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M E M O R A N D U M

TO: Penns Neck Area EIS Partners' Roundtable members and alternates

FROM: Jon A. Carnegie, AICP/PP
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DATE: March 21, 2003

SUBJECT: Penns Neck Area EIS – Secondary and Cumulative Effects Analysis and Construction Impacts

At the upcoming March 26, 2003 Partners' Roundtable meeting we will present the discussion on the Secondary and Cumulative Effects Analysis (SCEA) conducted for the Penns Neck EIS, as well as construction impacts associated with the Action Alternatives. This memorandum serves as the basis for this discussion.

SECONDARY AND CUMULATIVE EFFECTS ANALYSIS

Potential secondary and cumulative effects on the environment were assessed for the Action Alternatives. As required by the National Environmental Policy Act (NEPA) (40 CFR Part 1508.7), past, present and reasonably foreseeable future actions have been included in this secondary and cumulative effects analysis (SCEA). The SCEA was performed pursuant to 23 CFR Part 771 and the Council on Environmental Quality's guidelines contained in the document entitled *Considering Cumulative Effects under the National Environmental Policy Act*, January 1997. This SCEA was performed using existing readily available data. In cases where data was not readily available, such was noted and an alternative methodology was employed.

Secondary Effects Analysis

"*Secondary effects*" are those that are caused by an action, and are later in time or farther removed in distance, but are still reasonably foreseeable. These may include growth inducing effects, and other effects related to induced changes in the patterns of land use, population density or growth rate, and the related effects on the natural and/or socioeconomic environment (40 CFR 1508.8(b)).

Secondary Effects Study Area

The study area for secondary effects was determined by answering the question of whether the implementation of a Penns Neck Area EIS Action Alternative would cause other development to occur consistent with the definition of secondary effects. The approved General Development Plan (GDP) for the Sarnoff property located in West Windsor Township provides for up to 3 million square feet of office/research space and associated parking areas at the site. The GDP requires that a roadway functionally equivalent to an east-side connector (ESC) be constructed to accommodate traffic demand generated by development on the site beyond Phase I of the approved GDP. Phase I development would add 600,000 square feet of new office/research space to the existing 600,000 square feet of research space. Development of the site beyond Phase I is directly linked to the construction of a road facility similar to the ESC roads proposed in some of the Action Alternatives. Aside from the Sarnoff property, there are no other development proposals or approvals contingent upon the construction of a Penns Neck area improvement. Therefore, the study area for secondary effect analysis was limited to the Sarnoff property.

Methodology and Findings of Secondary Effects Analysis

Secondary effects consist of the impacts that would occur as a result of growth induced by an Action Alternative. For instance, if a sewer line were proposed through land that is currently vacant, the impact of building a home that is now feasible due to installation of that sewer line would be considered a secondary effect. The home is dependent upon the sewer line. In the case of the actions considered in the EIS, if an Action Alternative enhances access to a particular undeveloped site, thus enabling development of that site, the development of the site after road construction would be considered a secondary effect.

The time frame of the secondary effects analysis is from completion of an Action Alternative (ETC) 2008 through Design Year 2028. This 20-year period is the design life of the project, which means the time period during which the project has been designed to be effective in terms of its purpose and need.

For those alternatives that include an ESC road, the EIS employment projections assume that market demand could result in an additional 1.2 million square feet of new office/research space and associated parking on the site by the Design Year 2028. Accordingly, total development on the site would be 1.8 million square feet or approximately 60% of the total space permitted under the GDP approval. The EIS employment projections assume that if an ESC road is not present, development on the Sarnoff site would be constrained to Phase I development which includes a total of 1.2 million square feet of office/research space. Because the provision for an ESC road in some Action Alternatives would enable the development of an additional 600,000 square feet of space by 2028 (total of 1.8 million square feet), this increment of development and its associated impacts would be considered secondary effects of those alternatives. Table 1 provides a brief summary of development potential on the Sarnoff site and associated traffic and impervious cover effects.

Table 1
Summary of Potential Secondary Effects

	Full Build-out	2028 w/o ESC	2028 w/ESC	Secondary Effect
Development (square feet)	3,000,000	1,200,000	1,800,000	600,000
AM peak hour traffic (vehicles)	3,000	1500	2000	500
Impervious surfaces (acres)	78	31	47	16

Sources: Approved GDP for the Sarnoff property, Penns Neck Area EIS travel demand forecasting model.

The 600,000 square feet of additional office and research space enabled by construction of the ESC road would generate an estimated additional 500 peak hour trips and result in an additional estimated 16 acres of impervious cover on the Sarnoff site by 2028. Although the timeframe for this analysis is 2028, it is appropriate to note that at full-build out, the ESC road could enable an additional 1.2 million square feet of office/research space, beyond the time-frame of the analysis. This additional development could result in an estimated 1,000 additional AM peak hour trips and 47 additional acres of impervious surface.

