land characterized by medium and slow permeability, although no loss of land characterized by high permeability. However, construction of the proposed SMBs is expected to at least partially mitigate this impact, as the detention basins will provide an opportunity for recharge of the stormwater.

4.2.3.2.2 Sole Source Aquifers

The construction of approximately 100 acres of impermeable land would reduce the area of recharge by the same amount. Much of the project area lies above the Coastal Plain aquifer, which is a sole source aquifer. However, as discussed above, the soils overlying the aquifer have medium to slow permeability; therefore, impacts to the sole source aquifer would not be great. These soils would allow for adsorption and microbiological degradation of pollutants, preventing their infiltration into the aquifer. In addition, the SMBs could provide enhanced percolation of the Route 92 runoff.

4.2.3.2.3 Wells

The proposed Route 92 project has the potential to affect up to 140 wells located within the Proposed Route 92 Corridor, as revealed by a well search completed in October 2002. Of these, 69 are owned by NJTA. The remaining 71 wells are private, industrial, and testing wells. Many of these would likely not be affected, since construction would not necessarily extend the entire width of the defined Proposed Route 92 Corridor. If any wells were displaced or otherwise affected by construction of proposed Route 92, relocation of these wells would be required as part of the applicant's mitigation measures.

4.2.3.3 Water Supply

4.2.3.3.1 Public Water Supply

As no active water supply wells are located within the Proposed Route 92 Corridor, construction of proposed Route 92 would not directly impact the public water supply. The sole public water supply well located within the Proposed Route 92 Corridor is neither in use nor expected to be used in the future (refer to Section 3.3.3).

4.2.3.3.2 Private Water Supply Wells

A total of 27 domestic wells were identified within the Proposed Route 92 Corridor during the well search completed in October 2002. It is likely that not all of these wells would suffer direct impact, as construction would not necessarily extend the entire width of the defined corridor. If any domestic wells were impacted by the construction of proposed Route 92, they would be relocated to ensure a safe and plentiful supply of drinking water.

4.2.3.4 Wetlands

The existing wetland conditions have been described in Section 3.3.4. The functions and values of the major wetland systems, as assessed in prior environmental studies for the project, are presented in the wetland conditions and summarized in Table 4-10. The wetlands assessment evaluated the functions/values of the three major wetland systems present in the project corridor. The major wetland systems in the study area are depicted in Figure 3-9. The wetland descriptions further divided those systems into seven wetland units along the project corridor, as shown in Figure 3-11. The correlation of the three major wetland systems to seven wetland units is presented in Table 4-10. The seven wetland units are used to report wetland impacts for the purposes of this assessment. The seven wetland units comprise many smaller wetland areas as shown on project design plans; the plans also show specific areas of wetland alteration (Harris, 1999a; 1999b).

Table 4-10
Summary of FHWA Wetland Functional Assessment

Wetland System	Ground Water Recharge	Ground Water Discharge	Flood Storage	Sediment Trapping	Shoreline Anchoring	Nutrient Retention	Basin Food Chain Support	Aquatic Diversity/ Abundance	Wildlife Diversity/ Abundance	Recreation
Rte 1 – NJT (Wetland Unit #1)	High	Low	Low	Moderate	Moderate	High	Low	Low	Low	Low
Perrine Rd. – Rte 130 (Units 2 – 6)	High	Moderate	High	Moderate	High	High (Long Term & Seasonal)	Moderate to Low	High (Warm Water Fishery) Low (Cold Water Fishery)	Moderate to Low	Moderate to Low
Rte 1 – Perrine Rd. (Unit 7)	High	Moderate	High	High	Moderate	High (Long Term & Seasonal)	Low	Low	Low	Moderate

Note: The previously reported assessments did not consistently follow FHWA terminology; therefore, this table presents reported criteria and assigned results to the criteria as appropriate.

The proposed Route 92 project would result in permanent filling of 12.03 acres of wetlands, including 0.45 acres of open water. The project would also create permanent shading impacts to 1.16 acres of wetlands. In addition, the project would result in temporary alteration of 2.92 acres of wetlands, including 0.05 acres of open water. A summary of wetland impacts by wetland type is presented in Table 4-11. The majority of wetland filling would occur in the Devil's Brook wetland complex in the western half of the alignment. This impact is approximately 10.39 acres (78.4%) of the total fill area. In addition, vegetation removal for the construction of bridge spans might be required in places where fill is not to be placed. Although the forested vegetation might be removed in some areas, existing hydrology would be maintained as a consequence of the two bridge structures (i.e., the 525-foot bridge over the Devil's Brook floodway and the 535-foot bridge over the Amtrak Northeast Corridor). Therefore, wetland hydrology and wetland soils would not be significantly disturbed in this area. However, the bridge structures would result in the shading of 1.16 acres beneath the structures. Under these conditions, the existing forested vegetation might not be able to grow after bridge construction. It is anticipated that more shade-tolerant wetland plant species would be able to flourish.

Table 4-11
Summary of Wetland Impacts

Wetland Type	**Temporary Wetland Impacts**	**Permanent Wetland Impacts**	
		Impact by Filling (acres)	Impact by Shading (acres)
PFO1	1.58	7.42	1.16
PEM	0.63	1.54	0
PSS1	0.66	2.62	0
Open Water	0.05	0.45	0
Total Impacts	**2.92**	**12.03**	**1.16**

Table 4-10 shows that the Broadway Swamp (wetland units 2 through 6) is generally rated high for wetland functions associated with hydrology – ground water recharge, flood storage, shoreline anchoring, and warm water fisheries. Broadway Swamp is rated as moderate for ground water recharge and sediment trapping, and moderate to low for the remainder of the functions – in basin food chain support, wildlife diversity/abundance and recreation. The wetland to the east (wetland unit 1) is rated high for ground water recharge and nutrient retention, but low for all other functions except sediment trapping and shoreline anchoring, which are rated as moderate. Similarly, wetlands at the western end of the corridor (wetland unit 7) are rated lower than the Broadway Swamp. The eastern and western ends are currently developed, thus diminishing the functional value of wetland in those areas. The central portion of the corridor supports mostly agricultural and low-density residential development, which have lower impact on the adjacent wetland resources and result in higher functional value.

4.2.3.5 Fish and Wildlife

4.2.3.5.1 Endangered and Threatened Species

As stated in Section 3.3.5.2, according to the United States Fish and Wildlife Service (USFWS) the area near the Proposed Route 92 Corridor potentially contains habitat for the federally listed threatened bog turtle. Field surveys performed specifically for this species within the project corridor did not reveal any suitable habitat. Several field surveys were previously conducted to confirm the presence or absence of individual threatened or rare plant species within the proposed right-of-way. The surveys revealed that the state-endangered plant, southern arrowhead, was present in seven locations along the ROW. However, only three stands were located within the expected limit of disturbance. The proposed Route 92 project would impact approximately 25% of the known southern arrowhead population situated within the Devil's Brook study area identified in the USACE Section 404 Permit Application (Harris, 1999). The observed population of southern arrowhead extends from approximately 600 feet north of the proposed ROW at Devil's Brook, south to McCormack Lake. The spanning of the entire Devil's Brook floodway by a 525-foot bridge would reduce impacts to this population. Because southern arrowhead propagates by both seed and rhizome, both present in the Devil's Brook floodplain, and there is significant acreage of suitable habitat for this plant outside of the proposed ROW, the construction of proposed Route 92 would not jeopardize the continuation of this population. Refer to Section 5.3.6 for proposed southern arrowhead mitigation.

Surveys were also conducted for Species of Concern (SOC) as identified by the New Jersey Division of Fish, Game and Wildlife (NJFGW). Although some of the SOC are not present within the project area due to lack of suitable habitat, some SOC might utilize habitat within the project area.

4.2.3.5.2 Critical Habitat

No critical habitats for threatened or endangered species have been designated within the Proposed Route 92 Corridor (refer to Section 3.3.5.2); therefore, the proposed Route 92 project would not result in impacts to designated critical habitats.

4.2.3.5.3 Other Wildlife Habitat

Evaluation of Impacts to Habitats Identified Along the Proposed Route 92 Corridor

Based on sizes of forest and grassland habitats, several areas have been identified as important natural habitats along the proposed Route 92 project (refer to Section 3.3.5.3). Two important forested habitats are located east of the Amtrak Northeast Corridor. Both areas are fairly wide forest corridors connecting larger forests found to the north and south of the Proposed Route 92 corridor. These tracts provide secluded travel corridor habitat as well as limited interior forest habitat. Two tracts of grasslands along the highway corridor are ranked as marginal and suitable. The marginal grassland habitat is an approximately 8.5-acre early successional field west of the railroad tracks. The complex of agricultural fields, ranked as suitable grassland habitat, between the power line easement and railroad tracks is greater than 25 acres within the Proposed

Route 92 Corridor. Contiguous fields to the south increase the effective size of this grassland mosaic.

Target species used to assess anticipated habitat impacts resulting from the proposed construction of proposed Route 92 are a subset of the species of concern with habitat ratings of 3 (potential habitat) as identified in Table 3-9, as well as mammals anticipated to use the wetland forests along Devil's Brook. The subset of species selected from Table 3-9 includes only those species that are expected to be present based on the previous field efforts conducted by ASGECI and the ERI of the Turkey Island Corporation property (Fishback, 1994). The list of species, along with the range of territory/home range size for each (as reported in DeGraaf and Rudis (1986), except savannah sparrow and bobolink), includes:

Birds:
Cooper's Hawk (45–1300 ac)
Savannah Sparrow (20–40 ac)
Bobolink (5-10 ac)

Mammals:
Raccoon (180–1500 ac)
Eastern Cottontail (0.5–40 ac)
Red Fox (140–400 ac)
White-Tailed Deer (40–300 ac)

The mammals selected for this assessment are species that are common to the area as well as species that can utilize a variety of habitats, both upland and wetland. The study area includes forested wetlands and a variety of upland habitats. The mammals listed above have been documented to occur in red maple swamps, but are primarily facultative wetland species (Golet et al., 1993); they are primarily upland species that will utilize wetland habitats. Golet et al. (1993) report that red maple swamps have become important habitats for deer as these habitats provide refuge in developed areas and protection from predators and humans. Wetlands along watercourses offer travel corridor habitat to deer as well as other large mammals.

The approximate acreage of upland vegetation that lies within the proposed Route 92 right-of-way is as follows (Harris, 1999c):

Forest	100 acres
Agricultural	195 acres
Non-Farm Field	29 acres
Shrub-Scrub/Successional	36 acres
Total	**360 acres**

The proposed Route 92 project has the potential to disturb the sum of upland vegetation listed above, if the entire right-of-way is developed.

Forest Habitat Impacts

The upland and wetland forests associated with Broadway Swamp and the Devil's Brook watershed are currently split into two lobes by the upland that flanks Friendship Road. The central portion of proposed Route 92 would be constructed on this section of upland, most of which is not currently forested.

Proposed Route 92 is designed to avoid wetlands to the maximum extent possible. However, the bridges over Devil's Brook and the Amtrak Northeast Corridor would cause minor forest habitat impacts. The construction of proposed Route 92 in the Devil's Brook area would require clearing of forested land in the path of the highway. Therefore, birds may perceive the forests north and south of the bridge as two distinct woodlots instead of a single forested tract.

The forest remaining immediately south of the alignment and to the northeast of McCormack Lake would be approximately 50 acres, and the forest to the northwest of McCormack Lake would be approximately 35 acres south of the proposed highway. The northerly parts of these finger-like forest tracts would remain contiguous to the 1150-acre forest complex to the north. Neotropical birds could be adversely affected by the fragmentation in this immediate area. However, an additional 500 acres of forest would remain further south, along Devil's Brook. If Broadway Swamp is included, a minimum of 2400 acres of forested land will remain south of proposed Route 92.

The southern portions of these woodlands, in their entirety, meet the minimum territory/home ranges for the majority of forest species identified above. Raccoon is reported to have a large home range (DeGraaf and Rudis, 1986); however raccoon habitat includes a complex of woods, fields and watercourses, not usually dense woodland. In addition, they are adapted to living in close proximity to human development. Red fox also is reported to utilize extensive areas for its home range. Again, fox habitat includes a complex of forest and open areas, preferring field/forest edges. Fox typically avoid dense woods and open fields. Cooper's hawk may be present within the study area. Its habitat is described as mixed deciduous forest and scattered woodlots interspersed with open fields. Utilizing more agricultural land has broadened Cooper's hawk habitat. Sufficient habitat also would likely remain within the project vicinity should this species be present in the area.

Due to the existing edges to the east and west, and the proposed new edge to the north, the total interior forest habitat of the two forest tracts south of proposed Route 92 would be less than their total area of 85 acres. These tracts, however, would continue to provide their principal habitat function of secluded travel corridor habitat, connecting the forests to the north of the alignment to the forest, lake and grassland habitats to the south.

Grassland Habitat Impacts
The two tracts of grassland along the highway corridor that are ranked as marginal and suitable are the early successional field of approximately 8.5 acres west of the Amtrak Northeast Corridor (marginal), and the large complex of agricultural fields between the power line easement and Amtrak Northeast Corridor (greater than 25 acres) with additional contiguous fields to the south.

The early successional field west of the Amtrak Northeast Corridor may provide suitable habitat for bobolink but is too small for most other grassland birds. The proposed highway would follow along the south margin of this old field, with minimal effect to its size. Therefore, based on area this old field could continue to provide suitable bobolink habitat. The proposed highway alignment would cross through the northern portion of the large complex of old fields and agricultural lands east of McCormack Lake. Approximately 20 acres of field habitat would remain north of the proposed highway alignment, while a large contiguous complex of fields (approximately 200 acres) would remain intact south of the highway alignment. The northern fragment of approximately 20 acres is slightly too small for species such as savannah sparrow, but could provide habitat for bobolink. The large expanse of fields south of the proposed alignment would continue to provide suitable habitat for a wide variety of grassland birds that require extensive grassland habitat.

In summary, it appears that implementation of the proposed Route 92 project would not significantly reduce the usable habitat within the Proposed Route 92 Corridor. Some interior forest habitat would be lost; however, secluded travel and connection to the forest to the north with the forest, lake and grassland in the south would continue to exist. The post-development grassland habitat should continue to provide suitable habitat for a variety of bird species.

4.2.4 Farmland

The proposed Route 92 roadway and associated interchanges would displace approximately 210 acres of active agricultural land. In addition, the proposed roadway would interfere with access to an additional 78 acres of agricultural land. None of the agricultural land that would be displaced or made inaccessible is in an agricultural development area (ADA), and none of the land is subject to preservation easement under the New Jersey Farmland Preservation Program.

4.2.5 Historic and Cultural Resources

4.2.5.1 Impacts to Historic Sites

Hunter Research, Inc. selected five sites in the Project Study Area for Phase I/Phase II cultural resources investigation (Hunter, 1996). These were the Major-Mount farmstead, the Van Pelt-Clark farmstead, the Boyko prehistoric site, the Ayres-Lane farmstead, and the Dey-Bayles farmstead. Architectural evaluations were performed at the four historic sites (farmsteads), and included all structures, including outbuildings. In addition, archeological field investigations were performed at the Boyko site, the Van Pelt-Clark farmstead, and the Ayres-Lane farmstead. The goal of this study was to offer an opinion as to which sites were eligible for listing on the National Register of Historic Places, and to determine the impacts of the proposed project to those sites.

The study concluded that the Major-Mount House, Van Pelt-Clark Farmstead, and the Dey-Bayles House were eligible for listing on the National Register on historic architectural grounds. Of these, proposed Route 92 was judged to have adverse impacts to the Van Pelt-Clark Farmstead and the Dey-Bayles House.

In 2002 Richard Grubb & Associates, Inc. conducted a cultural resources assessment for proposed Route 92. Grubb found that the Van Pelt-Clark House had been destroyed by fire in 2001 and that the Dey-Bayles House also no longer exists (Grubb, 2003).

Grubb concluded that an existing house not identified in previous cultural resources investigations, the Crespo House at 96 Perrine Road, is eligible for listing in the National Register of Historic Places. Grubb further concluded, however, that proposed Route 92 would have no impact on the Crespo House. Relocated Perrine Road would pass approximately 800 feet south of the Crespo House, beyond the area of anticipated audible, visual or atmospheric effects. (Grubb, 2003)

The overall conclusion of the Richard Grubb & Associates cultural resources assessment is that no historic architectural properties would be affected by proposed Route 92, and that there is a low probability that proposed Route 92 would affect archaeological or historic properties (Grubb, 2003).

A draft *New Jersey Historic Roads Study* (Kise Straw & Kolodner 2001) has identified most of US Route 1 between Trenton and New Brunswick, known historically as the Trenton and New Brunswick Straight Line Turnpike, as potentially eligible for listing in the National Register of Historic Places. The interchange between US Route 1 and proposed Route 92 would fall along this stretch of US Route 1. Construction of the interchange would not change the historic alignment of the primary roadway of US Route 1, but would alter the character of the roadway at the new interchange. Grubb recommends that the existing integrity of the roadway be assessed to determine its eligibility for inclusion in the National Register.

4.2.5.2 Impacts to Historic Districts

Proposed Route 92 would not pass through any historic districts. Traffic modeling indicates that implementation of Route 92 would reduce traffic in the Cranbury Village Historic District, especially in the peak morning hour, but would slightly increase traffic in the Kingston Historic District.

4.2.5.3 Section 106 Compliance

The proposed Route 92 project has been reviewed by the Historic Preservation Office of NJDEP pursuant to Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended. In a letter to NJTA dated December 11, 1996, NJDEP stated that no archaeological resources have been identified within the area of potential impacts, and that the proposed project could adversely impact two historic architectural properties, the Van Pelt-Clark House and the Dey-Bayles House. As noted above, the cultural resources assessment conducted by Richard Grubb & Associates in 2002 found that these two houses no longer exist.

4.2.6 Air Quality

The emissions loading data in Table 4-3 reveal that all four alternatives are predicted to produce lower VOC loadings and higher CO and NO_x loadings in 2028 as compared to existing loadings of these pollutants in 2001. Proposed Route 92 would produce a 23% VOC reduction compared to an 11% reduction with the No Action scenario. The smallest increases in CO and NO_x loadings, 13% and 8% respectively, occur with proposed Route 92.

Note that all 2028 scenarios show a reduction of emission factors for CO, VOC and NO_x. Proposed Route 92 displays the largest emission rate reduction for CO and VOC. The increased CO loading that occurs from proposed Route 92 can be attributed to the 33% increase in VMT when compared to the Existing Year scenario. This 33% increase is also the smallest VMT increase of all 2028 scenarios.

This analysis shows that proposed Route 92 would produce emissions of VOC, CO, and NO_x that are all significantly less than the 2028 No Action scenario. Based on the above information, proposed Route 92 is expected to meet USEPA's conformity regulations.

4.2.6.1 CAL3QHC Modeling

A CO "hot-spot" analysis was performed for the Horizon Year (2028) No Action and Build scenarios for the four worst-case intersections within the Proposed Route 92 traffic network area. The input parameters used in these analyses can be found in Appendix B. A surface roughness coefficient of 108 cm was used to represent the surrounding land use. In addition, the Project Study Area was determined to be more rural than urban; therefore, stability class E was used to represent atmospheric conditions in the area.

CAL3QHC predicted worst-case one-hour average CO concentrations for the Horizon Year No Action and Proposed Route 92 alternatives. The results were added to ambient CO levels and compared with the National Ambient Air Quality Standards (NAAQS). The one-hour analysis was multiplied by a persistence factor to determine the eight-hour result. A persistence factor of 0.7 is recommended as a conservative conversion from a 1-hour average concentration to an 8-hour average concentration (USEPA, 1992).

Table 4-12 presents the results of the CO microscale analysis for the Horizon Year No Action and Build for the four worst-case intersections. The maximum one-hour CO concentrations ranged from 7.6 ppm at the Kingston Lane/Route 522 intersection to 19.3 ppm at the Route 32/CR 535 intersection for the No Action alternative. The maximum one-hour CO concentrations decreased at all four intersections for the Route 92 alternative. The maximum one-hour CO concentrations ranged from 6.7 ppm at the Kingston Lane/Route 522 intersection to 9.4 ppm at the Route 32/CR 535 intersection for the Route 92 alternative. In both the No Action and Build alternatives the one-hour CO concentrations for all four intersections were below the one-hour NAAQS of 35 ppm.

Table 4-12
CAL3QHC Predicted Maximum CO Concentrations, in ppm

Intersections	1-Hour Average 2028		8-Hour Average 2028		NAAQS	
	No Action	**Build**	**No Action**	**Build**	**1 hour**	**8 hour**
Dey Road and CR 535	**8.5**	8.2	6.0	5.7	35	9
US 130 and Dey Road	11.4	8.6	8.0	6.0	35	9
Kingston Lane /Route 522	7.6	6.7	5.3	4.7	35	9
Route 32 and CR 535	19.3	9.4	13.5	6.6	35	9

Maximum 8-hour CO concentrations ranged from 5.3 ppm at the Kingston Lane/Route 522 intersection to 13.5 ppm at the Route 32/CR 535 intersection for the No Action alternative. The maximum eight-hour CO concentrations decreased at all four intersections for the proposed Route 92 alternative. The maximum 8-hour CO concentrations ranged from 4.7 ppm at the Kingston Lane/Route 522 intersection to 6.6 ppm at the Route 32/CR 535 for the Route 92 alternative. For both the No Action and Build alternatives, the eight-hour CO concentrations for all four intersections were below the 8-hour NAAQS of 9 ppm, except for the Route 32/CR 535 intersection for the No Action alternative.

CAL3QHC output files for each intersection are provided in Appendix B1.

4.2.6.2 Impacts During Construction

Potential air quality impacts from construction of proposed Route 92 include emissions from trucks and construction equipment, and fugitive dust on construction sites. Construction fugitive dust impacts are generally temporary.

Almost all trucks and equipment involved in construction will be diesel-powered. Diesel engines contribute a substantial portion of the NO_x, PM, and, to a lesser extent, hydrocarbon (HC) emissions from mobile sources.

Projects located in severe ozone nonattainment areas are required under transportation conformity rules to demonstrate that potential emission increases of NO_x (precursor to ozone) do not exceed the 25 ton per year (tpy) de minimis threshold.

Recently, USEPA promulgated new emissions standards for new on-road (highway) and non-road engine models. These new emissions standards will reduce NO_x, PM and HC emissions up to 90 percent from today's models. On-road emissions standards went into effect with the 2004 model year, with more stringent standards to begin in 2007. Non-road emissions standards began with the Tier 1 (1994 model year), with Tier 2 emission standards established for 2001-2006 model years and Tier 3 emissions standards established for model year 2007 and beyond. Newer equipment used by contractors constructing proposed Route 92 would have to comply with the new emissions standards. Emission controls for older equipment are addressed in Section 5.2.3.

