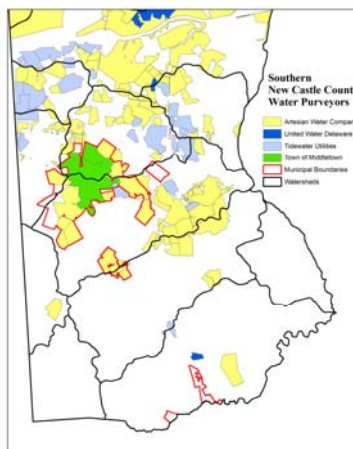


NINTH REPORT TO THE GOVERNOR AND THE GENERAL ASSEMBLY

Regarding the Progress of the

DELAWARE WATER SUPPLY COORDINATING COUNCIL

Estimates of Water Supply and Demand in Southern New Castle County through 2030



*Final Report
June 30, 2006*

Prepared by the

Delaware Department of Natural Resources and Environmental Control

Delaware Geological Survey

University of Delaware, College of Human Services, Education, and Public Policy
Institute for Public Administration – Water Resources Agency



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Executive Summary

The population of southern New Castle County is expected to double from 41,000 in 2005 to 96,000 by 2030, thus the demand for public water supply is expected to increase at a similar rate. In 2005 there was sufficient ground-water availability to meet peak demands from public water supply and agriculture/golf course irrigation uses (Figures ES.1, ES.2, and ES.3). By 2030, the projections indicate there will be sufficient ground-water availability (20 to 30 mgd) to meet peak demands from public water supply and irrigation uses even if these peak demands occur simultaneously provided that:

- Public water supply and irrigation wells are pumped in accordance with Delaware Department of Natural Resources and Environmental Control (DNREC) water allocation limits. DNREC will continue to monitor demands and water levels from allocated public water supply wells and irrigation wells so as not to diminish the capacity of irrigation wells for producers that wish to sustain farming in southern New Castle County.
- Water purveyors interconnect between and within systems, add new finished water storage and aquifer storage and recovery, and transport water from aquifers with excess availability south of Townsend to growth areas between Middletown/Odessa and the Chesapeake & Delaware Canal.

Figure ES.1. Ground-water availability, currently allocated supply, and peak day public water and irrigation demand in southern New Castle County.

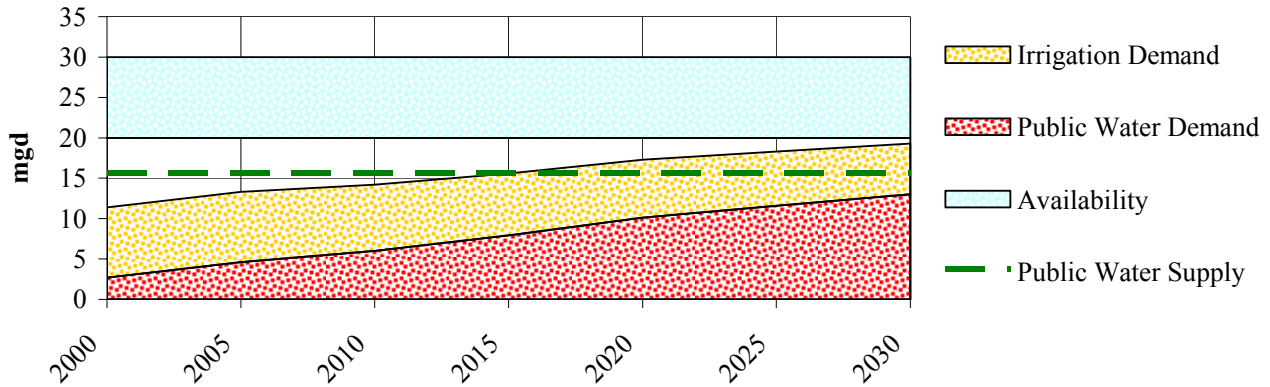


Figure ES.2. Ground-water availability, currently allocated supply, and peak day public water demand in southern New Castle County.

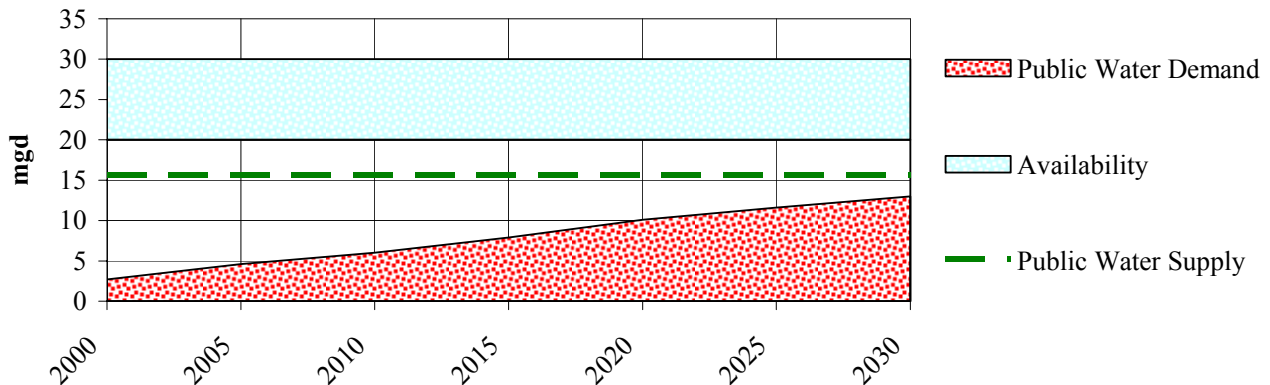


Figure ES.3. Ground-water availability, currently allocated supply, and peak day irrigation demand in southern New Castle County.