The consequent air quality and noise effects of the additional 500 trips generated by the 600,000 square feet of space have been quantified and incorporated into the analyses of the Action Alternatives that include an ESC road. The direct effects of impervious surface associated with the ESC road have also been quantified and incorporated into the analyses of the Action Alternatives that include an ESC road.

In terms of potential secondary impacts to wetlands, floodplains and water quality, it appears that the Sarnoff GDP was developed with a general knowledge of and respect for the natural resources on the property. In addition, development on the Sarnoff site will be subject to a variety of federal, state and local regulatory processes designed to protect these resources. As such, secondary effects on wetlands, floodplains and water quality should be minimized.

As noted in the EIS, there are a number of cultural resources located on the Sarnoff property and a portion of the Sarnoff Property itself has been deemed eligible for listing on the National Register of Historic Places. Although it is reasonable to assume that development on the Sarnoff site may have an impact on these resources, it is impossible to predict with any certainty what these impacts may be. In addition, it is reasonable to assume that some of these impacts would result without the ESC road. As a private development, it will be the responsibility of the property owner and the municipality to ensure the protection of the natural and built environments as part of the site development process.

Cumulative Effects Analysis

"*Cumulative effects*" are defined by the Council on Environmental Quality's (CEQ) regulations for implementing the National Environmental Policy Act (NEPA) as:

> *"the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions (40 CFR 1508.7)."*

In other words, "cumulative effects" look beyond the direct effects, and secondary effects to account for general changes and developments in the study area. Cumulative effects are not caused by the action. Rather, cumulative effects attempt to describe the context in which any action would exist. Thus, they provide an additional perspective for evaluating proposed action alternatives.

Scope of Study

The scope of study is defined by three key elements that shape the boundaries of the SCEA. These include:

- Key resources analyzed;
- Geographic study area; and
- Timeframe of study.

Key Resources

The universe of resources initially considered for inclusion in this analysis were those resources directly affected by an Action Alternative. Ultimately, the selection of key resources for this study considered not only the local importance of a resource, but its importance on a more regional and cumulative level. The key resources selected and evaluated in this SCEA include:

Traffic, Air Quality and Noise
Wetlands
Impervious Surfaces
Floodplains
Surface Water Quality
Groundwater Recharge
Historical and Archaeological Resources
Open Space Resources

Geographic Study Area

Definition of the geographic study area for the cumulative effects analysis (CEA) considered a variety of geographic inputs including the following:

- Project impact zone. The project impact zone is the area that would be affected by any Action Alternative. This area is located in West Windsor Township, Mercer County, and a portion of Plainsboro Township, Middlesex County. The project impact zone is illustrated on handout Figure 1.

- Primary Study Area (PSA). The PSA includes Plainsboro Township, Princeton Borough, Princeton Township, and West Windsor Township. The PSA is illustrated on handout Figure 2.

- The geographic area occupied by the key resources, within and outside of the project impact zone. Since many of the key resources to be evaluated in the CEA are related to the watershed, the geographic extent of the watershed was evaluated for inclusion in the CEA study area. All Action Alternatives are located within the Millstone River Watershed; Watershed Management Area (WMA) 10 in New Jersey's Raritan Basin. WMA 10 encompasses 24% of the Raritan Basin. The Millstone River WMA is further divided into three sub-watersheds: 1) the Millstone River above Carnegie Lake; 2) the Millstone River below Carnegie Lake; and 3) Stony Brook, which is a tributary to the Millstone River. The proposed action is situated in two of the three sub-watersheds within WMA 10: the Millstone (above Carnegie Lake) and the Stony Brook.[1] WMA 10 and the three sub-watersheds are illustrated on handout Figure 3.

These three geographic inputs were overlaid to form the composite CEA study area illustrated in handout Figure 4. Of the three geographic areas, the project impact zone is the smallest, the PSA is larger, and the watershed is the largest geographic area. The CEA study area totals 104,850 acres or 163.83 square miles of land in Middlesex and Mercer Counties, New Jersey. In summary, the CEA study area can be defined as follows:

CEA Study Area = Project Impact Zone + PSA + Portion of WMA 10

[1] WMA 10 encompasses 285 acres. Each of the Action Alternatives is situated in two of the three sub-watersheds within WMA 10: the Millstone Sub-watershed above Carnegie Lake and the Stony Brook Sub-watershed. These two sub-watersheds were included in the CEA study area, except for small portions of East and West Amwell Townships which are located at the far west end of the Stony Brook sub-watershed, in Hunterdon County.

The third sub-watershed of WMA 10 is the Millstone River (below Carnegie Lake) sub-watershed. This sub-watershed is predominately in Somerset County and includes Montgomery Township, Rocky Hill Borough, Hillsborough Township, Millstone Borough, Franklin Township and Manville Borough. It was determined that since the Action Alternatives do not lie within these municipalities, the portion of the sub-watershed in those municipalities could be excluded from the CEA study area. The portions of this sub-watershed that were retained in the CEA study area include portions of Princeton and Hopewell Townships in Mercer County and South Brunswick and Plainsboro Townships in Middlesex County, due to their close proximity.