4.2.7 Transportation

The changes in year 2028 peak-hour traffic flows that would result from the construction of proposed Route 92 were estimated using a detailed "Central Jersey" traffic model developed for this project. This model contains a detailed representation of the entire area from New Jersey Route 18 in the north to Mercer County Route 571 in the south, and from the New Jersey Turnpike and Middlesex County Route 535 on the east to New Jersey Route 27 on the west. It uses 985 zones to represent this area, and 53 "external stations" to represent entry and exit points to/from the area.

The detailed local traffic model is "nested" within the 22-county regional model recently developed for the Penns Neck Improvements EIS. The regional model provides information relating to the orientation, mode choice, and route usage of relatively long trips. This regional model essentially provides the context within which travel in the Central Jersey study area is conducted.

The chief output of the local model is a set of detailed traffic assignments to the streets and highways of the study area. The local model also contains a comprehensive database of existing and future land use that drives the estimation of trip making in the local area. Both the local and regional models use this land use database.

In the road network, link free-flow speeds and per-lane hourly capacities are assigned based on link facility type. This approach is an efficient one that ensures consistency among links of the same type. For links with a control device (signal, stop or yield sign) at its end, the model adjusts the free-flow speed and per-lane capacity values using intersection delay and capacity calculations based on formulas in the Highway Capacity Manual of the Transportation Research Board. A.M. and P.M. peak-hour traffic counts for the 2000-2002 period were used to calibrate the model.

Peak-hour vehicular zone-to-zone matrices for the Central Jersey area were prepared based on data from the regional and local models. The regional 22-county model was executed to create a set of "subarea" vehicle trip matrices for the area covered by the Central Jersey traffic model. Four vehicle trip matrices (auto home-based work trips, auto home-based non-work trips, auto non-home-based trips, and truck trips) were generated for each of two time periods: a 2-1/2 hour morning peak period, and a 3-hour evening peak period.

At the same time, standard ITE vehicle trip generation rates were applied to the detailed Central Jersey area land use inventory to estimate the number of vehicles entering and leaving each Central Jersey model zone during the A.M. and P.M. peak hours. This information was used to derive factors that were used to allocate the trips in the subarea matrices from the zones in the regional model to the much more detailed Central Jersey model zones. The resulting trip tables were then factored to ensure that the number of autos entering and leaving each zone agreed with the numbers obtained using the ITE rates, to convert from peak periods to peak hours, and to obtain the proper balance between internal and external trip-ends. The Central Jersey trip tables resulting from this factoring process were then further adjusted to achieve better agreement with the counted peak-hour traffic volumes.

An iterative process was used to "assign" peak-hour auto and truck trips to the road network. Each traffic assignment consisted of ten iterations of capacity restraint, starting with the free-flow link speeds on the first iteration. Ten percent of the trips were assigned for each iteration.

In the assignment process, Turnpike tolls were handled using the same method employed in the regional model. Representative auto and truck toll amounts were used for each Turnpike segment, and these amounts were translated into equivalent quantities of time, based on assumed representative time/cost trade-off rates (values of time) for autos and for trucks.

The model was validated for year 2001 traffic conditions. For the 2001 base year, the total assigned traffic volumes on links with counts were very close to the counted volumes. In addition, "goodness of fit" statistics generated from the 2001 assignments are in general agreement (and in some cases substantially better) than FHWA standards.

For all future year (2028) model runs, all funded highway improvement projects in this area were added to the network. Displays of the model outputs are included in Appendix C.

For more detailed information regarding this traffic model, please refer to Appendix C of this EIS.

The model indicates that the construction of Route 92 would meet the objectives of this project as stated in Section 1 (Project Purpose and Need):

1. **Achieve an east/west roadway system in southwestern Middlesex County/northeastern Mercer County that emphasizes the use of local streets for local access and circulation, and provides an east-west connection for through traffic moving between the major north-south corridors (US Route 1, US Route 130, and the New Jersey Turnpike) that minimizes adverse impacts on established communities.**

The construction of proposed Route 92 is expected to reduce the amount of peak-hour through traffic on the local and secondary east-west roads crossing the screenline defined in Section 1 by 18 percent in 2028, as compared with the No Action alternative. As shown in Table 4-13, through traffic may decrease by more than 60 percent on several of these roads.

Table 4-13
Projected 2028 Total Daily Peak-Hour Through-Traffic Volumes (A.M. + P.M.)
Proposed Route 92 vs. No Action

Screenline Crossing	NO ACTION	NJTA ROUTE 92	PERCENT CHANGE
CR-610 (Deans Ln)	1,384	1,322	-5%
Major Road	265	101	-62%
CR-522 (Ridge Rd)	208	78	-63%
New Road	179	180	1%
Dey Road	890	317	-64%
Plainsboro Road	835	423	-49%
Cranbury Neck Road	886	646	-27%
CR-535	1,301	1,482	14%
CR-571	2,212	1,973	-11%
Dutch Neck Road	20	18	-9%
Hankins Road	1,938	1,793	-7%
Total	**10,117**	**8,334**	**-18%**

Figures 4-1 and 4-2 display the projected changes in 2028 peak-hour traffic volumes in the Traffic Study Area that would result from the construction of proposed Route 92. In these figures, red bars indicate roadways where peak-hour traffic volumes are expected to increase, and green bars indicate roadways where peak-hour traffic volumes are expected to decrease. The thickness of the bars indicates the magnitude of the peak-hour traffic volume change predicted by the model.

The model indicates that construction of Route 92 would result in substantial reductions in peak-hour traffic volumes on the local and secondary east-west roads in the Traffic Study Area, including in the sensitive areas listed in Section 1 (Plainsboro Center, South Brunswick Center, and Princeton Junction Center), as well as along Route 27 in Kingston.

2. **Provide alternative routings for north-south traffic currently using US Route 1, to relieve congestion while minimizing impacts on the abutting communities. Appropriately divert regional traffic to US Route 130 and the New Jersey Turnpike.**

In addition to reducing peak-hour traffic levels on the existing east-west roads in the Traffic Study Area, the model indicates that construction of proposed Route 92 would generally reduce peak-hour traffic volumes along the most constricted portion of US Route 1 in South Brunswick and North Brunswick. This would result from the rerouting of longer-distance north-south trips to US Route 130 and the New Jersey Turnpike, via Route 92.

Figure 4-1

2028 A.M.

Peak Hour Traffic Changes

Route 92 vs. No Action

US Army Corps of Engineers

Proposed Route 92

Environmental Impact Statement

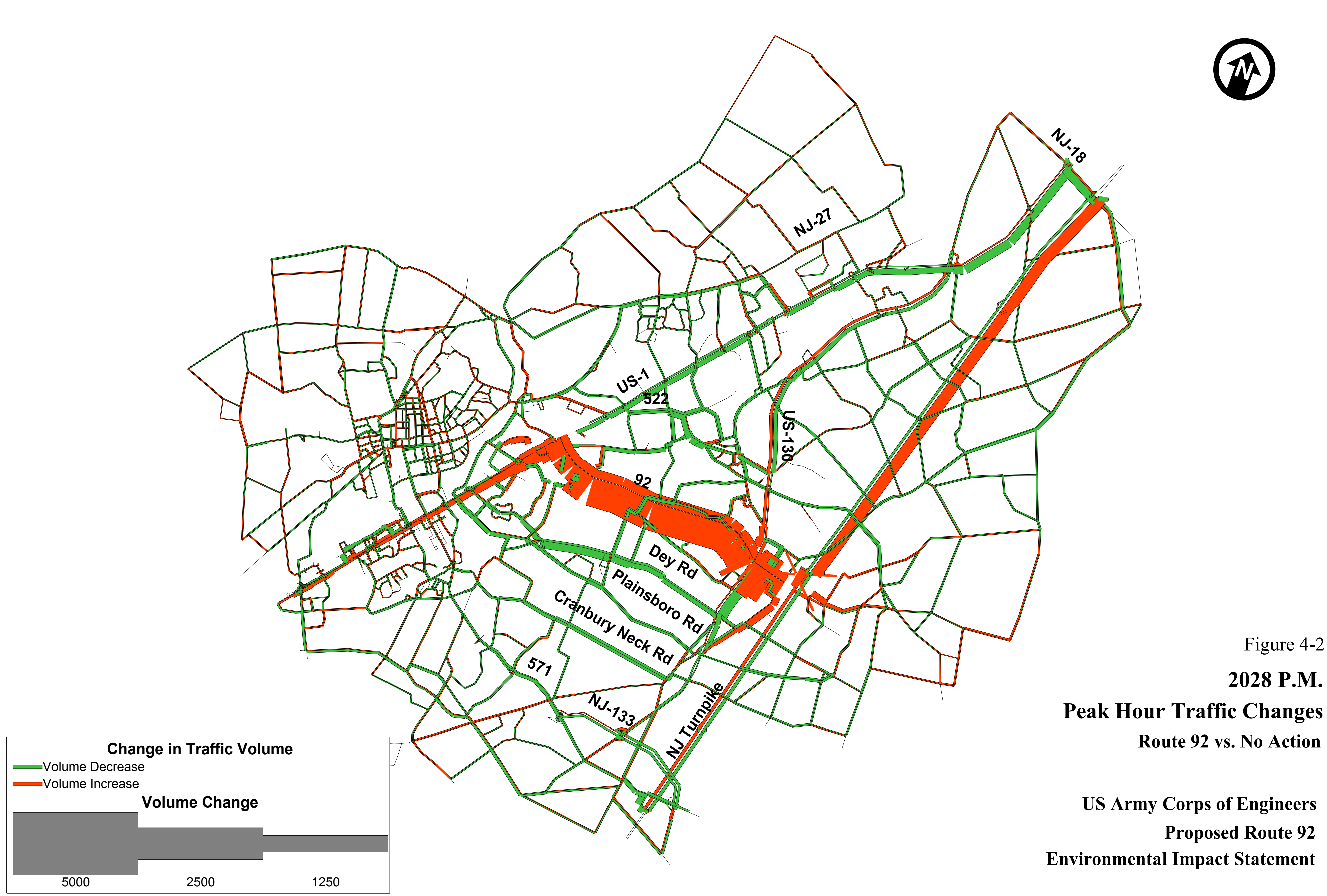

Figure 4-2

2028 P.M.

Peak Hour Traffic Changes

Route 92 vs. No Action

US Army Corps of Engineers

Proposed Route 92

Environmental Impact Statement

3. Reduce truck traffic on the local roadway network.

Figures 4-3 and 4-4 display the projected changes in 2028 peak-hour truck volumes in the Traffic Study Area that would result from the construction of proposed Route 92. In these figures, red bars indicate roadways where peak-hour *truck* volumes are expected to increase, and green bars indicate roadways where peak-hour *truck* volumes are expected to decrease. The thickness of the bars indicates the magnitude of the model-projected changes in peak-hour *truck* volumes. The model indicates that the construction of Route 92 would result in substantial reductions in peak-hour truck volumes on the local and secondary east-west roads in the Traffic Study Area, and along NJ Route 27 in Kingston.

Peak-hour truck volumes on the local and secondary east-west roads are expected to drop by 17 percent, as compared with the No Action scenario, as shown in Table 4-14.

Table 4-14
Projected 2028 Total Daily Peak Hour Truck Volumes (A.M. + P.M.)
Proposed Route 92 vs. No Action

Screenline Crossing	NO ACTION	NJTA ROUTE 92	PERCENT CHANGE
CR-610 (Deans Ln)	101	48	-52%
Major Road	69	24	-66%
CR-522 (Ridge Rd)	203	92	-55%
New Road	13	6	-55%
Dey Road	79	14	-83%
Plainsboro Road	79	39	-51%
Cranbury Neck Road	131	98	-26%
CR-535	525	561	7%
CR-571	403	448	11%
Dutch Neck Road	449	436	-3%
Hankins Road	291	176	-40%
Total	**2,343**	**1,940**	**-17%**

On Dey Road and Plainsboro Road, truck volumes are expected to be reduced by about 85 percent and 50 percent, respectively. These reductions are predicted despite the expected imposition of tolls on trucks using proposed Route 92.

As discussed in Section 3.7, severe peak-hour congestion is expected to occur in the Traffic Study Area, due to the large amount of development expected over the next 25 years, particularly in Plainsboro and West Windsor. While it is not specifically the purpose of the proposed Route 92 project to accommodate this development, the construction of proposed Route 92 would help to ameliorate the traffic impacts of this development. This positive impact is described below in several ways.

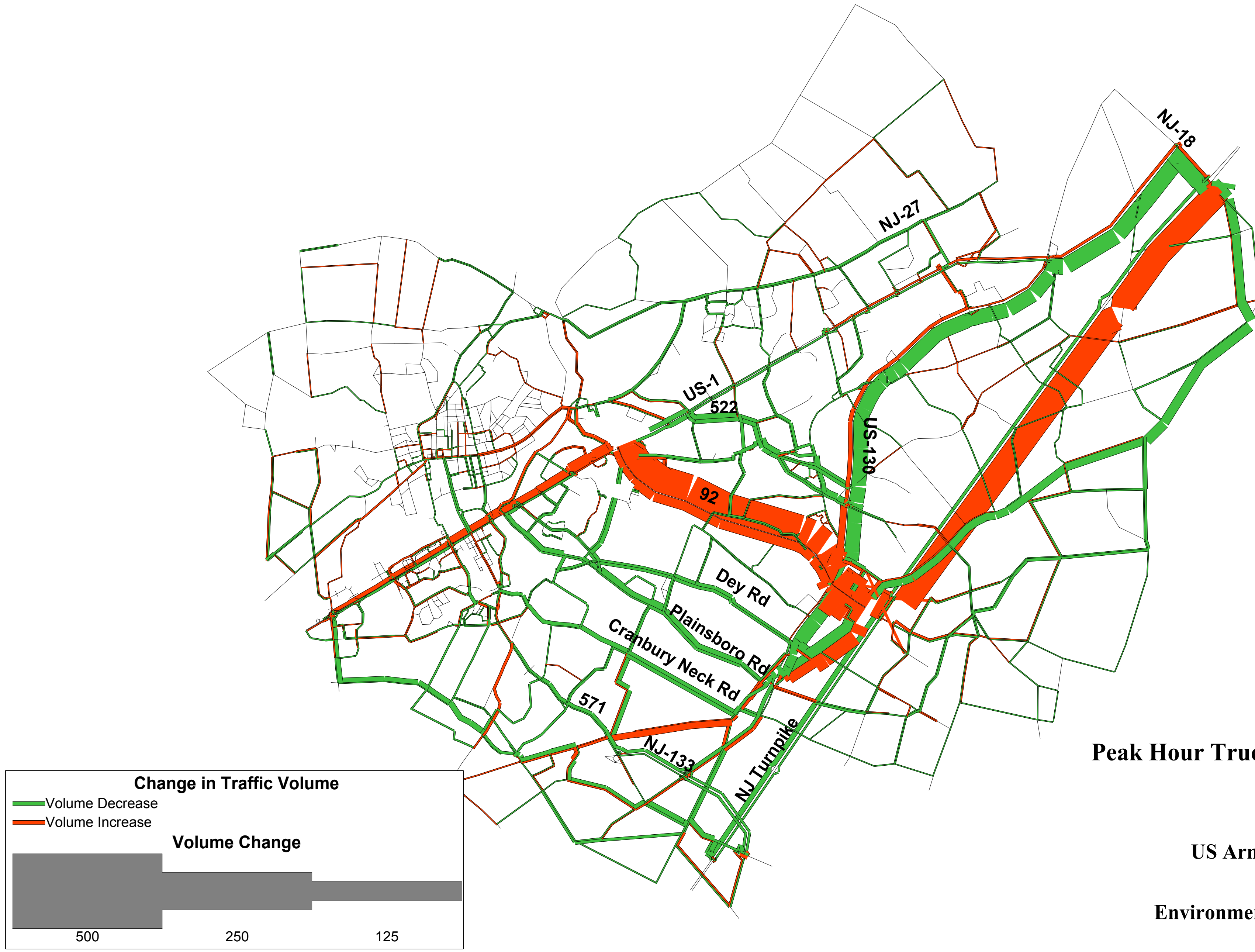

Figure 4-3

2028 A.M.

Peak Hour Truck Volume Changes

Route 92 vs. No Action

US Army Corps of Engineers

Proposed Route 92

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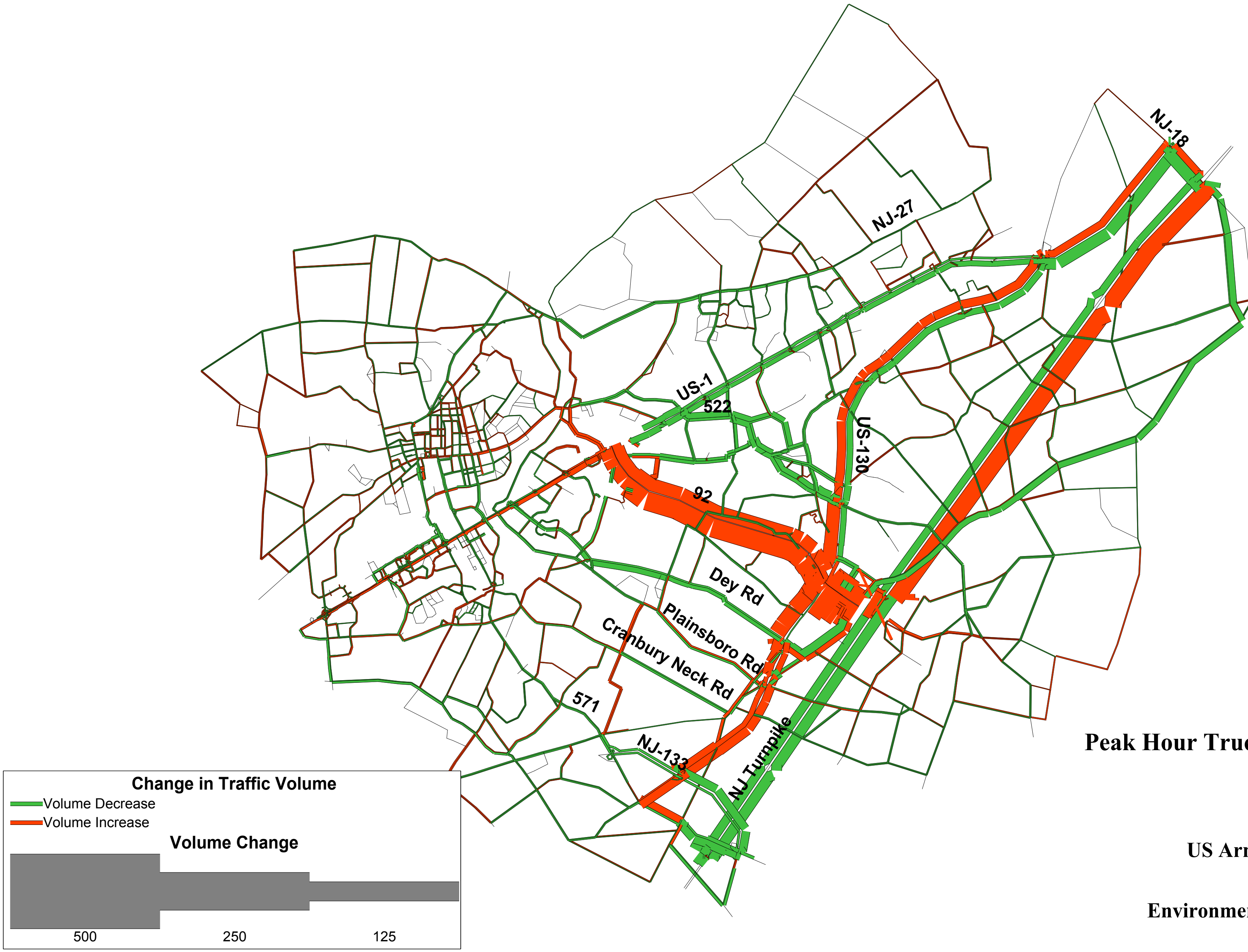

Figure 4-4

2028 P.M.

Peak Hour Truck Volume Changes

Route 92 vs. No Action

US Army Corps of Engineers

Proposed Route 92

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Figures 4-5 and 4-6 depict the projected 2028 peak-hour traffic flows and congestion levels in the Traffic Study Area with the construction of proposed Route 92. In these figures, bars of different colors indicate projected levels of congestion, expressed as ranges of peak-hour volume to roadway capacity ratios. The thickness of the bars indicates the model-projected peak-hour traffic volume. By comparing these figures with the corresponding figures for the No Action alternative shown in Section 3.7, it can be seen that several roadway sections in the study area are predicted to be less congested if Route 92 is built.

Another way to present this information is shown in the following table:

Additional Lanes Needed	Miles of Roadway	
	No Action	With 92
1	413.8	380.5
2	60.3	48.9
3	1.3	0.4
4	0.3	0.3
TOTAL	475.7	430.2

Out of a total of 1,253 miles of roadways (counting each direction as a separate roadway) represented in the Traffic Study Area model, 476 miles are predicted to operate at sub-standard conditions (volume-to-capacity ratio of greater than 0.9) during at least one of the peak hours if Route 92 is not built. Of these 476 miles, 62 miles would require the addition of more than one lane to be brought up to standard. With the construction of proposed Route 92, 430 miles are predicted to operate at sub-standard conditions, with 50 of these miles requiring the addition of more than one lane to be brought up to standard. Thus, it is projected that construction of proposed Route 92 would eliminate the need for the widening of 46 miles of other roadways, including 12 miles that would need to be widened by more than one lane.

Yet another way to describe the impact of proposed Route 92 on traffic conditions is through expected changes in travel times between various parts of the Traffic Study Area, as shown in Table 4-15.