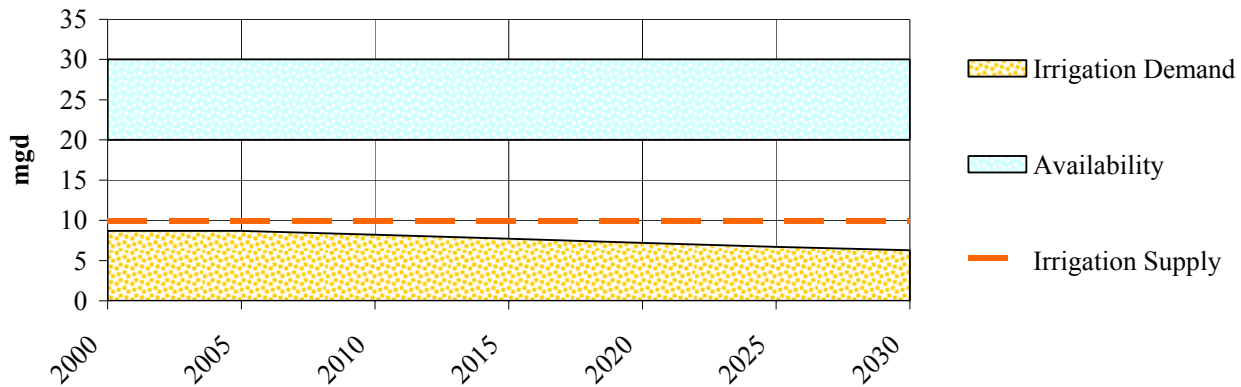


Table ES.1 compares water supply and demand for public water purveyors for existing (2005) and future (2030) population conditions. In 2005, public water suppliers had existing supplies that exceed peak demands thus accounting for a healthy surplus. By 2030, the public water purveyors are projected to have supplies that exceed the forecasted peak demand. Surplus/deficit calculations are based upon maximum daily supplies in accordance with current DNREC water allocation permits. The water purveyors will apply for additional allocations in the future. Since this analysis compares peak day supply capacity and peak day demands with average long-term ground-water availability, the Delaware Water Supply Coordinating Council believes these projections are conservative and that the public water purveyors are equipped to comfortably meet future peak water demands in southern New Castle County.

Agriculture irrigation demand is expected to decrease at a rate similar to the decline in agricultural land by 2030. However, there is a possibility that declining agricultural demand due farmland loss may be offset by producers' needs to irrigate additional acres of specialty crops to remain competitive.

Table ES.1. Comparison of water supply and demand in southern New Castle County.

Surplus/deficit calculations are based upon maximum daily supplies in accordance with current DNREC water allocation permits. Water purveyors will apply for additional allocations in the future.

<i>Water Purveyor</i>	<i>Current Max Daily Allocation (mgd)</i>	<i>2005 Peak Day Demand (mgd)</i>	<i>2005 Surplus / Deficit (mgd)</i>	<i>Current Max Daily Allocation (mgd)</i>	<i>2030 Peak Day Demand (mgd)</i>	<i>2030 Surplus / Deficit (mgd)</i>
Artesian Water Company	8.8	1.6	+ 7.2	8.8	5.0	+ 3.8
AWC: DE Correctional Center	2.1	0.2	+ 1.9	2.1	0.2	+ 1.9
Tidewater Utilities, Inc.	2.7	1.2	+ 1.5	2.7	3.7	- 1.0
Middletown	1.7	1.2	+ 0.5	1.7	3.7	- 2.0*
Mt. Pleasant and Cantwell	0.1	0.1	0.0	0.1	0.1	0.0
Self-Supplied	0.3	0.3	0.0	0.3	0.3	0.0
Subtotal Public Water Supply	15.7	4.6	+ 11.1	15.7	13.0	+ 2.7
Individual Wells	1.4	1.4	0.0	1.9	1.9	0.0
Total Potable Water	17.1	6.0	+ 11.1	17.6	14.9	+ 2.7
Agriculture/Golf Course Irrigation	10.0	8.7	+ 1.3	10.0	6.3	+ 3.7
Total	27.1	14.7	+12.4	27.6	21.2	+ 6.4

* An existing agreement between Artesian and Middletown ensures that AWC will provide water within the municipal boundaries of Middletown such that this deficit will be met by Artesian's excess supply capacity.

Table ES.2 provides an overall summary of ground-water availability compared to peak water demands in southern New Castle County. The sum of peak public water supply demand and agriculture and golf course irrigation demand begins to approach the ground-water availability of 20 to 30 mgd by 2030. Thus, there is the possibility after 2020 or 2025 of increased competition between the public water supply and agriculture irrigation sectors for limited ground-water availability if peak agriculture irrigation demands coincide with rising peak public water supply demands during an abnormally hot dry summer. The amount of future competition for available ground-water between public and irrigation supply wells is not certain. Adverse impacts can be averted by locating new public supply wells in appropriate locations. This will require proactive investigation and analysis of hydrologic and geologic conditions and application of numerical simulation techniques to forecast likely locations of potential problems and improve the accuracy of water availability estimates.

Table ES.2. Ground-water availability and peak demand in southern New Castle County.

<i>Water Purveyor</i>	<i>2005 Availability (mgd)</i>	<i>2005 Peak Day Demand (mgd)</i>	<i>2030 Availability (mgd)</i>	<i>2030 Peak Day Demand (mgd)</i>
Artesian Water Company		1.6		5.0
AWC: DE Correctional Center		0.2		0.2
Tidewater Utilities, Inc.		1.2		3.7
Middletown		1.2		3.7
Mt. Pleasant and Cantwell		0.1		0.1
Self-Supplied		0.3		0.3
Public Water Supply		4.6		13.0
Individual Wells		1.4		1.9
Subtotal Potable Wells		6.0		14.9
Agriculture/Golf Course Irrigation		8.7		6.3
Total	20.0 – 30.0*	14.7	20.0 – 30.0*	21.2
* DGS, 1983 and 1996				

Recommendations

Given that long term ground-water availability in southern New Castle County is estimated to be 20 to 30 mgd and the population may increase from 41,000 in 2005 to 96,000 people by 2030, the Delaware Water Supply Coordinating Council recommends the following approach to sustain the most efficient delivery of drinking water without overuse of a limited ground-water resource:

1) Water Supply CPCNs: The Water Supply Coordinating Council (WSCC) shall establish a subcommittee to review 26 Del Code Section 203C (Certificates of Public Convenience and Necessity for Water Utilities) to determine if legislative changes are needed to ensure that service territories are granted in a manner that considers water supply planning principles. If amendments are needed then the subcommittee shall prepare such amendments to the Section for consideration and approval by a vote of the full WSCC. The subcommittee shall consider water supply planning principles as part of its review, including but not limited to, long-term water supply sustainability and sufficiency; service and infrastructure cost effectiveness; sizing, location and optimization of service areas; and enhanced landowner and public notification process and procedures. The WSCC shall forward any approved

amendments to the Governor and General Assembly for consideration. The dissenting opinion of Artesian Water Company regarding this recommendation is presented beginning on page ES-5.

2) Periodic WSCC Updates: By December 2010, the WSCC should update these supply and demand estimates in conjunction with the public water purveyors in southern New Castle County and include the following information:

- Estimates of supply and peak demand in comparison to ground-water availability.
- A water supply service area map showing distribution mains and interconnections with other water purveyors, water treatment plants and finished water storage tanks, and boundaries of existing and proposed water supply CPCNs.

3) Ground-water Availability: The WSCC should work with the Delaware Geological Survey (DGS) and DNREC to develop comprehensive programs to reevaluate both the long-term and short-term availability and sustainability of ground-water in southern New Castle and northern Kent Counties.