Based on the foregoing decisions, the CEA study area includes the following local jurisdictions:

Mercer County:
- East Windsor (portion within WMA 10)
- Hightstown Borough
- Hopewell Borough
- Hopewell Township (portion within WMA 10)
- Lawrence Township (portion within WMA 10)
- Pennington Borough (portion within WMA 10)
- Princeton Borough (All)
- Princeton Township (All)
- West Windsor (All)

Middlesex County:
- Cranbury Township
- Monroe Township (portion within WMA 10)
- Plainsboro Township
- South Brunswick Township (portion within WMA 10)

Study Time Frame

The implementing regulations for NEPA require that cumulative effects analysis address past, present and reasonably foreseeable actions. A definition of past actions is necessary to define the "start-date" of the analysis. For the Penns Neck Area EIS, it was necessary to look back in planning history to determine what major land use changes indicated the onset of development that has historically taken place throughout this Route 1 corridor.

It was determined that construction of the Princeton Forrestal Center and Quakerbridge Mall in 1978 was an important indicator of the large office complex/residential development that occupies the area today.[2] Therefore, 1978 was selected to be the "start-date" for the cumulative impact analysis. The horizon year of the EIS, 2028, was selected as a reasonable "end-date" for the analysis. This 25-year projection into the future is a time span for which planning projections can be made with a reasonable level of confidence and with the support of state, regional, county, and local planning documents. Therefore, this SCEA spans a 50-year period from 1978 to 2028.

Methodology and Findings of Cumulative Effects Analysis

The methodology used to determine cumulative impacts varies based on the resource being evaluated. Three basic methodologies were used to determine cumulative impacts. For some resources, a combination of these methodologies was used. These methodologies include the following:

[2] NJDOT, 1986. Route 1 Corridor Transportation Study.

Growth/Trends Analysis: When historic information and data was available, this data was used to conduct a growth trends analysis. This approach utilized historic growth factors and resource impact information to estimate future impacts within the designated timeframe.

Pavement-Based Analysis: Several areas of potential impact relate directly to increase in impervious surfaces. In these cases, impacts to a resource were assessed based on estimated increases in impervious surface.

Regulation-Based Analysis: When potential impacts were governed by local, state and federal regulations, regulatory standards were used to estimate impacts. In cases where this methodology was used, the governing regulations are described.

The remainder of this section presents the potential cumulative effect findings for the resources listed above. Table 2 presents each studied resource and indicates the methodology used with a shaded cell. In some cases a combination of methodologies were used.

Table 2
Methodologies Used in SCEA

	Methodology Used		
Area of Potential Impact	**Growth and Trends Analysis**	**Pavement-Based Analysis**	**Regulation Based Analysis**
Traffic, Air Quality and Noise			
Wetlands			
Impervious Surface			
Floodplains			
Surface Water Quality			
Groundwater Recharge			
Historical/Archaeological Resources			
Open Space Resources			

**** Shading indicates use of Methodology**

Traffic, Air Quality and Noise

Regional growth in traffic and its consequent air quality and noise impacts is largely determined by demographic changes in any given region. The magnitude of population and employment growth and patterns of development determine what impact growth will have on communities and the environment. The greater the growth and the more dispersed the land pattern, the greater the impact traffic will have.

As shown in Table 3, between 1980 and 2000, the CEA region added approximately 86,000 persons and 65,500 jobs. This represents a 64% increase in population and a 98% increase in employment. The regional and local population and employment forecasts prepared for the EIS

and incorporated into the EIS travel demand forecasting model project a 42% increase in population and a 76% increase in employment within the CEA region by 2028. The cumulative effect of this growth and development in terms of increased traffic and its consequent air quality and noise impacts are presented in the EIS as part of the analysis of the Action and No-Action Alternatives.

The air quality and noise impact analyses conducted as part of the EIS appropriately utilized these cumulative traffic forecasts. As presented at the previous Roundtable meeting, the results of the air analysis indicate that none of the Action Alternatives would cause violation of the National Ambient Air Quality Standards in the core study area. Thus, the cumulative impact with an Action Alternative would not be adverse.

The results of the noise analysis indicate that existing conditions, as well as No-Action and Action Alternatives cause or would cause violations of the federal noise standard. Overall, the alternatives were determined to have an incremental noise impact due to cumulative traffic in the core study area.

Table 3
CEA Region Population & Employment Forecasts

	Base year *	2028	Absolute Change	Percent Change
Population	217,000	307,000	90,000	42%
Employment	143,000	251,000	108,000	76%

* Base year = 1999, 2000, or 2001 depending on data source.
Sources: US Census Bureau, DVRPC, NJTPA, NJDOL, Urbitran Associates

Wetlands

Wetlands of the CEA study area consist primarily of palustrine, forested and palustrine emergent wetlands associated with the various non-tidal watercourses including the Millstone River, Little Bear Brook, Stony Brook and Carnegie Lake, and other waterways. There are approximately 23,696 acres or 37.025 square miles of NJDEP regulated wetlands within the CEA study area.