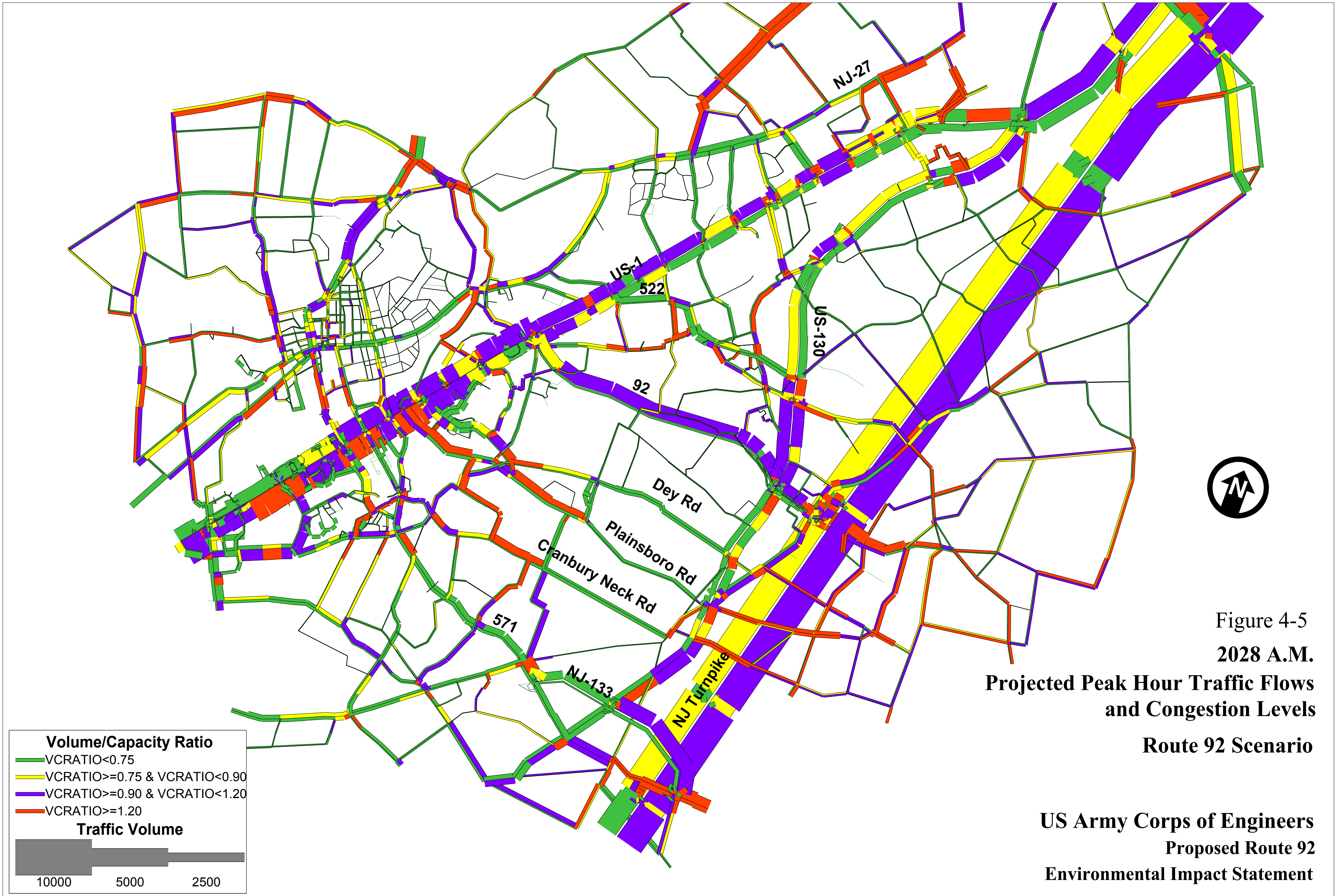

Figure 4-5

2028 A.M.

Projected Peak Hour Traffic Flows and Congestion Levels

Route 92 Scenario

US Army Corps of Engineers

Proposed Route 92

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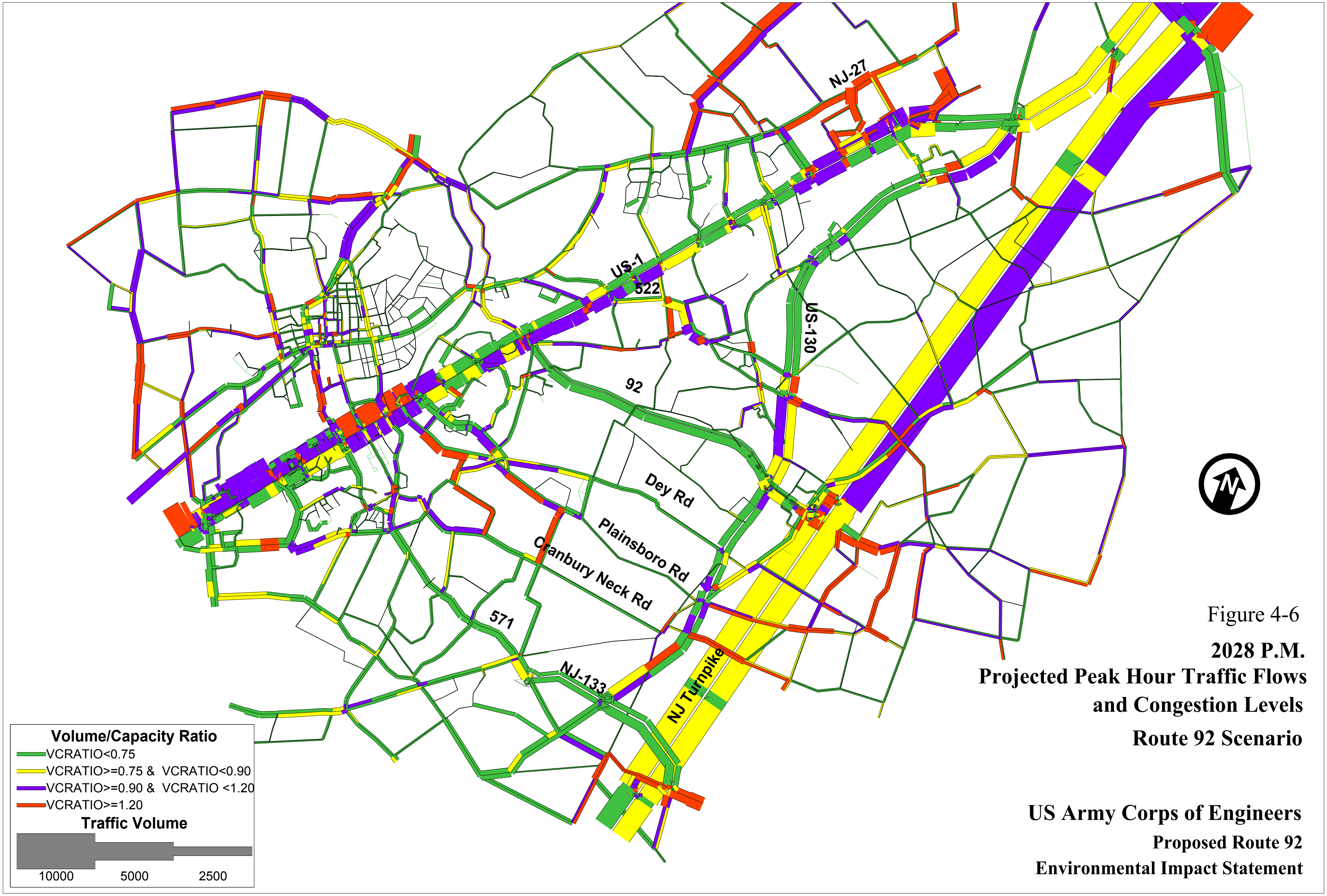

Figure 4-6

2028 P.M.

Projected Peak Hour Traffic Flows and Congestion Levels

Route 92 Scenario

US Army Corps of Engineers

Proposed Route 92

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Table 4-15
Estimated 2028 Peak Hour Travel Times (minutes)

FROM	TO	NO ACTION		WITH 92		CHANGE (WITH 92 vs. NO ACTION)		PERCENT CHANGE (WITH 92 vs. NO ACTION)	
		AM	PM	AM	PM	AM	PM	AM	PM
Princeton Junction	Princeton University	22.9	15.1	19.7	14.2	-3.2	-0.9	-14%	-6%
Princeton Junction	Plainsboro Center	30.3	12.4	27.5	11.8	-2.8	-0.6	-9%	-5%
Princeton Junction	South Brunswick Ctr.	41.8	38.2	37.0	32.5	-4.8	-5.7	-12%	-15%
Princeton Junction	Interchange 8A	35.7	30.4	40.1	28.9	4.4	-1.6	12%	-5%
Princeton Junction	Hightstown	21.4	29.0	20.4	26.8	-1.0	-2.2	-5%	-8%
Princeton University	Princeton Junction	13.1	22.4	12.0	20.1	-1.1	-2.4	-8%	-11%
Princeton University	Plainsboro Center	22.6	14.1	19.0	12.3	-3.6	-1.9	-16%	-13%
Princeton University	South Brunswick Ctr.	30.6	34.8	27.4	27.7	-3.2	-7.2	-11%	-21%
Princeton University	Interchange 8A	36.8	39.6	30.5	27.8	-6.3	-11.9	-17%	-30%
Princeton University	Hightstown	30.9	48.8	29.6	44.8	-1.4	-4.0	-4%	-8%
Plainsboro Center	Princeton Junction	15.3	25.2	12.7	21.8	-2.7	-3.3	-17%	-13%
Plainsboro Center	Princeton University	12.8	18.3	12.9	16.9	0.2	-1.3	1%	-7%
Plainsboro Center	South Brunswick Ctr.	21.4	36.6	20.4	28.4	-1.0	-8.2	-5%	-22%
Plainsboro Center	Interchange 8A	19.0	31.1	20.0	23.0	1.0	-8.1	5%	-26%
Plainsboro Center	Hightstown	25.0	44.9	24.2	38.6	-0.8	-6.2	-3%	-14%
South Brunswick Ctr.	Princeton Junction	49.7	36.3	38.2	33.8	-11.5	-2.5	-23%	-7%
South Brunswick Ctr.	Princeton University	48.5	27.3	32.6	23.8	-15.9	-3.5	-33%	-13%
South Brunswick Ctr.	Plainsboro Center	52.5	22.1	37.7	21.0	-14.8	-1.0	-28%	-5%
South Brunswick Ctr.	Interchange 8A	14.6	15.5	15.5	13.5	1.0	-2.0	7%	-13%
South Brunswick Ctr.	Hightstown	38.0	45.6	33.0	43.6	-5.0	-2.0	-13%	-4%
Interchange 8A	Princeton Junction	42.1	30.1	33.0	30.9	-9.1	0.8	-22%	3%
Interchange 8A	Princeton University	52.4	35.1	34.4	25.9	-18.0	-9.2	-34%	-26%
Interchange 8A	Plainsboro Center	47.5	20.8	34.4	19.1	-13.1	-1.7	-28%	-8%
Interchange 8A	South Brunswick Ctr.	20.2	15.4	15.9	13.3	-4.2	-2.1	-21%	-13%
Interchange 8A	Hightstown	30.4	38.0	27.8	39.1	-2.6	1.1	-9%	3%
Hightstown	Princeton Junction	43.9	20.2	39.3	20.6	-4.6	0.4	-11%	2%
Hightstown	Princeton University	64.3	32.0	57.2	31.7	-7.2	-0.3	-11%	-1%
Hightstown	Plainsboro Center	68.2	25.4	60.7	25.7	-7.5	0.4	-11%	1%
Hightstown	South Brunswick Ctr.	66.5	35.4	63.9	35.4	-2.6	0.0	-4%	0%
Hightstown	Interchange 8A	51.7	27.6	56.7	30.0	4.9	2.4	10%	9%
					Average:	-4.5	-2.8	-11%	-9%

The table shows that peak hour travel times between representative points are projected to decrease by an average of 10 percent as a result of the construction of proposed Route 92. The table shows that peak direction travel times between US Route 1 in Plainsboro and New Jersey Turnpike Interchange 8A are expected to improve by about 30 percent.

Projected 2028 peak hour traffic conditions at 15 key intersections within the Traffic Study Area were evaluated for the No Action and Route 92 scenarios. The computed Level of Service (LOS) designations are shown in Table 4-16.

Table 4-16
Intersection Level of Service
Proposed Route 92 vs. No Action

Intersection	No Action		With 92	
	A.M.	P.M.	A.M.	P.M.
US-1 @ Cozzens Ln	F	F	F	F
US-1 @ Major Rd (Sandhill)	F	F	F	E
US-1 @ New Rd	F	F	F	F
NJ-27 @ Raymond Rd	F	B	F	E
NJ-27 @ CR-522	E	F	D	D
Scudders Mill Rd @ Schalk's Crossing Rd	F	F	F	F
Scudders Mill Rd & Dey Rd	F	F	F	F
Plainsboro Rd & CR-535	E	F	D	B
US-130 @ Dey Rd	F	F	F	F
Dey Rd & CR-535	F	F	F	F
NJ-32 @ CR-535	F	F	*	*
US-130 @ Friendship Rd	F	F	F	F
George's Rd & Kingston Rd	D	B	C	B
CR-522 & Kingston Rd	F	F	F	F
US-1 @ CR-522	F	F	F	F

* This intersection would be replaced with two intersections on either side of proposed Route 92. It is presumed that the new intersection would be planned such that the peak-hour level-of-service would be at least "D".

Four intersections exhibit improved LOS designations, as compared with the No Action scenario, and one exhibits a worse designation. Although most of these intersections are expected to remain at LOS "F," average delays at most of them would likely decline by at least 25 percent during the morning peak hour, and by more than 30 percent in the evening peak hour, as shown in Table 4-17.

Another expected impact of constructing Route 92 is that trucks traveling between the New Jersey Turnpike Interchange 8A and Princeton could find it attractive to use Ridge Road between NJ Route 27 and US Route 1 in combination with Route 92. The network model used for this project estimates that during each peak hour, an additional 20 trucks would use this portion of Ridge Road (as compared with the No Action alternative, both directions together). This would be undesirable from safety and operation perspectives, due to tight geometry on this section of Ridge Road as well as tight clearances at the intersections on Route 27. Section 5.3.10 of this document presents possible measures for mitigating this impact.

Table 4-17
Projected Intersection Delays--Proposed Route 92 vs. No Action

Intersection	Seconds of Delay per Vehicle				Percent Change (With 92 vs. No Action)	
	2028 No Action		2028 w/ 92			
	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.
US-1 @ Cozzens Ln	290	336	233	225	-20%	-33%
US-1 @ Major Rd (Sandhill)	191	112	154	75	-19%	-33%
US-1 @ New Rd	172	168	160	119	-7%	-29%
NJ-27 @ Raymond Rd	170	18	115	63	-32%	250%
NJ-27 @ CR-522	77	202	54	54	-30%	-73%
Scudders Mill Rd @ Schalk's Crossing Rd	206	154	159	135	-23%	-12%
Scudders Mill Rd & Dey Rd	697	296	556	142	-20%	-52%
Plainsboro Rd & CR-535	67	167	50	16	-25%	-90%
US-130 @ Dey Rd	341	333	247	172	-28%	-48%
Dey Rd & CR-535	458	213	273	356	-40%	67%
NJ-32 @ CR-535	269	234	*	*	*	*
US-130 @ Friendship Rd	330	467	179	145	-46%	-69%
George's Rd & Kingston Rd	38	18	22	10	-42%	-44%
CR-522 & Kingston Rd	300	203	238	103	-21%	-49%
US-1 @ CR-522	230	179	147	128	-36%	-28%
US-1 @ Ridge Rd	362	264	290	234	-20%	-11%
				Median:	-26%	-39%

* This intersection would be replaced with two intersections on either side of proposed Route 92. It is presumed that the new intersection would be planned such that delays would be minimal.

4.2.8 Noise

This section presents the results of the noise monitoring and modeling impact analysis performed for the proposed Route 92 EIS. Noise monitoring and modeling was conducted based on procedures presented in:

- New Jersey Turnpike Authority (NJTA), *Policy for Construction of Sound Barriers*, October 24, 1991;
- Federal Highway Administration (FHWA), *Highway Traffic Noise Analysis and Abatement Policy and Guidance*, June 1995; and
- New Jersey Department of Transportation (NJDOT), *Highway Traffic Noise Policy Technical Appendix*, December 2000.

The purpose of this noise impact analysis was to assess the potential for sensitive receivers to be adversely affected by the proposed Route 92 alignment, and if necessary, to evaluate the benefits of noise barriers. The STAMINA 2.0/OPTIMA model was used to characterize noise conditions along the Proposed Route 92 corridor. Refer to

Appendix D for more detailed information regarding the modeling procedures used for noise analysis.

4.2.8.1 Noise Modeling Analysis

This section describes the noise modeling procedures used to evaluate the potential traffic noise impacts for the Horizon Year (2028) of the proposed Route 92 project. The results of the noise modeling and noise abatement measures evaluation are also included in this section.

4.2.8.1.1 STAMINA 2.0 Noise Modeling

The STAMINA 2.0 highway noise model was used to characterize noise conditions along segments of the Proposed Route 92 Corridor. Locations for which noise impacts were modeled are listed in Table 4-18. Model input parameters include:

- Length of road segments
- Receptor locations
- Grade adjustment
- Structure barrier effects
- Shielding factors
- Alpha factors (reflectivity of surface)
- Vehicle type
- Vehicles per hour
- Vehicle speed

The model calculates hourly L_{eq} noise levels for each receptor. Traffic data for the proposed Route 92 alternative, obtained from the traffic modeling analysis, were used in STAMINA 2.0. Each of these data requirements is described in detail in Appendix D.

4.2.8.2 Modeling Results

4.2.8.2.1 Route 92 Existing and Future Modeling Results

The noise modeling results are summarized in Table 4-19. This table presents a summary of the Existing, Horizon Year No Action and Route 92 alternative noise levels and compares them to the applicable FHWA noise abatement criteria (NAC). Under the Route 92 alternative, eight receivers would experience noise levels exceeding the applicable NAC. Two of the eight are commercial receivers at which the Activity Category C NAC of 72 dBA would be exceeded. Five of the eight receivers are residential receivers that would experience noise levels exceeding the applicable NAC of 67 dBA. One of the eight receivers is an institutional receiver (R-12 in Table 4-19) at which the 67 dBA NAC would be exceeded. This receiver is inside the proposed Route 92 right-of-way (ROW). Properties located within the ROW would be purchased and, therefore, are not considered in evaluating noise impacts under the Route 92 alternative.

Table 4-18
Noise Modeling Receptors

Model Receptor Id.	**Monitoring Station Id.**	**Location Description**
C-1	**1**	East of Commerce Dr./South of Rt. 32
C-2	--	West of CR-535/South of Rt. 32
C-3	--	West of CR-535/South of Rt. 32
C-4	--	East of Commerce Dr./South of Rt. 32
C-5	--	West of Herrod Blvd/North of Rt. 32
C-6	--	East of Herrod Blvd/North of Rt. 32
C-7	13	30 Friendship Road
C-9	P22	Tile Institute
R-13	**2**	West of 84 Friendship Rd.
R-1	12	39 Friendship Road
R-2	P25	84 Miller Road
R-3	9	80 Miller Road
R-4	**3**	194 Friendship Rd.
R-5	**4**	273 Friendship Rd.
R-6	--	287Friendship Road
R-7	--	307 Friendship Road
R-8	7	343 Friendship Road
R-9	**5**, 5	Silvers Lane Dead End
R-10	**6**	100 Perrine Rd.
R-11	**--**	South of Perrine Rd./West of Major Rd.
R-12	**7**, 3	Rt. 1 Boy Scout Council
R-14	--	177 Friendship Road
R-15	--	111 Perrine Road
R-16	--	60-74 Perrine Road
R-17	--	107 Friendship Road

Note: Bold values indicate 2002 monitoring locations.

Table 4-19
Summary of Noise Modeling Results

Model Receiver Id.[1]	Monitoring Station Id.[2]	Location Description[3]	NAC	Peak Hour L_{eq} Noise Levels (dBA)[4]		
				Existing Year (2002)	Horizon Year (2028) No Action	Horizon Year (2028) Route 92
				Measured	Estimated	Modeled
C-1	**1**	East of Commerce Dr. /South of Rt. 32	C	65.9	68.0	**72.5**
C-2	--	West of CR-535/South of Route 32	C	--	--	65.8
C-3	--	West of CR-535/South of Route 32	C	--	--	68.8
C-4	--	East of Commerce Dr. /South of Rt. 32	C	--	--	**73.7**
C-5	--	West of Herrod Blvd/North of Route 32	C	--	--	71.3
C-6	--	East of Herrod Blvd/North of Route 32	C	--	--	69.3
C-7	13	30 Friendship Road [ROW]	C	62.0	64.1	68.7
R-1	12	39 Friendship Road	B	**66.8**	**68.9**	59.3
R-13	**2**	West of 84 Friendship Road	B	63.2	65.3	**68.9**
R-2	P25	84 Miller Road	B	50.0	52.1	59.1
R-3	9	80 Miller Road	B	55.1	57.2	55.6
R-4	**3**	194 Friendship Road	B	61.1	63.2	61.7
R-5	**4**	273 Friendship Road	B	60.5	62.6	62.2
R-6	--	287 Friendship Road	B	--	--	**71.2**
R-7	--	307 Friendship Road	B	--	--	66.2
R-8	7	343 Friendship Road	B	65.2	**67.3**	59.3
R-9	**5**, 5	Silvers Ln. Dead End	B	49.7	51.8	55.3
R-10	**6**	100 Perrine Road	B	54.0	56.1	61.6
R-11	**--**	South of Perrine Rd./West of Major Rd.	B	--	--	59.5
R-12	**7**, 3	Route 1 Boy Scout Council [ROW]	B	**71.0**	**73.1**	**71.1**
R-14	**--**	177 Friendship Road	B	--	--	**68.6**
R-15	**--**	Perrine Road	B	--	--	66.5
R-16	**--**	Perrine Road	B	--	--	**68.8**
R-17	**--**	107 Friendship Road	B	--	--	**67.2**
C-9	P22	Tile Institute [ROW]	C	64.0	66.1	68.8
		No. of Receivers Impacted		2	3	8

[1]Receiver Id. represents both commercial (C) and residential (R) receivers based on the FHWA Noise Abatement Criteria description.
[2]Bold values indicate 2002 monitoring locations.
[3][ROW] indicates that the receiver would be located in the Route 92 right-of-way.
[4]Bold and shaded values indicate noise levels that exceed the 67 dBA and 72 dBA NAC.

The comparison of 2028 Route 92 Alternative projected traffic noise levels with existing and 2028 No Action noise levels indicates that projected noise levels do not exceed the existing noise levels by 10 dBA or greater. Proposed Route 92 would increase the Existing and 2028 No Action traffic noise levels by up to 9 and 7 dBA, respectively.

Under the No Action alternative, two residential receivers and one institutional receiver would be impacted by noise exceeding the applicable NAC in 2028. Under the Route 92 alternative, five residential receivers would be impacted in 2028. Under existing (2002) conditions, the applicable NAC is exceeded at one residential receiver and one institutional receiver.