The last investigation of ground-water availability in southern New Castle County was conducted by the Delaware Geological Survey in 1996. That effort relied on information from relatively few wells and test borings. Since that time newer DGS geologic and hydrogeologic mapping studies have collected and interpreted geologic and hydrologic information from a number of new wells leading to improved understanding of some aspects of aquifer systems in the area.

Additional work incorporating this information is needed to refine predictions of ground-water availability and the effects of increased pumping on surface- and ground-water resources. Two types of potential projects are recommended and both will require additional funding and detailed proposals.

- One project is focused on developing a sophisticated ground-water simulation application and supporting monitoring points and data for the shallower aquifers (Magothy, Mount Laurel, Rancocas, and Columbia), and streams. DGS is in the process of hiring a ground-water modeling specialist in anticipation of the need for this type of work throughout the State.
- The second project is a drilling study designed to increase information about the deeper Potomac Formation. Components of this study are analyses of the spatial distributions and water-bearing properties of aquifer sands and confining beds, and gathering water-quality data that would help determine the location of salty water in the deep subsurface.

4) Peak Demands by 2030: The projections indicate there is sufficient availability (20 to 30 mgd) to meet peak demands in 2030 from public water supply and agriculture/golf course irrigation uses in southern New Castle County provided: 1) DNREC updates the allocated irrigation well data base identifying the latitude/longitude, capacity, depth, and owner, and 2) continues to monitor public water supply and agricultural wells during the summers so as not to diminish the capacity of irrigation wells by producers who wish to remain competitive and sustain agriculture in southern New Castle County.

5) Treated Wastewater for Irrigation Use: The utilization of treated wastewater for irrigation, particularly irrigation of golf courses and agriculture, should be further encouraged by DNREC and the local governments in southern New Castle County. Because some wastewater is placed back into the local hydrologic system through spray irrigation and individual domestic septic systems and not

consumed, the rate of ground-water recharge by land-based wastewater disposal practices should be systematically evaluated. Ultimately, this water should be incorporated into the estimation of the quantity of available water.

Artesian Water Company Dissenting Opinion to the Recommendation on Water Supply CPCNs

The Water Supply Coordinating Council's Ninth Report to the Governor and the General Assembly provides estimates of water supply and demand in southern New Castle County through 2030, consistent with its duties as enumerated in Section 1306 of Title 26 of Delaware Code. However, the Ninth Report also makes recommendations beyond the bounds of the duties enumerated in statute.

In particular, the Council recommends that a subcommittee of the Council should propose amendments to 26 Del. Code Section 203C, which address the process for the issuance of Certificates of Public Convenience and Necessity (CPCNs). Rather than the current process that permits individual landowner choice as to the award of a water supply franchise for their parcel, the Council initially considered a recommendation that CPCNs should be awarded by the Public Service Commission on a "regional basis." The Council's final recommendation instead refers to the "optimization of service areas" among a list of "planning principles" to be considered by the subcommittee as they review the existing CPCN process and propose amendments to the statute.

Artesian Water Company (Artesian) dissented from the majority opinion of the Council's members in regard to this recommendation. The primary basis for the dissent is Artesian's belief that the Council is acting outside its stated statutory duties as set by the General Assembly. In addition, the Council's report offers no concrete examples of existing issues or problems associated with the current CPCN process that suggest the need for amendment of the current statute.

Section 1306(c) of Title 26 of Delaware Code reads: "The principal duty of the Council shall be to work cooperatively with WRA, DGS, DNREC, and DPH to achieve water supply self sufficiency in northern New Castle County by 2010, and to develop and publish water supply plans for southern New Castle County, Kent County and Sussex County. These plans shall identify and describe uses, localities or areas where water supply issues exist and identify and describe localities or areas where future water supply issues may occur."

It goes on to state "Additional duties of the Council shall consist of performing the following *specific* [emphasis added] functions:

(1) To provide technical input in conducting hydraulic field tests and/or modeling to optimize and expand, where appropriate, water utility connections;

(2) To work with water utilities to develop cost and capacity agreements subject to approval by the applicable rate-setting authority for the purchase of water supplies during drought and other times emphasizing the need for providers with supply deficiencies to enter agreements which assure adequate supply to customers; and

(3) To conclude the authorized United States Army Corps of Engineers Groundwater Availability Study for northern New Castle County and provide technical support on any groundwater availability studies as deemed necessary by the WSCC."

Artesian believes that the statute is clear in regard to what the Council's water supply plans "shall identify and describe" and about the "specific" duties of the Council. There is no mention of review and consideration of the process for issuance of CPCNs. Other members of the Council have argued that the Council may undertake any matter not specifically proscribed by the statute. We find that argument counter to the smooth and proper functioning of a body created by legislation to address particular matters of importance to the legislature. Without a proper focus on the designated duties, the legislative intent to have them addressed may not be timely met. It is even more surprising that a Council created by the legislature would find it appropriate to stray from its enumerated duties to address a matter addressed by the legislature not very long ago.

In 1991, the current process for the granting of CPCNs for water utilities was enacted into law as Senate Bill 144, as amended, by the 136th General Assembly. The preamble to Senate Bill 144 expressed an urgent intention of the General Assembly to prohibit wide area franchising to protect the rights of farmers and other landowners. Section 203C of Title 26 of the Delaware Code was amended as recently as 2000 to address additional concerns raised by landowners who wanted the right to opt-out of a proposed franchise and as recently as 2004 to address matters related to municipalities.

The changes made to Section 203C of Title 26 in 2000 were in response to recommendations of the Governor's Water Supply Task Force, which was formed in response to difficulties experienced by certain water suppliers in meeting water system demands during the drought of 1999. However, when Senate Bill 370 was passed by the 140th General Assembly in 2000, it did not implement all of the recommendations made in the December 2, 1999 Final Report of the Governor's Water Supply Task Force. In particular, the 2000 Act did not implement the recommendation for regional water planning. It has been the clear intent of the legislature to ensure that landowners, not a State agency, should determine which water utility should serve their land. As noted, Artesian does not believe that the legislature has requested the Council to re-address this decision.

In reaching beyond the enumerated duties of the Council, those recommending changes to the CPCN process have failed to provide any concrete support or examples of problems under existing law. Although new development may initially occur with infrastructure serving a single or a few neighboring communities, proper planning by the utility can ensure a cost effective, efficient and reliable integrated water system as an area develops. This is the situation that has occurred in northern New Castle County during Artesian's first 100 years as a water utility, and is now occurring in southern New Castle County. Attached as EXHIBIT A is a map of Artesian's water distribution system for New Castle County, which includes southern New Castle County as part of the integrated water system. Clearly, Artesian is developing a regional water supply system for all of New Castle County. Integration of systems will also prove to be the case in Kent and Sussex Counties, where it has not already occurred.

