

5.3.1.2 Evaluation of the Alternatives

Objective 1: Reduces travel delay and rate of growth in congestion

- a) All of the action alternatives, except the G-series alternatives and the No-Action, would provide for uninterrupted flow of traffic along Route 1 and at least one grade-separated interchange north of Alexander Road for east-west access in the Penns Neck area. In addition, all of the action alternatives except the C and G-series alternatives and Alternative D.2 provide for an ESC road.
- b) All of the action alternatives, except the G-series, would provide significant public benefit in terms of system-wide congestion relief:
 - i. Vehicle Hours of Traveled (VHT) reduced 21% to 45%;
 - ii. VHT under congested conditions reduced 23% to 50%; and
 - iii. Vehicle Miles Traveled (VMT) under congested conditions reduced 11% to 34%.
- c) The G-series alternatives would provide significantly less relief from congestion. In addition, Alternative G.2 would increase VMT under congested conditions.
- d) Compared to the No-Action Alternative, it appears that Alternatives F and F.1 would be the best performers, while the C and G-series alternatives and Alternative D.2 would be the worst performers relative to system-wide congestion relief.
- e) With regard to system-wide congestion relief, it appears that the key components of a successful alternative are the elimination of the Route 1 Penns Neck area traffic signals, maintenance of at least one east-west crossing of Route 1 north of Alexander Road and the provision of an ESC road.

Objective 2: Improves flow of traffic on Route 1

- a) All alternatives, except G.2, would reduce north-south travel time in the AM peak hour, especially in the non-peak direction:
 - i. Northbound travel time in the AM peak hour is reduced 4% to 26%; and
 - ii. Southbound (non-peak direction) travel time in the AM peak hour is reduced 15% to 43%.
- b) Alternative G.2 would increase north-south travel time in the AM peak hour.
- c) Compared to the No-Action Alternative, it appears that Alternatives C and C.1 would be the best performers, while Alternatives G, G.1 and G.2 would be the worst performers relative to reducing north-south travel time.

- d) Alternatives C and C.1 would constrain access to and from Route 1 to the point that less traffic is attracted to using Route 1 than the other action alternatives. As a result, more traffic would remain on roadways that parallel Route 1. This would result in less congestion and better travel times on Route 1.
- e) With regard to north-south travel time, it appears that a key component of a successful alternative is the elimination of the Route 1 Penns Neck area traffic signals which would provide unrestricted flow of traffic on Route 1. This finding is consistent with the previous finding related to reductions in system-wide congestion.

Objective 3: Improves flow of traffic on east-west routes

- a) All alternatives, except C.1 and G.2, would reduce east-west travel time in the AM peak hour from 3% to 31%.
- b) Alternative C would increase east-west travel time between West Windsor and Nassau Street in the vicinity of Washington Road.
- c) Alternatives C.1 and G.2 would increase east-west travel time between West Windsor and Nassau Street in the vicinity of Alexander Road, Washington Road, and Harrison Street.
- d) Compared to the No-Action alternative, reductions in east-west travel time between West Windsor and Nassau Street in the vicinity of Alexander Road, Washington Road and Harrison Street in Princeton Borough would vary by alternative. Alternatives A and D would be the best overall performers, providing the most consistent reduction in east-west travel time to/from all three points. Alternatives G, G.1 and G.2 would be the worst performers relative to reducing east-west travel time.
- e) With regard to east-west travel time, it appears that those alternatives that include a grade-separated east-west connection across Route 1 at both Washington Road (Route 1 in-a-cut) and Harrison Street would be superior to those which include only a grade-separated interchange in the vicinity of Harrison Street.

Objective 4: Reduces intersection delays when crossing Route 1

- a) All of the action alternatives, except the G-series alternatives, would eliminate the Penns Neck area traffic signals and provide for grade-separated through movement of traffic across Route 1 at Harrison Street, Washington Road or both. Although many of the Route 1 interchanges proposed in the alternatives include traffic signals at entrance and exit ramps, under these alternatives, east-west traffic becomes the dominant traffic movement that receives the largest portion of signal cycle green time. This is in stark contrast to existing conditions and conditions that would be present under the G-series

alternatives, which would give Route 1 traffic the greatest amount of signal cycle green time. Consequently, all of the alternatives except the G-series would significantly reduce intersection delays on Washington Road and Harrison Street approaching Route 1.

- i. Intersection delays on east-west approaches under future No-Action conditions are estimated to exceed 16 minutes.
 - ii. For those alternatives that include grade-separated through movement of east-west traffic across Route 1 at Washington Road, Harrison Street, or both, delays would be reduced to 1 minute or less.
- b) Intersection delays on Alexander Road, which provides grade-separated through movement of traffic across Route 1, are largely unaffected by the alternatives.

Objective 5: Ensures an equitable balance of traffic on east-west routes

- a) When considering this objective, it is important to understand that the distribution of traffic on Alexander Road, Washington Road and Harrison Street on both sides of Route 1 will change over time with or without improvements in the Penns Neck area (Existing 2001 vs. No-Action distribution). Although traffic would grow on all east-west routes under the No-Action Alternative, the distribution of two-way traffic west of Faculty Road (Location 1) would shift from Alexander Road and Harrison Street to Washington Road. The distribution of two-way traffic between the NEC rail line and Route 1 (Location 2) would shift from Alexander Road to Washington Road.

	<u>Base Year</u>		<u>No-Action</u>	
	Vol	%	Vol	%
<u>Location 1</u>				
-Alexander Rd	1,736	45%	2,229	40%
-Washington Rd	1,222	32%	2,058	37%
-Harrison St	899	23%	1,231	22%
<u>Location 2</u>				
-Alexander Rd	2,301	59%	2,631	49%
-Washington Rd	1,607	41%	2,670	51%
-ESC Rd	-	-	-	-

- b) All alternatives, except the C and G-series alternatives, would significantly improve access to/from Route 1 at Harrison Street. As such, these alternatives would enhance the function of Harrison Street as an attractive east-west travel corridor. Under these alternatives, the balance of traffic on Alexander Road, Washington Road and Harrison Street west of Faculty (Location 1) would shift from Washington Road to Harrison Street. Alternatives C, C.1, G and G.1 would provide the least variation in distribution compared to the No-Action Alternative; meanwhile, Alternative B.2 would provide the most equal distribution between the three routes (see Section 4.1.8 for more detail)

- c) All alternatives except the C and G-series alternatives and Alternative D.2 would include and ESC road. The ESC road provides an alternative to Washington Road for accessing and crossing Route 1. Consequently, under these alternatives, there would be a significant shift in two-way traffic east of Route 1 between the NEC rail line and Route 1 (Location 2) from Washington Road to the ESC road (see Section 4.1.8 for more detail)

Objective 6: Discourage traffic on residential streets

A number of key travel routes were identified as primarily residential for the purposes of comparing the potential effects of the alternatives relative to this objective. Changes in traffic on these routes is summarized below.

- a) Core area between D&R Canal and NEC rail line:
 - i. All Action Alternatives, except the C and G-series alternatives and Alternative D.1, would decrease traffic on **Lower Harrison Street** between Route 1 and the Canal more than 95%. The C alternatives would increase traffic 10%-11% and the G alternatives would increase traffic 32-41%. Alternative D.1, which intersects with Lower Harrison Street in the vicinity of Logan Drive, would increase traffic on Lower Harrison Street west of Logan Drive 83%.
 - ii. All Action Alternatives, except G, G.1 and G.2, would significantly decrease traffic on **Washington Road in Penns Neck**. Reductions range from 25% (Alt. C.1) to 80% (Alt. E). Alternative D.2 would reduce traffic 9%. Alternatives G and G.1 would increase traffic marginally (2%).
 - iii. Fisher Place under the No-Action alternative becomes a cul-de-sac. Consequently, for modeling purposes, through traffic on **Fisher Place between Fairview Ave and Route 1** under the No-Action Alternative would be zero. Alternatives A, A.2, A.4, and the D and F-series alternatives would increase traffic on Fisher Place.
- b) West of the D&R Canal:
 - i. All Action Alternatives except C, C.1 and G.2, would decrease traffic on **Alexander Road between Faculty Road and Mercer Street**. Reductions range from 4% to 10%. Alternatives C, C.1 and G.2 would increase traffic 1-2%.
 - ii. All Action Alternatives, except C and C.1, would increase traffic on **Upper Harrison Street between Faculty Road and Nassau Street**. Increases range from 14% (Alt. G, G.1 & G.2) to 37% (Alt. F & F.1). Alternatives C and C.1 would decrease traffic less than 2%.
- c) Vicinity of the NEC rail line

- i. All Action Alternatives would decrease traffic on **Alexander Road east of the NEC rail line**. Reductions range from 3% (Alt. G.2) to 31% (Alt. B.2 and F.1).
 - ii. All Action Alternatives, except B and the G alternatives, would decrease traffic on **Wallace Road**. Reductions range from 11% (Alt. F.1) to 43% (Alt. C.1). Alternative B and G.2 would increase traffic 20% and 38%, respectively. Alternatives G and G.1 would increase traffic 4%.
 - iii. All Action Alternatives, except G and G.1, would decrease traffic on **North Post Road**. Reductions range from 2% (Alt. G.2) to 24% (Alt. B.1). Alternatives G and G.1 would increase traffic 4%.
 - iv. All Action Alternatives, except B, B.1 and the G-series alternatives, would be neutral or decrease traffic on **Clarksville Road between North Post Road and CR571**. Reductions range from 2% (Alt. D.2) to 7% (Alt. D). Alternatives B, B.1 and the G-series alternatives would increase traffic on Clarksville Road 5% (Alts. B.1, G & G.1) to 19% (Alt. G.2).
 - v. All Action Alternatives, except B and G.2, would increase traffic on **Bear Brook Road**. Increases range from 2% (Alt. C.1) to 19% (Alt. A.1). Alternatives B and G.2 would decrease traffic 11% and 1%, respectively.
- d) Those Action Alternatives which include a VDC road would generally decrease traffic on Alexander Road east of the NEC rail line, Wallace Road, and North Post Road. These alternatives would also generally increase traffic on Bear Brook Road and Alexander Road between Vaughn Drive and Roszel Road. The VDC road, especially when combined with an ESC road, would provide a competitive north-south roadway connection serving traffic related to Carnegie Center and other developments located east of Route 1.
 - e) Those alternatives that include an ESC road linked directly to Route 1 and Harrison Street via a grade-separated interchange would enhance the function of Harrison Street as an attractive east-west travel corridor. As a result, traffic on Upper Harrison Street would increase and traffic on Washington Road would decrease.
 - f) Alternatives B.2 and C, which include a WSC road between Washington Road and Alexander Road, would increase traffic on Canal Pointe Boulevard. Canal Pointe Blvd combined with a west-side connector road from Alexander Road to Washington Road would provide a parallel roadway that serves local traffic in competition with Route 1.

Objective 7: Discourages heavy truck through movements on local east-west streets

- a) In all cases, heavy trucks would represent less than 7% of total 2-way traffic using east-west roads in the Penns Neck area.

- b) Compared to the No-Action Alternative, the overall change in heavy truck percentages using east-west roads would be less than 2%.

Objective 8 and 9 (merged): Encourage alternative transportation choices, regional use of travel demand management (TDM) strategies; and provide better access and safety for pedestrians and bicyclist and effective transportation options for underserved populations.

- a) All of the action alternatives would include concurrent implementation of a Commute Options package which includes complementary TDM strategies, transit service enhancements and pedestrian and bicycle improvements. Consequently, it is anticipated that all of the action alternatives would encourage the use of non-auto travel modes and improve conditions for pedestrians and bicyclists.

Objective 10: Reduces Route 1 curb cuts and uses collector/distributor roads as appropriate –

- a) Alternatives A.1, A.2, A.3, A.4, E, and F.1 and the D-series alternatives would eliminate curb cuts along Route 1 and would include a frontage road system.
- b) Alternatives A and F and the B, C, and G-series alternatives would eliminate some curb cuts but would not include a frontage road system.
- c) The No-Action Alternative would not eliminate curb cuts or include a frontage road system.

Objective 11: Addresses the needs of emergency response personnel

- a) The A and D-series alternatives and Alternative E would reduce north-south travel time, reduce east-west travel time, and maintain grade-separated through movement of traffic across Route 1 at both Washington Rd and Harrison St. These alternatives would address the needs of emergency response personnel.
- b) The B, C and F-series alternatives and Alternatives G and G.1 would reduce north-south travel time and reduce east-west travel time, but they would not maintain grade-separated through movement of traffic across Route 1 at Washington Rd. These alternatives would only partially address the needs of emergency response personnel.
- c) The No-Action Alternative and Alternative G.2 would not address the needs of emergency response personnel.

5.3.2 Potential Impacts to the Natural Environment

A series of four objectives were used to assess the performance of the alternatives relative to potential impacts to the natural environment in the Penns Neck area. Tables 5-4, 5-5 and 5-6 present the performance "grades" given to each alternative for each objective and the back-up data and information used to derive the performance grades. An explanation of the objectives, performance measures and performance scales, as well as a narrative evaluation of the alternatives relative to the objectives, are presented below.

5.3.2.1 Objectives, Performance Measures, and Performance Scales

The performance measures and performance scales for each objective are presented below.

Objective 1: Protect wetlands and avoid habitat fragmentation – The measures used to assess performance relative to this objective include the following:

- a) Potential changes to aquatic habitat (wetlands and water bodies), which includes:
 - Total acres of permanent disturbance;
 - Percent reduction in study area wetlands;
- b) Potential changes to upland vegetation habitat, including acres of permanent disturbance to:
 - upland forest;
 - agricultural fields; and
 - landscaped lawn.
- c) Potential for habitat fragmentation.
- d) Potential impacts to threatened and endangered species.

Measure 1a – potential changes to aquatic habitat, permanent wetlands disturbance - the performance scale for this measure includes: ***Best***, which represents less than 0.5 acres of permanent wetlands disturbance; ***Good***, which represents between 0.5 and 1.0 acres of disturbance; and ***Poor***, which represents greater than 1.0 acres of disturbance. In addition, data related to the percent reduction in study area wetlands and acres of aquatic habitat shading have been quantified and are presented.

Measure 1b - potential changes to upland vegetation habitat – the performance scale for this measure ranges from ***Best***, which represents less than 1.0 acre of permanent disturbance to ***Poor***, which represents greater than 6.0 acres of disturbance.