Modeling outputs for the Route 92 alternative are included in Appendix D.

4.2.8.3 Construction Noise Impacts

Construction noise impacts were evaluated based on the steps specified in accordance with FHWA Technical Advisory Memorandum, *Analysis of Highway Construction Noise*, T6160.2, March 13, 1984.

Highway construction activities include both mobile and stationary equipment. Mobile equipment such as dozers, scrapers, graders, and haul trucks operate in a cyclical manner in which a period of full power is followed by a period of reduced power. Stationary equipment falls into two categories: 1) equipment that operates at a fixed power, such as pumps, compressors and generators; and 2) impact equipment such as pile drivers, jack hammers and pavement breakers. The first group generates a constant background noise level, whereas the second group generates a much higher noise level, but over a very short time period (FHWA, *Special Report Highway Construction Noise: Measurement, Prediction and Mitigation*, 1987). Table 4-20 presents typical maximum noise levels (L_{max}) measured at 50 feet from construction equipment. Maximum noise levels range from 70 dBA for generators to 90 dBA for a mounted impact hammer at 50 feet away.

Table 4-20
Typical Construction Equipment Noise Levels

Equipment Category	L_{max} Level (dBA)
Backhoe	80
Chain Saw	85
Compactor	80
Compressors	80
Concrete Mix Truck	85
Concrete Pump	82
Concrete Saw	90
Crane (Mobile or Stationary)	85
Dozer	85
Front End Loader	80
Generator (25 kVA or less)	70
Generator (25 kVA or more)	82
Gradall	85
Grader	85
Jackhammer	85
Mounted Impact Hammer	90
Paver	85
Pneumatic Tools	85
Pumping Equipment	77
Scraper	85
Tractor	84
Vibrator (rollers)	80
All Other Equipment with Engines Larger than 5 HP	85

Source: Noise Control Engineering Journal, Construction Noise Control Program and Mitigation Strategy at the Central Artery Project, Sep-Oct 2000.

Highway construction is completed in the following phases:

- Mobilization
- Clearing and grubbing
- Earthwork
- Foundations
- Base preparation
- Paving and cleanup

Each construction phase would generate short-term noise impacts for noise sensitive land uses adjacent to the proposed Route 92 construction activity. In general construction noise impacts occur only during daytime working hours of 7:00 a.m. to 7:00 p.m., and would be highest during the clearing and earthwork phases of construction. The noisiest equipment would likely be earthmoving equipment, such as dozers, graders, scrapers and other heavy-duty diesel equipment. Noise levels decrease by 6 dBA for every doubling of distance. It is anticipated that the daytime L_{max} noise levels would not exceed 80 dBA at 150 feet away and the daytime L_{eq} noise level would not exceed 75 dBA at 150 feet away.

4.2.9 Aesthetics

Potential project-related visual impacts have been identified and determined based upon an examination of significant topological features as they would be seen from the highway and as the highway would be seen from nearby receptors. For the purpose of this study, valuable views are defined to include natural, historic and culturally significant landmarks; agricultural and natural open space; and natural and man-made water features. Less valuable views include paved transportation routes and parking areas and non-residential developments that do not serve as landmarks or congregation sites. The aesthetic benefits of proposed Route 92 would be enjoyed by its users, who would have new access to scenic vistas of South Brunswick and the other townships in the Project Study Area. Negative visual impacts would fall on those residents whose present enjoyment of these vistas would be permanently interrupted by the proposed highway.

Aesthetic features of the Project Study Area were studied using US Geological Survey (USGS) maps, aerial photographs, engineering plans and field reconnaissance. The 1994 DEIS and subsequent studies were consulted and updated to 2003. Man-made and natural visual resources were identified and considered in terms of its users. Parks were given highest consideration being that they have a significant volume of users and are specifically intended to serve as public open space for the enjoyment of scenic resources. Residences are also sensitive to visual and aesthetic impacts as residents are continually exposed to neighboring views.

Neighborhood character and community cohesion are sometimes affected by aesthetic surroundings. Agricultural and other uninhabited open spaces would be less affected because there might only be occasional viewers. In areas where zoning or plans restrict land use to residential uses, effects on expected future use should also be addressed. In considering future residential or other view sensitive development, opportunities for mitigation at the site planning stage are addressed.

The most significant potential for aesthetic impacts occur at the boundaries of the residential subdivisions along the proposed Route 92 alignment. These neighborhoods include the Princeton Collection, Drinking Brook Estates, Heather Knolls of South Brunswick and Friendship Road and Perrine Road residences.

Princeton Collection
Residents of the Princeton Collection may experience adverse visual impacts. The Princeton Collection is a subdivision of single-family homes located approximately 400 feet south of the proposed Route 92 alignment. The subdivision is bounded on the north by Perrine Road and a hedgerow of deciduous trees. The most significant impacts may be those experienced by residents viewing Route 92 across Perrine Road.

Drinking Brook Estates
Drinking Brook Estates is a 46-lot development of single-family residences. Proposed Route 92 would be approximately 1000 feet from the nearest houses in this development. Current views from Drinking Brook Estates to the south, in the direction of proposed Route 92, include agricultural fields and forested uplands and wetlands beyond. The western portion of the subdivision's frontage on Friendship Road would be buffered from views to the proposed Route 92 by a berm planted with evergreens. This vegetative buffer would function to partially obstruct some of the views from individual homes to the proposed Route 92, although this obstruction would not be complete, since this portion of the highway would be elevated above the existing grade. Therefore some residents of the Drinking Brook Estates would experience an adverse visual impact. This impact results from the removal of agricultural field views and replacement with views of proposed Route 92.

Heather Knolls of South Brunswick
The Heather Knolls Subdivision includes numerous single-family residences along Periwinkle Drive, Black Gum Drive and New Turkey Island Road. Several of the residences along Black Gum Drive have existing natural screening along the perimeter of the property lines. Because of the existing screening and greater than 1000-foot distance, views of the proposed Route 92 from these homes would be limited. However, several homes, primarily along Periwinkle Drive and Black Gum Drive, do not have a natural vegetative screen and would therefore likely experience some visual impacts, although these would be limited by the 1500-2000 foot distance to proposed Route 92. These homes currently have distant views of the Princeton Forrestal Center. Homes along New Turkey Island Road have moderately thick deciduous vegetation that would limit views of the proposed Route 92 during the warmer seasons.

Friendship Road Residences
Several single-family homes are located along the length of Friendship Road. People in these residences may experience varying degrees of visual impact. Several residences

are located in the vicinity of the proposed western crossing of Friendship Road, designed as a single span bridge. Residents here would experience visual impacts. The southern view from these homes would be of the bridge span and an elevated portion of the proposed Route 92. Those residents with no vegetative screening would experience the most significant impacts. Scattered residences to the east of the western bridge span of Friendship Road would also experience visual impacts.

Residents of Friendship Road homes in the vicinity of the proposed bridge crossing of Miller Road would experience adverse visual impacts. Existing scattered vegetation would provide a limited degree of screening, thus reducing the visual impact to these residences.

Residences are located in the vicinity of the span bridge, which constitutes the proposed eastern crossing of Friendship Road. The northern view from these residences could be subject to adverse visual impact, with the greatest impact for those residents without vegetative screening.

On the other hand, favorable views from the highway for users would be similar to those that are favorable for residents and other viewers. These would include forested and agricultural landscapes. A majority of the proposed Route 92 alignment traverses wooded, open and agricultural areas, although in several cases residential subdivisions would be within view of roadway passengers. Portions of the proposed Route 92 east of US Route 130 and within the vicinity of US Route 1 are more densely developed and the view from the proposed highway would include fewer open spaces and more urban activity.

Perrine Road
The existing environment surrounding Perrine Road is primarily open agricultural land with several single-family homes. These homes would likely experience some adverse visual impact from the proposed Route 92.

4.2.10 Known Contaminated Sites

Two Known Contaminated Sites (KCS) listed by the NJDEP Site Remediation Program (SRP) could potentially be impacted by construction of the proposed Route 92 project. The sites are located at 298 Friendship Road and 24 Friendship Road in South Brunswick. The pesticide-contaminated soil at 298 Friendship Road might be disturbed, depending on its exact location and the grading requirements of the highway. If soil removal were required at that location, the contaminated soil would require special handling and disposal procedures, as it might not be suitable for use as fill. If fill were to be added to the site, the potential for disturbance would be decreased.

Because information is not available regarding the nature of the contamination at 24 Friendship Road, potential impacts cannot be assessed. Depending on the type and location of contamination (soil contamination, underground storage tanks, etc.), the degree of impact, if any, would vary.

Consultation with NJDEP SRP will be required to determine exactly how the construction of proposed Route 92 would affect the KCS within the Proposed Route 92 Corridor.

In addition, much of the Proposed Route 92 Corridor is, or in the recent past was, utilized as farmland. Historically, many farms have used pesticides and insecticides. Many of these substances are environmentally persistent and in some instances have been found to be toxic and/or hazardous to human, animal and environmental receptors. Use of many of these more hazardous substances has since been discontinued or less toxic compounds have been substituted; however, residues from past use may still remain in the soil or groundwater. Whether or not these compounds are confirmed onsite, their presence should not be expected to pose an imminent concern to the construction of the proposed roadway. As with the KCS at 298 Friendship Road, if soil removal were required, the use of the soil as fill might be restricted. If fill, rather than excavation, were required at these locations, the impact would be expected to be minimal.

In addition to the potential for contamination by pesticides, it is possible that farms, businesses, and residences in the Proposed Route 92 Corridor have utilized or currently utilize underground or aboveground storage tanks (USTs or ASTs) for storing heating oil or motor fuel. New Jersey does not require registration of ASTs, USTs up to 1,100 gallons used to store motor fuel at a farm residence, USTs up to 2,000 gallons used to store heating oil for onsite use in a nonresidential building, or USTs of any size used to store heating oil for onsite use in a residential building (N.J.A.C. 7:14B-1.4(b)). Information regarding such tanks may not be available in local or state files. However, should such tanks be discovered during construction of the roadway, the conduct of any necessary environmental actions would not be expected to pose significant delays in the construction process. USTs or ASTs would be decommissioned in accordance with the current environmental regulations.

4.2.11 Human Health

4.2.11.1 Air Quality

Air quality is a public health concern associated with the construction of proposed Route 92. An air quality analysis conducted for the project area indicates that the project would comply with federal transportation conformity guidelines. The project would not cause or contribute to any new localized carbon monoxide (CO) violations. By transferring through traffic from local roads to proposed Route 92, levels of service at many intersections in the region would improve. Consequently, a positive impact should occur to localized air quality. If Route 92 is constructed, in 2028 CO emissions are expected to be about 26% higher than current emissions, NO_x about 9% higher than current, and VOCs about 15% lower than current. The smallest increases in CO and NO_x are predicted to occur with proposed Route 92 when compared with all other potential build and no action scenarios.

4.2.11.2 Noise

Noise impacts can include annoying noises, which generally cause people to seek quieter environments and can affect the performance of work tasks, and high noise levels that can affect hearing, either temporarily or permanently. Sensitivity to noise depends on the individual, as well as on the frequency of the sound and the length of time a person is exposed. As demonstrated by the noise modeling discussed in Section 4.2.8, the project would not produce noise that exceeds levels that cause damage to hearing.

4.2.11.3 Water Quality

Increased highway runoff is a primary public health concern related to proposed Route 92, as runoff may contain harmful contaminants. An increase in runoff would be anticipated to result from the project, as an increase in impervious surface would be required for construction of the proposed roadway. Treatment measures would be provided to remove potential pollutants from runoff prior to discharge to surface and groundwater. Such treatment measures include the installation of 25 stormwater management basins (SMBs) throughout the Proposed Route 92 Corridor. These SMBs would be utilized as the primary treatment mechanism along the proposed roadway. The SMBs were designed in accordance with NJDEP stormwater management guidelines (N.J.A.C 7:13-2.8). Further information regarding these facilities is presented in the Engineer's Reports in Appendix E.

4.2.12 Socioeconomics

4.2.12.1 Construction Impacts

As a major construction project, proposed Route 92 would provide temporary employment, principally for people from outside the local area. The project would stimulate spending in the local area during the construction period.

Construction of proposed Route 92 could potentially complicate access to a small number of business establishments, primarily near the eastern and western ends of the alignment. These include approximately seven businesses on NJ Route 32 east of US Route 130. The affected businesses are not the types that draw their customers from among passing motorists. Therefore, the economic impact would be relatively small.

4.2.12.2 Community Services

Proposed Route 92 is expected to draw traffic off local roads, and would be patrolled by the New Jersey State Police. Route 92 would not increase the burden on local police departments, and could reduce that burden by reducing traffic and traffic-related incidents on roads for which the local police are responsible.

Local fire companies and rescue squads would provide services on proposed Route 92. South Brunswick would provide services to approximately 6 miles of the main roadway and the interchanges, and Plainsboro Township would provide services to approximately 0.8 miles of the main roadway. Monroe Township and South Brunswick would be expected to share responsibility for fire protection and emergency medical services around the interchange between proposed Route 92 and the existing Interchange 8A of the New Jersey Turnpike.

In South Brunswick, the portion of the proposed Route 92-US Route 1 interchange west of US Route 1 would be in the service area of the Kingston fire company and rescue squad. The remainder of proposed Route 92 in South Brunswick would be in the service area of the Monmouth Junction fire company and rescue squad.

Although proposed Route 92 would increase the total miles of roadway to be covered by local fire companies and rescue squads, this increase would be offset by a reduction in traffic on local roads. In addition, by improving traffic movement on local roads, Route 92 would reduce the time required to respond to emergencies on local roads.

Because proposed Route 92 would be a limited-access highway with few interchanges, emergency response vehicles would have to travel relatively long distances to reach people in need of help on Route 92. Proposed Route 92 would not have an interchange along the 4.7-mile stretch between the Perrine Road interchange and US Route 130. The limited access to Route 92 would be partially mitigated by the higher speeds at which emergency vehicles could travel on Route 92.

4.2.13 Land Use

4.2.13.1 Direct Impacts

Proposed Route 92 would be visible from a small number of existing residences, and traffic noise from proposed Route 92 would cause the applicable FHWA noise abatement criterion to be exceeded at five residences and two business establishments. In addition, Route 92 would be visible from the southern portion of Friendship Park in South Brunswick and could be heard from a larger portion of the park and from a portion of the Plainsboro Preserve. See Sections 4.2.8 and 4.2.9 on noise and visual impacts.

Acquisition of the right-of-way for proposed Route 92 and associated interchanges would displace four residential properties, all in South Brunswick Township:

- Block 5, Lot 2.01, near the power line easement at the end of a private drive off the south side of Friendship Road across from New Road
- Block 5, Lot 4.04, at the end of another private drive off the south side of Friendship Road, immediately east of Lot 2.01
- Block 6, Lot 2.02, on the south side of Friendship Road southeast of Haypress Road
- Block 11, Lot 16, off the north side of Friendship Road just west of US Route 130

Acquisition of the right-of-way for proposed Route 92 and associated interchanges would displace one business, the Solar Motel at the intersection of US Route 1 and Ridge

Road, west of US Route 1 and north of Ridge Road. The motel is directly in the path of the proposed ramp from southbound US Route 1 to Ridge Road. A building owned by NJTA at US Route 1 and Campus Drive would also be displaced. The building is currently leased by the Central New Jersey Council of the Boy Scouts of America and by an accounting business, but the leases provide for termination by NJTA.

Two vacant commercial/industrial buildings would be displaced because they are at the point where the ramp connecting proposed eastbound Route 92 would merge with northbound US Route 1.

Realignment of Research Way at the proposed Perrine Road-Route 92 interchange would displace three ball fields on a 20-acre recreational facility owned by Princeton University.

The eastbound service road for proposed Route 92 would pass through the northern end of four developed commercial properties on the south side of NJ Route 32 between Cranbury-South River Road and Herrod Boulevard in South Brunswick. The two properties closer to Herrod Boulevard are not currently accessed off NJ Route 32. The two properties closer to Cranbury-South River Road are currently accessed from NJ Route 32, and this access would be eliminated. Substitute access for one of the two properties would be provided off the northern end of Abeel Avenue. Access to the other property, an office/warehouse building, could be provided off Cranbury-South River Road. Construction of the service road would require displacement of the parking area in front of the office/warehouse building.

4.2.13.2 Consistency with Planning Principles and the NJ State Development & Redevelopment Plan

Proposed Route 92 would draw regional through-traffic away from local roads. This would make local driving more amenable and efficient and facilitate alternative forms of transportation, such as walking and bicycle riding. Removal of through traffic from neighborhood centers would improve quality of life and would tend to strengthen the identification of residents with their communities while allowing more efficient development designs (such as interconnected developments, which are not desirable because the connections tend to become routes for through traffic).

Construction of proposed Route 92 would contradict the policy of South Brunswick Township as reflected in its current planning documents. Proposed Route 92 and related improvements were included in the Circulation Element of the 1988 South Brunswick Master Plan, but were deleted from the Circulation Element when the Master Plan was revised in 1994. The 1994 Master Plan Reexamination Report presented no reasons for deleting Route 92 from the Circulation Element.

South Brunswick's 2000 Master Plan Reexamination Report asserted, "with the completion of Route 522, the Township will have adequately contributed a much needed arterial road, significantly meeting the east/west circulation goal of many decades."

The 2000 Master Plan report stated that the Planning Board, Township Council and Environmental Commission strongly opposed the construction of proposed Route 92. The report endorsed the USEPA Modified No-Build Alternative (see Section 2.3.1), stating that it would achieve "essentially the same goal as Route 92" with less damage to the environment and at lower cost.

Traffic modeling performed for this EIS indicates that under the USEPA Modified No-Build Alternative, morning non-local trips on local roads would *increase* by 4 percent, and there would be no reduction in the number of evening non-local trips using local roads. Because this alternative would not reduce regional through traffic on the local east-west road system, local driving would be more difficult as a result of congestion. Walking and bicycling would be less safe. Congestion, caused by regional traffic attempting to use local roads to reach their destinations more quickly, tends to decrease the quality of life in neighborhoods and decrease the identification of local residents with their community. Consequently, this alternative would not fulfill the purpose of the proposed project, nor would it address the region's needs for improved mobility.

The 2001 South Brunswick Master Plan and the 2001 Circulation Element state that proposed Route 92 is inconsistent with the Master Plan and is not endorsed by the Township, but neither document explains how Route 92 is inconsistent with the plan. Proposed Route 92 would promote the principle, consistently stated in South Brunswick planning documents, that "local traffic should be separated, as much as possible, from through traffic".

The western end of proposed Route 92, including the US Route 1 and Perrine Road interchanges, would be constructed in an area of South Brunswick designated for office parks on the Land Use Plan Map in the 2001 South Brunswick Master Plan. The central portion of proposed Route 92, where there would be no interchanges, would pass through an area designated for rural residential use on the 2001 map. The eastern end of proposed Route 92, including the US Route 130 interchange and the South Brunswick portion of NJ Turnpike interchange 8A, is in an area designated for general industrial development on the 2001 land use map. Therefore, the areas in South Brunswick where proposed Route 92 might potentially stimulate development—the interchange areas--are areas the Township has designated for commercial and industrial development. The area in South Brunswick where Route 92 would have no interchanges, and would therefore have little potential to stimulate development, is an area South Brunswick has designated for relatively sparse development. Proposed Route 92 could stimulate development in areas where South Brunswick has planned for commercial and industrial development to occur.

East of Perrine Road, proposed Route 92 would pass through the northern portion of Plainsboro Township. In this part of Plainsboro, Route 92 would pass through the northern end of the Plainsboro Preserve, designated for open space and conservation on the Land Use Plan Map in the Plainsboro Master Plan, last revised in 2000. The remainder of the Plainsboro section of proposed Route 92 would pass through agricultural land recently acquired by the Township for preservation as open space. The Township refers to this property as the Perrine Tract. Plainsboro has reserved a right-of-way for proposed Route 92 through both the Plainsboro Preserve and the Perrine Tract. The Plainsboro Master Plan states that proposed Route 92 is "a priority for the Township," and that the Township supports Route 92 and "encourages [its] timely implementation."

The 1998 Monroe Township Master Plan expresses concern that proposed Route 92 could cause significant increases in through traffic in the Township, but notes that changes have been made in the design of Route 92 to address this potential problem.

The 2001 New Jersey State Development and Redevelopment Plan (State Plan) divides the state into the following planning categories:

- Metropolitan Planning Areas: PA1
- Suburban Planning Areas: PA2
- Fringe Planning Areas: PA3
- Rural Planning Areas: PA4
- Environmentally Sensitive Planning Areas: PA5

The State Plan "anticipates continued growth throughout New Jersey in all Planning Areas." Development is encouraged in PA1 and PA2 and is accommodated in PA3, PA4 and PA5. The State Plan specifies that development is expected to occur, within guidelines, in all planning areas. The State Plan directs that infrastructure investment decisions should encourage growth in areas that are already developed or are currently developing, and should discourage development sprawl into undeveloped areas.

Proposed Route 92 would begin and end in a Suburban Planning Area, PA2, and would pass through an Environmentally Sensitive Planning Area, PA5. From US Route 1 to the Amtrak rail lines in Plainsboro, proposed Route 92 would be in a Suburban Planning Area. From the Amtrak lines east to the US Route 130 corridor, Route 92 would pass through an Environmentally Sensitive Planning Area. From the western edge of the US Route 130 corridor to its eastern terminus at NJ Turnpike Interchange 8A, proposed Route 92 would again be in a Suburban Planning Area.

The State Plan anticipates that the Suburban Planning Area will provide for much of the state's future development, promote compact development in "centers" and "nodes," and protect the character of existing stable communities. Proposed Route 92 would link a linear development center, US Route 1, with a development node, Interchange 8A of the New Jersey Turnpike. Route 92 would have only two other interchanges: at Perrine Road, less than 1 mile east of US Route 1, and at US Route 130, approximately 1 mile west of the NJ Turnpike. The areas around the proposed US Route 1 interchange and around Interchange 8A are currently developed, and the areas around the proposed Perrine Road and US Route 130 interchanges are planned for development and are currently developing. To the extent that proposed Route 92 promotes development, it will be compact development in the interchange areas, consistent with the State Plan's vision for the Suburban Planning Area.

Traffic modeling indicates that proposed Route 92 would reduce traffic on local roads. This would help protect the character of existing stable communities, thus advancing another element of the State Plan's vision for the Suburban Planning Area.

