NJ 42 Corridor Study

A Plan of Action

Delaware Valley
Regional Planning
Commission

August 2008

Created in 1965, the Delaware Valley Regional Planning Commission (DVRPC) is an interstate, intercounty and intercity agency that provides continuing, comprehensive and coordinated planning to shape a vision for the future growth of the Delaware Valley region. The region includes Bucks, Chester, Delaware, and Montgomery counties, as well as the City of Philadelphia, in Pennsylvania; and Burlington, Camden, Gloucester and Mercer counties in New Jersey. DVRPC provides technical assistance and services; conducts high priority studies that respond to the requests and demands of member state and local governments; fosters cooperation among various constituents to forge a consensus on diverse regional issues; determines and meets the needs of the private sector; and practices public outreach efforts to promote two-way communication and public awareness of regional issues and the Commission.

Our logo is adapted from the official DVRPC seal, and is designed as a stylized image of the Delaware Valley. The outer ring symbolizes the region as a whole, while the diagonal bar signifies the Delaware River. The two adjoining crescents represent the Commonwealth of Pennsylvania and the State of New Jersey.

DVRPC is funded by a variety of funding sources including federal grants from the U.S. Department of Transportation's Federal Highway Administration (FHWA) and Federal Transit Administration (FTA), the Pennsylvania and New Jersey departments of transportation, as well as by DVRPC's state and local member governments. The authors, however, are solely responsible for its findings and conclusions, which may not represent the official views or policies of the funding agencies.

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This report benefited from the support and involvement of the Study Advisory Committee members through a series of meetings and presentations. Thanks are hereby given to all participants for their input in the planning process.

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1.0 EXECUTIVE SUMMARY

The NJ 42 Corridor Study was undertaken by the Delaware Valley Regional Planning Commission (DVRPC) to address the transportation and land use issues within the corridor. The NJ 42 corridor comprises parts of Washington and Monroe townships in Gloucester County and Gloucester and Winslow townships in Camden County. This is a congested corridor, as identified by the Congestion Management Process.

NJ 42 and US 322, commonly known as Blackhorse Pike, is primarily a four-lane Urban Principal Arterial within the study area. It is a multipurpose facility that is used for local and regional traffic within New Jersey. It is also a major commuter corridor for traffic to Philadelphia, as well as destinations along the New Jersey Shore. There are congestion and traffic safety concerns in primary shopping areas during peak periods. Berlin-Cross Keys, an Urban Principal Arterial, acts as a major connector between the Atlantic City Expressway and NJ 42.

This study documents and describes the existing conditions along the corridor and identifies alternative concepts and policies that address existing deficiencies. Rationalizing the median openings in Washington and Monroe townships is one operational improvement recommended for the corridor. Blackhorse Pike is divided by a 20- to 30-foot wide grass median along eight miles of the study corridor. It is occasionally interrupted by breaks to serve an intersecting street or driveway, or to provide a U-turn opportunity. An analysis identified those median breaks that are adequate and safe, as well as those that should be modified or closed to improve traffic safety and efficiency.

This is a major commuter transit corridor in which there is a dearth of available Park-and-Ride sites. In an attempt to address this deficiency, 12 potential Park-and-Ride sites in the study corridor were analyzed and ranked. The analysis includes factors such as vehicular access, existing bus service, security, and the improvements necessary to make the site functional. This analysis provides background information that can be used by NJ Transit and NJDOT in pursuing Park-and-Ride development in the corridor.

A travel time survey was performed to assess mobility in the study corridor. The survey was conducted along the length of the Black Horse Pike, from the North-South Freeway to the intersection of Malaga-New Brooklyn Road in Monroe Township. AM peak data suggests that traffic moves efficiently, although drivers encounter localized delays. Speeds were somewhat slower in the northern end of the corridor, where traffic volume increases approaching the North-South Freeway. There is an increase in PM peak travel time, compared to the AM peak, but much of the increase is concentrated around Berlin-Cross Keys Road and, to a lesser extent, Sicklerville Road. Berlin-Cross Keys Road is one of two facilities in the study corridor that provide access to the Atlantic City Expressway, as well as Camden County population centers. Delays also increase significantly in the vicinity of Sicklerville Road, the other Atlantic City Expressway access road.

An analysis of vehicle speeds was conducted on Berlin-Cross Keys Road to identify periods when motorists are most likely to speed. The data shows that on the roadway segment between Sicklerville Road and the Atlantic City Expressway, most speeding occurs between the hours of 6:00 AM and 2:00 PM There was much less speeding during the PM peak, when volumes are highest. The segment between Johnson Road and the Atlantic City Expressway exhibits a similar trend, although volumes are twice as high.

An extensive and integrated bicycling and walking infrastructure is essential in providing nonmotorized connections between residential areas and schools, parks, businesses, and transit routes. This study

examines ways of promoting bicycle use by identifying an interconnected network of clearly designated bicycle routes. On-road segments have been identified that would complement the proposed off-road trails network, some of which have already been built, by connecting it to selected bicycle origins and destinations.

Locations for pedestrian facilities and amenities have also been identified. These facilities can provide a viable alternative to the use of the automobile for local travel and function as a feeder service for longer trips.

Access management is one of many strategies recommended to be used to improve the function of the corridor's roadways. The methods recommended to be employed seek to optimize and maintain the existing transportation system while preparing for its future growth. With fewer new highways being built, the need for effective management of the current transportation network is even more pronounced.

Based on discussions with stakeholders and independent field visits, several access management issues have been identified in the NJ 42 study corridor. First, there are numerous access points, but few acceleration and/or deceleration lanes, resulting in disruption of traffic flow due to turning vehicles. In addition, there are few opportunities to access properties adjacent to the roadway without using NJ 42. Finally, with the presence of a considerable amount of vacant and undeveloped properties within the study area, combined with recent development pressure, it is expected that the corridor will experience significant growth in the near future.

Several corridor-wide improvements were recommended, including:

1: Encourage shared access along the Black Horse Pike and Berlin-Cross Keys Road.
2: Install acceleration and/or deceleration lanes at high-volume turning locations.
3: Encourage improved internal circulation among businesses.
4: Complete the network of sidewalks along the Black Horse Pike and Berlin-Cross Keys Road and at business access points.

To achieve the implementation strategies and tools outlined in this report, each municipality will have to engage in individual actions, such as the amendment of local ordinances, as well as multimunicipal collaboration on issues such as the creation of an official map or overlay district. The access management tools serve as initial guidance for study area municipalities to implement the recommendations.

The study area's environment—which includes nationally significant water systems, prime agricultural soils, and a cherished rural heritage—is impacted by the auto-dependent, sprawl-style development patterns that characterize much of the recent growth in the area. The report provides an overview of the most significant environmental resources in the area. It examines the challenges and opportunities involved in ensuring the sustainability of these resources. This information can be used to make planning decisions about the kinds of development that are appropriate for the study area, where new growth should occur, and what measures communities can take to enforce protections that will preserve and enhance their unique environmental assets.

2.0 PURPOSE AND NEED

The purpose of this study is to develop a plan identifying specific strategies that would improve mobility, reduce congestion, and improve the safety of road users within the context of a sustainable environment in the Route 42 corridor. The study addresses the problem of congested roadways largely caused by rapid suburban development and a lack of alternatives to the single occupant vehicle. Land use policies that encourage sprawl are evident in this corridor. These have also resulted in environmental degradation. This study attempts to address these needs by identifying immediate and long-term context-sensitive solutions that can improve traffic mobility, circulation, and safety while protecting the integrity of the environment. The study does this by exploring integrated transportation and land use planning solutions to address concerns about growth, congestion, access, and quality of life in the study area.

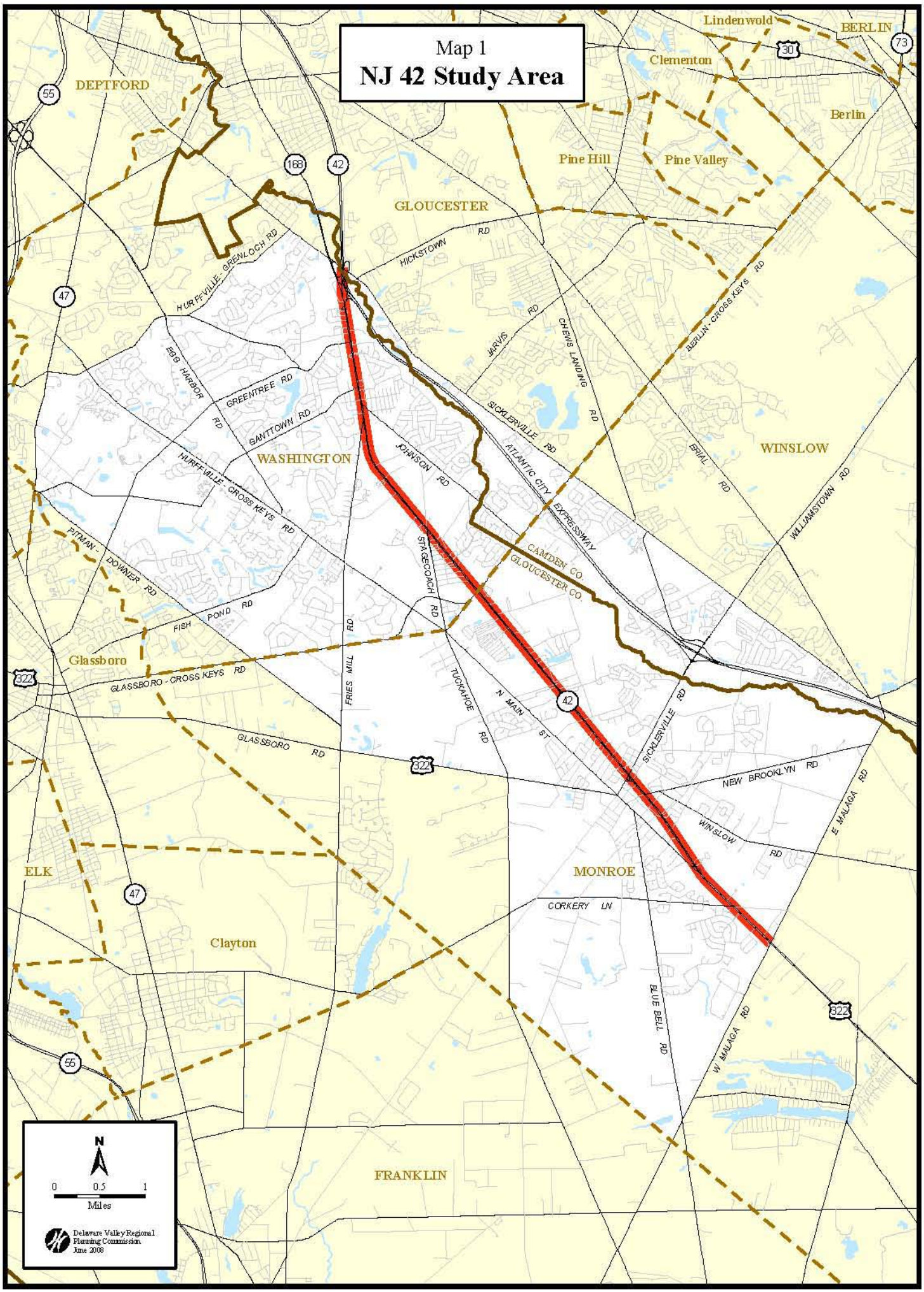
3.0 INTRODUCTION

The study corridor comprises parts of Washington and Monroe townships in Gloucester County and Gloucester and Winslow townships in Camden County. It extends from Sicklerville Road in the north to Malaga - New Brooklyn Road in the south, a distance of 8.9 miles. The study corridor is shown in Map 1.

The study municipalities have been undergoing strong, steady residential growth—a trend that is likely to continue in the future. Along the roadways that weave through the study corridor, fields and farms exist next to suburban-style subdivisions. A major challenge is protecting natural and recreational resources for the future while accommodating the demand for growth in the present. The region's adopted long-range plan, *Destination 2030*, recommends goals and policies to achieve a more sustainable region, predicated on better linking land use and transportation plans and projects to achieve smart growth.

Residential and employment growth is driving reciprocal commercial and retail growth on or near the Black Horse Pike (NJ 42/US 322), the locus of commercial and retail activity in the study corridor. It is also increasing the demand for travel on NJ 42 and the Atlantic City Expressway. These two facilities are important conduits for commuter trips between the study area and employment centers in Philadelphia, Camden, Atlantic City, and central New Jersey. One important goal of the study is to promote seamless access to these two facilities. Traffic congestion at expressway ramps has received specific attention, as has Berlin-Cross Keys Road, a major expressway access road.

NJ Transit operates local and commuter bus service on NJ 42 and commuter bus service on the Atlantic City Expressway. These commuter transit services remove single-occupancy vehicles from crowded roadways during periods of peak travel. A major limitation to increased ridership is lack of access to the routes. Gloucester County and NJ Transit have made several failed attempts to construct Park-and-Ride lots in the corridor. A study task has been to review these past efforts, to work with the county and NJ Transit to revive those projects that seem most promising, and to identify other potential sites.


Map 1
NJ 42 Study Area
Lindenwold
BERLIN
Clementon
Berlin
DEPTFORD
Pine Hill
Pine Valley
GLOUCESTER
WASHINGTON
WINSLOW
Glassboro
ELK
Clayton
MONROE
FRANKLIN
HICKSTOWN RD
HURFFVILLE-GRENLOCH RD
EGG HARBOR RD
GREENTREE RD
GANTTOWN RD
HURFFVILLE-CROSS KEYS RD
PITMAN-DOWNER RD
FISH POND RD
GLASSBORO-CROSS KEYS RD
GLASSBORO RD
JARVIS RD
CHEWS LANDING RD
BERLIN-CROSS KEYS RD
SICKLERVILLE RD
ATLANTIC CITY EXPRESSWAY
JOHNSON RD
STAGECOACH RD
FRIES MILL RD
TUCKAHOE RD
N MAIN ST
CAMDEN CO.
GLOUCESTER CO.
ERIAL RD
WILLIAMSTOWN RD
NEW BROOKLYN RD
WINSLOW RD
E MALAGA RD
W MALAGA RD
CORKERY LN
BLUE BELL RD
55
47
168
42
30
73
322
N
0 0.5 1
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4.0 DEMOGRAPHICS

For the past 20 years, the study corridor municipalities have experienced steady population and employment growth. According to DVRPC's *Analytical Data Report #14* (August 2007), this trend is likely to continue, although the location of the fastest growth has shifted from Gloucester Township to Washington, Monroe, and Winslow townships.

4.1 Population Forecast

Population growth is expected to rise between 2005 and 2035. The four municipalities will add a total of 32,897 residents by 2035. Monroe Township will experience the largest population boom, with over 15,000 new residents. The population forecast for each municipality is summarized in Table 1.

4.2 Employment Forecast

Employment growth is expected to rise between 2005 and 2035. The four municipalities will add a total of 11,106 jobs by 2035. Employment will increase the most in Washington Township (51 percent), followed by Monroe Township (35 percent). Washington Township is projected to overtake Gloucester Township in jobs. The employment forecast for each municipality is summarized in Table 2.

Table 1: Population Forecast

Municipality	County	Year				
		2005 Estimate	2020 Forecast	2035 Forecast	2005 - 2035 Absolute Change	2005 - 2035 Percent Change
Monroe Twp.	Gloucester	31,156	39,663	46,709	15,553	50%
Washington Twp.	Gloucester	50,198	54,284	57,695	7,497	15%
Winslow Twp.	Camden	37,274	40,126	42,506	5,232	14%
Gloucester Twp.	Camden	66,025	68,540	70,640	4,615	7%
Total:		**184,653**	**202,613**	**217,550**	**32,897**	**18%**

Source: DVRPC 2007

Table 2: Employment Forecast

Municipality	County	Year				
		2005 Estimate	2020 Forecast	2035 Forecast	2005 - 2035 Absolute Change	2005 - 2035 Percent Change
Monroe Twp.	Gloucester	8,128	9,690	10,993	2,865	35%
Washington Twp.	Gloucester	12,861	16,409	19,372	6,511	51%
Winslow Twp.	Camden	7,893	8,351	8,733	840	11%
Gloucester Twp.	Camden	15,663	16,148	16,553	890	6%
Total:		**44,545**	**50,598**	**55,651**	**11,106**	**25%**

Source: DVRPC, 2007

5.0 ENVIRONMENTAL RESOURCES AND MANAGEMENT

The study area's environment—which includes nationally significant water systems, prime agricultural soils, and a cherished rural heritage—is impacted by the auto-dependent, sprawl-style development patterns that characterize much of the recent growth in the area. This chapter provides an overview of the most significant environmental resources in the study area. It examines the challenges and opportunities involved in ensuring the sustainability of these resources. The information in this chapter can be used to make planning decisions about the kinds of development that are appropriate for the study area, where new growth should occur, and what measures communities can take to enforce protections that will preserve and enhance their unique environmental assets.

5.1 Historic and Cultural Resources

The study area was originally populated by Lenni-Lenape Indians. Artifacts and records indicate that a number of Indian encampments were located throughout parts of Gloucester and Camden counties.

In the late-1700s, settlers began farming the area, taking advantage of the prime soils. The area remained largely agrarian, with some manufacturing and canning operations, until the mid-1900s. Today, two buildings dating from this period of agricultural settlement are listed on the National Register of Historic Places. The two-room Hall Street School in Monroe Township, built in approximately 1877, was added to the Register in 2006. The Free Library and Reading Room/Williamstown Memorial Library in Williamstown is also listed in the Register. It opened in 1878 and still functions as a library.

In the post-war era, road construction opened the area up to suburban residential and commercial development. The New Jersey Turnpike and the Atlantic City Expressway opened in the 1960s, and Route 42 was built in the 1970s. In addition to local traffic, daily commuters from southern New Jersey and weekend commuters to the Jersey shore contribute to high levels of congestion in the area.

The construction of roadways led to growth and development that created a shift in character from rural village to bedroom community. Communities in the study area are increasingly dominated by auto-oriented development patterns. There is tremendous pressure to convert farmland and open space for residential and commercial uses. Because the area has grown so quickly, local governments have struggled to keep up with demands on the local infrastructure system. As a result, congestion is widespread.

5.2 Water Resources

Of the many natural resources in the study area, the water resources merit particular attention. The study area includes several water systems that are recognized as nationally significant. More importantly, area residents are dependent on local groundwater for their drinking supply. Although the water resources in the study area are of crucial importance, they are increasingly threatened by development patterns that increase stormwater runoff and reduce natural filtration and recharge processes. Communities in the study area can be more vigilant about protecting water resources to ensure the long-term viability of their drinking water supply and water-based recreation areas. Strategies to protect water resources are also often the cheapest and best ways to provide for the

meaningful conservation of other natural resources, including land and wildlife.

The water systems in the study area with recognized national significance are the Kirkwood-Cohansey aquifer system, the Great Egg Harbor River, and the Maurice River. The Kirkwood-Cohansey aquifer system underlies the Pinelands. The Pinelands is our country's first National Reserve, established by Congress in 1978. The Kirkwood-Cohansey aquifer is estimated to contain over 17 trillion gallons of some of the purest drinking water in the country. The study area covers parts of the watersheds for the Great Egg Harbor and Maurice Rivers. These rivers are designated by Congress as National Wild and Scenic Rivers. This program recognizes the country's most outstanding free-flowing rivers, establishes protections to ensure that river water quality is maintained, and requires development of comprehensive river management plans.

Watersheds and River Systems

A watershed is a geographic land area that drains to a specific water body. Environmental planners like to define regions by watersheds because they are natural ecological units that link the water, soil, and plant and animal life systems in an area. Headwaters are of particular importance in watersheds because headwater condition affects water quality downstream. Headwaters are easily impaired because they tend to be small and shallow. Headwaters are also important parts of water-based ecosystems because they typically contain a variety of aquatic life. Map 2: Watersheds depicts the watersheds in the study area.

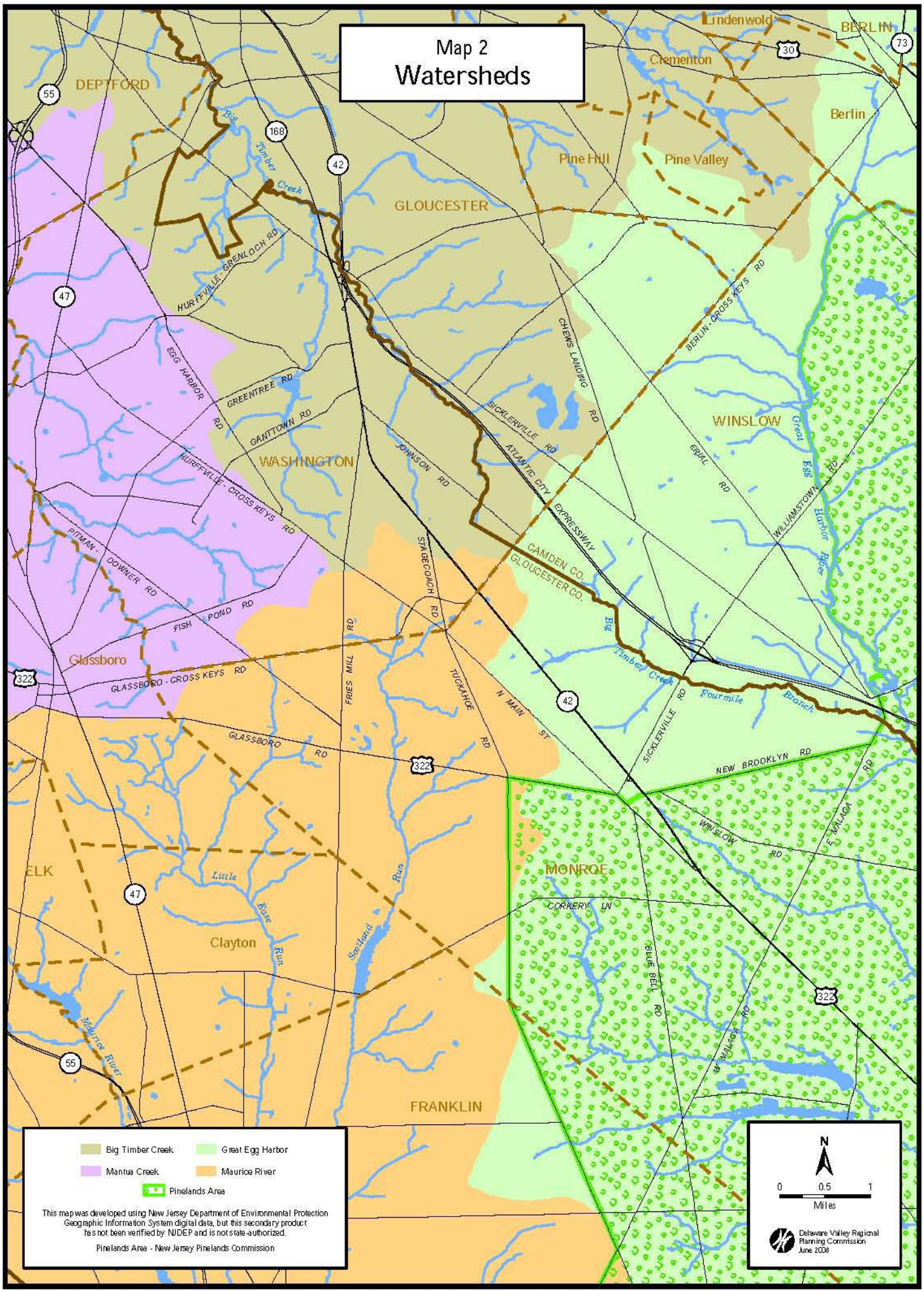
Great Egg Harbor Watershed

The southeastern part of the study area is in the Great Egg Harbor Watershed. Headwaters of the Great Egg Harbor River found in the study area include Hospitality Branch, Timber Lake, Sunset Lake, and Victory Lake.

Great Egg Harbor River was named by early navigators for the waterway's abundant nesting birds and their eggs. The river is still home to diverse bird and fish populations, including many threatened and endangered species, such as the bald eagle, the peregrine falcon, and the Pine Barrens tree frog. The striped bass and alewife herring spawn in the River on an annual basis. As the largest canoeing river in the Pine Barrens, it is an important recreational destination.

In 1992, Congress designated segments of the Great Egg Harbor River and its tributaries as a National Wild and Scenic River. More than 99 percent of the eligible waterways and adjacent lands of the designated river corridor are within the boundary of the Pinelands National Reserve. The use of land and water in the Pinelands Area is regulated by the Pinelands Comprehensive Management Plan, which means that much of the Great Egg Harbor River is substantially protected. However, in the Route 42 corridor study area, parts of the Great Egg Harbor Watershed are not located within the Pinelands. These headwater areas may be more vulnerable to contamination because development is not as stringently constrained here.

The National Wild and Scenic River designation requires development of Local River Management Plans by each of the 12 municipalities along the river corridor, as well as joint development of a Comprehensive Management Plan. The Local River Management Planning process encourages townships along the river corridor to review their ordinances, identify compatible uses, delineate a local boundary for the river, and employ best management practices. During designation and development of the Comprehensive Management Plan, it was determined that local zoning among the 12


Map 2
Watersheds
Lindenwold
BERLIN
Clementon
Berlin
DEPTFORD
Pine Hill
Pine Valley
GLOUCESTER
WINSLOW
WASHINGTON
Glassboro
ELK
Clayton
MONROE
FRANKLIN
Big Timber Creek
Great Egg Harbor
Mantua Creek
Maurice River
Pinelands Area
This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not state-authorized.
Pinelands Area - New Jersey Pinelands Commission
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June 2008

municipalities is consistent with necessary protections. Therefore, the requirement for the Local River Management Plan for each municipality can be met through the local zoning and ordinance process. Alternately, municipalities may develop a Local River Management Plan.

Two of the 12 municipalities in the Great Egg Harbor River corridor are in the study area. Monroe Township in Gloucester County has 17.58 miles of water frontage on the Great Egg Harbor River and its tributary, the Squankum Branch. Winslow Township in Camden County has 26.39 miles of water frontage along the Great Egg Harbor River and Big Bridge Branch. The Great Egg Harbor River forms a boundary between Monroe and Winslow townships.

Monroe Township produced a Local River Management Plan, which included a goal of keeping the river corridor undeveloped while allowing for low-intensity recreational activities. In Monroe, the local river management boundary is entirely within the Pinelands. Zoning in the boundary allows primarily for agricultural uses and low-density rural development, with some more intensive development permitted along the Black Horse Pike and Route 659.

In Winslow Township, much of the Great Egg Harbor River corridor is within the Pinelands. Winslow's zoning conforms to the Local River Management Plan requirements. In the river management boundary, zoning allows for recreation, conservation, environmentally sensitive area districts, agriculture uses, and some additional development in areas of existing development.

The Great Egg Harbor Watershed Association is an active and successful watershed association that serves as the host organization for the local management and implementation of the Comprehensive Management Plan for the Great Egg Harbor National Scenic and Recreational River. The Comprehensive Management Plan sets goals of public awareness, improved river management, compatible land use, appropriate recreational use, and enhanced resource protection.

Maurice River Watershed

A portion of the Maurice River Watershed is located in the center of the study area in parts of Monroe and Washington townships. Its tributaries drain into the southwest portion of the Pinelands. Some of the headwaters of the Maurice River in the study area include Scotland Run, Still Run, and Little Ease Run.

The Maurice River Watershed is home to more than half of the species of plants and animals listed on the New Jersey Threatened and Endangered Species List. Located along the Atlantic Flyway route, it provides habitat to a rich variety of birds and aquatic life. Vestiges of the river's fishing, boating, and oystering heritage may be seen along the waterway. New Jersey's largest stand of wild rice is located along the river.

The Maurice River provides a crucial link between the Pinelands National Reserve and the Delaware Estuary. The Delaware Estuary is one of 28 National Estuaries and is home to the world's largest population of spawning horseshoe crabs and the second largest concentration of migrating shorebirds in the western hemisphere.

In 1993, Congress designated segments and tributaries of the Maurice River as a National Wild and Scenic River in 1993. Although the designated Wild and Scenic River corridor is not in the study area, the headwaters of the Maurice River in Monroe and Washington townships should be protected to reflect their connectivity with this valuable water resource.

Mantua Creek Watershed

The northwestern part of the study area is located in the Mantua Creek Watershed. Tributaries to Mantua Creek in the study area include Duffield Run and Bethel Run. Washington Township is in the process of establishing a greenway in part to protect these water resources and to support continuity with the Upper Mantua Creek Greenway. Kandle Lake is another water resource in the study area that is part of the Mantua Creek Watershed.

Big Timber Creek Watershed

The northeast portion of the study area is in Big Timber Creek Watershed. The South Branch of Big Timber Creek runs through parts of Washington Township and Gloucester Township. Bells Lake is part of the Big Timber Creek Watershed. Big Timber Creek is home to numerous bird and fish species, as well as other turtles, crabs, crayfish, clams, and other aquatic life. Fauna located in the watershed include wild rice and wildflowers. A number of point and nonpoint pollution sources pose threats to the river, with a primary threat coming from stormwater runoff.

Streams

Several streams pass through the study area. Streams and stream buffers are important to water resources for a number of reasons. Streams play an important role in water quality and reflect or impact the health of other natural resource systems. Water quality in stream headwaters, where a stream is "born," affects downstream water quality. Headwaters provide important habitat for a variety of aquatic life at the base of the food chain.

Stream buffers are strips of land along each side of a stream and include trees, shrubs, and other vegetation. When stream buffers are maintained in their natural condition, instead of being paved, mowed, or planted with farm crops, they serve as important filters to absorb pesticides and fertilizer that would otherwise enter the stream and impair water quality. Stream buffers absorb and slow down the speed of flood waters. Greenways (vegetated buffers) located along stream corridors serve as wildlife habitat and migration routes.

The New Jersey Department of Environmental Protection (NJDEP) has established Surface Water Quality Standards (SWQS) that establish designated uses, classify streams based on uses, designate antidegradation categories, and develop water quality criteria for surface waters in the state. The highest level of protection afforded to surface waters under the SWQS is applied to Outstanding National Resource Waters, which includes surface waters classified as Freshwater 1 (FW1) waters and Pinelands (PL) waters. FW1 waters have unique ecological or exceptional ecological, recreational, or water supply significance and are not to be subject to any manmade wastewater discharges or activities that might alter water quality. PL waters are maintained in their natural state. Other SWQS categories include Category One waters, which are protected from any measurable change in water quality, and Category Two waters, which are also protected from any measurable change in existing water quality, with certain exceptions.

The New Jersey Department of Environmental Protection protects streams in New Jersey by setting requirements for riparian buffers. Required buffers range from 50 to 300 feet on either side of the stream, depending on the stream SWQS classification. A buffer of 300 feet is best for protecting the ecological integrity of a stream. The required buffers help protect drinking water, minimize impacts from stormwater

runoff, provide floodwater storage, control erosion, recharge ground water, and maintain habitat.

In addition to state regulations, municipalities in the study area can fortify stream protection by adopting a stream corridor protection ordinance. A stream corridor protection ordinance ensures that vegetated riparian buffers are maintained by requiring development to be set back from stream banks, floodplains, and wetland areas, and by limiting the use and intensity of activities within the corridor.

A stream corridor protection ordinance should be adopted in combination with an outreach program that educates the community at large—and especially streamside landowners—about the importance of vegetated stream buffers. By integrating an educational component into stream protections, property owners are more likely to comply with the ordinance and the township may be better able to avoid the need for enforcement and penalties.

Stream crossings are locations where a roadway goes over a stream. In the study area, there are a number of stream crossings along Route 42, as well as a number of places where streams are located in close proximity to Route 42 and other major roads, including Glassboro-Cross Keys Road, Sicklerville Road, and Greentree Road. Whether directly crossing or located near major roads, streams are more likely to be contaminated when located near roads and related commercial and residential development because of the increase in impervious surface. With increased impervious surfaces, some of the stormwater runoff from paved streets, shopping centers, office parks, and homes is likely to end up in streams.

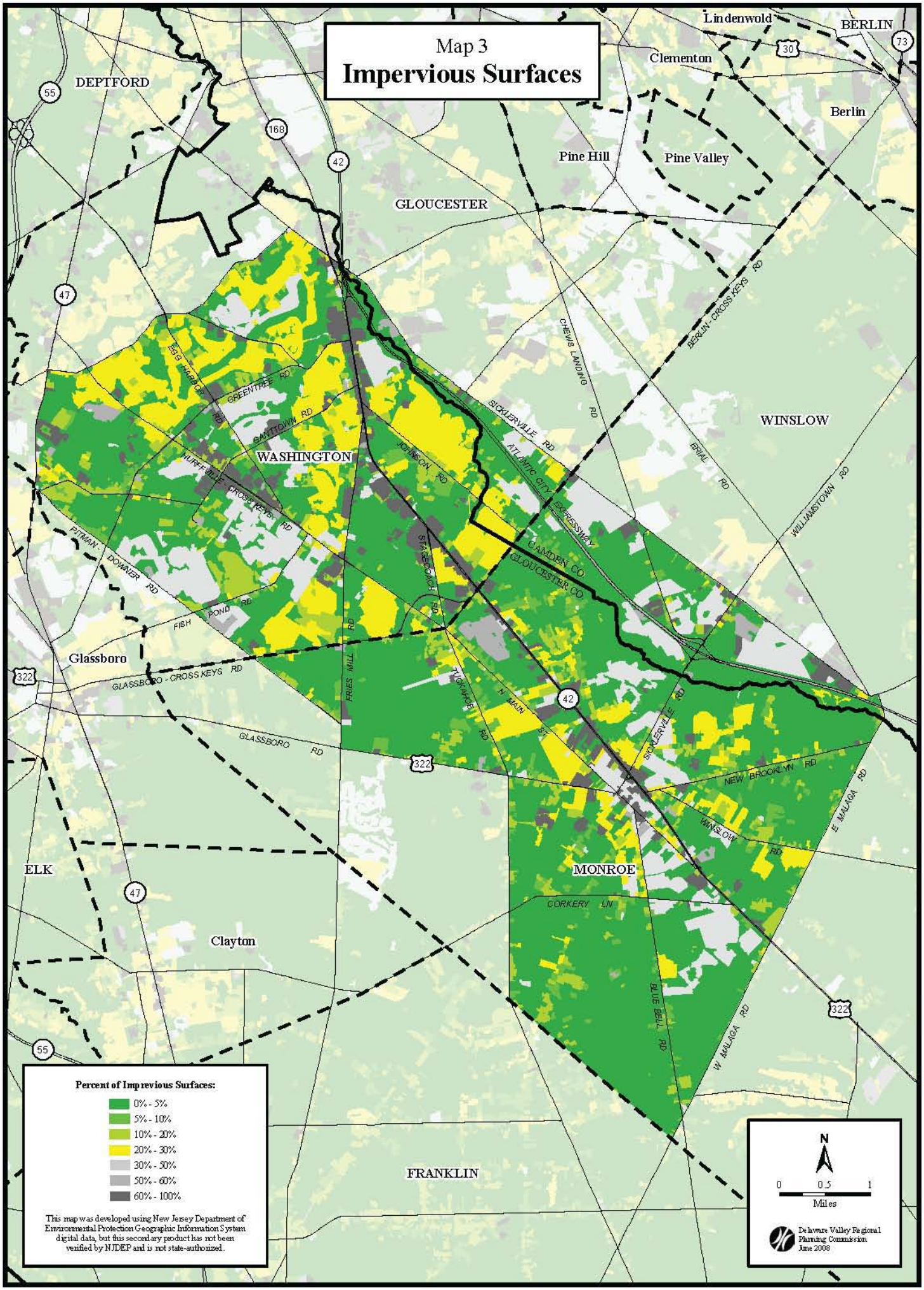
Runoff from impervious surfaces is not cleaned before going into water bodies. Impervious surfaces also accelerate the speed at which water runs off, increasing erosion and stream bank degradation. Experts calculate that stream degradation occurs at levels of 10 to 20 percent imperviousness of the watershed. When impervious coverage reaches 25-30% or more of the watershed, streams will often be severely degraded. Map 3: Impervious Surfaces shows impervious surface coverage in the study area. Comparing the map of impervious surface coverage to Map 4: DVRPC Land Use demonstrates that areas with commercial development along Route 42 are heavily paved, creating increased risk of flooding and water quality impairment. Townships can review site plans to ensure that new development in these areas incorporates best management practices for stormwater management.

Groundwater

The communities in the study area are dependent on groundwater for their drinking water supply. Groundwater is drawn from layers of porous, water-bearing rock, gravel, sand, silt, or clay, known as aquifers. Groundwater quantity and quality is constrained by the underlying geology in an area.

The primary geographic formation in the study area is the Cohansey Formation, as can be seen in MAP 5: Surface Geology. The soils developed from the Cohansey formation are very porous, with a large proportion of coarse sand particles. The Cohansey Sand contains the Cohansey Aquifer, one of the most important aquifers in New Jersey.