Measure 1c - potential for habitat fragmentation – the performance scale for this measure includes the following:

YES – The alignment would impact or fragment a wetland and/or area of contiguous upland habitat that currently supports commonly occurring species such as: whitetail deer, gray squirrel and painted turtle. Wildlife species utilizing this area may be forced to relocate permanently and/or a potential travel route would be severed, thereby limiting movement of certain species.

SOME – The alignment would impact a wetland or upland habitat which supports commonly occurring species as described above; however, the impact would occur on the periphery of the habitat, in an isolated area, or in a habitat not considered high quality wildlife habitat due to limited shelter or continual occupation by humans and machines (e.g., an agricultural field or non-contiguous upland forest). Remaining adjacent habitat would continue to support existing wildlife populations.

NO – The alignment would occur within or adjacent to existing development in areas currently utilized abundantly by humans and/or in an area that provides low quality wildlife habitat, such as disturbed/cleared areas, athletic field or landscaped lawn.

Measure 1d notes the documented presence or absence of Federal and State threatened or endangered species and designated critical habitat known to be located in or near the study area. The scale for this measure is **YES/NO**.

Objective 2: Protect against flooding and encourage groundwater recharge – The measures used to assess performance relative to this objective include the following:

- a) Total acres of permanent floodplain disturbance and percent reduction in study area floodplains.
- b) Potential reduction in study area groundwater recharge capability, including total acres of new impervious surface, assuming alignment three for the VDC road which has the most impervious surface; and percent reduction in total study area groundwater recharge capability.
- c) Whether a stormwater management plan to control the volume and rate of runoff is required by statute or regulation.

The performance scale for **Measure 2a** ranges from **Best**, which represents less than 1.0 acre of permanent disturbance, to **Poor**, which represents greater than 6.0 acres of disturbance. In addition, data related to the percent reduction in study area floodplains is presented.

Given the nature of the data, no performance scale was developed for **Measure 2b**. Instead **raw data** is presented for total acres of new road-related impervious surface and percent reduction in study area groundwater recharge capability. For additional reference, Table 2B includes the calculated reduction in groundwater recharge potential expressed in millions of gallons per year (mgv).

Finally, **Measure 2c** notes whether, in accordance with NJDEP Flood Hazard Area Control regulations, a stormwater management plan to control the volume and rate of

runoff would be required for all action alternatives. The scale for this measure is **YES/NO**.

Objective 3: Preserve/improve water quality in the Millstone River watershed and D&R Canal – The measures used to assess performance relative to this objective include the following:

- a) *Relationship of alternative to stream corridor buffer guidelines* – The action alternatives were reviewed relative to various guidelines for maintaining effective stream corridor buffers as defined by the Center for Watershed Protection and the NJDEP.
- b) *Stormwater management facilities in place to control the volume, rate and quality of runoff from existing roads* – Existing use of stormwater management facilities was noted in relationship to existing study area roads.
- c) *Potential pollutant impact from existing road surfaces* – Given the relationship between volume of traffic and pollutant loading from road-related impervious surfaces, change in two-way daily traffic on existing east-west roadways in the core study area was used to assess potential change in pollutant loading from existing roads.
- d) *Potential pollutant impacts from new roads* – Future concentrations of select pollutants common to road-related stormwater runoff were estimated and compared to State Surface Water Quality Standards for FW2-NT water bodies.
- e) *Stormwater management plan to ensure stormwater discharge meets state water quality standards required by statute/regulation* – Requirement of stormwater management planning to ensure future water quality was noted in reference to each of the alternatives.

Measure 3a – The performance scale for measure 3a is **YES/NO**. **YES** – indicates that the alternative meets or exceeds guidelines for maintaining an effective stream corridor buffer as defined by the Center for Watershed Protection and the NJDEP. **NO** – indicates that minimum guidelines have not been met.

Measure 3b – The performance scale for measure 3b is **YES/NO**. **YES** – indicates that stormwater management facilities are in place to control the volume, rate and quality of runoff from existing roads. **NO** – indicates that there are no stormwater management facilities in place to control the volume, rate and quality of stormwater runoff from existing roads.

Measure 3c – The performance scale for measure 3c ranges from **BEST**, which represents greater than a 30% reduction in traffic, to **POOR**, which represents greater than a 15% increase in traffic on existing roads.

Measure 3d – The performance scale for measure 3d ranges from **BEST**, which represents a post-discharge pollutant concentration less than 60% of State Surface Water Quality Standards, to **POOR**, which represents a post-discharge pollutant

concentration in excess of 81% of water quality standards. In addition, there is a special symbol (solid circle with an up arrow) which indicates that water quality standards may be exceeded. For the purpose of this analysis, pollutant levels of 81-100% of water quality standards are considered to be approaching the standard. Finally, data on a variety of other potential pollutants, for which there is no corresponding State Surface Water Quality Standards, are included for reference in the data table.

Measure 3e – The performance scale for measure 3e is **YES/NO**. **YES** – indicates that a stormwater management plan to control the volume, rate and quality of stormwater runoff is required by statute or regulation. **NO** – indicates that no such plan is required.

Objective 4: Consider impacts to underlying geological conditions – The measure used to assess performance relative to this objective is the volume of rock material that would have to be excavated and removed to accommodate construction of Route 1 in-a-cut.

Given the nature of **Measure 4a**, no performance scale was created. Instead, **raw data** is presented.

Objective 5 - Meet Federal and State air quality standards – the measures used to assess performance relative to this goal/objective include the following:

- a) Complies with regional air quality protection procedures based on MPO air quality conformity analysis; and
- b) Complies with the Federal 8-hour Carbon Monoxide (CO) standard at area intersections.

Measure 5a – considers the potential impact of the alternatives on regional air quality. In accordance with federally-mandated procedures, a Penns Neck area improvement was included and assessed as part of the Delaware Valley Regional Planning Commission's air quality conformity analysis. A **YES/NO** scale was used for this measure. **YES** indicates that a Penns Neck area improvement would comply with regional air quality protection requirements. **NO** indicates it would not comply.

Measure 5b – considers the potential localized air quality impacts from the alternatives and determines whether it complies with the Federal air quality standard for Carbon Monoxide (CO). In accordance with FHWA and USEPA guidance and regulations, an intersection "hot spot" analysis was conducted to determine if CO concentrations at the three worst performing intersections under each series of alternatives exceeded the Federal air quality standard for CO.

Table 5-5 includes data for the highest 8-hour CO concentration at the single worst performing intersection under each series of alternatives. CO concentrations at the other analyzed intersections were below the "worst case" intersection presented in the

table. The 8-hour CO air quality standard is nine parts per million (9 ppm). This standard is noted in the Table 5-5 for reference and comparison purposes.

The performance scale for this measure is *YES/NO*. *YES* indicates that CO levels would be below the Federal air quality standard. *NO* indicates that CO levels would exceed the air quality standard. Note that while CO concentrations were calculated for the three worst intersections under each series of alternatives, only data for worst case intersection for each series is reported in the tables.

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TABLE 5-4: Potential Impacts to the Natural Environment

PERFORMANCE SCALES:		SCALE FOR SUBJECTIVE 1b	SCALE FOR OBJECTIVE 1b & 2a	SCALE FOR OBJECTIVE 3b	SCALE FOR OBJECTIVE 3d
		Acres of disturbance	Acres of disturbance	Decreases Traffic Increases Traffic	Post discharge concentration as % of WQ standard
		Best Good Poor	Best Better Good Fair Poor	Best Better Good Fair Poor	Best Good Poor Exceeds Std.
		<0.5 0.5 - 1.0 >1.0	<1 1-2 2-4 4-6 >6	>30% 15-30% 0-15% 1-15% >15%	<60% of Std. 60-80% of Std. 81-100% of Std. >100%

NO Action	Route 1 in-d-cut					Route 1 at-grade					Route 1 in-d-cut					Route 1 at-grade			
	A	A.1	A.2	A.3	A.4	B	B.1	B.2	C	C.1	D	D.1	D.2	E	F	F.1	G	G.1	G.2
1. Protect wetlands and avoid habitat fragmentation																			
a) Potential changes to aquatic habitat (wetlands & waterbodies)																			
Total acres of permanent wetlands disturbance	0.12%	0.12%	0.12%	0.12%	0.12%	0.13%	0.13%	0.13%	0.02%	0.02%	0.08%	0.06%	0.03%	0.07%	0.12%	0.12%	0.04%	0.04%	0.04%
Percent reduction in study area wetlands																			
b) Potential changes to upland vegetation habitat																			
Acres of permanent upland forest disturbance																			
Acres of permanent agricultural field disturbance																			
Acres of permanent landscaped lawn disturbance																			
c) Potential for habitat fragmentation	YES	YES	YES	YES	YES	YES	YES	YES	SOME	NO	YES	YES	SOME	YES	YES	YES	NO	NO	NO
d) Potential impacts to threatened & endangered species:																			
May impact documented Federal threatened & endangered species ¹	YES/NO	YES/NO	YES/NO	YES/NO	YES/NO	YES	YES	YES	SOME	NO	YES	YES	SOME	YES	YES	YES	NO	NO	NO
May impact designated critical habitat for Federal threatened & endangered species	YES/NO	YES/NO	YES/NO	YES/NO	YES/NO	YES	YES	YES	SOME	NO	YES	YES	SOME	YES	YES	YES	NO	NO	NO
May impact State threatened & endangered species ²	YES/NO	YES/NO	YES/NO	YES/NO	YES/NO	YES	YES	YES	NO	NO	YES	YES	NO	YES	YES	YES	NO	NO	NO
2. Protect against flooding and encourage groundwater recharge																			
a) Acres of permanent floodplain disturbance	0.44%	0.44%	0.44%	0.44%	0.44%	0.50%	0.50%	0.46%	0.12%	0.12%	0.44%	0.44%	0.44%	0.37%	0.44%	0.44%	0.12%	0.12%	0.06%
Percent reduction in study area floodplains																			
b) Potential reduction in study area groundwater recharge capability (worst case VDC 3)	28.18	29.99	29.03	28.3	29.29	24.66	29.84	32.77	15.05	12.49	27.84	27.51	23.12	25.46	28.19	30.22	8.59	9.44	3.24
Increase in impervious surface (acres)	1.42%	1.58%	1.48%	1.45%	1.51%	1.44%	1.52%	1.74%	0.93%	0.78%	1.44%	1.43%	1.13%	1.42%	1.41%	1.55%	0.23%	0.27%	0.16%
Percent reduction in study area recharge capability																			
c) Stormwater management plan to control volume and rate of runoff required by statute/regulation	YES/NO	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
3. Preserve/improve water quality in the Millstone River watershed and DAR Canal																			
a) Meets or exceeds stream corridor buffer guidelines	YES/NO	YES	YES	YES	YES	YES	YES	YES	N/A	N/A	YES	YES	N/A	YES	YES	YES	N/A	N/A	N/A
b) Stormwater management facilities in place for existing roads	YES/NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
c) Potential pollutant impacts from existing road surfaces																			
Potential change in pollutant loading from existing roads (increased/decrease in traffic Existing vs. Alt)																			
Washington Rd in Penns Neck																			
Washington Rd b/w Route 1 and DAR Canal																			
Lower Harrison St b/w Route 1 and DAR Canal																			
Alexander Rd b/w Canal and Route 1																			
Alexander Rd b/w Vaughn Dr and Rozell Rd																			
d) Potential pollutant impacts from new road surfaces																			
Parameters w/ State Water Quality (SWQ) Standards:																			
Suspended Solids																			
Total Nitrate																			
Total Phosphorus																			
Chloride																			
Lead																			
Cadmium																			
Chromium																			
Acres of new road-related impervious surface	28.18	29.99	29.03	28.3	29.29	24.66	29.84	32.77	15.05	12.49	27.84	27.51	23.12	25.46	28.19	30.22	8.59	9.44	3.24
e) Stormwater management plan to ensure stormwater discharge meets state water quality standards required by statute/regulation	YES/NO	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
4. Consider impacts to underlying geological conditions																			
Volume of rock to be removed (cubic yards)	48,400	48,400	48,400	48,400	48,400	0	0	0	0	0	2,87,700	48,400	87,700	48,400	48,400	48,400	0	0	0
5. Meet Federal and State air quality standards	YES/NO	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
a) Complies with regional air quality protection procedures based on MPO air quality conformity analysis	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
b) Complies with Federal 8-hour Carbon Monoxide standard at study area intersections	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

NOTES:

1 - According to the US Fish and Wildlife Service, "...except for an occasional transient Bald Eagle, no other federally listed or proposed endangered or threatened flora or fauna under service habitat is in the vicinity of the vicinity of the proposed project site." It should be noted, that there have been several citizen reports of Bald Eagle sightings in the vicinity of Carnegie Lake. This is consistent with the increase in nesting and wintering Bald Eagle population in New Jersey that has trended over the past two decades. According to officials from NUDEP Endangered and Nongame Species Program (ENSP) and NJ Audubon Society, there are no known human impacts of Bald Eagles in Mercer County. In addition, officials from ENSP advised that if there was a Bald Eagle nest in the vicinity of Carnegie Lake, given the nature of human activity in the area, the ENSP would be aware of such an occurrence.

2 - A Long-eared Owl (State Threatened Species) has been reported and documented as present in the wooded area of the Sarnoff property in the vicinity of the Little Bear Brook.

