

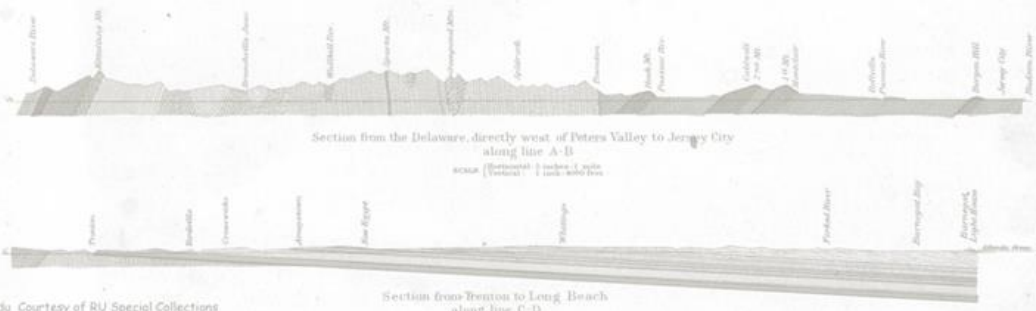
# Protecting and Restoring Places of Ecological Significance

## An Implementation Plan for the Kirkwood-Cohansey Aquifer Cluster

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## **Regional Profile**



The Kirkwood-Cohansey aquifer is the water embedded in the sands and gravel that make up the topmost geologic formations of New Jersey's outer coastal plain (see Figure 1.). It supplies approximately 90% of the base flow of the region's streams and rivers. This tight connection between the aquifer and surface waters led us to approach the aquifer as an interconnected *system*, rather than simply an underground reservoir. The aquifer's aerial extent is just under 2 million acres – about one-third of the entire state. It underlies the Pinelands National Reserve, much of southern New Jersey's Delaware River watershed, and most of the state's Delaware Bayshore region – covering all or part of all nine South Jersey counties.

The Kirkwood-Cohansey aquifer system provides more than 35 billion gallons of clean water each year to residents, farmers, businesses and industry throughout South Jersey. Sixty-five percent of this water goes to public water supply, with the balance used principally for agricultural irrigation. About one million residents, and millions more visitors, depend on the Kirkwood-Cohansey for drinking water. In addition to farmers who use the aquifer for irrigation, the region's cranberry industry uses vast amounts of Kirkwood-Cohansey water to maintain its cranberry bogs. All of these uses are effectively 100% depletive of the aquifer, as the region's sewer systems discharge virtually all public water directly into waterways leading to the ocean and irrigation water is lost to the atmosphere through evaporation and transpiration. A 2009 report by the U.S. Department of Agriculture identified South Jersey watersheds as one of the Northeastern United States' large-scale watersheds most critical to water supply and, therefore, most in need of protection.

The Kirkwood-Cohansey forms the shallow water table and supplies virtually all the water in streams, rivers, ponds, and wetlands within its area. Water moves through the aquifer in predictable ways. Since water in the aquifer flows toward nearby streams, the movement of water through the aquifer generally follows the surface topography that defines watersheds. Rain water that percolates into the aquifer just takes longer to reach a stream, wetland or estuary than water that falls on or flows directly into a stream. Watersheds, therefore, are critical to understanding both the natural dynamics of Kirkwood-Cohansey water and the ways human uses of the water and alteration of the landscape affect the aquifer.

About two-thirds of the aquifer's area (1,406,475 acres) lies within the Pinelands and Coastal Area Facilities Review Act (CAFRA) jurisdiction. But nearly one-third of the aquifer (557,959 acres) is outside of any regional planning and regulatory protections. As of 2007, 392,000 acres (20%) of the Kirkwood-Cohansey's area was already in urban and suburban development, with another 200,000 acres (10%) in upland agriculture (of which just over one-third is in the state's farmland preservation program). About 743,000 acres (38%) of the aquifer's area was in private ownership, not preserved, not yet developed and not wetlands – so potentially developable. Some of this land is in the Pinelands, and much of that land enjoys some degree of regulatory protection through the Pinelands Plan, though such protections could be lost if the Pinelands rules are changed or revoked. The rest is subject only to local zoning and must be considered as likely to be developed if not preserved.

### **The Pinelands**

Within the Pinelands, there are four major river systems. The largest is the Mullica River Watershed, encompassing the Mullica, Wading, Batsto and Oswego Rivers, empties into Great Bay and ultimately the Atlantic Ocean. The second largest watershed is the Rancocas Creek Watershed, the only one that drains to the west into the Delaware River. The Great Egg Harbor River Watershed includes the Great Egg Harbor and Tuckahoe Rivers and drains into Great Egg Harbor and then into the Atlantic Ocean. The smallest of the watersheds, located in Ocean County, is the Toms River Watershed. The New Jersey Department of Environmental Protection, however, considers the Toms River drainage area and four other smaller drainage areas as the Barnegat Bay Watershed. Another river

system that is not typically considered a “major” Pinelands river system is the Maurice River. However, portions of three Pinelands towns do drain into this river system.

One of the characteristic qualities of typical Pinelands streams is the unusual brown or ‘tea-colored’ appearance of the water. This color is the result of high iron content of iron and natural vegetative dyes such as tannin. Under natural conditions these streams and rivers are quite acidic, with a pH of 5.0 or less. Nitrogen and phosphorous concentrations are very low under natural conditions, with nitrate-nitrogen levels typically around 0.17 ppm as compared to the federal drinking water standard of 10 ppm. Because of the sandy nature of soils in the Pinelands, the area is very susceptible to surface and groundwater contamination.

It has been documented that pH and specific conductance are excellent indicators of the overall health of Pinelands water quality, because changes in natural water chemistry lead to changes in aquatic and wetland-dependent plant and animal communities – specifically, the displacement of native species with non-natives.<sup>1</sup> Agricultural and residential development causes Pinelands waters to have higher pH and specific conductance due to concentration of stormwater, fertilizing and liming of the soil and septic systems.

### **The Delaware Bayshore**

The Kirkwood-Cohansey aquifer system also supplies most of the water supply needs of the Delaware Bayshore, an area characterized by a cultural, physical and economic connection to the Delaware Bay and extends across Salem, Cumberland, and western Cape May Counties. These counties together make up an area of 1,482 square miles and are home to 319,598 full-time residents. This region is dominated by agricultural land, woodlands, forested wetlands, and tidal marshes.

In Salem, the least populated county (65,902 pop.), land uses tend toward smaller rural communities that are surrounded by row crop agriculture. In Cumberland County, while agriculture is the dominant land use, it also has several urbanized areas with significant concentrations of commercial and industrial uses including fishing and shellfish industries which still play an important role in Cumberland’s economy. Cape May County has much of the same mix of land uses, but it also experiences large economic and environmental impacts from tourism and seasonal population shifts.

The agricultural industry continues to be the largest economic driver in the region thanks to the availability of open land and high quality soils. All manner of agricultural products are grown including vegetables, nursery/horticulture plants, and fruits. In the summer months the vitality of the agriculture industry can be seen firsthand by a short drive through the area as corn, soybeans, and fruit trees line the roads.

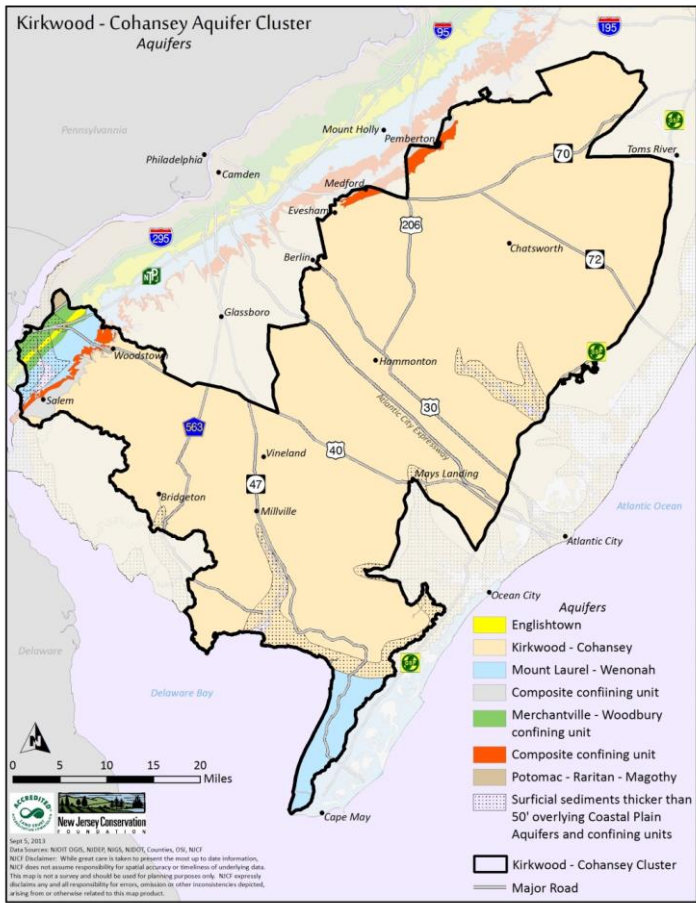
Industry exists in many forms within the Bayshore region. For many years, glass making and textiles were the staples of the local economy but today, the region has diversified into areas such prepared food production, manufacturing, and healthcare. Fishing and shellfish operations along the Delaware Bay have a long history which has faded in and out of economic relevance for the region. In the early 1900’s the shellfish operations along the bay employed thousands and created fortunes but the industry was hurt by overfishing and a parasite which led to a precipitous industry decline in the mid-1900’s. Today, attempts are being made to restore the shellfish populations of the Bayshore for their economic and ecological value.

With a rich history and spectacular natural areas, the environmental economy (ecotourism, agritourism, and historic tourism) has the potential to thrive in the Bayshore region. The diversity of habitats and their interconnections create a landscape unseen elsewhere in New Jersey. It is the availability of appropriate habitats that make the Bayshore an important stop for birds migrating along the North American Flyway. This unique landscape results from, and depends upon the water resources of the Kirkwood Cohansey aquifer system.

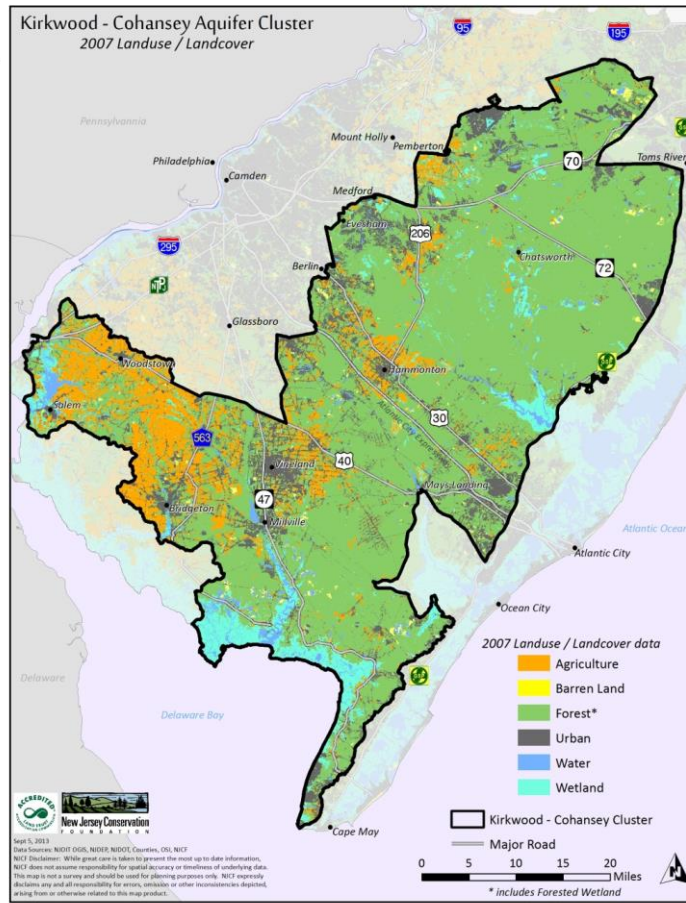
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<sup>1</sup> Charles L. Dow and Robert Zampella, 2000, Specific Conductance and pH as Indicators of Watershed Disturbance in Streams of the New Jersey Pinelands, USA, in Environmental Management Vol. 26, No. 4, pp. 437 -554, Springer-Verlag, New York Inc.