The Cohansey Aquifer is often referred to in a combined, hyphenated name with the Kirkwood Aquifer because the two are not always separated by a confining bed. A confining bed is a relatively impermeable layer of soil. The Cohansey Aquifer is mostly unconfined, which means that the soil above the aquifer is permeable. Unconfined aquifers are often shallow, frequently overlie one or


Map 3
Impervious Surfaces
Lindenwold
BERLIN
Clementon
Berlin
DEPTFORD
Pine Hill
Pine Valley
GLOUCESTER
WINSLOW
WASHINGTON
Glassboro
MONROE
ELK
Clayton
FRANKLIN
BERLIN-CROSS KEYS RD
CHEWS LANDING RD
SICKLERVILLE RD
ATLANTIC CITY EXPRESSWAY
ERIAL RD
WILLIAMSTOWN RD
JOHNSON RD
GREENTREE RD
GAYTTOWN RD
EGG HARBOR RD
HURFFVILLE CROSS KEYS RD
PITMAN - DOWNER RD
FISH POND RD
STAGECOACH RD
CAMDEN CO
GLOUCESTER CO
FRIES MILL RD
TUCKAHOE RD
N MAIN ST
GLASSBORO - CROSS KEYS RD
GLASSBORO RD
NEW BROOKLYN RD
WINSLOW RD
E MALAGA RD
W MALAGA RD
CORKERY LN
BLUE BELL RD
Percent of Impervious Surfaces:
0% - 5%
5% - 10%
10% - 20%
20% - 30%
30% - 50%
50% - 60%
60% - 100%
This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not state-authorized.
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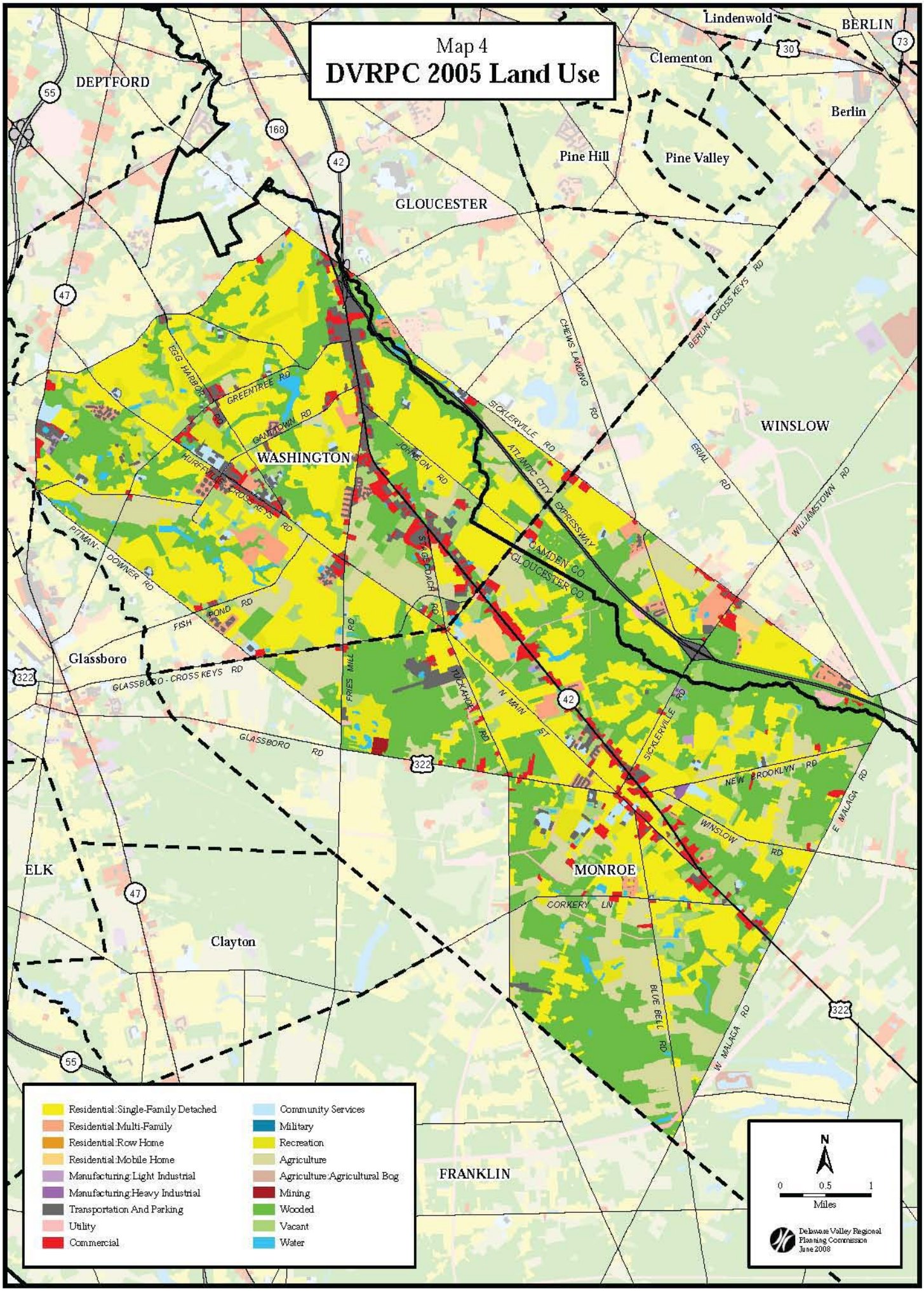
Map 4
DVRPC 2005 Land Use
Lindenwold
BERLIN
Clementon
Berlin
DEPTFORD
Pine Hill
Pine Valley
GLOUCESTER
WINSLOW
WASHINGTON
Glassboro
Clayton
ELK
MONROE
FRANKLIN
GREENTREE RD
EGG HARBOR RD
GAMMONS RD
HURFFVILLE CROSS KEYS RD
PITMAN-DOWNER RD
FISH POND RD
GLASSBORO - CROSS KEYS RD
GLASSBORO RD
JOHNSON RD
STRADACH RD
FRIES MILL RD
TUCKAHOE RD
N MAIN ST
CHEWS LANDING RD
ATLANTIC CITY EXPRESSWAY
CAMDEN CO.
GLOUCESTER CO.
SICKLERVILLE RD
BERLIN-CROSS KEYS RD
ERIAL RD
WILLIAMSTOWN RD
NEW BROOKLYN RD
WINSLOW RD
E MALAGA RD
W MALAGA RD
CORKERY LN
BLUE BELL RD
Residential:Single-Family Detached
Residential:Multi-Family
Residential:Row Home
Residential:Mobile Home
Manufacturing:Light Industrial
Manufacturing:Heavy Industrial
Transportation And Parking
Utility
Commercial
Community Services
Military
Recreation
Agriculture
Agriculture:Agricultural Bog
Mining
Wooded
Vacant
Water
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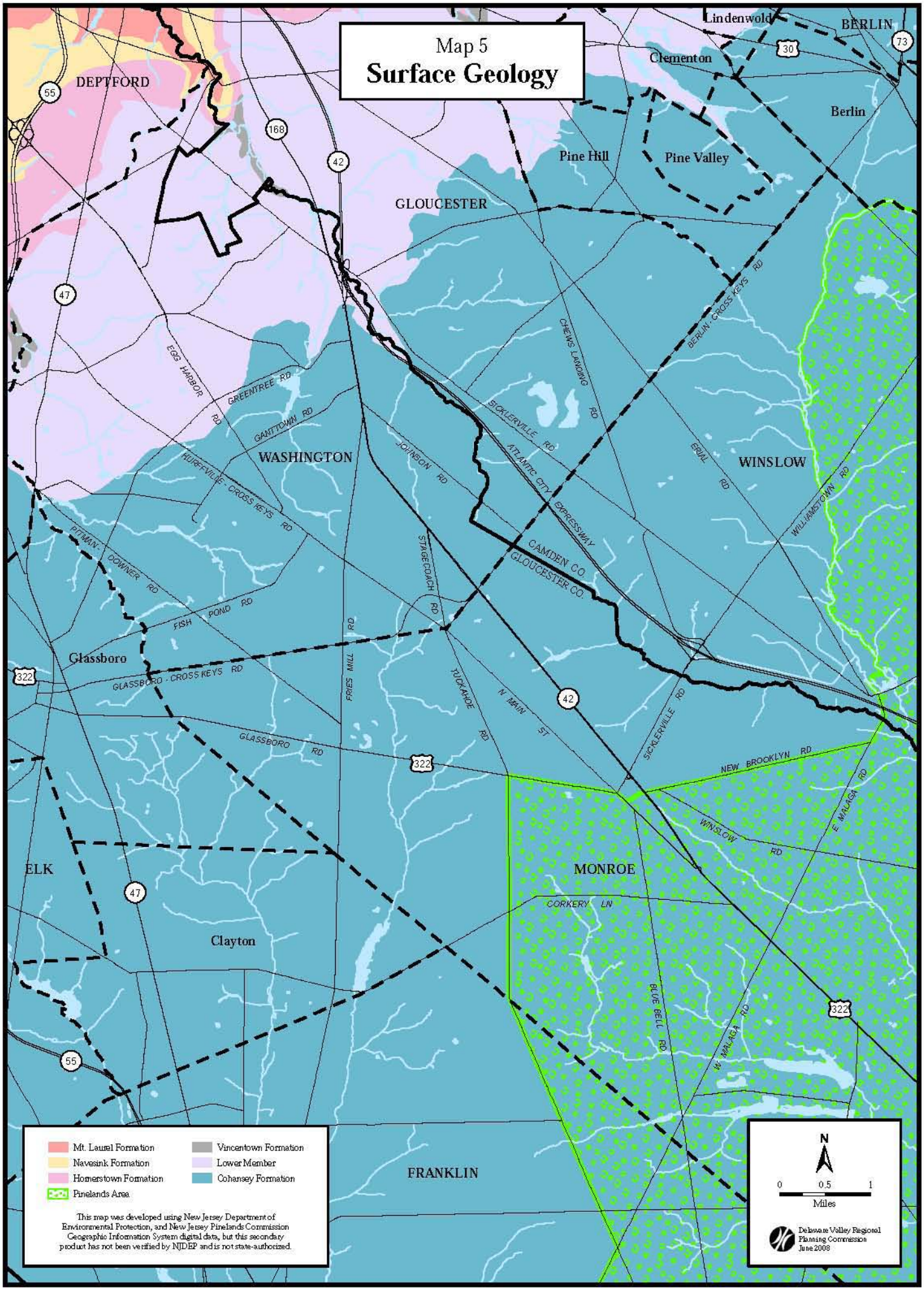
Miles
Delaware Valley Regional Planning Commission
June 2008


Map 5
Surface Geology
Lindenwold
BERLIN
Clementon
Berlin
Pine Hill
Pine Valley
DEPTFORD
GLOUCESTER
WASHINGTON
WINSLOW
MONROE
ELK
Clayton
Glassboro
FRANKLIN
CAMDEN CO.
GLOUCESTER CO.
55
168
42
47
30
73
322
EGG HARBOR RD
GREENTREE RD
GANTTOWN RD
HURFFVILLE-CROSS KEYS RD
PITMAN-DOWNER RD
FISH POND RD
GLASSBORO-CROSS KEYS RD
GLASSBORO RD
FRIES MILL RD
STAGECOACH RD
JOHNSON RD
CHEWS LANDING RD
SICKLERVILLE RD
ATLANTIC CITY EXPRESSWAY
BERLIN-GROSS KEYS RD
ERIAL RD
WILLIAMSTOWN RD
TUCKAHOE RD
N MAIN ST
NEW BROOKLYN RD
E MALAGA RD
WINSLOW RD
CORKERY LN
BLUE BELL RD
W MALAGA RD
Mt. Laurel Formation
Navesink Formation
Homerstown Formation
Pinelands Area
Vincentown Formation
Lower Member
Cohansey Formation
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more confined aquifers, and are easily recharged by rainwater—which can drain into the aquifer without difficulty.

The Kirkwood-Cohansey aquifer system is estimated to contain over 17 trillion gallons of some of the purest drinking water in the country. The Kirwood-Cohansey aquifer system underlies much of the Pinelands National Reserve, the first National Reserve in the United States. The strong natural resources protections in the Pinelands were established in large part to protect this extraordinary water resource.

The Kirkwood-Cohansey is close to the surface and is unconfined in the study area. Although the permeable soils above the aquifer make it a bounteous and rechargeable drinking water resource, the soil permeability also allows for easy contamination of groundwater. Because of this, land uses in the study area have a direct relationship to the quality of groundwater. Stormwater runoff carrying pollutants and fertilizers, underground storage tanks, septic systems, sanitary landfills, leaking drums, road salt piles, industrial lagoons, and surface impoundments are major sources of groundwater contamination in New Jersey. Communities in the study area must ensure that their codes protect against groundwater contamination from these sources and that effective enforcement of code provisions is in place.

Wetlands

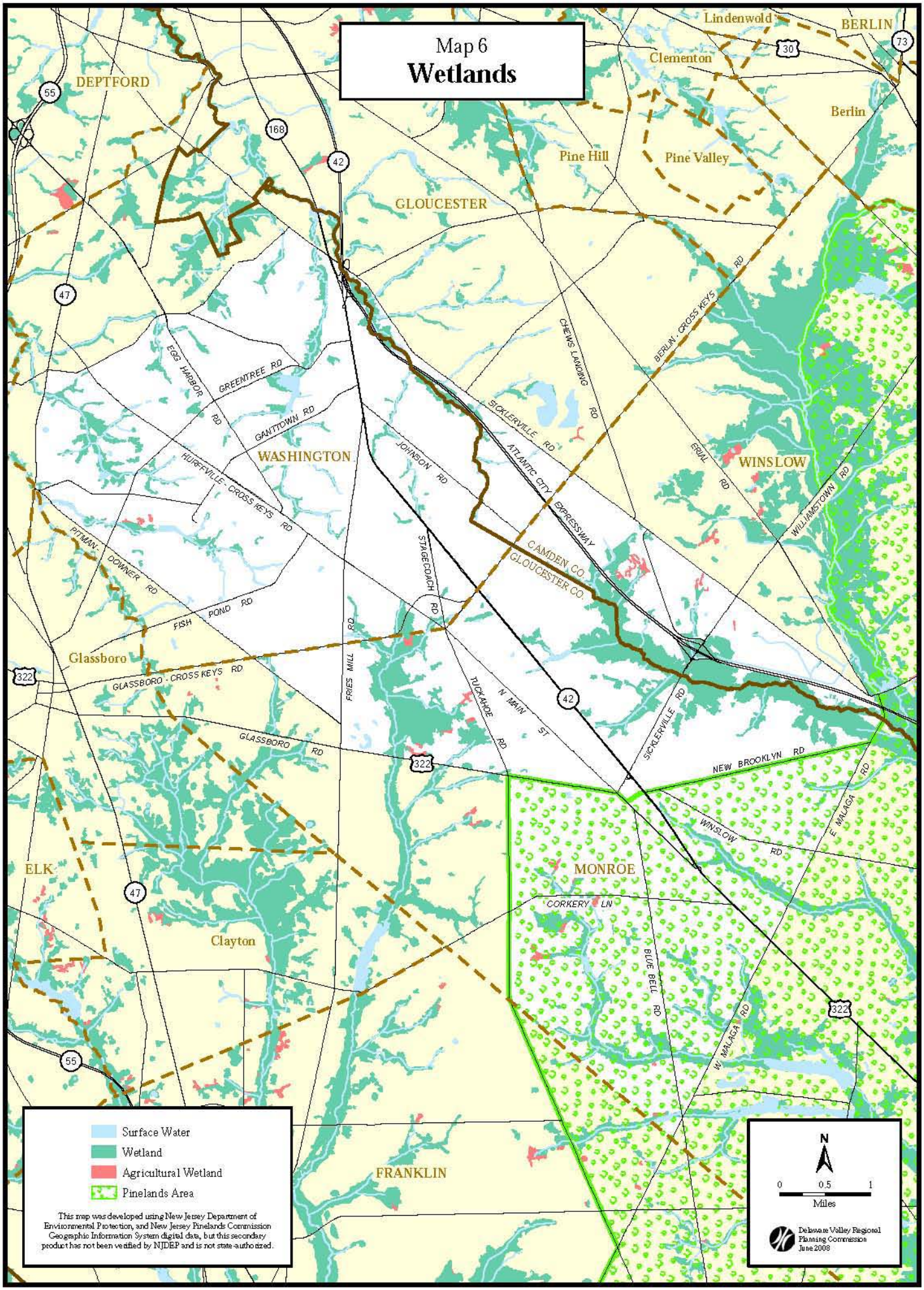
Map 6: Wetlands depicts wetlands in the study area. Nearly all wetlands in the study area are found in association with major streams and their tributaries. Because the study area is inland, most of the wetlands are classified by NJDEP, which uses US Geological Survey guidelines, as interior wetlands. Interior wetlands provide high-quality plant and animal habitat, help purify surface and ground water, and create picturesque landscapes that enhance the quality of life for area residents.

New Jersey protects wetlands under the New Jersey Freshwater Wetlands Protection Act. The New Jersey freshwater wetlands program protects freshwater wetlands, as well as upland areas within 150 feet of wetlands (sometimes called "buffers"), from development that would impair the ecological functions of wetlands.

The Freshwater Wetlands Protection Act requires NJDEP to regulate virtually all activities proposed in the wetland, including the cutting of vegetation, dredging, excavation or removal of soil, drainage or disturbance of the water level, the filling or discharge of any materials, driving of pilings, and the placing of obstructions. Likewise, activities in areas within 150 feet of wetlands may be regulated. The width of the transition area buffer required depends on the presence of endangered species and other indicators of the ecological value of the wetlands.

Agricultural wetlands are scattered as small sites throughout the study area. These “quasi-wetlands” are lands under cultivation that are modified former wetland areas. These areas still exhibit evidence of soil saturation in aerial infrared photo surveys, but do not support natural wetland vegetation. As long as agricultural wetlands remain in agricultural use, they are exempt from New Jersey’s Freshwater Wetlands Rules. However, if an agricultural area is removed from agricultural production for more than five years, any wetlands located within that area lose their exempt status.

Although development on wetlands is regulated by NJDEP, townships can be more vigilant about encroachments into wetlands by requiring that wetlands be shown as a feature on major subdivision and site plan submissions. This allows the township to determine where wetlands may be threatened by inappropriate development and request site plan changes as appropriate. If wetlands


Map 6
Wetlands
Lindenwold
BERLIN
Clementon
Berlin
DEPTFORD
Pine Hill
Pine Valley
GLOUCESTER
WASHINGTON
WINSLOW
Glassboro
ELK
Clayton
MONROE
FRANKLIN
CAMDEN CO.
GLOUCESTER CO.
55
168
42
47
30
73
322
EGG HARBOR RD
GREENTREE RD
GANTTOWN RD
HURFFVILLE-CROSS KEYS RD
PITMAN-DOWNER RD
FISH POND RD
GLASSBORO-CROSS KEYS RD
GLASSBORO RD
FRIES MILL RD
JOHNSON RD
STAGECOACH RD
TUCKAHOE RD
N MAIN ST
SICKLERVILLE RD
CHEWS LANDING RD
BERLIN-CROSS KEYS RD
ATLANTIC CITY EXPRESSWAY
ERIAL RD
WILLIAMSTOWN RD
NEW BROOKLYN RD
WINSLOW RD
E MALAGA RD
W MALAGA RD
BLUE BELL RD
CORKERY LN
Surface Water
Wetland
Agricultural Wetland
Pinelands Area
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or hydric soils appear to be present based on NJDEP maps, townships should also require the submission of a Letter of Interpretation (LOI) with the submission of the preliminary plan. The plan should show the state-certified wetlands as proofed from the LOI or wetlands permit and any required wetland transition areas.

Floodplains

Areas naturally subject to flooding are called floodplains, or flood hazard areas. Floodplains in the study area can be seen on Map 7: Floodplains. Floodplains encompass a floodway, which is the portion of a floodplain subject to high velocities of moving water, and the adjacent flood fringe, which helps to hold and carry excess water during overflow of the normal stream channel. The 100-year floodplain is defined as the land area that will be inundated by the overflow of water resulting from a 100-year flood (a flood that has a one percent chance of occurring in any given year).

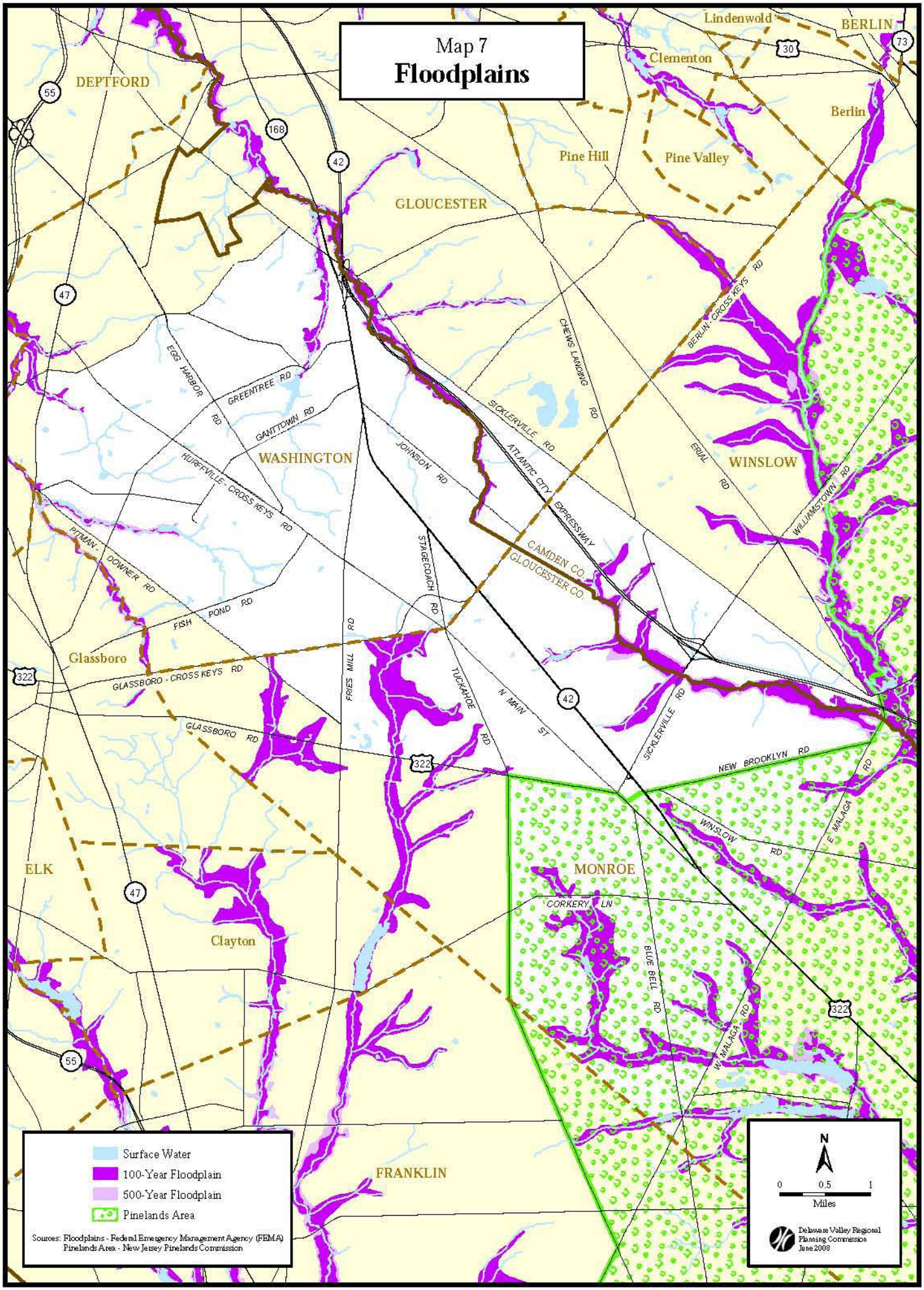
Although the terms “flood hazard area” and “100-year floodplain” denote similar concepts, NJDEP defines them in slightly different ways. New Jersey’s regulations define the flood hazard area as the area inundated by a flood resulting from the 100-year discharge increased by 25 percent. This type of flood is called the “flood hazard area design flood” and it is the flood regulated by NJDEP.

Floodplains require protection in order to prevent loss of life and property, especially within the boundaries of the floodway. Equally important is the preservation of the environmentally sensitive aquatic communities that exist in floodplains. These communities are often the first link in the food chain of the aquatic ecosystem. In addition, floodplains serve the function of removing and mitigating various pollutants through the uptake by their vegetation of excess chemical loads in the water and by the filtering of sediments generally. All efforts to keep development out of floodplains will help to preserve the flood-carrying capacity of streams and their water quality.

In New Jersey and throughout the country, building in areas subject to flooding is regulated to protect lives, property, and the environment. New Jersey regulates construction in the flood hazard area under the Flood Hazard Control Act. Activities that are proposed to occur in a flood hazard area will require issuance of a stream encroachment permit or a letter of non-applicability from the NJDEP.

In the past, roads and rail lines were built directly along streams and in floodplains because the land in these areas is usually fairly level. In the study area, the Atlantic City Expressway runs along the floodplain. The presence of the roadway and related development increase the amount of impervious service in the floodplain, creating increased risk of flooding and impairment of water quality. As with proposals for development near wetland areas, townships should carefully review site plans for projects located near floodplains to ensure that adequate stormwater management practices are utilized.

In southern New Jersey, steep slopes are often associated with stream banks. However, there are very few steep slopes in the study area, as can be seen in Map 8: Steep Slopes. The few steep slopes in the study area follow along stream banks in the northern section of the study area. These areas also should not be disturbed to avoid excess sedimentation runoff and slope collapse.


Map 7
Floodplains
DEPTFORD
Lindenwold
BERLIN
Clementon
Berlin
Pine Hill
Pine Valley
GLOUCESTER
WASHINGTON
WINSLOW
Glassboro
ELK
Clayton
MONROE
FRANKLIN
CAMDEN CO.
GLOUCESTER CO.
EGG HARBOR RD
GREENTREE RD
GANTTOWN RD
HURFFVILLE-CROSS KEYS RD
PITMAN-DOWNER RD
FISH POND RD
GLASSBORO-CROSS KEYS RD
GLASSBORO RD
FRIES MILL RD
STAGECOACH RD
TUCKAHOE RD
N MAIN ST
JOHNSON RD
SICKLERVILLE RD
ATLANTIC CITY EXPRESSWAY
CHEWS LANDING RD
BERLIN-CROSS KEYS RD
ERIAL RD
WILLIAMSTOWN RD
NEW BROOKLYN RD
WINSLOW RD
E MALAGA RD
W MALAGA RD
BLUE BELL RD
CORKERY LN
55
168
42
47
322
30
73
Surface Water
100-Year Floodplain
500-Year Floodplain
Pinelands Area
Sources: Floodplains - Federal Emergency Management Agency (FEMA)
Pinelands Area - New Jersey Pinelands Commission
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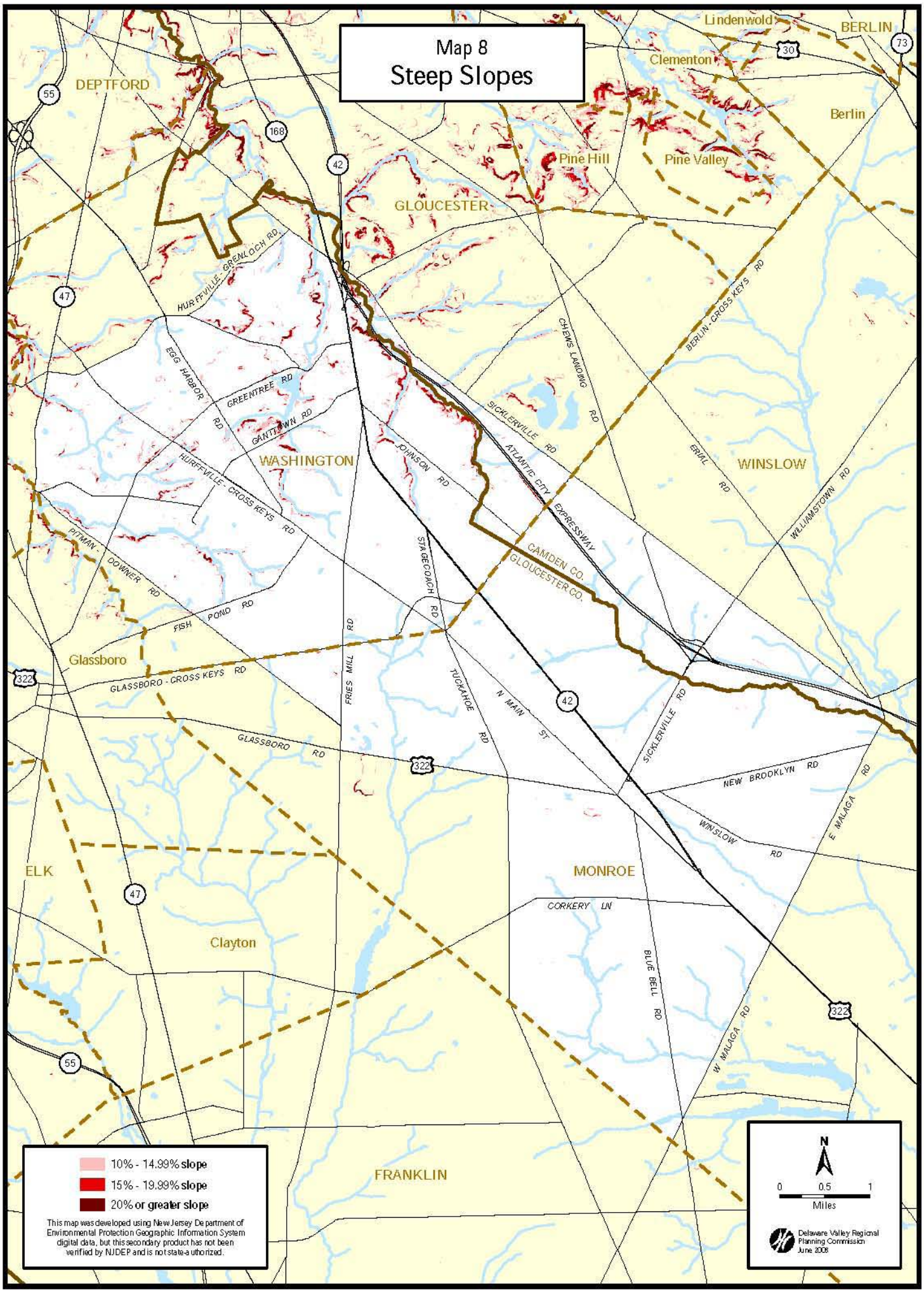
Map 8
Steep Slopes
DEPTFORD
GLOUCESTER
Lindenwold
BERLIN
Clementon
Berlin
Pine Hill
Pine Valley
WASHINGTON
WINSLOW
Glassboro
ELK
Clayton
MONROE
FRANKLIN
HURFFVILLE - GRENLOCH RD
EGG HARBOR RD
GREENTREE RD
GANTTOWN RD
HURFFVILLE - CROSS KEYS RD
PITMAN - DOWNER RD
FISH POND RD
GLASSBORO - CROSS KEYS RD
GLASSBORO RD
FRIES MILL RD
JOHNSON RD
STAGECOACH RD
TUCKAHOE RD
N MAIN ST
CHEWS LANDING RD
SICKLERVILLE RD
ATLANTIC CITY EXPRESSWAY
CAMDEN CO.
GLOUCESTER CO.
BERLIN - CROSS KEYS RD
ERIAL RD
WILLIAMSTOWN RD
NEW BROOKLYN RD
WINSLOW RD
E MALAGA RD
W MALAGA RD
CORKERY LN
BLUE BELL RD
10% - 14.99% slope
15% - 19.99% slope
20% or greater slope
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5.3 Stormwater Management

Overview

The study area includes several water systems that are recognized as nationally significant, including the Kirkwood-Cohansey aquifer and headwaters to the Great Egg Harbor and Maurice River systems. Most importantly, area residents are dependent on local groundwater for their drinking supply.

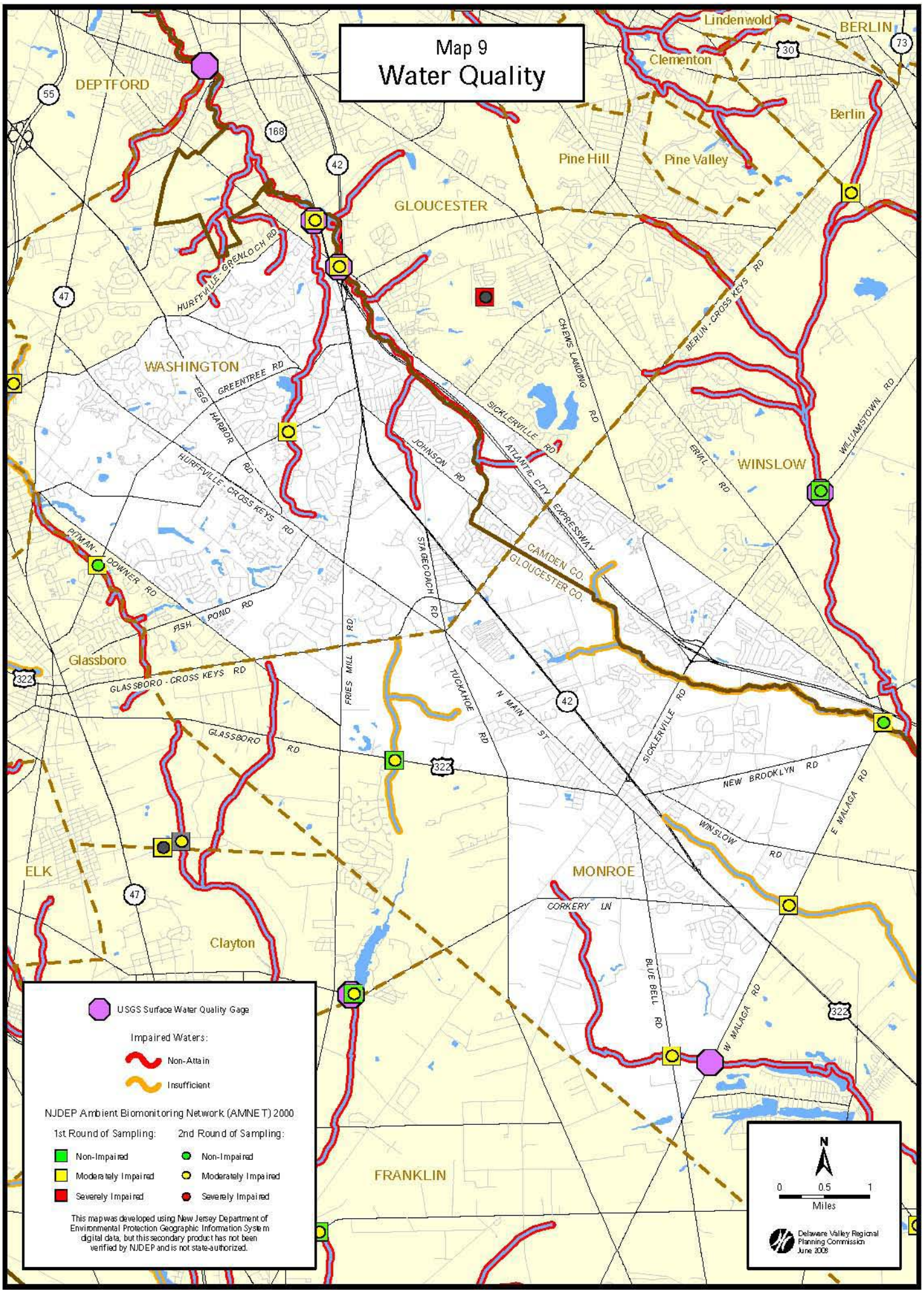
Although the water resources in the study area are of crucial importance, they are increasingly threatened by development patterns with inadequate stormwater management. Stormwater runoff is affected by land use, geology and soils, surface and ground water, riparian buffers, woodlands, floodplains, wetlands, and slope. In the study area, sprawling development patterns have contributed to high levels of impervious surface coverage. Impervious surfaces disrupt natural absorption, filtration, and recharge processes. As a result, stormwater can pick up pollutants before flowing into water bodies used for drinking, recreation, and fishing. The installation of storm sewer pipes, which efficiently collect and discharge runoff, also prevent the natural infiltration of rainwater into the soil and underlying groundwater aquifers. Stormwater runoff leads to impaired water quality and increased flooding, which seriously threatens community health, safety, and quality of life.

Stormwater management entails the control of water that runs off land during rain events or from melting ice and snow. The volume (the amount and rate) of runoff substantially increases as land development occurs. High volume of stormwater discharge detrimentally affects a surface waterway—eroding the stream banks, washing out natural vegetation along the stream banks, increasing sediment in the water that destroys aquatic life habitat, carrying pollutants, and increasing the frequency and intensity of flooding. It therefore increases damage to private property and public infrastructure, such as roads and bridges.

At first glance, the study corridor appears to have limited natural resources or environmental assets. However, several streams and wetland areas are located throughout the study area. There is also a significant amount of wooded areas for a heavily built-out corridor. If preserved in a natural state or appropriately managed, stream banks, wetlands, and wooded areas can serve important stormwater filtration and absorption functions.

Unfortunately, the study area has a preponderance of impervious surfaces. Map 3: Impervious Surfaces shows impervious surface coverage in the study area. Comparing the map of impervious surface coverage to Map 4: DVRPC Land Use demonstrates that areas with commercial development along Route 42 are heavily paved, with impervious coverage in excess of 50 percent along much of the corridor. Single-family residential properties account for the bulk of land use in the study area, representing 37 percent of the study area's nearly 25,000 acres. Individual home lots tend to have less impervious surfaces than an industrial park or shopping center, but landscaped lawns tend to have higher rates of runoff than forested or "dry-scaped" areas. Local codes can limit the amount of impervious surface coverage on sites and create incentives for developers to increase pervious surface coverage.

A direct environmental impact of stormwater runoff is the degraded water quality of the corridor's waterways. Experts calculate that stream degradation occurs at levels of 10-20 percent imperviousness. When impervious coverage reaches 25 to 30 percent or more, streams will often be severely degraded. As shown in Map 9: Water Quality, most of the streams in the study area are impaired. Even the streams shown to have insufficient data for a nonattaining classification are shown to


Map 9
Water Quality
DEPTFORD
GLOUCESTER
Pine Hill
Pine Valley
Clementon
Lindenwold
BERLIN
Berlin
WASHINGTON
WINSLOW
Glassboro
ELK
Clayton
MONROE
FRANKLIN
HURFFVILLE - GRENLOCH RD
GREENTREE RD
EGG HARBOR RD
HURFFVILLE - CROSS KEYS RD
PITMAN - DOWNER RD
FISH POND RD
GLASSBORO - CROSS KEYS RD
GLASSBORO RD
FRIES MILL RD
STAGECOACH RD
TUCKAHOE RD
N MAIN ST
JOHNSON RD
CHEWS LANDING RD
SICKLERVILLE RD
ATLANTIC CITY EXPRESSWAY
CAMDEN CO.
GLOUCESTER CO.
BERLIN - CROSS KEYS RD
ERIAL RD
WILLIAMSTOWN RD
NEW BROOKLYN RD
WINSLOW RD
E MALAGA RD
W MALAGA RD
CORKERY LN
BLUE BELL RD
USGS Surface Water Quality Gage
Impaired Waters:
Non-Attain
Insufficient
NJDEP Ambient Biomonitoring Network (AMNET) 2000
1st Round of Sampling:
Non-Impaired
Moderately Impaired
Severely Impaired
2nd Round of Sampling:
Non-Impaired
Moderately Impaired
Severely Impaired
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have moderately impaired waters in NJDEP Ambient Biomonitoring Network sampling. This is partly caused by compromised floodplains. In the study area, the Atlantic City Expressway runs along the floodplain, as shown in Map 7: Floodplains.

Municipal Stormwater and Waste Water Programs

Within the last two decades, the US Environmental Protection Agency (USEPA) mandated a reduction in water pollution consistent with the requirements of the Clean Water Act of 1970 for all urbanized and semiurbanized municipalities in the United States. The first phase of this program, commenced in 1990, aims to reduce or eliminate combined sewer systems, which, during storm events, overflow and send wastewater into surface waters *combined* with stormwater. However, reducing or eliminating these older sewer systems is very difficult and expensive. Phase II of the USEPA program applies to smaller municipalities and is referred to as Municipal Separate Stormwater Sewer Systems (MS4).

Section 208 of the Clean Water Act requires states to compile regional plans, called areawide Water Quality Management (WQM) plans. These plans are intended to prevent water pollution from point sources, such as sewer plants and factories, as well as nonpoint sources, such as stormwater and septic systems. As a result of this requirement, local governments must address wastewater pollutions caused by their sewer and septic policies.

New Jersey augments the federal WQM plan requirements by requiring every municipality (or a regional agency authorized by NJDEP to act for a municipality) to have a Wastewater Management Plan (WMP). These plans must be updated every six years and must be consistent with the applicable areawide WQM plan. In New Jersey, there are 12 areawide WQM planning areas. The areawide WQM plans incorporate the plans of the municipal WMPs. The study area falls under the Tri-County WQM planning area, which covers Burlington, Camden, and Gloucester counties.

The majority of the study area is approved for sewer service according to the Tri-County WQM Plan. For approved sewer service areas, sewage is pumped to the Gloucester County Utility Authority's sewage treatment plant in West Deptford near the mouth of Mantua Creek and discharged to the Delaware River. Because water is transferred from groundwater in the study area to the Delaware River through this sewer system (rather than recharging the Kirkwood-Cohansey aquifer), the total amount of sewage connections in the sewer service area is regulated.

The southern section of the study area that lies in the Pinelands Area is not an approved sewer service area. Development in these areas requiring on-site septic waste water treatment must meet design and discharge standards, permit requirements, and other requirements as set forth in the Pinelands Comprehensive Management Plan. Because the withdrawal and transfer of water from Pinelands streams and aquifers is actively managed under this plan, certain types of development, especially those with greater water quality impacts, may be constrained in these areas.

Stormwater Management Design

The best stormwater management practices are those that increase the amount of infiltration of rainwater into the ground. This can be achieved through interruptions in the paved surface that break up the stormwater runoff and infiltrate it at various points. Stormwater from smaller rainstorms can often be handled entirely by various low-impact or nonstructural designs.

Smaller storms consist of the one- and two-year storms, up to the five-year storm. A two-year storm has a 50 percent chance of

occurring in a given year (or once in two years) and is equal to 3.2 inches of rain within 24 hours. A one-year storm is equivalent to 2.5 inches of rainfall within 24 hours. It is the runoff from smaller storms that tends to have the greater effect on waterways and water quality because of the frequency of these storms and the fact that they are not detained in detention basins, most of which are designed to control only the 10- to 100-year frequency storms.

Specific measures to manage stormwater from smaller storms rely on utilizing the natural contours and features of the land on a site, whenever possible. The best designs often use a mix of many small solutions, such as:

- Designing or redesigning vegetated islands, which are usually on raised beds in parking lots, so that they capture and recharge rainfall; using appropriately vegetated sunken beds just below the parking lot surface will allow rain from adjoining paved surfaces to infiltrate rather than run off.
- Incorporating filter strips to receive runoff and removing or slotting curbs to allow stormwater to reach these strips.
- Designing or replacing drain pipes with infiltration trenches.
- Creating bioretention facilities in existing natural depressions.
- Installing or utilizing existing roadside swales.
- Replacing macadam with gravel or granular materials or porous paving, where practical.
- Designing or redesigning parking lot detention basins so that low-flow channels are eliminated or replaced with meandering vegetated swales or designing a wetland area near the outfall or throughout the basin.

Stormwater Best Management Practices (BMPs)[1]

Rain Gardens

Rain gardens are small bioretention areas—shallow depressions made up of a mixture of sand and soils that are planted with native vegetation—that serve as small islands to filter stormwater runoff from their immediate surroundings. They can be positioned to capture the first level of runoff, while being part of the naturalistic landscaping of a site. In parking lots, these can be created along the edges of smaller paved areas, such as the walkways in front of buildings.

Vegetated Filter Strips

Strips of close-growing grasses or forest along the perimeter of an impervious area allow stormwater to be slowed and also for a certain percentage of it to infiltrate. This can reduce runoff volumes by up to 40 percent in some areas. Although a filter strip cannot handle high levels of stormwater, it can be part of a series of stormwater control measures and can reduce the size of a receiving detention basin or other structure.

Filter strips work best where slopes are less than 15 percent and they should be located as close to the runoff source as possible. Incoming flows may need to be spread out before reaching the strip. The proper vegetation and avoidance of soil compaction are key to successful filter strip operation.

[1] See Delaware Riverkeeper Network. *Stormwater Runoff, Lost Resource or Community Asset?* for extensive details on these BMPs.

Bioretention Facilities

These facilities can be utilized to capture stormwater runoff from a diversion structure in a traditional drainage system or a large grassed area. They can also be designed as part of the drainage system itself as a measure to enhance pollution removal from the stormwater by settling and infiltration. They can be installed in median strips, parking lot islands, lawn areas, grass swales, or other conveyance systems. They typically have several parts, including an energy dissipation area that reduces runoff velocity, a ponding or treatment area, and a mulch layer, a permeable soil layer, and a sand layer. Native plants are a necessity and trees and shrubs should be included.

Drainage Swales

Swales are long, grassed, shallow depressions designed to intercept sheet flow from surrounding land. Unlike curbs and gutters, which concentrate runoff, swales reduce the volume and the speed of runoff and will capture the coarser sediment. Grassed swales can be designed to convey large storm events as well as small ones (10-year storms). Dry swales filter runoff through 30 inches of soil before collecting it in an underdrain. Wet swales can be used where the water table is close to the surface. They should be planted with wetland plants.

Swales work best where slopes are less than 2 percent. The vegetation must be tough and preferably native. Soil permeability is a factor in swale design, and checkdams or other features to improve infiltration may be needed along the length of a swale.