TABLE 5-5: Potential Impacts to the Natural Environment - Data 1 (Natural Ecosystems)

	Existing Condition	NO Action	Route 1 In-a-cut					Route 1 at-grade					Route 1 In-a-cut					Route 1 at-grade		
			A	A.1	A.2	A.3	A.4	B	B.1	B.2	C*	C.1*	D	D.1	D.2*	E	F	F.1	G*	G.1*
1. Impacts to wetlands and habitat																				
a) Potential changes to aquatic habitat (assumes VDC3)																				
Acres of permanent wetland disturbance																				
Little Bear Brook																				
Milestone River																				
TOTAL																				
Total acres of wetlands in study area																				
Percent reduction in study area wetlands																				
b) Potential changes to upland vegetation habitat (assumes VDC3)																				
Acres of permanent upland forest disturbance																				
Acres of permanent agricultural field disturbance																				
Acres of permanent landscaped lawn disturbance																				
TOTAL																				
Total acres of floodplains in study area																				
Percent reduction in study area floodplains																				
b) Potential changes to study area groundwater recharge capability (w/worst case VDC 3)																				
Increase in impervious surface																				
Existing study area groundwater recharge capability – millions of gallons per year (mg/y)																				
Reduction in recharge capability (mg/y)																				
Percent reduction in study area recharge capability																				
4. Impacts to underlying geology																				
Volume of rock to be removed (cubic yards)																				
5. Highest 8-hour Carbon Monoxide (CO) concentrations - parts per million (ppm)																				
NOTE: 8-hour CO ambient air quality standard is 9 ppm																				
Worst performing intersection in each alternative series:																				
Route 1 / Samoff driveway																				
Alexander Road / Vaughn Drive																				
Route 1 / Washington Road																				

*Assumes constrained development on Samoff property

TABLE 5-6: Potential Impacts to the Natural Environment - Data 2 (Water Quality)

Existing Condition	NO Action	Route 1 In-s-cut					Route 1 at-grade					Route 1 In-s-cut					Route 1 at-grade		
		A	A.1	A.2	A.3	A.4	B	B.1	B.2	C*	C.1*	D	D.1	D.2	D.3	D.4	G*	G.1*	G.2*
3. Preserve/improve water quality in the Millstone River watershed and D&R Canal																			
a) Performance relative to stream corridor buffer guidelines																			
Minimum distance to Millstone River and/or Little Bear Brook at closest point (feet)		169	169	169	169	169	169	169	169	N/A	N/A	169	169	N/A	N/A	N/A	N/A	N/A	N/A
Minimum distance to 100-year flood plain line at closest point (feet)		100	100	100	100	100	100	100	100	N/A	N/A	100	100	N/A	N/A	N/A	N/A	N/A	N/A
Stream corridor/buffer crossing performance criteria:																			
- minimizes crossing width	YES/NO	YES	YES	YES	YES	YES	YES	YES	YES	N/A	N/A	YES	YES	N/A	N/A	N/A	N/A	N/A	N/A
- minimizes crossing angle	YES/NO	YES	YES	YES	YES	YES	YES	YES	YES	N/A	N/A	YES	YES	N/A	N/A	N/A	N/A	N/A	N/A
- permits passage of 100-year flood event	YES/NO	YES	YES	YES	YES	YES	YES	YES	YES	N/A	N/A	YES	YES	N/A	N/A	N/A	N/A	N/A	N/A
- distance from nearest adjacent crossing (feet)	YES/NO	1400	1400	1400	1400	1400	1400	1400	1400	N/A	N/A	1400	1400	N/A	N/A	N/A	N/A	N/A	N/A
c) Potential pollutant impacts from existing road surfaces																			
Traffic on existing study area roads (2028 2-way Average Daily Traffic)																			
Washington Rd in Penna Neck		20,100	30,900	115,200	145,500	145,500	145,500	145,500	145,500	145,500	145,500	145,500	145,500	145,500	145,500	145,500	27,500	27,500	24,500
Washington Rd b/w Route 1 and D&R Canal		17,500	25,700	115,200	145,500	145,500	145,500	145,500	145,500	145,500	145,500	145,500	145,500	145,500	145,500	145,500	25,200	25,200	16,100
Lower Harrison St b/w Route 1 and D&R Canal		12,100	16,500	115,200	145,500	145,500	145,500	145,500	145,500	145,500	145,500	145,500	145,500	145,500	145,500	145,500	19,600	19,600	20,000
Alexander Rd b/w Canal and Route 1		20,400	27,300	115,200	145,500	145,500	145,500	145,500	145,500	145,500	145,500	145,500	145,500	145,500	145,500	145,500	26,200	26,200	29,600
Alexander Rd b/w Vaughn Dr and Roszel Rd		25,900	34,700	115,200	145,500	145,500	145,500	145,500	145,500	145,500	145,500	145,500	145,500	145,500	145,500	145,500	37,600	37,600	38,700

3d) Potential pollutant impacts from new road surfaces			Alternative A.1						Alternative B.2						Alternative C						Alternative D																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
			Post discharge Concentration (mg/l)			Percent of WQ Standard			Post discharge Concentration (mg/l)			Percent of WQ Standard			Post discharge Concentration (mg/l)			Percent of WQ Standard			Post discharge Concentration (mg/l)			Percent of WQ Standard																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
			No BMPs	Low	High	Low	High	No BMPs	Low	High	Low	High	No BMPs	Low	High	Low	High	No BMPs	Low	High	Low	High	No BMPs	Low	High	Low	High																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
Pollution concentration range [existing concentration + (discharge from new road surfaces x BMP reduction factor)]			Low = low range of BMP effectiveness			High			SWQ Std.			Existing																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
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Suspended Solids			7			40			120.74			32.89			10.93			82%			27%			180.28			47.12			13.82			118%			35%			88.48			25.81			10.14			65%			25%			104.59			29.25			10.42			73%			26%																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
Total Nitrate			10			1.79			1.56			1.49			1.36			15%			14%			1.66			1.55			1.35			16%			14%			1.71			1.66			1.57			17%			16%			1.6			1.54			14%			15%			14%																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
Total Phosphorus			0.1			0.05			0.45			0.31			0.16			310%			160%			0.66			0.45			0.22			450%			220%			0.34			0.24			0.13			240%			180%			0.39			0.27			0.15			270%			150%																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
Chloride			250			20			22.64			22.64			22.64			9%			9%			0.28			28.37			28.37			28.37			11%			11%			22.85			22.85			22.85			9%			9%			22.47			22.47			22.47			9%			9%																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
Lead			0.005			0.001			0.09			0.03			0.003			600%			60%			0.14			0.05			0.004			1000%			80%			0.07			0.02			400%			40%			0.08			0.03			0.002			600%			40%			20%																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
Cadmium			0.01			0.00005			0.01			0.005			0.003			50%			30%			0.01			0.007			0.004			70%			40%			0.01			0.004			0.002			40%			20%			0.01			0.004			0.002			40%			20%																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
Chromium			0.16			0.005			0.01			0.01			0.01			6%			6%			0.02			0.01			0.01			6%			40%			0.01			0.01			0.01			6%			6%			0.01			0.01			0.01			6%			6%																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
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3d) Potential pollutant impacts from new road surfaces	SWQ Std.	Existing	Alternative E						Alternative F.1						Alternative G.1					
			Post discharge Concentration (mg/l)		Percent of WQ Standard		Low	High	Post discharge Concentration (mg/l)		Percent of WQ Standard		Low	High	Post discharge Concentration (mg/l)		Percent of WQ Standard		Low	High
			No BMPs	Low	High	Low	High		No BMPs	Low	High	Low	High		No BMPs	Low	High	Low	High	
Pollution concentration range [existing concentration + (discharge from new road surfaces x BMP reduction factor)]																				
Low = low range of BMP effectiveness																				
High = high range of BMP effectiveness																				
Parameters w/State Water Quality Standards (mg/l):																				
Suspended Solids	40	7	106.94	29.02	10.68	75%	27%	117.74	32.14	10.74	80%	27%	6.98	6.64	6.57	17%	15%			
Total Nitrate	10	1.79	1.64	1.58	1.48	16%	15%	1.54	1.47	1.34	15%	13%	1.68	1.68	1.67	17%	17%			
Total Phosphorus	0.1	0.05	0.40	0.29	0.15	280%	150%	0.44	0.3	0.16	300%	160%	0.05	0.05	0.05	50%	50%			
Chloride	250	20	23.00	23.00	23.00	9%	9%	22.32	22.32	22.32	9%	9%	19.09	19.09	19.09	8%	1%			
Lead	0.005	0.001	0.08	0.03	0.002	600%	40%	0.09	0.03	0.003	600%	60%	0.002	0.001	0.001	20%	2%			
Cadmium	0.01	0.0005	0.007	0.004	0.003	40%	30%	0.01	0.005	0.003	50%	30%	0.006	0.006	0.006	6%	2%			
Chromium	0.16	0.005	0.01	0.01	0.01	6%	6%	0.01	0.01	0.01	6%	6%	0.005	0.005	0.005	3%	2%			
Other parameters: (data table only)																				
Volatile Suspended Solids	5		28.8	9.9	5.23			30.95	10.2	5.01			4.99	4.75	4.69					
Total Volatile Solids	32		66.72	35.93	27.73			71.07	34.8	25.73			31.25	30.24	29.99					
Total Kjeldahl Nitrogen	1.22		1.86	1.86	1.86			1.87	1.87	1.87			1.15	1.15	1.15					
Biological Oxygen Demand	10		12.91	12.03	8.58			12.74	11.76	8.85			9.5	9.48	9.37					
Chemical Oxygen Demand	0.163		0.391	0.317	0.21			0.423	0.3619	0.21			0.68	0.644	0.51					
Zinc	0.63		0.22	0.18	0.13			0.22	0.18	0.12			0.15	0.15	0.15					
Iron	0.034		0.08	0.06	0.05			0.08	0.06	0.05			0.07	0.06	0.06					

* assumes constrained development on the Samoff site

acres. This alternative, which includes a WSC road between Washington Road and Alexander Road, disturbs the most agricultural lands located west of Route 1 on Princeton University-owned land.

- (c) The best performing alternatives relative to disturbance of landscaped lawn/athletic fields would be the G-series alternatives with 0.98 acres of disturbance. The worst performing alternatives would be B and B.1 with 9.44 acres of disturbance.
- iv. The A, B and F-series alternatives and Alternatives D, D.1 and E would impact the Little Bear Brook wetland corridor and the adjacent upland forest. The location of the ESC road through these areas would sever potential north-south travel routes of land and water animals using these resources. In order to maintain these routes, wildlife species would be required to cross the roadway or travel beneath the bridge span or culvert constructed over Little Bear Brook. In addition, these alternatives would impact wetland and upland forest areas in the vicinity of the D&R Canal at Harrison Street. As such, these alternatives would have the most potential for habitat fragmentation.
- v. Alternative C, which includes a WSC road between Washington Road and Alexander Road that bisects agricultural fields located west of Route 1 and south of Washington Road, would result in some habitat fragmentation.
- vi. Alternative D.2, which includes a WSC road connecting Route 1 to Harrison Street in the vicinity of the D&R Canal, would impact wetland and upland forest areas near the Canal at this location. Consequently, this alternative would result in some habitat fragmentation.
- vii. Because of the limited nature and location of improvements anticipated as part of Alternative C.1 and the G-series alternatives, these alternatives would not be likely to fragment wildlife habitat.
- viii. According to the U.S. Fish and Wildlife Service, "...except for an occasional transient Bald Eagle, no other federally listed or proposed endangered or threatened species are known to occur within the vicinity of the proposed project site."
- ix. According to the New Jersey Department of Environmental Protection, the presence of a long-eared owl, a State threatened species, has been documented in the upland forest adjacent to the Little Bear Brook on the Sarnoff property. All of the action alternatives, except the C and G-series alternatives and Alternative D.2, include an ESC road which would disturb this area. Consequently, these alternatives would potentially impact the habitat of the long-eared owl. Consultation with NJDEP on this potential impact is ongoing.

Objective 2: Protects against flooding and encourages stormwater recharge

a) Floodplains

- i. There are 821.2 acres of floodplains in the primary study area.

- ii. All of the Action Alternatives would result in permanent flood plain disturbance ranging from 0.63 acres (Alt. G.2) to 4.1 acres (Alts. B & B.1). This represents a reduction in study area flood plains of between 0.08% to 0.5%.
 - (a) The best performing alternatives relative to flood plain disturbance would be the C-series alternatives G and G.2 which impact less than 1 acre of floodplains.
 - (b) The worst performers would be A.3, A.4, the B-series and F-series alternatives which impact approximately 4 acres of flood plains.

b) Groundwater recharge.

- i. The study area contains a total of 3061 acres of land. Current groundwater recharge capability within the study area is estimated to be 530.5 million gallons per year.
- ii. All of the action alternatives would result in 3.24 acres (Alt. G.2) to 32.77 acres (Alt. B.2) of new road-related impervious surface in the study area.
 - (a) Alternative G.2, which would include the lowest level of transportation improvement, would add the least impervious surface (3.24 acres). This increase would be associated with the widening of Route 1 through the Penns Neck area to include safety shoulders.
 - (b) Alternative B.2, which contemplates the most extensive combination of alternative components including an ESC road, a WSC road between Route 1 and Washington Road, a WSC road between Washington Road and Alexander Road and a VDC road, would add the most impervious surface (32.77 acres).
- iii. New road-related impervious surfaces would result in a net reduction in total study area groundwater recharge capability of 0.87 (Alt. G) to 9.21 (Alt. B.2) million gallons per year. This represents a 0.16% to 1.74% reduction in annual groundwater recharge potential and is roughly equivalent to the annual water usage of approximately 4 to 40 single-family 4-bedroom homes.

Objective 3 - Preserves/improves water quality in the Millstone River watershed and D&R Canal

a) Relationship of alternatives to stream corridor buffer guidelines.

- i. The component of the Action Alternatives most related to stream corridor buffer concerns is the ESC road. The A, B and F-series alternatives and

Alternatives D, D.1 and E include an ESC road. The No-Action and C and G-series alternatives and Alternative D.2 do not include an ESC road.