**Commented [CM1]:** This is a more specific standard than the language here implies and doesn't really go here. It is the permitted, predicted concentration at the boundary of a property to be developed.



**Figure 1.** Major surface aquifers of the Kirkwood-Cohansey Aquifer Cluster



**Figure 2.** Land use in the Kirkwood Cohansey Aquifer Cluster

## Conservation Objectives



The Kirkwood-Cohansey aquifer is the lifeblood of South Jersey's ecosystems and an essential resource for people and their communities throughout this region. The aquifer, however, is threatened by both systematic over-pumping to serve human demands and non-point source pollution associated with urban/suburban and agricultural development. Protecting the aquifer was the single most important justification for the Pinelands Protection Act and the growth management program initiated 34 years ago, and the aquifer sustains important natural and agricultural areas in the Delaware Bayshore that today have no regional planning program. Abuse of the aquifer represents a serious long-term threat to the entire Pinelands protection program. Throughout its extent, contamination of the aquifer and lack of stewardship of its natural landscapes threaten the aquifer's ability to support human, plant and wildlife communities of the region. This plan aims to address the key stressors affecting the aquifer and the natural and human communities which rely upon it.

### **Key Stressors**

Because it is a surficial aquifer lying just below the surface of the land or exposed in streams, ponds and wetlands, the Kirkwood-Cohansey aquifer system is highly vulnerable to harms flowing from human activities on the land that makes up the aquifer's large aerial extent. Extensive studies over the last several decades have identified and quantified the following key stressors on the aquifer:

1. **Development of forested land** results in a variety of harms to the quality and quantity of the aquifer's waters, and the natural systems that rely on the aquifer. Both urban/suburban development and farming bring contamination of ground and surface waters via runoff from impervious and semi-pervious surfaces (containing, e.g., hydrocarbons and nitrogen from fossil fuel combustion; high pH), fertilizers (both agricultural and lawn/turf), poorly functioning septic systems and, most critically, the loss of the filtering, storage and treatment functions provided by forest vegetation. Indirect effects of land development include the release of naturally-occurring radium particles into the aquifer caused by fertilizers seeping into the aquifer. Urban/suburban development and some forms of farming also reduce aquifer recharge due to the loss of infiltration that follows from replacement of vegetated land with less pervious surfaces – a problem often aggravated in this region by the installation of poorly designed, constructed and maintained stormwater systems. And finally, land alteration brings direct destruction and fragmentation of habitats, reducing the biodiversity of aquatic and upland systems and opening these areas to non-native, invasive species and increased deer populations.

The strong linkage between urban/suburban and agricultural land uses and nutrient loading leading to impaired downstream water quality in New Jersey's Outer Coastal Plain watershed, has been well-documented in a number of studies. The state's 2010 list of "impaired" waters (303(d) list) states that 63% of all HUC-14s in the Kirkwood-Cohansey aquifer are impaired for one or more contaminants, including 34% listed for elevated pH, 20% for excessive phosphorous, and 44% for various pesticides. (There are few listed for excessive nitrogen, but this is a result of the state's failure to adopt a numeric nitrogen standard applicable to these waters.)

Nutrient contamination represents a form of contamination with well-documented impacts on downstream ecosystems. The more land in the watershed that is developed, the greater the nutrient input to the watershed's streams, lakes and estuaries. Studies in the Kirkwood-Cohansey have shown that significant ecological changes begin to occur at 10% alteration of a watershed, at whatever scale one looks, and native conditions and natural communities are generally lost at 30% alteration. Residential development is the greatest stressor on water resources in the Pinelands growth areas. In the Bayshore, agriculture has the greatest ecological and economic impact in areas like Salem County, where a full 43% of land is in agricultural production.

2. **Pumping of the aquifer for depletive uses** results in lowering of the water table, the drying of wetlands, reduction of stream flows and loss of freshwater flows to coastal estuaries. The Kirkwood-Cohansey is extensively exploited as a source of water for various human uses. In 2009, there were almost 3,000 wells (not including private domestic wells) withdrawing a total of more than 125 million gallons per day for public water supply, industrial, irrigation and other uses. Studies by the USGS indicate that all these uses must be treated as effectively 100% depletive of the aquifer, in part because so much wastewater is disposed of in the surface waters leading to the ocean and in part because home and agricultural irrigation has been shown not to return much water to the aquifer, due to a combination of evapotranspiration effects and runoff into surface waters. It is also important to note that the heavily-exploited Atlantic City 800-Foot Sands aquifer, on which the Atlantic shore depends for water supply, is hydrologically continuous with the Kirkwood-Cohansey, so pumping from this deeper aquifer draws water from the Kirkwood-Cohansey through which it receives most of its recharge.

There is substantial scientific and anecdotal evidence that the Kirkwood-Cohansey aquifer is already over-exploited in many areas, but there exists today no analyses of the vast majority of watersheds or the overall status of the aquifer. In addition, studies have analyzed how reductions in water level affect the natural communities in the area, demonstrating that given reductions in water table level and stream flows will cause changes in plant and wildlife populations, including the loss of rare species from affected surface waters. A USGS study of the Mullica and Great Egg Harbor watersheds provides a larger scale analysis of portions of the Kirkwood-Cohansey and Atlantic City 800-Foot Sands aquifers in the Pinelands National Reserve. The study found that current uses are causing base-flow deficits in 7 of the 14 modeled sub-basins (at the HUC-11 scale). In the scenario in which permittees pumped to their full current regulatory allocations, deficits occurred in 11 sub-basins. In a scenario projecting groundwater withdrawals in 2050, deficits occurred in 9 sub-basins. Under all scenarios, base-flow deficits resulted in at least half of the sub-basins examined. The largest base-flow deficits occurred in a sub-basin in which existing surface-water diversions and groundwater withdrawals have already resulted in base-flow depletion. In modeling scenarios aimed at reducing or eliminating these deficits, the only action that was effective at eliminating deficits was reducing withdrawals. Because of the inter-connectedness of the aquifers, shifting withdrawals to a deeper part of the aquifer system or implementing seasonal conjunctive use of shallow and deep aquifers did not eliminate base-flow deficits. The study also found that the Atlantic City 800-Foot Sands aquifer has been declining for many years, placing more pressure on the Kirkwood-Cohansey aquifer above and bringing saltwater intrusion and land subsidence in its wake.

3. **Poor stewardship of forests and wetlands** results in a range of harms to watershed health in the cluster area. Principal forms of poor stewardship include: irresponsible motorized recreation (trucks, Off-Road Vehicles and motorcycles), suppression of natural disturbance regimes (principally fire), insufficient control of invasive plants and deer populations, unlawful collecting of rare plants and wildlife, and poor road paving and maintenance practices in forested areas. These practices have collectively resulted in significant degradation of habitats and loss of native biodiversity in large swathes of theoretically preserved land, particularly in State Parks, Forests and Wildlife Management Areas. The impacts of these practices on the land have not been well-studied by government or academic scientists, but extensive experience in the field verifies that they have drastically altered habitats and natural communities in many places.

#### **Goals of the Plan**

This plan aims to preserve and restore watershed health, including both abiotic and biotic characteristics of the aquifer and associated habitats, by addressing the key stressors identified above. The plan's specific goals are:

1. **Prevent Forest Loss:** Intact forests are the best protection for the Kirkwood-Cohansey aquifer system, while conversion of forest to urban/suburban or agricultural development is the key driver of aquifer degradation. Indicators of success in achieving this goal include (a) acres of forest preserved vs. acres replaced with urban/suburban land or agriculture, and (b) percent of watersheds permanently protected vs. altered.

2. **Preserve and Restore Water Quality:** This plan focuses on countering alteration of pH (acid waters) and nutrient inputs (all waters in the cluster). Other forms of pollution are important in many parts of the cluster, but we believe we can have the greatest impact on watershed health by focusing on nutrients as the major contaminants in stormwater associated with altered land in this region.

3. **Preserve and Restore Water Table and Stream Flows:** This plan focuses on preventing new or increased withdrawals from the Kirkwood-Cohansey and associated aquifers, while promoting conservation measures that will reduce current and future withdrawals through more efficient use of water by residential, commercial and agricultural users.

4. **Preserve and Restore Ecological Communities:** By advancing the three goals above and engaging in a range of restoration and stewardship projects, this plan aims to protect healthy native ecological communities and restore others that have been damaged by development of land, exploitation of the aquifer and other human activities in the region's forests and wetlands.

## Conservation Strategies



The Project Partners (see Appendix A), after consultation with the existing literature, scientific community, relevant stakeholders and their own organizational expertise, propose these five strategies to achieve the conservation goals identified above:

### 1. Preserve Natural Lands through Acquisition and/or Easements

Cluster organizations will negotiate and raise funds to complete the acquisition of land and/or easements that protect natural areas from development and other abuses of the land's natural resources.

*How strategy relates to conservation goals:* Acquisition of land and/or easements is a critical strategy for achieving the conservation goals for this cluster because (a) regulatory protections, such as the Pinelands CMP or municipal zoning, can be revoked, weakened or poorly enforced by government, while acquisition should provide permanent protection from development, and (b) acquisition provides the opportunity for public agencies and private organizations to implement good stewardship, resource conservation and restoration on the preserved land, and, in the case of natural areas, to promote compatible recreation and education programs. Key to this strategy is ensuring that the easements used in these transactions are enforceable and have clear provisions that are designed to protect water resources from contamination and overuse.

*Organizations implementing this strategy:* ALS, NLT, NJCF, TNC, SJLWT and TPL.

*Activities:* Through existing acquisition planning processes, the Project Partners have prioritized target lands that are high-value groundwater recharge areas, important habitat, and or contiguous with existing preserved lands. All organizations implementing this strategy will engage in landowner outreach and negotiations, valuation and surveys of target lands, coordination among public and private funders, and contracting and closing activities.

*Key risks:* Three key risks characterize all land acquisition projects in New Jersey: (a) landowners who are not willing to sell land or easements for their current market value; (b) competition with commercial developers for land that is developable under current regulations; and (c) insufficient funds, particularly with respect to the state Garden State Preservation Trust which in the past has played a significant role in acquisitions. It is our hope that the state Garden State Preservation Trust will receive new and sustained funding beginning in 2015, and that any funding secured is not excessively redirected to Blue Acres Program projects.

### 2. Targeted Policy Initiatives

This strategy will advance specific statewide, regional and local policies to better protect the Kirkwood-Cohansey aquifer and its surface waters. These policy measures focus on providing funding for open space preservation, reforming the standards for allocating water for public supply, advancing water conservation, changing Pinelands CMP boundaries, and providing better stewardship of natural lands.

*How strategy relates to conservation goals:* Policy initiatives will advance each of the plan's four goals by creating or improving government programs that promote forest preservation, reduce contamination of the aquifer from developed lands, prevent increased withdrawals from the Kirkwood-Cohansey, increase infiltration and promote restoration of ecosystems.

*Organizations implementing this strategy:* ALS, ANJEC, NJAS, NJCF, NLT, CU and PPA.