Infiltration Trenches

An infiltration trench is a stone-filled subsurface trench in which stormwater is collected and percolates slowly into the soil from the trench. They reduce both the volume of runoff and peak flows. In addition, the particulates in the stormwater are filtered out as the water moves slowly through the soil below the trench.

Infiltration trenches generally can capture and treat water from an area no larger than five to 10 acres. They work best when combined with some other pretreatment technique, such as a grassed swale or vegetated filter strip, which can filter coarser sediment. They require periodic low-level maintenance so that sediments do not build up and clog the drainage.

Porous Paving

There are several types of porous paving surfaces, including a conventional asphalt mixture with reduced fine particles so that there are invisible, small openings for rain to penetrate; porous cement; open-celled pavers filled with soil or other porous aggregate; spaced impervious pavers; pavement blocks or grids; compacted gravel; and permeable interlocking concrete paving blocks. All but the first are generally appropriate only for lightly traveled areas, but are useful for overflow parking areas and in certain other conditions.

The porous asphalt mixture is not limited to low-travel sites. It has been extensively used in stormwater management and described by Cahill and Associates in several reports and in *The Use of Porous Paving for Groundwater Recharge in Stormwater Management Systems*. This type of porous paving is combined with an underground recharge bed filled with crushed stone of a uniform size, which provides storage capacity until the

rainwater can percolate into the soil. A special filter fabric is placed under the paving, as well.

Such paving with an underground recharge bed has been found to be effective in capturing and infiltrating stormwater for both the two-year storm and the 100-year storm. This paving system has a long life and requires no more repair or maintenance than conventional paving. Although it tends to cost about 10 percent more for installation and maintenance, other savings in the storm drain system can actually reduce the overall costs of a project by 12 to 38 percent.

Detention Basin Redesign or Replacement

Parking lots generally require fairly large detention basins to capture peak stormwater flows from the extensive paved surfaces, which then channel the stormwater to an outflow structure and out to a waterway. There are several alternatives to the conventional dry detention basin, depending on conditions at a site. These include constructed wetlands, which can be built as part of the stormwater treatment plan, wet ponds (retention ponds with a permanent pool) that hold and slow peak flow and remove pollutants, and infiltration basins. The last allow gradual infiltration through the soil of the bed and the sides of the basin. A stormwater management design can include several small infiltration basins to accomplish the same aim as one larger basin.

Good stormwater management uses a combination of these BMPs in a treatment train—a series of small to large structures and devices that will capture, break up, and infiltrate the stormwater throughout the site. Not only is it essential that the design take site contours, soils, and ultimate use into account, but it must also assure that the construction of a parking lot and associated buildings does not damage these features by extensively grading or compacting the soils or otherwise reducing natural permeability.

Finally, an effective and well-implemented inspection and maintenance program for any parking lot design is critical. This should be part of the stormwater management plan that is part of the site plan approved by a municipality, with standards for permanent maintenance outlined in site plan requirements. In addition, a municipality can impose a requirement in its ordinance that makes an owner responsible to make corrective measures if any stormwater management facility is eliminated, altered, or improperly maintained.

"Green Streets"

A large part of a municipal stormwater program can be the implementation of a "Green Streets" program, which incorporates stormwater controls into the built environment, often in combination with streetscape improvements, traffic calming devices, and greening efforts. The Green Streets program was first developed in Portland, Oregon, by its Bureau of Environmental Services, and the program has since been adopted and adapted by the Seattle Public Utilities and the Philadelphia Water Department.

Portland defines a Green Street as "a street that uses vegetated facilities to manage stormwater runoff at its source." Portland's Green Streets program integrates urban design, multimodal transportation, water quality, and parks and open space within realistic public budgets with the added benefit of recreating existing neighborhoods as inviting and livable communities.

Any community in the study area can adopt the Green Streets approach and install vegetated stormwater facilities along cross streets of NJ 42 or certain segments of NJ 42.

Public entities, like municipal or county government, can undertake the Green Streets program in public right-of-ways. Municipalities can also adopt landscaping and parking regulations (in addition to municipal stormwater ordinances) that mandate new development and redevelopment on private property to incorporate appropriate Green Streets elements.

The benefits to creating a Green Street are multiple and include:

- Improving water quality and replenishing groundwater through infiltration.
- Creating attractive streetscapes that enhance a neighborhood's livability.
- Enhancing pedestrian and bicycle connectivity by creating a green connector between open spaces, trails, and destinations along the corridor.

The Green Streets program uses two strategies to manage stormwater in existing built environments. The first strategy uses landscape elements to manage stormwater through the integration of trees and root systems, contained planters, vegetated swales, vegetated infiltration basins, and/or infiltration planters into stormwater control facilities. The second strategy is to use paving materials, such as pervious pavers, pervious pavement, or turf blocks, to infiltrate stormwater into the ground. The advantage of the Green Streets approach is that almost any size roadway can accommodate a landscape or paving element to capture and treat stormwater at its source.

Green Streets programs may incorporate some or all of these principles and strategies:

- Trees are suitable for residential neighborhoods, large parking lots, and some roadway medians.
- Contained planters accept precipitation only, not stormwater runoff. Contained planters are placed on top of flat impervious surfaces, such as sidewalks and plazas. Rainwater is temporarily stored in the planter's soil and filters down slowly to the impervious surfaces. These are suitable for commercial corridors and public buildings.
- Vegetated swales are gently sloping depressions of land planted with dense and "thirsty" plants. Swales are located in strategic positions to capture runoff from rooftops, streets, and parking lots and allow it to filter into the ground. If located in an area with poor draining soils, a swale can convey runoff to a soakage trench. Many landscaped islands in large parking lots can be excavated and retrofitted into a swale system. This type of facility is suitable for large parking lots, residential streets, or commercial corridors in need of traffic calming and/or crosswalks.
- Vegetated infiltration basins are landscape basins that temporarily store stormwater runoff until it can infiltrate into the ground. Basins can be planted with trees, shrubs, and grasses. Basins should not be located in areas with high water tables, nor designed as ponds (which would negate stormwater infiltration). Basins are suitable for large parking lot areas or large building complexes.
- Infiltration planters, or tree trenches, are structures with open bottoms that allow stormwater to slowly infiltrate into the ground. They contain a layer of gravel, soil, and vegetation. These planters are ideal for space-limited sites with soils that drain well. Infiltration planters have numerous environmental benefits and are also very attractive and easily integrated into a sidewalk or building site; they can be placed closely to building walls. This type of stormwater control facility is suitable for nearly any site, including

shopping centers, residential neighborhoods, commercial corridors, and public buildings.

Landscaping Regulation

Townships in the study area can strengthen landscaping regulations within their land development ordinances to encourage the use of native, drought-resistant plants for decorative plantings. Landscaped areas with swale systems, infiltration planters, and other stormwater BMPs can absorb stormwater runoff from residential and commercial parking areas.

Durango, Colorado adopted landscaping regulations in 1983 and has had a surprising amount of success. First, the city complied with the new regulations on all of its public properties. Then the city created an annual landscaping award to recognize public and private entities' investment in landscaping for beautification or stormwater purposes. By doing this, the city was able to encourage property owners who did not have to comply with the ordinance because the property was developed prior to the adoption to redesign parking lots and building entries to effectively manage stormwater and attract customers.

Municipalities should partner with local business organizations to install planters and landscape medians throughout the corridor that display plaques that read "Sponsored by…" These planters could act as gateways to business districts and town centers and serve as moderate stormwater controls. Alternately, townships could organize landscaping competitions to encourage businesses to improve landscaping as they compete for recognition.

5.4 Green Infrastructure

Overview

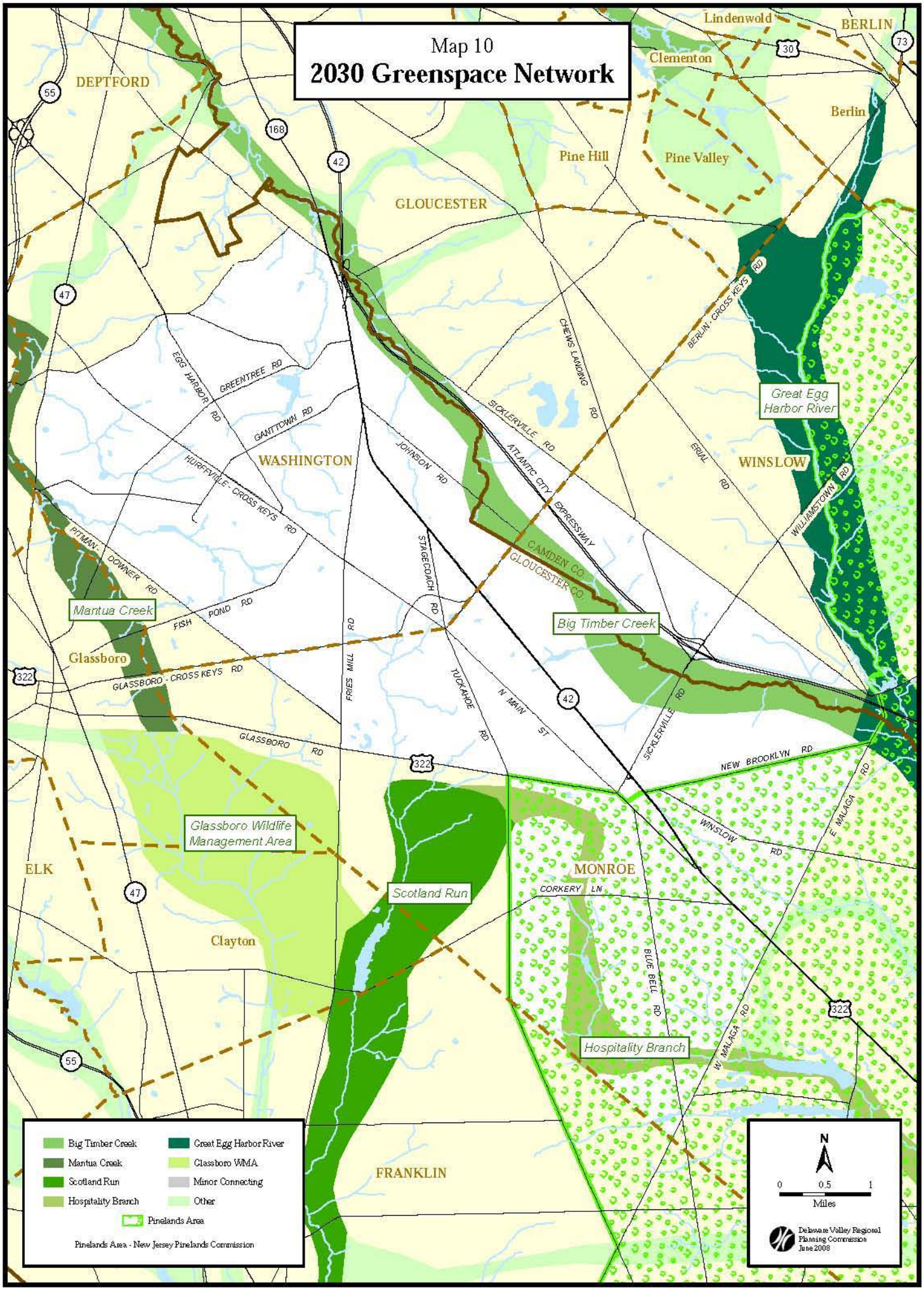
Green infrastructure is a term used to describe a community's interconnected network of open spaces and natural areas. These may include greenways, wetlands, parks, forests, and native vegetation. A greenway is a ribbon of open space linking natural, cultural, and recreational resources. Greenways are often implemented along creeks and streams because they help preserve environmental features and provide natural protection from flooding, improve water quality, and provide wildlife migration corridors, while enhancing resident enjoyment

A green infrastructure system provides important services, including managing stormwater, reducing flood risk, improving water quality, regulating temperatures, maintaining viable populations of native plants and animals, and contributing to cleaner air. Green infrastructure usually costs less to install and maintain when compared to traditional forms of infrastructure.

A regional vision for restoring and preserving green infrastructure throughout the Delaware Valley region is embodied by DVRPC's 2030 Greenspace Network. The network consists of 100 individually named greenspace corridors throughout the Philadelphia metropolitan region.

Public Parks, Natural Areas, Trails, and Greenways

Map 10: 2030 Greenspace Network shows the Greenspace Network in the study area. Greenways are envisioned along Big Timber Creek, Hospitality Branch, and Scotland Run. These proposed greenways interconnect with each other, as well as other nearby green infrastructure areas, including the Glassboro Wildlife Management Area and greenways


Map 10
2030 Greenspace Network
Lindenwold
BERLIN
Clementon
Berlin
Pine Hill
Pine Valley
DEPTFORD
GLOUCESTER
WASHINGTON
WINSLOW
MONROE
ELK
Clayton
FRANKLIN
Glassboro
Great Egg Harbor River
Mantua Creek
Big Timber Creek
Glassboro Wildlife Management Area
Scotland Run
Hospitality Branch
CAMDEN CO.
GLOUCESTER CO.
ATLANTIC CITY EXPRESSWAY
BERLIN - GROSS KEYS RD
CHEWS LANDING RD
SICKLERVILLE RD
ERIAL RD
WILLIAMSTOWN RD
EGG HARBOR RD
GREENTREE RD
GANTTOWN RD
HURFFVILLE - CROSS KEYS RD
JOHNSON RD
PITMAN - DOWNER RD
FISH POND RD
GLASSBORO - CROSS KEYS RD
GLASSBORO RD
FRIES MILL RD
STAGECOACH RD
TUCKAHOE RD
N MAIN ST
NEW BROOKLYN RD
WINSLOW RD
E MALAGA RD
W MALAGA RD
BLUE BELL RD
CORKERY LN
Big Timber Creek
Great Egg Harbor River
Mantua Creek
Glassboro WMA
Scotland Run
Minor Connecting
Hospitality Branch
Other
Pinelands Area
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along Mantua Creek and the Great Egg Harbor River. By targeting greenways to areas along streams, communities can provide recreation and open space benefits while protecting their water resources.

Municipalities in the study area should identify opportunities to purchase, protect, or enhance land to achieve a greenspace network. As a starting point, municipalities should develop an inventory of parcels that can help achieve greenspace goals. To achieve a vision of a combination riparian buffer and recreational trail system in the identified Greenspace Network, municipalities should create an inventory of property in these areas that can be purchased or protected through conservation easements. To enhance water resource protections, communities should also undertake an inventory of underutilized parking lots and commercial properties that are located near streams or wetlands in the Greenspace Network. If development applications are submitted to the municipalities, the planning boards can request parking lots be repaved or relocated and riparian corridors restored with tree plantings.

In addition to creating a Greenspace Network, townships may wish to consider acquisition of some of the underutilized parcels of land located along Route 42 to create public parks and natural areas within more developed settings. Within the context of the mostly built-out Route 42 corridor, pocket parks would provide pedestrian refuges, temper urban "heat island" affects, absorb vehicular emissions to improve air quality, and provide visual interest.

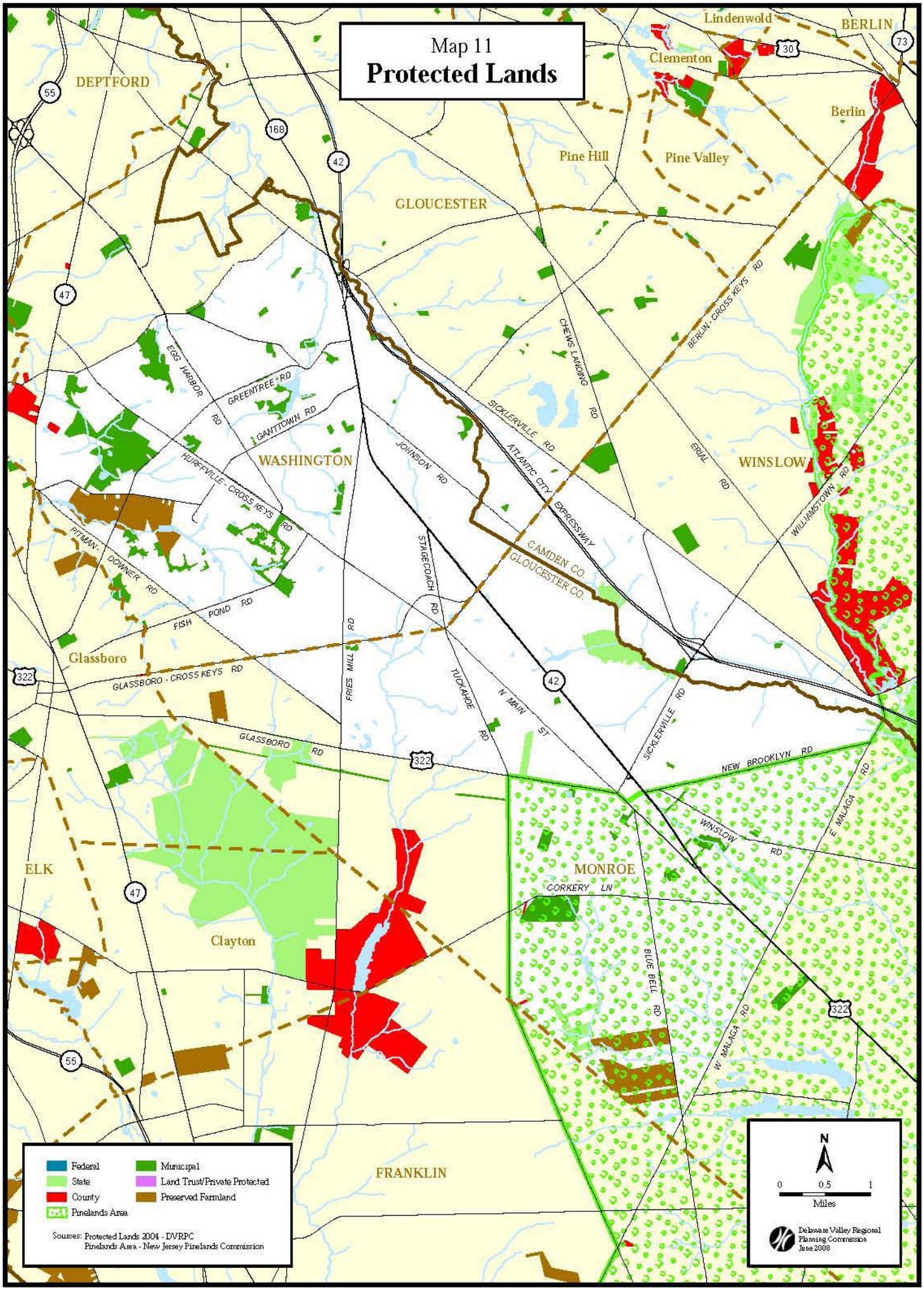
Protected Land and Open Space

Well-managed, protected land enhances and supports natural resources. Preserved land is vitally important for protecting watersheds and ensuring a sustainable drinking water supply. Conserved land also contributes to important air quality benefits and provides vital habitat for plants and animals. Protected land is valuable for a host of social reasons, including providing space for gatherings and recreation supporting educational functions, and for aesthetic pleasure. Open space improves quality of life and is shown to increase property values within a community.

The study area incorporates a total land area of 27,788 acres. Of this, 1,377 acres of land, or nearly 5.55 percent of the study area, is protected, as can be seen on Map 11: Protected Lands. Municipal land preservation efforts account for the bulk of protected land, with 823 acres. Preserved farmland accounts for 274 acres of the protected land. There are 250 acres of state-owned protected land, 22 acres of county-owned protected land, and 7.7 acres of land protected by land trusts or private organizations.

As a comparison, municipalities in the study area have protected from 3.12 to 17.82 percent of their land area. The ratio of protected land is 3.12 percent in Gloucester Township, 7.98 percent in Washington Township, 11.90 percent in Monroe Township, and 17.82 percent in Winslow Township.

A southwesterly portion of the study area in Monroe Township falls within the Pinelands Area. It is sometimes incorrectly assumed that land in the Pinelands is protected from development. Most of the study area within the Pinelands is classified as a Rural Development Area under the Pinelands Comprehensive Management Plan. In Rural Development Areas, low-density residential development averaging one home for every five acres and roadside retail is permitted. This is one of the least restrictive management areas in the Pinelands Plan and it gives a lot of leeway to municipalities to determine land uses. Townships can enhance these protections through local ordinances to achieve local goals and protect community resources.


Map 11
Protected Lands
DEPTFORD
GLOUCESTER
WASHINGTON
Glassboro
ELK
Clayton
FRANKLIN
MONROE
WINSLOW
BERLIN
Lindenwold
Clementon
Berlin
Pine Hill
Pine Valley
CAMDEN CO.
GLOUCESTER CO.
55
168
42
47
322
30
73
EGG HARBOR RD
GREENTREE RD
GANTTOWN RD
HURFFVILLE - CROSS KEYS RD
PITMAN - DOWNER RD
FISH POND RD
GLASSBORO - CROSS KEYS RD
GLASSBORO RD
FRIES MILL RD
JOHNSON RD
STAGECOACH RD
TUCKAHOE RD
N MAIN ST
SICKLERVILLE RD
ATLANTIC CITY EXPRESSWAY
CHEWS LANDING RD
BERLIN - CROSS KEYS RD
ERIAL RD
WILLIAMSTOWN RD
NEW BROOKLYN RD
WINSLOW RD
E MALAGA RD
W MALAGA RD
BLUE BELL RD
CORKERY LN
Federal
State
County
Pinelands Area
Municipal
Land Trust/Private Protected
Preserved Farmland
Sources: Protected Lands 2004 - DVRPC
Pinelands Area - New Jersey Pinelands Commission
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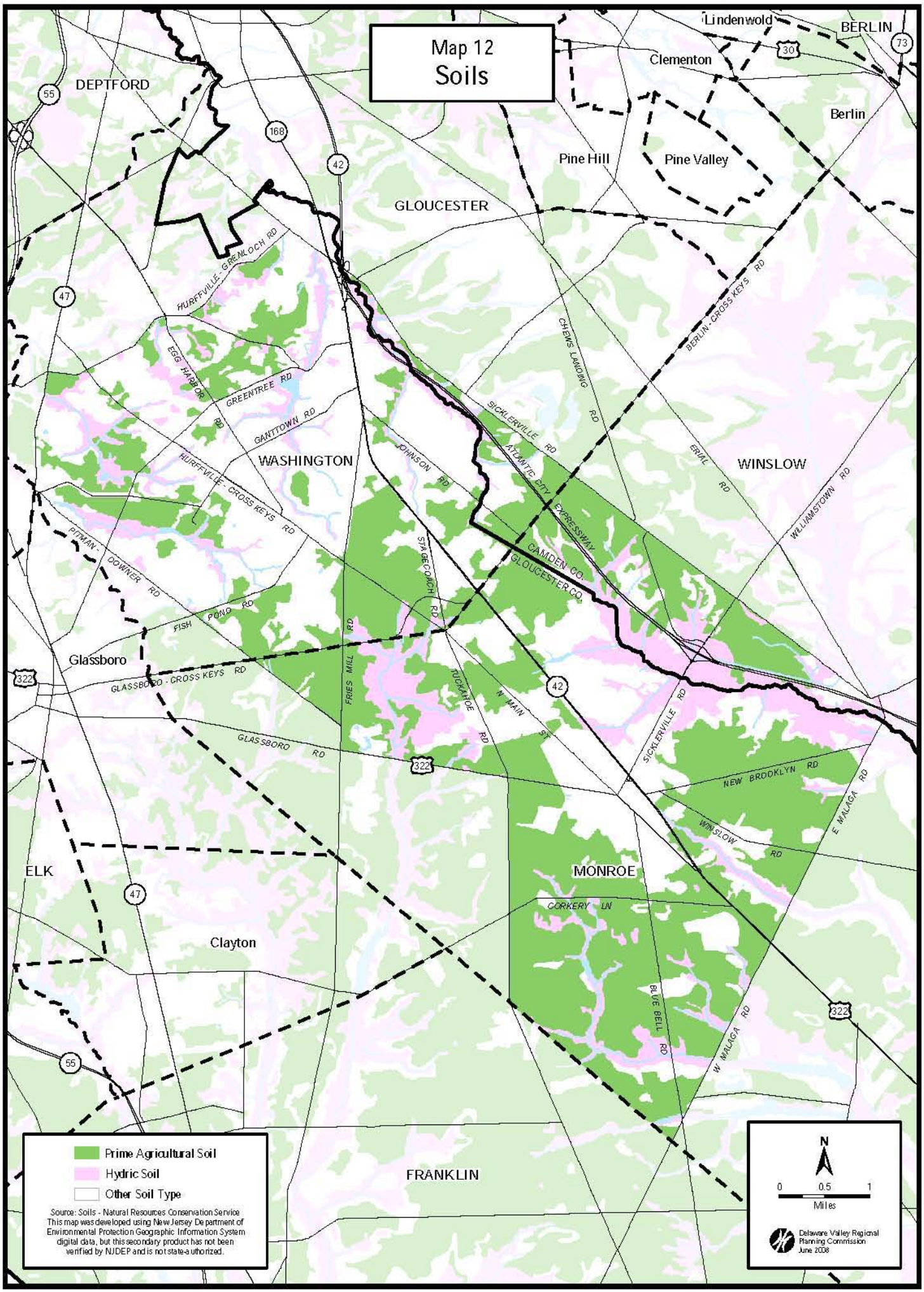
Agriculture

Soils are an important factor in land use. The quality and character of soils is a determining factor in the location of agricultural operations. However, soil qualities that create conditions for viable agricultural production—including slope, drainage, and regenerative capabilities—also create ideal sites for development. Such soils are also often capable of supporting lush, upland forests. Understanding the types of soils present in an area helps inform planning decisions about the placement of roads and buildings, suitability of sites for septic systems, potential groundwater recharge opportunities, and issues related to wildlife habitat.

As shown on Map 12: Soils, there are three basic types of soils in the study area: prime agricultural soils, hydric soils, and other soil types, mostly soils with shallow depth to bedrock. Hydric soils exhibit characteristics of wetness and are typically located near streams and wetlands. As the map shows, there are vast swaths of prime agricultural soil throughout the study area. Just as early agricultural settlers flocked to the study area because of these soils, today the study area is attracting new development, in large part due to the ease with which the land can be developed.

Agriculture is recognized as an important asset for the study area, as reflected in such plans as the Gloucester County Comprehensive Farmland Preservation Plan, the Camden County Open Space and Farmland Preservation Plan, Washington Township's Farmland Preservation Program, and the Monroe Township Economic Development Plan. In addition to economic value, farmland is increasingly recognized as an important open space asset that enhances quality of life. Locally grown foods are important for community health and reduce the use of fossil fuels compared to food imported from other areas.

In the study area, 274 acres of farmland have been protected in Washington Township. These preservation efforts are commendable and should be extended throughout the study area, where prime agricultural soils are located and a critical mass of farming activities takes place. Communities interested in preserving farmland and retaining an agricultural character can use a repertoire of tools including agricultural zoning, conservation design ordinances, transferable development rights, purchase of development rights, and right-to-farm laws, which can prevent sprawl from encroaching into valuable agricultural areas.


Map 12
Soils
Lindenwold
BERLIN
Clementon
Berlin
Pine Hill
Pine Valley
DEPTFORD
GLOUCESTER
WASHINGTON
WINSLOW
Glassboro
ELK
Clayton
MONROE
FRANKLIN
HURFFVILLE - GREENLOCH RD
EGG HARBOR RD
GREENTREE RD
GANTTOWN RD
HURFFVILLE - CROSS KEYS RD
PITMAN - DOWNER RD
FISH POND RD
GLASSBORO - CROSS KEYS RD
GLASSBORO RD
JOHNSON RD
SICKLERVILLE RD
ATLANTIC CITY EXPRESSWAY
CHEWS LANDING RD
BERLIN - CROSS KEYS RD
ERIAL RD
WILLIAMSTOWN RD
CAMDEN CO.
GLOUCESTER CO.
STAGECOACH RD
FRIES MILL RD
TUCKAHOE RD
N MAIN ST
NEW BROOKLYN RD
WINSLOW RD
E MALAGA RD
W MALAGA RD
CORKERY LN
BLUE BELL RD
Prime Agricultural Soil
Hydric Soil
Other Soil Type
Source: Soils - Natural Resources Conservation Service
This map was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not state-authorized.
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June 2008

6.0 PLACE MAKING IN THE NJ 42 CORRIDOR

The study area faces several challenges, including the lack of a sense of place, traffic congestion, limited alternatives to the personal automobile, and a rapidly vanishing rural heritage. The sustainable solutions presented in this chapter demonstrate how to transform the study area into a more sustainable and liveable place by integrating transportation and land use planning.

Sustainable solutions respect economic and social needs today and tomorrow. They minimize negative impacts—to the environment, to mobility, and to municipal budgets. The patterns of development in the study area today are not sustainable because they create a cycle of wasteful land consumption, demand for expanded infrastructure, and inefficient use of local tax dollars.

This section describes sustainable planning solutions that are appropriate for use in the study area. Sustainable transportation strategies include the use of context sensitive solutions and road network designs that respect local landscapes and better organize traffic. Smart Growth solutions include innovative zoning that supports walkability and a mix of land uses as well as parking policies that promote more efficient use of land. It is hoped that these strategies will help the study area meet the interrelated transportation and land use challenges that it faces.

6.1 Transportation Solutions

Context Sensitive Solutions

Context sensitive solutions (CSS) seek to preserve the scenic, aesthetic, historic, and natural resources of an area, while maintaining safety and mobility. The underlying principle of CSS is that roadways should respect the character of the community, including its current and planned land uses. CSS helps create sustainable, livable places by supporting multimodal transportation, preserving environmental assets, and ensuring that road systems do not foster sprawl.

Based on CSS standards, roadway type and land use context should determine the selection of roadway design values. Land use context is a product of built and natural characteristics, such as architectural types, urban form, building density, and topography. As a road transitions from rural to suburban to urban areas, changes in roadway widths, the presence or absence of parking lanes, and other factors should provide clues to motorists about appropriate speeds. Land use contexts include:

- Rural
- Suburban Neighborhood
- Suburban Corridor
- Suburban Center
- Town/Village/Urban Neighborhood
- Town Center
- Urban Core

The components of these context areas are described in detail in the *Smart Transportation Guidebook*, developed by PennDOT, NJDOT, and DVRPC.

In the study area, the land use context transitions from north to south. In the northern section of the study area, Washington Township's more densely developed core includes Town Center and Town/Village/Neighborhood contexts. In the central part of the study area, Suburban Neighborhood, Suburban Corridor, and Suburban Center contexts dominate. In the southern section of the study area, as one enters the Pinelands in Monroe Township, the context is primarily rural. Roadway design should complement the different contexts for each area and provide signals to drivers about appropriate speed and safety choices.

Traffic Calming

Traffic calming is a context sensitive solution that uses mainly physical measures to alter driver behavior to fit the surrounding context. It is grounded in the principle that some roads, namely residential and local streets, do not exist solely to facilitate automobile use. Instead, their design should create a sense of place and meet the needs of all users: drivers, transit riders, pedestrians, and bicyclists, as well as older people, children, and people with disabilities. The goal is a reduction in the number and severity of collisions and an increase in the safety and comfort of pedestrians and bicyclists.

Generally, the toolbox of available traffic calming measures gets smaller as one moves up the functional road hierarchy. Both vertical and horizontal deflection measures (speed tables, raised intersections, and traffic circles) have been successfully applied to collector roadways. Signal retiming, on-street parking, and roundabouts have been implemented on arterial roadways. The road diet—removing or narrowing travel lanes—is one of the most common traffic calming practices for higher-order roadways.

Network Design

There are two types of roadway networks: traditional grid and contemporary branching networks. In a traditional grid system, there are typically multiple route options available for roadway users. As a result, grids disperse traffic across a network of roads and can carry more traffic. Grids also create more direct routes—generating fewer vehicle miles of travel (VMT). Finally, grid systems provide connectivity and are of a scale that is comfortable, safe, and convenient for bicyclists and pedestrians.

Contemporary branching networks are characterized by mostly isolated developments that link to a single, higher-order road. Motorists are funneled onto arterial roads for most trips. Traffic from every residential and commercial property is forced into a single corridor, creating congestion. An advantage of the contemporary branching network is that traffic is directed off local roads. However, the concentration of development along a single roadway can contribute to sprawl, automobile dependence, and a lack of human scale in the built environment.

The New Jersey Department of Transportation (NJDOT) is working with the Project for Public Spaces on strategies to retrofit auto-dependent corridors to create a network of streets that support mixed-use development and a variety of transportation modes. In the *Smart Transportation Guidebook*, PennDOT, NJDOT, and DVRPC suggest these principles for well-connected networks:

- Arterial roadways should be continuous and networked in generally rectilinear form, with spacing of one-half to one mile in suburban contexts and one-quarter to one-half mile in urban contexts. Closer spacing may be needed depending on activity levels and through movements. Collectors may be spaced at one-eighth-mile intervals, if needed.
- All neighborhoods in the community should be connected to the larger street system at least every one-quarter mile. Where streets cannot be connected, provide bike and pedestrian connections at cul-de-sac heads or midblock locations as a second-best solution to accessibility needs. Recommended maximum spacing is 330 feet.
- Communities can improve network connectivity by requiring at least a 1.4 to one ratio of street segments to street ends, or capping the length of blocks at 300 to 600 feet.

6.2 Smart Growth Strategies

Overview

So-called sprawl development has three characteristics: 1) single-use zoning, 2) low-density land use, and, a consequence of the first two, 3) auto-dependent communities. Single-use zoning and low-density land use have been written into the rules of conventional zoning practice. The application of these rules produces the ubiquitous elements of suburban sprawl development: residential subdivisions, strip malls, shopping malls, and fast food restaurants. They also produce the same auto-dependent style wherever they are followed.

Smart growth focuses on reducing sprawl and concentrating development in a way that is pedestrian friendly and encourages fewer automobile trips. Although Route 42 is designed almost exclusively for automobile-oriented uses, smart growth strategies can help communities along the corridor identify steps that can be taken over the long term—as well as techniques that can be applied today—to retrofit the area to become a walkable, liveable, more sustainable place.

Smart Growth Zoning

One of the most important prerequisites for smart growth development is to modify existing zoning codes to allow developers to respond to consumer demand for smart growth development. Conventional zoning requirements, such as deep building setbacks and separated uses, can make it legally impossible to build vibrant, walkable, human-scale places, such as those in older urban areas or traditional neighborhoods. Smart growth zoning enables developers and communities to create the multifaceted, compact, and pedestrian-friendly places where many people say they want to live, work, and visit.

Townships should review their zoning ordinances to incorporate smart growth zoning strategies. Washington and Monroe townships should consider combining zoning districts to establish consistency along the corridor. Alternately, a corridor-based zoning overlay district could be created to foster smart growth development along Route 42. With vision and appropriate zoning regulations in place, the sea of parking and strip malls along Route 42 can be transformed over time into a walkable, visually interesting, mixed-use growth center.

Smart growth zoning policies that should be implemented in the Route 42 corridor include:

- Encourage a mix of land uses.
- Minimize building setbacks.
- Enable access for alternate forms of transportation.
- Encourage site parking in the rear of buildings or in structured lots.
- Promote shared parking.
- Encourage first floor retail uses to enhance the pedestrian experience.
- Permit higher densities to encourage mixed use and create a sense of enclosure for pedestrians.
- Require street furniture such as benches to improve pedestrian comfort.
- Promote context-sensitive architecture.

Many national retailers prefer stand-alone sites on which they erect a standard configuration of their stores. However, they will build different types of structures in competitive markets where the “big box” model is not permitted. For this reason, study area municipalities should consider limiting commercial development outside selected growth centers. Limiting development sites will actually help developers by making development more predictable for municipalities, giving them an opportunity to plan for the consequences of development, such as traffic congestion. It will also prevent

sprawl from creeping into rural communities. Furthermore, growth centers make it more likely that shoppers will park once and patronize several businesses, rather than making single trips to stand-alone retail locations.

Form-based Zoning

One of the tools both for encouraging smart-growth development and creating a sense of place is form-based zoning. Traditional zoning regulates use, whereas form-based zoning permits a mix of uses. Rather than regulating use, form-based zoning focuses on coordinating the form of the built environment (building architecture, massing, setbacks, heights). Form-based zoning often contains illustrations to show, rather than simply describe, the type of design guidelines that the code regulates. Form-based zoning can be incorporated into an entire zoning code or utilized as an element of a single zoning district or overlay.

Form-based zoning often relies on concepts from the transect model developed by urban designer and smart growth advocate Andres Duany. The transect model describes how the built environment transitions from urban to rural as one moves from downtown or core areas to the metropolitan edge. Similar to principles from CSS, the transect model indicates that planning solutions should be tailored to the local context.

Rethink Parking

Parking creates numerous sustainability challenges. It disrupts pedestrian mobility, erodes a sense of place, and creates stormwater runoff that impairs water quality. Some argue that minimum parking requirements cause an oversupply of parking and lead to inefficient land use. In contrast, innovative parking strategies give developers and planners the flexibility to deal with variable local conditions. These strategies are described in this section; stormwater best management practices are described in the previous chapter.

- Some communities have established maximum limits on parking, usually based on the square footage of a specific land use. Others have made the allowed number of parking spaces an "entitlement" that can be transferred or sold to another development if they are unused. This approach works best in neighborhoods where there is a range of travel options and where surrounding residential areas are protected from spillover parking from other users.
- Sometimes minimum standards can be eliminated altogether and the parking needs left to developers who will want to provide sufficient parking to satisfy potential occupants without oversupplying it. Again, this requires consideration of spillover parking impacts.
- Context-specific standards make codes more flexible and sensitive to local conditions. For example, there can be lower parking requirements in walkable town centers and downtowns than in outlying areas. Parking needs at senior facilities, low-income housing sites, locations where transit exists, and generally in mixed-use areas are often much lower than standards require.
- Varying minimums may work well in some locations. For example, commercial properties would be required to have a fixed number of parking spaces for the first 2,000 square feet and a lower number for additional square footage beyond that.
- Shared parking between different time-based uses on a site can allow lower minimums for parking. For example, an office that has peak

parking during the day can share the same parking spaces with a restaurant that operates in the evening. Establishing such minimums requires site-specific assessment and works best on mixed-use sites.

- In addition to reducing the oversupply of parking spaces, strategies to reduce the size of parking facilities can create more comfortable, pedestrian-friendly environments, while also reducing stormwater runoff. Reduced parking lot size can be achieved by creating smaller parking spaces for compact cars, designing lots with angled parking, and creating spillover parking areas to be paved with alternative pavers.
- Improving pedestrian and bicycle facilities may reduce demand for parking. In addition to on-site facilities, such as bike racks and walkways, designs that improve pedestrian and bicycle access to a site from other locations and that encourage safe biking and walking throughout a community are essential.
- Centralized parking in business districts through thoughtful placement of lots or garages enables travelers to park once to visit multiple destinations. This allows the elimination of small surface parking lots and driveways that break up the fabric of the urban landscape. These facilities can be built and operated by a public entity or by a public/private partnership and can be funded through various mechanisms, including in-lieu parking fees where developers pay monthly into a fund for each parking space they would otherwise have had to build.
- Parking is often free. Free parking encourages overuse and requires more parking spaces. Parking fees may foster greater use of alternate modes of transport, including increased carpooling, and may enable more customers to access retail establishments by preventing all-day parking.

Sense of Place

In his book, "Geography of Nowhere," journalist James Howard Kunstler describes how sprawl and automobile-based suburbia have created places that bear little relationship to the local environment and history. In the study area, the tremendous presence of strip shopping malls, big box retailers, and vast parking lots diminish the sense of a unique local identity. A variety of measures can be taken to strengthen the sense of place in the area.

Gateway treatments use a combination of signage, landscaping, colored or textured pavement materials, lighting, and street furniture to create an impression of an entrance or focal point for a community. Although gateway treatments provide a powerful way to create a sense of local identity, they can also impart traffic calming and stormwater benefits through the use of landscaping.

Community programming, such as public art or landmarks that celebrate the area's heritage, can be incorporated into gateways or neighborhood nodes to further enhance a sense of place and community pride. Throughout the townships in the study area, building and landscaping design can be promoted that incorporates local materials, native vegetation, historic scale, or architectural details that represent and enhance the local community context.

7.0 ACCESS MANAGEMENT

Access management is one of many strategies that a municipality can use to improve the function of its roadways. The methods employed in access management seek to optimize and maintain the existing transportation system while preparing for its future growth. With fewer new highways being built, the need for effective management of the current transportation network is even more pronounced. Access management is a relatively low-cost strategy to increase public safety, extend the life of major roadways, reduce congestion, and support alternative transportation modes.

7.1 The Basics of Access Management

What is Access Management?

Access management entails the careful planning of the location, design, and operations of driveways, median openings, interchanges, and street connections. Access control can serve to decrease total travel time by increasing average travel speed and lessening delay. Access control can also increase highway capacity and fuel efficiency.

There is no uniform approach to access management. The appropriate degree of access control, as well as the access controlling technique, varies according to the function and traffic characteristics of a roadway, the abutting land use, and long-term planning objectives. The use of access management techniques is especially important along primary roadways, like NJ 42, that are expected to be both safe and efficient for through traffic, while providing adequate access to property. Although the emphasis of access management is the reduction of problems attributable to vehicular access, it is important to consider a full range of transportation modes.

A key component of access management is that it recognizes the relationship between land use and transportation. Although commercial and residential development is good for the local and regional economy, poorly planned development can lead to traffic problems that can be detrimental to a community.

Benefits of Access Management

Considering that the roadway network is an important and costly public resource, the effective management of the transportation system is essential. The most notable benefits of the implementation of an access management program are reduced traffic congestion and increased public safety. The use of access management techniques results in fewer conflicts for drivers to handle and fewer access points to interfere with pedestrians.