Wetlands and waterbodies within the CEA study area are freshwater and as such are regulated by the New Jersey Department of Environmental Protection (NJDEP), Freshwater Wetlands Protection Act (FWPA), as governed by the Freshwater Wetlands Protection Act Rules (NJAC 7:7A-1 et al.). These Rules regulate activities proposed within and adjacent to freshwater wetlands and State open waters. Certain activities are regulated by Statewide General Permits (SGPs), which apply to minor activities that would not result in a significant environmental impact. Activities in wetlands, waterbodies or transition areas for which there are no associated SGPs or for those that exceed the allowable criteria, would need individual freshwater wetlands permit (IP). All permit activities are subject to review and approval by the NJDEP.

The methodology developed for estimating future cumulative wetland impacts within the CEA was based on three main objectives, which are outlined below:

- Determine past wetland impact trends in the Millstone River watershed;
- Using the developed trend, estimate future cumulative wetland impacts in the CEA study area; and,
- Using the cumulative wetland impacts trends analysis for the CEA study area and available mitigation data for the Millstone watershed, estimate future annual wetland mitigation rates in the CEA study area.

The Millstone watershed is estimated to have incurred approximately 133.64 acres of freshwater wetland impacts over a thirteen-year span (1988-2001). This is equivalent to an average of approximately 10.28 acres per year. As the CEA study area comprises 57.5% of the Millstone watershed, it can be estimated that 76.84 acres of wetland impact occurred within the CEA study area (57.5% x 133.64 acres) between 1988 and 2001 (past impacts). This includes SGP and IP impacts and does not consider mitigation compensation or possible illegal wetland disturbance activity. Given the anticipated continuation of growth within the Millstone watershed, this wetland impact trend can be expected to continue.

Using the afore-mentioned trend, in a 27-year span between July 1, 2001 and June 30, 2028 of the Design Year, freshwater wetland impacts within the Millstone watershed would total an additional 277.56 acres (10.28 acres per year x 27 years). The CEA study area (104,850 acres) comprises 57.5% of the Millstone watershed, which is 182,400 acres. Of the 277.56 acres of wetland impacts projected for the Millstone watershed through June 30, 2028, it can be assumed that 57.5% or 159.59 acres would be within the CEA study area. Approximately 75% of the CEA study area wetland impacts, or 119.7 acres would be impacted by SGPs and 25% or 39.89 acres would be impacted by IPs. The formula for estimating future wetland impacts in the CEA study area through the Design Year is shown in Table 4, below.

Table 4
Summary of Estimated Future Wetland Impacts in the CEA Study Area Through Design Year 2028

Annual Wetland Impacts – Millstone Watershed (from NJDEP reports)	Wetland Impacts Projected Through 6/30/28 (27-Year Span)	Estimated Annual Wetlands Projected for CEA (57.5% of Millstone Watershed)
10.28 Acres	277.56 Acres	159.59 Acres
159.59 Acres X 75% SGPs = 119.7 Acres 159.59 Acres X 25% IPs = 39.89 Acres		

Activities within the CEA study area requiring an IP must provide mitigation intended to compensate for the loss or disturbance of freshwater wetlands or State open waters. The Rules require that mitigation "shall, at a minimum, fully compensate for the loss of ecological value caused by disturbance, by replacing any freshwater wetlands and/or State open water values and

functions lost or disturbed with equal values and functions." Therefore, the intent of the Rules is to minimize cumulative impacts to wetlands to the greatest extent practicable.

Following past trends, wetland mitigation within WMA 10 and the CEA study area can be expected to achieve approximately 67.7% of the goal. Mitigation for the estimated 39.89 acres of wetland impacts for IPs in the CEA study area would depend on the creation requirement set for each IP. If a one-to-one creation to impact ratio was required with a mitigation goal of 39.89 acres, it is estimated that only 67.7% or 27 acres of wetland creation would be achieved in the CEA study area. If a 2 to 1 creation to impact ratio was required, whereby a goal of 79.78 acres was set, it is estimated that 67.7% of this goal, or 54.01 acres would be achieved. Based on the former, more conservative scenario, where a one-to-one ratio for wetland mitigation would be achieved, 27 acres of mitigation would occur to compensate for the 159.59 acres impacted in the CEA study area between July 1, 2001 and June 30, 2028. Using the same formula to calculate past mitigation amounts, approximately 13 acres of mitigation would be achieved (76.84 acres of impact x 25% for IPs x 67.7% = 13 acres) to compensate for the 76.84 acres of past (1988-2001) wetland impacts. Therefore, in total, approximately 40 acres of wetland mitigation would be achieved for the cumulative wetland impacts of 236.74 acres. The primary reason that this mitigation appears low is that most of the wetland impacts (75%) are authorized through SGPs, which require no mitigation. In addition, there are numerous problems associated with creating, managing and maintaining successful wetland mitigation systems that result in mitigation failures.