*Activities:* The Project Partners will present policy proposals and supporting analyses to the Pinelands Commission, NJDEP, USDA, USFWS and local governments; organize public meetings and communications (email and letter-writing) campaigns; and drive media coverage of the policy proposals. Each policy initiative has different, though often overlapping, target agencies and actors, but all share the need to generate active public support that is communicated to the relevant actors. In the case of the Pinelands Commission, for example, reforming standards for Kirkwood-Cohansey withdrawals, boundary changes for headwaters protection in the Black Run sub-watershed, and new standards for motorized vehicle events are currently under discussion as part of the agency's periodic Plan Review process, so advocacy efforts will focus on and be timed to support this process.

*Key risks:* Without change in current policies, the Kirkwood-Cohansey will suffer accelerating depletion and contamination. But, because they affect the interests of a range of businesses and individuals, meaningful policy reforms in this area are difficult to advance, may take many years to achieve, sometimes are defeated altogether or shelved to await the next shift in political winds, and usually turn out different from the proponents' original designs.

### **3. Ecological Restoration**

The Project Partners will seek to restore natural hydrologic and/or ecological functions in targeted, degraded areas by promoting conservation of water, reducing aquifer withdrawals, improving soil infiltration and reintroducing native vegetation and disturbance regimes.

*How strategy relates to conservation goals:* The restoration activities in this plan aim directly to restore the water table and stream flows in areas adversely affected by withdrawals for residential and commercial purposes, and to restore natural communities in areas where human activities, such as motorized vehicle use, agricultural operations and fire suppression, have damaged native natural communities.

*Organizations implementing this strategy:* ALS, NLT, NJAS, NJCF and PPA

*Activities:* This strategy encompasses a range of activities detailed in each of the planned projects for each focus area. Activities include engaging the public in restoring wetlands and stream buffers in targeted areas of the Pine Barrens and Bayshore, carrying out ecological prescribed fire and reducing motorized vehicle damage to Pine Barrens wetlands, and public education and engagement projects aimed at reducing domestic and commercial water use in stressed watersheds.

*Key risks:* Each element of this strategy carries different risks. On the ground habitat restoration carries the risk that the restoration will fail due to factors like invasive species or weather. The projects on public land risks of losing the cooperation of the agencies which own or manage the land, of opposition from the public based on lack of information or lack of sympathy for the objective, and of damage by members of the public using the land irresponsibly, such as off-road vehicle riders. The public education and engagement projects run the risk of not influencing the behavior of enough residents and businesses to achieve a meaningful reduction in water pollution and depletive water uses, or an increase in groundwater recharge.

### **4. Minimize Agricultural Impacts to Water Resources**



Working primarily with USDA staff, the Project Partners will aim to reduce water use and contamination by farm operations and increase infiltration through a combination of land protection and farm-practice modification.

*How strategy relates to conservation goals:* This strategy directly addresses the goals of preserving and restoring water quality and water table and stream flows. By improving water quality, reducing withdrawals and increasing infiltration, this strategy will also promote the restoration of downstream aquatic communities degraded by contamination and depletion of the water on which they rely. In addition, by preserving farmland through programs such as the Federal Farm and Ranch Land Protection Program (FRPP), we will ensure that farms will remain in open-field agriculture and employ conservation practices that minimize their impact on natural systems.

*Organizations implementing this strategy:* ALS, ANJEC, NJCF, NLT, PDE and PPA.

*Activities:* This strategy includes two initial actions: comprehensive analysis of agricultural withdrawals in the cluster to identify areas where we can have the greatest impact (for example, identify which farms and segments of the industry are using spray vs. drip irrigation today, and why), followed by outreach to farmers that is shaped to address the concerns, motivations and other factors identified through the analysis phase. Because farmers who are already using better practices, like drip irrigation, can make the most persuasive case for their neighbors who are not, we will attempt to recruit farmers as examples and spokespersons for the practices we advocate. As part of the William Penn funding process, an incentive fund has been requested to further encourage farmland owners to participate in the USDA practices. Parallel to that work is the continued solicitation of owners of prime agricultural lands to preserve their lands in the Federal Farm and Ranch Land Protection Program to protect those soils and their ecological function development or other impervious land uses.

*Key risks:* The success of this project depends on our ability to reach and persuade landowner with information and options that speak to their needs, both economic and cultural. The key risks are that these individuals will not find our presentation sufficiently persuasive, that cultural tensions between farmers and environmentalists will undermine good communications, that funding through Department of Agriculture programs will not be renewed or prove sufficient incentive, and that farmers will adopt but later abandon best practices.

##### **5. Community Engagement to Reduce Cumulative Impacts on Water**

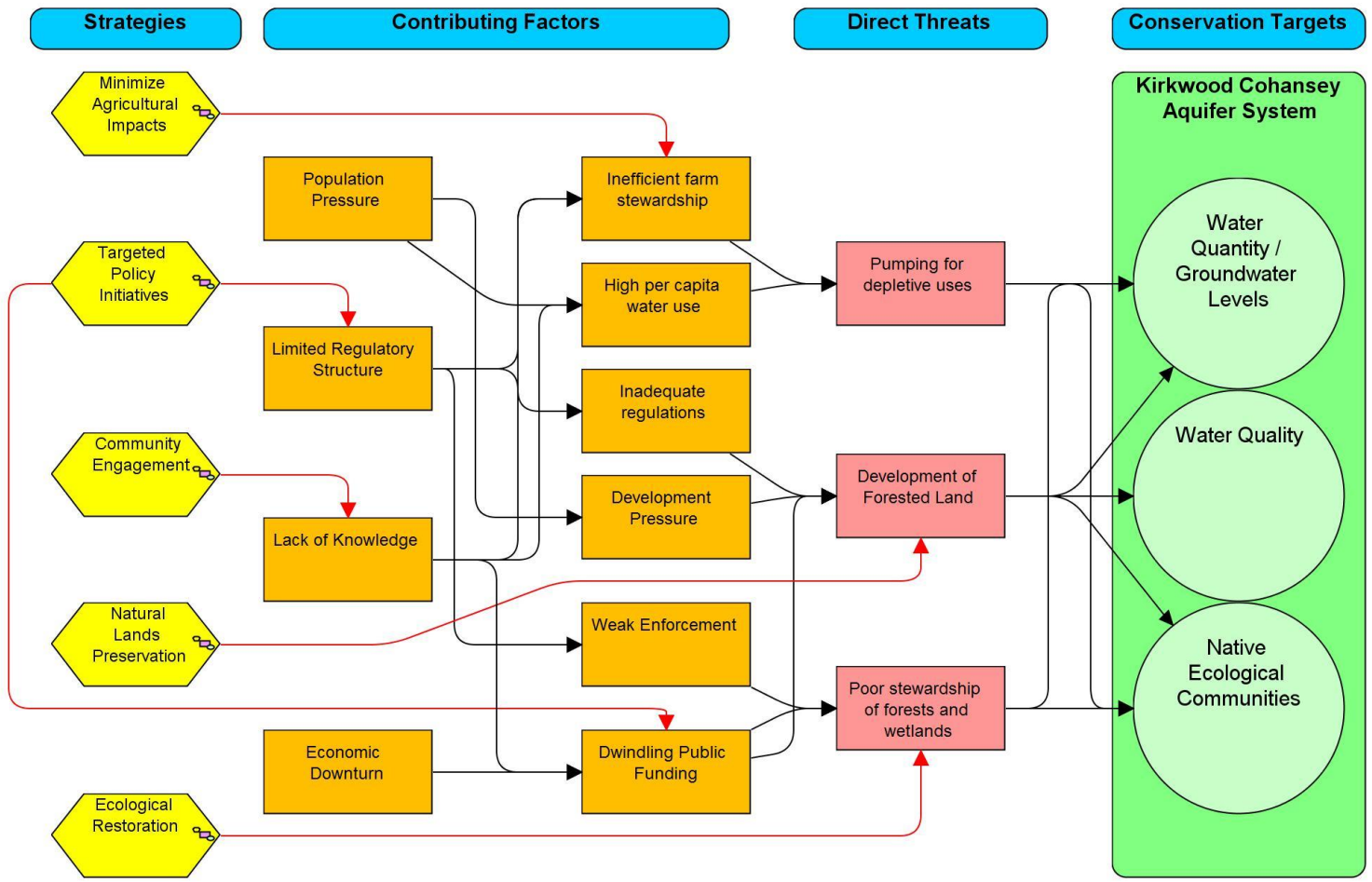
Through community education and engagement, this strategy will encourage local government, residents and local business to reduce water usage, address sources of water contamination and improve groundwater recharge methods.

*How strategy relates to conservation goals:* The two principal uses and sources of contamination of Kirkwood-Cohansey water are agriculture and developed communities (as opposed, for example, to major industrial points sources). This strategy, therefore, parallels the effort to reduce agricultural impacts above. By promoting a range of activities that reduce impacts of developed communities on water supply and quality, this strategy advances all four of this plan's goals.

*Organizations implementing this strategy:* ALS, ANJEC, NLT, NJAS, NJCF and PPA

*Activities:* This strategy includes educating the public and their representatives about the role the aquifer plays in their lives, the threat that over-pumping poses to the prosperity of their communities and the surrounding natural areas, and the ways they can conserve this limited resource. Cluster organizations will team with local utilities, environmental commissions and other community-based groups to produce analyses of water consumption and impacts by focus area communities, create new outreach materials for homeowners and local businesses, and then conduct public meetings, canvassing and presentations before local private and public agencies to distribute these materials. Organizations will seek to monitor progress through follow-up contacts with homeowners and businesses, simple surveys and analysis of where and why individuals, businesses and local agencies do or do not adopt the suggested conservation practices.

*Key risks:* The key risks to this strategy are of two kinds: (a) that local actors will not be sufficiently motivated to change behaviors to preserve their water resources, and (b) that other activities, such as new development that is poorly-designed or located, will overwhelm the benefits gained by this strategy among existing residents, businesses and public agencies.



**Figure 3.** Conceptual diagram of the conservation targets, their direct threats, contributing factors and our intervening strategies

## Focus Areas

In order to maximize the impact of our strategies to protect the Kirkwood Cohansey aquifer system, a set of six focus areas were chosen where the Project Partners will focus their work to address the unique challenges and opportunities of each area. They are as follows:

### Southwest Branch of the Rancocas Creek (see Figure 7.)

This focus area represents a suburbanizing part of the Pinelands that contains very high-value resources and opportunities to preserve these resources through improved planning, preservation and public engagement. The Black Run watershed in Evesham Township is a model for these activities. Despite the proximity of suburban development at the edge of the Pinelands, this watershed's streams and wetlands are pristine, displaying classic Pine Barrens water with low pH (4.5-5) and low nutrient levels while hosting a variety of native, threatened and endangered plant and animal species. Much of the watershed is within the municipally-owned Black Run Preserve, but the watershed's headwaters are not protected from development. An effective local constituency has arisen for protection and stewardship of the watershed, focused on the Friends of the Black Run Preserve, and both the township and Pinelands Commission have devoted significant time and resources in planning for protection of the headwaters. This area, therefore, represents an excellent opportunity for concerted public and private action to save a surviving, but imperiled resource.

### Core Pine Barrens (see Figure 8.)

The single most important part of the Pinelands is its extensive core forests, lying mostly within the Pinelands Preservation Area established by the Pinelands Protection Act. This area enjoys strong regulatory protections, large-scale public and private preserved lands, and characteristic Pine Barrens ecology; it also holds the healthiest waters of the Kirkwood-Cohansey aquifer. Despite large-scale conservation ownership, however, the core Pine Barrens is suffering from abuse and poor stewardship, while some key natural areas are not yet permanently protected. State Forest managers, law enforcement agencies, and recreational users of preserved lands are increasingly persuaded of the need for action. The core Pine Barrens provides a unique arena for high-impact restoration and stewardship actions that are necessary for the health of numerous watersheds, particularly restoration of natural fire regimes and reversing the extensive damage from illegal motorized vehicle recreation.