With the use of access management techniques, government agencies can provide accessibility to adjacent properties in a manner that preserves the mobility, efficiency, and safety of the transportation network. Access management techniques can contribute to reductions in traffic delays and the prolonged life of transportation infrastructure. Well-planned access creates a more efficient roadway system to serve local businesses, which in turn helps to preserve long-term property values and economic viability for properties abutting a significant community roadway. Access management also benefits the environment, as improved traffic flow results in greater fuel efficiency and reduced emissions.

Access Management Techniques

The Transportation Research Board identifies

10 main principles of access management that help municipalities to arrive at the goal of a safe and efficient roadway corridor. These techniques serve to reduce the number and complexity of events to which the driver must respond, and increase the spacing of those events. This simplifies the driving task, which often results in improved traffic operations and reduced accidents.

Principles of Access Management

1- *Provide a Specialized Roadway System*
2- *Limit Direct Access to Major Roadways*
3- *Promote Intersection Hierarchy*
4- *Locate Signals to Favor Through Movements*
5- *Preserve the Functional Area of Intersections and Interchanges*
6- *Limit the Number of Conflict Points*
7- *Separate Conflict Areas*
8- *Remove Turning Vehicles from Through Traffic Lanes*
9- *Use Nontraversable Medians to Manage Left-Turn Movements*
10- *Provide a Supporting Street and Circulation System*

7.2 Access Management in the NJ 42 Study Corridor

Access to NJ Route 42 is permitted by NJDOT, based on regulations included in the *NJ State Highway Access Management Code*. This code promotes managed access on all state highways through the use of techniques such as encouraging shared and alternate access, minimizing the number of access points along a given highway, and requiring progression for new traffic signals. According to the access code, NJ Route 42 within the study corridor is classified as an access level of three (3), which generally allows left-turn access through jughandles with traffic signals and right-turn access into and out of lots along the roadway. This access code should be referenced when proceeding with any of the recommendations contained herein.

Current Conditions

NJ 42 serves a dual purpose as a regional throughway and a local commercial corridor. While retail, commercial, and office space is located along the length of the corridor, the development pattern and intensity varies between roadway segments. In Washington Township, the northernmost portion of the study area, there are few vacant parcels and few opportunities for infill development. Commercial and retail developments are a mixture of large shopping centers and small unique businesses with individual access and parking. Frequent breaks in the roadway median allow for direct access and U-turn movements to these individual parcels. Farther south in Monroe Township, development is just beginning to shape the landscape along NJ Route 42. In this area of the corridor the presence of many vacant parcels provides an opportunity to create a commercial corridor with a look and feel considerably different than that in Washington Township. Finally, the extension of the study area along Berlin-Cross Keys Road signifies an area in transition between the built-out characteristics of Washington Township and the beginning stages of commercial development exhibited in Monroe Township. Here, development has primarily taken the shape of large commercial destinations with ingress and egress controlled at limited access points along major arterial highways.

Areas of Improvement

Based on discussions with stakeholders and independent field visits, several access management issues have been identified in the NJ 42 study corridor. First, there are numerous access points but few acceleration and/or deceleration lanes, resulting in disruption of traffic flow due to turning vehicles. In addition, there are few opportunities to access properties adjacent to the roadway without using NJ 42. Finally, with the presence of a considerable amount of vacant and undeveloped properties within the study area, combined with recent development pressure, it is expected that the corridor will experience significant growth in the near future. This influx of new development may require increases in roadway capacity and further transportation investments. However, the application of relatively inexpensive access management techniques along NJ 42 can help to increase the efficiency and safety of the roadway and minimize any necessary future improvements.

Recommendations

Access management techniques should not be relegated to the highway right-of-way. An emphasis on connectivity of the entire transportation network through sound development practices can reduce traffic on major arterials by providing alternate routes for local trips. Improvement of internal traffic circulation within properties along commercial corridors should also be considered as a strategy for dealing with access and traffic flow issues on adjacent arterials. Simple site design considerations, such as limiting the number of driveways, sharing access points with adjacent parcels, and locating access on perpendicular roadways, can increase roadway efficiency without impeding the use of the property.

Corridor-wide and site-specific recommendations follow. To affect the greatest change, communities should coordinate efforts to create a uniform corridor plan with consistent implementation and enforcement.

Corridor-Wide Improvements

1: Encourage shared access along NJ 42.

One primary disruption of traffic flow along NJ 42, and many other like facilities, is the accommodation of turning vehicles. Turning vehicles not only decrease lane capacity but also create conflict points with through traffic, opposing turning traffic, and pedestrians. By limiting turning opportunities, the potential for conflicts is limited and the flow of traffic is improved. Shared access is the preferred method of providing adequate and reasonably convenient access to properties directly from an arterial such as NJ 42. This development approach results in fewer conflict points for both motorists and pedestrians and also provides ample access for individual businesses.

2: Install deceleration and/or acceleration lanes at high turning volume locations.

Deceleration lanes allow vehicles to safely make right turns onto intersecting local streets or into business access points without causing disruptions to the flow of through traffic. Similarly, acceleration lanes increase both safety and efficiency by providing a lane for drivers to merge with through traffic at or near the same speed as the traffic flow. These additional lanes are most effective when instituted at access points that experience a high volume of turning traffic.

A complete turning movement analysis is needed to identify the exact locations within

the corridor where deceleration and/or acceleration lanes are most appropriate. Preliminary discussions and field visits indicate that properties containing large commercial developments, or locations where multiple driveways have been consolidated into one access point, are the primary candidates for this improvement.

3: Encourage shared parking, improved internal circulation among businesses, and connections to the local street network.

One of the most effective methods to limit conflicts between turning traffic and through traffic on an arterial roadway like NJ 42 is to remove local traffic by providing an alternate route for these drivers to access businesses and link to the local street network. The accomplishment of this goal relies on the success of many layers of access management techniques. The first facet is to limit the number of access points along the roadway by consolidating individual driveways into shared driveways. By improving internal connections between businesses with small links and service roads, drivers can navigate between adjacent destinations without utilizing NJ 42.

Also important to the success of this approach is sufficient and convenient parking facilities. Considering that the majority of businesses patrons along NJ 42 arrive by car, parking facilities are a necessity to nearly every property owner. With shared access and efficient internal circulation, the opportunity to "park once" increases, thus possibly reducing the total number of parking spaces needed among adjacent businesses. Shared parking facilities are useful in this situation to ensure that adequate parking is available for patrons of all businesses, especially those that have relinquished property for the creation of internal access roadways. Shared parking agreements help to explain the parameters of this shared ownership and maintenance relationship and ensure that involved parties are not subject to unfair liability.

Site-Specific Improvements

Site-specific improvements were suggested for three sites in the study corridor. Sites chosen exhibit characteristics typical of the corridor, and thus it may be possible to implement these recommendations at other sites. All three scenarios are hypothetical suggestions of changes that could be made to the roadway and adjacent land use, resulting in an opportunity for more safe and efficient travel.

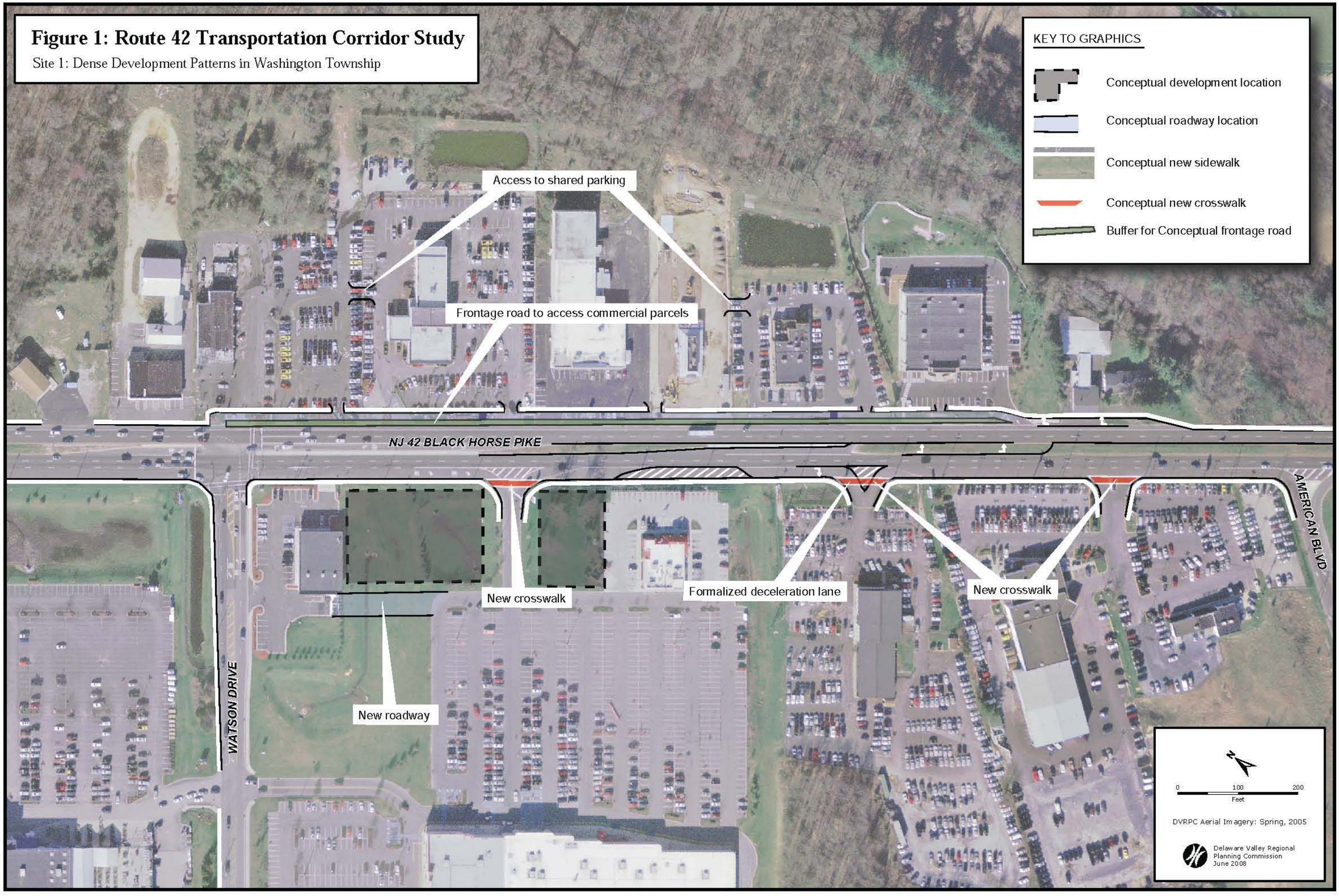
Site 1: Dense Development Patterns in Washington Township.

Located in the northernmost portion of the study area, Washington Township has experienced vast development over the past decades, resulting in a disjointed landscape of multiple access points to individual businesses and exclusive parking arrangements. This portion of the roadway can be difficult and potentially dangerous for pedestrians, as they are forced to cross multiple access points along NJ 42. The provision of direct access to NJ 42 for each parcel, as well as dedicated parking areas for each property, forces each trip along this portion of the corridor to utilize NJ 42 rather than internal circulation connections or the local street network. The result is an increase in roadway congestion and conflict points between through and turning/merging traffic and decreased roadway efficiency.

As shown in the graphic for Site 1 (Figure 1), by limiting access points to fewer shared

Figure 1: Route 42 Transportation Corridor Study

Site 1: Dense Development Patterns in Washington Township



driveways, and encouraging both shared parking arrangements and improved internal circulation, more trips can be made within the destination properties without requiring access to NJ 42. Furthermore, pedestrian safety is improved by limiting the number of access points that pedestrians need to cross. A deceleration and acceleration lane is shown along southbound NJ 42 to serve the suggested shared access point, since it is expected that this consolidated access point will experience a significant increase in use. In most areas along NJ 42, deceleration and acceleration lanes can be accommodated within the current cartway width.

The conceptual site plan also shows that additional infill development can be accommodated within this plan without significantly contributing to its congestion.

Perhaps the most ambitious recommendation made for this portion of NJ 42 is the installation of a frontage road. Frontage roads separate the land access and mobility functions of a roadway to make both of them more successful. Turning traffic is segregated to a slower speed facility where parcels can be accessed individually without interrupting through traffic flow. Despite these benefits, frontage roads are not useful in all situations. If designed improperly, frontage roads can be difficult to enter and exit, especially on highways. Also, in some cases they can promote commercial strip style development due to the lack of access control along the frontage road. Finally, frontage roads require considerable right-of-way and may be costly to implement. Therefore, they should only be used if a significant development density exists.

Even with these concerns, the DVRPC study team recommends this portion of NJ 42 for further consideration of the frontage road concept. The exact design of this roadway requires a more detailed analysis by the township, in conjunction with NJDOT and the affected business owners.

Site 1 Improvements

1: Install a frontage road along the northbound side of NJ Route 42 between American Boulevard and Watson Drive.

2: Install northbound deceleration lane and southbound turning lane to support entrance to the frontage road.

Corridor-Wide Improvements

1: Encourage shared access along NJ Route 42.

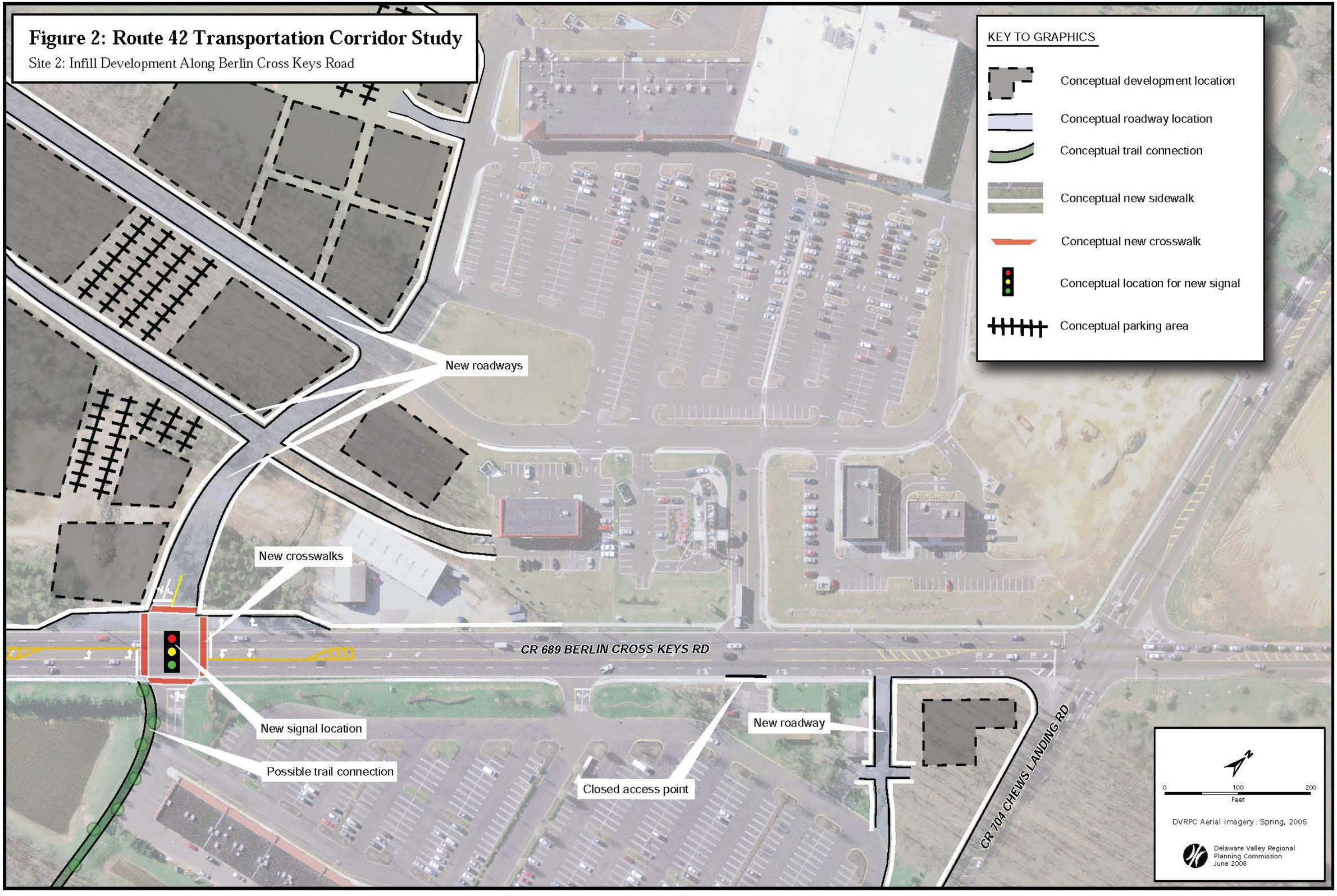
2: Install acceleration and/or deceleration lanes at high volume turning locations.

3: Encourage shared parking and improved internal circulation among businesses.

4: Complete the network of sidewalks and crosswalks between NJ Route 42 and

Figure 2: Route 42 Transportation Corridor Study

Site 2: Infill Development Along Berlin Cross Keys Road



Site 2: Infill Development on Berlin-Cross Keys Road.

Berlin-Cross Keys Road is a rapidly developing segment of the study area. The bulk of development thus far has been characterized by major community shopping destinations with large setbacks, ample parking, numerous outparcels fronting the roadway, and limited access points. While the majority of this roadway does not suffer from the multiple access point conflicts seen in Washington Township, the volume of traffic centered at the current access points may contribute to congestion along Berlin-Cross Keys Road. The primary recommendation for this site is to encourage connections and augmentations to the local street network as future developments are approved.

Additions to the current street network may be implemented as vacant land is developed. As shown in the conceptual site plan (Figure 2), an internal street network would link current and future developments.

The current access point on northbound Berlin-Cross Keys Road would feed into the internal street network. As volume increases at this intersection, a traffic signal could be added to ensure controlled, safe access. Assisting movement at this intersection is the addition of a deceleration and acceleration lane and the formalization of left-turn lanes.

When complete, the network of streets would allow motorists to bypass the intersection of Berlin-Cross Keys Road and Chews Landing Road. The site plan also shows the possible accommodation of future development opportunities within the networked street plan. Finally, a trail connection is proposed from the site of the future signalized intersection on the south side of Berlin-Cross Keys Road to the park and playing fields located behind the shopping center.

Site 2 Improvements

1: Require connections and enhancements to the current street network and internal circulation roadways.

2: Install a traffic signal at the newly created four-way intersection along Berlin-Cross Keys Road.

3: Install a trail connection from Berlin-Cross Keys Road to the local park on Chews Landing Road to encourage alternative modes of travel.

Corridor-Wide Improvements

1: Encourage shared access along Berlin-Cross Keys Road.

2: Install acceleration and/or deceleration lanes at high volume turning locations.

3: Encourage improved internal circulation among businesses.

4: Complete the network of sidewalks along Berlin-Cross Keys Road and at business access points.

Figure 3: Route 42 Transportation Corridor Study

Site 3: Creating an Identity in Monroe Township

KEY TO GRAPHICS

- Conceptual development location
- Conceptual roadway location
- Conceptual new sidewalk
- Conceptual parking area

US 322 BLACK HORSE PIKE

CORKERY LANE

Connection to local street network

N

0 100 200

Feet

DVRPC Aerial Imagery: Spring, 2005

Delaware Valley Regional Planning Commission
June 2008

Site 3: Creating an Identity in Monroe Township.

Access management is most successful when implemented proactively. Monroe Township has a unique opportunity to shape the landscape along its quickly developing portion of NJ 42. Currently, there are many vacant lots along the roadway that will probably be developed due to market forces. In a conventional development plan, a shopping center or big box store is set back from the roadway with a large parking lot fronting the roadway. However, there are alternate development plans available. The site plan (Figure 3) shows one such alternative.

The development pattern envisioned in the site plan is one of multiple smaller commercial units configured so that building facades rather than parking lots are the main attraction along the roadway. This configuration would also work well with mixed-use development, using a zoning overlay to allow such departures from the traditional commercial zoning that lines much of NJ 42. An internal street network, with limited connections to both NJ 42 and residential neighborhoods bordering this commercial strip, provides ample access to these parcels and connects this commercial hub to other community assets without adding significant congestion to NJ 42. It should be noted that all access points along NJ 42 should adhere to the NJ Access Code regulations for the spacing and design of access points. Shared parking is provided in small lots dispersed throughout the development while sidewalks and the dense placement of buildings invite pedestrians. The key elements of the alternate development plan, which should be considered when reviewing all development proposals for vacant parcels such as this, are:

- limited direct access to NJ 42
- connections to local neighborhoods and the local street network
- internal circulation
- shared parking
- pedestrian accommodations
- numerous smaller businesses with facades facing the highway and internal circulation streets as much as possible

Access management techniques stress the connection between land use decisions and transportation impacts. It is important to recognize that sound land use planning can result in valuable commercial amenities and tax dollars without compromising the efficiency of important roadways and without placing a parking lot at the forefront of the community's image.

Site 3 Improvements

1: Require development to occur with considerable density of smaller buildings and shared parking.

2: Require connections and enhancements to the current street network and internal circulation roadways.

Corridor-Wide Improvements

1: Encourage shared access along NJ Route 42.

2: Encourage improved internal circulation among businesses.

3: Complete the network of sidewalks along NJ Route 42 and at business access points.

7.3 Implementing Access Management Strategies

Implementation of access management techniques involves a variety of tools. Discussions between NJDOT, local municipal officials, and affected business owners will be necessary to lead to a plan of action for each roadway segment and each property. Ultimately, access management principles should be clarified in local plans and ordinances to enable local governments to consistently enforce these practices. Adjacent municipalities can ensure uniform controls by coordinating to create access management overlay zoning, complementary Official Maps, and a corridor access management plan.

For undeveloped parcels, these strategies are much easier to implement proactively through ordinances and the development approval process. Yet even for developed communities like Washington Township, retrofit options are available and restrictions on property design can be implemented in the future as properties are redeveloped. With ordinances in place, incremental improvements can slowly shape the landscape and improve travel conditions within the most densely developed communities.

Intergovernmental Coordination

Close coordination between adjacent local governments, state transportation agencies, and landowners/developers when creating and enforcing access management policies is very important. Just as traffic congestion easily crosses political boundaries, impacting a broad portion of the local roadway network, so too do the effects of access management. Similarly, some access management strategies that affect an entire corridor rather than a single parcel, such as installation of a frontage road, may require cooperation among several municipalities to generate the largest impact. Even less intensive access management techniques, such as the consolidation of driveways into fewer access points, can produce more significant results if implemented along an entire corridor rather than in isolated locations.

Considering that access points along NJ 42 are controlled through NJDOT access permits based on the regulations in New Jersey's State Highway Access Management Code (adopted in April 1992), communities in the study area also need to coordinate with NJDOT to develop access management goals that can be implemented at both the state and local level. This code applies the principles of access management to all state roads. It also allows county and municipal governments to collaborate with the Department of Transportation to develop local access management plans. The following excerpt is taken from the New Jersey Department of Transportation State Highway Access Management Code and New Jersey Administrative Code, and it defines the term access management plan:

> *Title 16 Chapter 47. "Access management plan" means a plan showing the design of access for every lot on a State highway segment developed jointly by the Department, the municipality in which the highway is located, and the county, if a county road intersects the segment.*

In addition to the NJ Highway Access Code, NJDOT recently collaborated with Pennsylvania's DOT to create and publish the *Smart Transportation Guidebook*, which proposes to "manage capacity by better integrating land use and transportation planning"[2]. This publication encourages the use of many less traditional tools and techniques, including access management, to improve the function of roadways and protect

[2] Smart Transportation Guidebook, March 2008, pg 1

past investments in transportation assets.

Multimunicipal access management plans create the advantage of a cohesive and uniform approach to land planning throughout a corridor, regardless of political boundaries. This coordinated approach contributes to a corridor's sense of place and impacts the behavior of drivers as they maneuver through fewer conflict points. In addition, multimunicipal plans offer developers identical standards and requirements along a given corridor regardless of the municipality in which they chose to build. This consistency among adjacent municipalities ensures that the enforcement of access management regulations in one community does not result in development opportunities being lost to an adjacent community with less stringent regulations.

Intergovernmental cooperation is particularly essential in the case of access management given the separation of authority and responsibility between local governments and state agencies. State agencies are not responsible for making the land development decisions that lead to access requests, while local governments have little control over access-permitting decisions on state highways. Because of this mutual dependency, it is important for state and local entities to understand one another's access management goals and work together from the beginning of a project to ensure that each site-specific decision compliments the broader community vision for the corridor. Additionally, cooperation between local municipalities and state agencies benefits landowners and developers by creating a more streamlined and efficient access permitting process.

The major aspects of intergovernmental coordination are shown below:

1- **Policy Development** – Consistent state and local access management standards and policies remove confusion and uncertainty, which results in a more clear and efficient access permitting process.

2- **Access Management Plans** – Plans facilitate consistent access management decision making along sections of roadway that may involve state agencies and/or multiple local governments. As each property development or opportunity occurs, access permits can be issued according to the agreed upon access management plan rather than on independent neighboring parcels.

3- **Development Review** – Early coordination between local and state agencies on permitting issues reduces the potential for conflicts while making the permitting process more efficient and user friendly.

Retrofit Strategies for Developed Areas

In many Delaware Valley communities, development has already created a landscape that does not meet traditional minimum access management standards. Though such situations are more difficult to recover, it is still very possible to improve this landscape. While existing property access can be allowed to remain, communities can also adopt policies that avoid further deterioration. In addition, when opportunities arise because of a change in use or a roadway improvement project, properties, or even entire corridors, can be retrofitted with access management techniques to improve the safety and efficiency of the transportation network. The following is a list of a variety of retrofit strategies that have been utilized by communities across the country in an effort to manage access:

- Work with property owners to obtain permission for driveway closures, consolidation, or relocation during roadway projects, sidewalk

maintenance, additions, etc.
- Purchase strategically located vacant or abandoned properties and resell them with access restrictions.
- Place planter boxes along unnecessarily wide access points to help define the driveway break.
- Require access consolidation where adjacent parcels come under common ownership.
- Redesign internal road and parking systems.
- Eliminate closely spaced or off-set intersections.

Retrofitting access is a long-term commitment that takes continuous effort. However, with access management strategies in place, each opportunity that arises can be taken advantage of to improve the community landscape and provide safe and efficient travel within the transportation network.

Implementation Tools

As mentioned earlier, integration of access management strategies into local plans and ordinances is one of the most important methods to ensuring a continued focus on improving the transportation network and coordinating land use decisions and transportation impacts. The following tools are suggested to assist communities in implementing the access management techniques discussed in the aforementioned recommendations.

Integration into Current Plans

Local comprehensive plans and zoning ordinances are the policy documents that guide future development and conservation for a municipality. Access management techniques can be included in various portions of the community's master plan such as the statement of objectives, the land use plan element, and/or the circulation plan element. The following techniques cited in the Iowa *Access Management Handbook* include other ways that these standard documents can address access management issues:

- Designate compact growth areas and limit the amount of development that can take place in rural areas along arterials.
- Prohibit strip development along arterials, including the proliferation of single-lot, house-by-house development.
- Develop regulations to require that development along the arterials be clustered or limited to certain areas.
- Include guidelines in a local ordinance to ensure that arterial development will not significantly reduce traffic safety and traffic carrying capacity.
- Require traffic impact analyses and site plans for all developments exceeding a certain threshold.
- Meet with officials of adjacent communities to review transportation issues and develop a coordinated, regional approach to access management.

Access Management Ordinances

Access management techniques can be integrated into current ordinances, or a separate access management ordinance can be created. Pennsylvania's *Access Management Model Ordinances for Pennsylvania Municipalities* guide gives examples of ordinance changes or additions that can improve access management. This document also provides sample language for communities to integrate into their current zoning and subdivision and land development ordinances. Items covered in this guide that could be useful to communities along NJ 42 are:

- Number and spacing of driveways permitted for each property;
- Corner clearance and sight distance;

- Driveway channelization; and
- Auxiliary lanes (including right and left turn lanes, acceleration / deceleration lanes and lane storage).

Overlay Districts

Corridor access management is an approach that applies the techniques of access management at a corridor level, rather than at a municipal or state level. This is particularly useful when planning for the future of a roadway, like NJ 42, that spans several municipalities and counties. One way to approach corridor access management is to create an access management overlay district. This tool can be developed to accommodate the unique characteristics of a particular corridor, or multimunicipal partnership. Like other overlay districts, the access management overlay adds special restrictions and requirements to the existing zoning regulations. Though underlying zoning regulations remain, the parcels included in the overlay district are subject to further regulation of use, setback, number and location of driveways, internal circulation, and other access management principles. If desired, the overlay district may also contain regulations pertaining to signage and landscaping features to preserve the character of the district. Pennsylvania's *Access Management Model Ordinances for Pennsylvania Municipalities* guide states that a planning study should be completed before an overlay district is adopted, and it should focus on the following issues:

- Purpose of the overlay district;
- Analysis of existing traffic conditions;
- Analysis of future traffic conditions based on projected land development patterns;
- Recommended access improvements and management practices; and
- Establishment of the boundary for the overlay district.

This type of study helps to ensure that the overlay districts are properly developed and contain clearly defined regulations that can be easily implemented.

Official Map

The creation of an official map can also work hand in hand with the access management overlay district to assist a municipality in preserving right-of-way for the future implementation of access management techniques, such as a frontage road or intersection widening. Like zoning and subdivision and land development ordinances, the official map serves as a guide through which communities can relay their vision for the future development of the municipality. Guidelines for the creation of an official map are noted in Article 5 of the *New Jersey Municipal Land Use Code*. This code gives municipalities the authority to adopt an official map, showing the location of public streets, drainage ways, flood basins, and other public areas, whether they are currently in existence or proposed as a preferred future location. The map can include the entire municipality or only a portion of the municipality and can always be amended, just like zoning ordinances, master plans, and other municipal plans.

When a property owner submits an application for development, a municipality can reserve for future public use any portion of the property shown on the official map. This reservation continues for up to one year (or a longer period agreed to by the property owner), at which point the municipality must decide to forgo purchase of the property, or compensate the property owner at a fair market value[3]. In addition, when a community has enacted an official map, permits cannot be issued for a building or structure unless the lot gains access from a currently existing

[3] Source: NJ Municipal Land Use Law, Section 40:55D-44

street or one that is shown on the official map or a plan that was previously approved by the planning board.

With the coordinated use of official maps, municipalities along NJ 42 can ensure that future development takes a shape that is preferred by the community. With each new development, the current roadway network is augmented to help distribute additional traffic. Likewise, developers benefit from the knowledge of where streets, basins, and other necessary areas should be located on their site plan, which saves them time and money in the planning stages of their development.

Conclusion

To achieve the implementation strategies and tools outlined in this report, each municipality will have to engage in individual actions, such as the amendment of local ordinances, as well as multimunicipal collaboration on issues such as the creation of an official map or overlay district. The tools included in this report serve as initial guidance for study area municipalities to advance the recommendations to implementation.

8.0 TRANSPORTATION ANALYSIS

The Black Horse Pike and its immediate highway network carry a large share of study area traffic. This chapter provides an overview of study area travel conditions, including traffic volume, crashes and travel time. It also analyzes issues that directly affect the performance and safety of the transportation system. The topics covered are speeding, major intersections, median openings and transit service, as well as bicycle and pedestrian infrastructure. For each topic, improvement scenarios have been examined and recommended improvements identified.

8.1 Traffic Volume Analysis

Traffic volume, a major determinant of traffic conditions, varies widely in the study corridor. In this section, the distribution of traffic volume on the Black Horse Pike and on parallel and perpendicular facilities is described.

Black Horse Pike (NJ 42 and NJ 322)

Traffic volume on the Black Horse Pike is divided into three different sections by Berlin-Cross Keys Road (Route 689) and Williamstown Road (Route 536 Spur). Both roads provide access to the Atlantic City Expressway. South of Williamstown Road, traffic volume is generally less than 25,000 average annual daily trips (AADT). The only exception is near Williamstown Road itself, where traffic volume is 25,700 AADT. North of Williamstown Road extending to Berlin-Cross Keys Road, traffic volume is almost 35,000 AADT. North of Berlin-Cross Keys Road, traffic increases in a series of steps, as feeder roads used by Washington Township commuters and shoppers meet the Black Horse Pike. These feeder roads include Fries Mill Road, Ganttown Road, and Greentree Road. North of Ganttown Road, the roadway carries 43,700 AADT. North of Greentree Road, it carries 48,200 AADT. Much of the traffic is bound for, or is from, the North - South Freeway (NJ 42); the rest use NJ 168.

Parallel and Perpendicular Facilities

There are parallel facilities west and east of the Black Horse Pike. To the west, North Main Street and Hurffville-Cross Keys Road offer an alternative travel route for local trips between Williamstown Road and Fries Mill Road. No data is available for these sections of roadway, but traffic volume on Hurffville-Cross Keys Road north of Fries Mill Road is 8,300 AADT. To the east, Johnson Road is used as a bypass for the Black Horse Pike north of Berlin-Cross Keys Road. Traffic volume on Johnson Road is 7,300 AADT.

The two most important perpendicular facilities are Berlin-Cross Keys Road, which carries 30,900 AADT between the Black Horse Pike and the Atlantic City Expressway, and Williamstown Road, which carries 20,600 AADT between the same two points. East of the expressway, traffic volume on Williamstown Road is 33,100 AADT.

As previously noted, three facilities provide access to the Black Horse Pike for residents of Washington Township: Fries Mill Road, Ganttown Road, and Greentree Road. Traffic volume on Fries Mill Road near the Black Horse Pike is 14,100 AADT. Traffic volume on Ganttown Road and Greentree Road is 15,300 AADT and 16,000 AADT, respectively.

Summer "Shore Traffic"

During the summer, the convergence of traffic bound for the New Jersey Shore leads to traffic congestion on shore routes. Using traffic count data collected by DVRPC for the week August 22-29, 2007, it was possible to estimate the effect of shore traffic in the study area. Traffic volume on an average summer

weekday (Thursday) was compared to a Friday, when most travelers depart.

From Thursday to Friday, traffic volume at two Black Horse Pike locations north of Berlin-Cross Keys Road increases two to three percent, which may reflect extra retail activity. In contrast, traffic volume at three Black Horse Pike locations south of Sicklerville Road increases 10 to 11 percent. Shore traffic probably accounts for the differences between the northern and southern sections of the Black Horse Pike (7-9 percent). Traffic volume at Atlantic City Expressway ramps increases four to eight percent.

It is likely that the actual effect of shore traffic, which is concentrated in Friday afternoon and evening, is even more pronounced than suggested by the 24-hour traffic counts used here.

8.2 Crash Analysis

The purpose of this analysis is twofold. First, it will provide a comprehensive safety overview of the study corridor. Second, it will complement issue areas that were identified during field visits and meetings with the study area municipalities.

Introduction

Crash data for the years 2004 to 2006 was analyzed for 10 locations in the NJ 42 study corridor. The data was taken from the New Jersey Department of Transportation (NJDOT) crash database. Most of the locations are in Washington Township or Monroe Township. The other locations include the Atlantic City Expressway interchanges and the intersection of Berlin-Cross Keys Road and Sicklerville Road. Crashes at each location were analyzed by crash type, lighting conditions, weather conditions, and crash severity. Detailed data is available in Appendix B.

1. NJ 42 and Berlin-Cross Keys Road (Rt. 689)

The rate of rear-end crashes is high (40 percent) compared to other locations analyzed. There is also an unusually high number of crashes that occurred at night (46 percent).

2. NJ 42 and Sicklerville Road (Rt. 536 Spur)

Sideswipe crashes account for one-quarter of all crashes at this location, a proportion significantly higher than the average of other locations analyzed.

3. NJ 322 and Poplar Street/New Brooklyn Road (Rt. 536)

Right-angle crashes make up one-quarter of all crashes at this location. The high rate of right-angle crashes could explain the high rate of injuries compared to other locations analyzed. Almost half of all crashes at this location (45 percent) resulted in injury.

4. NJ 322 and Corkery Lane

The rates of right-angle crashes (28 percent) and left-turn/U-turn crashes (31 percent) are high compared to other locations analyzed. These crash types may predominate due to the difficulty of making left turns at the intersection.

5. Berlin-Cross Keys Road and Sicklerville Road

Located in Camden County, this intersection has the second highest number of crashes (103) over the three-year period. The rate of rear-end crashes is high (41 percent) compared to other locations analyzed. The occurrence of injuries is also high (41 percent). A pedestrian was struck in 2006.

6. Cross Keys Bypass between Hurffville-Cross Keys Road and Tuckahoe Road

The segment of the Bypass referenced has a

high rate of crashes, although there is no intersection there. No crash types stand out, but the rate of crashes at night is high (43 percent). There was also a fatality in 2005. The analysis was limited by a lack of data for 2006.

7. Berlin-Cross Keys, Hurffville-Cross Keys Road / North Main Street and Tuckahoe Road

Although there were 58 crashes overall for the three-year period at this location, the number of crashes decreased each year. For example, there were 29 crashes in 2004, but only 11 in 2006. Of those crashes, rear end crashes amounted to almost half of the total (45 percent), higher than at any of the other locations analyzed.

8. Berlin-Cross Keys Road and Fries Mill Road

This location is one of the worst analyzed due to the high number of crashes (77) and the rate of injuries. Nearly half of all crashes (48 percent) resulted in an injury. A factor in the high rate of injuries may be the high rate of right-angle and left-turn/U-turn crashes, which together represent slightly more than half of all crashes.

9. Atlantic City Expressway Interchange at Berlin-Cross Keys Road

This location has the highest number of crashes (107) from 2004 to 2006. Sideswipes make up an unusually high share of total crashes (17 percent). These may occur where the queue at the interchange backs up into the travel lane. The rates of rear-end and left-turn/U-turn crashes are also above average.

10. Sicklerville Road / Williamstown Road between Atlantic City Expressway and Chews Landing Road

This location has an unusually high rate of right angle and left turn/U-turn crashes. Together they make up more than half (52 percent) of all crashes there.

8.3 Travel Time Survey

A travel time survey was performed to assess mobility in the study corridor. The travel time survey was conducted along the length of the Black Horse Pike, NJ 42/US 322, from the North-South Freeway to the intersection of Malaga-New Brooklyn Road, Route 659 in Monroe Township. The survey was conducted in January 2008.

Normally, three time periods (AM peak, Midday, and PM peak) would be utilized to understand travel time characteristics in the corridor. However, due to the preponderance of retail complexes adjacent to Route 42 in Gloucester County and the tendency of this land use to create a mini peak during the lunch hour (Midday period), it was deemed necessary to add a fourth period between the AM Peak and Midday period. This period was intended to simulate “Free Flow” conditions. It turned out that travel times were faster in the AM Peak due to shopping trips in the typical “Free Flow” hours.

Methodology

Test vehicles equipped with Geo Positioning Satellite (GPS) technology drove the corridor, moving with the flow of traffic. The technician operating the GPS unit recorded the position of the vehicle and the time at each cross street. The technician also recorded stopped delay, defined as the vehicle coming to a complete stop in traffic.

Three runs were conducted in each direction in each time period. These were scheduled with varying starting times so that samples from different times within each time period would be collected. Mondays and Fridays were excluded as survey days, as were days following or preceding a holiday.

Results

Table 3 shows data from the travel time survey by time period for northbound and southbound travel, respectively. Travel time and stopped delay data have been aggregated between major cross streets. Average speed has also been calculated.

The results of the AM Peak and PM Peak periods are summarized below. The PM peak was selected to heighten the contrast with the AM peak period. The worst delays occurred during the PM Peak.

AM Peak

The data suggests that traffic moves efficiently, although drivers encounter localized delays. AM peak travel time to traverse the eight-mile study corridor on NJ 42/US 322 was approximately 12 minutes 55 seconds northbound and 12 minutes 25 seconds southbound. That corresponds to an average speed of 40 mph northbound and almost 42 mph southbound. Speeds were somewhat slower in the northern end of the corridor, where traffic increases approaching the North-South Freeway. Between Ganttown Road and the North-South Freeway, the average speed was just over 33 mph northbound and over 27 mph southbound. The slowdown occurs in both directions, suggesting that the study corridor is both a generator and attractor of commuter trips. Northbound speeds were also somewhat slower near Sicklerville Road (Route 536 Spur). Between South Main Street and Sicklerville Road, the average speed was just over 31 mph. Some of this traffic may be bound for the Atlantic City Expressway interchange on Sicklerville Road.

PM Peak

Compared to the AM Peak, travel time on Route 42/322 increases in the PM Peak but much of the increase is concentrated around Berlin-Cross Keys Road and, to a lesser extent, Sicklerville Road. As a result, overall travel time is mostly unchanged. It takes approximately three additional minutes to traverse the study corridor northbound and somewhat more than two additional minutes southbound. Average speed is approximately 33 mph northbound and 36 mph southbound, down from 40 mph and 42 mph, respectively, in the AM Peak.

The slowdown in the middle of the study corridor in the area of Berlin-Cross Keys Road is more dramatic. Northbound between Berlin-Cross Keys Road and Tuckahoe Road speed drops from 48.5 mph to 36 mph. Between Grandview Avenue and Berlin-Cross Keys Road, speed drops from 47.4 mph to 32.8 mph. Southbound between Berlin-Cross Key Road and Grandview Avenue, speed drops from 54.7 mph to 35.7 mph. Between Tuckahoe Road and Berlin-Cross Keys Road speed drops 48.1 mph to 38.6 mph. The delays occur there because Berlin-Cross Keys Road is one of two facilities in the study corridor that provide access to the Atlantic City Expressway, as well as Camden County population centers.