- ii. All of the Action Alternatives that include an ESC road would maintain at least a 100-foot buffer from the 100-year flood plain. In addition, at its closest point, the alignment of ESC 1 and ESC 2 would be located approximately 170 feet from the Millstone River. At its closest point, the alignment of ESC 3 would be located approximately 260 feet from the Millstone River. These distances exceed minimum recommended buffer distance guidelines. Finally, with regard to stream corridor/buffer crossing performance criteria, the ESC road crossing of the Little Bear Brook would meet or exceed suggested performance criteria for stream crossing angle, elevation and frequency.
 - iii. All three ESC road alignments would cross the Little Bear Brook at close to a right angle, which would minimize disturbance of the stream corridor and buffer.
 - iv. All three ESC road crossings of the Little Bear Brook would be sized to pass a 100-year flood event.
 - v. All three ESC road alignments would cross the Little Bear Brook approximately 1400 feet north of the existing Washington Road crossing. This distance would exceed the minimum suggested performance criteria of one crossing every 1000 feet.
- b) Stormwater management facilities - These facilities are put in place to control the volume, rate and quality of runoff from existing roads:
- i. With the exception of the stormwater management facilities in place to address stormwater runoff from the Route 1/Alexander Road interchange, there are presently no stormwater management facilities in place to control the volume, rate and quality of stormwater runoff from Alexander Road between Vaughn Drive and the D&R Canal, Washington Road between the NEC rail line and the canal, or Lower Harrison Street between Route 1 and the canal.
- c) Potential pollutant impacts from existing road surfaces.
- i. Under the No-Action Alternative, traffic increases would occur throughout the core study area. Specifically, daily traffic on Washington Road from the NEC rail line to the D&R Canal would increase 47-54%. Traffic on Lower Harrison Street would increase 36%; and traffic on Alexander Road between Vaughn Drive and the D&R Canal would increase 34%.
 - ii. Because there are presently no stormwater management facilities in place to control the quality of stormwater runoff from these roads, as traffic increases, pollutants contained in runoff from these roads would be expected to increase, thereby increasing pollutant levels in local water bodies.

- iii. All of the action alternatives would change local traffic and circulation patterns.

(a) Washington Road in Penns Neck

- (1) Under all of the action alternatives except the C and G-series alternatives and Alternative D.2, traffic would decrease 24-65% compared to existing conditions. As such, pollutants contained in runoff from Washington Road in Penns Neck would be expected to decrease, thereby decreasing pollutant levels in local water bodies.
- (2) Under the C and G-series alternatives, traffic would increase 18-37% from existing conditions. Pollutants contained in runoff from Washington Road in Penns Neck would be expected to increase, thereby increasing pollutant levels in local water bodies.
- (3) Under Alternative D.2, traffic would increase by 43% from existing conditions. Pollutants contained in runoff from Washington Road in Penns Neck would be expected to increase, thereby increasing pollutant levels in local water bodies.

(b) Washington Road between Route 1 and the D&R Canal

- (1) Under Alternatives A, A.1, A.3, A.4, C.1, D, D.1, D.2, E and F.1, traffic would increase 2-15% compared to existing conditions. Under Alternatives C, G and G.1 traffic would increase 44-49%. Under each of these alternatives, pollutants contained in runoff from Washington Road between Route 1 and the D&R canal would be expected to increase, thereby increasing pollutant levels in area water bodies.
- (2) Under Alternatives A.2, F, G.2 and the B-series alternatives, traffic would decrease 2-52% compared to existing conditions. Under these alternatives, pollutants contained in runoff from Washington Road between Route 1 and the canal would be expected to decrease, thereby decreasing pollutant levels in local water bodies.

(c) Lower Harrison Street

- (1) Under all of the action alternatives, except D.1 and the C and G-series alternatives, traffic would decrease approximately 96% compared to existing conditions. As such, pollutants contained in runoff from Lower Harrison Street would be expected to decrease, thereby decreasing pollutant levels in local water bodies.

- (2) Under the C and G-series alternatives, traffic would increase 42-65% compared to existing conditions. Under Alternative D.1, traffic would increase approximately 117% compared to existing conditions. Under these alternatives, pollutants contained in runoff from Lower Harrison Street would be expected to increase, thereby increasing pollutant levels in local water bodies.

(d) Alexander Road between Vaughn Drive and the D&R Canal

- (1) Under all of the action alternatives, traffic would increase 16-55% compared to existing conditions. As such, pollutants contained in runoff from Alexander Road between Vaughn Drive and the canal would be expected to increase, thereby increasing pollutant levels in local water bodies.

d) Potential pollutant impacts from new roads (pollutants with corresponding State Surface Water Quality Standards).

- i. **Suspended Solids, Total Nitrate, Chloride, Lead, Cadmium and Chromium** – All of the “representative” alternatives (Alts. A.1, B.2, C, D, E, F.1 and G.1) would result in post-discharge pollutant concentrations below State Surface Water Quality Standards for Suspended Solids, Total Nitrate, Chloride, Lead, Cadmium and Chromium.
- (a) By comparing the levels of new road-related impervious surface associated with each of the other alternatives, it can be inferred that the remaining action alternatives would also result in post-discharge pollutant levels below State standards for these pollutants.
- ii. **Total Phosphorus** – All of the “representative” alternatives except G.1 would result in post-discharge pollutant concentrations that approach or exceed State Surface Water Quality Standards for Total Phosphorus.
- (a) By comparing the levels of new road-related impervious surface associated with each of the other alternatives, it can be inferred that the remaining A, B, C, D and F-series alternatives would also result in post-discharge pollutant levels that approach or exceed standards for Total Phosphorus.
- (b) It can also be inferred that the remaining G-series alternatives would result in pollutant levels that do not approach or exceed State standards for Total Phosphorus.

- e) Stormwater management plan to ensure stormwater discharge meets state water quality standards required by statute/regulation.
 - i. In accordance with State statutes/regulations, implementation of Best Management Practices (BMPs) to control the volume, rate and quality of stormwater runoff from new road-related impervious surfaces and meet state water quality standards would be required for all of the action alternatives.

Objective 4: Considers impacts to underlying geological conditions

- a) The A and F-series alternatives and Alternatives E and D.1, which include Route 1 in-a-cut, would require the excavation of approximately 48,400 cubic yards of rock material in the vicinity of Washington Road.
- b) Alternatives D and D.2, which include an extended cut and cover section, would require the excavation of approximately 87,700 cubic yards of rock material in the vicinity of Washington Road.
- c) The B, C and G-series alternatives, which include improvements to Route 1 at-grade, would not impact underlying geological formations.

Objective 5: Meet Federal and State air quality standards.

- a) The No-Action alternatives and all of the action alternatives would comply with federal air quality protection requirements and standards.

5.3.3 Potential Impacts to Built Environment

A series of six objectives was used to assess the performance of the alternatives relative to potential impacts to the built environment in the Penns Neck area. Tables 5-7 to 5-10 present the performance "grades" given to each alternative for each of the built environment objectives and the data and information used to derive the performance grades. An explanation of the objectives, performance measures and performance scales, as well as a narrative evaluation of the alternatives relative to the objectives, is presented below.

5.3.3.1 Objectives, Performance Measures, and Performance Scales

Objective 1 – Protect and enhance historic and archeological resources – potential impacts to the following National Register listed or eligible cultural resources were considered:

a) *Archeological resources:*

- i) 28ME2 – This site is located in the vicinity of the Harrison St./Route 1 intersection on the east side of Route 1. It contains artifacts indicating prehistoric occupations dating to the Late Archaic, Terminal Archaic and Woodland periods.
- ii) 28ME23 – This site is located in the vicinity of the proposed east-side connector road crossing of the Little Bear Brook on the east side of the brook. It contains artifacts indicating prehistoric occupations dating to the Late Archaic and Late Woodland periods.
- iii) 28ME86 – This site is located in the vicinity of the proposed east-side connector road crossing of the Little Bear Brook on the west side of the brook. It contains artifacts indicating prehistoric occupations dating to the Late Archaic, Middle Woodland and Late Woodland periods.
- iv) 28ME291 – This site is located in the vicinity of the Vaughn Drive connector road interchange (Alignment 3) with CR571/Washington Rd. It is a small but intact deposit dating to the Early Woodland period.

b) *Historic architectural resources:*

- i) Aqueduct Mills Historic District
- ii) Aqueduct Mills Historic District Extension
- iii) Covenhoven-Logan-Silvers House
- iv) Delaware & Raritan Canal Bridge
- v) Delaware & Raritan Canal Historic District

- vi) Lake Carnegie Historic District
- vii) Penns Neck Baptist Church (a.k.a. – Princeton Baptist Church at Penns Neck)
- viii) Penns Neck Cemetery
- ix) Pennsylvania Railroad Historic District
- x) Princeton Operating Station (a.k.a. – Eden Institute)
- xi) Sarnoff Corporation (formerly RCA Laboratories – David Sarnoff Research Center)
- xii) David S. Voorhees House
- xiii) Washington Road Elm Allée

The performance scale for this objective is intended to facilitate a cross-comparison of alternatives relative to potential positive and negative impacts on National Register listed or eligible resources in the area of potential effects. It should be noted that under Section 106 of the National Historic Preservation Act, gradations of “adverse effect” are limited. If a proposed action would result in a temporary or permanent negative impact on a resource, the impact, whether minor or significant, is deemed to be an “adverse effect” that must be avoided, minimized or mitigated.

In addition, the presence of potentially off-setting positive impacts does not negate “adverse effects” under Section 106 regulations. Consistent with Section 106 regulations, the performance scale categories of Good, Fair and Poor would indicate that the alternative would result in an “adverse effect” on the resource under Section 106 regulations. For a more detailed explanation of the criteria for “adverse effects,” please refer to Chapter 4, section 4.5.

Potential impacts to National Register eligible or listed resources are presented in shorthand notation in Table 5-8. Potential impacts include:

- Au** – potential negative impact due to audible intrusion;
- D** – potential negative impact due to physical destruction;
- Vs** – potential negative impact due to visual intrusion;
- +** – potential positive impact due to decreased traffic proximate to the resource; and
- LI** – longitudinal impact – impacts due to a road running parallel to a resource.

The performance scale for potential impacts to National Register listed or eligible resources includes the following:

BEST – Positive impact – the alternative would reduce traffic proximate to the resource compared to the No-Action alternative, resulting in less visual and

auditory intrusion on the resource. No other permanent negative impacts are present.

BETTER – Neutral – the alternative would not impact the resource.

GOOD – Some positive impact – the alternative would reduce traffic proximate to the resource compared to the No-Action alternative, resulting in less visual and auditory intrusion on the resource. Other permanent negative impacts may be present but appear to be substantially offset by the positive impacts.

FAIR – Some negative impact – the alternative would increase traffic proximate to the resource compared to the No-Action alternative, resulting in one or more of the following:

- New or increased visual intrusion;
- New auditory intrusion exceeding Federal Highway Administration Noise Abatement Criteria (NAC);
- Increased auditory intrusion creating an increase in excess of 10 decibels above existing noise levels; and/or
- Any other negative impact that would compromise a resource's historic integrity.

POOR – Negative impact – the alternative would result in a significant physical disruption or destruction of the resource.

Objective 2 - Protect and enhance the integrity of residential neighborhoods – The measures used to assess performance relative to this objective are the following:

- a) Avoids fragmentation of residential neighborhoods;
- b) Avoids residential relocations and displacements;
- c) Minimizes adverse traffic impacts on residential neighborhoods; and
- d) Enhances vehicular, pedestrian and bicycle access and safety to schools and other community facilities.

Measure 2a – notes whether the physical alignment of the alternative fragments existing residential neighborhoods. The performance scale is **YES/NO**.

Measure 2b – notes whether the physical alignment of the alternative would result in the displacement of any residential properties. No performance scale is used for this measure. Instead, *raw data* for the total number of residential displacements/relocations is reported in the table.

Measures 2c – notes if the alternative minimizes adverse traffic impacts on residential neighborhoods. The performance scale for Measure 2c is intended to recognize the difference between impacts from traffic on roads which bisect a neighborhood compared to impacts from traffic on roads that are adjacent to or

peripheral to a neighborhood. As such, traffic changes on both bisecting and peripheral roads were considered using different performance criteria. The performance scale includes the following:

BEST – Positive impact – the alternative would reduce traffic on roads bisecting the neighborhood and/or roads adjacent to the neighborhood, thereby resulting in less visual and auditory intrusion:

Bisecting roads – traffic reduced greater than 15%

Peripheral roads – traffic reduced greater than 30%

BETTER – Some positive impact – the alternative would reduce traffic on road bisecting the neighborhood and/or roads adjacent to the neighborhood, thereby resulting in less visual and auditory intrusion:

Bisecting roads – traffic reduced 0-15%

Peripheral roads – traffic reduced 6-30%

GOOD – Neutral – the alternative would be neutral relative to traffic-related impacts on the neighborhood:

Peripheral roads – traffic change +/- 5%

FAIR – Some negative impact – The alternative would increase traffic on roads bisecting a neighborhood and/or roads adjacent to a neighborhood, thereby resulting in more visual and auditory intrusion.

Bisecting roads – traffic increased 0-5%

Peripheral roads – traffic increased 6-15%

POOR – Negative impact – The alternative would increase traffic on roads bisecting a neighborhood and/or roads adjacent to a neighborhood, thereby resulting in more visual and auditory intrusion.

Bisecting roads – traffic increased greater than 5%

Peripheral roads – traffic increased greater than 15%

The residential neighborhoods considered under this objective include those located within or adjacent to the core study area. The core study area is generally bounded by the Millstone River to the north, Alexander Road to the south, Clarksville Road to the east and Nassau Street to the west. The neighborhoods considered under this objective are listed in column 1 of Table 5-9. The road(s) used to assess change in traffic are listed in parentheses next to the neighborhood. In all cases, two-way AM peak hour traffic volumes for the alternatives were compared to traffic volumes under the No-Action Alternative. Traffic data for these road segments is presented in Table 5-2.

The performance scale for *Measure 2d* - enhances vehicular, pedestrian and bicycle access and safety to schools and other community facilities, includes the following:

YES – indicates that the action alternative includes concurrent implementation of a Commute Options package and also reduces traffic on roads adjacent to schools and community facilities.

SOME – indicates that the action alternative includes concurrent implementation of a Commute Options package but does not change traffic on roads adjacent to schools and community facilities (e.g., traffic change is +/- 5%).

NO – indicates that the action alternative includes concurrent implementation of a Commute Options package but increases traffic proximate to schools and community facilities.

For the purposes of this objective, schools and community facilities located within or adjacent to the core study area were considered. The schools and facilities considered are listed in column 1 of Table 5-9. The road(s) used to assess change in traffic are listed in parentheses next to the school/facility. Again, two-way AM peak hour traffic volumes for the alternatives were compared to AM peak hour traffic volumes under the No-Action Alternative.

Objective 3 - Maintain the viability of institutional/business communities – the measures used to assess performance relative to this goal/objective include the following:

- Avoids institutional/business relocations and displacements;
- Minimizes adverse effects to campus development (e.g., fragmentation of land reserved for future development);
- Enhances vehicular access and safety to institutional/business communities; and
- Enhances transit, pedestrian and bicycle access and safety to institutional/business communities.