To summarize cumulative wetland impacts, of the total 23,696 acres of wetlands within the CEA study area, 236.74 acres would be impacted by Design Year 2028. Of this total, 159.90 acres are anticipated to occur over the next 25 years, representing 0.67% of the total wetlands present in the CEA study area. Of the 236.74 acres of cumulative wetland impact, a maximum of 0.31 acres, or 0.13% is attributable to the potential implementation of one of the Penns Neck Action Alternatives. This 0.31 acres of wetland impact represents 0.0013% of the 23,696 acres of existing wetlands within the CEA study area. Based on this information, and with proper adherence to and enforcement of state and federal wetland regulations, the portion of cumulative wetland impacts in the CEA study area would be negligible. Table 5 below provides a summary of the above.

Table 5
Summary of Past, Present & Reasonably Foreseeable Wetland Impacts in CEA Study Area

Time Frame	Wetland Impacts (acres)	% of Cumulative Wetland Impacts	% of Total Wetlands in CEA Study Area
Past (1988-2001)	76.84	32.46%	0.32%
Present & Reasonably Foreseeable (2001–2028)	159.59	67.41%	0.67%
Penns Neck ETC (2008) – Action Alt.	0.31	0.13%	0.0013%
TOTALS	236.74	100%	1.0%

Impervious Surfaces

According to a land consumption analysis conducted by the Regional Planning Partnership (RPP), a Princeton-based not-for-profit land use and planning advocacy organization, developed land in the central New Jersey region grew by 61% between 1976 and 1996. The study region used for the analysis included 32 municipalities in Mercer County and the southern portions of Middlesex and Somerset Counties (RPP region). The CEA is located entirely within this analysis region. In 1996, 38% or approximately 127,000 acres of land in the RPP region was developed. This "developed" area included land used for commercial, industrial, residential, transportation, communication and utilities purposes. (Carnegie and Brake, 1999).

Assuming that land use patterns in the RPP region are representative of patterns within the CEA, it is reasonable to estimate that approximately 40,000 acres (104,850 acres x 38%) of the CEA were developed in 1996. According to data provided by NJDEP, in 1996, there were an estimated 10,700 acres of impervious surfaces in the CEA study area. This would indicate that impervious surfaces represent approximately 27% of developed land.

It is reasonable to assume that historic development trends and patterns in this portion of central New Jersey will continue into the foreseeable future. As development occurs, the amount of impervious surface will increase. Past development trends and data regarding existing impervious surface in the CEA was used to estimate the acreage of impervious surfaces that could be present in the CEA study area in 2028.

Given past trends and future forecasts for growth in population and employment, it is reasonable to assume that developed land in the CEA could increase at a rate similar to that of the past 25 years. Assuming a 3% annual increase in developed land through the year 2028 would yield an additional 38,400 acres of developed land in the CEA. Assuming a similar proportion of impervious surface will be present in the future, this growth rate would yield an estimated 10,400 acres of additional impervious surface by 2028. As shown in Table 6, the worst case action

alternative in terms of new road-related impervious surface (Alternative B.2) would contribute less than half of one percent to the cumulative impervious cover effects that can be anticipated in the CEA.

Table 6
Impervious Surfaces
Summary of Past, Present and Reasonably Foreseeable
Paved Surfaces in CEA Study Area

Timeframe	Pavement (acres)	Percent of Cumulative Paved Surfaces
1996	10,700	50.6%
1996-2028	10,400	49.2%
Worst Case Action Alternative B.2 (e.g., greatest amount of impervious surface)	33	0.2%
Cumulative Total	21,133	100%

Floodplains

The CEA study area contains portions of the National Flood Insurance Program (NFIP) and NJDEP mapped floodplains for the Millstone River, Little Bear Brook, Stony Brook, Carnegie Lake and the D&R Canal. Flood-prone areas within the CEA study area total approximately 16,989 acres or 26.55 square miles.

The NJDEP regulates development affecting floodplains under the Flood Hazard Area Control Act N.J.A.C. 7:13. These regulations provide protections for floodplains from physical disturbance, as well as control the discharge of runoff from paved surfaces to floodplains and water bodies. Under these regulations, a stream encroachment permit must be obtained for development that would either directly impact a floodplain or discharge stormwater to a regulated floodplain. Private development must also include stormwater management measures to comply with municipal drainage requirements.

Using the pavement-based method, a total of approximately 21,100 acres of impervious surfaces may cover the CEA study area by 2028, as shown on Table 6. The addition of the Penns Neck Action Alternative with the greatest amount of paved surfaces (32.77 acres for Alternative B.2) brings this total to approximately 21,133 acres. The project portion of cumulative impervious surfaces in the CEA would be negligible as compared to cumulative impacts overall.

Surface Water Quality

Five major waterbodies are found within the CEA study area. These are the Millstone River, Little Bear Brook, Stony Brook, the D&R Canal, and Carnegie Lake. The predominant nonpoint pollution sources in the Millstone River watershed are those associated with suburban development, which is on the increase throughout the watershed. Runoff and erosion from construction sites, paved surfaces, landscaped areas, storm sewers and roads all contribute to excessive sediment loading. Septic systems are also believed to be a potential pollution problem throughout the watershed.