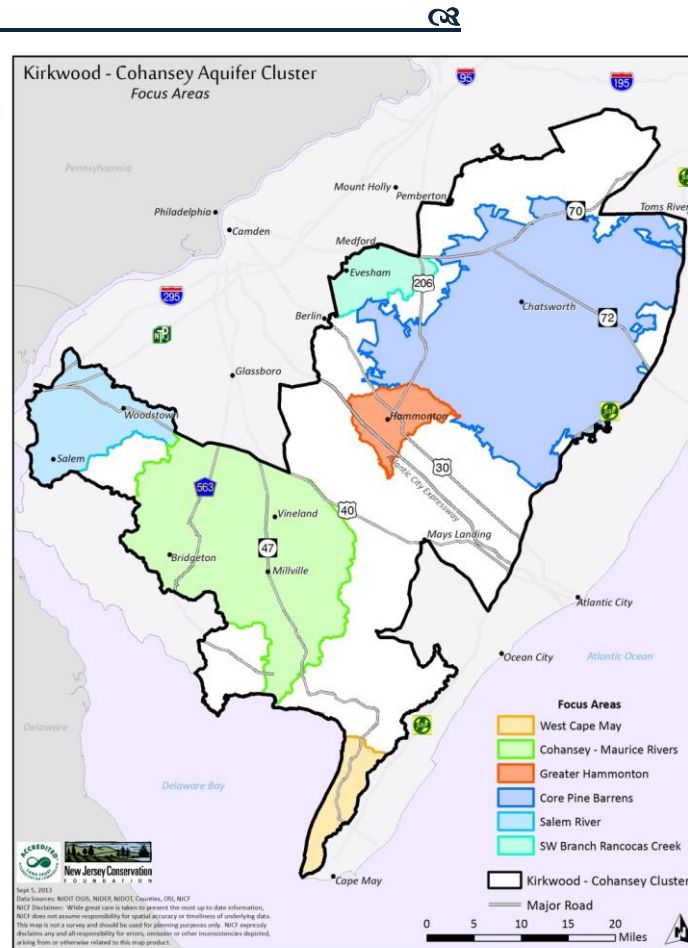


Figure 4. Project Focus Areas for the Kirkwood-Cohansey Aquifer Cluster

**Greater Hammonton** (see Figure 9.)

Hammonton is a Pinelands town in Atlantic County, one of the delineated growth areas whose success is vital to the Pinelands Plan’s long-term ability to protect its designated conservation zones from sprawling development. Intensive pumping of Kirkwood-Cohansey wells for public water supply and irrigation has over-taxed the aquifer and threatened the town’s ability to accommodate regional housing and business demand. In addition to water quantity deficits, the water quality in and downstream of Hammonton is the highly degraded by human activities in the town and surrounding farms. The town’s government leaders support reforms to increase the quality of life for residents and workers in the area. Hammonton is certified through Sustainable Jersey, and has several committees including a green team and environmental commission. Hammonton represents a prime area for community engagement on water conservation and water quality protection, covering residential, commercial and agricultural areas.

**Salem River** (see Figure 10.)

This focus area includes the Salem River and its surrounding landscape, from the river’s headwaters to the lower reaches near Salem City. The area is heavily influenced by agriculture, with low to moderate development increasing in density near Woodstown Borough and Salem City. While agriculture is a dominant land use and an economic force in this region, other large employers include manufacturers both here and along the Delaware River, including Mannington Mills and DuPont. PSEG is another significant employer in this region.

The majority of land in the Salem River watershed is in agricultural production. Water resource issues in this area include high levels of agricultural, residential, and industrial water consumption, and impacts from agricultural runoff. Documented impairments include high phosphorus levels, sedimentation, and high fecal coliform levels. The Upper Salem River watershed is included in the federal National Water Quality Initiative, which directs enhanced NRCS funding here to encourage landowners to implement conservation activities on their properties, as well as the Rutgers Cooperative Extension Water Resources Program restoration, which focuses on reductions in fecal coliform and phosphorus loading. The Lower Salem River and the Mannington Meadows areas are high-priority natural resources that have received significant attention from organizations at scales ranging from international to federal to state to local. A long list of designations includes status as part of the Delaware Estuary Ramsar site (Wetland of International Importance); Important Bird Area; and Natural Heritage Priority Macrosite. Additional threats to the lower Salem include altered hydrology due to diversion of the Salem River via canal, and habitat degradation, including monocultures of invasive plants.

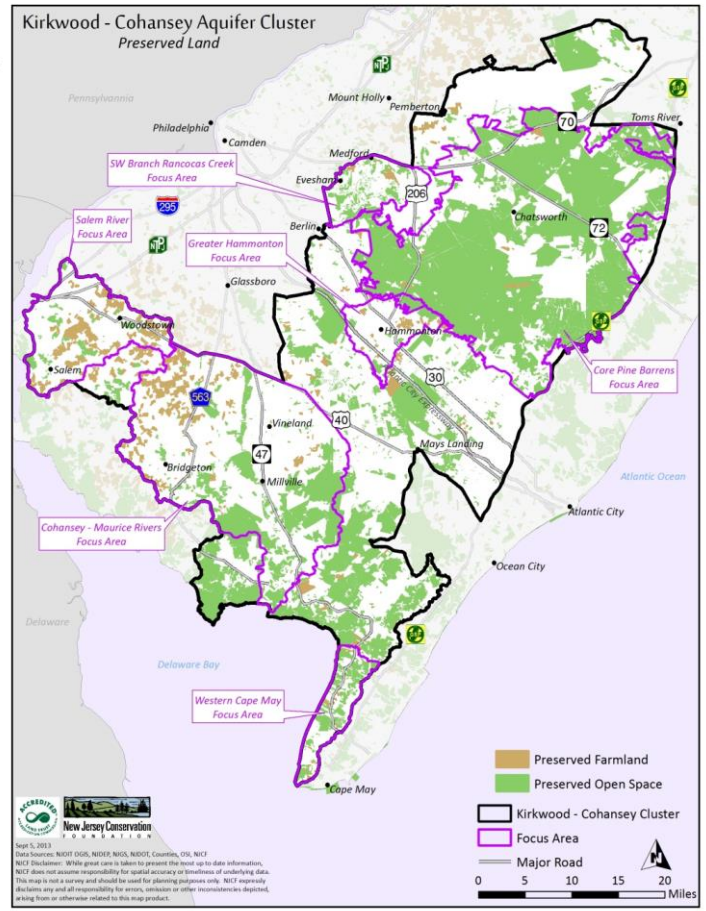


Figure 5. Preserved Land in the Kirkwood-Cohansey Aquifer Cluster

**Cohansey-Maurice Rivers** (see Figure 11.)

The region surrounding the Cohansey and Maurice Rivers is an important part of the Kirkwood-Cohansey aquifer offering a rich diversity of environments and a multitude of challenges. In this region are expansive urban areas serving as hubs of industry, fishing villages on the Delaware Bay nestled in wetlands, and small communities surrounded by farmland. Economies have grown and deflated through the decades creating a push for economic development but this often comes in conflict with environmental concerns. Undeveloped green-space is abundant in this region; wide expanses of land and cheap land prices have proved attractive to builders. The collapse of the housing market had slowed the pace of development, but with the improving economy the developers are beginning to return. Many homes in the region lack access to municipal sewer and rely on septic systems for wastewater; this extensive use of septic has created issues with fecal coliform in the waterways. As the largest economic driver in the region agriculture drives concerns about water use for irrigation and agricultural runoff into the waterways. Further exacerbating pollution from point and non-point sources in this region are the sandy soils which allow for easy infiltration into groundwater supplies. The Cohansey and Maurice River focus area is replete with challenges and conflicting needs and is an area which requires strong environmental stewardship.

**Western Cape May** (see Figure 12.)

The Cape May peninsula, in southernmost New Jersey, is a coastal plain surrounded by the Delaware Bay and the Atlantic Ocean. Rich in salt marshes, freshwater wetlands, streams and forests, Cape May County is an internationally recognized migratory stop for thousands of shorebirds, raptors and songbirds, and its productive ecosystem provides a spawning ground for fish, shell fish and a myriad other creatures. People also flock to the county, with the year-round population of 96,000 rising to 808,000 in the summer. The tourism economy is supplemented by the second largest fishing industry on the East Coast and ecotourism. Cape May County's public and private wells have had increasing salt water intrusion, which is caused by excessive withdrawals stemming from development and population that has steadily increased since the 1960's. Sea level rise and land subsidence exacerbate the problem. Streams and wetlands south of Burleigh, Middle Township, are being depleted and stream flow has been reduced at times by 80% of the normal flow. The County has no regional water supply plan, and the NJDEP has failed to uphold its regulations or institute meaningful conservation measures.

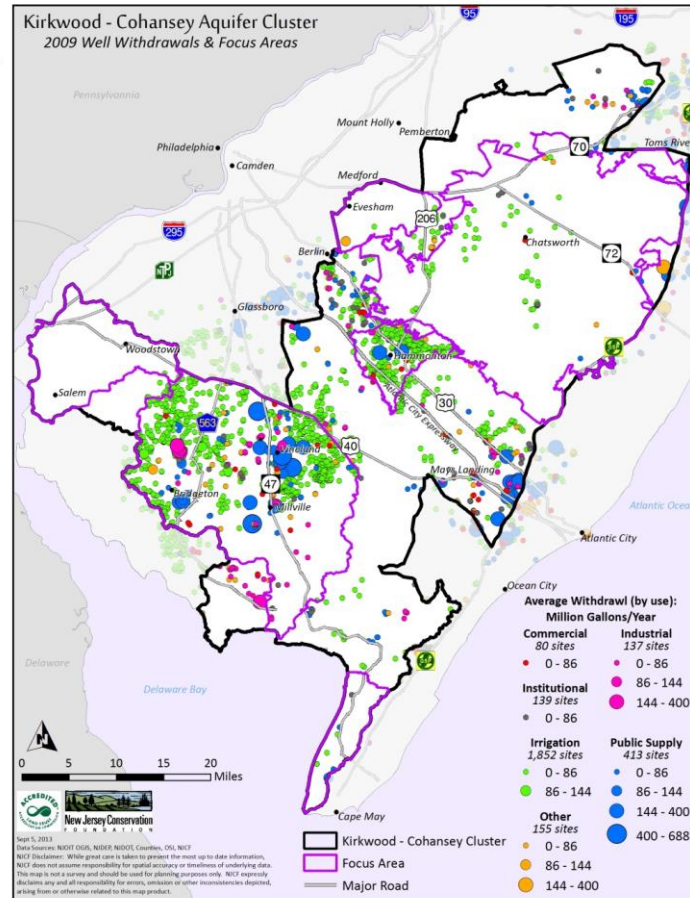


Figure 6. Major groundwater withdrawals in the Kirkwood-Cohansey Aquifer Cluster

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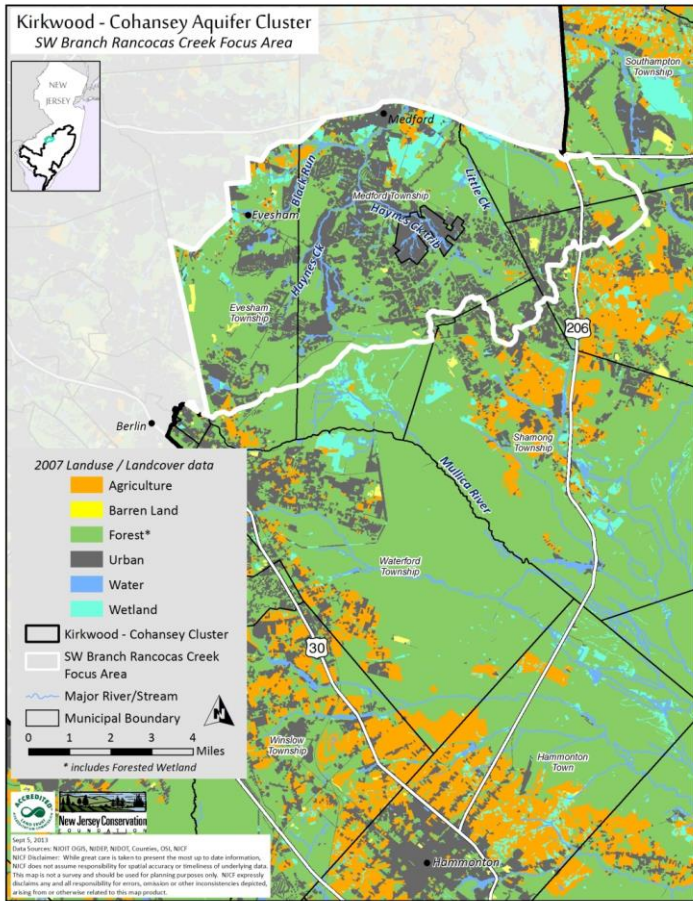