The alignment of proposed Route 92, specifically the portion that would pass through an Environmentally Sensitive Planning Area, has been modified to minimize impact to wetlands and other environmental resources. The design of proposed Route 92 includes no interchanges in the Environmentally Sensitive Planning Area, and would therefore preclude construction of connecting roads that would promote development in that area.

4.2.13.3 Effect of Proposed Route 92 on Growth Patterns

Proposed Route 92 is designed to maintain mobility on the local and regional road networks. Maintaining mobility in the road network would have the potential to make undeveloped properties in the area more attractive for development, because their accessibility would remain stable. New development creates the ability to accommodate increased population and economic activity. Transportation modeling conducted for this EIS indicates that Route 92 would not provide transportation capacity beyond what is currently needed (i.e., no excess capacity is proposed). Rather, traffic modeling indicates that Route 92 would provide only the transportation capacity needed to accommodate growth that has already occurred or is already in the process of occurring. Without improvements such as Route 92, traffic growth would continue and the gap between the volume of traffic and the capacity to accommodate traffic would become steadily larger. The effect of the widening gap would be to decrease the quality of life for residents as a result of significant congestion.

A key to managing growth is effective land use regulation. Without effective land use controls, any road system in an area with strong development pressure will become congested. If land use regulators and other public officials accept current traffic conditions as the standard, and allow traffic-generating development to continue unchecked, construction of new roads or highways would likely increase the total traffic volume that could be accommodated in the local area and the region. If construction of Proposed Route 92 were combined with effective control of development, however, traffic conditions would be maintained, and perhaps improved. The NJTA has no direct control over the land development review and approval process, which is principally the jurisdiction of municipalities and counties, but it notes that new highway development can be a significant factor in the rate and shape of growth. State agencies have affirmed their interest in collaborating closely with local communities to ensure that future development occur in sustainable patterns.

Much local traffic (see Section 4.2.7) is traveling on local roads as a substitute for the congested regional highway system. Route 92, if built, is predicted to draw traffic away from local roads. This would discourage growth of business activity on local roads generally, but could accelerate growth at the new interchanges. Proposed Route 92 would be a limited-access highway with four interchanges: US Route 1, Perrine Road, US Route 130, and a tie-in to Interchange 8A of the New Jersey Turnpike. All of these locations are in areas where commercial development has been strong in the past, and growth in these locations is encouraged by local zoning ordinances and land use planning documents. The interchange areas in South Brunswick are zoned for development because of the proximity of these lands to US Route 1 and the extensive office development that currently exists in this area (between US Route 1 and the Northeast Corridor railway). The interchange areas in Monroe Township host a major warehouse distribution center serving the region.

Proposed Route 92 would provide a needed connection between the New Jersey Turnpike corridor and the US Route 1 corridor, and the limited access design precludes it from creating a new development corridor of its own.

For a distance of approximately 4.4 miles along the middle two-thirds of proposed Route 92, vehicles would not be able to enter or exit the highway. Although proposed Route 92 would cross currently undeveloped lands (in this central section), no direct access would be available to adjacent lands (either as frontage or via connecting local roads) because proposed Route 92 is designed as a limited access highway. For this reason, proposed Route 92 would not create opportunities for linear development along its route, and direct access to nearby undeveloped lands would only be possible through the interchange areas. There would be no interchanges along the road segment between Perrine Road and US Route 130, and thus it would not connect to local or cross streets that could provide access to new lands for development. Route 92 would therefore not enhance access to the area between the development corridors that are present at its eastern and western ends.

While Proposed Route 92 might accelerate zoned development near its interchanges, it would also divert traffic away from local roads to the major highways. This would discourage traffic-dependent commercial development along the local roads, consistent with anti-sprawl initiatives.

Because proposed Route 92 would be a limited access highway, it would not enable linear development along its route. With no interchanges between Perrine Road and US Route 130, it would not connect to cross streets that would make available new lands for development. Secondary development impacts could occur at the interchanges of proposed Route 92 with US Route 1, Perrine Road, US Route 130 and New Jersey Turnpike Interchange 8A. These interchange areas are already well developed or approved for development; further development in these locations would remain under the jurisdiction of the municipal development review process and the guidance of municipal Master Plans.

Proposed Route 92 would not induce development of the area east of Perrine Road that Plainsboro Township has designated for low-density residential development. This area currently has direct access to Perrine Road, but after realignment of Perrine Road during construction of the Perrine Road interchange of Route 92, the area would have to be accessed by a circuitous route.

4.2.13.4 "Smart Growth" Initiative

On January 31, 2002, New Jersey Governor James McGreevey issued Executive Order #4 addressing "smart growth" in the state. The executive order states, "it is the law and policy of the State of New Jersey to promote smart growth and to reduce the negative effects of sprawl and disinvestments in older communities." Among other things, Executive Order #4 did the following:

- Created in the Office of the Governor a Smart Growth Policy Council whose members include the commissioners of the New Jersey Department of Environmental Protection (NJDEP), the New Jersey Department of Transportation (NJDOT), and the New Jersey Department of Community Affairs (NJDCA).

- Made the Smart Growth Policy Council responsible for ensuring that state transportation and infrastructure spending and regulation are consistent with the principles of smart growth and the State Development and Redevelopment Plan (the State Plan).

Later, an Office of Smart Growth was created in NJDCA. The web site of the Office of Smart Growth lists the following "smart growth principles":

- Mixed land uses
- Compact, clustered community design
- Range of housing choices and opportunity
- Walkable neighborhoods
- Distinct, attractive communities offering a sense of place
- Open space, farmland and scenic resource preservation
- Future development strengthened and directed to existing communities using existing infrastructure
- Transportation option variety
- Predictable, fair and cost-effective development decisions
- Community and stakeholder collaboration in development decision-making

These principles of land use planning are reflected in the land use analysis in this EIS.

4.2.14 Environmental Justice

4.2.14.1 Minority Groups in the Proposed Route 92 Corridor

The percentage of people of Asian descent in the Proposed Route 92 Corridor is essentially the same as in South Brunswick as a whole and is substantially less than in Plainsboro as a whole (see Table 3-17 in Section 3.12 and Table 3-19 in Section 3.14). In addition, the percentage of Asians in the Proposed Route 92 Corridor is only moderately higher than the percentage in Middlesex County as a whole, which is 14 percent. Because they are not disproportionately concentrated in the corridor that would be affected by Route 92, the proposed project would not be anticipated to have disproportionate environmental impact on people of Asian descent.

The percentage of Blacks and African Americans in the Proposed Route 92 Corridor is less than half the percentage in South Brunswick and Plainsboro as a whole, and is less than one third the percentage in Middlesex County as a whole (see Table 3-19). Therefore, Route 92 would not be anticipated to have disproportionate environmental impacts on Blacks or African Americans.

Similarly, the percentage of Hispanics in the Proposed Route 92 Corridor, 2.9 percent, is less than the percentage in South Brunswick and Plainsboro as a whole, and is less than one quarter the percentage in Middlesex County as a whole. Therefore, proposed Route 92 would not be anticipated to have disproportionate environmental impacts on Hispanics.

4.2.14.2 Economic Groups in the Proposed Route 92 Corridor

Census data indicate that the overall financial status of the residents of the Proposed Route 92 Corridor is higher than the financial status of Middlesex County residents taken as a whole (see Section 3.14.2). Therefore, construction of proposed Route 92 would not be anticipated to have disproportionate environmental impacts on low-income people.

4.2.15 Cumulative Impacts

Federal regulations define "cumulative impact" as the impact on the environment that results from the impact of a proposed action combined with other past, present and reasonably foreseeable future actions (40 CFR 1508.7). The regulations further state that cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. This section examines potential cumulative impacts of proposed Route 92.

4.2.15.1 Natural Resources

4.2.15.1.1 Wetlands

As discussed in Section 4.2.3.4, approximately 12.03 acres of wetlands and open water would be permanently filled during construction of proposed Route 92, and an additional 1.16 acres would be permanently affected by shading from elevated sections of the roadway. To mitigate the impact of this construction, NJTA proposes to construct a wetland of approximately 57 acres extending north and south from the proposed Route 92 alignment east of Haypress Road (see Section 5.3.4).

The constructed wetland would be hydrologically connected to the wetland bordering Devil's Brook, the same wetland that would experience most of the wetland filling associated with proposed Route 92. The replacement wetland would be designed as a wetland complex composed of 0.85 acres of open water, 12.24 acres of emergent marsh and wet meadow, 8.2 acres of scrub-shrub wetland, and 36.7 acres of forested wetland.

Because proposed Route 92 would not cause a net loss of wetlands after construction of replacement wetlands, it would not contribute to a cumulative loss of wetlands.

4.2.15.1.2 Wildlife

The middle section of Route 92 passes between two wetland complexes that provide important wildlife habitat: the Devil's Brook wetland complex to the north of the proposed alignment, and the wetland complex that includes Broadway Swamp to the south. Between East New Road and the Amtrak rail lines in South Brunswick, Devil's Brook turns southwest through the Plainsboro Preserve and the two wetland complexes merge. Route 92 would pass through the merged wetlands in the Plainsboro Preserve. To maintain existing wetland hydrology and to allow terrestrial and aquatic wildlife to move between the two wetland complexes, Route 92 would be elevated in the wetland area. Proposed Route 92 would therefore not contribute significantly to cumulative fragmentation of the wildlife habitat provided by the wetlands.

4.2.15.2 Farmland

The proposed Route 92 roadway and associated interchanges would displace approximately 210 acres of active agricultural land and would interfere with access to an additional 78 acres. Proposed Route 92 would not contribute to cumulative loss of farmland beyond this direct impact, however. The agricultural land in the Route 92 study area is already undergoing a rapid process of division into three categories:

- Agricultural land in the process of being developed for residential and commercial use, such as the agricultural land near US Route 1 and US Route 130.
- Agricultural land subject to legal restrictions designed to preserve its agricultural nature, including farmland north and south of the proposed Route 92 alignment in south-central South Brunswick Township.
- Agricultural land being preserved as recreational and natural open space, such as Friendship Park and the Boyko property in South Brunswick near the eastern end of the Plainsboro Preserve.

The process of dividing agricultural land among these three categories is proceeding, and will continue whether or not Route 92 is built. Construction of proposed Route 92 would not contribute to the process. Therefore, proposed Route 92 would not contribute to cumulative impacts to farmland.

4.2.15.3 Air Quality and Transportation

The air quality and transportation analyses performed for this EIS are cumulative impact analyses. The air quality and transportation analyses include the effects of recently completed transportation improvements in the area potentially affected by implementation of proposed Route 92. These improvements include addition of a right-hand turning lane from southwest-bound Dey Road to northwest-bound Scudders Mill Road; widening of US Route 1 from four to six lanes from Adams Lane in North Brunswick Township to US Route 130; addition of a 500-space NJTA park-and-ride lot adjacent to the intersection of US Route 130 and Route 32; and widening the New Jersey Turnpike to seven lanes per direction north of Interchange 11. The air quality and transportation analyses also include the projected effects of the proposed Penns Neck improvements, for which funds have been committed by the New Jersey Department of Transportation.

The air quality and transportation analyses address the combined impacts of proposed Route 92, past actions, and foreseeable future actions, and therefore meet requirements for cumulative impact analyses as defined in federal regulations. As shown in sections 4.2 6 and 4.2.7, the air quality and transportation analyses indicate that proposed Route 92 would provide a cumulative environmental benefit as compared to the no-action alternative and the other action alternatives considered in the EIS. Because proposed Route 92 would have positive air quality and transportation impacts, it would not contribute to cumulative negative impacts to air quality and transportation.

4.2.15.4 Noise and Aesthetics

Proposed Route 92 would have localized noise and aesthetic impacts, as discussed in Sections 4.2.8 and 4.2.9. These impacts could combine with noise and aesthetic impacts of other development projects to create more significant cumulative impacts. The potential of proposed Route 92 to contribute to cumulative noise and aesthetic impacts is limited, however, by the absence of interchanges from proposed Route 92 between US Route 130 and Perrine Road. This section of proposed Route 92 is largely undeveloped and therefore more susceptible to noise and aesthetic impacts caused by new development. Because proposed Route 92 would have no interchanges in this section, it would not facilitate additional development that could combine with Route 92 to cause cumulative impacts.

4.2.15.5 Land Use

4.2.15.5.1 Displacement

Proposed Route 92 would displace four residences, one business, and three ball fields (see Section 4.2.13). Construction of new highways and interchanges displaces existing land uses, and this impact may be cumulative. Highway projects are difficult to implement in central New Jersey, however, and this limits the potential for cumulative displacement impacts. No highway projects are currently foreseen that could combine with proposed Route 92 to cause significant cumulative displacement impacts. Proposed Route 92 would be a limited-access toll road, and construction of intersecting roads that could combine with Route 92 to cause cumulative impacts would be restricted.

4.2.15.5.2 Parkland

Proposed Route 92 would pass through the northern end of the Plainsboro Preserve, displacing approximately 12 acres of the 630-acre preserve and cutting off another 12.5 acres of the preserve from the rest. If additional through-roads were built through the preserve, a significant cumulative impact could result. Because the preserve is encumbered under New Jersey's Green Acres Program, promoters of an additional through-road would have to show that construction of the road would have a significant public benefit and that there was no feasible alternative to routing the road through the preserve (see Section 3.13.1). In addition, replacement land would have to be provided. These requirements are a strong deterrent to construction of additional through-roads in the Plainsboro Preserve, and therefore a strong barrier to the development of cumulative road-related impacts to the preserve.

4.2.16 Phased Route 92 Sub-alternative

The phased Route 92 alternative would involve two phases of construction. The first phase of construction would involve building one travel lane in each direction along the proposed Route 92 alignment. In the second phase of construction a second lane would be added when travel demand requires it. Under this alternative, key elements of the roadway structure, such as bridges and embankments, would be built out to the full four-lane highway specifications, but only one travel lane (in each direction) would be paved and marked.

Most of the physical environmental impacts of the sub-alternative would be the same as for the proposed Route 92 project. Other impacts, such as traffic and potential induced development near the interchanges, would be reduced in the short-term. However, the impacts of the full implementation of the phased Route 92 alternative are the same as the proposed Route 92 alternative, namely a four-lane highway between US Route 1 and New Jersey Turnpike interchange 8A. As a result, by the end of the project, the ultimate impacts would be the same as those described for Route 92 as proposed by NJTA.

4.3 US Route 1 Widening and Signal Removal

This section addresses potential impacts of the US Route 1 Widening and Signal Removal alternative. Because the potential new US Route 1 interchanges are now only preliminary concepts, rather than preliminary engineered designs as in the case of proposed Route 92, many of the impacts discussed below should be regarded as potential impacts rather than impacts that are expected to occur if the alternative is implemented.

4.3.1 Topography, Geology and Soils

4.3.1.1 Topography

Since US Route 1 has already been graded, the effects to topography as a result of US Route 1 Widening and Signal Removal would be minimal. In the Sand Hills area, where US Route 1 currently is bounded by steep embankments, some excavation would likely be required to accommodate the widening. In addition, some excavation and/or fill would likely be required to construct the grade-separated intersections.

4.3.1.2 Geology

Unique or economically significant geologic features do not occur within the Project Study Area, and existing quarries are outside the project area limits. Excavation associated with US Route 1 Widening and Signal Removal would be minimal. Fill would be required to construct the grade-separated interchanges and an overpass at Major Road in the Sand Hills area.

4.3.1.2.1Acid-Producing Deposits

Certain geologic formations may contain iron sulfide minerals known as “acid-producing deposits” that, when exposed to oxygen, oxidize and produce sulfuric acid. This acid increases the solubility of metals to the extent that these metals may represent a toxic source to aquatic life, vegetation, and potable water supplies. According to the *Technical Manual for Stream Encroachment*, the Magothy and Raritan geologic formations of the Coastal Plain physiographic province sometimes contain substantial acid-producing deposits. Construction of the US Route 1 Widening and Signal Removal alternative could require excavation within the Magothy Formation; therefore, it is important to note the possibility of exposing acid-producing deposits to oxygen so that appropriate mitigation could be implemented if necessary.

4.3.1.3 Soils

The major anticipated impact to soils would be erosion of soil particles. Soil erosion causes problems when downstream water features become laden with sediment, thus degrading water quality. Sediment from soil erosion also tends to obstruct natural and manmade drainage structures and channels.

Construction activities increase the amount of soil exposed to flowing water, thus increasing the extent of soil erosion leading to adverse impacts to nearby surface water features. Soil erosion control guidelines and mitigation would be adhered to in accordance with New Jersey's *Standards for Soil Erosion and Sediment Control*.

The resistance of a soil to erosion depends upon the composition of particles that make up the soil, as well as the presence of vegetative cover and steepness of the slope. Sandy soils on steep slopes with minimal vegetative cover, such as a sand dune, are highly susceptible to erosion. Conversely, clayey silts with binding particles found on gentle to level slopes with significant vegetative cover, such as a forested wetland, are less susceptible to erosion. In accordance with the USDA Natural Resources Conservation Service, all soil types are assigned an erosion factor, K, which predicts an area's annual rate of soil loss by sheet and rill erosion. These estimated erosion factors are based on the percentage of silt, sand and organic matter and on soil structure and permeability. K-factor values from 0.17 to 0.24 indicate low erodibility, 0.28 to 0.37 indicate medium erodibility, and 0.43 to 0.49 indicate high erodibility.

Table 4-4 lists the soils anticipated to be disturbed for the construction of the US Route 1 Widening and Signal Removal and its K-factor. Most of the soils that would be impacted for construction of this alternative are characterized by K-factor values of 0.28 to 0.49, representing soils of medium to high erodibility.

4.3.2 Natural Resources

4.3.2.1 Surface Water

4.3.2.1.1 Waterways, Streams, and Lakes

The impacts to existing surface water bodies from the US Route 1 Widening and Signal Removal would be expected to be minimal, as the water bodies that cross the Route 1 Corridor are already bridged or culverted. Some bridges or culverts would be altered by the project.

The creation of additional impervious surface would result in increased stormwater runoff rates compared to current conditions. If uncontrolled, the additional stormwater from US Route 1 could carry significant amounts of vehicle-related contaminants from the roadway into surface and groundwater resources. In addition, increased runoff can exacerbate flooding during rain events. The current stormwater system in place along US Route 1 would have to be updated to convey and treat the additional stormwater created by this alternative. Various state, county and regional agencies have set forth stormwater management regulations with which this alternative would have to comply.

4.3.2.1.2 Floodplains

Development within floodplains is regulated at the federal level by Floodplain Management Executive Order 11988 and at the state level by the Flood Hazard Area Control Act (N.J.S.A. 58:16A-50 et seq.) and Rules and Regulations Governing Flood Hazard Area for Stream Encroachment Permits (N.J.A.C. 7:13-1.1 et seq.). The placement of fill within a floodplain results in adverse impacts to the function of the floodplain including a reduction of the flood storage capacity of the stream, an increase in the flood height of the stream and an increase in flood hazards extending to areas beyond the disturbed area itself. Implementation of the US Route 1 Widening and Signal Removal alternative could require construction in the floodplains of Heathcote Brook and Oakey Brook. NJDEP Stream Encroachment permits would be required for construction of the stream crossings of Heathcote Brook, Oakey Brook, and various smaller tributaries associated with these brooks.

FEMA prohibits encroachment within the 100-year flood boundary that will cause an increase in flood heights of greater than 1.0 foot. The State of New Jersey prohibits encroachment within the flood hazard area that will cause an increase in flood heights of greater than 0.2 feet. NJDEP's Flood Hazard Area Control regulations require that any new or modified channel of a watercourse be designed and constructed so that during low-flow conditions the water is at least as deep as in the existing channel (N.J.A.C. 7:13-3.6(c)). This preserves the ability of fish to pass through the watercourse during low flow conditions. NJDEP regulations limit the fill or reduction of floodplain volume below the 100-year flood to a maximum of 20 percent of the flood storage volume in the flood fringe area within the right-of-way (N.J.A.C. 7:13-2.14(a)(1)). Highway projects that cannot meet this requirement because of limited right-of-way may be granted an exemption if a need for the project has been demonstrated and the project is designed to minimize fill (N.J.A.C. 7:13-2.14(a)(7)).

4.3.2.1.3 Water Quality

Construction of the US Route 1 Widening and Signal Removal alternative would not require any additional water crossings, no new impacts to water quality would occur as a result of the alternative. However, the generation of additional stormwater runoff could increase the degree of impact that already occurs along US Route 1. Section 4.3.2.1.3 contains a discussion of the types of impacts that could occur to water quality. In addition, temporary impacts to water quality could occur during construction (namely, erosion and accidental spills).

4.3.2.2 Groundwater

4.3.2.2.1 Aquifers/Aquifer Recharge in Project Area

Implementation of the US Route 1 Widening and Signal Removal alternative would generate stormwater runoff containing various pollutants as described in Section 4.3.2.1.3. These pollutants include nutrients, petroleum hydrocarbons, sediments, floatables, pathogens, pesticides, metals, and road salts. The likelihood of these pollutants entering the groundwater table is dependent upon the permeability and structure of the overlying soils. As described in Section 3.3.2.1, most of the Route 1 Corridor is characterized by a moderate vulnerability to groundwater contamination resulting from moderate transmissivity rates. No soils in the Route 1 Corridor are designated as hydrologic group A, defined as soils with a high rate of water transmission. Nearly all of the soils in the Route 1 Corridor are hydrologic group B, C or D, representing moderate, slow and very slow rates of water transmission, respectively. The only soil phase in hydrologic group A is Evesboro sand, which is found in one relatively small area and is not under the US Route 1 right of way. Due to these generally moderate transmissivity rates, increased infiltration of contaminated stormwater runoff generated by this alternative would not be expected to pose an adverse threat to groundwater quality. Many of these pollutants would be taken up by plants, adsorbed by sediments and soil, or broken down by microorganisms in the soil before they reached the groundwater table.

Aquifer recharge is also highly dependent upon the permeability of overlying geologic formations. The more permeable a geologic formation, the greater the recharge to the aquifer. Increased development leads to a decrease in pervious surfaces by the placement of impervious pavement. This results in a reduction of surface area by which aquifer recharge can be conducted. Construction of this alternative would result in a loss of pervious lands, reducing the surface area through which an aquifer can be recharged. The Route 1 Corridor is largely composed of geologic units characterized by fine sand and silt deposits of medium permeability. The remainder of the Route 1 Corridor comprises uppermost geologic units characterized by fractured bedrock of low permeability. The US Route 1 Widening and Signal Removal alternative would represent a minor impact to aquifer recharge, as there would be a small loss of land characterized by medium and slow permeability, although no loss of land characterized by high permeability.