Measure 3a – notes whether the physical alignment of the alternative would result in the displacement of any business/institutional properties. No performance scale is used for this measure. Instead, the total number of business/institutional displacements/relocations is reported in the table.

Measures 3b – notes whether the physical alignment of the alternative fragments commercial land reserved for future development. The only land within the project area qualifying under this objective was property owned by the Sarnoff Corporation and Princeton University. Note that impacts to commercial properties potentially affected by the VDC road alignments are accounted for under measure 3a. The scale for this measure is **YES/NO**.

Change in average north-south and east-west travel time was used as the indicator for **Measure 3c** – enhances vehicular access and safety to business/institutional communities. The performance scale for this measure ranges from **BEST**, which represents greater than 25% reduction in travel time to **POOR**, which represents less

than a 10% reduction in travel time. The scale also includes a special symbol (solid circle with up arrow) to denote which alternative(s) resulted in increased travel time. In all cases, average travel times for each alternative were compared to travel times under the No-Action alternative.

Measure 3d – enhances transit, pedestrian and bicycle access and safety to institutional/business communities; notes that all of the action alternatives include concurrent implementation of a Commute Options package.

Objective 4 - Protect and enhance natural areas, parks and recreational facilities – the measures used to assess performance relative to this goal/objective include the following:

- a) Protects open space permanently preserved as part of the state's Green Acres program;
- b) Protects/enhances access to and use of parks and recreational facilities for their intended purpose; and
- c) Protects parks and natural areas from adverse visual and noise impacts.

Potential impacts to parks, recreational facilities and natural areas are noted in Table 5-9. The following key explains the shorthand notations that appear in the data table:

Potential negative impacts:

Au – Auditory impact – potential negative impact due to audible intrusion from increased traffic (> 5% increase);

Vs – Visual impact – potential negative impact due to visual intrusion from increased traffic (> 5% increase);

RA – Restricted access – Potential negative impact due to restricted/limited access to and/or diminished ability to use the resource for its intended purpose;

PI – Perpendicular impact – potential negative impacts are associated with a perpendicular crossing of the resource; and

LI – Longitudinal impact – potential negative impacts are associated with a road running parallel to the resource.

Potential positive impacts:

+ – Positive impact – potential positive impact due to decreased traffic proximate to the resource (>5% decrease);

IA – Improved access – potential positive impact due to improved access and/or sight distance for vehicles, pedestrians and bicyclists at perpendicular crossing.

Measure 4a – avoids physical taking of land designated as park or permanently preserved open space; notes whether the physical alignment of the alternative would result in the taking of permanently preserved open space.

Measure 4b – protects/enhances access to and use of parks and recreational facilities; considered whether the alternative would limit access to and or prevent the use of a recreational facility for its intended purpose. This measure also considers whether the alternative would enhance access and or use of a park or recreational facility. The performance scale for this measure includes:

BEST –Positive impact – the alternative would improve access to and/or enhance the use of a resource by improving sight distance for vehicles, pedestrians and bicyclists at a perpendicular crossing.

GOOD – Neutral – the alternative would not affect access to a resource or diminish the ability of users to the use of a resource for its intended purpose.

FAIR – Some negative impact – the alternative would partially restrict/limit access to and/or use of a resource for its intended purpose.

POOR – Negative impact – the alternative would restrict/limit access to and/or use of a resource for its intended purpose.

Measure 4c - protects parks and natural areas from adverse visual and noise impacts, considered whether a new or existing road or traffic on an existing or new road would result in increased visual and noise intrusion on the resource. The performance scale for this measure includes:

BEST –Positive impact – the alternative would reduce traffic proximate to the resource compared to the No-Action alternative, resulting in less visual and auditory intrusion on the resource.

GOOD – Neutral – the alternative would not impact the resource.

FAIR – Some negative impact – the alternative would increase traffic proximate to the resource compared to the No-Action alternative, resulting in increased visual and auditory intrusion. However, the impacts are associated with an existing perpendicular crossing of the resource (PC).

POOR – Negative impact – the alternative would result in increased traffic on an existing or new roadway facility proximate to the resource, resulting in increased visual and auditory intrusion. The impacts are associated with a new perpendicular crossing (PC) and/or a new road running parallel to the resource (LI).

Objective 5 - Avoid/minimize potential disturbance of contaminated materials – the measure used to assess performance relative to this goal/objective includes the following:

- a) The number of potential disturbances to contaminated materials sites.

Measure 5a – notes whether the physical alignment of the alternative would result in the disturbance of a contaminated materials site. For the purpose of this analysis, contaminated materials sites have been categorized into two groups based on the type of material involved at each location. Site categories include: 1) sites of lower to moderate concern; and 2) sites of higher concern. No performance scale is used for

this measure. Instead, *raw data* regarding the total number of potential disturbances in each category are reported in Table 5-9. Each site potentially disturbed by one or more of the alternatives is listed individually in column 1 of Table 5-10.

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TABLE 5-7: Potential Impacts to the Built Environment - Cultural Resources

PERFORMANCE SCALES:																					
SCALE FOR OBJECTIVE 1 *																					
Composite of potential positive & negative impacts																					
Best	Better	Good	Fair	Poor																	
Positive Impact	Neutral	Some positive impact	Some negative impact	Negative impact																	
NO Action	Route 1 In-a-cut					Route 1 at-grade					Route 1 In-a-cut						Route 1 at-grade				
	A	A.1	A.2	A.3	A.4	B	B.1	B.2	C	C.1	D	D.1	D.2	E	F	F.1	G	G.1	G.2		
1. Protect and enhance historic and archeological resources																					
a) Potential impacts to archeological resources																					
28ME2	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
28ME23	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
28ME86	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
28ME291 ¹	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
b) Potential impacts to historic architectural resources																					
Aqueduct Mills Historic District	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Aqueduct Mills Historic District Extension	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Covenhoven-Logan-Silvers House	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Delaware & Raritan Canal Bridge	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Delaware & Raritan Canal Historic District	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Lake Carnegie Historic District	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Penns Neck Baptist Church (a.k.a - Princeton Baptist Church at Penns Neck)	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Penns Neck Cemetery	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Pennsylvania Railroad Historic District ²	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Princeton Operating Station (a.k.a - Eden Institute)	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
David Sarnoff Research Center (a.k.a. - Sarnoff Corporation)	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
David S. Voorhees House ²	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Washington Road Elm Allee	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○

NOTES:

1 - Impacts would only occur if VDC 3 were constructed

2 - Impacts would only occur if VDC 1 were constructed

* The performance scale used in the summary tables is intended to facilitate a cross-comparison of alternatives relative to potential positive and negative impacts on National Register listed or eligible resources in the area of potential effects. It should be noted that under Section 106 of the National Historic Preservation Act, there are no gradations of "adverse effect." If a proposed action would result in a temporary or permanent negative impact on a resource, the impact, whether minor or significant, is deemed to be an "adverse effect" that is avoided, minimized or mitigated. In addition, the presence of potentially off-setting positive impacts does not negate "adverse effects" under Section 106 regulations. Consistent with Section 106 regulations, the performance scale categories of Good, Fair, and Poor would indicate that the alternative would result in an "adverse effect" on the resource under S 106 regulations.

TABLE 5-8: Potential Impacts to the Built Environment - Data 1 (Cultural Resources)

last revised 4-13-03

Route 1																				
NO Action	Route 1 in-a-cut					Route 1 at-grade					Route 1 in-a-cut					Route 1 at-grade				
	A	A.1	A.2	A.3	A.4	B	B.1	B.2	C	C.1	D	D.1	D.2	E	F	F.1	G	G.1	G.2	
1. Protect and enhance historic and archeological resources																				
a) Potential impacts to archeological resources																				
28ME2	D	D	D	D	D	D	D	D	D	D	D	D			D	D				
28ME23	D	D	D	D	D	D	D	D			D	D		D	D	D				
28ME86	D	D	D	D	D	D	D	D			D	D		D	D	D				
28ME291	D ¹	D ¹	D ¹	D ¹	D ¹		D ¹	D ¹	D ¹	D ¹	D ¹	D ¹	D ¹	D ¹	D ¹	D ¹	D ¹	D ¹		
b) Potential impacts to historic architectural resources																				
Aqueduct Mills Historic District	Vs	D, +	D, +	D, +	D, +	D, +	D, +	D, +	D, +	D, +	D, +	D, +	D, +	D, +	D, +	D, +	D, +	D, +	D, +	
Aqueduct Mills Historic District Extension	Au, Vs	Vs, +	Vs, +	Vs, +	Vs, +	Vs, +	Vs, +	Vs, +	Au, Vs	Au, Vs		Au, Vs			Vs, +	Vs, +	Au, Vs	Au, Vs	Au, Vs	
Covenhoven-Logan-Silvers House		D	D	D	D	D	D	D			Au, Vs	Au, Vs	Au, Vs	Vs	Au, Vs	Au, Vs		Vs		
Delaware & Raritan Canal Bridge																				
Delaware & Raritan Canal Historic District	Au, Vs	Au, Vs	Au, Vs	Au, Vs	Au, Vs	LI: Au, Vs	LI: Au, Vs	Vs	Au, Vs	Au, Vs	Au, Vs	Au, Vs	Au, Vs	Au, Vs	Au, Vs	Au, Vs	Au, Vs	Au, Vs	Au, Vs	
Lake Carnegie Historic District																				
Penns Neck Baptist Church (a.k.a - Princeton Baptist Church at Penns Neck)		Au ² , +	Au ² , +	Au ² , +	Au ² , +						Au ² , +	Au ² , +	Au ² , +	Au ² , +	Au ² , +	Au ² , +				
Penns Neck Cemetery																				
Pennsylvania Railroad Historic District		D ³	D ³	D ³	D ³		D ³	D ³	D ³	D ³	D ³	D ³	D ³	D ³	D ³	D ³	D ³	D ³	D ³	
Princeton Operating Station (a.k.a - Eden Institute)		D	D	D	D	D	D	D	D	D					D	D				
David Samoff Research Center (a.k.a. - Samoff Corporation)											Vs	Vs		Vs						
David S. Voorhees House		Vs ³	Vs ³	Vs ³	Vs ³	Vs ³	Vs ³	Vs ³	Vs ³	Vs ³	Vs	Vs	Vs	Vs	Vs	Vs	Vs	Vs	Vs	
Washington Road Elm Allee	Vs		+	+	+	+	D, +	D, +	D, +	D, +	+	+	+	+	+	+	+	D, +	+	

KEY:

Au - Potential negative impact due to noise

D - potential negative impact due to physical destruction

Vs - potential negative impact due to visual intrusion

+ - potential positive impact due to decreased traffic proximate to the resource

LI - Longitudinal Impact - Impacts due to road running parallel to resource

NOTES:

1 - Impacts would only occur if VDC 3 were constructed

2 - Temporary noise impacts would occur due to excavation activities related to the construction of Route 1 in-a-cut

3 - Impacts would only occur if VDC 1 were constructed

TABLE 5-9: Potential Impacts to the Built Environment - Neighborhoods; Business Communities; Open Space, Parks, and Recreation; and Contaminated Materials

last revised 5-15-03

PERFORMANCE SCALES:		SCALE FOR OBJECTIVE 2c						SCALE FOR OBJECTIVE 3c						SCALE FOR OBJECTIVES 4b and 4c							
		Potential positive & negative impacts						Reduces travel time						Potential positive & negative impacts							
		Best	Better	Good	Fair	Poor		Best	Better	Good	Fair	Poor		Best	Good	Fair	Poor				
		Positive Impact	Some positive impact	Neutral	Some negative impact	Negative Impact		>25%	21-25%	16-20%	10-15%	<10%	Increases travel time	Positive Impact	Neutral	Some negative impact	Negative Impact				
NO Action		Route 1 in-cut					Route 1 at-grade					Route 1 in-cut					Route 1 at-grade				
		A	A1	A2	A3	A4	B	B1	B2	C	C1	D	D1	D2	E	F	F1	G	G1	G2	
3. Protect and enhance the integrity of residential neighborhoods	a) Avoids fragmentation of residential neighborhoods	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	
	b) Avoids residential relocation/displacement. (Total number of potential displacements) ¹	2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0	0	0	0	
	c) Minimizes adverse traffic impacts on residential neighborhoods (Road segment(s) considered shown in parenthesis)																				
	Alexander Rd residences - (Alexander Rd b/w Canal Pointe Blvd. and D&R Canal)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Dear Brook Road/Windward Haven - (Dear Brook Rd)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Benford Estates - (North Post Rd)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Bentley City - (Alexander Rd b/w NEC and CRST1 & Wallace Rd)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Canal Pointe - (Canal Pointe Blvd)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Clarksville Road/Washington Estates - (Clarksville Rd b/w No. Post Rd and CRST1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Lower Harrison Street - (Harrison St b/w Route 1 and D&R Canal) ²	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
4. Enhance vehicular access and safety to schools and other community facilities in the core study area	Penns Neck - (Washington Road b/w NEC and Route 1 and ESCC) ³	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Shenandoah Estates and Princeton Junction Business District - (CR ST b/w Alexander Rd and Wallace Rd)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Upper Harrison Street, including "Jughead" - (Harrison St west of Faculty Rd)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Mercer Hill Historic District - (Alexander Rd b/w University Pl & Mercer St)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Central District - South of Washington, including Bank St district - (Pleasant St b/w Mercer St & Washington Rd)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Central District - North of Washington - (Pleasant St b/w Washington Rd & Harrison St)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Central District - North of Washington - (Pleasant St b/w Washington Rd & Harrison St)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Central District - North of Washington - (Pleasant St b/w Washington Rd & Harrison St)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Central District - North of Washington - (Pleasant St b/w Washington Rd & Harrison St)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Central District - North of Washington - (Pleasant St b/w Washington Rd & Harrison St)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
5. Maintain the viability of institutional/business communities	Maurice Hawk School / West Windsor-Princeton High School - South (Clarksville Rd b/w No. Post Rd and CR ST)	SOME	SOME	SOME	SOME	SOME	NO	SOME	YES	YES	SOME	YES	SOME	SOME	SOME	SOME	SOME	SOME	SOME	NO	
	West Windsor Township Municipal Committee (No. Post Rd)	YES	YES	YES	YES	YES	SOME	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	SOME	
6. Protect and enhance outdoor recreational facilities	a) Avoids institutional/business relocation/displacement. (Total number of potential displacements) ⁴	5	5	5	5	5	3	3	3	5	5	3	3	5	2	5	5	2	5	0	
	b) Minimizes adverse effects to campus development (e.g., fragments land reserved for future development)	YES	YES	YES	YES	YES	YES	YES	YES	YES	NO	YES	YES	YES	NO	YES	YES	YES	YES	YES	
7. Avoid/minimize potential disturbance of contaminated materials	c) Enhances vehicular access and safety to institutional/business communities - (Average 2-way travel time)																				
	North-south access	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
8. Protect and enhance outdoor recreational facilities	East-west access	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	d) Enhances transit/bicycle/pedestrian access and safety to institutional/business communities	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	
4. Protect and enhance natural areas, parks, and recreational facilities	a) Avoids physical taking of lands designated as park or permanently preserved open space	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	
	b) Protect/enhances access to and use of parks and recreational facilities for their intended purpose																				
	D&R Canal State Park	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Alexander Rd crossing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Washington Rd crossing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Harrison St crossing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Princeton University athletic fields	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Sarnoff Corporation athletic fields	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	c) Protects parks and natural areas from adverse visual and noise impacts																				
	D&R Canal State Park and Carnegie Lake	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
5. Avoid/minimize potential disturbance of contaminated materials	Alexander Rd crossing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Washington Rd crossing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Harrison St crossing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	b/w Harrison St and Washington Rd	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Mifflin River - east of Little Bear Brook (including the area known locally as the "Sheephead")	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Mifflin River - west of Little Bear Brook	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Little Bear Brook stream corridor and greenbelt ⁵	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	a) Number of potential disturbances	5	5	5	5	5	1	1	1	3	3	6	6	5	5	5	5	2	4	0	
	b) Sites of major concern	5	5	5	5	5	6	5	5	5	2	4	4	2	4	5	5	1	1	1	
	c) Sites of lower to moderate concern ⁶	5	5	5	5	5	6	5	5	5	2	4	4	2	4	5	5	1	1	1	