Figure 7. Southwest Branch Rancocas Creek Focus Area - 2007 Land Use

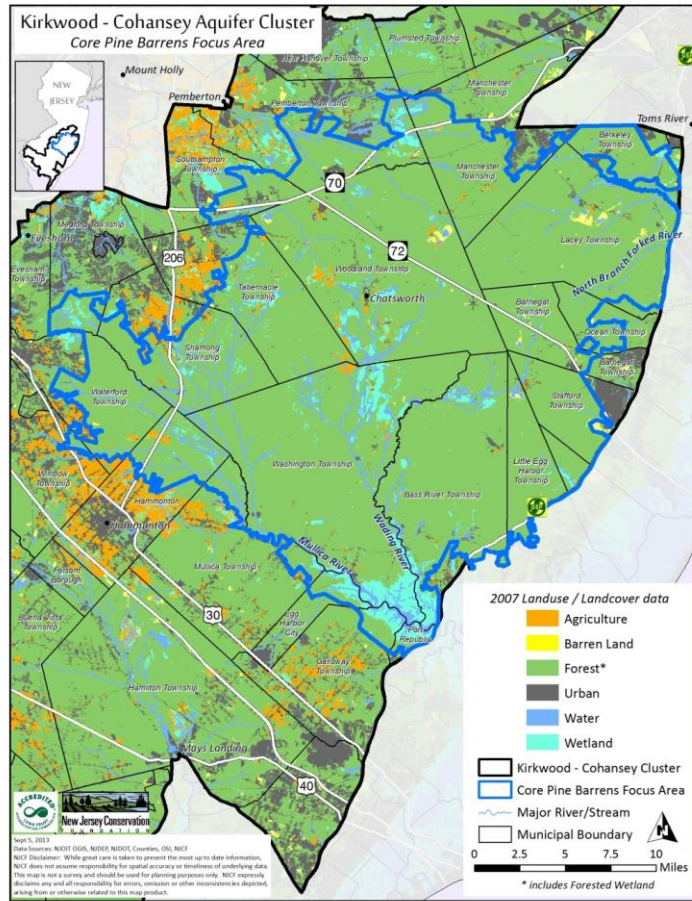


Figure 8. Core Pine Barrens Focus Area - 2007 Land Use

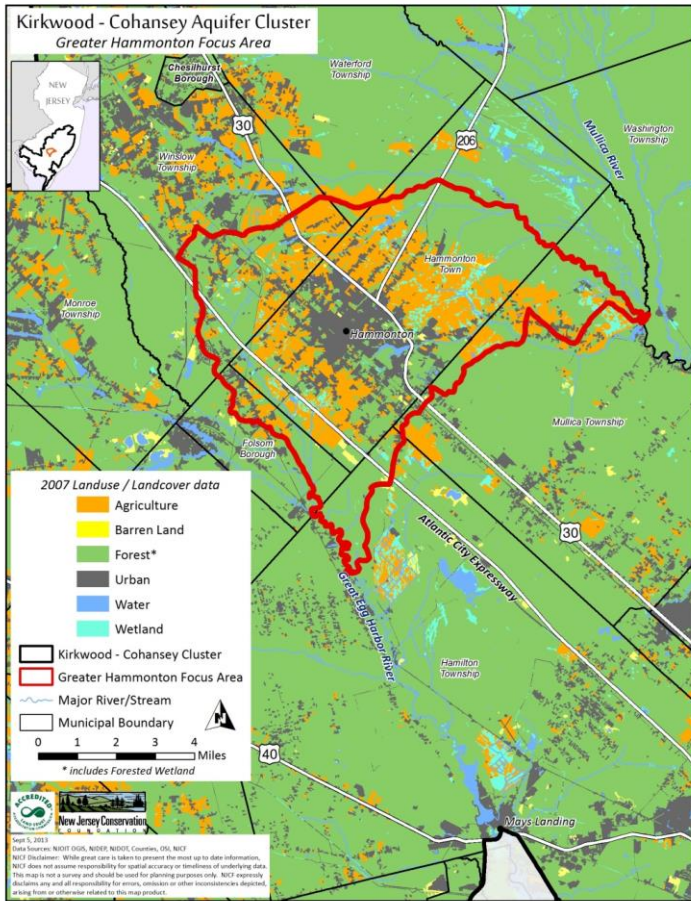


Figure 9. Greater Hammonton Focus Area - 2007 Land Use

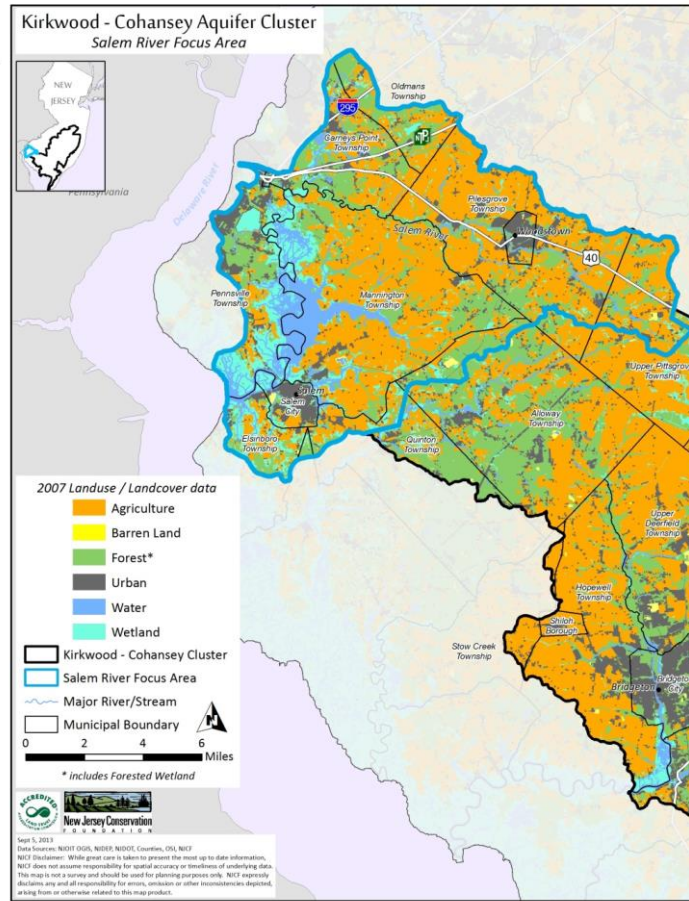


Figure 10. Salem River Focus Area - 2007 Land Use



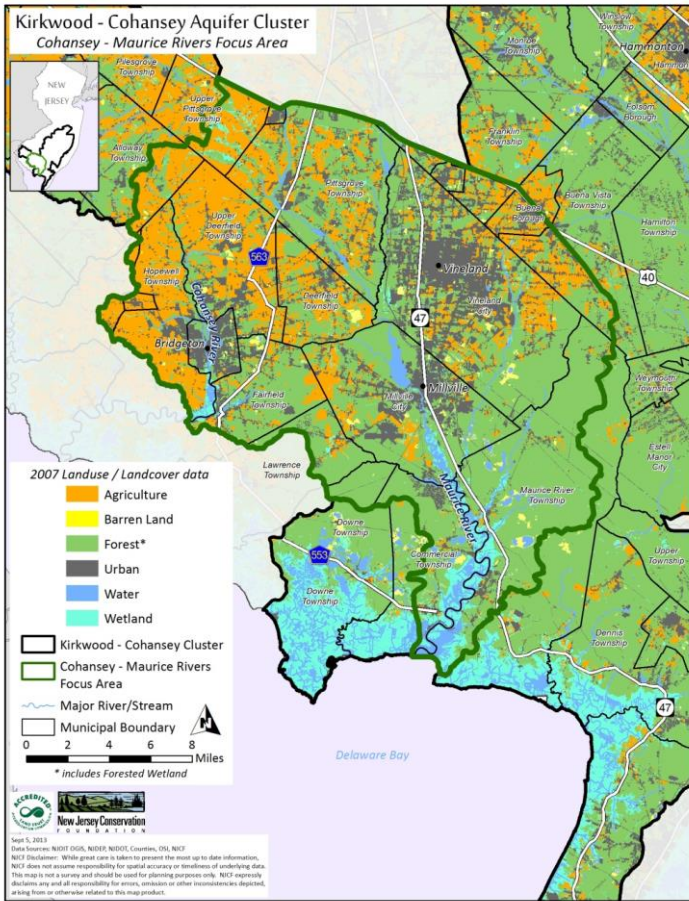


Figure 11. Cohansey-Maurice Rivers Focus Area - 2007 Land Use

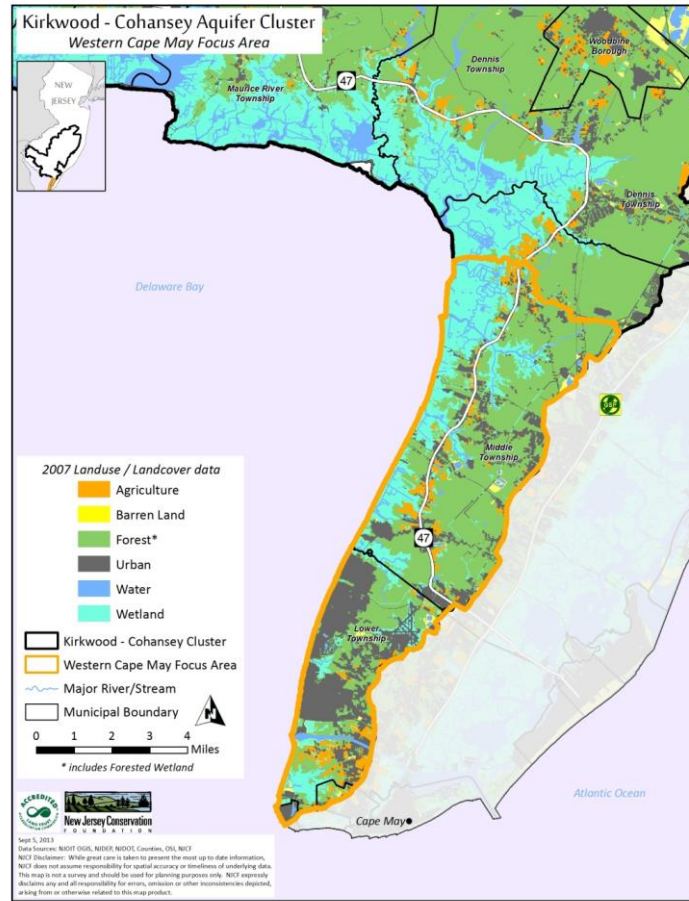


Figure 12. Western Cape May Focus Area - 2007 Land Use

## Implementation Projects



The following is a concise aggregation of the projects that the Project Partners propose to undertake over the next three years in an effort to implement the strategies identified above. Detailed project budgets are located Appendix B.