4.3.2.2.2 Sole Source Aquifers
The construction of additional impermeable land would reduce the area of recharge by the same amount. Approximately half of the Route 1 Corridor lies above the Northwest New Jersey aquifer, which is a sole source aquifer. However, as discussed above, the soils overlying the aquifer have medium to slow permeability; therefore, impacts to the sole source aquifer would not be great. In addition, these soils would also allow for the absorption and adsorption of pollutants and prevent their infiltration into the aquifer. The central portion of the Route 1 Corridor is over formations that are not sole source aquifers.

4.3.2.2.3 Wells
A well search was not performed for the US Route 1 Widening and Signal Removal alternative; however, it is known that there are no active public water supply wells in either South Brunswick or North Brunswick along the corridor (see Section 3.3.3). Any wells within the footprint of the project would be affected by construction of this alternative.

4.3.2.3 Water Supply
4.3.2.3.1 Public Water Supply
As no active water supply wells are located within the Route 1 Corridor, the construction of this alternative would not directly impact the public water supply.

4.3.2.3.2 Private Water Supply Wells
It is unlikely that any private water supply wells are located within the footprint of the US Route 1 Widening and Signal Removal alternative, since the corridor is mainly

commercial and the water source for North Brunswick is the Delaware and Raritan Canal.

4.3.2.4 Wetlands

Widening Only

US Route 1 is approximately 80 feet wide as it travels through this corridor. This accounts for two lanes traveling north, two lanes traveling south, a center divider and an 8 to 10 foot shoulder on either side. Widening US Route 1 by two lanes (one northbound and one southbound lane) would impact approximately 4 acres of palustrine forested wetlands. Construction easements associated with temporary disturbance would increase this impact.

Widening and Signal Removal

The following text addresses the additional wetland loss expected as a result of construction activities at each of the five intersections targeted for grade-separated interchanges.

Cozzens Lane/Adams Lane

This intersection contains a dense development of both residential and commercial uses. Based on the available mapping, no known wetlands exist at this intersection; therefore, no wetland impacts would be anticipated.

Finnegan's Lane

Wetlands are located to the south and east of US Route 1, as well as to the northwest at this intersection. Based on available wetland mapping, approximately 1.5 acres of forested wetlands would be filled during grade-separation of this intersection. Reconstruction at this intersection could result in sediment and runoff entering the wetland areas that surround this intersection.

Beekman Road/Northumberland Way

Open water wetlands and forested wetland areas are present on the northwest side of US Route 1. A small wetland area (about 0.2 acres) is also present in the southwestern intersection quadrant. This small wetland area could be lost due to construction activities at this intersection required to grade-separate this intersection.

New Road

Approximately 1 acre of wetlands would be lost as a result of intersection improvements required to grade-separate this intersection. The wetland area is located in the southwestern quadrant of the intersection.

Promenade/Route 522

Although a relatively new intersection, modifications required to grade-separate the intersection would impact areas not previously affected by the recent improvements. Approximately 1 acre of wetland would be lost in the southwestern quadrant of the intersection as a result of construction activities needed to grade-separate this intersection.

Summary
Approximately 3.7 acres of wetlands would be lost as a result of roadway improvements needed to grade-separate the five targeted intersections for the US Route 1 Widening and Signal Removal alternative.

4.3.2.5 Fish and Wildlife

4.3.2.5.1 Endangered and Threatened Species

Widening Only
Since the vegetated area affected would consist of relatively narrow bands on both sides of developed US Route 1, no threatened or endangered species habitat is anticipated to be affected by this action.

Widening and Signal Removal
As noted in Section 3.3.5.1, records of occurrence of both federal and state endangered species are documented for the Proposed Route 92 Corridor. As the study area for the proposed Route 92 project and the US Route 1 Widening and Signal Removal overlap and contain similar habitats, it is possible that the range of these species could extend within the Route 1 Corridor. Construction impact at the five intersection reconstruction locations could impact these species' habitat. Additional studies would be required to determine if these species inhabit this area, but the long history of US Route 1 as a major travel route and the habitat fragmentation caused by existing development indicate a low potential for suitable habitat, especially at the roadway fringe.

4.3.2.5.2 Vegetation and Wildlife

Widening Only
US Route 1 widening would result in the loss of vegetation and associated wildlife habitat along the new roadway right-of-way. Assuming the US Route 1 widening requires an additional 8 to 10 feet of roadway to accommodate the proposed third north- and southbound lanes, approximately two acres of vegetated habitat would be taken for roadway construction. Additional vegetation would be disturbed during construction as staging areas would be required along the approximate 7-mile length of affected roadway. Although revegetation is usually required at the end of a construction period, it takes several decades to recreate forest habitat lost during construction.

Widening and Signal Removal
The impacts discussed below are in addition to those described above for just the widening of US Route 1 from a four-lane road to a six-lane road. The following is an estimate of the additional vegetation and associated habitat that could be disturbed and lost as a result of roadway improvements required to grade-separate the five targeted intersections.

Cozzens Lane/Adams Lane (CR 608)**:** Natural vegetation at this intersection is very limited as a result of residential and commercial development. To limit the impacts to the existing residences and businesses, the intersection would need to be designed to use undeveloped lands. Therefore, an estimated 0.5 acres of vegetated land would need to be taken to accommodate the roadway modifications required to grade-separate this intersection.

Finnegan's Lane: Natural vegetation is predominantly located in the southeastern and southwestern quadrants of this intersection. To make the modifications necessary to remove the signal at this intersection, it is estimated that 4 acres of vegetation would be lost on the southeastern side of US Route 1.

Beekman Road/Northumberland Way: Natural vegetation is predominantly located in the southeastern and southwestern quadrants of this intersection. It is estimated that approximately 2 acres of vegetation and habitat would be lost as a result of removing the signal at this intersection.
New Road: Improvements at this intersection associated with grade-separation and the removal of the signal would result in the loss of approximately one acre of natural vegetation and associated habitat in the southwest quadrant of this intersection.

Promenade/Route 522: Natural vegetation predominantly occurs to the south of this intersection. Roadway improvements required to remove the signal at this intersection would remove approximately one acre of vegetation.

Summary: Approximately 8.5 acres of vegetation and associated habitat would be lost as a result of roadway improvements needed to reconstruct the five targeted intersections.

4.3.3 Farmland

Widening Only

Because the widening of US Route 1 from four lanes to six would take place within the existing right-of-way, no significant impacts to farmland along US Route 1 would occur.

Widening with Signal Removal

As described in Section 2, the US Route 1 Widening and Signal Removal Alternative would create five new signal-free interchanges along US Route 1. It is likely that portions of three of the five interchanges would have to be constructed on land assessed as farmland. Construction of a new interchange at Beekman Road and Northumberland Way could require acquisition of several acres of farmland east of US Route 1 and south of Northumberland Way. Construction of a new interchange at New Road could require acquisition of two narrow lots apparently used to access a large area of agricultural land east of US Route 1 and New Road. It is likely that a new interchange at Route 522 would be built primarily in farmland-assessed woodland south of Route 522 on both sides of US Route 1.

4.3.4 Historic and Cultural Resources

4.3.4.1 Impacts to Historic Sites

A cultural resources assessment conducted by Richard Grubb & Associates, Inc. (Grubb) in 2002 identified five small areas near the potential new US Route 1 interchanges that have a moderate to high probability for the presence of prehistoric and historic archaeological resources (Grubb, 2003). The locations of the five areas are as follows:

- The south quadrant of the potential Beekman Road/Northumberland Road interchange
- The east quadrant of the potential New Road interchange
- The east, west and south quadrants of the potential Route 522/Promenade Boulevard interchange

Nineteenth century maps indicate the presence of structures in these areas prior to the Civil War. Grubb recommends that these five areas be investigated further through background research, site assessment and subsurface testing to evaluate the potential impacts of interchange construction on prehistoric and historic archaeological resources (Grubb, 2003).

Grubb concluded through background research and field reconnaissance that no structures exist in the vicinity of the five potential new US Route 1 interchanges that appear to be eligible for listing in the National Register of Historic Places (Grubb, 2003). It is therefore unlikely that construction of the interchanges would affect historic architectural resources.

A draft *New Jersey Historic Roads Study* (Kise Straw & Kolodner 2001) has identified most of US Route 1 between Trenton and New Brunswick, known historically as the Trenton and New Brunswick Straight Line Turnpike, as potentially eligible for listing in the National Register of Historic Places. All of the potential new interchanges would fall along this stretch of US Route 1. The US Route 1 Widening and Signal Removal alternative would not change the historic alignment of the primary roadway of US Route 1, but would alter the character of the roadway at the new interchanges. Grubb recommends that the existing integrity of the roadway be assessed to determine its eligibility for inclusion in the National Register.

4.3.4.2 Impacts to Historic Districts

There are no historic districts along US Route 1 between Ridge Road in South Brunswick and US Route 130 in North Brunswick. There are also no historic districts in the vicinity of any of the five potential new US Route 1 interchanges. The Kingston historic district is approximately 1 mile from US Route 1. Therefore, the US Route 1 Widening and Signal Removal Alternative would not have significant impacts on any historic district.

4.3.4.3 Section 106 Compliance

Section 106 of the National Historic Preservation Act of 1966 (16 USC 470f) applies to the effects of proposed actions on districts, sites, buildings, structures, and objects included in or eligible for inclusion in the National Register of Historic Places. The cultural resources assessment conducted by Grubb in 2002 concluded that no structures exist in the vicinity of the five potential new US Route 1 interchanges that appear to be eligible for listing in the National Register of Historic Places (Grubb, 2003). However, a draft *New Jersey Historic Roads Study* (Kise Straw & Kolodner 2001) states that the stretch of US Route 1 along which the new interchanges would be constructed may itself be eligible for listing in the National Register of Historic Places. Grubb recommends that the eligibility of this stretch of US Route 1 for inclusion in the National Register be assessed.

4.3.5 Air Quality

There are two scenarios for US Route 1: widening to six lanes with signalization and widening to six lanes with signal removal. Although both of these scenarios show a 10% increase in NO_x, over existing conditions, the latter produces nearly a 4% greater reduction of VOC and a 5% lower increase in CO loading (see Table 4-3). From an air quality standpoint, removing signals is advantageous because it increases network speeds. The US Route 1 Widening and Signal Removal alternative is predicted to have a positive air quality impact in comparison to the No Action alternative, but is not predicted to have as large a positive impact as proposed Route 92.

Hotspot analyses were not performed for either US Route 1 widening scenario. Both alternatives, when compared to No Action, provide higher network speeds and lower vehicle miles, which would result in reduced congestion. It is expected that these conditions would reduce CO emissions.

4.3.6 Transportation

The changes in year 2028 peak-hour traffic flows that would result from US Route 1 Widening and Signal Removal were estimated using the detailed network model developed for this project. This model demonstrates that US Route 1 Widening and Signal Removal would partially meet the objectives of this project as stated in Section 1 (Project Purpose and Need):

1. **Achieve an east/west roadway system in southwestern Middlesex County/northeastern Mercer County that emphasizes the use of local streets for local access and circulation, and provides an east-west connection for through traffic moving between the major north-south corridors (US Route 1, US Route 130, and the New Jersey Turnpike) that minimizes adverse impacts on established communities.**

   The US Route 1 Widening and Signal Removal would be expected to reduce the amount of through traffic on the local and secondary east-west roads crossing the screenline defined in Section 1 by 10 percent, as compared with the No Action Alternative (see Table 4-21).

Table 4-21
Projected 2028 Total Daily Peak-Hour Through-Traffic Volumes (A.M. + P.M.)
US Route 1 Widening and Signal Removal vs. No Action

	PROJECTED 2028 PEAK-HOUR (A.M. + P.M.) THROUGH-TRAFFIC VOLUMES		
Screenline Crossing	**NO ACTION**	**US ROUTE 1 WIDENING AND SIGNAL REMOVAL**	**PERCENT CHANGE**
CR-610 (Deans Ln)	1,384	920	-34%
Major Road	265	535	102%
CR-522 (Ridge Rd)	208	253	22%
New Road	179	40	-78%
Dey Road	890	732	-18%
Plainsboro Road	835	764	-8%
Cranbury Neck Road	886	747	-16%
CR-535	1,301	1,393	7%
CR-571	2,212	2,000	-10%
Dutch Neck Road	20	3	-87%
Hankins Road	1,938	1,770	-9%
Total	**10,117**	**9,156**	**-10%**

Figures 4-7 and 4-8 display the projected changes in 2028 peak-hour traffic volumes in the Traffic Study Area that would result from the US Route 1 Widening and Signal Removal alternative. In these figures, red bars indicate roadways where peak-hour traffic volumes are expected to increase, and green bars indicate roadways where peak-hour traffic volumes are expected to decrease. The thickness of the bars indicates the magnitude of the peak-hour traffic volume change predicted by the model.

As indicated by the figures, the US Route 1 Widening and Signal Removal alternative would be expected to result in modest reductions in peak-hour traffic volumes on the local and secondary east-west roads in the Traffic Study Area, including in the sensitive areas listed in Section 1 (Plainsboro Center, South Brunswick Center, and Princeton Junction Center). More significant reductions in peak-hour traffic volumes would be expected along NJ Route 27 in Kingston.

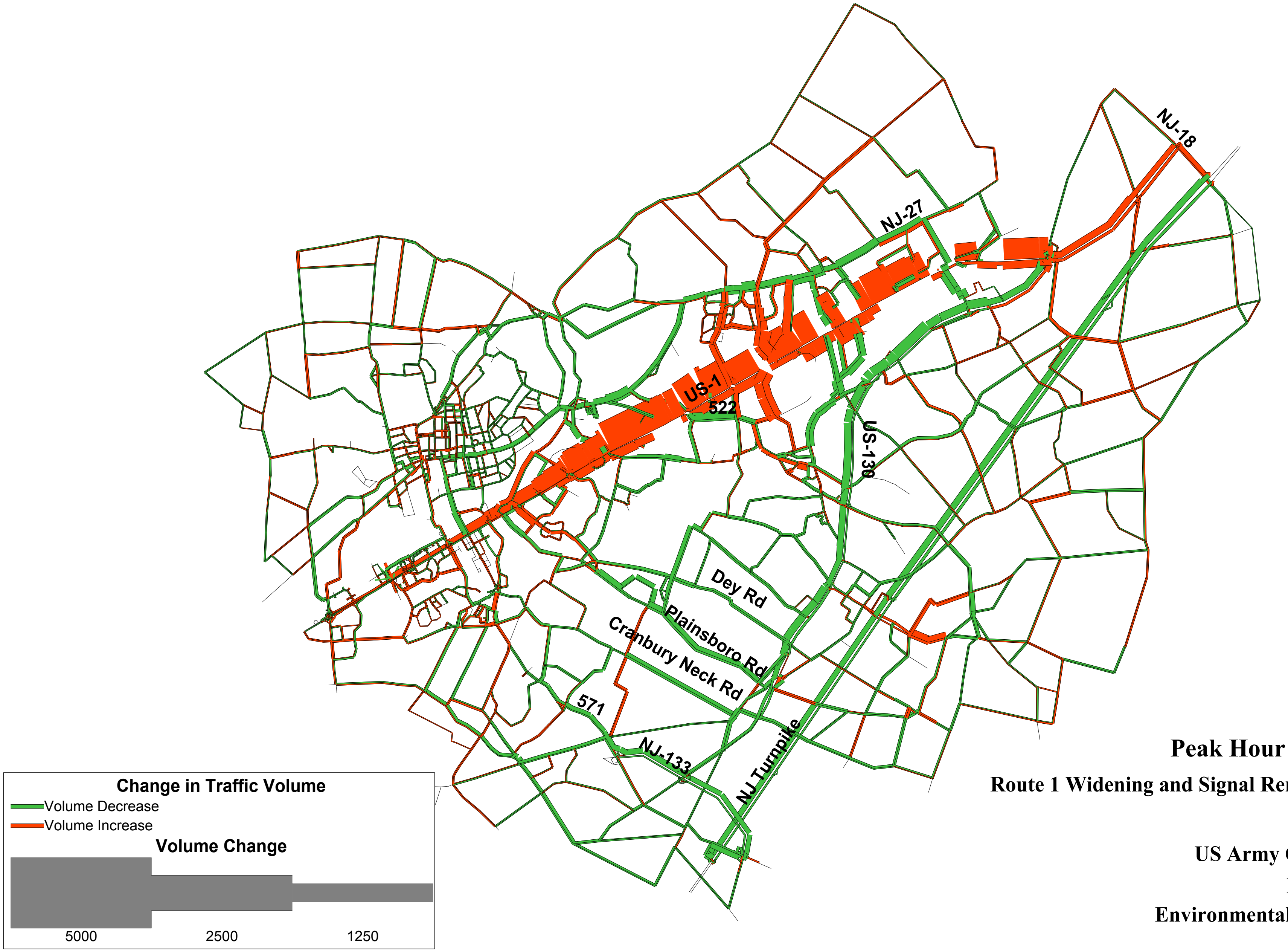

Figure 4-7

2028 A.M.
Peak Hour Traffic Changes

Route 1 Widening and Signal Removal vs. No Action

US Army Corps of Engineers

Proposed Route 92

Environmental Impact Statement

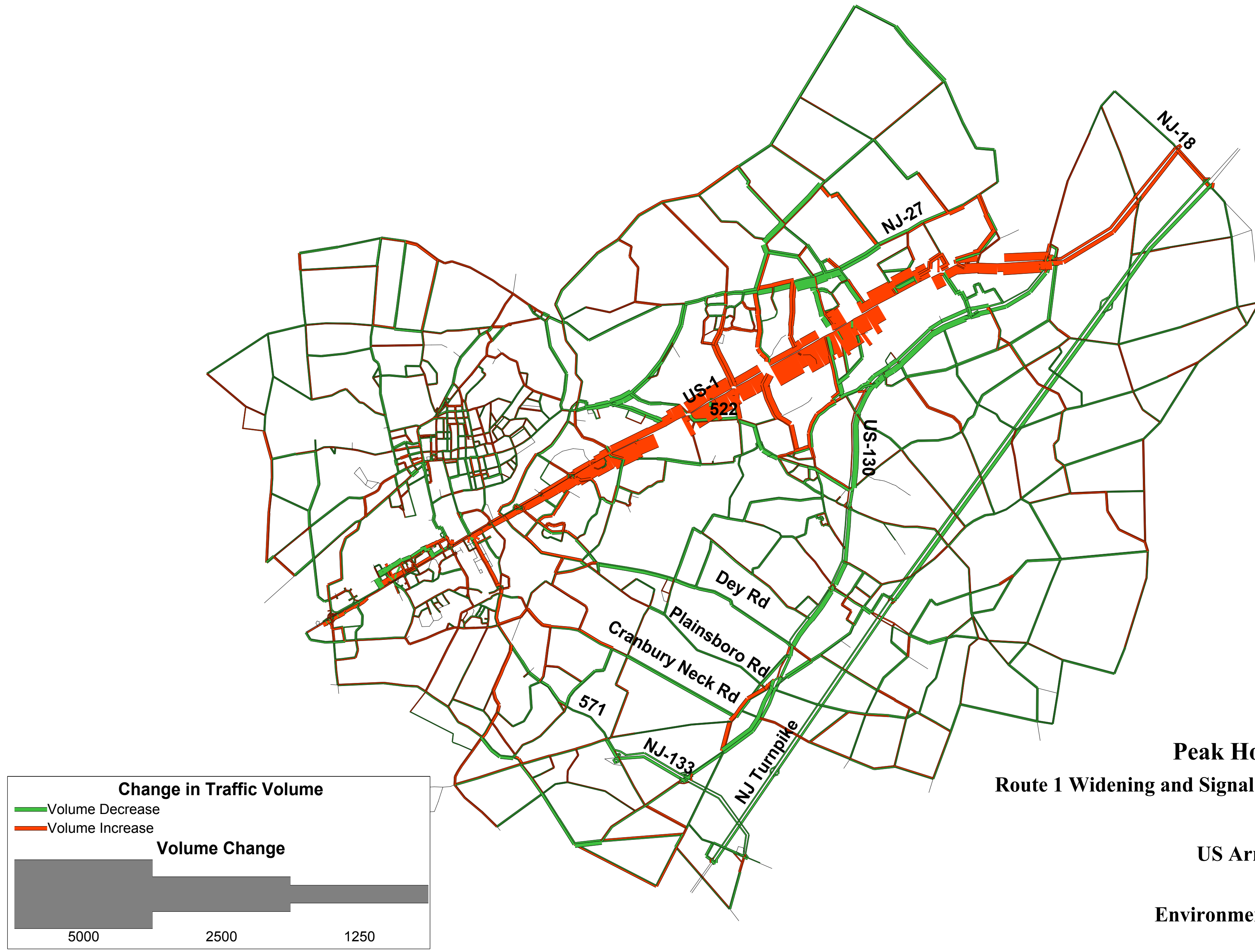

Figure 4-8

2028 P.M.

Peak Hour Traffic Changes

Route 1 Widening and Signal Removal vs. No Action

US Army Corps of Engineers

Proposed Route 92
Environmental Impact Statement

2. Provide alternative routings for north-south traffic currently using US Route 1, to relieve congestion while minimizing impacts on the abutting communities. Appropriately divert regional traffic to US Route 130 and the New Jersey Turnpike.

While the US Route 1 Widening and Signal Removal would substantially increase the traffic-carrying capacity of US Route 1, this capacity increase would attract to US Route 1 a large number of vehicles that would otherwise use alternate routes to avoid congestion on US Route 1. As a result, US Route 1 would be expected to remain heavily congested in the peak hour in the peak direction.

Most of the new traffic attracted to US Route 1 would be rerouted away from US Route 130 and the New Jersey Turnpike, which would likely be left with spare capacity.

3. Reduce truck traffic on the local roadway network.

Figures 4-9 and 4-10 display the projected changes in 2028 peak-hour truck volumes in the Traffic Study Area that would result from the US Route 1 Widening and Signal Removal. In these figures, red bars indicate roadways where peak-hour *truck* volumes are expected to increase, and green bars indicate roadways where peak-hour *truck* volumes are expected to decrease. The thickness of the bars indicates the magnitude of the model-projected changes in peak-hour *truck* volumes. As can be seen, this alternative would be expected to result in modest changes in peak-hour truck volumes on the local and secondary east-west roads in the Traffic Study Area, and along NJ Route 27 in Kingston.