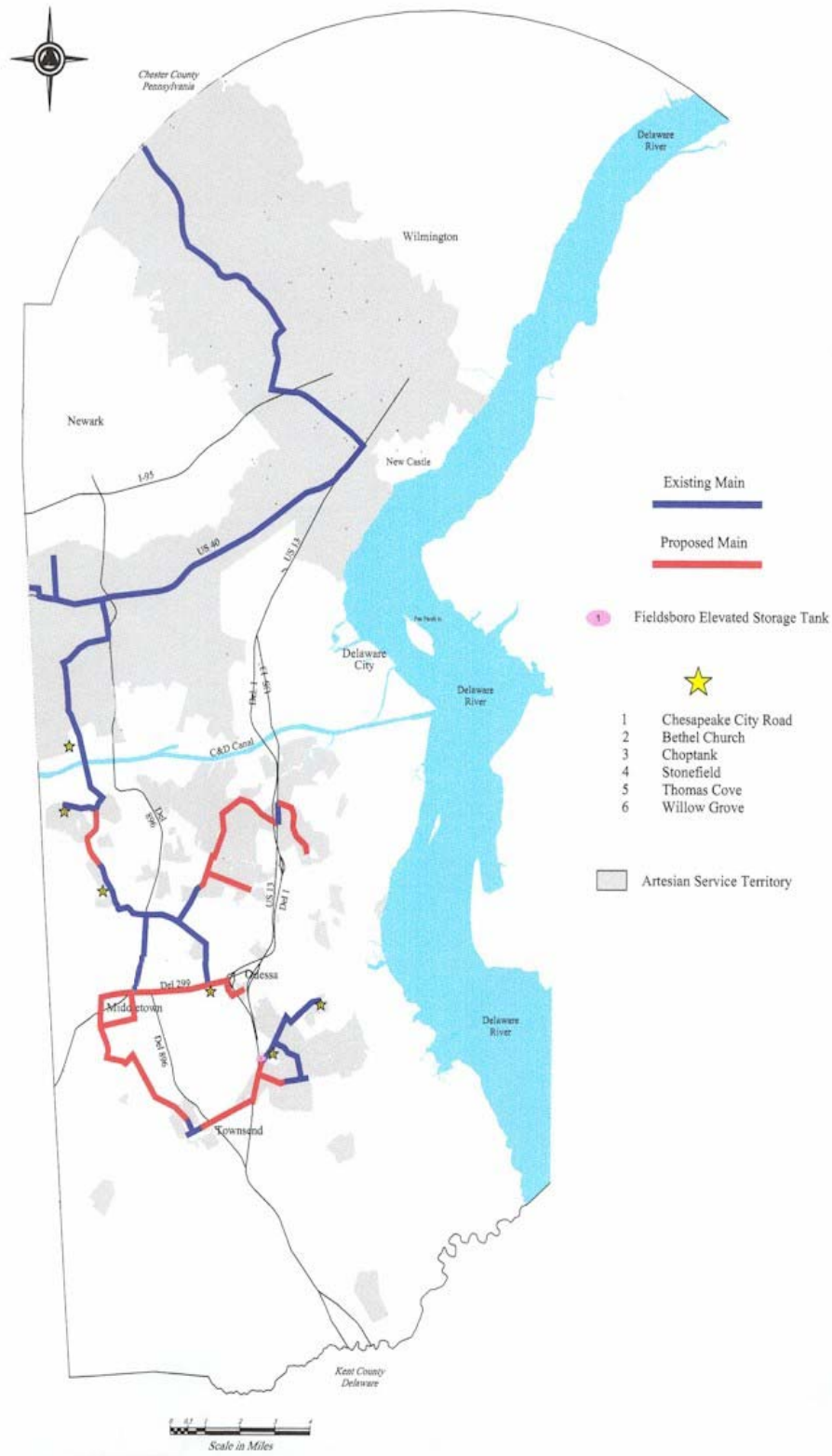
The Council has failed to provide specific examples of "inefficient management" and "duplication of infrastructure", perhaps because it is so rare. In addition, any time there is more than one water utility providing service in the state, there will be the occasional "duplication of infrastructure." In fact, in northern New Castle County, the proximity of Artesian and United Water's water transmission mains provides Christiana Hospital with an

emergency back-up available from United Water should Artesian ever experience a system failure that might threaten supply to the hospital. In addition, the many interconnections among the different water providers ensures a higher degree of reliability of service to all, particularly those relying upon only one or two sources of supply. The interconnections also provide fire protection redundancy.

It is also important to recognize that the water resource allocation process is managed by the Department of Natural Resources and Environmental Control (DNREC) and not at all controlled or affected by the CPCN process. DNREC has acted to protect the water resource to ensure it is not over-used. Transmission mains are used to move water from where it is found to be plentiful to where it is needed. Delaware is fortunate to have relatively plentiful sources of water that do not need to be moved great distances, as is the case in more arid parts of the country, but it is quite common for water to travel miles from its source to its point of use even in Delaware. As long as DNREC continues its excellent efforts to protect the resource through its existing allocation process, over-use of the groundwater resource is not a concern.

For the reasons stated, Artesian dissents from the recommendation of the Council to create a subcommittee to draft amendments to 26 Del. Code Section 203C. The existing process appropriately allows for landowner choice of a water supplier to serve an unfranchised area. Artesian respectfully submits that the recommendation is an unnecessary and inappropriate diversion from the Council's statutory duty of developing water supply plans that identify and describe areas where water supply issues exist or may occur.

EXHIBIT A



1. Delaware Water Supply Coordinating Council

Introduction

In August 2003, Governor Minner signed House Bill 203 reauthorizing the Delaware Water Supply Coordinating Council (WSCC) through January 1, 2010. HB 203 authorized the WSCC to encourage the development of over one billion gallons of additional water supply storage in northern New Castle County (north of the Chesapeake and Delaware Canal) since the drought of 1999 and coordinate water supply planning and management. The new law also expanded membership statewide and authorized the WSCC to prepare updated water supply and demand studies for growing areas in Delaware including:

- Southern New Castle County: Middletown, Odessa, Townsend, and environs
- Kent County: Greater Dover area and suburbs
- Sussex County: Inland Bays and coastal regions

This *Ninth Report to the Governor and General Assembly Regarding the Progress of the Delaware Water Supply Coordinating Council* provides estimates of water supply and demand for southern New Castle County through 2030. This is the ninth in a series of reports which began in 2000. Previous reports are available online at www.wr.udel.edu.