ID	Project Name	Focus Area	Partners	Description	Goal	Timeframe
<b>Minimize Agricultural Impacts</b>						
A11	FRPP Farmland Preservation	Greater Hammonton, Salem River, Cohansey-Maurice	NJCF	Preserve priority farmland utilizing the Federal FRPP program to ensure proper natural resource protection	Protect from land from development and ensure that on-farm practices will minimize their impact on soil and water resources	2014: Secure Wm Penn Funding, Exercise options 2015: Close on properties
A12	Private Landowner Best Management Practice (BMP) Outreach and Implementation	Salem River, Cohansey-Maurice, Western Cape May, Greater Hammonton	NJAS, NLT, NJCF, SJLWT, CU, PPA	Partners engage private landowners in agricultural, forest, and stream-related BMPs. This will protect water resources and reduce agricultural impacts to streams, wetlands and groundwater resources. Partners assess need for increased cost-share to increase adoption of selected BMPs.	Enroll landowners in federal BMP incentive programs; reduce water use and agricultural impacts such as fertilizers, pesticides, and soil erosion; protect the integrity of forest, streams, and other natural areas that are protective of watershed health.	2014 Q1,2 & 3: Outreach, enroll, implement and provide cost-share to landowners, seek matching funds. 2014 Q,4: Review cost-share info with federal agencies  (Repeat cycle in 2015 and 2016)
A13	Acquire lands around the Mannington Meadow and along the Salem River	Salem River	DRG	Continue the preservation of lands surrounding the Meadow and preserving lands along the Salem River	Land Protection along waterways.	2014-2016
<b>Community Engagement</b>						
CE1	Bridgeton Community-based Aquifer Initiative	Cohansey-Maurice	ALS, PDE	Engage the citizens and authorities in Bridgeton to reduce NPS impacts through a green, low impact development program with a public education and outreach, project implementation, and impact assessment.	Conserve water and reduce non-point source pollution impacts to the aquifer by reducing storm water runoff to groundwater and the upper Cohansey River.	2014: Planning, outreach and two demonstration projects 2015-16: Green roof demo and community-based project implementation, monitoring and assessment.
CE2	Septic education and outreach program for Laurel Lake & Seeley Lake	Cohansey-Maurice	ALS	Develop and deliver a septic system outreach and education campaign to inform property owners and renters in areas with a high density of septic systems about proper septic maintenance practices and work with town officials on an upgrade implementation plan.	Reduce private septic seepage into aquifer	2014: Planning, outreach and delivery in Laurel Lake. 2015: continue in Laurel Lake and expand to Seeley Lake. 2016: Continue in Laurel and Seeley Lakes, and expand to Sunset Lake, Mary Elmer lake or other identified sites.
CE3	Water Quality/Quantity Education in Schools	Salem River, Cohansey-Maurice, Western Cape May	NLT	Maintain and to expand existing program that focuses on field experiences for children and young adults from grade 3 through graduate school, with an emphasis on educating students from underserved communities and backgrounds. The majority of the students are grades 3 to 12	Educate young residents about the local land and water they essentially "own", how their activities impact water quality and quantity, how water rights have recreational, private and commercial use components that may or may not involve actual costs for use. Exposing students to public water access points, public waterways and recreational water-based activities.	2014: Maintain current level of 20 schools/groups per year and 500 + participants but improve/increase in-class presentations to focus more on infiltration and water quality issues. 2015-16: Increase full-service (in-class presentations and at least one field trip per school/group) participation level by at least 10% per year.

ID	Project Name	Focus Area	Partners	Description	Goal	Timeframe
CE4	Outreach on the benefits and need for ecological fires	Core Pine Barrens	PPA, NJCF, NJAS	Create an educational program to overcome current obstacles to using prescribed fire for ecological goals in the Pinelands. We will plan and coordinate a series of three workshops over a three-year period.	Increase awareness about benefits of fire and need for ecological fires	2014, Q1-3: Plan workshop 1 2014, Q4 (October): Conduct workshop 2015, Q1-3: Plan workshop 2 2015, Q4: Conduct workshop 2 2016, Q1-3: Plan workshop 3 2016, Q4: Conduct workshop 3
CE5	Pinelands Model Municipal Easement Project	Greater Hammonton	NJCF	Work with a municipality (Hammonton) to engage their residents in understanding the shared values and responsibilities of easements; create a model easement program; assemble all the relevant information to monitor and enforce existing easements and make sure that future easements are drafted and enforced according to established standard operating procedures.	Catalog and map all municipal easements related to environmental quality; Develop a monitoring and enforcement protocol for the Town	2015: Outreach and education. Inventory and mapping of easements. Municipal adoption of model documents and standard operating procedures 2016: Landowner outreach. Site visits and status reports. Baseline information compiled and enforcement and monitoring schedules established.
CE6	Conservation Landscaping	Salem River, Cohansey-Maurice, Western Cape May	ALS, NJAS, PDE, CU, SJLWT	The program will focus on outdoor home and property maintenance such as landscaping with native plants; reducing the use of water, pesticides and fertilizer. We would implement demonstration sites, establish a public outreach program, and create corresponding educational materials.	To reduce stressor impacts on the aquifer by engaging homeowners and residents and local businesses to adopt property and home management best practices which embody pollution reduction techniques and approaches.	2014: Factsheets, presentations developed and presented; plant lists & garden designs; demonstration sites, identification of partners 2015: Presentations given, demonstration sites, implementation of partner sites 2016: Presentations given, demonstration sites, implementation of partner sites
CE7	Aquifer Friendly Golf Course Certification Program	Salem River, Cohansey-Maurice, Western Cape May	ALS	Modeled after our existing program, this certification process leads golf courses to implement soil, turf, and water management practices; cultural practices; and education practices that reduce water consumption and the amount of non-point source pollution entering groundwater, streams, ponds, lakes.	To conserve water and reduce non-point source pollution impacts to the aquifer by implementing best management practices in golf courses in the project area.	2014: Identify local partner and investigate potential projects; webpage for applicants; educational articles; one public workshop 2015: One public workshop Implement projects; implement projects; using partnership as a model, identify other partners; investigate project sites, work with partners to select projects 2016: One public workshop; continue to implement projects and work with new applicants
CE8	Land and Water Resource Protection along Bayshore Heritage Byway	Salem River, Cohansey-Maurice, Western Cape May	ANJEC, NJCF, SJLWT, PDE, CU	Implement conservation planning ordinances for aquifer protection. Provide education for local officials about aquifer restoration measures and recharge areas protection. Provide public education facilities. Offer grants to municipalities to encourage ordinance adoption.	1. Improve water recharge through conservation planning and open space protection 2. Increase public awareness and concern for the protection of our water resources.	2014: Research ordinances, create educational materials, hold training workshops, meet with officials in individual towns. Develop Fischera public viewing site  2015: Monitor municipal progress on planning projects, enlist additional towns. 2016: Continue municipal outreach and assistance, publicize success stories.
CE9	Black Run Advocacy and Community Engagement	SW Branch Rancocas	PPA	Protect the pristine water quality of the Black Run watershed by building on successful work in organizing community activism and Pinelands Commission scientific and policy work to advocate for these changes before the Pinelands Commission and municipal council. The project seeks to hold a series of public meetings and field trips.	Increase number of members to Friends of the Black Run Preserve/change zoning/seek protections. Pinelands Commission changes headwaters to Forest Area	2014 Q1 & 2: Community meetings (2); public field trips (2); organize public to attend Pinelands Commission and municipal meetings to discuss Black Run protection. 2014 Q3 & B4: Comment on Pinelands Commission CMP-amendment proposal, continued organizing as necessary in light of progress on CMP and zoning amendments

ID	Project Name	Focus Area	Partners	Description	Goal	Timeframe
CE10	Improving water quality from septic systems	SW Branch Rancocas	ANJEC	Workshops, presentations and publications to educate local officials on septic system maintenance for clean water. Small pass-through grants to encourage municipal adoption of ordinances.	Improved water quality and maintained groundwater recharge.	2014: Develop guidance manual for septic system mgmt. Conduct workshop/webinar for local officials. 2015: Make at least 3 presentations to local gov'ts to encourage septic ordinance. Work with Env. Comm to gain support for ordinance.
CE11	Analysis and Monitoring to Reduce of Over-withdrawals and Restore Our Waters Initiative	Salem River, Cohansey-Maurice, Western Cape May	ANJEC, ALS, PDE	Develop a baseline for annual monitoring and analysis of water usage. Engage entities to reduce overwithdrawals of aquifers. Implement Restore Our Waters strategy by improving creeks and waterways for the health of our community.	1) Protection of the Kirkwood Cohansey aquifer from ground water decline 2) Improve in-stream base flow and water quality.	2014: Analyze water use, develop educational materials, review ordinances of sewerer municipalities, MUAs, policy and potential fiscal partners. Begin collaborative efforts to reduce water use, educate, restore habitat and monitor aquifer. 2015-16: Implement strategies & monitor aquifer health.
CE12	Water Conservation Outreach in Hammonton	Greater Hammonton	PPA, ANJEC	Implement water conservation ordinances and resident education program and canvassing.	Reduce water use and the resulting need for wastewater treatment. Investigate water quality problems.	2014 Q1 & 2: Conduct reviews of municipal ordinances, compare these to sample ordinances. Identify amendments and new ordinances for Hammonton. 2014Q3: Educate and work with the environmental commission to identify water conservation and protection ordinances for presentation to the township council. 2014 Q4: Develop materials for an education campaign for residents and local businesses Spring 2015Q 1& 2: Begin 10 month education campaign. 2015 Q3 & 4: Canvas residents and businesses. 2016 – Identify additional opportunities to further education and improvements to local ordinances as next steps.
<b>Ecological Restoration</b>						
ER1	Barrett's Run Stream Corridor Restoration	Cohansey-Maurice	ALS	Restore and enhance an existing stream buffer in the recently preserved Barrett's Run property, an innovative preservation project that created a greenway that connects an existing city park and a wilderness area in the neighboring suburban town.	Restore a natural buffer that will reduce the impact of non-point source pollution on a stream in the aquifer while engaging members of the public who will benefit.	2014: Restore the gap in the existing buffer. 2015-16: Restore the remaining 3,200 feet along both sides of Barrett's Run Creek.
ER2	Forest Stewardship on Public and Private Lands	Core Pine Barrens	NJAS	Secure implementation of forest stewardship practices to restore ecosystem function and maintain watershed health. Overcome the obstacle of high cost by providing cost-share payments to implement existing approved forest stewardship plans. Engage core Pinelands landowners through their consulting foresters.	To implement restoration projects focused on Atlantic white cedar establishment, forest fuel reduction, and ecological burning, for biodiversity, ecosystem health, and watershed health	2014-16: Outreach to forestry consultants and landowners, identify participants, provide cost share to implement projects.
ER3	Replicate natural fire regime to protect forest and aquifer	Core Pine Barrens	NJAS	Restore natural fire regime to Pinelands forests by overcoming obstacles that include inadequate state capacity to implement prescribed fire, and a lack of attention to ecological burning goals in the state of New Jersey.	Create ecological fire management plan for a forest tract in the Core Pine Barrens focal area. Apply prescribed fire to up to 300 acres of forest in the Core Pine Barrens focal area. Create a model for Pinelands ecological burning.	2014: Develop ecological burn plan, conduct stakeholder outreach. 2015-16: Stakeholder outreach, conduct prescribed fire