NOTES:

1 - The A and B-series alternatives would result in 2 residential displacements along Stony Edge Way. If combined with VDC 3, all of the action alternatives except B and G.2 would disturb 1 residential displacement on Washington Rd.

2 - Under the No-action alternative, Fisher Place provides a cul-de-sac. As such, future traffic volumes are expected to be very low. Under Alternatives A, A.2, and the D and F Series alternatives, Fisher Place would provide access to and from the frontage road system. Under these alternatives, traffic on Fisher Place increases from a forecast volume of 0 to approximately 60-570 vehicles in the AM peak hour. Alternative E would introduce a new road (ESCG) adjacent to the Penn Neck neighborhood, thereby significantly increase traffic on a road adjacent to the neighborhood.

3 - If combined with VDC 2, all of the action alternatives except B and G.2 would result in 1 additional business relocation. VDC 1 & 2 would not result in additional business relocations.

4 - The proposed location of the ESC road crossing of the Little Bear Brook would necessitate the relocation of the existing footbridge known locally as the "Boy Scout Bridge."

5 - If combined with VDC 1, all of the action alternatives except B and G.2 would disturb 1 additional site of moderate to lower concern. VDC 2 and VDC 3 would each disturb 1 additional site of moderate to lower concern.

6 - For Alternatives D and E, traffic volumes west of the WSC road connection to Lower Harrison St were compared.

TABLE 5-10: Potential Impacts to the Built Environment - Data 2 (Other)

last revised 4-13-03

	Existing 2001	No Action	Route 1 in-grade					Route 1 at-grade					Route 1 in-grade					Route 1 at-grade				
			A...	A1	A2	A3	A4	B	B1	B2	C	C1	D	D1	D2	E	F	F1	G	G1	G2	
2c. Change in traffic volume on key routes (Two-way traffic volume - AM peak hour)			Refer to TABLE 5-2																			
2d. Potential business relocations/displacements			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Eden Institute			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Larry's Sarcos			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Pitts/Cumford Gulf			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Princeton Circle Exxon			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Princeton City			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
14 Harrison St (office building)			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
14 Washington Road - Office Building (with VDC 2 only)			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
3c. Travel time on Route 1 (Travel time in minutes - AM peak hour)																						
Northbound	5.15	15.13	12.53	12.30	12.25	12.25	12.04	12.12	12.35	11.29	11.18	11.97	12.95	12.71	12.14	12.90	11.85	11.80	14.54	14.54	15.64	
Southbound	4.34	6.86	4.60	4.28	4.18	4.73	4.85	5.35	4.96	4.37	3.92	3.99	5.08	4.88	4.52	4.48	4.98	4.95	5.80	5.80	7.64	
Average N-S travel time	4.75	11.00	8.57	6.29	8.40	8.49	8.45	9.74	8.66	7.83	7.55	7.58	9.02	8.80	8.33	8.69	8.32	8.38	10.17	10.17	11.64	
			-22%	-26%	-24%	-23%	-23%	-21%	-21%	-29%	-31%	-27%	-18%	-20%	-24%	-21%	-24%	-25%	-8%	-8%	6%	
3c. Travel time on E-W streets (Average 2-way travel time in minutes - AM peak hour)																						
Travel from Clarksville Road/CR 571 intersection in W. Windsor to Nassau Street in the vicinity of:																						
Alexander Rd	12.88	21.34	18.84	19.15	18.62	18.67	18.05	20.89	19.08	19.22	20.36	22.66	18.13	19.07	18.67	19.10	18.69	17.67	20.67	20.67	26.54	
Washington Rd	10.45	18.32	13.64	14.05	13.74	14.61	14.14	16.47	16.35	16.84	18.95	19.79	13.55	13.88	13.92	15.04	13.28	14.62	17.41	17.41	23.18	
Harrison St	11.55	19.79	13.66	13.69	14.08	14.75	14.25	16.84	16.01	16.84	18.91	20.64	13.64	13.91	14.40	14.24	14.54	15.72	18.77	18.77	23.21	
Average E-W travel time	11.63	19.81	15.44	15.63	15.48	15.69	15.48	18.06	17.14	17.63	19.41	21.03	15.14	15.59	15.33	16.13	15.50	15.97	18.95	18.95	24.31	
			-22%	-21%	-22%	-19%	-22%	-9%	-13%	-11%	-2%	6%	-24%	-21%	-21%	-19%	-22%	-16%	-4%	-4%	23%	
4b & 4c. Potential impacts to natural areas, parks, and recreational facilities																						
D&R Canal State Park and Cananda Lake																						
Alexander Rd crossing																						
Washington Rd crossing																						
Harrison St crossing																						
low Harrison St and Washington Rd																						
Milhouse River - east of Little Bear Brook (including the area known locally as the "Sheepwash")																						
Milhouse River - west of Little Bear Brook																						
Little Bear Brook stream corridor and greenbelt																						
Princeton University athletic fields																						
Samoff Corporation athletic fields																						
5. Potential disturbances of contaminated materials sites																						
Stages of highest concern																						
Larry's Sarcos			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Princeton Circle Exxon			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Pitts/Cumford Gulf Station			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Princeton City Station			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Century 21 Realty Office (former gas station)			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Samoff - chlorinated compounds release site, former USAs and processing systems			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Stages of moderate to lower concern																						
Samoff - former lab equipment dump site			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Samoff - former low level radiation dump site			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Roadway Fuel Oil Releases (dates: 4/95 & 7/95)			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Eden Institute			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Farmstead - west of Rte 1 (potential pesticides/herbicides)			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Princeton Station Garage (with VDC 1 only)			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Princeton-Windsor News (with VDC 2 only)			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
14 Washington Road - office building (with VDC 2 and VDC 3 only)			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		

NOTES:

1. LI = Longitudinal impact; PI = Perpendicular impact; Vs = Visual impact; Au = Noise impact; RA = Restricted access; IA = Improved access; and + = Potential positive impact due to reduced traffic

5.3.3.2 Evaluation of the Alternatives

Objective 1 – Protect and enhance historic and archeological resources

a) Archeological resources:

- i) 28ME2 – All of the action alternatives, except Alternative E, D.2 and the G-series alternatives, include either an ESC road or an interchange in the vicinity of Harrison Street. Consequently, these alternatives would result in a physical disturbance of this archeological site.
- ii) 28ME23 – All of the action alternatives, except the C, D.2 and G-series alternatives, include an ESC road. Consequently, these alternatives would result in a physical disturbance of this archeological site.
- iii) 28ME86 – All of the action alternatives, except the C, D.2 and G-series alternatives, include an ESC road. Consequently, these alternatives would result in a physical disturbance of this archeological site.
- iv) 28ME291 – All of the action alternatives, except Alternatives B and G.2, may result in a physical disturbance of this archeological site, if Vaughn Drive Connector road (VDC) alignment 3 were constructed. This site would not be disturbed if VDC 1 or VDC 2 were constructed.
- v) The No-Action alternative would have no impact on archeological resources.

b) Historic architectural resources:

i) Aqueduct Mills Historic District

- The No-Action Alternative would result in increased auditory and visual intrusion on the district due to increased traffic on Mapleton Rd. and Route 1 in the vicinity of Mapleton Rd. This alternative would result in some negative impact.
- All of the action alternatives include widening of Route 1 to accommodate safety shoulders and auxiliary lanes as needed for acceleration and deceleration of traffic merging on and off of Route 1. Consequently, all of the action alternatives would result in the physical disturbance and/or destruction of a dry-laid stone wall immediately adjacent to the southbound lanes of Route 1. This stone wall is a contributing resource to the district. This impact would be negative.

ii) Aqueduct Mills Historic District Extension

- The C and G-series and No-Action alternatives do not include WSC roads that reduce traffic on Lower Harrison Street.

Consequently, these alternatives would result in increased auditory and visual intrusion on the district due to increased traffic on Lower Harrison St. These alternatives would result in some negative impact.

- The A, B and F-series alternatives would result in both positive and negative impacts on the district. It is likely that portions of the proposed interchange and west-side connector road included in these alternatives would be visible from parts of the district; however, compared to the No-Action alternative, traffic on at least a portion of Lower Harrison St would be reduced, because the alternatives include a WSC road that diverts traffic off of Lower Harrison Street. The net impact of these changes is expected to be positive.
- Alternative D.1 intersects Lower Harrison Street at Logan Drive. As such, traffic reductions only occur in the area east of Logan Drive. This alternative would result in increased visual and auditory intrusion in the portions of the district located west of Logan Drive.
- Compared to the No-Action alternative, Alternatives D, D.2 and E would result in less traffic on Lower Harrison St, and given the location of the proposed interchange and west-side connector road, no visual intrusion on the district would occur. The impact of Alternatives D, D.2 and E is expected to be positive.

iii) Covenhoven-Logan-Silvers House

- The C-series, G, G.2 and No-Action alternatives would not impact this resource.
- The D, E and F-series alternatives, which include a WSC road adjacent to the property and Alternative G.1 which includes a jughandle adjacent to the property, would result in increased traffic proximate to the resource. This increase in traffic would introduce visual and auditory intrusion not currently present, resulting in some negative impact.
- The A and B-series alternatives, which include a WSC road that would run through the property, would result in the physical disturbance and/or destruction of this resource. This impact would be negative.

iv) Delaware & Raritan Canal Bridge

- The Action and No-Action alternatives would not impact this resource.

v) Delaware & Raritan Canal Historic District

- The No-Action alternative would increase traffic crossing the D&R Canal State Park at Alexander Road, Washington Road and Harrison Street. This increase in traffic would increase visual intrusion and increase auditory intrusion in excess of noise abatement criteria at the Alexander Road, Washington Road and Harrison Street crossings. This would result in some negative impact.
- Like the No-Action alternative, all of the action alternatives except the C-series alternatives would increase total traffic crossing the D&R Canal State Park in the project area. While total traffic increases overall under these alternatives, traffic at the Alexander Road and Washington Road crossings would decrease compared to the No-Action alternative. This would result in comparatively less visual and auditory intrusion on the district in the vicinity of Alexander Road and Washington Road; however, noise levels would still approach or exceed noise abatement criteria at these locations.

Traffic at the Harrison Street crossing would increase compared to the No-Action alternative. This would result in increased visual intrusion and increased auditory intrusion that approaches or exceeds noise abatement criteria in the vicinity of the Harrison Street crossing.

Although the decrease in traffic crossing the district in the vicinity of Alexander Road and Washington Road would have some positive impact, similar to conditions under the No-Action Alternative, future noise levels at all three canal crossings are expected to approach or exceed noise abatement criteria under these alternatives. The net effect of these changes is expected to result in some negative impact.

- Compared to the No-Action alternative, the C-series alternatives would marginally decrease total traffic crossing the D&R Canal State Park in the project area. While traffic at the Alexander Road crossing would increase somewhat, traffic at the Washington Road and Harrison Street crossings would remain the same or decrease slightly. As was the case under the No-Action Alternative, future noise levels at the canal crossings are expected to approach or exceed noise abatement criteria under this alternative. Consequently, the C-series alternatives would result in some negative impact.
- Alternatives B and B.1 include a WSC road between Route 1, Harrison Street and Washington Road. The WSC road would be located within 350 feet of the D&R Canal at its closest point. The road would be visible from a portion of the district. The increased

visual and auditory intrusion from the new road running parallel to the park would result in a significant disruption to the resource. This would have a negative impact on the district.