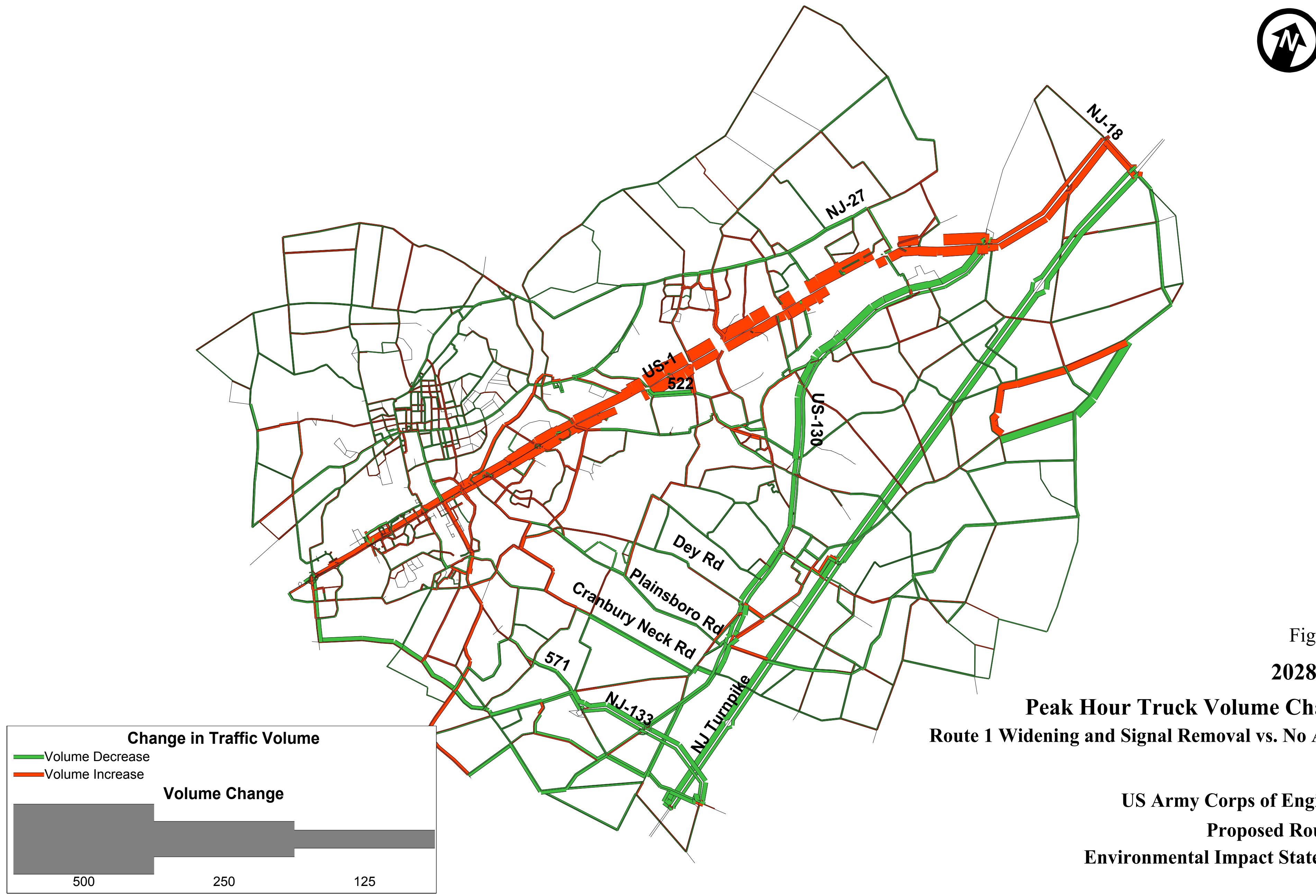

Figure 4-9

2028 A.M.

Peak Hour Truck Volume Changes

Route 1 Widening and Signal Removal vs. No Action

US Army Corps of Engineers

Proposed Route 92

Environmental Impact Statement

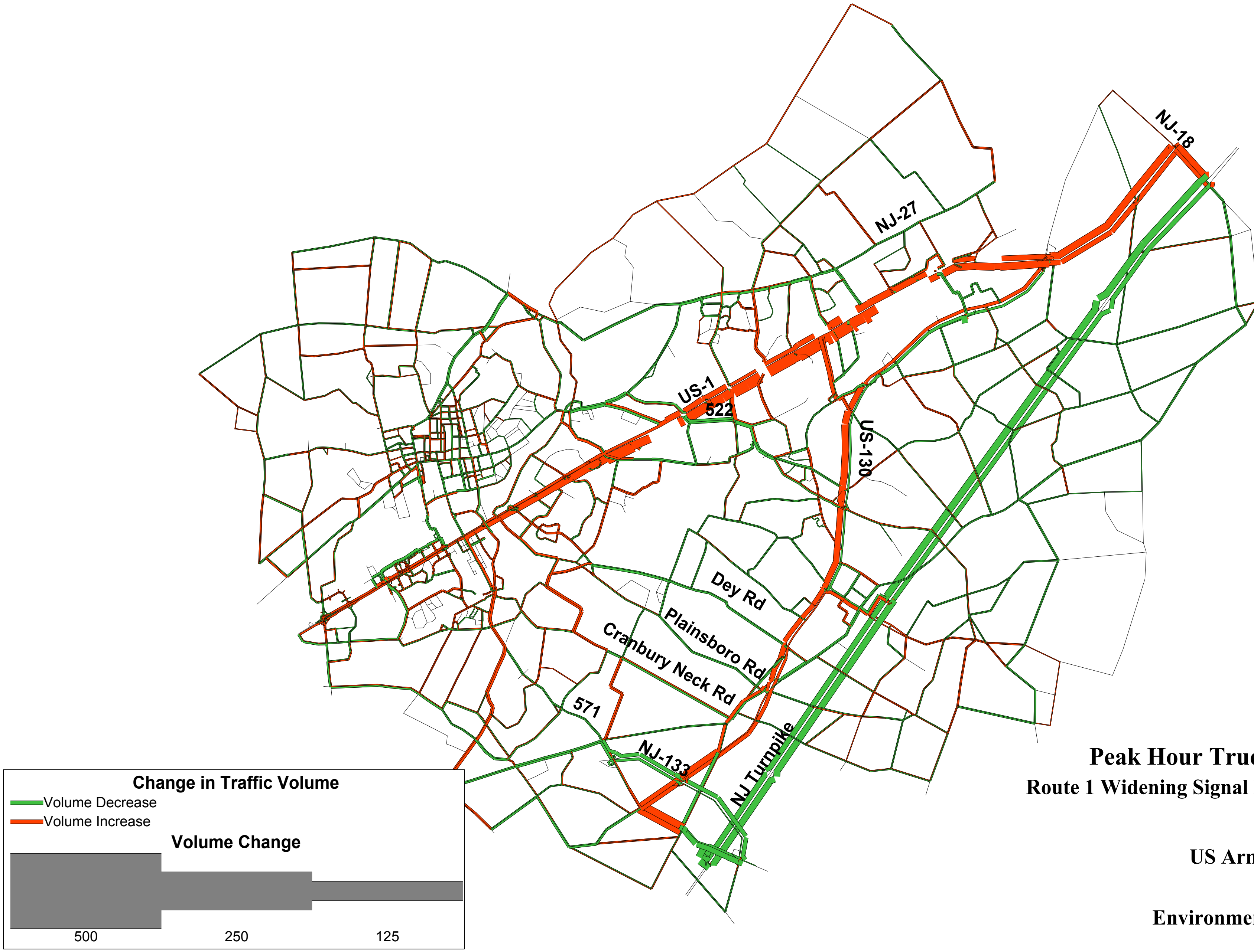

Figure 4-10

2028 P.M.

Peak Hour Truck Volume Changes

Route 1 Widening Signal Removal vs. No Action

US Army Corps of Engineers

Proposed Route 92

Environmental Impact Statement

Peak-hour truck volumes on the local and secondary east-west roads would be expected to drop by 8 percent, as compared with the No Action scenario, as shown in Table 4-22.

Table 4-22
Projected 2028 Total Daily Peak-Hour Truck Volumes (A.M. + P.M.)
US Route 1 Widening and Signal Removal vs. No Action

	PROJECTED 2028 PEAK HOUR (A.M. + P.M.) TRUCK VOLUMES		
Screenline Crossing	**NO ACTION**	**US ROUTE 1 WIDENING AND SIGNAL REMOVAL**	**PERCENT CHANGE**
CR-610 (Deans Ln)	101	72	-29%
Major Road	69	68	-2%
CR-522 (Ridge Rd)	203	174	-14%
New Road	13	20	54%
Dey Road	79	64	-20%
Plainsboro Road	79	69	-13%
Cranbury Neck Road	131	125	-5%
CR-535	525	540	3%
CR-571	403	329	-18%
Dutch Neck Road	449	438	-2%
Hankins Road	291	264	-9%
Total	**2,343**	**2,162**	-8%

The US Route 1 Widening and Signal Removal would not be expected to relieve the severe peak-hour congestion that is expected to occur in the Traffic Study Area due to the large amount of development expected over the next 25 years, particularly in Plainsboro and West Windsor. As discussed above, most of the trips that would be diverted to US Route 1 would come from other north-south routes that are relatively uncongested. The result is depicted in figures 4-11 and 4-12. In these figures, bars of different colors indicate projected levels of congestion, expressed as ranges of peak-hour volume to roadway capacity ratios. The thickness of the bars indicates the model-projected peak-hour traffic volume.

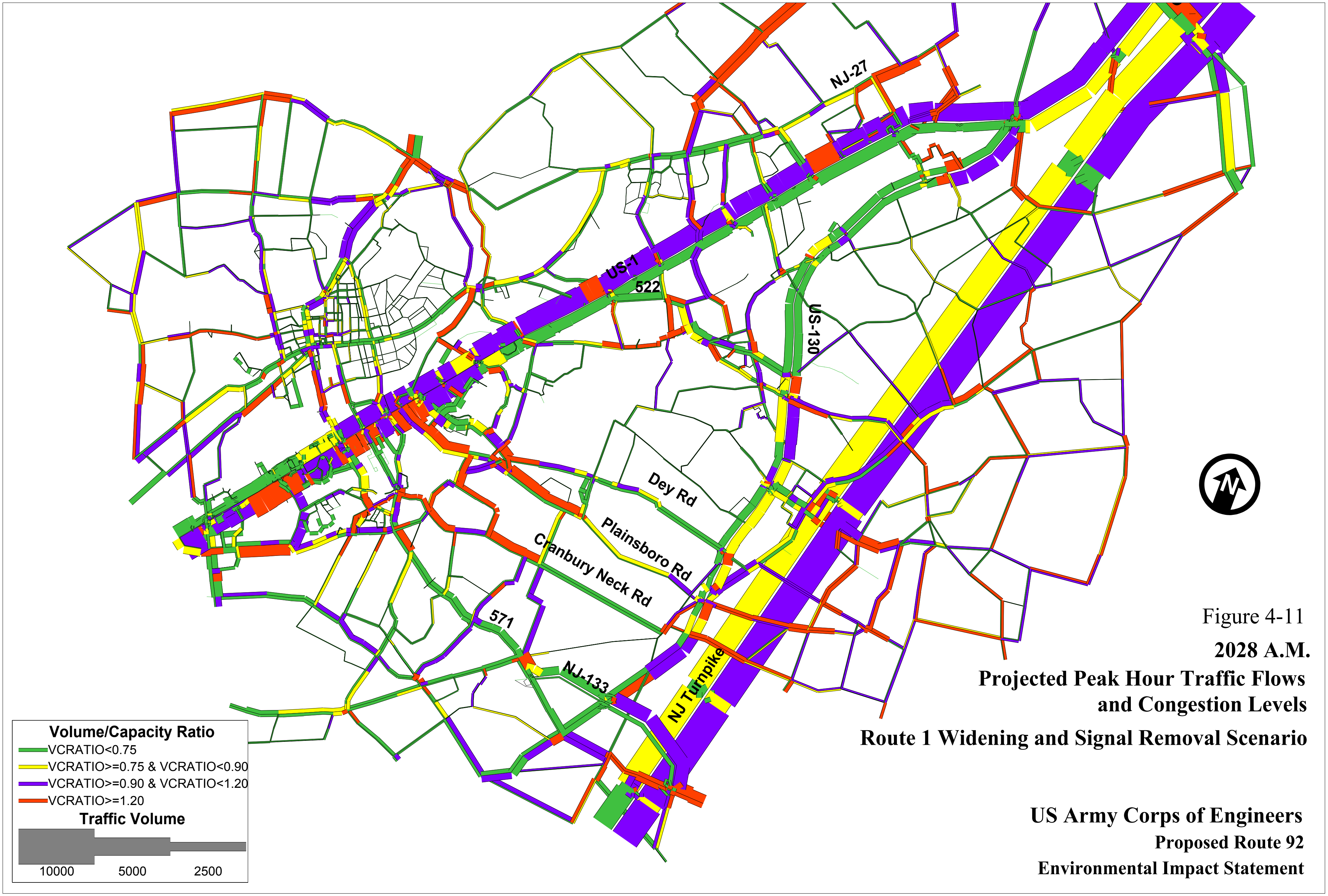

Figure 4-11

2028 A.M.

Projected Peak Hour Traffic Flows and Congestion Levels

Route 1 Widening and Signal Removal Scenario

US Army Corps of Engineers

Proposed Route 92

Environmental Impact Statement

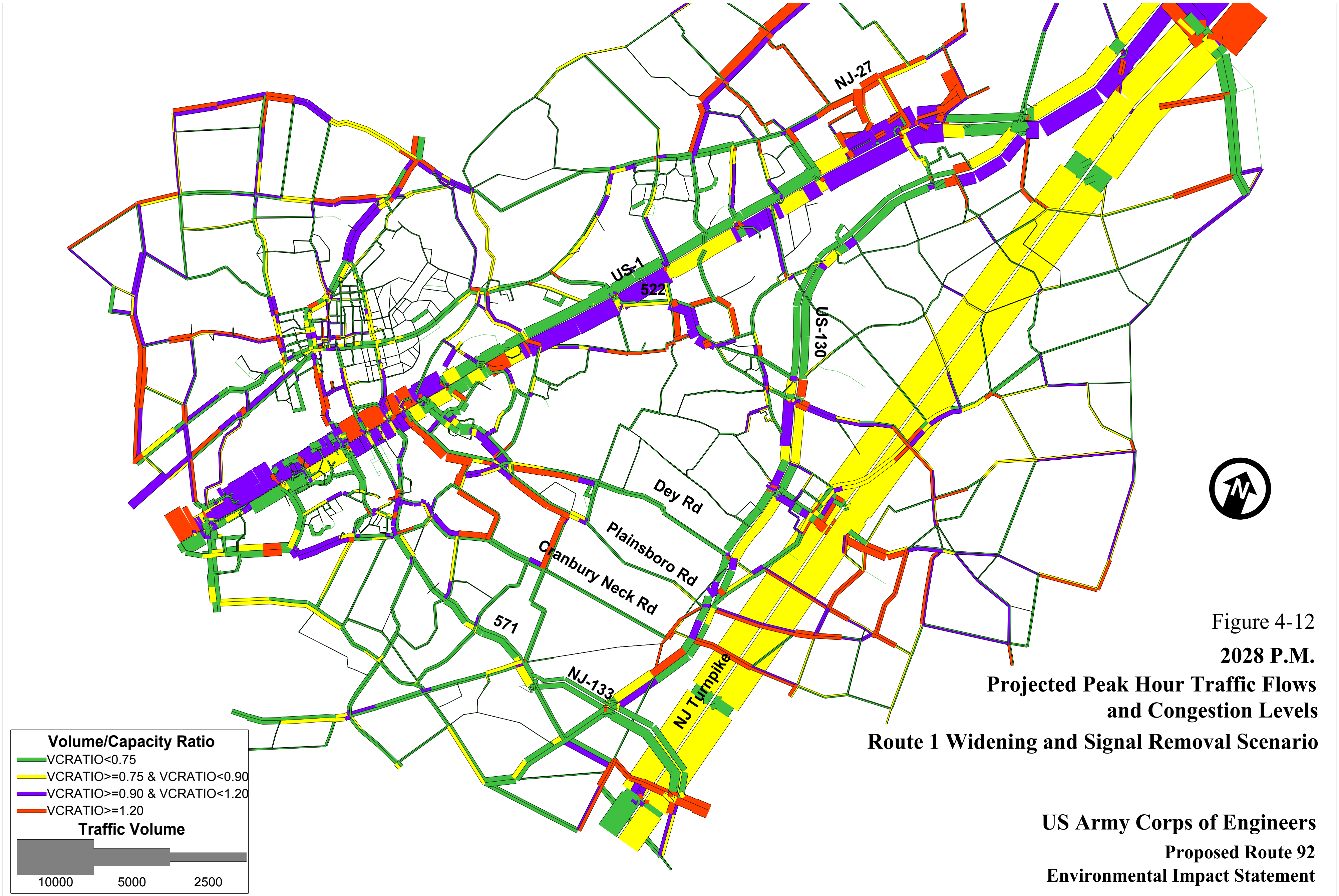

Figure 4-12

2028 P.M.

Projected Peak Hour Traffic Flows and Congestion Levels

Route 1 Widening and Signal Removal Scenario

US Army Corps of Engineers

Proposed Route 92
Environmental Impact Statement

As shown in the following table, this alternative would be expected to eliminate 14 out of 476 miles of roadway projected to operate at sub-standard conditions (volume-to-capacity ratio of greater than 0.9) during at least one of the peak hours if no action is taken:

Additional Lanes Needed	Miles of Roadway	
	No Action	US Route 1 Widening and Signal Removal
1	413.8	401.0
2	60.3	59.9
3	1.3	0.8
4	0.3	0.3
Total	475.7	462.0

In addition, 61 out of 62 roadway miles would still require the addition of more than one lane to be brought up to standard.

Table 4-23 shows the changes in travel times between various parts of the Traffic Study Area expected to result if US Route 1 Widening and Signal Removal were implemented.

As can be seen, peak hour travel times between these representative points are projected to decrease by an average of 5-to-6 percent as a result of this alternative. Peak direction travel times between US Route 1 in Plainsboro and New Jersey Turnpike Interchange 8A would be expected to improve by 10-15 percent.

Projected 2028 peak hour traffic conditions at 15 key intersections within the Traffic Study Area were evaluated for the No Action and US Route 1 Widening and Signal Removal scenarios. The computed Level of Service (LOS) designations are shown in Table 4-24.

Table 4-23
Estimated Changes in Travel Times - US Route 1 Widening and Signal Removal vs. No Action

FROM	TO	ESTIMATED 2028 PEAK HOUR TRAVEL TIMES (minutes)				CHANGE (US ROUTE 1 WIDENING AND SIGNAL REMOVAL vs. NO ACTION)		PERCENT CHANGE (US ROUTE 1 WIDENING AND SIGNAL REMOVAL vs. NO ACTION)	
		NO ACTION		US ROUTE 1 WIDENING AND SIGNAL REMOVAL					
		AM	PM	AM	PM	AM	PM	AM	PM
Princeton Junction	Princeton University	22.9	15.1	20.8	15.0	-2.0	-0.1	-9%	-1%
Princeton Junction	Plainsboro Center	30.3	12.4	27.7	13.1	-2.6	0.7	-9%	6%
Princeton Junction	South Brunswick Ctr.	41.8	38.2	38.5	35.6	-3.3	-2.7	-8%	-7%
Princeton Junction	Interchange 8A	35.7	30.4	33.9	29.2	-1.8	-1.2	-5%	-4%
Princeton Junction	Hightstown	21.4	29.0	21.3	29.0	-0.2	-0.1	-1%	0%
Princeton University	Princeton Junction	13.1	22.4	12.4	21.5	-0.7	-0.9	-5%	-4%
Princeton University	Plainsboro Center	22.6	14.1	21.8	12.7	-0.8	-1.5	-4%	-10%
Princeton University	South Brunswick Ctr.	30.6	34.8	28.1	31.7	-2.6	-3.1	-8%	-9%
Princeton University	Interchange 8A	36.8	39.6	33.0	35.6	-3.8	-4.0	-10%	-10%
Princeton University	Hightstown	30.9	48.8	30.1	48.2	-0.8	-0.6	-3%	-1%
Plainsboro Center	Princeton Junction	15.3	25.2	14.4	24.9	-1.0	-0.2	-6%	-1%
Plainsboro Center	Princeton University	12.8	18.3	13.3	18.4	0.5	0.2	4%	1%
Plainsboro Center	South Brunswick Ctr.	21.4	36.6	19.9	31.6	-1.5	-5.0	-7%	-14%
Plainsboro Center	Interchange 8A	19.0	31.1	18.0	26.8	-1.0	-4.3	-5%	-14%
Plainsboro Center	Hightstown	25.0	44.9	24.7	42.6	-0.2	-2.3	-1%	-5%
South Brunswick Ctr.	Princeton Junction	49.7	36.3	41.9	36.1	-7.8	-0.2	-16%	-1%
South Brunswick Ctr.	Princeton University	48.5	27.3	37.8	26.7	-10.8	-0.6	-22%	-2%
South Brunswick Ctr.	Plainsboro Center	52.5	22.1	43.4	21.8	-9.0	-0.3	-17%	-1%
South Brunswick Ctr.	Interchange 8A	14.6	15.5	13.4	14.7	-1.2	-0.8	-8%	-5%
South Brunswick Ctr.	Hightstown	38.0	45.6	34.0	44.5	-4.0	-1.1	-10%	-2%
Interchange 8A	Princeton Junction	42.1	30.1	35.9	30.6	-6.2	0.5	-15%	2%
Interchange 8A	Princeton University	52.4	35.1	49.8	35.4	-2.6	0.3	-5%	1%
Interchange 8A	Plainsboro Center	47.5	20.8	40.6	20.8	-6.9	0.0	-14%	0%
Interchange 8A	South Brunswick Ctr.	20.2	15.4	18.9	14.3	-1.2	-1.1	-6%	-7%
Interchange 8A	Hightstown	30.4	38.0	28.1	37.5	-2.4	-0.4	-8%	-1%
Hightstown	Princeton Junction	43.9	20.2	41.0	20.7	-3.0	0.5	-7%	3%
Hightstown	Princeton University	64.3	32.0	60.7	32.5	-3.6	0.5	-6%	2%
Hightstown	Plainsboro Center	68.2	25.4	63.5	25.9	-4.8	0.5	-7%	2%
Hightstown	South Brunswick Ctr.	66.5	35.4	62.3	33.1	-4.3	-2.3	-6%	-7%
Hightstown	Interchange 8A	51.7	27.6	48.8	26.7	-2.9	-0.9	-6%	-3%
					Average:	-3.1	-1.0	-7.7%	-3.1%

Table 4-24
Intersection Level of Service
US Route 1 Widening and Signal Removal vs. No Action

Intersection	**Intersection LOS**			
	No Action		**US Route 1 Widening and Signal Removal**	
	A.M.	**P.M.**	**A.M.**	**P.M.**
US-1 @ Cozzens Ln	F	F	*	*
US-1 @ Major Rd (Sandhill)	F	F	*	*
US-1 @ New Rd	F	F	*	*
NJ-27 @ Raymond Rd	F	B	D	B
NJ-27 @ CR-522	E	F	D	E
Scudders Mill Rd @ Schalk's Crossing Rd	F	F	F	F
Scudders Mill Rd & Dey Rd	F	F	F	F
Plainsboro Rd & CR-535	E	F	E	F
US-130 @ Dey Rd	F	F	F	F
Dey Rd & CR-535	F	F	F	F
NJ-32 @ CR-535	F	F	F	F
US-130 @ Friendship Rd	F	F	F	F
George's Rd & Kingston Rd	D	B	B	A
CR-522 & Kingston Rd	F	F	F	F
US-1 @ CR-522	F	F	*	*
US-1 @ Ridge Rd	F	F	F	F

* These intersections will be replaced with either grade-separated interchanges, or overpasses.