All discharges to surface and groundwater are required to be in compliance with the specifications of the New Jersey Pollutant Discharge Elimination System (NJPDES) program. Additionally, all proposed actions must meet stringent stormwater management requirements set forth in the Flood Hazard Area Control Act. The D&R Canal Commission (D&RCC) has set forth their own stormwater management standards under which they will review major projects under D&RCC jurisdiction.

The NJDEP has also proposed new rules and amendments to existing regulations pertaining to water quality and floodplain protection. The purpose of the new stormwater regulations is "to designate additional sources that need to be regulated to protect water quality and to establish a comprehensive stormwater program to regulate these sources." The proposed regulations would establish guidelines for the development of municipal and regional stormwater management plans. These plans, once adopted will subject future development to more stringent stormwater management requirements such that water quality will become better protected.

Development in the CEA study area has and will continue to cumulatively impact surface water quality. As land is developed, temporary soil erosion/sedimentation impacts could result from clearing and grading sites. As described above, the amount of impervious surface in the CEA region is expected to grow as a result of the conversion of open land to development. Non-point source pollution contained in runoff from impervious surfaces would be expected to contribute nutrients and sediment, as well as deicing salts, heavy metals, oils and greases, and other contaminants to the waterbodies.

Although future development can be expected continue to adversely effect surface water resources in the CEA study area, adherence to stringent NJDEP and D&RCC stormwater management regulations will partially mitigate impacts to surface water features during and after construction. The project contribution in the context of overall water quality in the CEA study area is incremental. As demonstrated in previous Roundtable discussions of water quality, the project would strive for better than average performance in its BMPs, so as to have a minimal water quality impact.

Groundwater Recharge

A cumulative impact resulting from anticipated development within the CEA study area is the reduction of groundwater recharge capability due to increased impervious surfaces. Impervious surfaces are estimated to be approximately 21,133 acres by 2028. This is almost doubling the impervious surface area present in 1996.

Municipal land use and zoning regulations govern the type and extent of development, including impervious surface area and the management of stormwater runoff from these surfaces. Current state regulatory programs pertain specifically to groundwater withdrawals and discharges, as well as stormwater management, where an action would impact a regulated area such as a floodplain or wetland. While these regulatory programs provide some protection of groundwater resources, requirements are relatively weak on groundwater recharge.

The NJDEP proposes to enhance existing regulations with new design and performance standards that would focus on water quality protection and recharge enhancement. These regulations, which are likely to be adopted during the design time frame of an Action Alternative, would establish guidelines for the development of municipal and regional stormwater management plans. It is anticipated that an Action Alterative, and other projects in the CEA, would be subject to these more stringent regulations. Thus, regulatory requirements that encourage groundwater recharge, and land preservation efforts will provide some compensation. Strong local, county and state initiatives to preserve parklands and open space will help to offset reduced groundwater recharge resulting from increased impervious surfaces in the CEA.

Historical and Archaeological Resources

A variety of historic architectural and archaeological resources are located within the project study area. These include historic districts, structures, cemeteries, bridges, archaeological and other sites. Potential impacts to cultural resources in the CEA study area are significant due to on-going development pressure. Federal and state funded projects are required to recognize and assess impacts on cultural resources. This regulatory requirement provides some measure of protection.

Protection of cultural resources threatened by private development is the purview of municipalities. Some municipal governments enact historic preservation ordinances; however, ordinances are often weak in terms of requiring property owners and developers to identify and protect cultural resources. The CEA study area communities are fortunate to have active historical organizations and interested individuals. These entities provide some protective benefit by alerting agencies to threatened resources, and pressing for their protection. The recognition of New Jersey as the *Crossroads of the American Revolution* is an example of an initiative that may foster protection of cultural resources.

Losses of cultural resources in the CEA study area have occurred over the years. Farm complexes and other resources have succumbed to development. In particular, commercial

growth along Route 1 has led to the loss of resources alongside the highway. Technological improvements have resulted in the demise of outdated artifacts. An example is the Camden and Amboy Railroad complex alongside the D&R Canal.

Today, the CEA study area remains rich in cultural resources. Some are contextual, such as the elm allee, while others have lost their context but remain important in their own rights, such as the Princeton Baptist Church. In aggregate, however, cultural resources serve as a "scrapbook" of area history. As growth and traffic demand pressures become greater throughout the CEA study area, cultural resources will be increasingly threatened both by public and private development.

Depending upon the Action Alternative selected, up to 13 cultural resources in the study area could be adversely affected. Although this is a relatively small number of resources in the context of the many resources in the CEA study area, it is a notable number considering the small size of the study area and extent of the contemplated alternatives. As with the other NEPA issues, selection and development of an Action Alternative must consider means to avoid, or at least minimize adverse cultural resource impacts, and must provide appropriate mitigation to overcome adverse impacts.