Acknowledgments

Special thanks to the WSCC work group who provided oversight of this report, namely: Joseph DiNunzio and Bruce Kraeuter (Artesian Water Company), Sheila Shannon (Tidewater Utilities, Inc.), Susan Skomorucha, Nancy Trushell, and Michael Blake (United Water Delaware), and Lorraine Fleming (Delaware Nature Society). Kevin Donnelly and Stewart Lovell (Delaware Department of Natural Resources and Environmental Control (DNREC)); John Talley, Stefanie Baxter, and Scott Andres (Delaware Geological Survey (DGS)); and Kevin J. Vonck and Gerald Kauffman (University of Delaware, Institute for Public Administration – Water Resources Agency (IPA-WRA)) co-authored this report on behalf of the WSCC.

State Water Coordinator

In July 2000, Governor Carper signed HB 549 which appointed the University of Delaware, Institute for Public Administration – Water Resources Agency as the State Water Coordinator. The mission of the Water Coordinator is to work cooperatively with the water purveyors in northern Delaware to ensure that over one billion gallons of new water supplies are developed in accordance with a schedule recommended by the Governor's Water Supply Task Force after the drought of 1999. Along with the Water Coordinator, HB 549 appointed the DGS and the Delaware DNREC as a triad of water advisors to the WSCC. The State Water Coordinator appointment expired by law on December 31, 2003, but continues formally into 2006 by resolution of the WSCC.

Water Supply Coordinating Council

HB 549 also appointed the WSCC for a tenure extending until December 31, 2003. The WSCC was directed to 1) promote new water supplies in northern New Castle County to meet peak demands based on the drought of record; and 2) work cooperatively in a public-private effort between government and water purveyors to manage water supplies more efficiently in Delaware.

The following public and private entities were appointed to the WSCC:

- Office of the Governor
- Secretary of the Delaware Department of Natural Resources & Environmental Control (Chair)
- Secretary of the Department of Public Safety
- Secretary of the Delaware Department of Agriculture
- Executive Director of the Public Service Commission
- Director of the Delaware Emergency Management Agency
- Director of the Delaware Geological Survey
- Director of the Delaware Division of Public Health
- Public Advocate
- Executive Director of the Delaware River Basin Commission
- New Castle County Executive
- Artesian Water Company
- City of Newark
- City of Wilmington
- New Castle Municipal Services Commission
- Tidewater Utilities, Inc.
- United Water Delaware
- New Castle County Chamber of Commerce
- Delaware State Chamber of Commerce
- Delaware Nursery and Landscape Association
- Delaware Professional Grounds Management Society
- Delaware State Golf Association
- Delaware Nature Society
- Coalition for Natural Stream Valleys
- New Castle County Civic League

The WSCC or its subcommittees have met on the following dates:

2000	March 3*	Carvel State Office Building, Wilmington, Del.
	March 24*	Carvel State Office Building, Wilmington, Del.
	May 22*	Delaware Geological Survey, Newark, Del.
	July 31	New Castle County Chamber of Commerce, Churchmans Crossing, Del.
	October 4	Artesian Water Company, Churchmans Crossing, Del.
2001	January 10	United Water Delaware, Stanton, Del.
	March 14	Artesian Water Company, Churchmans Crossing, Del.
	June 14	United Water Delaware, Stanton, Del.
	October 4	Artesian Water Company, Churchmans Crossing, Del.
2002	February 5	United Water Delaware, Stanton, Del.
	April 17	Artesian Water Company, Churchmans Crossing, Del.
	July 10	Artesian Water Company, Churchmans Crossing, Del.
	September 11	Artesian Water Company, Churchmans Crossing, Del.
	October 17	DNREC Lukens Building, New Castle, Del.
	November 21	Artesian Water Company, Churchmans Crossing, Del.
	December 12	Artesian Water Company, Churchmans Crossing, Del.

2003	May 22	Artesian Water Company, Churchmans Crossing, Del.
	July 16	Artesian Water Company, Churchmans Crossing, Del.
	October 9	Artesian Water Company, Churchmans Crossing, Del.
	December 11	Artesian Water Company, Churchmans Crossing, Del.
2004	January 13	University of Delaware Water Resources Agency, Newark, Del.
	February 25	University of Delaware Water Resources Agency, Newark, Del.
	June 24	Delaware Technical & Community College – Terry Campus, Dover, Del.
	September 30	DNREC Lukens Building, New Castle, Del.
	October 21	University of Delaware Water Resources Agency, Newark, Del.
2005	March 3	University of Delaware Water Resources Agency, Newark, Del.
	April 29	DELDOT – Farmington/Felton Room, Dover, Del.
	November 21	University of Delaware Water Resources Agency, Newark, Del.
	December 6	University of Delaware Water Resources Agency, Newark, Del.
	December 8	Kent County Administration Building, Dover, Del.
2006	January 12	University of Delaware Water Resources Agency, Newark, Del.
	January 26	Kent County Administration Building, Dover, Del.
	February 16	University of Delaware Water Resources Agency, Newark, Del.
	May 3	University of Delaware Water Resources Agency, Newark, Del.
	May 17	Kent County Administration Building, Dover, Del.
	June 13	University of Delaware Water Resources Agency, Newark, Del.
	June 20	DNREC Lukens Building, New Castle, Del.

* The WSCC met under Executive Order 74 (12/30/99) before HB 549 was signed in July 2000.

In August 2003, Governor Minner signed HB 203 which reauthorized the WSCC through January 1, 2010, expanded the membership of the WSCC to include statewide representation, and appointed the DGS and IPA-WRA as voting members. The new mandate of the WSCC is to work cooperatively to achieve water supply self sufficiency in northern New Castle County (eliminate dependence on out of state supplies) by 2010 and to develop water supply plans for southern New Castle County, Kent County, and Sussex County. Section 1306(c) of the WSCC law specifically states that:

"The principal duty of the Council shall be to work cooperatively with WRA, DGS, DNREC, and DPH to achieve water supply self sufficiency in northern New Castle County by 2010, and to develop and publish water supply plans for southern New Castle County, Kent County and Sussex County. These plans shall identify and describe uses, localities or areas where water supply issues exist and identify and describe localities or areas where future water supply issues may occur. These areas and uses should include, but not be limited to Middletown-Odessa-Townsend, Dover and central Kent County, Coastal Sussex County and agricultural irrigation uses. These plans shall contain an estimate of existing and future public and private water supplies and water demands through 2025. Private demands shall take into account, to the maximum extent practicable, all domestic, industrial, and irrigation uses."