ID	Project Name	Focus Area	Partners	Description	Goal	Timeframe
ER4	Ecological Succession and Carbon Sequestration following Restoration of Wetland Hydrology	Core Pine Barrens	NJCF, PPA	Monitor, document and educate public on the recovery of wetland communities with restored hydrologic function on former agricultural lands, regarding characteristic Pine Barrens species (esp. plants and mycorrhizae) and ecosystem services, including flood abatement and carbon sequestration.	Conduct the first detailed, long-term monitoring of pine barrens wetland restoration with the findings being shared with restoration ecologists, regulatory agencies and the general public to improve our understanding of how restore pine barrens wetland systems and why it is important.	2014: Conduct botany classes, hydrologic restorations, initiate baseline documentation, engage university colleagues, 2015: Continue classes, filed studies, conduct additional hydrologic restoration 2016: Continue long-term studies; disseminate progress reports to scientific community send public.
ER5	Protection and Restoration of three Forked River Headwater Stream Corridors	Core Pine Barrens	NJCF, PPA	Stabilize and restore the headwater riparian habitats of the Forked River and aggressively restrict future vehicular access to the area.	Reduce ORV activity and dumping; restore hydrology and erosion /vegetation damage to streams and wetlands	2014: Planning and permits, on ground restoration of area 1, 2015: Monitoring and strategy adjustments, on ground in area 2, 2016: Continue monitoring, revise strategies, and begin on ground in areas 3.
ER6	Possible Restoration of Connectivity of the Upper and Lower Salem River	Salem River	ALS, NJCF, NLT	Provide an evaluation of hydrologic conditions that will aid in the understanding of restoring all or partial connectivity between the lower and upper Salem River basins.	An evaluation of hydrologic conditions in Salem River basin by USGS based on additional data collection to define current conditions in the lower Salem River basin and three scenarios presented to provide comparable estimates of changes to the water budgets.	The project is planned for 18 months to include 12 months of data collection and 3 months of data and water budget analysis and report writing.
ER7	Freshwater Mussel Restoration for Water Quality Improvement	Salem River, Cohansey-Maurice	PDE, NLT	Launch in selected segments of the Maurice, Cohansey and Salem Rivers: 1) Mussel research and surveys 2) Pilot mussel reintroduction tests to gauge restorability in these streams 3) Initiation of a community volunteer mussel survey program.	1) Assess the current condition of the Maurice, Cohansey and Salem Rivers for mussel recovery purposes, through mussel surveys and stream assessment. 2) Initiate pilot mussel reintroduction trials in selected section of the targeted rivers to improve water quality and determine what (if any) greater reintroduction/stocking is warranted. 3) Introduce volunteer mussel monitoring in the three targeted watersheds	2014 Q 1 & 2: Historical Data Review; Permitting 2014 Q 3: Scientific Surveys 2014 Q3 & 4: Tagging and Pilot Reintroduction Study 2014 Q4 -2015 Q 2: Monitoring
ER8	Data repository/digital platform	ALL	ALS	Gather data on projects, incorporating into a single GIS map-based platform that can be viewable online by all project partners. Data would be added as projects are completed and would accessible to environmental community and general public.	Increase the success of the Implementation Plan by increasing access to necessary data. Will allow organizations to better evaluate current efforts and identify areas needing further attention.	2014: Build platform from existing data 2015-16: Add project data as it becomes available.
ER9	Public Land Restoration for Watershed Health	Salem River, Cohansey-Maurice, Western Cape May	NJAS	Identify and implement restoration projects on public lands to enhance watershed health. Restore natural cover; increase adoption of agricultural and forest-related BMPs to protect water resources.	Reduce agricultural impacts such as erosion, water use, and chemical runoff, and restore and enhance forests to protect watershed health. Maintain or restore ecological resilience, ecosystem health, and watershed health.	2014-16: Identify and implement projects, conduct monitoring, seek outside funding

ID	Project Name	Focus Area	Partners	Description	Goal	Timeframe
ER10	Black Run Preserve Restoration Project	SW Branch Rancocas	PPA	Work with local officials and volunteers in replanting and restoring wetland and upland habitats including the MUA's sedimentation ponds.	Restore Pine Barrens habitat in degraded areas of the Black Run Preserve	2014: Close off illegal access to the Preserve, close off approximately 2 miles of unsustainable trails within the Preserve's uplands and wetlands. 2015: Working with Trail Professionals, redesign and construct approximately 3 miles of sustainable multi-use trails, restore and replant two decommissioned effluent basin, restore a 5-acre area of denuded uplands.
<b>Land Protection (See Appendix C for a detailed listing of Priority Projects)</b>						
LP1	Farmland and Natural Area Protection & Acquisition	Salem River, Cohansey-Maurice, Western Cape May County, Greater Hammonton	NLT	Protect land through fee simple acquisition and conservation easements in the focus areas. Expansion of existing preserves is a priority, particularly the Harold Peek Preserve on the Maurice River and the Burden Hill Forest Preserve in Quinton and Alloway Townships. Collaboration with other nonprofits and government agencies will be emphasized, with assistance provided whenever appropriate. A more focused effort will be placed on farmland riparian buffer permanent protection utilizing existing USDA rental and incentive payments, and developing agreements that don't involve a change in current USDA approved practices.	For farmland, secure payment system to establish agreements not to retire limited-time (10-15 year) USDA farmland conservation contracts, thereby effectively creating perpetual conservation easements. For natural areas, protection through acquisition of fee simple or conservation easement rights on at least 100 acres per year within the focus area.	2014: For farmland: establish agreement and permanently protect at least 1,000 linear feet of riparian or wetland buffer. For natural areas: preserve 100 acres. 2015-16: For farmland: secure agreements to protect 1,500 linear feet each year with riparian or wetland buffers. For natural areas: protect at least an additional 100 acres each year.
LP2	Softening the Ground	Salem River, Cohansey-Maurice, Western Cape May	ALS	Work with land trusts as funding partners, and "soften the ground" for other organizations with outreach to landowners that includes presentations, press campaigns, direct outreach, engagement of landowners and towns.	To protect and restore the Kirkwood Cohansey Aquifer System through direct preservation of important lands and by enhancing the capacity of other land preservation practitioners to do the same through collaboration.	2014: New presentation created, made in 12 towns; plans move forward with projects already in work; targeted acquisitions work continues 2015-16: 100 landowners contacted by mail; projects in works close, and targeted acquisitions work continues
LP3	Natural Area Acquisition	Cohansey-Maurice	TNC	Preserve priority parcels in the Cohansey-Maurice Rivers Focus Area to ensure their permanent preservation and stewardship.	Preserve at least 68 acres of forested land and provide appropriate stewardship.	2014: Initiate contact with landowner 2015: Secure Wm Penn, other funding ; negotiate contract 2016: Close on property

ID	Project Name	Focus Area	Partners	Description	Goal	Timeframe
LP4	Natural Area Acquisition	Core Pine Barrens, Cohansey-Maurice	NJCF	Preserve priority parcels in the Bayshore and the core of the Pinelands Preservation and Forest zones to ensure their permanent preservation and proper stewardship.	Preserve 3,000 acres, document their natural resources and provide appropriate stewardship.	2014: Secure Wm Penn Funding, Exercise option 2015: Close on properties
LP5	Black Run Land Acquisition	SW Branch Rancocas	NJCF, RC	Preserve priority parcels in the headwaters of Black Run and incorporate their management into the Black Run Preserve in partnership with the Rancocas Conservancy	Protect at least 400 acres	2014: Negotiate acquisition terms 2015: Secure Wm Penn Funding, Exercise option 2016: Close on properties
LP6	Bear Swamp Addition	SW Branch Rancocas	TPL	Preserve 400 acres including stream corridor.	Lands protected in headwaters	2014: Option property, assemble due diligence and funding 2015: Close on property
<b>Targeted Policy</b>						
TP1	Expanding range and permanence of NJ USDA programs	ALL	NJAS, NLCF, NJCF	Work with the USDA to improve the effectiveness of USDA conservation incentive programs by adding practices that can be cost-shared in New Jersey USDA contracts, as well as by providing a way to secure permanent contracts.	Create a mechanism that would secure permanent landowner commitment to implementation/maintenance of USDA (NRCS, FSA) BMPs. Improve existing programs by expanding the variety of practices that can be included (cost-shared) in a contract in the state of New Jersey.	2014: Research practices to be added to NJ cost-share coverage; identify federal and state decision makers to be included in discussion of permanent agreements; draft recommended enhancements to programs 2015: Continue to develop recommended enhancements to programs; engage in discussions with decision-makers 2016: Continue to engage in discussions with decision makers and to refine enhancements to incentive programs. Secure enhancements, including mechanism and funding for long-term or permanent agreements.
TP2	Aquifer Protection Policy Reforms	ALL	PPA, ALS, ANJEC, NJCF	Advocate for reform of regulations and plans governing exploitation of the Kirkwood-Cohansey aquifer including Pinelands commission reforms, water supply master plan release	Advance county and municipal policies that protect and restore the KC aquifer system and provide for balanced, sustainable allocations among users, including ecological needs.	2014 Q1: Develop education materials and press and outreach plan 2014 Q2 & 3 Engage the public with materials developed to push the Commission to adopt policy reforms and for DEP to release water supply plan 2014 Q4: Hold public forum 2015 Q1: Continue push for reforms and engage citizens to advocate for support of Pinelands amendments to the CMP and water supply plan 2016: Seek implementation of the CMP amendments
TP3	Limit direct threats to waterways (ORV damage, dumping) on public land	Core Pine Barrens	PPA, SJLWT, NJCF, NJAS, ANJEC	Limit direct threats to waterways on state lands by: 1) hiring a consultant to map the damaged areas on state lands in the Pinelands, 2) working with state parks and forests in drafting a vehicle access plan, 3) advocating to the Pinelands Commission for changes to the Comprehensive management Plan, and 4) educating the public about the damage.	Identify areas in need of restoration, enforcement, and protection from off-road vehicles, illegal dumping, etc. Identify points of access for vehicles to reduce direct threats.	2014 Q1: Hire consultants and organize community meeting 2014 Q2: Survey partners and collect data. Provide comments on Pinelands CMP changes 2014 Q3-4: Draft locations for mapping project and conduct additional outreach to public about CMP changes 2015 Q1-2: Complete map and conduct a 2nd community meeting 2015 Q3-4 - comment on draft vehicle access plan 2016 - seek implementation of vehicle access plan

ID	Project Name	Focus Area	Partners	Description	Goal	Timeframe
TP4	Implementation of prescribed Burn bill to allow replication of natural fire regime	Core Pine Barrens	PPA, NJCF, NJAS	Seek implementation of prescribed burn bill policies to allow for use of ecological fire by private land owners.	Bill requirements for ecological prescribed fire program are implemented.	2014: work with DEP in modifying language to prescribed burn bill 2015: work with DEP in developing ecological burn policies as part of burn legislation 2016: seek implementation of policies

## Project Monitoring



Project monitoring should take place at two levels: (a) Project-specific outputs and near-term outcomes achieved, and (b) Project impact on addressing basic indicators of watershed health in the Kirkwood-Cohansey cluster.

### Project-Specific Outputs and Outcomes

Each grantee will identify and report on progress in achieving project-specific outputs and outcomes, such as the number of acres preserved, damaged habitats restored and individuals participating in outreach and engagement projects. In most cases, impacts on water table level, water chemistry and biological communities will be difficult or impossible to measure directly because these projects relate to a large area and the effects of any given action may take either years to develop and/or it may not be possible to isolate the effects of the project from a 'noisy' natural system. In some cases, however, the scale and nature of a project lends itself to direct measurements. In such cases, it will be appropriate to measure pH and aquatic plant and fish community composition in acid waters, such as in the Black Run watershed; nitrogen and phosphorous levels, such as in the Salem River; and withdrawals where real-time data is available from government monitoring programs, such as in the town of Hammonton. Project Partners will conduct these monitoring activities themselves and use field survey activities to engage members of the public and students. These monitoring activities will produce indicative data, but will not be conducted and documented to the level of rigor required for scientific or regulatory purposes.