- The A, B and F-series alternatives and Alternative D would improve sight distance at the Harrison Street crossing of the canal. This may enhance safety for park users crossing Harrison Street.

vi) Lake Carnegie Historic District

- The Action and No-Action alternatives would not impact this resource.

vii) Penns Neck Baptist Church (a.k.a. – Princeton Baptist Church at Penns Neck)

- The No-Action alternative would result in increased traffic on Route 1 and Washington Road proximate to the resource. While this increased traffic may result in increased visual and auditory intrusion, the increase in noise would not exceed noise abatement criteria for worsening an existing adverse condition. In addition, because the setting of the property does not represent a significant characteristic of its historic eligibility, the visual intrusion of increased traffic is also not expected to impact this resource negatively. Consequently, the impact of the No-Action alternative would be neutral relative to this resource.
- The B, C and G-series alternatives, which maintain Route 1 at-grade, would result in increased traffic on Route 1 proximate to the resource and decreased traffic on Washington Rd proximate to the resource. While increased traffic on Route 1 may result in increased visual and auditory intrusion, the increase in noise would not exceed noise abatement criteria for worsening an existing adverse condition. In addition, because the setting of the property does not represent a significant characteristic of its historic eligibility, the visual intrusion of increased traffic is also not expected to impact this resource negatively. Consequently, the impact of these alternatives would be neutral relative to this resource.
- The A, D, E and F-series alternatives, which include Route 1 in-a-cut, would result in decreased traffic on Route 1 and Washington Road proximate to and/or at the same grade as the resource. This decrease in traffic would result in less permanent visual and noise intrusion on the resource. While there may be temporary noise impacts related to constructing Route 1 in-a-cut, the net impact of these alternatives is expected to be positive. Alternatives D and D.2 would also include a covered plaza section over Route 1 in

front of the Church. This would result in further attenuation of noise effects and a visual enhancement for the Church grounds.

viii) Penns Neck Cemetery

- The Action and No-Action alternatives would not impact this resource.

ix) Pennsylvania Railroad Historic District

- The No-Action, B and G.2 alternatives do not include a VDC road. Consequently, these alternatives would not impact this resource.
- In association with the construction of the Vaughn Drive connector road alignment VDC 1, the A, C, D, E and F-series alternatives and Alternatives B.1, B.2, G and G.1 may result in the physical disturbance and/or destruction of the Princeton Junction Hotel, a contributing resource to the district. Alignments VDC 2 or VDC 3 would not impact this resource.

x) Princeton Operating Station (a.k.a. – Eden Institute)

- The D, E and G-series alternatives and the No-Action alternative would not impact this resource.
- The A, B, C and F-series alternatives, which would include the construction of an interchange in proximity to this resource, would result in the physical disturbance and/or destruction of this resource. This impact would be negative.

xi) Sarnoff Corporation (formerly RCA Laboratories – David Sarnoff Research Center)

- The No-Action, A, B, C and F-series alternatives and Alternative D.2 would not impact this resource.
- Alternatives D, D.1 and E would introduce a new road facility in an area of the Sarnoff property where one does not presently exist. This new road would result in visual intrusion proximate to the resource. Consequently, these alternatives would have some negative impact on this resource.

xii) David S. Voorhees House

- The No-Action, B and G.2 alternatives, which do not include a VDC road, would not impact this resource.
- In association with the construction of the Vaughn Drive connector road alignment VDC 1, the A, C, D, E and F-series alternatives and Alternatives B.1, B.2, G and G.1 may result in increased visual and auditory intrusion due to increased traffic proximate to the

resource. In addition, these alternatives may require the partial acquisition of a portion of the property. These changes could alter the setting of the house, resulting in some negative impact. Alignments VDC 2 or VDC 3 would not impact this resource.

xiii) Washington Road Elm Allée

- The No-Action alternative would result in increased auditory and visual intrusion on this resource due to increased traffic on Washington Road between Route 1 and the D&R Canal. The No-Action alternative would result in some negative impact.
- The A, F and D-series alternatives and Alternatives E, C.1, G and G.2 alternatives would result in decreased traffic on Washington Road between Route 1 and the D&R Canal. This decreased traffic would result in less visual and auditory intrusion on the resource, resulting in a positive impact.
- The B-series alternatives and Alternative C, which would include a WSC road that intersects with or crosses Washington Road, and G.1, which would include construction of a jughandle at the eastern edge of the Elm Allée, would result in the physical disturbance and/or destruction of one or more trees associated with the Elm Allée. This impact would be negative.

Objective 2: Protect the integrity of residential neighborhoods

- a) The No-Action alternative would result in no physical fragmentation of neighborhoods or residential displacement; however, under the No-Action alternative, traffic on existing roadways is expected to increase substantially throughout the study area. A number of neighborhoods may experience increased visual and auditory intrusion resulting from increases in traffic. Notably, AM peak hour traffic on Washington Road bisecting the Penns Neck neighborhood would increase from approximately 1610 vehicles today to 2670 in 2028, an increase of 66%. AM peak hour traffic on Alexander Road bisecting the Berrien City neighborhood would increase from approximately 610 vehicles today to 1565 vehicles in 2028, a 157% increase.
- b) All of the action alternatives would avoid physical fragmentation of residential neighborhoods; however, as noted below, a number of neighborhoods may experience increased visual and auditory intrusion resulting from increases traffic.
- c) The A and B-series alternatives, which include a loop-type interchange and WSC road in the vicinity of Harrison Street, would result in two residential displacements in the vicinity of Eden Way/Logan Drive. In addition, if combined with VDC 3, all of the action alternatives, except B and G.2, would result in one residential displacement in the vicinity of Washington Road and Station Drive.
- d) As noted in Chapter 3, section 3.1.6, a number of distinctive areas or neighborhood were identified within and adjacent to the study area. These include:

West Windsor Township

- Penns Neck;
- Princeton Junction, a mixed use, pedestrian-scaled area that includes the Princeton Junction business/shopping area, West Windsor's municipal complex, and the Berrien City, Sherbrooke Estates, Benford Estates, Clarksville Road and Wellington Estates neighborhoods;
- Lower Harrison Street;
- Alexander Road (west of Route 1);
- Canal Pointe; and
- Old Bear Brook Road and Windsor Haven.

Princeton Borough & Township

- Central District, a mixed use, pedestrian-scaled area that includes the Princeton Borough CBD and the Bank Street historic district;
- Mercer Hill; and
- Upper Harrison Street, which includes the Jugtown historic district.

- e) The action alternatives would result in the following traffic-related impacts to neighborhoods:
- i. All of the action alternatives except G.2 would be neutral or have a positive impact on the residences and neighborhoods located along Alexander Road between Route 1 and the D&R Canal.
 - ii. All of the action alternatives except B, D.2 and G.2 would have a negative impact on residences located along Bear Brook Road and the Windsor Haven neighborhood.
 - iii. All of the action alternatives would be neutral or have a positive impact on the Benford Estates neighborhood.
 - iv. All of the action alternatives except B and G.2 would have a positive impact on the Berrien City neighborhood.
 - v. All of the action alternatives except B.2 would be neutral or have a positive impact on the Canal Pointe neighborhood.
 - vi. All of the action alternatives except B and G.2 would be neutral or have a positive impact on residences located along Clarksville Road and the Wellington Estates neighborhood.
 - vii. All of the action alternatives except the C and G-series alternatives and Alternative D.1 would have a positive impact on the Lower Harrison Street neighborhood.
 - viii. All of the action alternative except E would be neutral or have a positive impact on the Penns Neck Neighborhood.
 - ix. All of the action alternatives would be neutral or have a positive impact on the Sherbrooke Estates neighborhood.

- x. All of the action alternatives except the C-series alternatives would have a negative effect on the Upper Harrison Street neighborhood, which includes the Jugtown Historic District. The C-series alternatives would be neutral.
- xi. All of the action alternatives except C.1 would be neutral or have a positive effect on the Mercer Hill Historic District.
- xii. All of the action alternatives except A, A.4, E, F.1, G and G.1 would be neutral or have a positive effect on Princeton Borough's Central District south of Washington Road, including the Bank Street Historic District.
- xiii. All of the action alternatives except G and G.1 would have positive effect on Princeton Borough's Central District north of Washington Road.
- f) All of the action alternatives except B and G.2 would at least partially enhance vehicular, bicycle and pedestrian access and safety to West Windsor's Maurice Hawk School and the West Windsor-Plainsboro High School (South Campus) located on Clarksville Road in West Windsor Township.
- g) All of the action alternatives except B, F.1 and the G-series alternatives would enhance vehicular, bicycle and pedestrian access and safety to community facilities located within the West Windsor Township municipal complex. Alternatives B, F.1 and the G-series partially enhance access to the municipal complex.

Objective 3: Minimize impacts to business and institutional communities

- a) The No-Action alternative would result in no business displacements or fragmentation of lands reserved for campus development; however, under the No-Action alternative, area-wide congestion will result in lengthy north-south and east-west travel times. This would limit access to area businesses and institutions.
- b) All of the action alternatives except G.2 would result in multiple business displacements. The B-series alternatives, which would maintain Route 1 on its existing alignment, would result in the fewest displacements, while the A and F-series alternatives would result in the most displacements.
 - i. The A, B, C and F-series alternatives, which would include an interchange located in the vicinity of Harrison Street, would displace the Eden Institute. The D-series alternatives and Alternative E, which would include interchanges located further south, would not.
 - ii. All of the action alternatives except G and G.2 would displace Larry's Sunoco located at the corner of Route 1 and Harrison Street.
 - iii. The A, C, D, E and F-series alternatives and Alternatives G and G.1, which shift the alignment of Route 1 to the west, would displace the Gulf and Exxon gas stations located west of the Route 1/Washington Road intersection.
 - iv. Alternative G.1, which includes a partial jughandle for Route 1 northbound traffic exiting onto Washington Road, would displace the Getty

gas station located east of Route 1 at the corner of Washington Road and Route 1.

- c) All of the action alternatives except B, C, D, and D.1 would minimize adverse impacts to campus development.
 - i. Alternatives B, C and E, which include WSC roads located centrally on Princeton University-owning lands west of Route 1, would bisect or fragment lands reserved for future campus development.
 - ii. Alternatives D and D.1, which include an ESC road located centrally on the Sarnoff property, would fragment Sarnoff and Princeton University-owned land east of Route 1. This land was approved by the West Windsor Planning Board for future commercial development.
- d) All of the action alternatives except the C and G-series alternatives would enhance vehicular access and safety to area businesses and institutions; however, under most alternatives, direct access to Route 1 for businesses fronting on Route 1 will be limited.
- e) All of the action alternatives would include concurrent implementation of the Commute Options package which is intended to enhance transit, bicycle and pedestrian access to area businesses and institutions.

Objective 4: Protect and enhance natural areas, parks, and recreational facilities

- a) The No-Action alternative would result in no physical changes that would affect natural areas, parks and recreational facilities; however, under the No-Action alternative, traffic on existing roadways is expected to increase substantially throughout the study area. Increased traffic at the three crossings of the D&R Canal State Park would result in increased auditory and visual intrusion at these locations. This would have a negative impact on the park.
- b) All of the action alternatives would avoid physical taking of lands designated as parks or permanently preserved open space.
- c) All of the action alternatives except B.2 and E would be neutral or have a positive impact regarding access to and use of parks and recreational facilities for their intended purpose.
 - i. The A, B, D, E and F-series alternatives provide an opportunity to enhance access and safety for motorists and park users at the Harrison Street crossing of the D&R Canal State Park by improving sight distance at the crossing.
 - ii. Alternative B.2, which would include a WSC road between Route 1 and Washington Road, would negatively affect the use of athletic fields located on Princeton University-owned land west of Route 1.
 - iii. Alternative E, which would include an ESC road along the southern edge of the Sarnoff property, would negatively affect the use of athletic fields located on Sarnoff-owned land east of Route 1.

- d) All of the action alternatives would result in both positive and negative traffic-related impacts to parks and natural areas:
- i. All of the action alternatives except A.1, C, C.1 and G.2 would have a positive impact on the D&R Canal State Park in the vicinity of the Alexander Road crossing. Alternatives A.1 and C would be neutral. Alternatives C.1 and G.2 would increase traffic at the Alexander Road crossing. Although this impact is associated with an existing perpendicular crossing of the park, it would still have a negative impact on the park at this location.
 - ii. All of the action alternatives except C would have a positive impact on the D&R Canal State Park in the vicinity of the Washington Road crossing. Alternative C would be neutral.
 - iii. All of the action alternatives would increase traffic-related visual and auditory intrusion on the D&R Canal State Park in the vicinity of the Harrison Street crossing. Although this impact is associated with an existing perpendicular crossing of the park, it would still have a negative impact.
 - iv. Alternatives B and B.1 would introduce a new road running parallel to the D&R Canal State Park between Harrison Street and Washington Road. This road would be located approximately 350 feet from the canal at its closest point. Increased visual and auditory intrusion to the park in this location would result in a negative impact.
 - v. All of the action alternatives, except the C and G-series alternatives and Alternative D.2, would introduce a new road running parallel to the Millstone River east of the Little Bear Brook. While the alignment of the road respects stream corridor buffer guidelines, at its closest point the road would be approximately 260 feet from the river's edge. Increased visual and auditory intrusion to the river corridor in this location would result in a negative impact.
 - vi. All of the action alternatives, except the C and G-series alternatives and Alternatives D.2 and E, would introduce a new road running parallel to the Millstone River west of the Little Bear Brook. While the alignment of the road respects stream corridor buffer guidelines, at its closest point the road would be approximately 160 feet from the river's edge. Increased visual and auditory intrusion to the river corridor in this location would result in a negative impact.
 - vii. Alternatives D and D.1, which include the ESC 2 alignment, are located further from the Millstone River west of the river's confluence with the Devil's Brook. This increased distance provides an additional buffer from the river west of the Devil's Brook.
 - viii. All of the action alternatives, except the C and G-series alternatives and Alternative D.2, would introduce a new perpendicular road crossing of the Little Bear Brook, approximately 1400 feet from the existing Washington Road crossing. Increased visual and auditory intrusion to the stream corridor in this location would result in a negative impact.

Objective 5: Avoid/minimize disturbance of contaminated materials sites.

- a) The No-Action alternative would result in no disturbance of contaminated materials sites.
- b) All of the action alternatives would result in the potential disturbance of multiple contaminated materials sites.
 - i. The B-series alternatives, which widen Route 1 on its existing alignment, have the least impact on sites of higher concern. Those alternatives that shift the alignment of Route 1 to the west, including the A, C, D, E and F-series alternatives and Alternatives G and G.1, have the greatest impact on sites of higher concern, including existing and former gas stations along Route 1.
 - ii. The D-series alternatives, which include the centrally located east-side connector road (ESC 2), would have the greatest potential for disturbing the site of chlorinated compound releases on the Sarnoff property.
 - iii. If combined with VDC 1, all of the action alternatives except B and G.2 would result in the potential disturbance of the Princeton Station garage on Washington Road, a contaminated materials site which is of moderate to lower concern. VDC 2 and VDC 3 would result in the potential disturbance of the Princeton-Windsor News building on Washington Road and one or more office buildings located at 14 Washington Road. Both are contaminated materials sites of moderate to lower concern.