The following entities were added as members of the expanded WSCC:

- University of Delaware, Institute for Public Administration – Water Resources Agency
- Kent County

- Sussex County
- Public Water Supply Utility in Sussex County Association of Towns (SCAT)
- Public Water Supply Utility in League of Local Governments, Kent County
- Delaware Rural Water Association
- National Association of Water Companies, Delaware Chapter (not already represented in NCC)
- Local Chamber of Commerce in New Castle County
- Local Chamber of Commerce in Kent County
- Local Chamber of Commerce in Sussex County
- Delaware Farm Bureau
- Center for Inland Bays
- State Fire Marshal

The Secretary of DNREC (or his/her designee) serves as Chair of the WSCC. The Council, by majority vote, may designate additional members and also establish subcommittees to deal with specific water supply issues and plans. IPA-WRA continues as State Water Coordinator by resolution of the WSCC.

2. Southern New Castle County

Population growth and the conversion of agricultural land to urban/suburban uses are expected to increase the demand for public drinking water in southern New Castle County. The rise in public water demand is expected to be offset somewhat by a decline in agricultural irrigation demand.

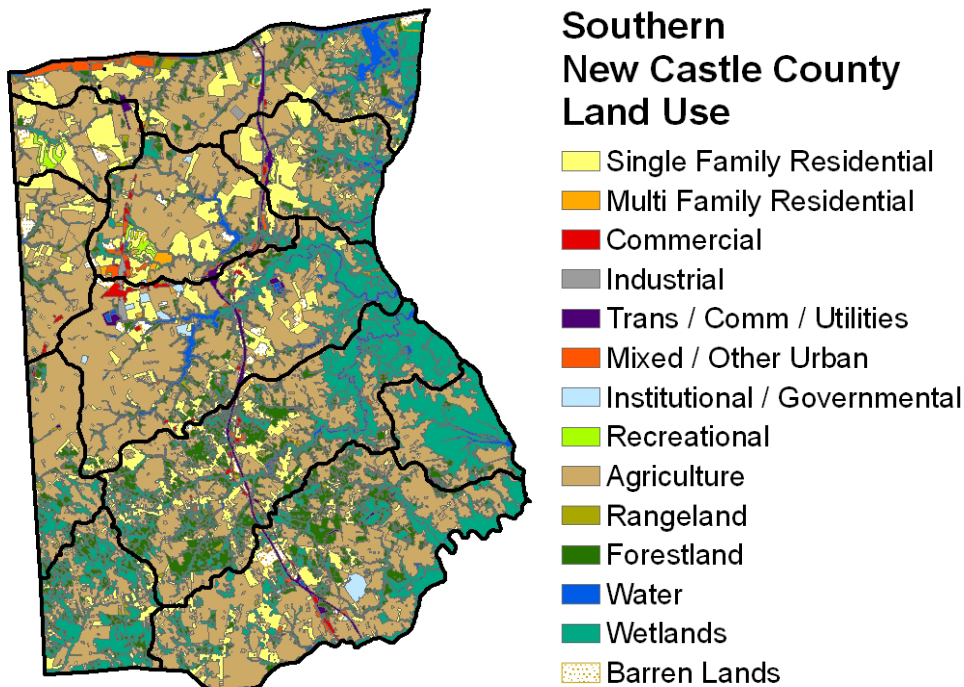
Land Use

Southern New Castle County, Delaware is a rural, yet rapidly-suburbanizing 200-square mile region south of the Chesapeake and Delaware Canal including the towns of Middletown, Odessa, and Townsend. According to 2002 land use data provided by the State of Delaware, 48% of the area is agriculture, 37% is forest, wetland, or open space, and 15% is urban/suburban (Table 2.1). The New Castle County Department of Planning estimates up to 20,000 dwelling units, with a mean gross density of one unit per acre, may replace 20,000 acres (31 square miles) of agricultural land, thus doubling the area of urban/suburban land by 2030. Forests, wetlands, and public open space are expected to remain constant as these areas are protected by federal, state, county, and municipal regulations.

Table 2.1. Land use in southern New Castle County, 2002 versus 2030.

<i>Land Use</i>	<i>2002 Area (sq. mi.)</i>	<i>2002 Area (%)</i>	<i>2030 Area (sq. mi.)</i>	<i>2030 Area (%)</i>
Urban/Suburban	30	15%	61	31%
Agriculture	96	48%	65	32%
Forest/Wetlands/Open	74	37%	74	37%
TOTAL	200	100%	200	100%

Figure 2.1. Land use in southern New Castle County, 2002.



Population

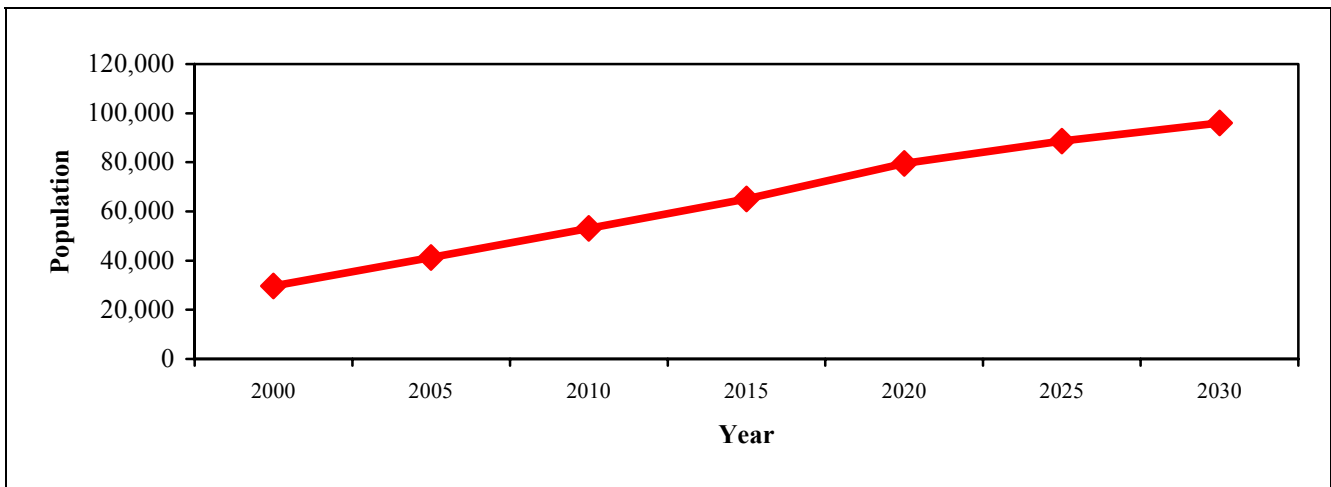
According to the October 8, 2005 Delaware Population Consortium estimates (Table 2.2, Figure 2.2), the population of southern New Castle County was 29,682 in 2000 and is projected to increase 223% to 95,996 by 2030.