Delays also increase significantly in the area of the other Atlantic City Expressway access road, Sicklerville Road. Northbound between South Main Street and Sicklerville Road, speed drops from 31.3 mph to 23.7 mph. Southbound between Sicklerville Road and South Main Street, speed drops from 53.6 mph to 36.0 mph. Map 13 shows average speeds during the PM peak period.

Map 13
PM Peak Speed, NJ 42/US 322

Average Traffic Speed:
- Less than 20 MPH
- 20 - 29 MPH
- 30 - 39 MPH
- 40 - 49 MPH
- More than 50 MPH

GLOUCESTER
WASHINGTON
WINSLOW
MONROE
Clayton
FRANKLIN

HICKSTOWN RD
GARWOOD RD
JARVIS RD
GREENTREE RD
WHITMAN DR
GANTTOWN RD
JOHNSON STAGECOACH RD
SICKLERVILLE RD
CHEWS LANDING RD
ATLANTIC CITY EXPRESSWAY
ERIAL RD
FISH POND RD
HURFFVILLE-CROSS KEYS RD
TUCKAHOE RD
BERLIN-CROSS KEYS RD
CAMDEN CO.
GLOUCESTER CO.
PROSSER AVE
HERBERT BLVD
LAKE AVE
WILLIAMSTOWN RD
GLASSBORO-CROSS KEYS RD
FRIES MILL RD
PITTMAN-DOWNER RD
N MAIN ST
GLASSBORO RD
NEW BROOKLYN RD
WINSLOW RD
BLUE BELL RD
CORKERY LN
E MALAGA RD
W MALAGA RD

168 42 705 688 687 651 639 655 654 689 705 706 689 704 536 $36 SPUR 555 633 612 659 322

0 0.25 0.5 Miles

Delaware Valley Regional Planning Commission
June 2008

Table 3: Travel Time Survey Results

Black Horse Pike

DATA POINT	AM Peak			Free Flow			Midday			PM Peak		
	Travel Time (sec)	Avg Speed (mph)	Total Delay (sec)	Travel Time (sec)	Avg Speed (mph)	Total Delay (sec)	Travel Time (sec)	Avg Speed (mph)	Total Delay (sec)	Travel Time (sec)	Avg Speed (mph)	Total Delay (sec)
NORTHBOUND												
CR 659 Malaga Rd												
S Main St / S.C. Entrance	100.7	40.8	13.3	88.0	46.6	1.0	88.7	46.3	8.3	96.0	42.8	7.3
CR 536 Spur Sicklerville Rd	141.3	31.3	39.3	115.3	38.4	33.0	119.7	37.0	21.7	187.1	23.7	74.7
Grandview Ave	104.3	44.5	5.7	132.7	35.0	35.9	135.0	34.4	23.3	127.7	36.4	18.0
CR 689 Berlin Cross Keys Rd	101.1	47.4	7.0	96.6	49.6	0.0	108.9	44.0	9.0	146.0	32.8	60.3
CR 555 Tuckahoe Rd	66.1	48.5	0.3	100.0	32.0	29.7	92.8	34.5	23.3	89.0	36.0	23.0
CR 639 Ganttown Rd	148.4	43.7	22.0	141.3	45.9	7.3	163.5	39.6	21.0	181.2	35.8	41.4
North-South Freeway	113.4	33.3	32.7	123.0	30.7	42.3	129.1	29.3	37.4	128.6	29.4	30.4
	775.3	**39.9**	120.3	**796.9**	**38.2**	149.2	**837.7**	**37.9**	144.0	**955.6**	**33.3**	255.1
SOUTHBOUND												
North-South Freeway												
CR 639 Ganttown Rd	136.3	27.7	42.7	127.3	29.7	37.4	137.7	27.5	52.3	135.4	27.9	49.4
CR 555 Tuckahoe Rd	163.0	39.8	22.7	207.7	31.2	48.4	180.7	35.9	27.0	190.3	34.1	40.4
CR 689 Berlin Cross Keys Rd	66.6	48.1	2.0	92.7	34.6	21.3	95.9	33.4	25.7	83.0	38.6	18.0
Grandview Ave	87.6	54.7	0.0	105.4	45.4	9.7	126.1	38.0	27.7	134.3	35.7	32.7
CR 536 Spur Sicklerville Rd	110.6	42.0	6.7	121.6	38.2	29.3	112.7	41.2	15.6	89.1	52.1	0.0
S Main St / S.C. Entrance	82.6	53.6	4.6	93.6	47.3	4.3	110.2	40.2	18.3	123.0	36.0	22.4
CR 659 Malaga Rd	101.0	40.6	6.3	84.1	48.8	0.0	81.1	50.6	0.0	127.4	32.2	34.7
Total:	**747.7**	**41.6**	85.0	**832.4**	**38.4**	150.4	**844.4**	**37.5**	166.6	**882.5**	**36.1**	197.6

Source: DVRPC, June 2008

8.4 Speed Analysis

An analysis of vehicle speeds was conducted on Berlin-Cross Keys Road to investigate reports of excessive speeding on this road. Berlin-Cross Keys Road is a four-lane road with a center Two-Way-Left-Turn-Lane (TWLTL) and wide shoulders. The road is flat and straight, signalized intersections are spaced approximately a half mile apart, and the posted speed limit is 45 mph.

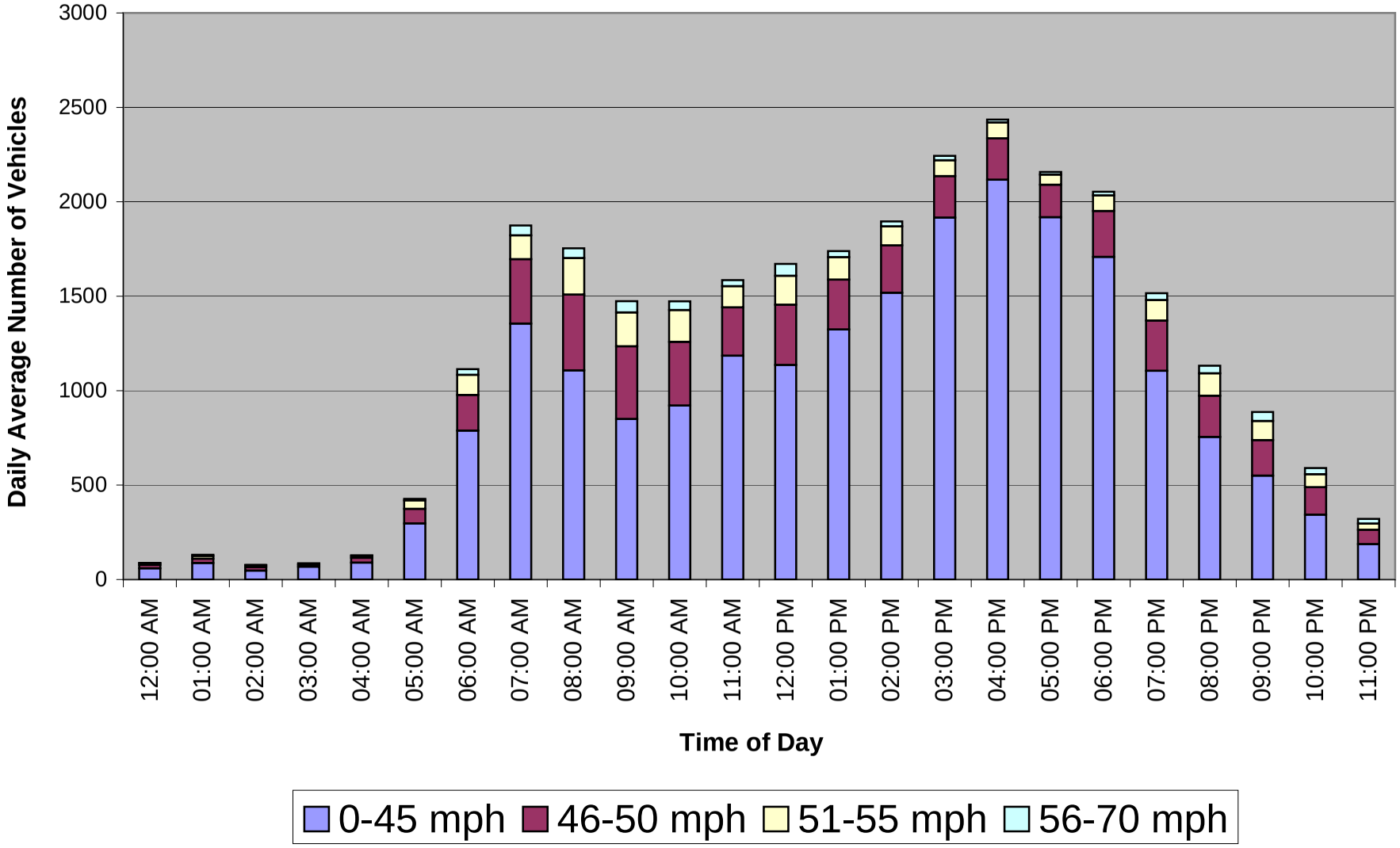
A typical speed study uses speed count data to calculate the 85th percentile speed. Bidirectional speed counts were taken over a 72-hour period at two locations on Berlin-Cross Keys Road: 1) between Johnson Road and the Atlantic City Expressway, and 2) between Sicklerville Road and the Atlantic City Expressway. For these two locations, the 85th percentile speed, in either direction, was in the range of 45 to 50 mph. Therefore, most drivers are traveling at or below the speed limit. (See Figures 4 and 5).

The data shows that between Sicklerville Road and the Atlantic City Expressway, most speeding occurs between the hours of 6:00 AM and 2:00 PM. There was much less speeding during the PM peak, when volumes are highest. The segment between Johnson Road and the Atlantic City Expressway exhibits a similar trend, although volumes are twice as high.

If a reduction in the prevailing travel speed is sought, it is best achieved via changes to roadway design. The *Smart Transportation Guidebook* outlines effective design features to bring about the "Desired operating speed" of a roadway i.e., the speed that best reflects the function of the roadway and the surrounding land use context. These include narrower roadway widths, narrower clear zones, higher signal density and a higher density of access points.

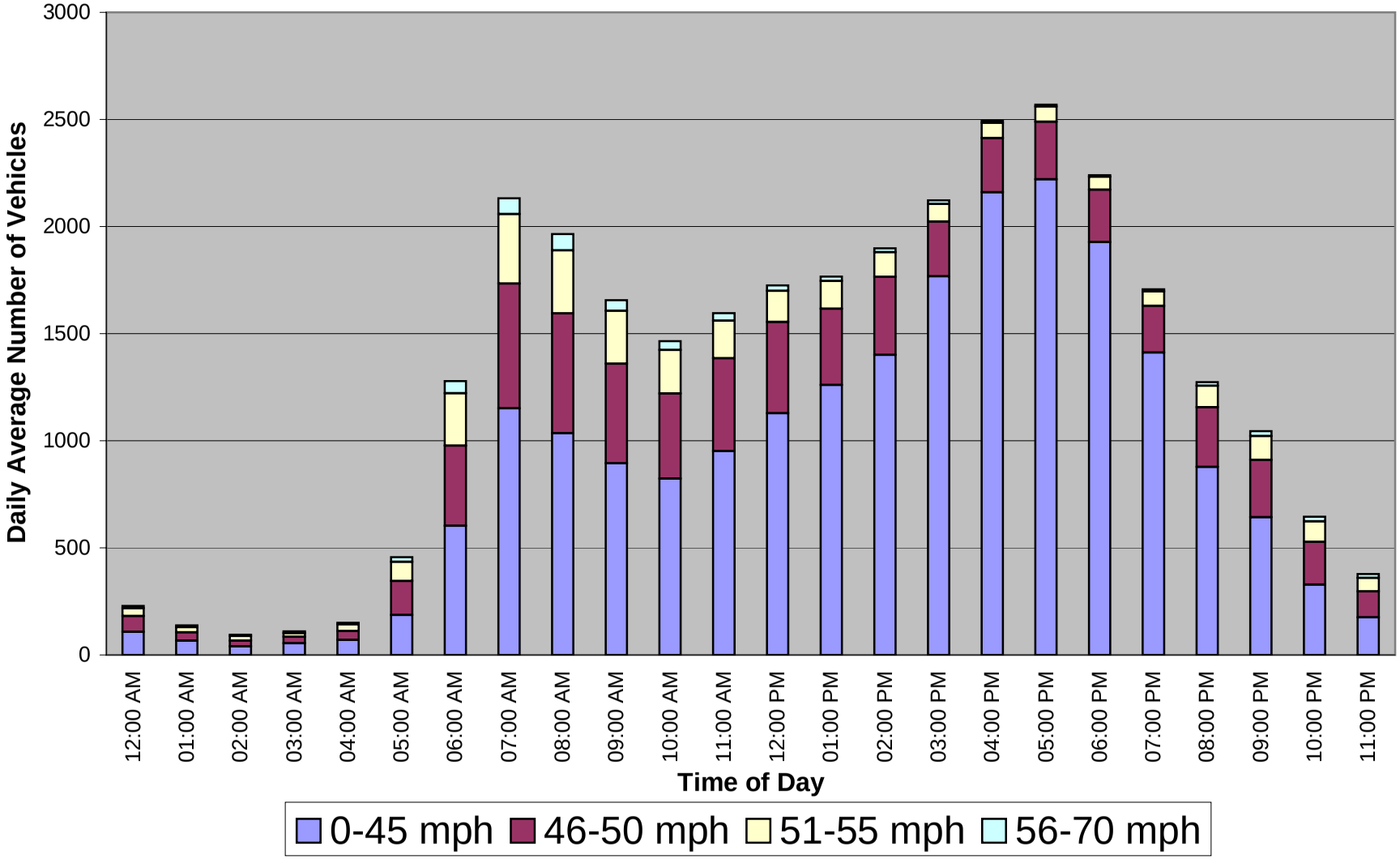
The other option, arbitrarily lowering the posted speed limit, would require strict enforcement. Changes to roadway design may include visual, tactile, or psychological reinforcement techniques. They may be simple in nature, such as narrower travel lanes, bicycle lanes, curbs, sidewalks, and textured crosswalks. Other techniques include a landscaped or hardscaped median, gateway treatments, and reduced building setbacks. To maximize effectiveness, implementation should be sensitive to local conditions.

Figure 4: Hourly Traffic Volume Along Berlin - Cross Keys Road (between Atlantic City Expressway and Johnson Road)



Source: DVRPC, 2008

Figure 5: Hourly Traffic Volume Along Berlin - Cross Keys Road (between Atlantic City Expressway and Sicklerville Road)



Source: DVRPC, 2008

8.5 Intersection Analysis

NJ 42/US 322

An intersection analysis was conducted for four signalized intersections on NJ 42/US 322 in Monroe Township. NJDOT had already conducted an analysis of all the signalized intersections along the Black Horse Pike in Washington Township in 2005. All four intersections operate on a 110-second cycle length, which is consistent with all of the signalized intersections along NJ 42 in Washington Township and Monroe Township. As a result, all of the alternatives were analyzed with a 110- or 55-second cycle length. The further south the intersections are located, the lower the total turning movement volume for each of the intersections. For example, at the intersection with Berlin-Cross Keys Road, there are roughly 4,600 vehicles during the PM peak hour, whereas there are only 2,100 at the Corkery Lane intersection. When the volumes of all four intersections are combined, the AM peak hour is 7:30 AM to 8:30 AM, and the PM peak hour is 5:15 PM to 6:15 PM.

1. NJ 42 and Berlin-Cross Keys Road

Existing Conditions

This is a major intersection that serves significant regional roadways and is often highly congested. During the AM peak hour, volumes are greater along Berlin-Cross Keys Road than NJ 42, though for the latter road, left turns comprise 27 percent of all movements. During the PM peak hour, the intersection's overall volume is 58 percent greater than the morning's, with NJ 42 carrying the majority of these vehicles, 30 percent of which are left-turn movements. Whereas NJ 42's left turns are signal protected, such protection is only provided for westbound Berlin-Cross Keys Road left turns, in the form of a westbound lead phase. However, it is the unprotected eastbound Berlin-Cross Keys Road approach that carries a greater number of left turns.

For the AM peak hour, the intersection operates with 116 seconds of delay, for an overall LOS of F. Delays are most pronounced for the southbound NJ 42 and eastbound Berlin-Cross Keys Road approaches due to a large proportion of left turns and reduced green time, respectively. During the PM peak hour, the intersection experiences even greater delay, with a LOS of F and 204 seconds of average delay. Similar to the morning, congestion is most evident along the north and eastbound approaches.

Alternative Scenarios

One short-term scenario to consider is the revision of the signal timing to include signal protection for left-turning vehicles from the eastbound Berlin-Cross Keys Road approach, and to lengthen the protected left-turn phase for NJ 42 left turns. With such revisions, the AM peak hour experiences a dramatic reduction in overall approach delay. The intersection operates with a minute less in overall delay, with the south and eastbound approaches improving by at least 90 seconds each. Similarly, the PM peak hour improves overall delay by over one minute, with improvements most apparent along the south and eastbound approaches. Such timing revisions will also provide longer pedestrian green times for crossing NJ 42.

A medium-term scenario involving the introduction of a formal right-turn lane at the northbound NJ 42 approach was analyzed. Currently, there is a 10-foot wide paved shoulder along this approach leg. The addition of this lane to an already revised signal plan provides a slight improvement to the overall intersection, with a more pronounced improvement for the northbound approach.

Table 4: Level of Service Analysis, NJ 42 and Berlin-Cross Keys Road

Berlin-Cross Keys Road and NJ 42									
Peak Hour	Approach Leg	Existing		Short-Term		Medium-Term		Long-Term	
		Existing Geometry		Existing Geometry		Revised Geometry: Introduce Exclusive RT Lanes at Both NJ 42 Approaches		Revised Geometry: Introduce 2nd Left-Turn Lane for SB NJ 42; Exclusive RT Lanes at Both NJ 42 Approaches	
		Existing Timing (110 sec. CL)		Revised Timing: Optimized with EB Left-Turn Signal Protection (110s. CL)		Revised Timing: Optimized with EB Left-Turn Signal Protection (110s. CL)		Revised Timing: Optimized with EB Left-Turn Signal Protection (110s. CL)	
	Cross Keys LT Type	WB Prot + Perm, EB Perm ONLY		Prot+Perm		Prot+Perm		Prot+Perm	
		Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS
AM Peak Hour	NJ 42 (NB)	142	F	50	D	45	D	44	D
	NJ 42 (SB)	47	D	50	D	43	D	38	D
	Cross Keys Rd (EB)	217	F	55	D	49	D	43	D
	Cross Keys Rd (WB)	38	D	35	D	35	D	33	C
	Total Intersection	**117**	**F**	**48**	**D**	**43**	**D**	**40**	**D**
PM Peak Hour	NJ 42 (NB)	221	F	136	F	129	F	95	F
	NJ 42 (SB)	153	F	119	F	82	F	71	E
	Cross Keys Rd (EB)	338	F	162	F	162	F	162	F
	Cross Keys Rd (WB)	59	E	81	F	81	F	81	F
	Total Intersection	**205**	**F**	**129**	**F**	**117**	**F**	**103**	**F**

Source: DVRPC, 2008

A long-term scenario to consider includes the aforementioned modifications, with the addition of a second left-turn lane for the southbound NJ 42 approach. Currently, the median at the intersection is sufficiently wide to accommodate an additional turning lane; however, modifications would have to be made in order to augment the diminished pedestrian refuge. Compared to the previous scenario, the AM peak hour's overall delay would improve by a marginal four seconds. For the PM peak hour, overall delay would improve by 18 seconds, with the NJ 42 approaches averaging a 24-second delay reduction.

Recommendations

The intersection's signal timing should be revised so that signal protection is provided for eastbound Berlin-Cross Keys Road left turns. Additionally, maximum green times for Berlin-Cross Keys Road's movements and for NJ 42's protected left turns should be extended to better reflect prevailing peak period conditions. The presence of detectors will provide a built-in check, thus minimizing any unwarranted reduction of green time for NJ 42 through movements. The consideration for increased capacity in the form of additional right- and left-turn lanes for north and southbound NJ 42, respectively, should be undertaken if the existing traffic pattern is anticipated to grow in volume.

2. NJ 42, US 322, and Sicklerville Road (County Route 536 Spur)

Existing Conditions

This intersection is unique in that it exclusively utilizes downstream jughandles to carry left-turn vehicles from either direction of NJ 42. The Sicklerville Road approaches are timed with a split phase; each approach receives its own exclusive, and thus protected, signal phase. During the AM peak hour, northbound US 322 is the dominant approach with twice as many vehicles as the opposing southbound approach. Though volumes along

Sicklerville Road are lower, one-quarter of such movements are left turns. For the PM peak hour, the overall volume is 44 percent greater than in the morning. Volumes are relatively balanced between the north and southbound approaches. And similar to the morning, left turns comprise a large share of movements from Sicklerville Road, in this case roughly 40 percent.

The AM peak hour LOS is D with an overall average delay of 37 seconds. The majority of the delay is experienced by vehicles at the Sicklerville Road approaches, which average 67 seconds of delay.

The PM peak hour LOS is also D, with an overall average delay of 42 seconds. Again, the majority of this delay is borne by the Sicklerville Road approaches, with a 69-second average delay.

Alternative Scenarios

A short-term scenario was analyzed: the replacement of the split phasing along the Sicklerville Road approaches with a standard concurrent phasing. Assuming the Sicklerville Road left turns are exclusively signal protected, the AM peak hour improves to an overall LOS of C. The average delay of the two Sicklerville Road approaches is reduced from 67 to 50 seconds. For the PM peak hour, the overall average delay improves by only four seconds. However, the Sicklerville Road approaches average 59 seconds of delay, for an eight-second improvement from existing conditions.

Recommendations

Revise the signal timing by eliminating the split phase along the Sicklerville Road approaches. Utilize concurrent phasing for these approaches.

Table 5: Level of Service Analysis, NJ 42/ US 322 and Sicklerville Road

NJ 42, US 322, and Sicklerville Road					
Peak Hour	Approach Leg	Existing		Short-Term	
		Existing Geometry		Existing Geometry	
		Existing Timing (110s. CL)		Revised Timing: Optimized with Concurrent Sicklerville Rd Phases (110s. CL)	
	Sicklerville Rd LT Type	Split Phasing		Prot ONLY	
		Delay (sec)	LOS	Delay (sec)	LOS
AM Peak Hour	US 322 (NB)	15	B	14	B
	NJ 42 (SB)	13	B	12	B
	Sicklerville Rd (EB)	49	D	52	D
	Sicklerville Rd (WB)	84	F	48	D
	Total Intersection	**37**	**D**	**29**	**C**
PM Peak Hour	US 322 (NB)	24	C	22	C
	NJ 42 (SB)	24	C	22	C
	Sicklerville Rd (EB)	74	E	60	E
	Sicklerville Rd (WB)	63	E	58	E
	Total Intersection	**42**	**D**	**38**	**D**

Source: DVRPC, 2008

3. US 322 and Poplar Street/New Brooklyn Road

Existing Conditions

In contrast to the Sicklerville Road intersection, both Black Horse Pike approaches at this location possess an exclusive left-turn lane. The southbound left-turn volume comprises 20 and 25 percent of that approach's volume during the AM and PM peak hours, respectively. The Poplar Street and New Brooklyn Road approaches each carry a single departure lane that must accommodate all movements. Although the volumes for these approaches are only one-third of the volume traveling along US 322, left turns account for 15 to 25 percent of the Poplar Street and New Brooklyn Road movements.

The AM peak hour averages an overall 80 seconds of delay for a LOS of E. The greatest delay is experienced by the southbound US 322 approach, a result of the dramatic delay upon left-turning vehicles, which operate with over 500 seconds of delay. During the PM peak hour, the intersection's average delay is 76 seconds at a LOS of E. Similar to the AM peak hour, southbound US 322 left turns incur exceptionally large delays; in this case, roughly five minutes.

Alternative Scenarios

One short-term scenario entailed the optimization of the signal's timing. Though the 110-second cycle length is retained, the amount of green time for protected left turns from US 322 is lengthened. As a result, the delay incurred by the southbound approach and the overall intersection is significantly reduced. This overall delay reduction is 27 seconds and 15 seconds for the AM and PM peak hours, respectively. The penalty for such an improvement is increased delays for the northbound US 322 through and right-turn movements.

A medium-term analysis evaluated the impact of adding an exclusive left-turn lane for the Poplar Street and New Brooklyn Road approaches. Though the immediate benefit would be increased capacity for these approaches, the intersection's overall improvement is experienced by the dominant US 322 approaches, as they are allocated more of the cycle's green time. This improvement measures 35 seconds and 30 seconds for the AM and PM peak hours compared to existing conditions.

Table 6: US 322 and Poplar Street/New Brooklyn Road

US 322 and Poplar Street/New Brooklyn Road							
Peak Hour	Approach Leg	Existing		Short-Term		Medium-Term	
		Existing Geometry		Existing Geometry		Revised Geometry: Add an Exclusive Left-Turn Lane for Poplar St and New Brooklyn Rd Approaches	
		Existing Timing: (110s. CL)		Revised Timing: Optimized (110s. CL)		Revised Timing: Optimized (110s. CL)	
		Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS
AM Peak Hour	US 322 (NB)	36	D	61	E	45	D
	US 322 (SB)	144	F	41	D	35	C
	Poplar St (EB)	61	E	86	F	72	E
	New Brooklyn Rd (WB)	39	D	42	D	56	E
	Total Intersection	**80**	**E**	**53**	**D**	**45**	**D**
PM Peak Hour	US 322 (NB)	39	D	75	E	45	D
	US 322 (SB)	113	F	47	D	38	D
	Poplar St (EB)	50	D	45	D	80	F
	New Brooklyn Rd (WB)	84	F	73	E	47	D
	Total Intersection	**76**	**E**	**61**	**E**	**46**	**D**

Source: DVRPC, 2008

Recommendations

Lengthen the phase for US 322 left turns. Since this phase is only triggered and extended by presence detection, it will not needlessly impede the opposing movement. And consider the potential for an additional left-turn lane at the Poplar Street and New Brooklyn Road approaches. Though there is sufficient right-of-way, it will require upstream realignment of the approaches.

4. US 322 and Corkery Lane

Existing Conditions

This is an acutely angled intersection that is the most recently updated of the four Black Horse Pike study intersections. The intersection's overall AM and PM peak hour volumes are less than half of the respective peak hour volumes of the NJ 42 and Berlin-Cross Keys Road intersections. During the AM peak hour, volumes along US 322 are predominantly balanced, whereas along Corkery Lane it is eastbound dominant with 50 percent of all eastbound movements comprised of left turns.

During the PM peak hour, there are 67 percent more vehicles at the intersection than during the morning. There is no predominant direction of travel along US 322 or Corkery Lane. And, similar to the AM peak, approximately half of all movements from the eastbound Corkery Lane approach are left turns.

For the AM peak hour, the overall intersection operates at a LOS of C, with an average delay of 33 seconds. The eastbound Corkery Lane approach experiences the most delay, with 58 seconds of delay and a LOS of E. Similarly, during the PM peak hour, the intersection's overall LOS is C, with an average delay of 39 seconds. The eastbound Corkery Lane approach incurs the most delay, at an average of 78 seconds.

Alternative Scenarios

Due to the intersection's relatively low overall volumes, the most promising short-term scenario involves halving the cycle length.

Table 7: Level of Analysis, US 322 and Corkery Lane

US 322 and Corkery Lane							
Peak Hour	Approach Leg	Existing		Short-Term		Medium-Term	
		Existing Geometry		Existing Geometry		Revised Geometry: Exclusive Left-Turn Lane for Corkery Lane Approaches	
		Existing Timing: (110s. CL)		Revised Timing: Optimize (55s. CL)		Revised Timing: Optimize (55s. CL)	
		Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS
AM Peak Hour	US 322 (NB)	25	C	19	B	16	B
	US 322 (SB)	23	C	18	B	16	B
	Corkery Ln (EB)	58	E	33	C	25	C
	Corkery Ln (WB)	27	C	12	B	14	B
	Total Intersection	**33**	**C**	**22**	**C**	**18**	**B**
PM Peak Hour	US 322 (NB)	33	C	26	C	21	C
	US 322 (SB)	32	C	31	C	24	C
	Corkery Ln (EB)	78	E	54	D	30	C
	Corkery Ln (WB)	34	C	21	C	24	C
	Total Intersection	**39**	**D**	**31**	**C**	**24**	**C**

Source: DVRPC, 2008

With a 55 second cycle length, the AM and PM peak hours experience an 11- and eight-second reduction in overall delay, respectively. This improvement is reflected by the eastbound Corkery Lane approach, with delay reductions averaging 25 seconds.

A medium-term scenario that was investigated entailed the addition of exclusive left-turn lanes at both Corkery Lane approaches. This additional capacity will only encourage a shorter cycle length, thus evaluating this scenario with a 55 second cycle length reveals additional overall delay reductions. Improvements in delay are most apparent for the left-turn dominated eastbound Corkery Lane approach, which averages a 41 second improvement from existing conditions.

Recommendations

A halving of the cycle length should be incorporated in order to reduce overall delay, and especially to relieve congestion along the single-lane approaches of Corkery Lane. If considerable growth is anticipated along areas that are served by Corkery Lane, consideration should be made for an additional turning lane at those approaches

Berlin-Cross Keys Road

Intersection performance has been analyzed at six intersections on Berlin-Cross Keys Road: NJ 42, Johnson Road, the Atlantic City Expressway On- and Off-Ramps, Sicklerville Road, and Williamstown-Erial Road/Chews Landing Road. AM and PM peak period turning movement counts were conducted for each intersection in Fall 2007. Based on the turning movement counts, an AM and PM peak hour was defined from 7:15 AM to 8:15 AM and from 5:15 PM to 6:15 PM, respectively. Peak hour data was entered into Synchro, a traffic analysis software program that was used to calculate LOS for each intersection. LOS is a measure of delay.

1. Berlin-Cross Keys Road and NJ 42

This intersection is discussed in the previous section.

2. Berlin-Cross Keys Road and Johnson Road

Existing Conditions

During the AM peak hour and the PM peak hour, southbound Johnson Road carries more than 200 left-turn movements. Simulation of this approach indicates that spillover of the left-turn queue blocks the adjacent travel lane 15 percent of the time, causing delays for through-movement vehicles. The intersection experiences an overall LOS of B, with an average delay of 16 seconds in the AM peak and 23 seconds in the PM peak. Delays are somewhat worse on Johnson Road than on Berlin-Cross Keys Road, but both roads are in the acceptable range.

Alternative Scenarios

Two scenarios were considered. The first scenario involved an optimization of the current signal timing. For the AM peak hour, average delay for the Johnson Road approaches decreased by 16 seconds, but vehicles on Berlin-Cross Keys Road incurred only a slight increase in delay. However, the effect on the PM peak hour LOS and average delay was negligible.

The second scenario added a lead interval for the southbound Johnson Road approach and eliminated the protected left-turn phase for northbound Johnson Road. For the AM peak hour, it was effective. The average delay on southbound Johnson Road was 17 seconds, a 24 second improvement over existing conditions.

However, for the PM peak hour, it made things worse. The southbound approach

experienced a modest improvement in delay of 6 seconds, but this was countered by a delay increase of 24 seconds for the opposing northbound approach.

Recommendations

To accommodate the high volume of left turns and the potential for their queue to block adjacent lanes, consider lengthening the storage bay for southbound Johnson Road left-turning vehicles from its current length of 115 feet to 200 feet. To reduce overall delay during the AM peak hour, consider incorporating a southbound Johnson Road lead interval for the AM peak period, roughly between 6:00 AM and 10:00 AM.

Table 8: Level of Analysis, Berlin-Cross Keys Road and Johnson Road

Berlin-Cross Keys Road and Johnson Road								
Peak Hour	Approach Leg	Existing		Short-Term			
		Existing Geometry		Existing Geometry			
		Existing Timing: (98 sec. CL)		Revised Timing: Optimized Signal Plan (70 sec. CL)		Revised Timing: Lead-Left for SB Johnson (50 sec. CL)	
		Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS
AM Peak Hour	Cross Keys Rd (EB)	13	B	16	B	12	B
	Cross Keys Rd (WB)	12	B	14	B	11	B
	Johnson Rd (NB)	26	C	16	B	22	C
	Johnson Rd (SB)	41	D	20	C	17	B
	Total Intersection	**16**	**B**	**16**	**B**	**13**	**B**
		Existing Timing: (94 sec. CL)		Revised Timing: Optimized Signal Plan (75 sec. CL)		Revised Timing: Lead-Left for SB Johnson (60 sec. CL)	
		Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS
PM Peak Hour	Cross Keys Rd (EB)	17	B	15	B	13	B
	Cross Keys Rd (WB)	23	C	23	C	15	B
	Johnson Rd (NB)	39	D	27	C	63	E
	Johnson Rd (SB)	34	C	43	D	28	C
	Total Intersection	**23**	**C**	**23**	**C**	**18**	**B**

Source: DVRPC, 2008

3 and 4. Berlin-Cross Keys Road and Atlantic City Expressway On- and Off-Ramps

Existing Conditions

The two Berlin-Cross Keys Road overpass intersections have a shared timing plan. During the AM peak hour, the largest turning volumes are of those vehicles destined for the Expressway northbound on-ramp, including 160 eastbound left turns. Neither of the off-ramps experience significant volumes.

For the AM peak hour, the average delay for each of the two intersections is nine seconds, for an average LOS of A.

During the PM peak hour, the combined vehicular volume amongst the two intersections is 50 percent greater than the AM peak hour's. Both off-ramps carry noticeably larger volumes. For example, the Atlantic City Expressway southbound off-ramp experiences over 800 vehicles during this peak hour.

Simulation reveals severe congestion at the southbound Atlantic City Expressway intersection, which experiences average delay of 109 seconds and a LOS of F. The bulk of this is derived from the eastbound Berlin-Cross Keys Road approach that operates with an average delay of approximately four minutes, which is a direct

result of the immediately downstream queue of left-turning vehicles bound for the northbound Atlantic City Expressway on-ramp. These left-turning vehicles create a "bottleneck," effectively leaving a single departure lane for eastbound vehicles at the intersection.

Alternative Scenarios

One alternative scenario was evaluated: the widening of the Berlin-Cross Keys Road overpass bridge from four to five lanes. The two travel lanes in each direction would remain; however, there would be an additional left-turn lane that would serve the north and southbound on-ramps.

For the PM peak hour, when the worst delays occur, the aforementioned four minute delay for eastbound vehicles at the southbound Expressway ramps intersection is reduced to approximately 30 seconds and a LOS of C. This simulation result is plausible because the downstream queue of left-turning vehicles that had precipitated the delay is now removed from the through-travel lanes. The northbound Expressway ramp's intersection also improves significantly.

Average delay is reduced from 32 to nine seconds. Furthermore, delays are reduced along both Atlantic City Expressway off-ramps.

Recommendations

Although it represents a significant investment in the roadway infrastructure at this location, it is recommended to analyze the feasibility of widening the overpass bridge from four to five lanes in order to accommodate an exclusive left-turn lane.

Such a feasibility analysis should consider the effects of various timing plans upon the average left-turn queue length along the overpass bridge, as well as of those vehicles along the Expressway off-ramps.

Specifically, a relatively short cycle length will reduce the likelihood for the left-turn queue to spillover beyond its storage bay, and a provision for exclusively accommodating left turns via signal "protection" may improve the safety of the two intersections.

Table 9: Level of Analysis, Berlin-Cross Keys Road and Atlantic City Expressway, Eastbound Ramps

Berlin-Cross Keys Road and Atlantic City Expressway Eastbound Ramps					
Peak Hour	**Approach Leg**	**Existing**		**Long-Term**	
		Existing Geometry		Revised Geometry: Widen the Overpass Bridge to 5 Lanes	
		Existing Timing: (105 sec. CL)		Revised Timing: Optimized Signal Plan (60 sec. CL)	
		Delay (sec)	LOS	Delay (sec)	LOS
AM Peak Hour	Cross Keys Rd (EB)	11	B	12	B
	Cross Keys Rd (WB)	3	A	3	A
	AC Expy EB Off-Ramp (EB)	36	D	26	C
	Total Intersection	**9**	**A**	**9**	**A**
		Existing Timing: (105 sec. CL)		Revised Timing: Optimized Signal Plan (90 sec. CL)	
		Delay (sec)	LOS	Delay (sec)	LOS
PM Peak Hour	Cross Keys Rd (EB)	273	F	28	C
	Cross Keys Rd (WB)	15	B	6	A
	AC Expy EB Off-Ramp (EB)	59	E	45	D
	Total Intersection	**109**	**F**	**23**	**C**

Source: DVRPC, 2008

Table 10: Berlin-Cross Keys Road and Atlantic City Expressway, Westbound Ramps

Berlin-Cross Keys Road and Atlantic City Expressway Westbound Ramps					
Peak Hour	Approach Leg	Existing		Long-Term	
		Existing Geometry		Revised Timing: Widen the Overpass Bridge to 5 Lanes	
		Existing Timing: (105 sec. CL)		Revised Timing: Optimized Signal Plan (60 sec. CL)	
AM Peak Hour		Delay (sec)	LOS	Delay (sec)	LOS
	Cross Keys Rd (EB)	5	A	3	A
	Cross Keys Rd (WB)	11	B	13	B
	AC Expy WB Off-Ramp (WB)	32	C	23	C
	Total Intersection	**9**	**A**	**8**	**A**
		Existing Timing: (105 sec. CL)		Revised Timing: Optimized Signal Plan (90 sec. CL)	
PM Peak Hour		Delay (sec)	LOS	Delay (sec)	LOS
	Cross Keys Rd (EB)	32	C	9	A
	Cross Keys Rd (WB)	29	C	28	C
	AC Expy WB Off-Ramp (WB)	27	C	19	B
	Total Intersection	**30**	**C**	**18**	**B**

Source: DVRPC, 2008

5. Berlin-Cross Keys Road and Sicklerville Road

Existing Conditions

The intersection is characterized by high through volume on Berlin-Cross Keys Road and high left-turn movement volume on both roads. To accommodate these movements, all four approaches provide exclusive left-turn lanes with protected left-turn phasing. Nonetheless, the simulation indicates that the queue for through movements at the northbound Sicklerville Road approach prevents entry to the exclusive left-turn lane for over 50 percent of the AM and PM peak hours.

AM peak hour overall average delay is 24 seconds, for an LOS of C. PM peak hour overall average delay is 34 seconds, for an LOS of C. However, the Sicklerville Road southbound and northbound approaches experience 53 and 71 seconds of delay, for an LOS of D and E, respectively.

Alternative Scenarios

Two alternative scenarios were considered: 1) optimizing the traffic signal, and 2) making the traffic signal split phase. Compared to existing conditions, the first scenario produces modest improvement. For the AM peak hour, there are significant delay reductions on Sicklerville Road, balanced by smaller delay increases on Berlin-Cross Keys Road. For the PM peak hour, the improvement is slightly greater.

There are significant delay reductions on Sicklerville Road, but the performance of Berlin-Cross Keys Road stays the same.

Under the second scenario, the three lanes of northbound Sicklerville Road would be reconfigured as two left-turn lanes and one shared through and right-turn lane. In addition, through- and left-turn movements would have their own phases. This revision to the timing plan could improve safety. However, this scenario actually increases intersection delay significantly.

Recommendations

From the analysis of the alternative scenarios, it is recommended to consider a split phase for the intersection. The additional calculated delay may be offset with improved safety for the large volume of left-turning vehicles. It is recommended to lengthen the left-turn

storage bays for both Sicklerville Road approaches in order to mitigate the blockage of adjacent travel lanes due to queue spillover.

It is also recommended to consider closing or retrofitting existing driveways proximal to the intersection, especially those that are immediately upstream of a departure lane, because conflicts with vehicles entering and exiting such points are not adequately provided for.

Table 11: Level of Analysis, Berlin-Cross Keys Road and Sicklerville Road

Berlin-Cross Keys Road and Sicklerville Road							
Peak Hour	Approach Leg	Existing		Short-Term		Medium-Term	
		Existing Geometry		New Timing with Existing Geometry		Revised Geometry: Reassignment of Sicklerville Approaches: 2 LT Lanes & 1 Th/RT Lane	
		Existing Timing: (92 sec. CL)		Revised Timing: Optimized Signal Plan (65 sec. CL)		Revised Timing: Optimized Signal Plan (70 sec. CL)	
	Cross Keys LT Type	Prot+Perm		Prot+perm		Prot ONLY	
	Sicklerville LT Type	Prot+Perm		Prot+perm		Prot ONLY	
		Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS
AM Peak Hour	Cross Keys Rd (EB)	15	B	17	B	23	C
	Cross Keys Rd (WB)	18	B	21	C	22	C
	Sicklerville Rd (NB)	47	D	34	C	52	D
	Sicklerville Rd (SB)	29	C	20	C	38	D
	Total Intersection	**24**	**C**	**22**	**C**	**30**	**C**
		Existing Timing: (93 sec. CL)		Revised Timing: Optimized Signal Plan (65 sec. CL)		Revised Timing: Optimized Signal Plan (80 sec. CL)	
	Cross Keys LT Type	Prot+Perm		Prot+perm		Prot ONLY	
	Sicklerville LT Type	Prot+Perm		Prot+perm		Prot ONLY	
		Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS
PM Peak Hour	Cross Keys Rd (EB)	19	B	18	B	33	C
	Cross Keys Rd (WB)	19	B	19	B	32	C
	Sicklerville Rd (NB)	71	E	56	E	65	E
	Sicklerville Rd (SB)	53	D	38	D	42	D
	Total Intersection	**34**	**C**	**29**	**C**	**40**	**D**

Source: DVRPC, 2008

6. Berlin-Cross Keys Road and Williamstown / Chews Landing Road

Existing Conditions

For the AM peak hour, the overall intersection experiences approximately 20 seconds of delay, for an overall LOS of C. These are acceptable conditions. However, in the PM peak hour, the intersection carries 70 percent more volume than in the morning. This increase in volume is reflected by the increase in left-turning volume at all four approaches.