Open Space Resources

Growth in the PSA and CEA through Design Year 2028 is expected to consume a significant part of remaining undeveloped lands. The pressures to preserve land for parks and open space in the CEA study area are great due to on-going development. Mercer and Middlesex County both have active land preservation programs and many of the CEA region municipalities have dedicated sources of local revenue to purchase open space. According to the RPP land consumption analysis, approximately 32,000 acres of land was permanently preserved in the RPP region between 1976 and 1996 (Carnegie and Brake, 1999).

Federal and state funded projects are required to recognize and assess impacts on parks and open space. This regulatory requirement provides some measure of protection. Protection of parks and open space threatened by private development is the purview of municipalities. Municipal and county master plans typically outline existing and future plans for parkland and open space preservation and development. Land designated for preservation must be set aside, purchased, deed restricted, or conserved through easement, trust, or other mechanism to ensure "planned" park and open space becomes a reality.

None of the Action Alternatives would physically impact dedicated parks or open space, although some alternatives may cause localized auditory or visual intrusion due to changes in traffic volumes on existing roads, or new roads. However, in the cumulative context, an Action Alternative would have a negligible adverse impact on the open space resources in the CEA.

Conclusion

In summary, throughout the 2028 SCEA timeframe, residential, research/development and office development is expected to continue to occur throughout the CEA study area. This growth and development is likely to result in impacts to most of the resources identified in the SCEA. As explained above, regulations have been and are expected to be enacted specifically to protect many of these resources. These regulations require that project sponsors make all reasonable efforts to avoid impacts, minimize unavoidable impacts, and as appropriate, implement compensatory mitigation for unavoidable resource impacts.

POTENTIAL CONSTRUCTION IMPACTS

Construction impacts are consequences of activities undertaken during the construction phase of a project. These impacts are considered to be temporary, and are distinct from the permanent impacts presented in fore-going Roundtable presentations of traffic, natural, and built environment impacts.

As is common in the preparation of an EIS, because of the conceptual nature of the Action Alternatives, this discussion of potential construction impacts is necessarily general in nature. The following summary includes the typical range of concerns to be encountered during construction of any of the Action Alternatives and the range of planning strategies that could be applied to avoid or minimize adverse impacts.

Developing a detailed construction approach typically occurs during the design phase of a project when specific alignments are known. Development of a construction approach during the design phase of project development ensures that the project can be built while avoiding, or minimizing to the greatest extent possible adverse temporary effects on the natural and built environments.

The types of concerns a typical construction approach will address include:

- Natural Resource Protection
- Maintenance and Protection of Traffic
- Community Protection
- Protection of Workers on the Construction Site
- Protection of Utility Services

Natural Resources Protection

The NJDEP regulatory framework specifies strategies that would have to be used during construction of any Action Alternative to avoid or minimize impacts to natural resources. The Flood Hazard Control Regulations (NJAC 7:13-1.1 et seq), the NJDEP's *Technical Manual for Stream Encroachment*, the Freshwater Wetlands Protection Act Rules (NJAC 7:7A), and

Regulations for the Review Zone of the Delaware and Raritan Canal State Park (NJAC 7:45-1.1 et seq) mandate that

- areas of temporary disturbance be minimized during construction;
- disturbance areas be delineated and fenced; and, ultimately,
- temporarily disturbed areas be restored at the end of the construction period.

During the final design phase of a project, drawings would be submitted to the NJDEP as part of the permit review and approval processes. These drawings must indicate the strategies that would be used to protect natural resources during construction. Strategies likely to be applied to design of an Action Alternative would include minimizing the construction disturbance area to the greatest extent possible, particularly at or near waterways and forested areas, protecting vegetation near watercourses, applying appropriate soil erosion and sediment control strategies, and restoring temporarily disturbed areas at the end of construction.

The NJDOT's *Standards for Soil Erosion and Sediment Control* were developed from the Natural Resource Conservation Service's *Standards for Soil Erosion and Sediment Control in New Jersey*, and contain specific requirements for stabilizing temporarily exposed soils and protecting waterways from the effects of erosion and soil movement. These standards typically require vegetative stabilization of exposed soils, use and proper maintenance of protective silt fencing and other devices to contain soils, temporary drainage systems, and, ultimately, permanent restoration of disturbed areas and permanent vegetative stabilization.

Maintenance and Protection of Traffic

Construction of an Action Alternative would occur in stages over approximately a 3-year period. A project construction phasing plan and appropriate traffic control plan would be developed during final design to coordinate construction activities and minimize disruption of traffic movements. Public awareness programs to inform residents and motorists about potential construction delays and patterns would be implemented by the NJDOT.

A purpose of a construction phasing plan is to avoid, or at least minimize, traffic impacts. During the traffic data presentations, a conceptual phasing plan for Route 1 in-a-cut demonstrated that traffic movements would be accommodated on Route 1 and east-west cross streets throughout the construction period. During final design, a detailed construction phasing plan would be developed for the entirety of an Action Alternative, including not only Route 1 but also the Northeast Corridor bridge crossing, Washington Road, Vaughn Drive, and the east- and west-side connectors as they apply. The overall phasing plan must also consider activities external to the project, such as the Alexander Road Bridge replacement project. Special attention would be paid to ensuring that the construction phasing and traffic control plans of multiple projects work together to minimize traffic impacts.