5.3.4 Other Project Goals and Objectives

There are several additional project goals and objectives that did not relate directly to the potential impact areas described above. A narrative evaluation of the alternatives relative to these goals and objectives are presented below.

Land Use and Transportation Objectives

Objective 1: Consider impacts on land use induced by any transportation improvement – The measure used to assess performance relative to this objective is whether the alternative would foster or “induce” development of land that would not otherwise be permitted to occur if the alternative were not constructed. The General Development Plan (GDP) for the Sarnoff Corporation property approved by the West Windsor Township Planning Board, links full development of the Sarnoff property (approximately 3 million square feet) to the construction of an ESC road or its “functional equivalent.” For the purpose of comparing alternatives under consideration in the EIS, if an alternative includes an ESC road it is assumed to foster development on the Sarnoff property. This assumption is made acknowledging that private construction of an ESC road or equivalent remains possible. Thus, if an alternative does not include an ESC road, it is assumed that development on the Sarnoff property would be constrained to 1.2 million square feet of research/office space until the functional equivalent of the ESC road is built.

- a) The A, B, E and F-series alternatives and Alternatives D and D.1 include an ESC road. In accordance with the General Development Plan for the Sarnoff property approved by the West Windsor Township Planning Board, these alternatives would permit the full build-out of the Sarnoff property, including 3 million square feet of research/office space.
- b) The C and G-series alternatives and Alternative D.2 would limit development on the Sarnoff property to 1.2 million square feet of research/office space until such time as the ESC road or its functional equivalent is constructed by Sarnoff or some other entity.

Objective 2: Ensure that improvements are sustainable – As noted earlier, all of the action alternatives except the No-Action and the G-series alternatives achieve and sustain transportation benefits through the Design Year 2028.

- a) **System-wide congestion relief** – Compared to the No-Action Alternative, all of the action alternatives except the G-series would provide significant public benefit in terms of system-wide congestion relief through the Design Year 2028. VHT would be reduced 21% to 45%; VHT under congested conditions would be reduced 23% to 50%; and VMT under congested conditions would be reduced 11% to 34%. The G-series alternatives would be the worst performing, followed by the C-series and Alternative D.2
- b) **North-south travel time** – Compared to the No-Action Alternative, all of the action alternatives except G.2 would reduce north-south travel time in the AM peak hour, especially in the non-peak direction. These benefits would be sustained through Design Year 2028. Northbound peak direction travel time in the AM peak hour would be reduced 4% to 26%; and southbound (non-peak direction) travel time in the AM peak hour would be reduced 15% to 43%. Alternative G.2 would increase north-south travel time in the AM peak hour. Compared to the No-Action Alternative, the G-series alternatives would be the worst performers relative to reducing north-south travel time.
- c) **East-west travel time** – Compared to the No-Action Alternative, all of the alternatives except C.1 and G.2 would reduce east-west travel time in the AM peak hour from 3% to 31%. Reductions in east-west travel time between West Windsor and Nassau Street in the vicinity of Alexander Road, Washington Road and Harrison Street in Princeton Borough would vary by alternative; however, Alternatives A and D would be the best overall performers, providing the most consistent reduction in east-west travel time to/from all three points. The G-series alternatives would be the worst performers, relative to reducing east-west travel time.
- d) **Intersection delays crossing Route 1** – Compared to the No-Action Alternative, all of the action alternatives except the G-series alternatives would significantly reduce intersection delays on Washington Road and Harrison Street approaching Route 1. Delays under future No-Action conditions are estimated to exceed 16 minutes. For those alternatives that include grade-separated through movement of east-west traffic across Route 1

at Washington Road, Harrison Street, or both, delays would be reduced to 1 minute or less. Intersection delays on Alexander Road approaching Route 1 are largely unaffected by the alternatives.

Objective 3: Maximize the compatibility of actions with the goals and objectives of the municipal Master Plans and the NJ State Development and Redevelopment Plan –
The No-Action and Action Alternatives were examined to determine their compatibility with the transportation/circulation goals, objectives and/or policies set forth in various state, regional, county and local plans. The following plans were considered:

1. West Windsor Township Master Plan
2. Plainsboro Master Plan
3. Princeton Community Master Plan
4. Mercer County Management Plan – Highways & Historic preservation plan elements
5. Delaware Valley Regional Planning Commission Horizons 2025
6. New Jersey State Development and Redevelopment Plan
7. Delaware and Raritan Canal State Park Master Plan & Regulations for the Review Zone of the Delaware and Raritan Canal State Park/Master Plan
8. New Jersey Long Range Transportation Plan – Choices 2025

A detailed comparison of the alternatives relative to municipal, county, regional and state planning documents is presented in Chapter 4, section 4.4. Table 5-11 provides a summary of plan compatibility for each alternative.

Table 5-11
Compatibility with Municipal, Regional and State Planning Documents

Action Alternative	West Windsor Master Plan	Plainsboro Master Plan	Princeton Community Master Plan	Mercer County Growth Management Plan	DVRPC Horizons 2025	New Jersey State Development and Redevelopment Plan	Regulations for the Review Zone of the D&R Canal State Park	New Jersey Long Range Transportation Plan - Transportation Choices 2025
A	YES	YES	0	YES	YES	0	YES	YES
A.1	YES	YES	0	YES	YES	YES	YES	YES
A.2	YES	YES	0	YES	YES	YES	YES	YES
A.3	YES	YES	0	YES	YES	YES	YES	YES
A.4	YES	YES	0	YES	YES	YES	YES	YES
B	YES	YES	0	YES	YES	0	NO	YES
B.1	YES	YES	0	YES	YES	0	NO	YES
B.2	YES	YES	0	YES	YES	0	YES	YES
C	0	YES	YES	YES	0	YES	YES	YES
C.1	0	YES	YES	YES	YES	-1	YES	YES
D	YES	YES	0	YES	YES	YES	YES	YES
D.1	YES	YES	0	YES	YES	YES	YES	YES
E	YES	YES	0	YES	YES	YES	YES	YES
F	YES	YES	0	YES	YES	YES	YES	YES
F.1	YES	YES	0	YES	YES	YES	YES	YES
G	NO	NO	YES	NO	0	NO	NO	YES
G.1	NO	NO	YES	NO	0	NO	NO	YES
G.2	NO	NO	0	NO	NO	NO	NO	YES
No Action	NO	NO	0	NO	NO	NO	NO	NO

YES = Compatible with plan. 0 = Neutral. NO = Not compatible with plan.

EIS Process and Public Participation Objectives

Objective 1: Create an open and inclusive EIS process that:

- meets or exceeds federal standards;
- provides a variety of forums to solicit broad public participation from a wide variety of perspectives;
- ensures that opportunities for public input are widely communicated;
- embraces the principles of context sensitive design, fosters innovation and considers all ideas;
- facilitates cross-communication between agencies, groups and individuals;
- ensures that important but tangential issues raised in the EIS process that cannot be addressed by the EIS process are directed to the appropriate entity for action; and
- ensures that data are accessible and the models and assumptions used to produce data are understandable and clearly defined.

The agency coordination and public involvement program for the Penns Neck Area EIS, which was comprehensive and extensive, was implemented throughout the 24-

month scoping and EIS process. It was developed in full compliance with federal public involvement regulations and significantly exceeded NEPA requirements for preparation of an EIS. It was specifically designed as an open and ongoing process aimed at establishing and maintaining effective dialogue between interested and involved constituencies, stakeholders, and public agencies.

The program's principal objective was to facilitate open lines of communication and information-sharing, active engagement, and maximum participation of the public throughout the scoping, strategy screening, alternatives evaluation, and impact analysis phases of the EIS process. This was achieved through a multi-faceted cooperative approach that involved municipal, state, regional and federal agencies, as well as a broad spectrum of interested publics.

Specific program elements included: stakeholder interviews, small group listening sessions/meetings, large group forums, the Partners' Roundtable Advisory Committee; project website, and six document repositories. Of particular relevance to the above stated objective was the Partners' Roundtable Advisory Committee. The Roundtable began meeting in June 2001 to assist in shaping the EIS process, providing input into screening and evaluating the actions and alternatives selected for detailed analysis in the Draft EIS, and achieving consensus on a wide range of topics. The Roundtable, which met 35 times during preparation of the Draft EIS, was composed of community partners from the public, private, and nonprofit sectors. Its 32 members represented citizens groups, business organizations and stakeholders; the governments of West Windsor Township, Princeton Township, Princeton Borough, Plainsboro Township, Mercer County and Middlesex County; transportation advocacy groups; FHWA; DVRPC; NJDOT; and other State agencies.

The Roundtable engaged in extended dialogue and document review related to all aspects of EIS development, including delineation of the project study area; preparation of a Purpose and Need Statement, Working Problem Statement, definition of project Goals and Objectives, and review of actions and alternatives that were considered for detailed analysis in the Draft EIS. All Roundtable meetings were open to the public and at most meetings members of the public participated in discussions.

Information related to the EIS process and public involvement activities were communicated on the project website and for large group forums display ads were placed in a variety of local and regional newspapers. In addition, notifications were mailed to more than 400 persons included on the EIS mailing list. All project-related data, reports, documents and presentations were made available on the project website and in six document repositories.

5.4 Preliminary Costs

Preliminary construction cost estimates were developed for each of the action alternatives. These cost estimates were based on NJDOT's *Construction Cost Estimation Preparation Manual for Preliminary Design*, July 2002. The construction

cost estimate formulas are based on historical construction cost data for a range of project types. The estimation procedures incorporate the following elements of roadway construction:

1. Earthwork
2. Pavement
3. Culverts & bridges
4. Drainage
5. Utility relocation
6. Landscaping
7. General and incidental items.

Costs related to engineering design, right-of-way acquisition, contaminated materials remediation and other environmental mitigation costs are not included because of the project-specific nature of these items.

Table 5-12
Preliminary Construction Cost Estimates (in 2006 dollars)

Alternative	Cost w/o VDC	Cost for VDC1	Cost with VDC1	Cost for VDC2/VDC3	Cost with VDC2/VDC3
A	\$50,000,000	\$10,000,000	\$60,000,000	\$5,000,000	\$55,000,000
A.1	\$52,000,000		\$62,000,000		\$57,000,000
A.2	\$51,000,000		\$61,000,000		\$56,000,000
A.3	\$54,000,000		\$64,000,000		\$59,000,000
A.4	\$54,500,000		\$64,500,000		\$59,500,000
B	\$36,500,000		N/A		N/A
B.1	\$34,500,000		\$44,500,000		\$39,500,000
B.2	\$42,500,000		\$52,000,000		\$47,500,000
C	\$28,500,000		\$38,500,000		\$33,500,000
C.1	\$22,500,000		\$32,500,000		\$27,500,000
D	\$87,500,000		\$97,500,000		\$92,500,000
D.1	\$60,000,000		\$70,000,000		\$65,000,000
D.2	\$79,000,000		\$89,000,000		\$84,000,000
E	\$51,500,000		\$61,500,000		\$56,500,000
F	\$50,500,000		\$60,000,000		\$55,500,000
F.1	\$53,500,000		\$63,500,000		\$58,500,000
G	\$13,000,000		\$23,000,000		\$18,000,000
G.1	\$14,000,000		\$24,000,000		\$19,000,000
G.2	\$12,000,000		N/A		N/A

Shaded cells: Alternatives that include Route 1 in-a-cut

As shown in Table 5-12, the preliminary cost estimates for the action alternatives range from approximately \$12 million for Alternative G.2 to \$97.5 million for Alternative D, if it were constructed with VDC road alignment 1. The most significant factors affecting the construction costs include:

- the amount of proposed structure required;
- whether Route 1 would be constructed at-grade or in-a-cut;
- if a VDC road is included with an alternative and if so, which VDC alignment is selected; and
- the amount of new roadway needed for an east-side connector road, west-side connector roads and/or frontage roads.

Table 5-13 presents estimates for select major components.

Table 5-13
Costs for Select Major Components

Major Component	Cost Estimate
Route 1 in-a-cut	\$18,000,000
Additional cost for cut-and-cover plaza included in Alternative D	\$27,000,000
East-side connector (ESC) road	\$8,000,000
Vaughn Drive Connector (VDC) road 1	\$10,000,000
VDC 2/3	\$5,000,000

5.5 Evaluation of Value Engineering Recommendations

In Chapter 2, section 2.5, the NJDOT Value Engineering proposals were described. Although these modified alternatives would meet the stated purpose of the project, each has a number of impacts on the natural and built environment that would conflict with the project goals and objectives. The Modified Alternative B and E options would require extensive property acquisition from Princeton University and Sarnoff Corporation to construct the interchanges, west-side connectors and ramps. As these stakeholders have indicated a desire to preserve the Route 1 frontage of their campuses, supported by the project goals and objectives, it is expected that the acquisitions would not be acceptable to them.

The Modified Alternative E options would result in physical and traffic-related noise and visual impacts to the Penns Neck neighborhood. The project goals and objectives sought to limit such impacts on neighborhoods. Negative community sentiment toward Action Alternative E, which features an ESC road on the southern side of the Sarnoff property, would indicate that both Options 1 and 2 would not be acceptable. However, it should be noted that Option 1 would meet other project goals and objectives by avoiding adverse impacts to the archaeological sites on the Sarnoff property and eliminating a new crossing of Little Bear Brook.

Adverse impacts to the Washington Road Elm Allee would likely occur as a result of any B or E options presented by the VE evaluation. This is a natural resource specifically identified for protection in the project goals and objectives. The cultural resources impacts from the Modified B options would be similar to those of the B-series Action Alternatives. The cultural resources impacts from Modified E Option 2 would be similar to those of the E Action Alternative. In both cases these would conflict with the project goals and objectives.

The Value Engineering VDC road modification takes a westerly alignment close to Bear Brook. As a result, it would avoid most commercial buildings south of Washington Road, as well as businesses and residences on the north side of Washington Road. No impacts to NJ TRANSIT's parking would occur. The loop ramp configuration near Washington Road would impact one archaeological site. The

direct environmental impact would be on wetlands and floodplains. Unlike the VDC alignments considered in this EIS, some wetland and floodplain impacts south of the Dinky rail line may be unavoidable in the VE-suggested alignment. This would conflict with project goals and objectives dealing with impact on wetlands and floodplains.