As expected by such an increase in volume, delay and LOS calculations reflect a noticeable decline in performance. Overall intersection delay increases by 19 seconds to 40 seconds and LOS drops from C to D. Most of this delay is on Berlin-Cross Keys Road.

Alternative Scenarios

The impact of optimizing signal timing was analyzed. For the AM peak hour, the analysis reveals a modest overall delay reduction (six seconds) and corresponding improvement from LOS C to LOS B. The improvement on Williamstown-Chews Landing Road is more dramatic (22 seconds). For the PM peak hour, overall delays decrease by seven seconds, with similar improvements to the individual approaches.

Recommendations

Based upon the alternative scenario analysis, it is recommended to consider a new timing plan that utilizes a shorter cycle length for both peak periods. In addition to the delay improvements, a shorter cycle length may reduce the likelihood of left- and right-turning vehicle queues spilling over into the adjacent through-movement lane.

Table 12 : Level of Analysis, Berlin-Cross Keys Road and Williamstown Road/Chews Landing Road

Berlin-Cross Keys Road and Williamstown Road/Chews Landing Road					
Peak Hour	Approach Leg	Existing		Short-Term	
		Existing Geometry		Existing Geometry	
		Existing Timing: (108 sec. CL)		Revised Timing: Optimized Signal Plan (55 sec. CL)	
		Delay (sec)	LOS	Delay (sec)	LOS
AM Peak Hour	Cross Keys Rd (EB)	11	B	11	B
	Cross Keys Rd (WB)	14	B	15	B
	Chews Landing Rd (NB)	46	D	21	C
	Williamstown-Erial Rd (SB)	36	D	18	B
	Total Intersection	**21**	**C**	**15**	**B**
		Existing Timing: (109 sec. CL)		Revised Timing: Optimized Signal Plan (80 sec. CL)	
		Delay (sec)	LOS	Delay (sec)	LOS
PM Peak Hour	Cross Keys Rd (EB)	32	C	29	C
	Cross Keys Rd (WB)	41	D	33	C
	Chews Landing Rd (NB)	48	D	40	D
	Williamstown-Erial Rd (SB)	47	D	34	C
	Total Intersection	**40**	**D**	**33**	**C**

Source: DVRPC, 2008

8.6 Median Analysis

NJ 42 and US 322 is divided by a 20- to 30-foot wide grass median along eight miles of the study corridor. It is occasionally interrupted by openings to serve intersecting streets or driveways, or to provide a U-turn opportunity. There are 54 such openings, for a corridor-wide average of eight openings per mile. Overall, many of the median openings are either poorly spaced or geometrically deficient, thus creating unsafe conditions for drivers. As a result, this median analysis seeks to identify those median openings that are adequate and safe, as well as those that require modification or should be closed to improve traffic safety and efficiency.

The evaluation of the study corridor's median openings began with an inventory of all 54 openings, including documentation of each opening's function, relative location, and physical dimensions.

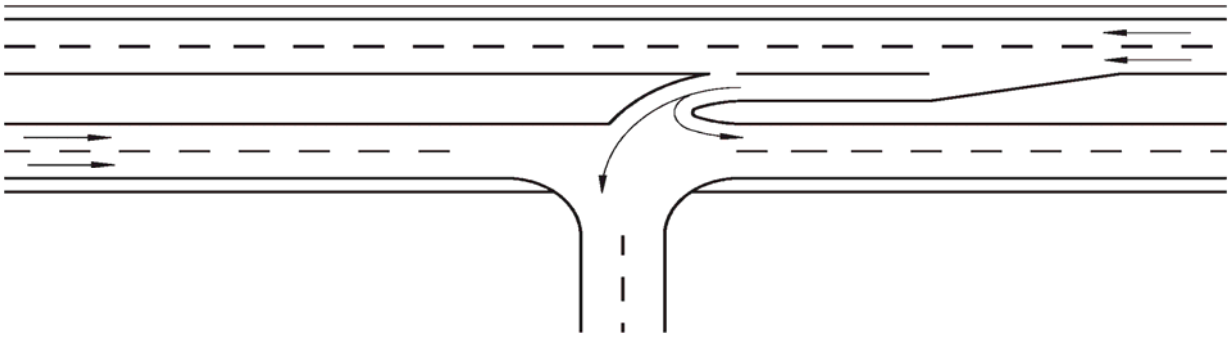
The utility and adequacy of the median openings were evaluated by using field observations in combination with aerial photography of the adjacent properties. Variables that were considered include the relationship between the purpose of an opening and its geometric dimensions, the proximity of an opening to another of a similar function, and the opening's likely number of users. Desirable variables included signalization of the median opening and the presence of a deceleration and storage lane for left-turning vehicles. Conversely, unsignalized median openings serving a four-leg intersection and thus exhibiting a larger number of conflict points were considered unsafe. As a result, the openings were divided into three categories: Retain, Close, and Improve.

The "Retain" category includes those median openings that are both highly utilized and adequately designed. There are 24 median openings of this category that are recommended for retention in their current form. Signalized intersections account for the majority of these median openings, with the remaining serving unsignalized three-legged intersections for single cross streets or driveways for multiple parcels.

The "Close" category includes median openings that may be removed without significantly affecting traffic patterns and accessibility. All but one of the 19 median openings in this category serves unsignalized single parcel driveways or exclusive U-turn opportunities. Thus, the primary reason for proposing the closure of an opening is its low utilization or redundancy with other openings.
The "Improve" category includes median openings that may be improved pending specific changes to that or other median openings. There are 11 median openings within this category, most of which are recommended for augmentation. Examples of augmentation include the installation of regulatory signage immediately visible at and upstream of the median opening, the construction of a directional opening to prevent overlapping turning movements (see Figures 6 and 7), and the provision for a sufficient deceleration and storage left-turn lane. The prerequisites for closure of a median opening typically include provisions for adequate U-turn opportunities and enhanced internal connections between parcels.

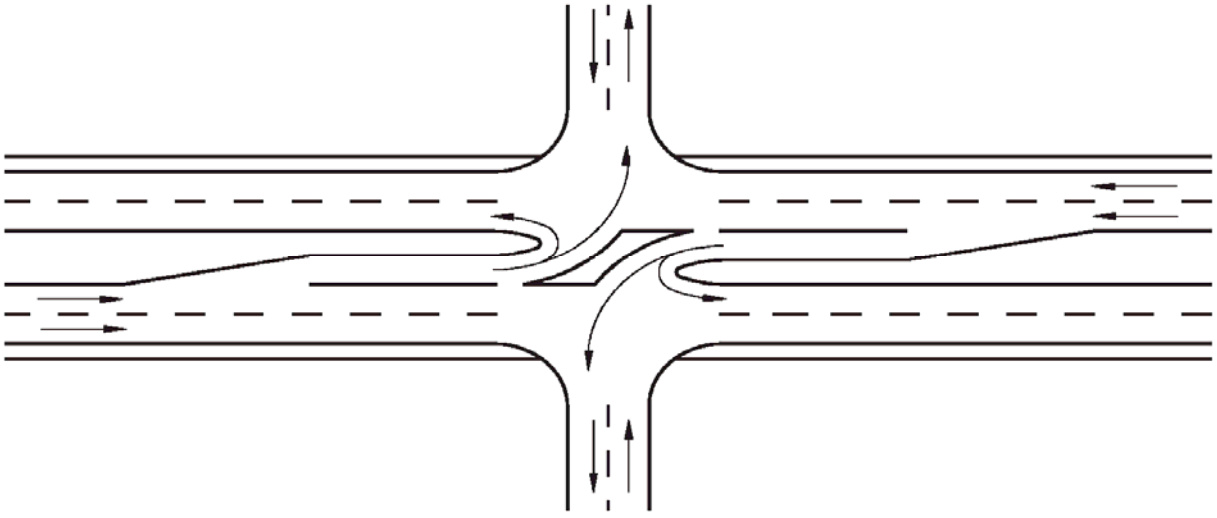
Due to the high speeds, volumes, and amount of activity along the corridor roadway, the median analysis sought to minimize conflict points, thus striving for a simpler and safer roadway. All involved parties, such as NJDOT, the local municipalities, and local property or business owners should be consulted prior to the implementation of these recommendations. Median openings are shown in Maps 14-17, color coded by category. Detailed descriptions of median openings and related recommendations are listed in Appendix C.

Figure 6: Directional Median Opening for 3-Leg Intersection



Source: NCHRP Report 524

Figure 7: Directional Median Opening for 4-Leg Intersection



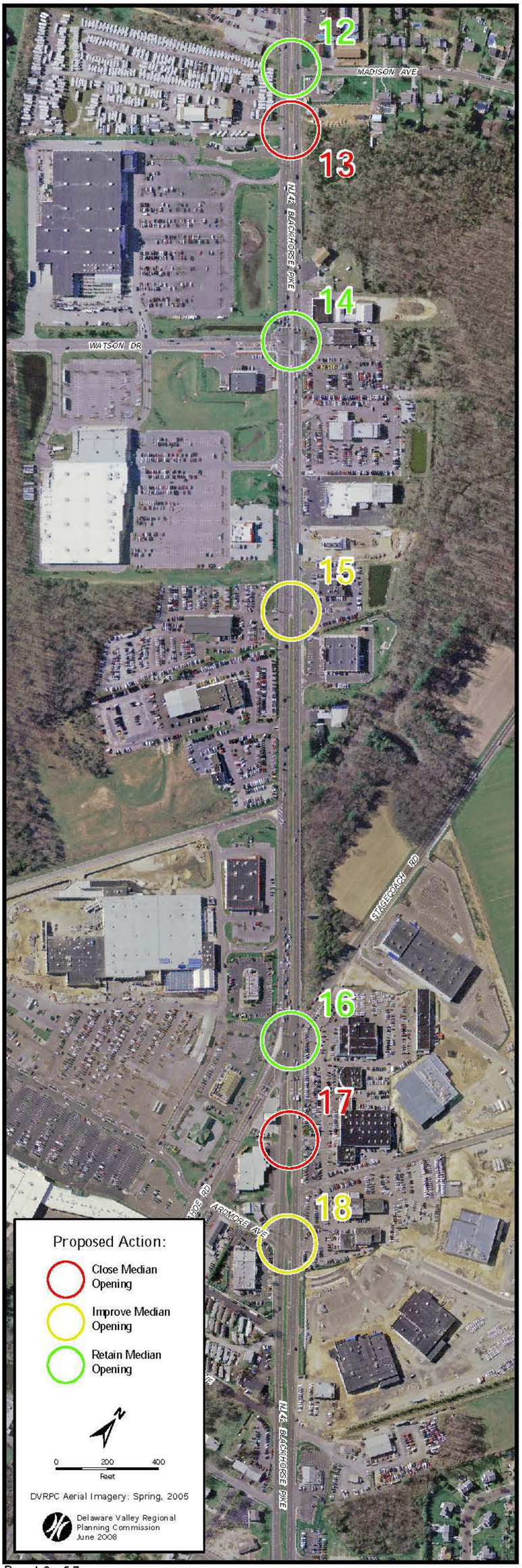
Source: NCHRP Report 524

Panel 1 of 7

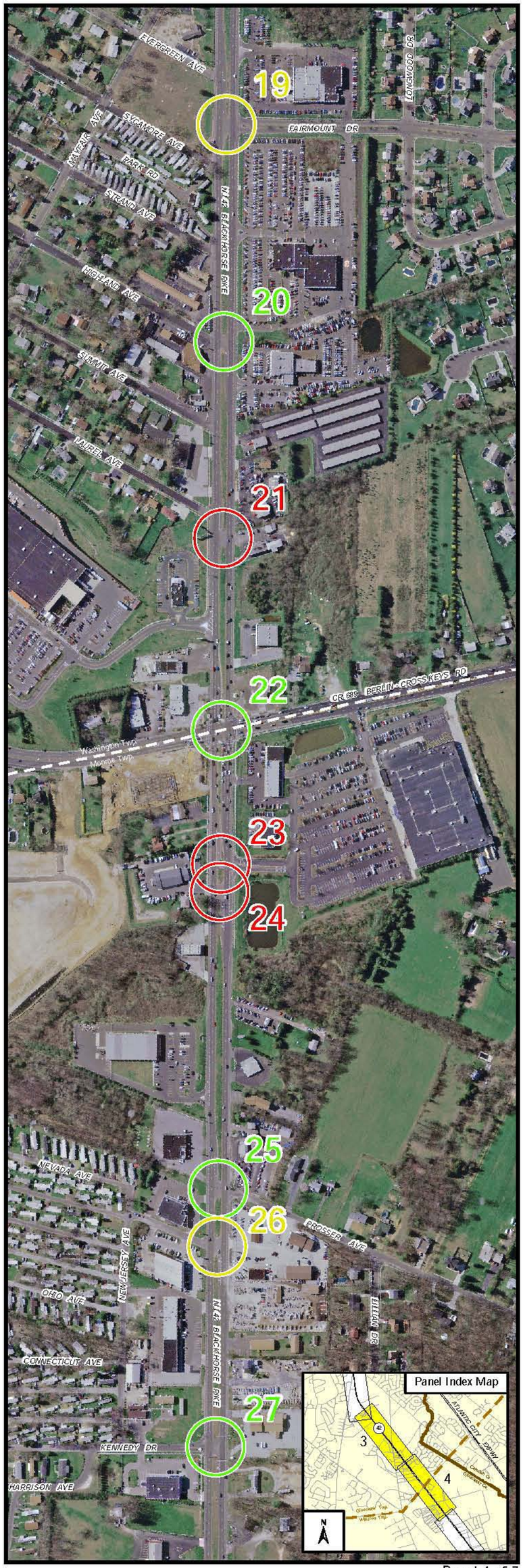
Panel 2 of 7

Map 14

Median Openings with Recommended Actions (Panels 1 & 2)



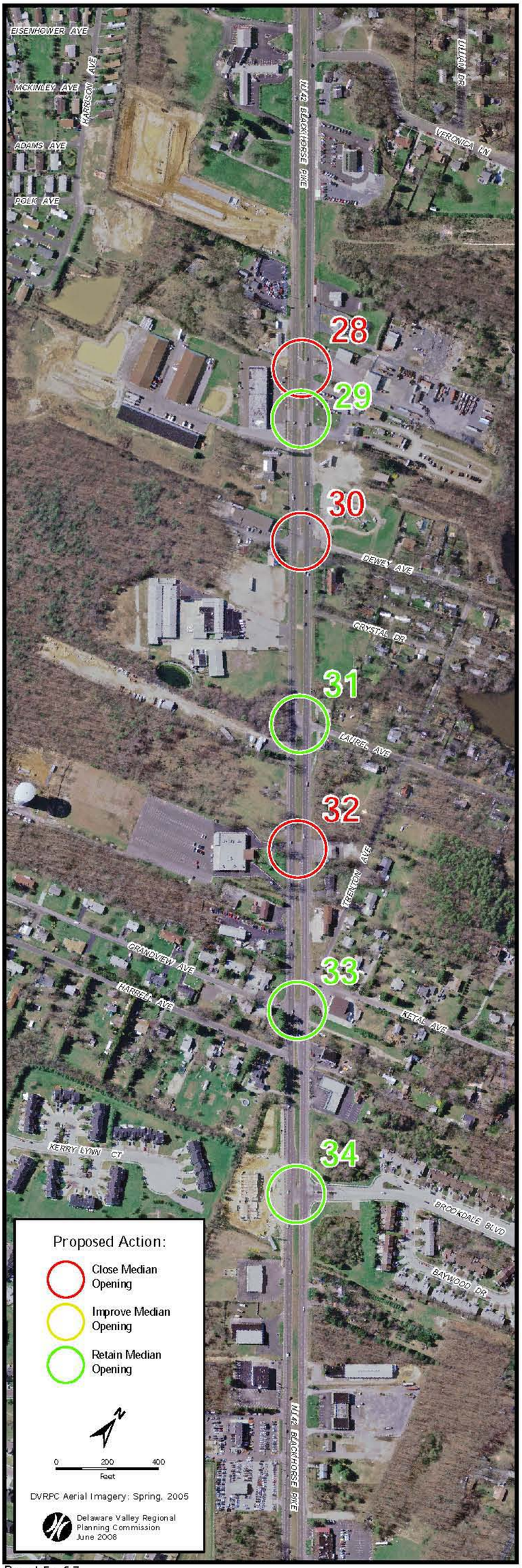
Panel 3 of 7



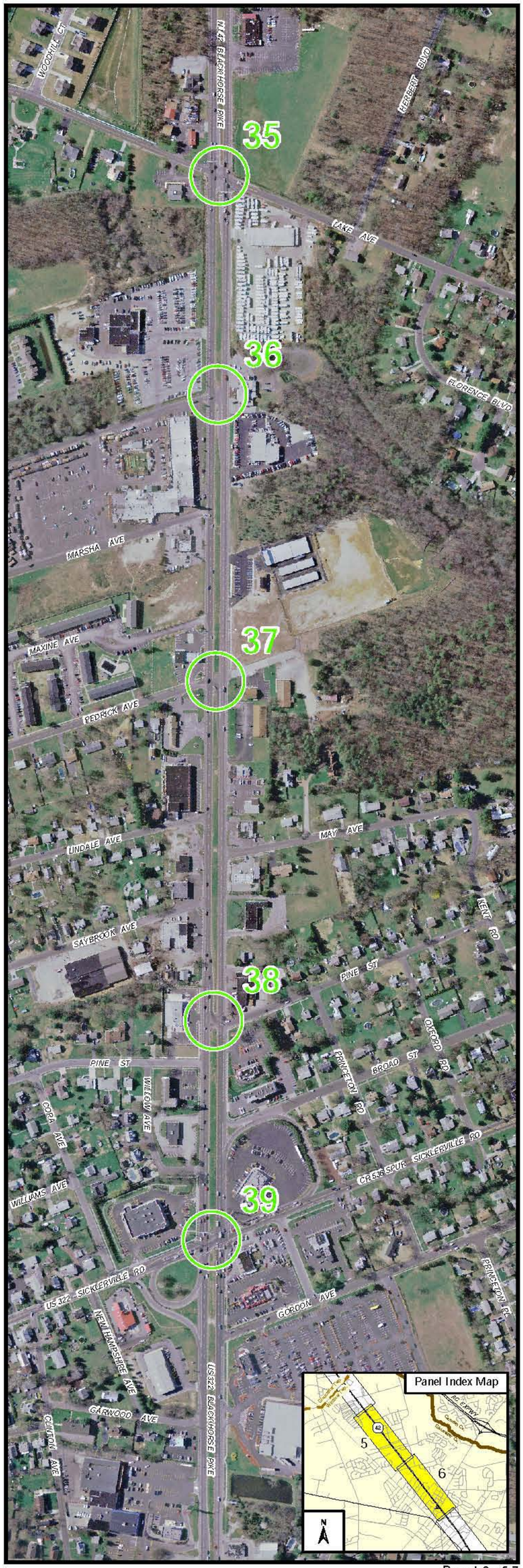
Panel 4 of 7

Map 15

Median Openings with Recommended Actions (Panels 3 & 4)



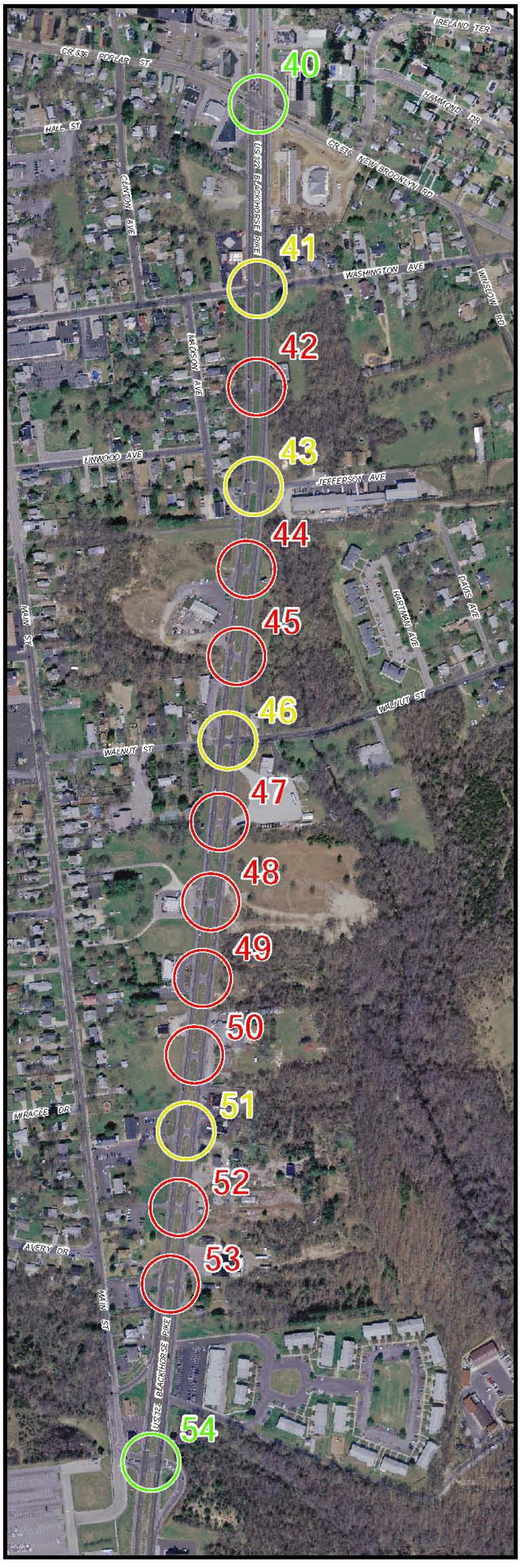
Panel 5 of 7



Panel 6 of 7

Map 16

Median Openings with Recommended Actions (Panels 5 & 6)



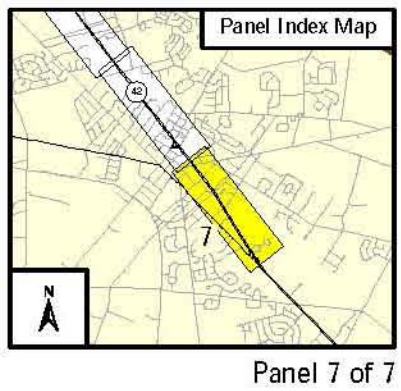
Proposed Action:

- Close Median Opening
- Improve Median Opening
- Retain Median Opening

0 200 400
Feet

DVRPC Aerial Imagery: Spring, 2005

Delaware Valley Regional Planning Commission
June 2008



Panel 7 of 7

Map 17

Median Openings with Recommended Actions (Panel 7)

8.7 Transit Analysis

Bus transit systems are challenged with providing a safe, efficient, reliable, convenient, and affordable transportation alternative to the private automobile. These challenges are not easily met, in part due to direct competition with the private automobile. Compounding the challenges in the study corridor is the suburban and strip development that prevails there. To meet rider needs, the bus network must be able to offer connections to locations inside and out of the corridor, connecting the places people live, work, and seek services. For example, some individuals may need to access the major retail locations on NJ 42, while others may need to reach major employment centers in Camden, Philadelphia, and Cherry Hill.

The benefits of an effective bus transit system are numerous. Beyond providing a social benefit to users and employers in the corridor, bus transit also can relieve roadway congestion, reduce air pollution, and provide an alternative to single-occupant vehicles. This chapter has two sections. The first section provides an overview of the current bus service in the corridor. The second section analyzes Park-and-Ride opportunities in the corridor.

Bus Service

Bus Routes

NJ Transit is the primary scheduled transit provider in this corridor. The following descriptions discuss the service area of each route, headways, and terminal points. Bus routes are either bidirectional or circular. Headways are synonymous with frequency, referring to the spacing between vehicles on the same route. The corridor bus routes are summarized in Table 13.

Route 315

Route 315 operates between Philadelphia and Cape May. This route serves NJ 42 for the entire length of the corridor. Travel time between the two end points, Philadelphia and Cape May, is approximately three hours and 15 minutes. In the eastbound direction, the route completes three runs per day. The westbound direction operates only twice per day. The schedule of the route is not convenient for individuals commuting daily from corridor locations to Philadelphia.

Route 400

Route 400 operates between Philadelphia and Sicklerville. This route, in the westbound direction, begins in Sicklerville, stops at the Avandale Park-and-Ride, and travels south on Thousand Oaks Drive/Sicklerville Road (536 Spur), travels east for a short distance on NJ 42, west on Gloucester County 554-Main Street, and on the expressway portion of NJ 42 for travel into Philadelphia. The service operates approximately 23 hours per day with one-hour headways. Travel time between Sicklerville and Philadelphia is either one hour, 20 minutes or one hour and 40 minutes, depending on the particular run. The route has four AM to Philadelphia and four PM from Philadelphia express runs on weekdays. The express runs are 32 – 50 minutes between Philadelphia and Greentree Road.

Route 403

Route 403 begins/terminates at Berlin-Cross Keys Commons transfer location. The start of the route is in Philadelphia. This route offers 30-minute to one-hour headways depending on time of day. Travel time of the entire route is approximately one and a half hours. However, the bus stops at the Lindenwold train station, where connections to Philadelphia are available on the PATCO line and NJ Transit's Atlantic City Line, making possible a shorter commute. Travel time

between Cross Keys Commons and Lindenwold is approximately 40 minutes.

Route 459

Route 459 operates between Winslow and Voorhees, with a stop at the Lindenwold PATCO station. The route operates seven days per week, with 25-minute peak-hour, and one-hour off-peak headways. In the study area, the route operates north of the Atlantic City Expressway. Travel time between study area locations and the Lindenwold PATCO station is approximately 40 minutes.

Route 463

Route 463 operates on weekdays between Avandale Park-and-Ride and Woodbury. Westbound, the route travels from the Park-and-Ride on Williamstown Road (536), Main Street (654), Tuckahoe Road to Cross Keys Commons, and then further west in Gloucester County. Travel time for the entire route length is approximately 52 minutes, and 15 minutes between Avandale and Cross Keys Commons. The route operates between 5:00 am and 11:00 pm.

Route 551

Route 551 operates between Philadelphia and Atlantic City, with limited stops. This bus stops at the Avandale Park-and-Ride, thereby permitting express service to Camden and Philadelphia via transfer from a local route at the Park-and-Ride. The service operates nearly 24 hours per day and offers between 30-minute and one-hour headways, depending on the time of day. Time between the Avandale Park-and-Ride and Philadelphia is 40-48 minutes.

Table 13: Bus Route Summary

Route	Coverage		End-to-End Time*	Headways		Weekend Service		Notes / POIs
	From	To		Peak	Off peak	Sat.	Sun.	
315	Cape May	Philadelphia	3:12	4:30	4:30	No	No	
400	Sicklerville	Philadelphia	1:20 / 0:41E	0:20	1:00	Yes	Yes	Avandale P-n-R
403	Turnersville	PATCO	0:40	0:20	1:00			Lindenwold PATCO
	PATCO	Philadelphia	0:54	0:20	1:00	Yes	Yes	
459	Winslow	PATCO	0:45	0:25	1:00			Avandale P-n-R
	PATCO	Voorhees	0:17	0:25	1:00	Yes	Yes	Lindenwold PATCO
463	Winslow	Woodbury	0:52	1:00	1:00	No	No	weekdays only
551	Atlantic City	Philadelphia	1:30	0:30	1:00	Yes	Yes	all express

E - Express, PATCO - Lindenwold Station

Source: NJ Transit, 2008

* Times vary by run, approximations given

Transfer Locations

Transfer locations serve an important function in the bus system for individuals who must use multiple bus routes to reach their destinations. Transit authorities can minimize passenger discomfort during transfer scenarios by offering a sheltered environment and timely transfers. Within the corridor the following locations are considered to be transfer locations by NJ Transit:

- Cross Keys Common Shopping Center (Routes 400, 403, 463)
- Sicklerville Road and Main Street intersection (Routes 400, 463)
- Avandale Park-and-Ride (Routes 400, 459, 463, 551)

The Avandale Park-and-Ride offers approximately 330 parking spaces and connections with bus routes 400, 459, 463, and 551. Route 551 offers express service to Camden and Philadelphia from the park-and-ride location. It is located north of the Atlantic City Expressway on Williamstown Road. The bus boarding location includes several shelters and posted bus schedules. Parking at this location is free.

Spatial Separation

The study area is characterized by commercial strip-style development on NJ 42 and suburban residential development surrounding NJ 42. Employment centers are also concentrated along NJ 42, with the notable exception of Kennedy Memorial Hospital, which is located away from NJ 42. These development patterns contribute to the challenges faced by the bus system in the study corridor and they underline the importance of park-and-ride facilities to attract transit commuters to NJ 42. The second half of this chapter presents an analysis of potential Park-and-Ride/rideshare sites.

Ridership

Ridership is an important measure of the success of a bus route in meeting the demands of its users. NJ Transit ridership data shows that Route 400 is the most heavily used route in the corridor. The next most heavily utilized routes are Routes 403 and 551, with the remainder having significantly lower ridership numbers. Table 14 lists ridership by route. The data is also broken out by trip origins and destinations: internal trips begin and end in the study corridor; internal/external trips begin or end in the study corridor but the other trip end is outside the study corridor; and external trips pass through the study corridor. Figure 8 shows a schematic of trip types.

Table 14: Bus Ridership

	Passengers (Average Weekday)			
Route	Internal	Internal/ External	External	Total
315	**0**	**10**	64	75
400	**231**	**162**	2,364	2,757
403	**19**	**107**	1,649	1,775
459	**72**	**93**	357	523
463	**68**	**81**	50	198
551	**1**	**711**	372	1,083

Source: NJ Transit, June 2007

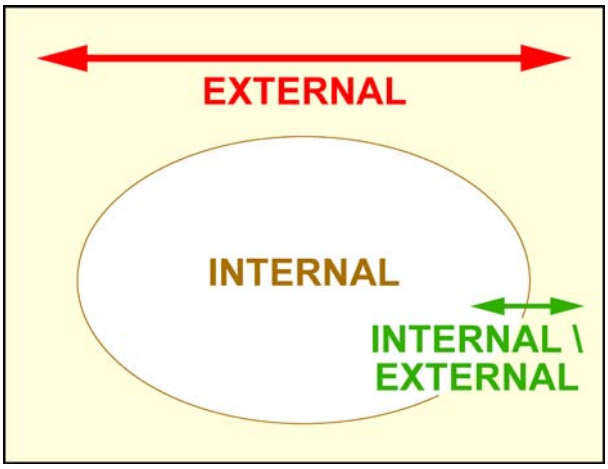
Study corridor residents are represented under internal and internal/external trips. Therefore, the most popular route for study corridor residents is the Route 551, which stops at Avandale Park-and-Ride.

Future Growth

DVRPC expects the study corridor to experience significant growth between 2005 and 2035. The projected growth presents challenges for the bus service in the corridor. Rising fuel prices and personal acceptance of the negative environmental aspects of private

automobile usage will also contribute to greater demand on the bus system in the future.

Figure 8 - Trip Types



Recommendations

Funding sources that become available should be focused on improving service on these routes in order to retain current ridership and attract new riders. Routes 400 and 403 operate on portions of the Black Horse Pike, therefore improvements may include:

- Giving buses traffic signal priority to ensure bus schedule adherence
- Installing dedicated bus lanes along frequently congested portions of the roadway
- Adding Park-and-Ride locations along the Black Horse Pike to allow for expanded commuting options for the area's residents
- Considering the rapid growth that is projected for the corridor, potential exists to require developers to make a fair share contribution by funding bus pullouts, shelters, and amenities as a condition of approval of large development applications.

Park-and-Ride Opportunities

NJ 42 Park-and-Ride Summary

Twelve potential Park-and-Ride sites in the NJ 42 study corridor have been analyzed and ranked. The analysis includes factors such as vehicular access, existing bus service, security, and the improvements necessary to make the site functional. Those improvements could be on-site or involve the adjacent road network. See Map 18: *Transit Network With Potential Park-and-Ride Sites*.

The primary criteria used to rank the sites are as follows:

- Traffic signal at site.
- Access to northbound NJ 42.
- Ability to intercept commuters ahead of traffic congestion.

In addition, NJDOT usually seeks sites with a minimum of 50 available spaces for Park-and-Ride lots. Sites with fewer than 50 available spaces would only be used as rideshare lots.

The sites have been ranked in one of four categories: High Priority, Medium Priority, Low Priority, and Unsatisfactory. There is a brief explanation of each ranking below. A detailed analysis follows the summary.

<u>High Priority</u>

1. *Greentree Road & NJ 42 (The Dump)* – Access from northbound NJ 42; large lot; low occupancy; possible capacity constraints exiting jughandle at Greentree Road.

2. *Whitman Plaza* – Neighborhood shopping center; somewhat run down, which could be an opportunity; access from northbound NJ 42; alternate access via Whitman Drive; three NJ Transit bus routes; driveways and internal circulation need improvement; poor signage.

3. *Cross Keys Commons and Campus* – Site of Wal-Mart Super Center, Marshalls, and other big box retail stores; located on southbound NJ 42; access from northbound NJ 42 via traffic signal at Stagecoach Road; commuters intercepted ahead of traffic congestion; large lot; medium occupancy; four NJ Transit bus routes; bus stops on Stagecoach Road would be safe for pedestrians.

4. *United Artists Theater* – Access from Berlin-Cross Keys Bypass and Stagecoach Road; commuters intercepted ahead of traffic congestion; large lot; low occupancy.

Medium Priority

5. *Washington Plaza* – Located on southbound NJ 42; access from northbound NJ 42 via traffic signal; good internal circulation; vacant parcel adjacent to site; three NJ Transit bus routes; also possible for direct bus access to shopping center.

6. *Plaza 42* – Located on southbound NJ 42; access from northbound NJ 42 via jughandle at Greentree Road; alternative access from Greentree Road at rear driveway; large lot; medium occupancy; bus stops at Greentree Road.

7. *Echo Plaza* – Hurffville-Berlin-Cross Keys Road has high traffic volume; commuters intercepted ahead of traffic congestion; one NJ Transit bus route; access road located near intersection could lead to vehicle conflicts.

8. *Library IV (restaurant)* – Access from northbound NJ 42; low occupancy lot; one NJ Transit bus route; currently somewhat isolated, but new construction in adjacent lot could add traffic.

Low Priority

9. *Ganttown Square* – Access from northbound NJ 42; high occupancy; internal circulation only fair; narrow aisles and poor visibility.

10. *Stagecoach Road & NJ 42* – Vacant parcel next to Comcast behind auto dealerships; access from northbound NJ 42; long and circuitous walk to NJ 42; isolated.

Unsatisfactory

11. *Fries Mill Road & NJ 42* – Driveway located near intersection could lead to vehicle conflicts; poor access from northbound NJ 42; three NJ Transit bus routes with no existing stop; dangerous for pedestrians; possible alternative access from Ganttown Road.

12. *1861 N. Black Horse Pike* – Currently under construction as a strip mall; no longer a candidate.

Detailed Park-and-Ride Analysis

This section of the report identifies locations in the NJ 42 study corridor that could be most appropriate as a Park-and-Ride lot and/or a rideshare lot. A sketch planning analysis is developed for the different conceptual alternatives. See Map 18: Transit Network With Potential Park-and-ride Sites.

1. Greentree Road and NJ 42 (The Dump)

This site is located on the Black Horse Pike (NJ 42) north of the intersection at Greentree Road. This site consists of The Dump, which opens for business two days each week, Friendly's, and Boston Market. The parking lot is underutilized.

Size of the Site: This lot is approximately 15.1 acres in area.

Vehicular Access: This site can intercept commuters from south and west before the freeway is reached.

Access from northbound NJ 42 is provided at the Greentree Road jughandle and at the main driveway, which is located midblock. Increased traffic volume could necessitate improvements at the jughandle. The main driveway approach lacks an adequate shoulder and the turning radius is tight. There is no access to the site from southbound NJ 42. Instead, vehicles must use the Whitman Drive jughandle located approximately one-half mile south.

Bus Routes: The area is served by three bus routes. NJ Transit buses 315, 400, and 403 have outbound destinations in Camden and Philadelphia. There are inbound and outbound bus stops one block from the site at Greentree Road.

Number of Existing Parking Spaces*:* The site has 800 parking spaces. Occupancy is low throughout the day.

Proximity to Amenities*:* Friendly's and Boston Market.

Security: Large lot but appears to have good visibility and adequate lighting.

Recommended Improvements:

- Install right-turn lane and increase turning radius at midblock driveway.
- Construct sidewalk from midblock driveway to NJ Transit bus stop.

2. Whitman Plaza

This site is located on the Black Horse Pike (NJ 42), south of the intersection with Whitman Drive. This site includes Wachovia Bank and Sakura Japanese Restaurant. The parking lot, which is situated between the Shell Service Station and fast food eateries that front NJ 42 and Whitman Plaza, appears to be relatively underutilized. The Wachovia Bank lot also has available spaces.

Size of the Site: This lot is approximately 12.8 acres in area.

Vehicular Access: Access from northbound NJ 42 is good. However, the midblock driveway approach lacks an adequate shoulder and the turning radius is tight. Access from southbound NJ 42 via Whitman Drive jughandle is circuitous. The internal circulation is rated "Fair" due to irregular site layout and poor signage.

Bus Routes: The area is served by three bus routes. NJ Transit buses 315, 400, and 403 have outbound destinations in Camden and Philadelphia. There are inbound and outbound bus stops one block from the site at Whitman Drive.

Number of Existing Parking Spaces: The site has 125 parking spaces. Occupancy is low.

Map 18
Transit Network with Potential Park-and-Ride Sites

GLOUCESTER

WASHINGTON

WINSLOW

MONROE

FRANKLIN

Avandale Park & Ride
400 459 463 551

Potential Park-and-Ride Sites:

1. Greentree Road & NJ 42 (The Dump)
2. Whitman Plaza
3. Cross Keys Commons & Campus
4. United Artists Theater
5. Washington Plaza
6. Plaza 42
7. Echo Plaza
8. Library IV (restaurant)
9. Ganttown Square
10. Stagecoach Road & NJ 42
11. Fries Mill Road & NJ 42
12. 1861 N. Black Horse Pike

NJ Transit Bus Routes:

- 315 (Cape May - Wildwood - Philadelphia)
- 400 (Sicklerville - Philadelphia)
- 403 (Turnersville - Philadelphia)
- 459 (Echelon Mall - Winslow Township)
- 463 (Woodbury - Avandale Park & Ride)
- 551 (Atlantic City - Philadelphia)

N

0 0.25 0.5
Miles

Delaware Valley Regional Planning Commission
June 2008

Proximity to Amenities: Wendy's, Taco Bell, Wachovia Bank.

Security: Buildings screen off the lot somewhat, but visibility is fair; lighting appears to be adequate.

Recommended Improvements:

- Install right-turn lane and increase turning radius at midblock driveway.
- Add wayfinding signage and pavement markings.
- Construct sidewalk from midblock driveway to NJ Transit bus stop.
- Construct ADA curb ramps (refuge area) in median on east side of Whitman Drive intersection

3. Cross Keys Commons and Campus

This site is located on the Black Horse Pike (NJ 42) at the intersection with Tuckahoe Road. This site is anchored by the Wal-Mart Super Center, Marshalls, Party City, and other big box retailers. The upper parking lot adjacent to McDonalds and Fuddruckers appears to be relatively underutilized. However, the site is somewhat south of the major commuter shed in the area.

Size of the Site: This lot is approximately 66.7 acres in area.

Vehicular Access: The site is west of NJ 42, forcing northbound commuters to leave the Black Horse Pike to reach the site. However, the site can be accessed via NJ 42 or Tuckahoe Road in both directions.

Bus Routes*:* The area is served by four bus routes. NJ Transit buses 315, 400, and 403 have outbound destinations in Camden and Philadelphia. The NJ Transit 463 bus operates between Woodbury and the Avandale Park-and-Ride lot. There are inbound and outbound bus stops adjacent to the site.

Number of Existing Parking Spaces: The site has 1,250 spaces, with moderate occupancy.

Proximity to Amenities: McDonalds, bank.

Security: This is a large lot, but it appears to have good visibility and adequate lighting. Wal-Mart draws traffic day and night.

Recommended Improvements:

- Construct sidewalk from parking lot to NJ 42.
- Construct one ADA curb ramp on SE corner.
- Construct two ADA curb ramps on NE corner.
- Construct ADA curb ramps (refuge area) in median on north side of the intersection.
- Install Pedestrian Crossing warning signs at all approaches.
- Paint Pedestrian warning symbol in right-turn auxiliary lane along Route 42 SB

4. United Artists Theater

This site is located on Cross Keys Bypass east of the intersection with Tuckahoe Road. This site consists of the United Artists Theater. The parking lot is underutilized.

Size of the Site: This lot is approximately 17.8 acres in area.

Vehicular Access: The site can intercept commuters from the south and west before the freeway is reached.

Access from northbound Cross Key Bypass is done via Tuckahoe Road.