### Impact on Key Indicators

The Academy of Natural Sciences, with assistance from the Project Partners, will monitor long-term impacts on fundamental indicators of watershed health which this plan aims to affect through reversing, mitigating, or avoiding the stressors on these indicators. The indicators are:

1. *Water chemistry*: measured in pH (for acid waters) and nitrogen inputs (for all waters in the cluster). While other water contaminants, including toxic chemicals, are degrading the aquifer in some specific places, the cluster organizations believe that they can have the greatest impact on the long-term health of the aquifer by focusing on pH and nitrogen as key drivers of ecological health or decline across the cluster. (Macroinvertebrates have proven to be an inferior and less reliable measure of water quality in Kirkwood-Cohansey waters.)
2. *Water volume measures*: including water table level, passing flows in streams, and depletive withdrawals from the Kirkwood-Cohansey and hydrologically-connected aquifers.
3. *Native biodiversity* of wetlands and riparian areas.



Monitoring of impacts on these indicators should take place through both field tests and modeling. Given the nature of the aquifer, the very extensive network of surface waters it sustains and the cost of continuous field testing and surveys, it is not feasible to measure impacts directly across most of the ground and surface waters which cluster organizations will be working to protect or restore. Fortunately, this cluster has the benefit of extensive, long-running monitoring programs by various public agencies and scientific studies by government and academic scientists. Key studies include the Kirkwood-Cohansey Aquifer Study, Pinelands Commission ecological monitoring studies, Rutgers Salem and Cohansey Watershed Restoration Plans and US Geological Survey studies. These data and studies make it possible to identify useable thresholds (such as percent land use alteration of a basin) and relationships (such as upland farming and nitrogen inputs) on which to model the impacts of the planned activities on the key indicators.

At this time, the Academy of Natural Sciences has not developed a specific long-term monitoring plan for this cluster or created a baseline characterization for this cluster. Pending the creation of such a plan and baseline characterization, cluster organizations propose to:

- 1) Create a baseline characterization of each focus area in terms of the key indicators we have identified. These will be based on publicly-available data from government agencies, particularly NJDEP, the Pinelands Commission and USGS.
- 2) Collect data on (a) land preservation and land use/land cover change, (b) estimated changes in withdrawals by the various users from the Kirkwood-Cohansey aquifer, and (c) water quality and water table measurements by government agencies and scientists working in the region.
- 3) Report results annually. It must be understood, however, that complete and reliable data on these indicators is not always available within annual reporting cycles. For example, aerial photography for measuring land use change is often years out of date and scientific data may not be released to the public for years after it has been collected.

## **Dissemination of Information**



Many of the projects that are proposed in the Plan are designed as model practices that, if successful, could be replicated in other areas of similar characteristics. Project successes and 'lessons learned' will be easily disseminated amongst the Project Partners through the existing professional networks and coalitions that are currently established. As conditions permit, successful projects will grow and replicate organically as has been our organizations' collective history. However, given that ours is but one of eight clusters throughout the Delaware Watershed, we feel that the William Penn Foundation should continue to convene all of the organizations that are working under their Watershed Protection Program to facilitate *cross-cluster* learning. Many of the groups that are involved in this process have little contact much less venues for such interaction especially for groups on either side of the Delaware River. An annual symposium that highlights some of the more interesting projects occurring in the clusters seems to be the most effective means to magnify the impact of all of the groups' work while minimizing the time that these same groups spend in the 'information dissemination' process.



## Appendix A: Project Partners



**NAME:** American Littoral Society (ALS)

**YEAR FOUNDED:** 1961

**STAFF MEMBERS:** 13 full-time, 1 part-time

**MISSION:** To promote the study and conservation of coastal marine life and habitat, defend the coast from harm, and empower others to do the same.

**IMPLEMENTATION ROLE:** The American Littoral Society will work in the three focus areas of the Delaware Bayshore and advocate for policy reforms and implementation, partner with landowners and land trusts to protect open space, promote public understanding and involvement, and support partners in restoration projects and research.



**NAME:** Association of New Jersey Environmental Commissions (ANJEC)

**YEAR FOUNDED:** 1969

**STAFF MEMBERS:** 5 full time, 6 part time

**MISSION:** The mission of the Association of New Jersey Environmental Commissions is to achieve responsible and sustainable use of New Jersey's natural resources and protection of environmental health. We are a statewide organization that provides leadership, education, and support for environmental commissions and other local boards and public officials, and partners with other organizations to advocate for strong state and regional environmental policy.

**IMPLEMENTATION ROLE:** ANJEC will provide education for local officials and their towns' residents and develop sound public policy on the municipal, regional and state levels. ANJEC will monitor water usage, encourage water conservation, work with local officials on land use planning that protects water resources, and educate municipal officials and homeowners about septic system management.



**NAME:** Citizens United to Protect the Maurice River and its Tributaries (CU)

**YEAR FOUNDED:** Founded 1979, 501C3 status in 1986

**STAFF MEMBERS:** 1 full time

**MISSION:** CU Maurice River is dedicated to protecting the watershed of the Maurice River and the region known as Down Jersey, thereby enabling current and future generations to enjoy the environmental, recreational, cultural and scenic resources of this Wild and Scenic global treasure. CU Maurice River is the federally designated steward of the section of the Maurice River that is protected under the NPS Wild and Scenic River Partnership Program.

**IMPLEMENTATION ROLE:** CU Maurice River will work in the Cohansey-Maurice region as an advocate for policy reforms and implementation, promote public understanding and involvement, and support partners in restoration projects and research.



**NAME:** Friends of the Black Run Preserve (FBRP)

**YEAR FOUNDED:** 2012

**STAFF MEMBERS:** All volunteer

**MISSION:** The mission of the Friends of the Black Run Preserve is to preserve and protect the unique natural beauty and Pine Barrens ecology of the Black Run Preserve for the benefit of all citizens.

**IMPLEMENTATION ROLE:** FBRP will work closely with PPA, advocating for funding & zoning regulations that make acquisition of the Black Run Headwaters possible. They will utilize volunteers and involvement with local middle and high schools to work on the monitoring and restoration projects within the Preserve.



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**NAME:** The Nature Conservancy, New Jersey Chapter (TNC)

**YEAR FOUNDED:** 1951

**STAFF MEMBERS:** 31

**MISSION:** The mission of The Nature Conservancy is to conserve the lands and waters on which all life depends.

**IMPLEMENTATION ROLE:** Conservation land acquisition in the Cohansey-Maurice Rivers and Western Cape May Focus Areas.



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**NAME:** Natural Lands Trust (NLT)

**YEAR FOUNDED:** 1953

**STAFF MEMBERS:** 56, with 2 based in New Jersey

**MISSION:** The Natural Lands Trust's work in southern New Jersey is guided by our latest Strategic Plan (December 2011) which emphasizes three strategic objectives: Saving Land, Stewarding Natural Resources, and Connecting People to Nature. We have been protecting land in South Jersey since the 1960s with a primary focus on areas that support threatened plant and animal populations.

**IMPLEMENTATION ROLE:** NLT staff will primarily implement projects in the Bayshore area (Salem, Cumberland and Cape May Counties) but will also be active in Atlantic County, the bridge county between the Bayshore and Pinelands areas.



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**NAME:** New Jersey Audubon Society (NJAS)

**YEAR FOUNDED:** 1897

**STAFF:** 47 full-time, 21 part-time

**MISSION:** New Jersey Audubon fosters environmental awareness and a conservation ethic among New Jersey's citizens; protects New Jersey's birds, mammals, other animals, and plants, especially endangered and threatened species; and promotes preservation of New Jersey's valuable natural habitats.

**IMPLEMENTATION ROLE:** NJAS will work in the Delaware Bayshore and Pinelands focal areas to accelerate the adoption of agricultural best management practices; implement ecological restoration projects and leverage funding to assure their success; broaden the acceptance of essential ecological stewardship techniques such as prescribed fire; secure permanent funding for open space protection; and advance policy reforms and implementation.



**NAME:** New Jersey Conservation Foundation (NJCF)

**YEAR FOUNDED:** 1960

**STAFF MEMBERS:** 35

**MISSION:** The mission of New Jersey Conservation Foundation is to preserve New Jersey's land and natural resources for the benefit of all.

**IMPLEMENTATION ROLE:** NJCF's staff will implement projects in five of the six focus areas that will employ the organization's three program strengths: land acquisition, land stewardship and restoration, and policy development and implementation.



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**NAME:** Partnership for the Delaware Estuary, Inc. (PDE)

**YEAR FOUNDED:** 1996

**STAFF MEMBERS:** 12 full time, 2 part time, 5 temporary employees (including Fellows, grad students and interns)

**MISSION:** The Partnership for the Delaware Estuary, a National Estuary Program, leads science-based and collaborative efforts to improve the tidal Delaware River and Bay, which spans Delaware, New Jersey, and Pennsylvania.

**IMPLEMENTATION ROLE:** The Partnership for the Delaware Estuary will work throughout the Bayshore focus areas to conduct scientific research, ecological restoration, and community engagement & education, as well as support other partners' restoration and outreach efforts.



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**NAME:** Pinelands Preservation Alliance (PPA)

**YEAR FOUNDED:** 1989

**STAFF MEMBERS:** 7 full time and 2 part time

**MISSION:** PPA is devoted to saving the natural and historic resources of the Pinelands by preserving the Pine Barrens ecosystem, its plants and wildlife, its water, and its landscape throughout the Pinelands National Reserve, promoting wide public awareness of the values of Pinelands resources and issues involved in their preservation, and advancing permanent acquisition of land and development rights by private and public conservation agencies.

**IMPLEMENTATION ROLE:** PPA will work in the three focus areas of the Pinelands and advocate for policy reforms and implementation, promote public understanding and involvement, and support partners in restoration projects and research.



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**NAME:** Rancocas Conservancy (RC)

**YEAR FOUNDED:** 1991

**STAFF MEMBERS:** 1 part time, 12 volunteer board members

**MISSION:** The mission of the Rancocas Conservancy is to preserve, protect, and enhance the ecological and cultural integrity of the Rancocas Creek watershed.

**IMPLEMENTATION ROLE:** The Rancocas Conservancy is the local land trust for the SW Branch of the Rancocas Focus Area and will work with NJCF to preserve key parcels in the headwaters of the Black Run Watershed.



**NAME:** South Jersey Land & Water Trust (SJLWT)

**YEAR FOUNDED:** 1990

**STAFF MEMBERS:** 2 full time 2 part-time

**MISSION:** The South Jersey Land & Water Trust's mission is to preserve and protect the land and water resources of southern New Jersey – maintaining and enhancing the natural, cultural, and historic heritage of the region. SJLWT does this through land preservation, monitoring and restoration of important habitats, education and public outreach, and advocacy for land and water protection at local, state, and national levels.

**IMPLEMENTATION ROLE:** SJLWT will work in the three of the six focus areas and will conduct land acquisition and stewardship as well as promote community stewardship with outreach, education, restoration projects, and research.



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**NAME:** The Trust for Public Land (TPL)

**YEAR FOUNDED:** 1972

**STAFF MEMBERS:** 6 full time in Morristown NJ office,

**MISSION:** The Trust for Public Land conserves land for people to enjoy as parks, gardens, and other natural places, ensuring livable communities for generations to come.

**IMPLEMENTATION ROLE:** Facilitate all aspects of acquiring land and transfer to final steward for permanent conservation.