Table 2.2. Projected population growth in southern New Castle County.

<i>Year</i>	<i>Population</i>	<i>% Increase</i>
2000	29,682	--
2005	41,243	39%
2010	53,060	29%
2015	65,021	22%
2020	79,501	22%
2025	88,651	11%
2030	95,996	8%

Source: Delaware Population Consortium, October 2005

Figure 2.2. Projected population growth in southern New Castle County.



Source: Delaware Population Consortium, October 2005

Households

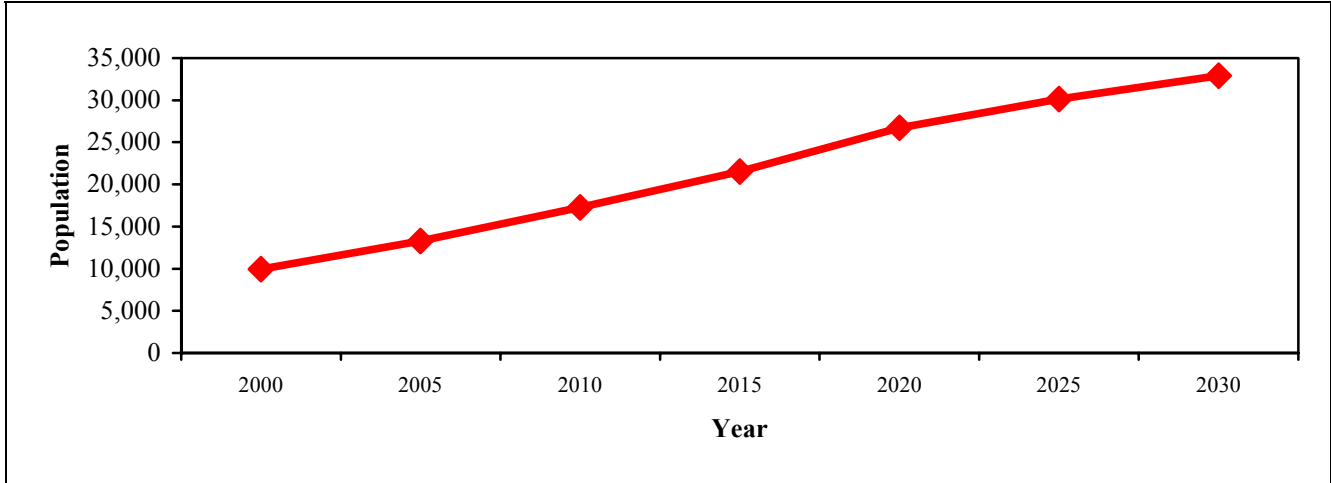
According to the October 8, 2005 Delaware Population Consortium estimates (Table 2.3, Figure 2.3), the number of households in southern New Castle County will increase 245% from 9,549 in 2000 to 32,913 by 2030. The number of persons per household was 3.1 (29,682/9,549) in 2000 and is projected to be 2.9 by 2030 (95,996/32,913).

Table 2.3. Projected growth in households in southern New Castle County.

<i>Year</i>	<i>Households</i>	<i>% Increase</i>
2000	9,549	--
2005	13,272	39%
2010	17,280	30%
2015	21,535	25%
2020	26,733	24%
2025	30,159	13%
2030	32,913	9%

Source: Delaware Population Consortium, October 2005

Figure 2.3. Projected growth in households in southern New Castle County.



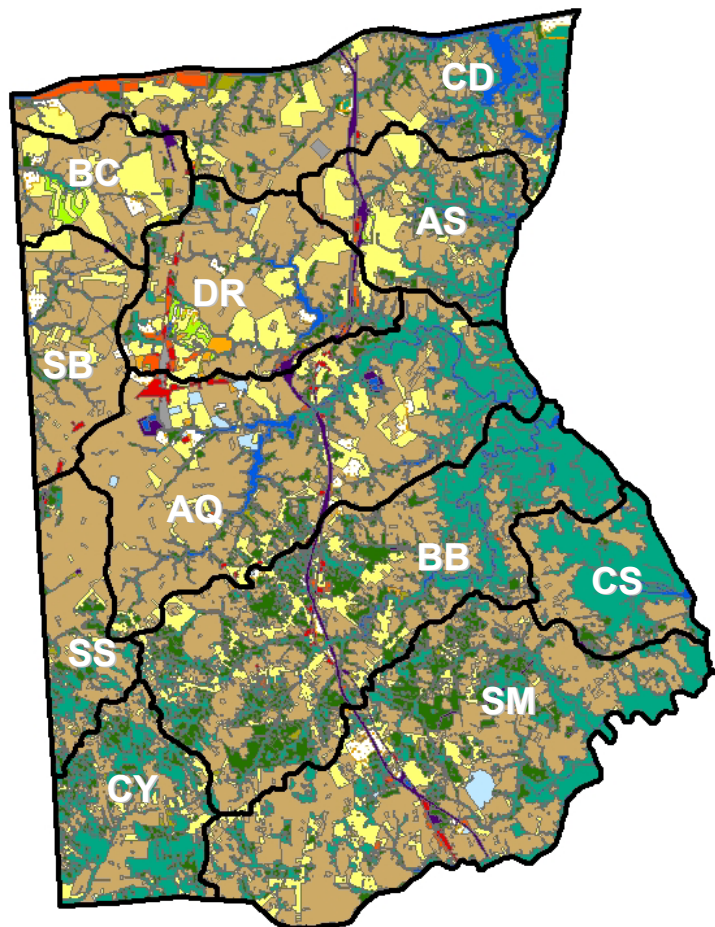
Source: Delaware Population Consortium, October 2005

Watersheds

The basic geographic units for water resources planning and management are the watersheds:

Figure 2.4. Southern New Castle County Watersheds

<i>ID</i>	<i>Watershed</i>	<i>Area (sq. mi.)</i>
CD	C & D Canal	31
AS	Augustine Creek / Silver Run	12
DR	Drawyers Creek	15
AQ	Appoquinimink River	32
BB	Blackbird Creek	32
CS	Cedar Swamp	8
SM	Smyrna River	34
CY	Cypress Branch / Chester River	11
SS	Sassafras River	8
SB	Sandy Branch / Great Bohemia Creek	9
BC	Back Creek	7
	TOTAL	199



3. Water Supply Service Areas

The following water systems provide drinking water in southern New Castle County:

Public Community Wells

- *Artesian Water Company*: 26 wells
- *Artesian Water Company, Delaware Correctional Center*: 4 wells
- *Tidewater Utilities, Inc.*: 24 wells
- *Town of Middletown*: 4 wells
- *Mount Pleasant Trailer Park*: 2 wells
- *Cantwell Water Company*: 2 wells