Bus Routes: The area is served by two bus routes. NJ Transit bus 400 has outbound destinations in Camden and Philadelphia. NJ Transit bus 463 operates between Woodbury and the Avandale Park-and-Ride lot. There

are inbound and outbound bus stops one block from the site at Tuckahoe Road.

Number of Existing Parking Spaces: The site has 750 parking spaces, with low occupancy.

Proximity to Amenities: None

Security: This is a large lot, but it appears to have adequate lighting. It is also somewhat isolated, with minimal foot traffic.

Recommended Improvements:

None

5. Washington Plaza

This site is located on the Black Horse Pike (NJ 42) south of the Atlantic City Expressway interchange. This site is anchored by Burlington Coat Factory and LA Fitness. The lower parking lot adjacent to Burlington Coat Factory appears to be relatively underutilized. There is a vacant parcel north of the site.

Size of the Site: This lot is approximately 20.1 acres in area.

Vehicular Access*:* This site is west of NJ 42, which forces northbound commuters to leave the Black Horse Pike to reach the site. A traffic signal provides access to the site from northbound NJ 42. There are two other driveways. One is "exit only," but neither provides access to northbound NJ 42.

Bus Routes: The area is served by three bus routes. NJ Transit buses 315, 400, and 403 have outbound destinations in Camden and Philadelphia. There are inbound and outbound bus stops adjacent to the site.

Number of Existing Parking Spaces: The site has 375 parking spaces, with moderate occupancy.

Proximity to Amenities: TGI Fridays.

Security: The lot appears to have adequate lighting. LA Fitness draws traffic day and night.

Recommended Improvements:

- Construct sidewalk from parking lot to traffic signal at the Black Horse Pike parallel to driveway; extend sidewalk from traffic signal to bus stops on the Black Horse Pike.
- Install crosswalk across NJ 42 on south side of intersection.
- Install crosswalk across driveway.
- Install push button activation system and pedestrian signal heads.

6. Plaza 42

This site is located on the Black Horse Pike (NJ 42) north of the intersection with Greentree Road. This site is anchored by Kohl's Department Store. The upper parking lot adjacent to the Ashley Furniture Home Store appears to be relatively underutilized.

Size of the Site: This lot is approximately 20.9 acres in area.

Vehicular Access: This site can intercept commuters from the south and west before the freeway is reached.

Access from northbound NJ 42 is problematic. It requires the use of the jughandle at Greentree Road and the back entrance of the shopping center further down Greentree Road. Two unsignalized driveways provide access to southbound NJ 42.

Bus Routes: The area is served by three bus routes. NJ Transit buses 315, 400, and 403 have outbound destinations in Camden and Philadelphia. There are inbound and outbound bus stops one block from the site at Greentree Road.

Number of Existing Parking Spaces: The site has 600 parking spaces, with a low occupancy rate.

Proximity to Amenities: McDonalds, Dunkin Donuts, dry cleaners.

Security: Large lot but appears to have good visibility and adequate lighting.

Recommended Improvements:

- Construct sidewalk from Dunkin Donuts to NJ Transit bus stop on southbound NJ 42.
- Install bus shelter on northbound side of NJ 42.

7. Echo Plaza

This site is located on Hurffville-Berlin-Cross Keys Road north of the intersection with Fries Mill Road. This site includes Active Fitness Gym and Cardio Zone. This parking lot appears to be relatively underutilized. More importantly, the driveway on Fries Mill Road could have a fatal flaw.

Size of the Site: This lot is approximately 18.3 acres in area.

Vehicular Access: This site can intercept commuters from the west before they reach the Black Horse Pike. Access on Fries Mill Road via the driveway is located 200 feet south of intersection. It has the potential for vehicular conflicts at the driveway, which is also at an acute angle with the roadway, which thus reduces the line of sight. Two other driveways are on Hurffville-Cross Keys Road, but both lack a designated left-turn lane.

Bus Routes: The area is served by one bus route. The 463 bus operates between Woodbury and the Avandale Park-and-Ride lot. There are inbound and outbound bus stops adjacent to the site at Fries Mill Road.

Number of Existing Parking Spaces: The site has 275 spaces, with low occupancy.

Proximity to Amenities: Bank, dry cleaners, day care center.

Security: This midsize lot appears to have good visibility and adequate lighting, although it is somewhat isolated.

Recommended Improvements:

- Install stop signs at the intersection of Hurffville-Cross Keys driveways and the parking lot.

8. Library IV (Restaurant)

This site is located on the Black Horse Pike (NJ 42) north of the intersection with Lake Avenue. Library IV Steak and Seafood restaurant is the only business on the site. This parking lot appears to be relatively underutilized. There are vacant parcels north and west of the site. Despite its promise, poor southbound NJ 42 access would have to be overcome.

Size of the Site: This lot is approximately 1.6 acres in area.

Vehicular Access: The site can intercept commuters from the south before they reach traffic congestion on the Black Horse Pike. There is no designated right-turn lane at driveway.

Access from southbound NJ 42 is done via the U-turn at Lake Road. Access from the site to southbound NJ 42 is one-half mile north at Grandview Avenue, which is an unsignalized intersection. There is no designated left-turn lane at Grandview Avenue.

Bus Routes: The area is served by one bus route. NJ Transit bus 315 has outbound destinations in Camden and Philadelphia.

There are inbound and outbound bus stops one block from the site at Lake Road.

Number of Existing Parking Spaces: The site has 140 spaces, with low occupancy.

Proximity to Amenities: None.

Security: This midsize lot appears to have good visibility, but minimal lighting. It is also currently somewhat isolated, but new construction in an adjacent lot could add traffic.

Recommended Improvements:

- Construct a right-turn lane on northbound NJ 42 at Library IV's driveway.
- Construct a left-turn lane on southbound NJ 42 at Grandview Avenue.
- Consider an access road between the site and Lake Road.

9. Ganttown Square

This site is located on the Black Horse Pike (NJ 42) at the intersection with Greentree Road. This site includes Commerce Bank, Forman Mills Clothing Store, Blockbuster Video, and the NJ Department of Motor Vehicles (NJ DMV). The parking lot appears to be well utilized, except at the north and south ends, which are empty. Since there is likely to be fewer than 50 available spaces, this site can only potentially become a rideshare lot.

Size of the Site: This lot is approximately 12.4 acres in area.

Vehicular Access: This site can intercept commuters from the south and west before the freeway is reached. The driveway is served by the Ganttown Road traffic signal, providing good access from northbound and southbound NJ 42. Internal circulation is rated fair due to narrow parking lot aisles and potential conflicts with Commerce Bank traffic.

Bus Routes: The area is served by three bus routes. NJ Transit buses 315, 400, and 403 have outbound destinations in Camden and Philadelphia. There are inbound and outbound bus stops adjacent to the site at Ganttown Road.

Number of Existing Parking Spaces: The site has 250 parking spaces, with high occupancy.

Proximity to Amenities*:* Commerce Bank

Security*:* This is a compact lot that appears to have adequate lighting.

Recommended Improvements:

- Paint direction markers on parking lot pavement to improve internal circulation.
- Construct sidewalk from Ganttown Road to NJ Transit bus stop on northbound NJ 42.
- Install bus shelter on southbound NJ 42.

10. Stage Coach Road and NJ 42

This site is located on the Black Horse Pike (NJ 42) south of the intersection with Stage Coach Road. This site consists primarily of auto dealerships and a large Comcast facility. An undeveloped parcel adjacent to Comcast is available. This site is also somewhat south of the major commuter shed in the area.

Size of the Site: This lot is approximately 50.5 acres in area.

Vehicular Access: This site can intercept commuters from the south and west before the freeway is reached.

Access from northbound NJ 42 provided via Please Boulevard. There is access from southbound NJ 42 at the traffic signal. The

second driveway, located on Stage Coach Road, is poorly marked.

Bus Routes: The area is served by four bus routes. NJ Transit buses 315, 400, and 403 have outbound destinations in Camden and Philadelphia. The 463 bus operates between Woodbury and the Avandale Park-and-Ride lot. There are inbound and outbound bus stops one block from the site at Stage Coach Road. However, the walk to the bus stop is long and out of the way.

Number of Existing Parking Spaces: None.

Proximity to Amenities: None.

Security: The lot is isolated, without foot traffic

Recommended Improvements: None

11. Fries Mill Road and NJ 42

This site is located on the Black Horse Pike (NJ 42) at the intersection with Fries Mill Road. This site consists of three contiguous undeveloped parcels adjacent to Midas.

Size of the Site: This lot is approximately 4.4 acres in area.

Vehicular Access: The site can intercept commuters from the west before they reach the Black Horse Pike. However, the site is west of NJ 42, forcing northbound commuters to leave the Black Horse Pike to reach the site. Furthermore, there appears to be no convenient access from northbound NJ 42; left-turn and U-turn movements are prohibited at the next intersection to north Johnson Road. Access from southbound NJ 42 could cause conflicts with through traffic unless the Fries Mill Road approach becomes widened.

Bus Routes: The area is served by two bus routes. NJ Transit buses 315 and 400 have outbound destinations in Camden and Philadelphia. There are inbound and outbound bus stops adjacent to the site.

Number of Existing Parking Spaces: None.

Proximity to Amenities: None.

Security: The site abuts residences; otherwise, it is isolated.

Recommended Improvements:

- Install crosswalk across Route 42 on the south side of the intersection (NJT stops on both sides).
- Extend sidewalk from Midas along Route 42 SB to bus stop.
- Construct four ADA curb ramps on both sides of Route 42 and through the median at crosswalk.
- Install crosswalk across Fries Mill Road approach with push button activation system and pedestrian signal heads.
- Install Pedestrian Crossing signs at crosswalk.

12. 1861 N. Black Horse Pike

This site is located on the Black Horse Pike (NJ 42) south of the intersection with Berlin-Cross Keys Road. It is currently under construction as a strip mall and is therefore no longer a candidate.

8.8 Bicycle Analysis

According to the New Jersey Statewide Bicycle and Pedestrian Master Plan, an extensive and integrated bicycling and walking infrastructure is essential in providing nonmotorized connections between residential areas and schools, parks, businesses, downtown and transit stations. One way of promoting bicycle use is to provide an interconnected network of clearly designated bicycle routes. These routes can provide a viable alternative to the use of the

automobile for local travel. However, most study area arterial and collector roads were not designed with bicycles in mind and must be retrofitted to accommodate them.

NJ 42 Bicycle Improvements

There are several strategies that can improve roadway compatibility conditions for bicycle travel and increase overall bicycle safety:

- Streets with wider shoulders can be repainted to create bicycle lanes (at least five feet in width in each direction) and still allow room for a shoulder or buffer between the road and sidewalk. Where appropriate, right-of-way for a bicycle lane can also be carved from the buffer between the sidewalk and the curb.

- In some cases, general-purpose travel lanes can be narrowed to 11 or 12 feet to accommodate the added bicycle lanes. The narrowed lanes will reduce vehicle speeds, which can increase safety and raise awareness of a bicycle rider's presence. On certain segments of Hurffville-Cross Keys Road, a reduction in lane width could provide the required space for a bicycle lane.

- Secure and convenient bicycle parking facilities can be built to better accommodate those who use bicycles for commuting or recreational purposes. Bicycle racks are freestanding structures that provide a secure location for bicycles. A single rack can generally provide storage for several bicycles. These areas should be well lighted and in full view from the surrounding area.

Proposed Bicycle Routes

The following proposed on-street routes have been identified for the study area. See Map 19: Proposed Bicycle Improvements.

1. Corkery Lane

The section of Corkery Lane to be improved is bounded by Whitehall Road to the east and Sherwood Road to the west. Traffic volume on this section ranges from 3,900 to 5,500 Annual Average Daily Traffic (AADT). The improvement of Corkery Lane would both extend and provide greater access to the existing Monroe Township Bicycle Path. The connection between Corkery Lane and the Monroe Township Bicycle Path would be made via Ames Road.

Once the connection is established, residents of Forest Hills, Stone Forest, Oxford Glen, and Mimosa Ridge will enjoy access to the path. In the other direction, Whitehall Road would join Corkery Lane and Sunset Avenue. As a result, the reach of the Monroe Township Bicycle Path would effectively be extended to the Timber Lakes/Victory Lakes amenities.

Another possibility is to use the Black Horse Pike (Route 322) to travel between Corkery Lane and Whitehall Road. Although it is a more direct route, traffic volume and traffic speeds are significantly higher than on Corkery Lane. Furthermore, future development on the roadside is likely to intensify activity there, increasing vehicle-bicycle conflicts and making the area even less hospitable for bicyclists.

Finally, the existence of large tracts of undeveloped land south of Corkery Lane suggests a third possibility: designation of a new right-of-way for an off-road trail. The trail would extend from Sykesville Road south and then follow a second alignment east across Blue Bell Road before terminating at the intersection of West Malaga Road and Sunset Avenue.

2. Hurffville-Cross Keys Road

Improvement of Hurffville-Cross Keys Road would result in a bicycle facility with both utilitarian and recreational features. The section of Hurffville-Cross Keys Road to be improved would begin at Tuckahoe Road just inside Monroe Township. It would end at Davis Way at Washington Lake Park in Washington Township. South of Egg Harbor Road, right-of-way is available for construction of a bicycle facility, as the adjacent land is undeveloped or setbacks are large. North of Egg Harbor Road, it would be necessary to retrofit some areas of the roadway.

Bicycle improvements would provide access to the retail center at Cross Keys Bypass, Echo Plaza, and Washington Lake Park. In addition, connections to two New Jersey Transit routes would be enhanced. The Route 463 bus travels between Woodbury and the Avandale Park-and-Ride. It would intersect the bicycle facility north of Fries Mill Road and at Tuckahoe Road. The Route 400 bus travels between Sicklerville, Camden, and Philadelphia. It would intersect the bicycle facility at Tuckahoe Road. The Hurffville-Cross Keys Road bicycle facility would increase the ridership of these transit routes.

3. Johnson Road/Herbert Boulevard

The sections of Johnson Road and Herbert Boulevard to be improved traverse a distance of approximately five miles. They run parallel to the Black Horse Pike (NJ 42) before intersecting it at both ends. Johnson Road intersects NJ 42 north of Fries Mill Road. Herbert Boulevard offers access to NJ 42 via a short segment of Lake Avenue north of the 536 Spur. Traffic volume on Johnson Road is approximately 7,300 AADT.

The bicycle facility would allow bicycle traffic to bypass NJ 42 or to access it via several intermediate connecting roads. The most promising connection is Stage Coach Road, which is largely undeveloped between Johnson Road and NJ 42. The roadway has a shoulder along much of its length and setbacks are generally large. It would also cross the retail corridor on Berlin-Cross Keys Road (Route 689).

Besides retail and commercial attractions, NJ 42 also has several New Jersey Transit bus routes. For example, the intersection of NJ 42 and Stage Coach Road is served by New Jersey Transit routes 315, 400, 403, and 463. The Route 315 bus is a long-distance route that travels between Cape May and Philadelphia. The Route 400 and Route 403 travel between Sicklerville and Philadelphia and Turnersville and Philadelphia, respectively. The Route 463 bus travels between Woodbury and the Avandale Park-and-Ride lot. The main benefit of the Johnson Road/Herbert Boulevard bicycle facility may be to connect adjacent residential neighborhoods on the route.

4. Hurffville Road/Greentree Road

Hurffville Road would be improved between Hurffville-Grenloch Road and Greentree Road, creating an approximately 1.5 mile east-west bicycle facility. Improvements to Greentree Road would further increase bicycle mobility. The improvements to Greentree Road would occur in two stages. First, an approximately 600-foot segment would connect Hurffville Road and Bells Lake Road. Bells Lake Road would also be improved as far as Hurffville-Cross Keys Road. Later, an approximately three-quarter-mile segment would extend the bicycle facility on Greentree Road to the Black Horse Pike (NJ 42). Hurffville Road would provide safe east-west bicycle travel in an area where the parallel arterial roadways are dangerous. Extension of the bicycle facility on Greentree Road would permit access to shopping on NJ 42. The cooperation of the privately-owned shopping centers would be necessary to provide for the installation of bicycle amenities.

Map 19
Proposed Bicycle Improvements

DEPTFORD
WASHINGTON
GLOUCESTER
Pine Hill
Pine Valley
Berlin
WINSLOW
Glassboro
Clayton
ELK
MONROE
FRANKLIN

HURFFVILLE - GRENLOCH RD
HICKSTOWN RD
GREENTREE RD
EGG HARBOR RD
HURFFVILLE - CROSS KEYS RD
JOHNSON RD
SICKLERVILLE RD
ATLANTIC CITY EXPRESSWAY
ERIAL RD
WILLIAMSTOWN RD
BERLIN - CROSS KEYS RD
JARVIS RD
CHEWS LANDING RD
CAMDEN CO.
GLOUCESTER CO.
PITMAN - DOWNER RD
FISH POND RD
STAGECOACH RD
FRIES MILL RD
GLASSBORO - CROSS KEYS RD
GLASSBORO RD
TUCKAHOE RD
N MAIN ST
NEW BROOKLYN RD
E MALAGA RD
WINSLOW RD
AMES RD
CORKERY LN
SYKESVILLE RD
BLUE BELL RD
CLAYTON RD
W MALAGA RD
BLACK HORSE PIKE
SUNSET AVE
WHITEHALL RD

55 168 42 47 322

Proposed Bicycle Improvements:

- Monroe Township Multi-Use Trail
- Corkery Lane Proposed Improvements
- Corkery Lane Alternative
- Hurffville - Cross Keys Road Proposed Improvements
- Hurffville Road Proposed Improvements
- Johnson Road/Herbert Boulevard Proposed Improvements

Protected Lands (includes parks):

- Federal
- State
- County
- Municipal
- Land Trust/Private Protected
- Preserved Farmland

Source: Protected Lands 2007 - DVRPC

School

N

0 0.5 1
Miles

Delaware Valley Regional Planning Commission
June 2008

8.9 Pedestrian Analysis

The spatial separation of residential and commercial/retail uses in the study corridor limits walking trips. As a result, the pedestrian analysis focused on two major roads with significant commercial and residential traffic: the Black Horse Pike and Berlin – Cross Keys Road. On the Black Horse Pike, which is served by several NJ Transit bus routes, the main issue is access to transit. On Berlin – Cross Keys Road, commercial/retail development is clustered at major intersections and residential neighborhoods are interspersed between them. This pattern of land uses, which contrasts with the rest of the study corridor, creates opportunities for walking.

The recommendations for Berlin – Cross Keys Road include construction of new sidewalks as well as intersection improvements such as crosswalks and pedestrian signal heads. It should be noted that much of the sidewalk network has been identified by municipal officials and will be constructed by developers as part of their "fair share" for adjacent development projects. This pedestrian analysis identifies missing elements of the pedestrian network. Map 20: Proposed Pedestrian Improvements, Berlin – Cross Keys Road shows existing sidewalks, sidewalks proposed by the municipality, and sidewalks proposed by DVRPC. Intersection improvements are shown as insets on the map.

NJDOT had completed a survey of pedestrian infrastructure on the section of Black Horse Pike north of Berlin – Cross Keys Road for its *Route 42 Concept Development Report* (August 2005). Their recommendations have been incorporated in this study and are listed under "Detailed Improvements" below. The section of Black Horse Pike south of Berlin – Cross Keys Road currently lacks significant pedestrian traffic. There is no critical mass of development to generate pedestrian trips. It is recommended that as development occurs, pedestrian infrastructure should be added consistent with the principles listed under "Area Wide Improvements" below.

NJ 42 Pedestrian Improvements

There are several strategies that can create a safer pedestrian environment and promote walking as a mode of transportation:

- Require retail owners to provide and maintain sidewalks in front of their stores. The Federal Highway Administration (FHWA) and the Institute of Transportation Engineers (ITE) recommend sidewalks of at least five feet in width, although they should be wider near schools, transit stops, and downtown areas.
- Sidewalks should exist on both sides of the street, extend continuously, and be accessible to those in wheelchairs. If the sidewalk ends and continues on the other side of the street, a crosswalk should be provided for safe access.
- Along with sidewalks, buffers of four to six feet in width are necessary between the sidewalk and road shoulder. Bike lanes or areas of parked cars act as buffer zones as well.
- Widen existing sidewalks, buffers, and shoulders to provide adequate space for pedestrians to pass one another while ensuring a sense of distance from the dangers of vehicle traffic. This will also constrain the roadway to slow traffic speeds.
- Plant trees along buffers and integrate street furniture (such as benches) into the more traveled retail areas in order to draw pedestrians and introduce a sense of community among the various distinct developments.
- Integrate raised medians and gateways that will lend to the community feel.

- Adequate street lighting not only creates a sense of security among shoppers, but also adds to the aesthetics of an area. Fixtures should be designed to illuminate both roadways and sidewalks and should provide a consistent level of lighting. Mercury vapor, incandescent, or less expensive high-pressure sodium lighting is preferable at the pedestrian level.
- Introduce pedestrian signals with features like electronic countdowns and scramble periods. Both the countdown, which shows the walker how much time he has left to cross, and the scramble period, which allows a separate phase in which vehicles are stopped and pedestrians can travel freely through the intersection, provide pedestrians with safer crossing alternatives on busier roads.

Proposed Detailed Improvements

Map 20: Proposed Pedestrian Improvements, Berlin – Cross Keys Road (CR 689) shows improvements for Berlin – Cross Keys Road.

1. Berlin-Cross Keys Road (Route 689) at NJ 42

- Construct sidewalk along Route 689 WB from NJ 42 to Home Depot Drive.
- Construct sidewalk from NJT bus shelter on NJ 42 SB to intersection.
- Construct sidewalk from NJT bus shelter on NJ 42 NB to intersection.
- Construct sidewalk along Route 689 WB from Waynes Borough Way to Commerce Bank.

2. Berlin-Cross Keys Road (Route 689) at Johnson Road

- Construct sidewalk along Route 689 WB from county line to Waynes Borough Way.
- Construct sidewalk along Route 689 WB from AC Expressway to Guzzo Retail (under construction).
- Install crosswalks across all four approaches.

3. Berlin-Cross Keys Road (Route 689) at Sicklerville Road

- Construct sidewalk from NJT bus stop on Sicklerville Road SB to intersection.
- Construct sidewalk from NJT bus stop on Sicklerville Road NB to intersection.
- Construct sidewalk along Route 689 EB from AC Expressway to Cross Keys Medical Dental Center.
- Construct sidewalk along Route 689 EB from McDonalds to Winslow Plaza.
- Construct sidewalk along Sicklerville Road SB from Route 689 to park entrance.

4. Berlin-Cross Keys Road (Route 689) at Chews Landing Road

- Install push button activation system and pedestrian signal heads.
- Install ADA curb ramps on SE and SW corners.
- Install crosswalk across Acme driveway.
- Construct sidewalk along Route 689 WB from Sicklerville Road to Commerce Bank.
- Construct sidewalk along Route 689 WB from STS Tire and Auto Center to Hollywood Tan.
- Construct sidewalk along Route 689 EB from Winslow Animal Hospital to Chews Landing Road.
- Construct sidewalk along Route 689 EB from Chews Landing Road to Orlando Drive.

5. Berlin-Cross Keys Road (Route 689) at Independence Boulevard

- Install crosswalk across Route 689 on west side of the intersection.
- Install push button activation system and pedestrian signal heads.
- Install ADA curb ramps.
- Construct sidewalk along Route 689 EB from Orlando Drive to greenway path.

6. Berlin-Cross Keys Road (Route 689) at Erial Road

- Construct sidewalk along Erial Road NB from Duchess Drive to intersection.
- Pave greenway path.
- Construct sidewalk along Erial Road SB from greenway path to Prospect Road.
- Install crosswalks across Erial Road and across Route 689 on east side of the intersection.

7. Route 42 at Tuckahoe Road/Stagecoach Road

- Construct one ADA curb ramp on SE corner.
- Construct two ADA curb ramps on NE corner.
- Construct ADA curb ramps (refuge area) in median on north side of the intersection.
- Install Pedestrian Crossing warning signs at all approaches.
- Paint Pedestrian warning symbol in right-turn auxiliary lane along Route 42 SB.

8. Route 42 at Watson Drive

- Construct sidewalk along Route 42 SB from the Auto Parts store to the NJ Transit stop past the Target entrance.

9. Route 42 at Fries Mill Road

- Install crosswalk across Route 42 on the south side of the intersection (NJ Transit stops on both sides).
- Extend sidewalk from Midas along Route 42 SB to bus stop.
- Construct four ADA curb ramps on both sides of Route 42 and through the median at crosswalk.
- Install crosswalk across Fries Mill Road approach.
- Install push button activation system and pedestrian signal heads.
- Install Pedestrian Crossing signs at crosswalk.

10. Route 42 at Johnson Road

- Construct sidewalk along Route 42 SB from Johnson Road to Midas.
- Construct ADA curb ramps (refuge area) in median on the south side of the intersection.
- Construct ADA curb ramp on SW corner.
- Clean up sidewalk along Route 42 NB from Johnson Road (minor slope failure).
- Install Pedestrian crossing signs at existing crosswalk.

11. Route 42 at Ganttown Road

- Install crosswalks across Route 42 at the southern end of the intersection and across the Shopping Center entrance.
- Construct ADA curb ramps at the NE and SE corners of the intersection.
- Construct sidewalk along Route 42 NB from Ganttown Road to Firestone driveway.

12. Route 42 at Whitman Drive

- Construct ADA curb ramps (refuge area) through the Route 42 median on both the northern and southern side of the intersection.
- Construct ADA curb ramps on all corners of the intersection, including through the median strip on Whitman Drive
- Install countdown pedestrian signal heads and push button activation.
- Install pedestrian crossing signs at crosswalks.
- Construct sidewalk from NJ Transit bus shelter on Route 42 SB to intersection.
- Construct sidewalk from NJ Transit bus shelter on Route 42 NB back to the Dunkin Donuts.

13. Route 42 at Washington Plaza/NJ Transit Depot

- Construct ADA curb ramps at both ends of the crosswalk across Route 42 (southern side of intersection).
- Construct sidewalk from southeast corner to NJ Transit bus shelter along Route 42 NB.
- Install pedestrian crossing warning sign labeled “Next 1 Mile” at Route 42 SB approach.

Map 20

Proposed Pedestrian Improvements
Berlin - Cross Keys Rd. (CR 689)

0 1,000 2,000
Feet

Date of Aerial Imagery in Insets - Spring 2005

Delaware Valley Regional Planning Commission
June 2008

- Existing Sidewalk
- Proposed Sidewalk (Municipal)
- Proposed Sidewalk (DVRPC)
- Install/Re-stripe Crosswalk
- Install Pedestrian Signal Head
- Construct ADA Curb Ramp

WASHINGTON

MONROE

GLOUCESTER

WINSLOW

CR 555 TUCKAHOE RD

CR 689 BERLIN - CROSS KEYS RD

JOHNSON RD

ATLANTIC CITY EXPRESSWAY

SICKLERVILLE RD

CHEWS LANDING RD

CR 704 CHEWS LANDING

ERIAL RD

Gloucester County

Camden County

42

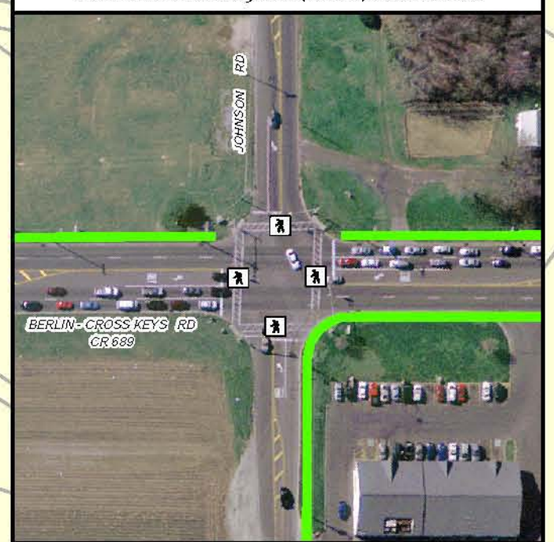
1

2

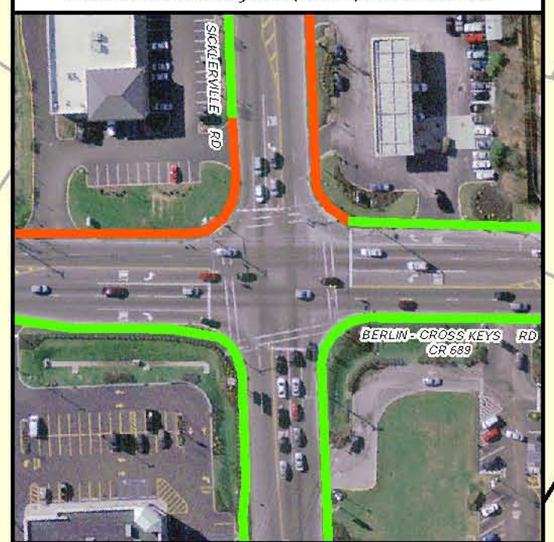
3

4

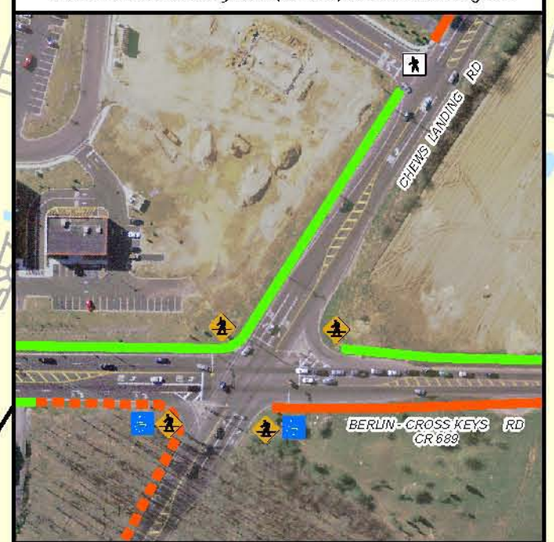
Inset 1: *Berlin Cross Keys Rd. (CR 689) & Johnson Rd.*



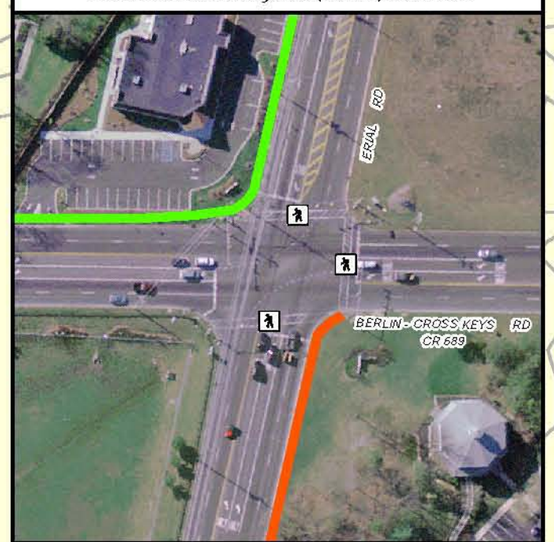
Inset 2: *Berlin Cross Keys Rd. (CR 689) & Sicklerville Rd.*



Inset 3: *Berlin Cross Keys Rd. (CR 689) & Chews Landing Rd.*



Inset 4: *Berlin Cross Keys Rd. (CR 689) & Erial Rd.*



9.0 IMPROVEMENT PLAN

9.1 Summary of Recommendations

This section of the report summarizes those issues within the study corridor that are critical to its orderly development. These improvements could have important implications for the economic vitality of the corridor municipalities. They are listed in no particular order.

1. Environmental Resources and Management

Issue:

In the study area, sprawling development patterns have contributed to high levels of impervious surface coverage. Impervious surfaces disrupt natural absorption, filtration, and recharge processes. As a result, stormwater can pick up pollutants before flowing into water bodies used for drinking, recreation, and fishing.

In addition, the volume (the amount and rate) of runoff substantially increases as land development occurs. High volume of stormwater discharge detrimentally affects a surface waterway—eroding the stream banks, washing out natural vegetation along the stream banks, increasing sediment in the water that destroys aquatic life habitat, carrying pollutants, and increasing the frequency and intensity of flooding.

Strategy:

Reduce stormwater runoff to protect groundwater and ensure community safety and health:

- Create a mandatory review process for site plans that will create large areas of impervious surface; plans should show wetlands, streams, floodplains, steep slopes, and stormwater management practices.
- Establish an inspection and maintenance program to ensure that stormwater management facilities function properly over time.
- Update and enforce codes to limit impervious surface coverage on development parcels and create incentives to increase pervious coverage.
- Implement a “Green Streets” program to manage stormwater runoff from roadways.

Create a greenway system along rivers, streams, and wetland areas to protect water resources, prevent stormwater runoff and flooding, and protect and link recreational areas:

- Create an inventory of parcels that should be purchased, protected, or enhanced to achieve a greenspace network.
- Create or update municipal stream corridor protection ordinances with buffers of 300 feet in environmentally sensitive areas.
- Educate landowners in vicinity of steams and residents in general about creating and maintaining vegetated stream buffers.

- Promote planting of native vegetation and landscaping.

Specific recommendations are included in this report on pages 24-26

2. Place Making in the NJ 42 Corridor

Issue:

Sprawl development has been implicated in the creation of public spaces that lack a sense of place. It is also associated with a pattern of development that provides limited alternatives to the personal automobile. Furthermore, it consumes land inefficiently and increases costs for local government, which must frequently duplicate infrastructure.

Strategy:

The solutions to sprawl recognize that transportation and land use are interrelated. Study corridor municipalities should focus on retrofitting auto-dependent development patterns to support walkability and a mix of uses and to create a sense of place:

- Utilize context-sensitive solutions to fit roadway design and traffic movement to local context.
- Improve network connectivity of street systems to distribute traffic more evenly and ensure that safe travel options are available for all roadway users.
- Update zoning codes to allow developers to respond to market demand for "smart growth" development, including a mix of uses and walkable neighborhoods.
- Promote innovative parking practices in local ordinances, such as shared parking, flexible minimums, parking fees to manage demand, and improved stormwater design for parking.

Specific recommendations are included in this report on pages 36-39.

3. Access Management

Issue:

Although commercial and residential development is good for the local and regional economy, poorly planned development can lead to traffic problems that can be detrimental to a community. Access management is a relatively low-cost strategy to increase public safety, extend the life of major roadways, reduce congestion, and support alternative transportation modes.

Strategy:

Corridor-wide improvements include the following access management practices:

- Enhance the local street network.
- Improve internal circulation among businesses.
- Require shared access and shared parking where possible.
- Encourage mixed-use development on smaller parcels.

Site-specific improvements were suggested for three sites in the study corridor. Sites chosen exhibit characteristics typical of the corridor, and thus it may be possible to

implement these recommendations at other sites. The site-specific improvements are included in this report on pages 44-50.

4. Intersection Analysis

Issue:

The performance and safety of major intersections in the study corridor has a direct impact on mobility. The intersection analysis covered four intersections on the Black Horse Pike (NJ 42/ US 322) and six intersections on Berlin-Cross Keys Road.

Strategy:

Based on the results of the intersection analysis, traffic congestion and crashes can be reduced by implementing one or more of the following strategies:

- Optimize signal timing.
- Alter phasing of traffic signal.
- Add turning lanes.

Specific recommendations are included in this report on pages 66-75.

5. Median Analysis

Issue:

There are 54 Black Horse Pike median openings in the study corridor that serve intersecting streets and driveways or provide a U-turn opportunity. Overall, many of the median openings create unsafe conditions for drivers.

Strategy:

After evaluation, the 54 median openings have been divided into three categories for further action as follows:

- Retain median openings that are highly utilized and adequately designed.
- Close median openings that are unnecessary.
- Improve median openings; close other median openings pending these improvements.

Specific recommendations are included in this report on pages 77-83 and Appendix C.

6. Transit Analysis

Issue:

The study area is characterized by commercial strip-style development on NJ 42 and suburban residential development surrounding NJ 42. Employment centers are also concentrated along NJ 42. These development patterns contribute to the challenges faced by the bus system in the study corridor and underline the importance of Park-and-Ride facilities to attract transit commuters to NJ 42.

In addition, Routes 400 and 403 operate on the Black Horse Pike, where traffic congestion leads to delays.

Strategy:

Transit improvements should be directed at retaining current ridership and attracting new riders:

- Add Park-and-Ride locations along the Black Horse Pike or feeder roads to allow for expanded commuting options.
- Give buses traffic signal priority to ensure bus schedule adherence.
- Considering the rapid growth that is projected for the corridor, require developers to make a "fair share" contribution by funding bus pullouts, shelters, and amenities.

Specific recommendations for Park-and-Ride locations are included in this report on pages 88-89.

7. Bicycle Analysis

Issue:

One way of promoting bicycle use is to provide an interconnected network of clearly designated bicycle routes. The routes can provide a viable alternative to the use of the automobile for local travel. However, most study area arterial and collector roads were not designed with bicycles in mind and must be retrofitted to accommodate them.

Strategy:

There are several strategies that can improve roadway compatibility conditions for bicycle travel and increase overall bicycle safety.

- Streets with wider shoulders can be repainted to create bicycle lanes and still allow room for a shoulder or buffer between the road and sidewalk.
- In some cases, general-purpose travel lanes can be narrowed to 11 or 12 feet to accommodate the added bicycle lanes.
- Secure and convenient bicycle parking facilities can be built to better accommodate those who use bicycles for commuting or recreational purposes.

Four proposed bicycle routes are included in this report on pages 97-99.

8. Pedestrian Analysis

Issue:

The pedestrian analysis focused on two major roads with significant potential for commercial and residential foot traffic: Berlin – Cross Keys Road and the Black Horse Pike. On Berlin – Cross Keys Road, commercial/retail development is clustered at major intersections and residential neighborhoods are interspersed between them. On the Black Horse Pike, which is served by several NJ Transit bus routes, the main issue is access to transit.

Strategy:

There are several strategies that can create a safer pedestrian environment and promote walking as a mode of transportation:

- Sidewalks should exist on both sides of the street, extend continuously, and be accessible to those in wheelchairs.
- Along with sidewalks, buffers of four to six feet in width are necessary

between the sidewalk and road shoulder.
- Plant trees along buffers and integrate street furniture (such as benches) into more traveled areas.

Specific recommendations are included in this report on pages 101-104.

9.2 Strategic Implementation Plan

Development of a strategic implementation plan for the corridor is based upon the inventory of land use and environmental resources, the transportation needs and the economic development strategy, in conformance with the policy goals and objectives of the New Jersey State Plan, DVRPC's Year 2035 Land Use and Transportation Plan, and local municipal plans. This implementation plan will include a definition of the roles and responsibilities of all affected agencies for each improvement project.

The *NJ 42 Corridor Study* can be used as a dynamic long range tool for the systematic selection of projects to create a significantly improved natural and built environment within the study area. This document can serve as a *punch list* for the government agencies with a stake in the implementation of improvements.

Characteristics

In choosing which projects should advance first, stakeholders can be guided by the information presented in Table 15 *NJ 42 Corridor Improvements Implementation Matrix*. Each improvement scenario identified is evaluated in terms of project priority, cost range and project benefits. The stakeholders necessary to carry out the plan are also identified.

Priority

Priorities are estimated in terms of three categories: high, moderate and low. Priorities are assigned to transportation issues based on the perception of the extent of the problems they present drivers, with safety being most important, but congestion (or time delay) and mobility also being considered. If a project is relatively small scale and low cost, yet offers a projected high benefit, it also receives a higher priority ranking.

Cost Range

Costs are also assigned to categories of high, moderate and low. High cost projects usually involve a major commitment from one or more funding source, lengthy public involvement and several years lead time in programming the required funds. They are typically large scale, complex or multi-phased improvements and can entail the construction of new facilities. In general, a project in this category is estimated to cost between $5 and $35 million, however some major projects have been known to cost in the hundreds of millions of dollars. An improvement estimated to have a moderate cost could involve a major reconstruction of an intersection, construction of a short connector road or a widening of an existing road. In general, a project in this category

is estimated to cost between $2 and $5 million. Low cost projects are often operational type improvements at isolated locations and typically cost less than $2 million.

Benefits

Benefits describe the kind of impact the improvement will yield, such as enhancing safety, lessening congestion, improving mobility or encouraging economic development. Economic development benefits are derived from a transportation improvement generally through an increase in the accessibility of affected individual properties or areas. The increased level of access to a property may make it attractive enough to induce new commercial or residential development or entice existing land uses to expand. Increased accessibility can also have a positive effect on property values.

Roles of Agencies

In terms of a hierarchy of agencies, the New Jersey Department of Transportation (NJDOT) is primary, both in terms of maintaining NJ 42 and US 322 as well as providing much of the design, right-of-way and construction funding for major improvements. The county has jurisdiction over a network of roads throughout the study area. In New Jersey, county roads are given 500, 600 or 700 route designations. The county has the ultimate decision concerning improvements on county roads but typically coordinates with the municipality in which the improvement is located. Municipalities make land use decisions in the corridor, which ultimately affect traffic levels within the corridor. In addition, many of the cross streets are designed, built and maintained by local and county government, and these also impact how well the state routes function. Lastly, developers actually build the housing, commercial and industrial projects which generate the trips which must be accommodated by a publicly-owned transportation infrastructure. In addition, some the transportation improvements themselves are designed and financed by developers.

DVRPC, serving as the MPO for this region, is required to coordinate a comprehensive and continuing transportation planning process. This process results in the development of a Transportation Improvement Program (TIP) which identifies all priority projects for which federal funds will be sought. The TIP represents a consensus among state and regional officials as to what regional improvements are to be made. In addition to the TIP, the MPO is required by federal legislation to develop a long range plan to help direct region-wide transportation decision making over a period of at least 20 years. Long range plans do not specify the design of actual projects. Rather, they identify future needs to address transportation deficiencies.