The purpose of a traffic control plan is to accommodate traffic movements that existed on roadways immediately prior to the construction period to the greatest extent practicable. A traffic control plan would be developed along with a construction phasing plan during final design of an

Action Alternative. Using the guidance provided in the *Manual of Uniform Traffic Control Devices*, the traffic control plan would specify where, how and when travel lanes would be maintained, what routes should be provided, when and where closures are necessary, and how signage should be presented to orient motorists.

Community Protection

Construction activities can have adverse visual and auditory impacts on the community in which they occur. In some cases, impacts can be avoided by carefully locating material stockpile and equipment storage areas away from places where people live. More than likely, however, some impacts are unavoidable and best efforts must be used to minimize the adverse impacts of construction. A key component in community protection is keeping the community apprised of activities during construction. To the greatest extent possible, the community would be kept informed of the elements of each construction stage that have the potential to affect them: traffic management, unavoidable noisy operations, and activity durations, for example. Community awareness minimizes surprises and allows the community to prepare for activities that may impact them.

Other efforts include physical protections. The placement and maintenance of fencing around the work area would contain the work activity and protect the community from potential construction hazards.

Construction may result in short-term impacts to local air quality resulting from construction equipment activities, temporary changes in traffic operations and distribution, and soil exposure. NJDOT *Standard Specification, 107.28 Environmental Protection, Section 2 – Control of Noise and Air Pollution*, would be followed during construction periods to minimize construction related air quality impacts. An appropriate traffic control plan, previously described, may limit localized emissions during construction. Soil erosion control measures on the worksite would minimize airborne dust: vegetative stabilization of soils and/or wetting of soils within the construction zone, and transport of topsoil in tarpaulin-covered trucks, among other techniques.

The area adjacent to the construction right-of-way of an Action Alternative would experience an increase in noise levels during construction. Generally, roadway construction involves land clearing and grading, placing of structures, and paving. Table 7 lists typical noise levels for various types of construction equipment. Construction noise levels are estimated to be as high as 90 decibels during construction.

Table 7
Noise Level dBA at 50 Feet
for Various Construction Equipment

Equipment (Earth Moving)	Noise Level (dBA)	**Stationary**	Noise Level (dBA)
Front Loader	79	Pumps	76
Back Hoes	85	Generators	78
Dozers	80	Compressors	81
Tractors	80	**Impact**	
Scrapers	88	Pile Drivers	100
Graders	85	Jackhammers	88
Truck	91	Rock Drills	98
Paver	89	**Other**	
Materials Handling		Saw	78
Concrete Mixer	85	Vibrators	76
Concrete Pump	82		
Crane	83		
Derrick	88		

NJDOT's standard construction noise mitigation measures would be included in the specifications for an Action Alternative to minimize noise impacts during construction. Key measures are:

1. All construction equipment powered by an internal combustion engine shall be equipped with a properly maintained muffler.

2. Air compressors shall meet current USEPA noise emission exhaust standards.

3. Air powered equipment shall be fitted with pneumatic exhaust silencers.

4. Stationary equipment powered by an internal combustion engine shall not be operated within 150 feet of a noise sensitive site without portable noise barriers placed between the equipment and the noise sensitive sites. Noise sensitive sites shall include residential buildings, motels, hotels, schools, churches, hospitals, nursing homes, libraries and public recreation areas.

5. Powered construction equipment shall not be operated before 8 a.m. or after 8 p.m. within 150 feet of a noise sensitive site.

6. To minimize the duration of high noise levels, noisy operations should be scheduled concurrently as the combined noise level would not be significantly greater than the level produced if the operations were done separately, and the duration of the activities would be less.

Preliminary geotechnical borings along Route 1 suggest that rock removal can be undertaken for Route 1 in-a-cut using typical excavation methods. As will be indicated in the DEIS, rock blasting is considered a last resort in the event that solid rock is encountered during construction and no other excavation techniques prove feasible. The community would be informed of the need and schedule for such activities and would adhere to local governmental requirements and NJDOT procedures.

Protection of Workers on the Construction Site

The community of construction workers on the job site must also be protected during construction activities. Construction specifications for an Action Alternative would include the provision for the development and use of a Health and Safety Plan. The Plan would identify procedures to be followed to ensure a safe working environment for workers on the job site, as well as specific procedures and contractor responsibilities to be followed in the event that a hazardous condition or emergency is encountered on the construction site.

Protection of Utility Services

Utility services are defined as vehicles that transmit water, sewer, stormwater, power, cable television, telephone, and other information or products. Construction of an Action Alternative would likely require the temporary or permanent relocation of utilities. Coordination of construction activities with local utility officials and implementation of staged construction would be undertaken as part of normal construction practice to insure that continuous utility services are provided to local area residents and businesses.