Of the 12 key intersections that would remain signalized, only three exhibit improved LOS designations, as compared with the No Action scenario. Most of these intersections would be expected to remain at LOS “F”.

Table 4-25 shows the projected changes in average peak hour delays at these intersections that would result from US Route 1 Widening and Signal Removal.

During the morning peak hour, 7 of the 12 intersections are projected to have lower average delays, while 4 are projected to have longer average delays. In the evening peak hour, 6 of the intersections are projected to have delay reductions of at least 20 percent.

Table 4-25
Projected Intersection Delays
US Route 1 Widening and Signal Removal vs. No Action

Intersection	Seconds of Delay per Vehicle: 2028 No Action A.M.	Seconds of Delay per Vehicle: 2028 No Action P.M.	Seconds of Delay per Vehicle: 2028 w/ US Route 1 Widening and Signal Removal A.M.	Seconds of Delay per Vehicle: 2028 w/ US Route 1 Widening and Signal Removal P.M.	Percent Change (US Route 1 Widening and Signal Removal vs. No Action) A.M.	Percent Change (US Route 1 Widening and Signal Removal vs. No Action) P.M.
US-1 @ Cozzens Ln	290	336	*	*	*	*
US-1 @ Major Rd (Sandhill)	191	112	*	*	*	*
US-1 @ New Rd	172	168	*	*	*	*
NJ-27 @ Raymond Rd	170	18	41	12	-76%	-33%
NJ-27 @ CR-522	77	202	51	78	-34%	-61%
Scudders Mill Rd @ Schalk's Crossing Rd	206	154	151	122	-27%	-21%
Scudders Mill Rd & Dey Rd	697	296	595	231	-15%	-22%
Plainsboro Rd & CR-535	67	167	60	164	-10%	-2%
US-130 @ Dey Rd	341	333	348	255	2%	-23%
Dey Rd & CR-535	458	213	477	177	4%	-17%
NJ-32 @ CR-535	269	234	275	221	2%	-6%
US-130 @ Friendship Rd	330	467	330	483	0%	3%
George's Rd & Kingston Rd	38	18	17	10	-55%	-44%
CR-522 & Kingston Rd	300	203	283	190	-6%	-6%
US-1 @ CR-522	230	179	*	*	*	*
US-1 @ Ridge Rd	362	264	384	294	6%	11%
				Median:	-8%	-19%

* These intersections will be replaced with either grade-separated interchanges or overpasses.

4.3.7 Noise

This section presents the results of the noise monitoring and modeling impact analysis completed for this EIS. For comparison purposes, a screening-level noise modeling analysis was conducted for two US Route 1 improvement alternatives. Both alternatives include widening US Route 1 from four to six lanes; however, one alternative assumes no changes to the existing intersections while the other alternative reduces the number of signalized intersections and constructs five grade-separated interchanges at five of the intersections.

4.3.7.1 Noise Modeling Analysis

This section will describe the noise modeling procedures for evaluating potential noise impacts for sensitive receivers that may be impacted by the widening US Route 1 to six lanes as part of the US Route 1 Widening alternatives (with and without signalization).

4.3.7.1.1 STAMINA 2.0 Noise Modeling

STAMINA 2.0 was used to estimate potential noise impacts for the five redesigned interchanges. The traffic engineer provided the necessary peak hour traffic volumes, vehicle speeds and interchange design information to be used in STAMINA 2.0. The purpose of this modeling analysis was to determine the distance of the 67-dBA-noise contour from the interchange center. Residential receivers near each interchange within the 67-dBA-noise contour were identified as potential impacted receivers.

4.3.7.1.2 FHWA Nomograph Modeling

The FHWA Nomograph Model is based on the FHWA, *Highway Traffic Noise Prediction Model FHWA-RD-77-108, December 1978*. The purpose of the nomograph modeling was to predict Horizon Year 2028 No Action and Build noise levels for the US Route 1 Widening alternatives with and without signalization. Sixteen residential receivers were identified adjacent to the existing US Route 1 alignment. The nomograph modeling was based on peak hour traffic modeling results for 2028 No Action and the two US Route 1 Widening alternatives. Distances from the center of US Route 1 were entered into the model along with: 1) the speed of the vehicles for each vehicle category (automobile, medium truck, and heavy truck); 2) roadway grade; 3) shielding factors; 4) ground attenuation (soft or hard); and 5) barrier height, receptor height and barrier to receptor distance (refer to Appendix D for more detail).

4.3.7.2 Modeling Results

4.3.7.2.1 US Route 1 Signalized Intersection Alternative STAMINA Modeling Results

The STAMINA 2.0 modeling results for the five redesigned intersections indicated that for the US Route 1/Adams Lane/Cozzens Lane interchange and the US Route 1/Finnegans Lane interchange that the 67-dBA noise contour would extend approximately 300 feet from the center of the interchange on either side of US Route 1. For the other redesigned interchanges (US Route 1/Beekman Road/Northumberland Road, US Route 1/New Road and US Route 1/Promenade Boulevard/Route 522) the 67-dBA-noise contour would extend approximately 200 feet from the center of each interchange on either side of US Route 1. Table 4-26 presents the number of potential residential receivers that would be within the 67-dBA-noise contour for each interchange based on aerial photography. One residential receiver would be impacted for three of these interchanges and none would be impacted at the other two interchanges. Since these are not new interchanges, but are only redesigned, the number of potential receivers that would be impacted compared to not redesigning these interchanges should be similar.

Table 4-26
Summary of Noise Modeling Results for Residences
Near the Potential New US Route 1 Interchanges

US Route 1 Redesigned Interchange	Number of Residential Receivers within the 67-dBA Noise Contour (2028)
Cozzens Lane/Adams Lane	0
Finnegans Lane	1
Beekman Road/Northumberland Road	1
New Road	1
Promenade Boulevard/Route 522	0

4.3.7.2.2 US Route 1 Widening Alternatives Nomograph Modeling Results

The nomograph modeling results indicated that during peak AM traffic conditions the No Action alternative traffic volumes and speeds would generate noise levels of 66 dBA or greater within approximately 150 feet from the center of US Route 1 or approximately 150 feet from the edge of US Route 1. There are 16 residential receivers within or close to 150 feet from the edge of US Route 1. Therefore, these residences would most likely experience noise levels that would approach or exceed the 67 dBA NAC. Adding a lane of traffic to both sides of US Route 1 would increase noise levels at 150 feet from the edge of US Route 1 by approximately 2 dBA. This increase in noise level is considered barely perceptible. Both US Route 1 Improvement alternatives would generate a 67-dBA-noise level approximately 200 feet away. Table 4-27 presents the modeling results for the US Route 1 improvement alternatives.

Table 4-27
Summary of Noise Modeling Results
US Route 1 Improvements vs. No Action

	One Hour L_{eq} Noise Levels (dBA)			
Scenario	100 ft	150 ft	200 ft	300 ft
2028 No Action	69	66	65	62
2028 Build (Signalized)	71	68	67	64
2028 Build (Unsignalized)	71	68	67	64

4.3.7.3 Construction Noise Impacts

Construction noise impacts were evaluated based on the steps specified in accordance with FHWA Technical Advisory Memorandum, *Analysis of Highway Construction Noise*, T6160.2, March 13, 1984.

Highway construction activities include use of both mobile and stationary equipment. Mobile equipment such as dozers, scrapers, graders, and haul trucks operate in cyclical manner in which a period of full power is followed by a period of reduced power. Stationary equipment falls into two categories: 1) equipment that operates at a fixed power, such as pumps, compressors and generators; and 2) impact equipment such as pile drivers, jack hammers and pavement breakers. The first group generates a constant background noise level where as the second group generators a much higher noise level, but over a short time period (FHWA, *Special Report Highway Construction Noise: Measurement, Prediction and Mitigation*, 1987). Table 4-20 in Section 4.2.8.3 presents typical maximum noise levels (L_{max}) measured at 50 feet from construction equipment. Maximum noise levels range from 70 dBA for generators to 90 dBA for a mounted impact hammer at 50 feet away.

Highway construction is completed in the following phases:

- Mobilization
- Clearing and grubbing
- Earthwork
- Foundations
- Base Preparation
- Paving and Cleanup

Each construction phase would generate short-term noise impacts for noise sensitive land uses adjacent to construction activity associated with the US Route 1 Widening and Signal Removal alternative. In general, construction noise impacts occur only during daytime working hours of 7:00 a.m. to 7:00 p.m., and should be highest during the clearing and earthwork phases of construction. The noisiest equipment would likely be earthmoving equipment, such as dozers, graders, scrapers and other heavy-duty diesel equipment. Noise levels decrease by 6 dBA for every doubling of distance. It is anticipated that the daytime L_{max} noise levels would not exceed 80 dBA at 150 feet away and the daytime L_{eq} noise level would not exceed 75 dBA at 150 feet away.

4.3.8 Aesthetics

Widening Only

Widening of US Route 1 would not significantly impact the aesthetics of the area or the views currently seen in the area. Widening of the roadway would not make it more visible to receptors, nor would it impede views. From residential locations along US Route 1, views would be relatively unchanged. However, the buffer between a few residences and US Route 1 would be reduced by approximately 10 feet.

Widening and Signal Removal

At Cozzens Lane/Adams lane the residential communities could have views of the grade-separated roadway.

There are no significant views from the Finnegan's Lane intersection that would be impacted by the addition of a grade-separated intersection. The same is true at the Beekman Road/Northumberland Way intersection. There are currently no receptors whose views would be impacted by the grade-separated roadway.

Residential development exists on the east side of US Route 1 and New Road. These receptors would have full view of the grade-separated roadway. This would be a negative impact on their current view of the roadway at-grade.

At the intersection of Promenade Boulevard/Route 522 and US Route 1, a grade-separated intersection would be visible to users of the Islamic Society facilities immediately north of the existing intersection. Although this can be considered a negative impact, a view of the roadway from an establishment along US Route 1 is a common and expected sight.

4.3.9 Known Contaminated Sites

Nineteen Known Contaminated Sites (KCS) listed by the NJDEP Site Remediation Program (SRP) could potentially be impacted by construction of the US Route 1 Widening and Signal Removal alternative. The location of these sites is shown on Figure 3-22 and listed in Table 3-16. The extent of impact to these sites would depend on whether fill or excavation was required. If soil removal were required at a location, the contaminated soil would require special handling and disposal procedures, as it would probably not be suitable for use as fill. If fill were to be added to the site, the potential for disturbance would be decreased.

Consultation with NJDEP SRP would be required to determine exactly how the construction of this alternative would affect KCS within the Route 1 Corridor.

4.3.10 Human Health

4.3.10.1 Air Quality

Air quality is a public health concern associated with the US Route 1 Widening and Signal Removal alternative. Air quality modeling conducted for the project area indicates that this alternative would comply with federal transportation conformity guidelines. The project would not cause or contribute to any new localized carbon monoxide (CO) violations. By adding more capacity to US Route 1 and eliminating signals vehicle speeds and idling times would improve. Consequently, a positive impact would be expected to occur to localized air quality. If the US Route 1 Widening and Signal Removal were implemented, in 2028 CO emissions are expected to be about 21% higher, NO_x about 10% higher, and VOCs about 19% lower than current emissions.

4.3.10.2 Noise

Noise impacts can include annoying noises, which generally cause people to seek quieter environments and can affect the performance of work tasks, and high noise levels that can affect hearing, either temporarily or permanently. Sensitivity to noise depends on the individual, as well as on the frequency of the sound and the length of time a person is exposed. As demonstrated by the noise modeling discussed in Section 4.3.7, the US Route 1 Widening and Signal Removal alternative would not produce noise levels that cause damage to hearing.

4.3.10.3 Water Quality

Increased highway runoff is a primary public health concern related to the US Route 1 Widening and Signal Removal alternative, as runoff may contain harmful contaminants. An increase in runoff would be anticipated to result from the project as an increase in impervious surface would be required for construction of the proposed roadway. The current stormwater system would have to be upgraded to allow for the additional runoff created by the improvements to US Route 1.

4.3.11 Socioeconomics

4.3.11.1Growth-Inducing Effects

Implementation of the US Route 1 Widening and Signal Removal Alternative would increase the capacity of the local and regional road networks. This would increase the population and the level of economic activity that could be accommodated in the local area and the region. If land use regulators and other public officials accept current traffic conditions as the standard, and allow traffic-generating development to continue unchecked, increasing the capacity of the road system would merely increase the total traffic volume that could be accommodated in the local area and the region. If improved capacity were combined with effective control of development, however, traffic conditions could be improved. The potential improvement in traffic conditions from implementation of the US Route 1 Widening and Signal Removal Alternative would not be as great as the potential improvement from implementation of proposed Route 92.

A widened and signal-free US Route 1 would draw traffic from local roads. This would discourage growth of traffic-related business activity on local roads to some degree, and encourage growth on US Route 1. Because US Route 1 would not be a limited access highway, the tendency for growth to concentrate at the new interchanges would be relatively weak.

4.3.11.2 Construction Impacts

Implementation of the US Route 1 Widening and Signal Removal alternative would provide temporary employment, principally for people from outside the local area. The project would stimulate spending in the local area during the construction period.

Construction activity during implementation of either alternative would temporarily interfere with access to businesses along US Route 1.

4.3.11.3 Community Services

Local police, fire companies and rescue squads would provide services on a widened and signal-free US Route 1, as they do on existing US Route 1. Because a widened, signal-free US Route 1 would draw traffic off local roads, it would reduce the time required to respond to emergencies on local roads. The improvement in average response time would not be as great as the reduction caused by construction of proposed Route 92.

Because implementation of the US Route 1 Widening and Signal Removal Alternative would eliminate left turns onto US Route 1, emergency response vehicles would have to travel farther to reach many points on the highway. Under peak traffic conditions, when congestion on the widened, signal-free US Route 1 is projected to be comparable to current congestion, the time required to respond to emergencies at many points on US Route 1 would be longer than under current conditions.

4.3.12 Land Use

4.3.12.1 Direct Impacts

US Route 1 is a long-established, major at-grade highway with linear, principally commercial development along most of its length. Communities and neighborhoods generally do not cross US Route 1. Widening US Route 1 to six lanes and removing traffic signals would not fundamentally alter the character of the highway, nor the character of the adjoining land uses and residential neighborhoods, where they are present. Widening and signal removal would reinforce the character of US Route 1 as a regional business-oriented highway.

Widening and signal removal on US Route 1 would draw regional through-traffic away from local roads to a modest degree. This would make local driving somewhat more amenable and efficient and facilitate alternate forms of transportation, such as walking and bicycle riding. Removal of through traffic from neighborhood centers would improve the quality of life and would tend to strengthen the identification of residents with their communities, while allowing more efficient development designs.

The widening of US Route 1 would occur within the existing right-of-way. Therefore, the US Route 1 Widening Alternative would not have significant impacts on existing land use. The following paragraphs describe potential land use impacts of the five new interchanges included in the US Route 1 Widening and Signal Removal Alternative.

Cozzens Lane-Adams Lane Interchange

It is likely that a new ramp from westbound Adams Lane to northbound US Route 1 would have to cut through the eastern end of the vehicle storage area at Malouf Buick-Pontiac. The ramp would probably pass through the current location of Coppa's Towing and Service Center, and could also impact the BP gas station on US Route 1 north of the existing intersection.

A ramp connecting southbound US Route 1 to Cozzens Lane could pass along the western edge of the parking lot of the Italian-American Social Club of North Brunswick, connecting with Cozzens Lane next to an existing single-family house.

Finnegans Lane Interchange

A new signal-free interchange at Finnegans Lane would probably include a ramp connecting eastbound Finnegans Lane to southbound US Route 1, and the new ramp would probably displace the Exxon gas station in the southwest quadrant of the existing intersection. The same ramp could displace one or two single-family residences on the south side of Finnegans Lane. Construction of ramps connecting northbound US Route 1 with Finnegans Lane could displace one of the catenary towers along the power line easement extending southeast from the existing intersection. A new ramp from southbound US Route 1 to westbound Finnegans Lane would probably pass close to an office building, the Bnai Tikvah temple, and the eastern end of the Indian Head townhouse development, but would not directly interfere with any of these uses.

Beekman Road-Northumberland Way Interchange

Construction of a new signal-free interchange at Beekman Road and Northumberland Way would not interfere with any developed land use, but could remove approximately 6 acres of open land from agricultural use.

New Road Interchange

Construction of a ramp connecting northbound US Route 1 with New Road could have a substantial impact on the Lazy Boy furniture store that opened in 2001 on the east side of US Route 1 north of the existing intersection. The ramp would potentially pass between the store and US Route 1, and could complicate access to the store’s parking lot. A ramp connecting northwest-bound New Road with northbound US Route 1 could also displace two single-family homes on the northeast side of New Road.

Construction of ramps connecting southbound US Route 1 with New Road could displace the Exxon gas station in the southwest quadrant of the existing intersection. These ramps could also displace a single-family home on the west side of US Route 1 southwest of the Exxon Station.

Route 522 Interchange

It is likely that the ramps required for a new US Route 1-Route 522 interchange would be concentrated in the undeveloped southwest and southeast quadrants of the existing intersection. This would have minimal impact on existing developed land uses, but would remove up to 12 acres of land from agricultural use.

4.3.12.2 Consistency with NJ State Development & Redevelopment Plan

The 2001 New Jersey State Development and Redevelopment Plan (State Plan) divides the state into the following planning categories:

- Metropolitan Planning Areas: PA1
- Suburban Planning Areas: PA2
- Fringe Planning Areas: PA3
- Rural Planning Areas: PA4
- Environmentally Sensitive Planning Areas: PA5

The State Plan "anticipates continued growth throughout New Jersey in all Planning Areas." Development is encouraged in PA1 and PA2 and is accommodated in PA3, PA4 and PA5. The State Plan specifies that development is expected to occur, within guidelines, in all planning areas. The State Plan directs that infrastructure investment decisions should encourage growth in areas that are already developed or are currently developing, and should discourage development sprawl into undeveloped areas.

On the State Plan Policy Map, the South Brunswick portion of the US Route 1 corridor is in a Suburban Planning Area (PA2), while the North Brunswick portion is in a Metropolitan Planning Area (PA1). Development is encouraged in both of these planning areas, especially in development centers such as the US Route 1 corridor. Because implementation of the US Route 1 Widening and Signal Removal alternative would do little to facilitate access to undeveloped areas, it would have little impact on "sprawl" development.

4.3.13 Environmental Justice

Potential impacts of the US Route 1 Widening and Signal Removal alternative to residential communities would be largely confined to the areas around the new signal-free interchanges. The analysis below is confined to residential communities near the five potential new interchanges described elsewhere in this document.

4.3.13.1 Minority Residents Near the US Route 1 Interchanges

The percentage of people of Asian descent near the potential new US Route 1 interchanges is essentially the same as in North Brunswick and Middlesex County as a whole and is lower than in South Brunswick as a whole (see Table 3-17 in Section 3.12 and Table 3-20 in Section 3.14). Because they are not disproportionately concentrated in the areas that would be affected by the US Route 1 Widening and Signal Removal Alternative, this alternative would not be anticipated to have disproportionate environmental impact on people of Asian descent.

The percentage of Blacks and African Americans near the potential new US Route 1 interchanges is similar to the percentage in South Brunswick and Middlesex County as a whole, and substantially lower than the percentage in North Brunswick as a whole. Therefore, implementation of the US Route 1 Widening and Signal Removal Alternative would not be anticipated to have disproportionate environmental impacts on Blacks or African Americans.

The percentage of Hispanics near the potential new US Route 1 interchanges is slightly lower than the percentage in South Brunswick as a whole, and is significantly less than the percentages in North Brunswick and Middlesex County as a whole. Therefore, the US Route 1 Widening and Signal Removal Alternative would not be anticipated to have disproportionate environmental impacts on Hispanics.

It is likely that a ramp connecting westbound Adams Lane to northbound US Route 1 would pass through census block 2009 in block group 62.07-2 in North Brunswick. This block has 125 residents of whom 61 percent belong to minority groups. However, the portion of block 2009 through which the ramp would pass is occupied by commercial operations rather than residences. Impact to the residents of the block would be minimal.

A ramp from eastbound Finnegans Lane to southbound US Route 1 could have a direct impact on the only residence in census block 1014 in block group 84.06-1, North Brunswick. This residence has two occupants, both of whom belong to minority groups.

It is possible that a ramp from southbound US Route 1 to Finnegans Lane would pass through census block 1003 in block group 62.04-1 in North Brunswick. This block has 216 residents of whom 80 percent are members of minority groups. It is likely that the ramp would pass near the residences in this block but would not require displacement of any residences.

It is likely that a ramp from eastbound Route 522 to southbound US Route 1 would pass through census block 1012 in block group 84.03-1, South Brunswick. This census block has 10 residents of which 5 are Black or African American and 5 are Asian. The ramp would pass through an undeveloped section of this block and would not impact any residences.

4.3.13.2 Low-Income Residents Near the US Route 1 Interchanges

Census data indicate that the overall financial status of people living near the potential new US Route 1 interchanges is higher than the financial status of Middlesex County residents taken as a whole (see Section 3.14.2). Therefore, implementation of the US Route 1 Widening and Signal Removal would not be anticipated to have disproportionate environmental impacts on low-income people.