TABLE 15

NJ 42 Corridor Improvements Implementation Matrix

	Improvement (Location)	*Priority*	*Cost Range*	*Benefits*	*Lead Role*	*Assisting Role*
1	Mandatory review process for site plans that will create large areas of impervious surface. (Corridor-Wide)	H	L	Water	MCD	Co, DEP
2	Inspection and maintenance program for stormwater facilities. (Corridor-Wide)	M	L	Water	MCD	Co, DEP
3	Revise municipal code to limit impervious coverage and increase pervious coverage. (Corridor-Wide)	H	L	Water	MCD	Co, DEP
4	"Green Streets" program. (Corridor-Wide)	M	L	Place, Water	DOT/ MCD	DEP
5	Inventory parcels: greenspace network. (Corridor-Wide.)	H	L	SCP, Water	MCD	Co
6	Municipal stream corridor protection ordinances with buffers of 300 feet in environmentally sensitive areas. (Corridor-Wide)	H	L	SCP, Water	MCD	Co
7	Educate landowners about creating and maintaining stream buffers. (Corridor-Wide)	M	L	SCP, Water	MCD	Co, Non Prof
8	Promote planting of native vegetation and landscaping. (Corridor-Wide)	M	L	SCP, Water	MCD	Co
9	Context-sensitive solutions. (Corridor-Wide)	M	L	Safe, Place, Mobl	MCD/ DOT	Co
10	Network connectivity. (Corridor-Wide)	H	M	Safe, Mobl	MCD	Co, DOT

TABLE 15

NJ 42 Corridor Improvements Implementation Matrix

	Improvement (Location)	*Priority*	*Cost Range*	*Benefits*	*Lead Role*	*Assisting Role*
11	Smart Growth zoning. (Corridor-Wide)	H	L	Place, Safe	MCD	Co
12	Innovative parking practices. (Corridor-Wide.)	M	L	Cong, Mobl, Safe	MCD	Co
13	Enhance local street network. (Access Management site)	H	M	Cong, Safe	MCD/ DOT	Co
14	Improve internal circulation among businesses. (Access Management site)	M	L	Cong, Safe	MCD	Co, DOT
15	Require shared access and shared parking. (Access Management site)	H	L	Cong, Safe	MCD	Co, DOT
16	Mixed use development on smaller parcels. (Access Management site)	M	L	Cong, Safe	MCD	Co, DOT
17	Intersection of NJ 42 and Berlin – Cross Keys Road (Washington Twp., Monroe Twp.)	M	M	Cong, Safe	Co	DOT, MCD
18	Intersection of NJ 42/US 322 and Sicklerville Road (Monroe Twp.)	L	L	Cong	Co	DOT, MCD
19	Intersection of US 322 and Poplar Street/New Brooklyn Road (Monroe Twp.)	M	M	Cong	Co	DOT, MCD
20	Intersection of US 322 and Corkery Lane (Monroe Twp.)	M	L	Cong	Co	DOT, MCD
21	Intersection of Berlin – Cross Keys Road and Johnson Road (Gloucester Twp., Winslow Twp.)	L	L	Cong	Co	DOT, MCD

TABLE 15

NJ 42 Corridor Improvements Implementation Matrix

	Improvement (Location)	*Priority*	*Cost Range*	*Benefits*	*Lead Role*	*Assisting Role*
22	Intersection of Berlin – Cross Keys Road and Atlantic City Expressway, On- and Off-Ramps (Gloucester Twp., Winslow Twp.)	H	H	Cong, Safe	Co/ DOT	MCD
23	Intersection of Berlin – Cross Keys Road and Sicklerville Road (Gloucester Twp., Winslow Twp.)	H	L	Cong, Safe	Co	DOT, MCD
24	Intersection of Berlin – Cross Keys Road and Williamstown Road/Chews Landing Road (Gloucester Twp., Winslow Twp.)	L	L	Cong	Co	DOT, MCD
25	Close median openings. (Washington Twp., Monroe Twp.)	H	L	Safe	MCD	Co, DOT
26	Improve median openings. (Washington Twp., Monroe Twp.)	H	L	Mobl, Safe	MCD	Co, DOT
27	Add Park-and-Ride locations. (Corridor-Wide.)	H	L	Air, Mobl	MCD	Co, DOT
28	Construct bicycle route. (Corridor-Wide.)	M	L	Air, Safe	MCD	Co
29	Construct sidewalk. (Corridor-Wide.)	M	L	Safe	MCD	Co

Key:

Priority: H = High, M = Moderate, L = Low
Cost Range: H = High, M = Moderate, L = Low
Benefits: Air = Air Quality, Cong = Congestion, Mobl = Mobility, Place = Sense of Place, Safe = Safety, SCP = Stream Corridor Protection, Water = Water Quality
Role: Co = county, DEP = NJ Department of Environmental Protection, DOT = NJ Department of Transportation, MCD = municipality, Non Prof = Non-Profit Environmental Group

APPENDIX A: Environmental Justice Analysis

As part of Title VI of the Civil Rights Act of 1964 and the 1994 President's Executive Order on Environmental Justice (EJ), DVRPC adopted guidelines to help mitigate potential direct and disparate impacts of transportation projects and programs on defined historically disadvantaged groups. DVRPC employs an environmental justice methodology that quantifies levels of disadvantage within the nine-county region. Using 2000 census tract information, categories of eight potential disadvantaged groups are analyzed, including female head of household with child, non-Hispanic minority, Hispanic, carless households, impoverished, elderly over 75 years of age, physically disabled, and limited English proficiency. Each category is analyzed for the total concentration in the region, generating a baseline number. If a census tract contains a concentration higher than the baseline threshold, it is considered disadvantaged. Census tracts can therefore contain zero to eight degrees of disadvantage (DOD).

Nineteen of the census tracts shown on Map A-1: Environmental Justice are located wholly or partly within the study area. The overall occurrence of degrees of disadvantage near NJ 42 is low: two census tracts contain three DOD, six census tracts contain two DOD, and four census tracts contain one DOD. There are seven census tracts with zero DOD.

In looking at the categories of disadvantaged populations, there are no census tracts that are sensitive for households in poverty, limited English proficiency, or Hispanic populations, while only one census tract is sensitive for carless households, as illustrated in Table A-1. In contrast, seven census tracts are sensitive for female held of household with child (FHHC) and physically disabled populations.

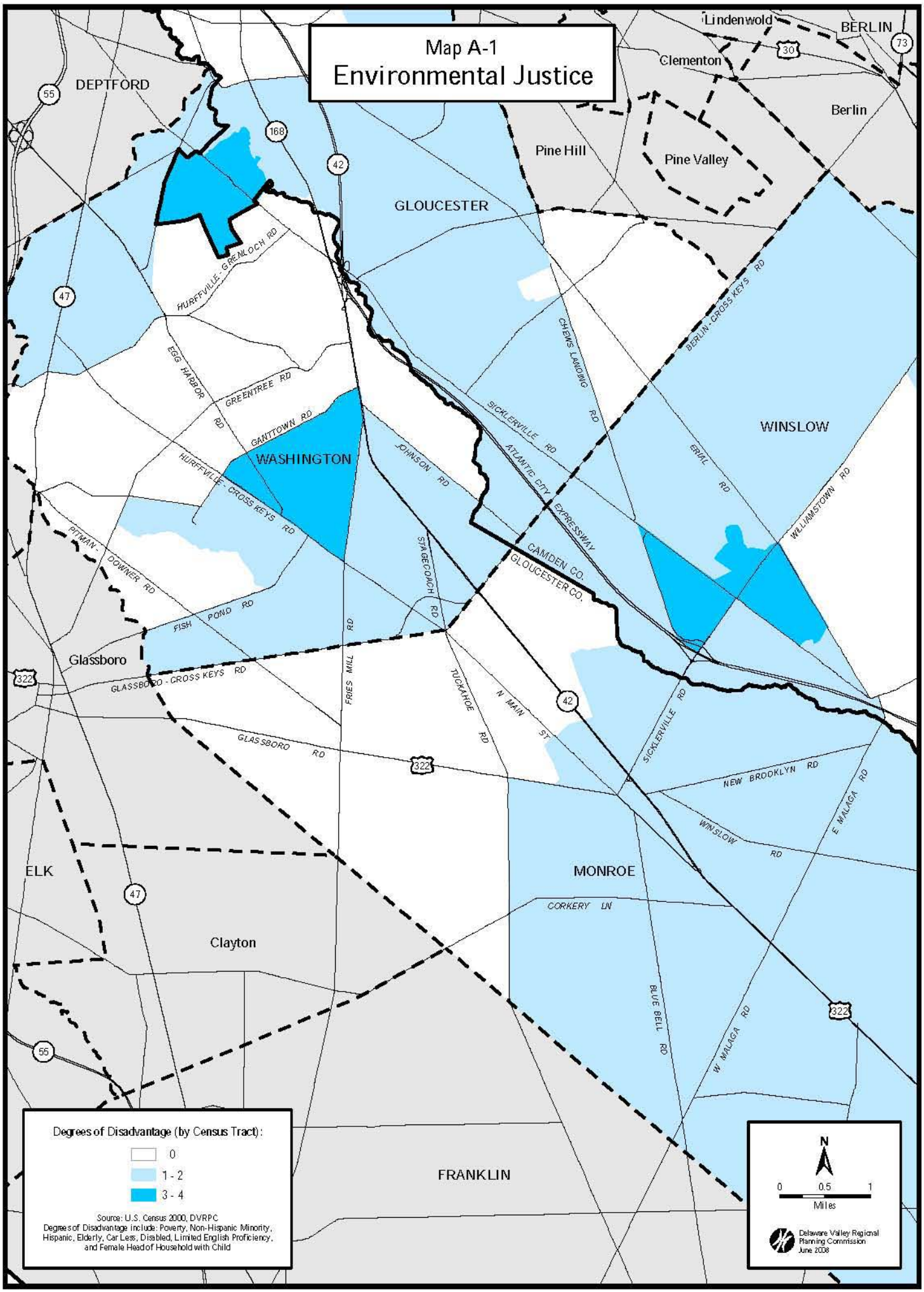
Table A-1: Degrees of Disadvantage by Type

Population Group	Number of DOD Tracts	Regional Threshold
Minority	4	24%
Carless Households	1	16%
Poverty	0	11%
Female Head of House with Child	7	8%
Elderly: Over 75	3	7%
Physically Disabled	7	7%
Hispanic	0	5%
LEP	0	2%

Source: DVRPC, 2008

The concentrations of the populations also need to be mentioned. Two census tracts in Winslow Township have minority concentrations of 62 and 71 percent, respectively, both twice the regional average. Several census tracts have FHHC and physically disabled concentrations which also approach twice the regional average. The higher concentrations of these two populations suggest that extra importance should be placed on the pedestrian environment, especially ADA accessibility. Outreach into the community is recommended to gauge any impacts or concerns this project may have on these three populations.

Although indicators point to a relatively low level of disadvantage within the NJ 42 study area, it is important to recognize this is only a broad-brush tool. For example, while only one census tract is considered sensitive for carless households, meaning a concentration of over 16 percent, there are over 1,800 households without cars in the study area.


Map A-1
Environmental Justice
Lindenwold
BERLIN
Clementon
Berlin
Pine Hill
Pine Valley
DEPTFORD
GLOUCESTER
WASHINGTON
WINSLOW
Glassboro
ELK
Clayton
MONROE
FRANKLIN
HURFFVILLE - GREENLOCH RD
EGG HARBOR RD
GREENTREE RD
GANTTOWN RD
HURFFVILLE - CROSS KEYS RD
PITMAN - DOWNER RD
FISH POND RD
GLASSBORO - CROSS KEYS RD
GLASSBORO RD
FRIES MILL RD
STAGECOACH RD
JOHNSON RD
CHEWS LANDING RD
SICKLERVILLE RD
ATLANTIC CITY EXPRESSWAY
CAMDEN CO.
GLOUCESTER CO.
BERLIN - CROSS KEYS RD
ERIAL RD
WILLIAMSTOWN RD
TUCKAHOE RD
N MAIN ST
SICKLERVILLE RD
NEW BROOKLYN RD
WINSLOW RD
E MALAGA RD
CORKERY LN
BLUE BELL RD
W MALAGA RD
55
47
168
42
322
30
73
Degrees of Disadvantage (by Census Tract):
0
1 - 2
3 - 4
Source: U.S. Census 2000, DVRPC
Degrees of Disadvantage include: Poverty, Non-Hispanic Minority, Hispanic, Elderly, Car Less, Disabled, Limited English Proficiency, and Female Head of Household with Child
N
0
0.5
1
Miles
Delaware Valley Regional Planning Commission
June 2008

APPENDIX B: Crash Analysis (2004 – 2006)

Intersection of NJ 42 & Berlin-Cross Keys Rd. (Rt. 689)

	2004		2005		2006		Total	
	Crash	Percent	Crash	Percent	Crash	Percent	Crash	Percent
Crash								
Reportable	20	30%	26	39%	21	31%	67	100%
Crash Type								
Rear End (Same Direction)	10	50%	9	35%	8	38%	27	40%
Sideswipe (Same Direction)	0	0%	3	12%	4	19%	7	10%
Right Angle	2	10%	6	23%	4	19%	12	18%
Left Turn/U Turn	3	15%	5	19%	5	24%	13	19%
Hit Parked Vehicle	0	0%	0	0%	0	0%	0	0%
Head On	0	0%	0	0%	0	0%	0	0%
Pedestrian	1	5%	1	4%	0	0%	2	3%
Bicycle	0	0%	0	0%	0	0%	0	0%
Other	4	20%	2	8%	0	0%	6	9%
Lighting Conditions								
Day	10	50%	12	46%	13	62%	35	52%
Night	10	50%	14	54%	7	33%	31	46%
Dawn	0	0%	0	0%	1	5%	1	1%
Dusk	0	0%	0	0%	0	0%	0	0%
Severity								
Fatality	0	0%	0	0%	0	0%	0	0%
Injury	5	25%	11	42%	6	29%	22	33%
Property	15	75%	15	58%	15	71%	45	67%
Weather Conditions								
Dry	15	75%	22	85%	18	86%	55	82%
Wet	4	20%	3	12%	3	14%	10	15%
Snowy	1	5%	1	4%	0	0%	2	3%
Icy	0	0%	0	0%	0	0%	0	0%

Source: NJDOT and DVRPC, 2008

Intersection of NJ 42 & Sicklerville Rd. (Rt. 536 Spur)

	2004		2005		2006		Total	
	Crash	Percent	Crash	Percent	Crash	Percent	Crash	Percent
Crash								
Reportable	8	32%	13	52%	4	16%	25	100%
Crash Type								
Rear End (Same Direction)	2	25%	5	38%	3	75%	10	40%
Sideswipe (Same Direction)	1	13%	5	38%	0	0%	6	24%
Right Angle	1	13%	1	8%	0	0%	2	8%
Left Turn/U Turn	1	13%	0	0%	1	25%	2	8%
Hit Parked Vehicle	3	38%	0	0%	0	0%	3	12%
Head On	0	0%	0	0%	0	0%	0	0%
Pedestrian	0	0%	0	0%	0	0%	0	0%
Bicycle	0	0%	0	0%	0	0%	0	0%
Other	0	0%	2	15%	0	0%	2	8%
Lighting Conditions								
Day	4	50%	9	69%	3	75%	16	64%
Night	4	50%	4	31%	1	25%	9	36%
Dawn	0	0%	0	0%	0	0%	0	0%
Dusk	0	0%	0	0%	0	0%	0	0%
Severity								
Fatality	0	0%	0	0%	0	0%	0	0%
Injury	1	13%	3	23%	3	75%	7	28%
Property	7	88%	10	77%	1	25%	18	72%
Weather Conditions								
Dry	8	100%	9	69%	3	75%	20	80%
Wet	0	0%	3	23%	1	25%	4	16%
Snowy	0	0%	0	0%	0	0%	0	0%
Icy	0	0%	1	8%	0	0%	1	4%

Source: NJDOT and DVRPC, 2008

Intersection of NJ 322 & Poplar St./ New Brooklyn Rd. (Rte. 536)

	2004		2005		2006		Total	
	Crash	Percent	Crash	Percent	Crash	Percent	Crash	Percent
Crash								
Reportable	7	23%	14	45%	10	32%	31	100%
Crash Type								
Rear End (Same Direction)	1	14%	3	21%	4	40%	8	26%
Sideswipe (Same Direction)	3	43%	2	14%	0	0%	5	16%
Right Angle	1	14%	4	29%	3	30%	8	26%
Left Turn/U Turn	1	14%	1	7%	3	30%	5	16%
Hit Parked Vehicle	0	0%	0	0%	0	0%	0	0%
Head On	0	0%	0	0%	0	0%	0	0%
Pedestrian	0	0%	0	0%	0	0%	0	0%
Bicycle	0	0%	0	0%	0	0%	0	0%
Other	1	14%	4	29%	0	0%	5	16%
Day	7	100%	13	93%	7	70%	27	87%
Night	0	0%	1	7%	3	30%	4	13%
Dawn	0	0%	0	0%	0	0%	0	0%
Dusk	0	0%	0	0%	0	0%	0	0%
Severity								
Fatality	0	0%	0	0%	0	0%	0	0%
Injury	3	43%	5	36%	6	60%	14	45%
Property	4	57%	9	64%	4	40%	17	55%
Weather Conditions								
Dry	5	71%	10	71%	9	90%	24	77%
Wet	2	29%	2	14%	1	10%	5	16%
Snowy	0	0%	2	14%	0	0%	2	6%
Icy	0	0%	0	0%	0	0%	0	0%

Source: NJDOT and DVRPC, 2008

Intersection of NJ 322 and Corkery Lane

	2004		2005		2006		Total	
	Crash	Percent	Crash	Percent	Crash	Percent	Crash	Percent
Crash								
Reportable	13	41%	10	31%	9	28%	32	100%
Crash Type								
Rear End (Same Direction)	4	31%	3	30%	2	22%	9	28%
Sideswipe (Same Direction)	0	0%	1	10%	0	0%	1	3%
Right Angle	4	31%	4	40%	1	11%	9	28%
Left Turn/U Turn	2	15%	2	20%	6	67%	10	31%
Hit Parked Vehicle	0	0%	0	0%	0	0%	0	0%
Head On	0	0%	0	0%	0	0%	0	0%
Pedestrian	0	0%	0	0%	0	0%	0	0%
Bicycle	0	0%	0	0%	0	0%	0	0%
Other	3	23%	0	0%	0	0%	3	9%
Lighting Conditions								
Day	8	62%	6	60%	6	67%	20	63%
Night	4	31%	3	30%	3	33%	10	31%
Dawn	0	0%	0	0%	0	0%	0	0%
Dusk	1	8%	1	10%	0	0%	2	6%
Severity								
Fatality	0	0%	0	0%	0	0%	0	0%
Injury	3	23%	4	40%	4	44%	11	34%
Property	10	77%	6	60%	5	56%	21	66%
Weather Conditions								
Dry	11	85%	8	80%	9	100%	28	88%
Wet	1	8%	2	20%	0	0%	3	9%
Snowy	0	0%	0	0%	0	0%	0	0%
Icy	1	8%	0	0%	0	0%	1	3%

Source: NJDOT and DVRPC, 2008

Intersection of Berlin-Cross Keys Rd. & Sicklerville Rd. (Rt. 705)

	2004		2005		2006		Total	
	Crash	Percent	Crash	Percent	Crash	Percent	Crash	Percent
Crash								
Reportable	32	31%	36	35%	35	34%	103	100%
Crash Type								
Rear End (Same Direction)	12	38%	16	44%	14	40%	42	41%
Sideswipe (Same Direction)	0	0%	5	14%	2	6%	7	7%
Right Angle	4	13%	3	8%	7	20%	14	14%
Left Turn/U Turn	7	22%	7	19%	7	20%	21	20%
Hit Parked Vehicle	0	0%	0	0%	1	3%	1	1%
Head On	3	9%	1	3%	0	0%	4	4%
Pedestrian	0	0%	0	0%	1	3%	1	1%
Bicycle	0	0%	0	0%	0	0%	0	0%
Other	6	19%	4	11%	3	9%	13	13%
Lighting Conditions								
Day	24	75%	26	72%	28	80%	78	76%
Night	7	22%	9	25%	4	11%	20	19%
Dawn	0	0%	1	3%	1	3%	2	2%
Dusk	1	3%	0	0%	2	6%	3	3%
Severity								
Fatality	0	0%	0	0%	0	0%	0	0%
Injury	12	38%	15	42%	15	43%	42	41%
Property	20	63%	21	58%	20	57%	61	59%
Weather Conditions								
Dry	23	72%	29	81%	27	77%	79	77%
Wet	8	25%	7	19%	8	23%	23	22%
Snowy	1	3%	0	0%	0	0%	1	1%
Icy	0	0%	0	0%	0	0%	0	0%

Source: NJDOT and DVRPC, 2008

Cross Keys Bypass between Hurffville-Cross Keys Rd. & Tuckahoe Rd.

	2004		2005		2006		Total	
	Crash	Percent	Crash	Percent	Crash	Percent	Crash	Percent
Crash								
Reportable	18	64%	10	36%	0	0%	28	100%
Crash Type								
Rear End (Same Direction)	6	33%	2	20%	0	0%	8	29%
Sideswipe (Same Direction)	0	0%	1	10%	0	0%	1	4%
Right Angle	2	11%	4	40%	0	0%	6	21%
Left Turn/U Turn	4	22%	1	10%	0	0%	5	18%
Hit Parked Vehicle	0	0%	0	0%	0	0%	0	0%
Head On	0	0%	0	0%	0	0%	0	0%
Pedestrian	0	0%	0	0%	0	0%	0	0%
Bicycle	0	0%	0	0%	0	0%	0	0%
Other	6	33%	2	20%	0	0%	8	29%
Lighting Conditions								
Day	8	44%	7	70%	0	0%	15	54%
Night	9	50%	3	30%	0	0%	12	43%
Dawn	0	0%	0	0%	0	0%	0	0%
Dusk	1	6%	0	0%	0	0%	1	4%
Severity								
Fatality	0	0%	1	10%	0	0%	1	4%
Injury	5	28%	2	20%	0	0%	7	25%
Property	13	72%	7	70%	0	0%	20	71%
Weather Conditions								
Dry	11	61%	6	60%	0	0%	17	61%
Wet	3	17%	2	20%	0	0%	5	18%
Snowy	2	11%	2	20%	0	0%	4	14%
Icy	2	11%	0	0%	0	0%	2	7%

Source: NJDOT and DVRPC, 2008

Intersection of Berlin-Cross Keys, Hurffville-Cross Keys/ North Main St. & Tuckahoe Rd.

	2004		2005		2006		Total	
	Crash	Percent	Crash	Percent	Crash	Percent	Crash	Percent
Crash								
Reportable	29	50%	18	31%	11	19%	58	100%
Crash Type								
Rear End (Same Direction)	12	41%	9	50%	5	45%	26	45%
Sideswipe (Same Direction)	2	7%	2	11%	1	9%	5	9%
Right Angle	4	14%	0	0%	0	0%	4	7%
Left Turn/U Turn	7	24%	4	22%	4	36%	15	26%
Hit Parked Vehicle	0	0%	0	0%	0	0%	0	0%
Head On	0	0%	0	0%	0	0%	0	0%
Pedestrian	0	0%	0	0%	0	0%	0	0%
Bicycle	0	0%	0	0%	0	0%	0	0%
Other	4	14%	3	17%	1	9%	8	14%
Lighting Conditions								
Day	24	83%	16	89%	7	64%	47	81%
Night	5	17%	1	6%	3	27%	9	16%
Dawn	0	0%	1	6%	1	9%	2	3%
Dusk	0	0%	0	0%	0	0%	0	0%
Severity								
Fatality	0	0%	0	0%	0	0%	0	0%
Injury	9	31%	4	22%	5	45%	18	31%
Property	20	69%	14	78%	6	55%	40	69%
Weather Conditions								
Dry	23	79%	11	61%	8	73%	42	72%
Wet	5	17%	3	17%	3	27%	11	19%
Snowy	0	0%	4	22%	0	0%	4	7%
Icy	1	3%	0	0%	0	0%	1	2%

Source: NJDOT and DVRPC, 2008

Intersection of Berlin-Cross Keys Rd. & Fries Mill Rd.

	2004		2005		2006		Total	
	Crash	Percent	Crash	Percent	Crash	Percent	Crash	Percent
Crash								
Reportable	22	29%	28	36%	27	35%	77	100%
Crash Type								
Rear End (Same Direction)	7	32%	9	32%	8	30%	24	31%
Sideswipe (Same Direction)	3	14%	4	14%	2	7%	9	12%
Right Angle	6	27%	6	21%	8	30%	20	26%
Left Turn/U Turn	5	23%	7	25%	8	30%	20	26%
Hit Parked Vehicle	0	0%	0	0%	0	0%	0	0%
Head On	0	0%	1	4%	0	0%	1	1%
Pedestrian	0	0%	0	0%	0	0%	0	0%
Bicycle	0	0%	0	0%	0	0%	0	0%
Other	1	5%	1	4%	1	4%	3	4%
Lighting Conditions								
Day	17	77%	19	68%	21	78%	57	74%
Night	3	14%	7	25%	6	22%	16	21%
Dawn	0	0%	0	0%	0	0%	0	0%
Dusk	2	9%	1	4%	0	0%	3	4%
Other/Unknown	0	0%	1	4%	0	0%	1	1%
Severity								
Fatality	0	0%	0	0%	0	0%	0	0%
Injury	9	41%	13	46%	15	56%	37	48%
Property	13	59%	15	54%	12	44%	40	52%
Weather Conditions								
Dry	15	68%	23	82%	21	78%	59	77%
Wet	6	27%	5	18%	6	22%	17	22%
Snowy	1	5%	0	0%	0	0%	1	1%
Icy	0	0%	0	0%	0	0%	0	0%

Source: NJDOT and DVRPC, 2008

AC Expressway Interchange at Berlin Cross Keys Rd. (Rte. 689)

	2004		2005		2006		Total	
	Crash	Percent	Crash	Percent	Crash	Percent	Crash	Percent
Crash								
Reportable	33	31%	38	36%	36	34%	107	100%
Crash Type								
Rear End (Same Direction)	13	39%	16	42%	11	31%	40	37%
Sideswipe (Same Direction)	5	15%	5	13%	8	22%	18	17%
Right Angle	7	21%	4	11%	0	0%	11	10%
Left Turn/U Turn	7	21%	9	24%	15	42%	31	29%
Hit Parked Vehicle	0	0%	0	0%	0	0%	0	0%
Head On	0	0%	2	5%	0	0%	2	2%
Pedestrian	0	0%	0	0%	0	0%	0	0%
Bicycle	0	0%	0	0%	0	0%	0	0%
Other	1	3%	2	5%	2	6%	5	5%
Lighting Conditions								
Day	21	64%	26	68%	27	75%	74	69%
Night	11	33%	11	29%	7	19%	29	27%
Dawn	0	0%	1	3%	0	0%	1	1%
Dusk	1	3%	0	0%	2	6%	3	3%
Severity								
Fatality	0	0%	0	0%	0	0%	0	0%
Injury	13	39%	11	29%	7	19%	31	29%
Property	20	61%	27	71%	29	81%	76	71%
Weather Conditions								
Dry	23	70%	31	82%	33	92%	87	81%
Wet	9	27%	7	18%	2	6%	18	17%
Snowy	0	0%	0	0%	0	0%	0	0%
Icy	0	0%	0	0%	0	0%	0	0%
Other	1	3%	0	0%	1	3%	2	2%

Source: NJDOT and DVRPC, 2008

Sicklerville Rd./ Williamstown Rd. between AC Expressway & Chews Landing Rd.

	2004		2005		2006		Total	
	Crash	Percent	Crash	Percent	Crash	Percent	Crash	Percent
Crash								
Reportable	14	36%	11	28%	14	36%	39	100%
Crash Type								
Rear End (Same Direction)	4	29%	3	27%	2	14%	9	23%
Sideswipe (Same Direction)	4	29%	2	18%	0	0%	6	15%
Right Angle	3	21%	2	18%	5	36%	10	26%
Left Turn/U Turn	1	7%	2	18%	7	50%	10	26%
Hit Parked Vehicle	0	0%	0	0%	0	0%	0	0%
Head On	0	0%	0	0%	0	0%	0	0%
Pedestrian	0	0%	0	0%	0	0%	0	0%
Bicycle	0	0%	0	0%	0	0%	0	0%
Other	2	14%	2	18%	0	0%	4	10%
Lighting Conditions								
Day	12	86%	5	45%	10	71%	27	69%
Night	2	14%	5	45%	3	21%	10	26%
Dawn	0	0%	1	9%	1	7%	2	5%
Dusk	0	0%	0	0%	0	0%	0	0%
Severity								
Fatality	0	0%	0	0%	0	0%	0	0%
Injury	3	21%	3	27%	8	57%	14	36%
Property	11	79%	8	73%	6	43%	25	64%
Weather Conditions								
Dry	12	86%	9	82%	14	100%	35	90%
Wet	2	14%	1	9%	0	0%	3	8%
Snowy	0	0%	0	0%	0	0%	0	0%
Icy	0	0%	1	9%	0	0%	1	3%

Source: NJDOT and DVRPC, 2008

APPENDIX C: Median Openings and Recommended Actions—Detailed Listing

Median Openings to be Retained

ID #	Municipality	Nearest Cross Street/Business	Mile Post (Primary Direction)	Primary Type	Secondary Type	Distance from Previous Median Break	Median Width	Posted Speed Limit (MPH)	Length of Break (ft)	Length of Storage (ft)	Length of Taper (ft)
1	Washington Twp	Shopping Center, NJ Transit Bus Depot	NJ 42 - 6.17	Signalized Intersection			20	45			
2	Washington Twp	Greentree Rd	NJ 42 - 5.78	Signalized Intersection		0.39	20	45			
3	Washington Twp	Whitman Dr	NJ 42 - 5.67	Signalized Intersection		0.11	20	45			
5	Washington Twp	Ganttown Rd	NJ 42 - 5.3	Signalized Intersection		0.20	20	45			
7	Washington Twp	McKinley Ave	NJ 42 - 5.01	Unsignalized Single Cross-Street	Unsignalized Multiple Parcel Access	0.09	20	45	23	0	0
8	Washington Twp	Fries Mill Rd	NJ 42 - 4.92	Signalized Intersection	Signalized Single Parcel Access	0.09	20	45/50			
12	Washington Twp	Madison Ave	NJ 42 - 4.24	Unsignalized Single Cross-Street	Southbound Left/U-Turn	0.31	20	50	64	125	110
14	Washington Twp	Watson Dr	NJ 42 - 4.03	Signalized Intersection	Single Parcel Access	0.17	20	50			
16	Washington Twp	Tuckahoe Rd, Stagecoach Rd	NJ 42 - 3.51	Signalized Intersection		3.80	20/30	50			
20	Washington Twp	Highland Ave	NJ 42 - 2.9	Unsignalized Single Cross-Street	Northbound Left/U-Turn	0.17	30	50	58	120	125
22	Washington Twp/ Monroe Twp	Berlin - Cross Keys Rd	NJ 42 - 2.62	Signalized Intersection		0.28	30	50			
25	Monroe Twp	Prosser Ave	NJ 42 - 2.28	Unsignalized Single Cross-Street	Northbound Left/U-Turn	0.22	30	50	60	110	145
27	Monroe Twp	Kennedy Dr	NJ 42 - 2.09	Signalized Intersection	Northbound Left/U-Turn	0.11	30	50			
29	Monroe Twp	Williamstown Pavilion	NJ 42 - 1.7	Unsignalized Multiple Parcel Access	Northbound Left/U-Turn	0.05	30	50	60	115	130
31	Monroe Twp	Laurel Ave	NJ 42 - 1.5	Unsignalized Single Cross-Street	Southbound Left/U-Turn	0.14	30	50	67	120	145
33	Monroe Twp	Grandview Ave	NJ 42 - 1.29	Unsignalized Single Cross-Street	Northbound Left/U-Turn, Unsignalized Single Parcel Access	0.11	30	50	58	105	150
34	Monroe Twp	Brookdale Blvd	NJ 42 - 1.15	Unsignalized Single Cross-Street	Southbound Left/U-Turn	0.14	30	50	57	135	180
35	Monroe Twp	Lake Ave	NJ 42 - 0.78	Signalized Intersection		0.37	30	50			
36	Monroe Twp	Maxine Ave	NJ 42 - 0.63	Unsignalized Single Cross-Street	Northbound Left/U-Turn, Unsignalized Single Parcel Access	0.15	30	50	69	120	135
37	Monroe Twp	Pedrick Ave, Hoffman Ave	NJ 42 - 0.42	Unsignalized Single Cross-Street	Northbound Left/U-Turn, Unsignalized Multiple Parcel Access	0.21	30	50	59	115	145
38	Monroe Twp	May Ave	NJ 42 - 0.29	Unsignalized Single Cross-Street	Southbound Left/U-Turn, Unsignalized Single Parcel Access	0.13	30	50	59	110	145
39	Monroe Twp	Sicklerville Rd	NJ 42 - 0.00	Signalized Intersection		0.29	30	50			
40	Monroe Twp	Poplar - New Brooklyn Rd	US 322 - 24.67	Signalized Intersection		0.20	30	50			
54	Monroe Twp	S Main St	US 322 - 25.68	Signalized Intersection		0.08	30	50	23	0	0

Source: Delaware Valley Regional Planning Commission, June 2008

Median Openings with Opportunities for Improvement

ID #	Municipality	Nearest Cross Street/Business	Mile Post (Primary Direction)	Primary Type	Secondary Type	Distance from previous Median Break	Median Width	Posted Speed (MPH)	Length of Break (ft)	Length of Storage (ft)	Length of Taper (ft)	Desired Outcome	Recommended Improvements
4	Washington Twp	Whitman Plaza	NJ 42 - 5.5	Unsignalized Multiple Parcel Access	Southbound Left/U-Turn	0.17	20	45	33	285	120	Augmentation	Prohibit Southbound U-Turns
6	Washington Twp	Johnson Rd	NJ 42 - 5.1	Signalized Intersection		0.20	20	20	45			Augmentation	Provide more sufficient local street access. Connect Willow St to the intersection of Black Horse Pike and Johnson Rd. Build northbound left/u-turn lane at the intersection.
10	Washington Twp	(Former) Lone Star Steakhouse	NJ 42 - 4.7	Unsignalized Single Parcel Access	Northbound Left/ U-Turn	0.15	20	50	44	125	120	Augmentation	Prohibit Northbound U-Turns
15	Washington Twp	Applebees	NJ 42 - 3.8	Unsignalized Single Parcel Access	Southbound Left/ U-Turn	0.23	20	50	25	200	200	Augmentation	Numerous curb cuts. Improve access and circulation with a frontage road along northbound NJ 42
18	Washington Twp	Ardmore Ave	NJ 42 - 3.36	Unsignalized Single Cross-Street	North and Southbound Left/ U-Turn	0.04	30	50	65	SB: 105 NB: 390	SB: 60 NB: 265	Augmentation	Prohibit Northbound moves
19	Washington Twp	Fairmount Dr	NJ 42 - 3.07	Unsignalized Full Cross-Street	Southbound Left/ U-Turn	0.29	30	50	66	190	150	Augmentation	Permit right-in, right-out only from westbound Fairmount Avenue
26	Monroe Twp	Georgia Ave	NJ 42 - 2.2	Unsignalized Single Cross-Street	Northbound Left/ U-Turn	0.08	30	50	68	115	120	Closure	NB improvement at #25. Improved internal access to adjacent properties, with access at #25. Longer northbound and southbound left-turn lanes at #27.
41	Monroe Twp	Washington Ave	US 322 - 24.81	Unsignalized Full Cross-Street	North/Southbound U-Turn	0.14	30	50	29	0	0	Augmentation	Insufficient and unsafe decelleration and storage opportunities. Build a north and southbound left and U-turn lane; potentially requires offset left-turn lanes.
43	Monroe Twp	Jefferson Ave	US 322 - 24.95	Unsignalized Full Cross-Street	North/Southbound U-Turn	0.15	30	50	33	0	0	Augmentation	Since many other adjacent medians are suggested for closure, #43 needs to be augmented to handle the transferred traffic demands. Same recommendations as to #41.
46	Monroe Twp	Walnut St	US 322 - 25.14	Unsignalized Full Cross-Street	North/Southbound U-Turn	0.04	30	50	21	0	0	Augmentation	Insufficient and unsafe decelleration and storage opportunities. Build a north and southbound left and U-turn lane; potentially requires offset left-turn lanes.
51	Monroe Twp	Nursery	US 322 - 25.5	Unsignalized Single Parcel Access	North/ Southbound U-Turn	0.10	30	50	24	0	0	Augmentation	#51 should be augmented to handle the transferred traffic demands. At this break, construct north and southbound left and U-turn lanes.

Source: Delaware Valley Regional Planning Commission, June 2008

Median Openings Recommended to be Closed

ID #	Municipality	Nearest Cross Street/Business	Mile Post (Primary Direction)	Primary Type	Secondary Type	Distance from previous Median Break	Median Width	Posted Speed (MPH)	Length of Break (ft)	Length of Storage (ft)	Length of Taper (ft)
9	Washington Twp	Unnamed Car Dealership	NJ 42 - 4.85	Unsignalized Single Parcel Access	Unsignalized Single Parcel Access	0.07	20	50	42	0	0
11	Washington Twp	Del Val Pool Store	NJ 42 - 4.55	Unsignalized Single Parcel Access	Northbound Left/ U-Turn	0.15	20	50	73	150	100
13	Washington Twp	Local Business	NJ 42 - 4.2	Unsignalized Single Parcel Access	Northbound Left/ U-Turn	0.04	20	50	59	125	125
17	Washington Twp	Turnersville Auto Mall	NJ 42 - 3.4	Unsignalized Multiple Parcel Access	Southbound Left/U-Turn	0.11	30	50	53	60	70
21	Washington Twp	Laurel Ave.	NJ 42 - 2.6	Unsignalized Single Parcel Access	Southbound Left/ U-Turn	0.30	30	50	66	100	150
23	Monroe Twp	Sam's Club	NJ 42 -]2.5	Unsignalized Multiple Parcel Access	Southbound Left/U-Turn	0.12	30	50	24	145	120
24	Monroe Twp	Franks Auto Repair Center	NJ 42 - 2.5	Unsignalized Single Parcel Access	Northbound Left/ U-Turn	0.00	30	50	63	115	125
28	Monroe Twp	Unnamed Garage	NJ 42 - 1.75	Unsignalized Single Parcel Access	Southbound Left/ U-Turn	0.34	30	50	58	90	170
30	Monroe Twp	Dewey Ave	NJ 42 - 1.64	Unsignalized Single Cross-Street	Southbound Left/U-Turn, Unsignalized Single Parcel Access	0.06	30	50	59	120	140
32	Monroe Twp	Columbus Manor	NJ 42 - 1.4	Unsignalized Single Parcel Access	Unsignalized Single Parcel Access	0.10	30	50	50	120	135
42	Monroe Twp	Unnamed	US 322 - 24.9	North/ Southbound U-Turn		0.01	30	50	22	0	0
44	Monroe Twp	Unnamed	US 322 - 25.0	North/ Southbound U-Turn		0.05	30	50	24	0	0
45	Monroe Twp	Unnamed	US 322 - 25.1	North/ Southbound U-Turn		0.20	30	50	25	0	0
47	Monroe Twp	Unnamed Parcel	US 322 - 25.2	Unsignalized Single Parcel Access	North/ Southbound U-Turn	0.06	30	50	24	0	0
48	Monroe Twp	Unnamed Parcel	US 322 - 25.3	Unsignalized Single Parcel Access	North/ Southbound U-Turn	0.10	30	50	23	0	0
49	Monroe Twp	Unnamed	US 322 - 25.4	North/ Southbound U-Turn		0.10	30	50	23	0	0
50	Monroe Twp	Unnamed Nursery	US 322 - 25.4	Unsignalized Single Parcel Access	North/ Southbound U-Turn	0.00	30	50	23	0	0
52	Monroe Twp	Unnamed Nursery	US 322 - 25.5	Unsignalized Single Parcel Access	North/ Southbound U-Turn	0.00	30	50	23	0	0
53	Monroe Twp	Unnamed Car Wash	US 322 - 25.6	Unsignalized Single Parcel Access	North/ Southbound U-Turn	0.10	30	50	23	0	0

Source: Delaware Valley Regional Planning Commission, June 2008

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Geographic Area Covered: The study area includes portions of Washington and Monroe townships in Gloucester County and Gloucester and Winslow townships in Camden County.

Key Words: sidewalks, context sensitive solutions, intersection analysis, crosswalks, level of service, access management, park-and-ride, pedestrian facilities, bus transit, traffic volume

Abstract: *This study addresses the problem of congested roadways largely caused by rapid suburban development and a lack of alternatives to the single-occupant vehicle within the NJ 42 corridor. Land use policies that encourage sprawl are evident in this corridor and this has impacted the environmental stability of the area. This study attempts to address these needs by identifying immediate as well as long-term context sensitive solutions that can improve traffic mobility, circulation, and safety, while protecting the integrity of the environment. A detailed write-up of the existing conditions and recommended improvement scenarios is presented. Improvements such as access management, improvement to the road network, signal timing, better pedestrian facilities and amenities and transit improvements have been identified and documented.*

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