Self-Supplied Non-Community Wells: 20 wells

- *Transient*: Restaurants, stores, hotels, parks
- *Non Transient*: Schools, daycare centers, office, factories

Residential Individual Wells

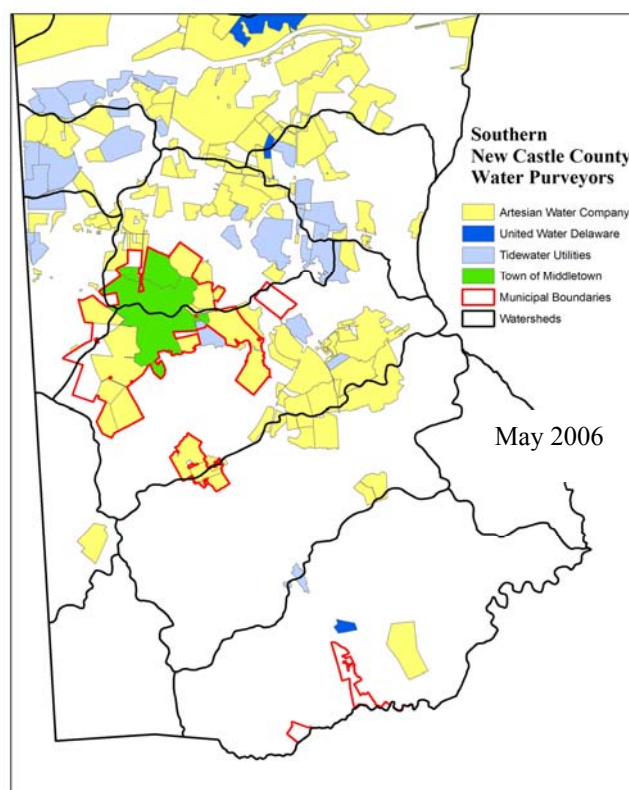
- 4,600 wells

Irrigation Water Supplies

- *Farms*: 26 wells
- *Golf courses, nurseries*: 1 well

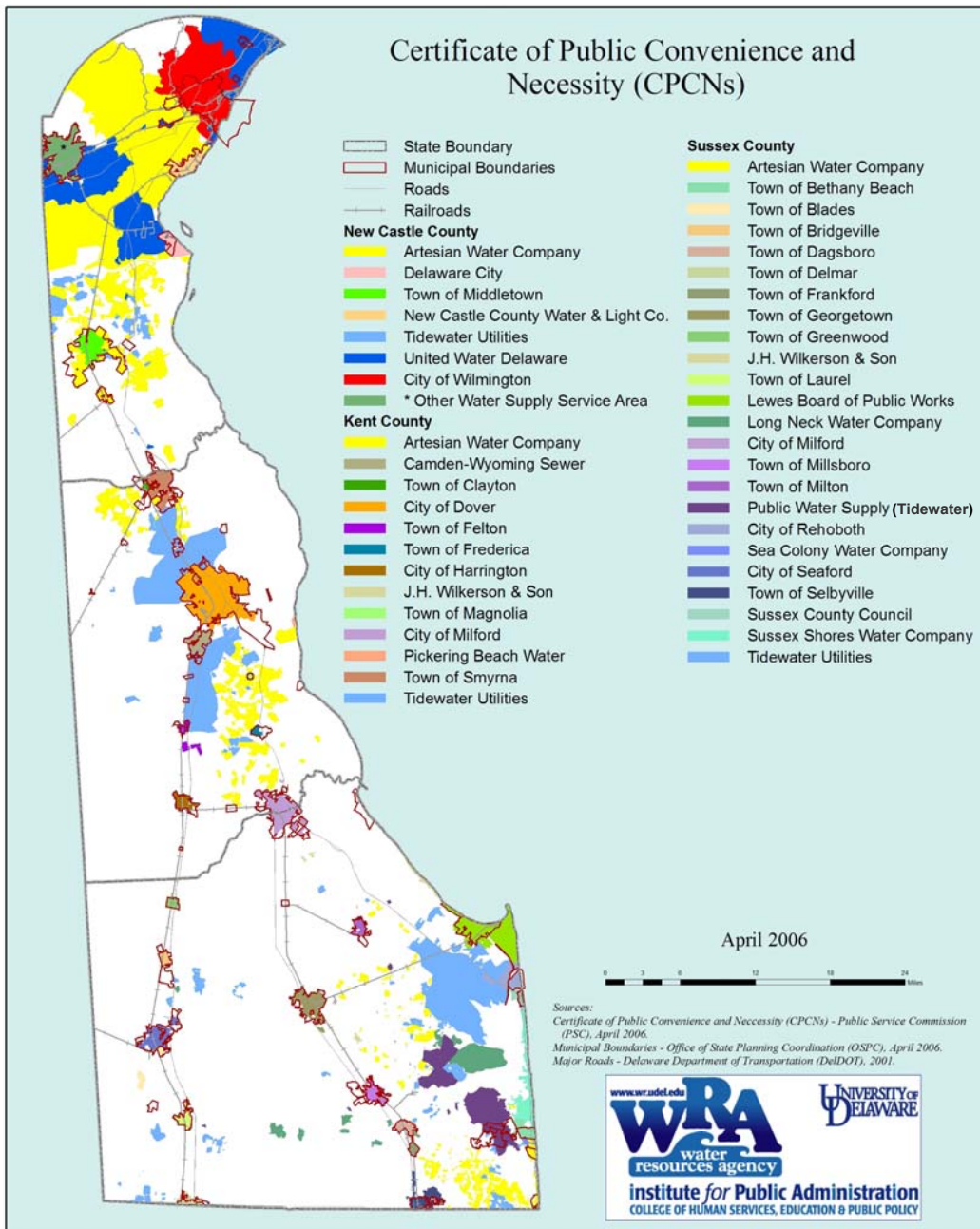
Figure 3.1 delineates the water supply franchise areas of purveyors in southern New Castle County and Figure 3.2 delineates the areas statewide. For a private water utility, and in certain circumstances a municipal water utility, to extend or expand its service territory it must apply for and be granted a Certificate of Public Convenience and Necessity (CPCN). Since 1991, when the Delaware legislature changed the requirements for obtaining a CPCN, service areas are primarily granted based upon the request of a landowner or landowners. This is a significant change from the prior practice of granting a regional franchise to a water utility, and has resulted in some situations where two different water utilities serve adjacent developments. This could lead to inefficient management of the water supply network with duplication of infrastructure. The Public Service Commission, which has had the authority to grant CPCNs since 2001 (from 1979 through 2001, that authority was with the DNREC), is presently drafting updated regulations with the intention of creating more compact service territories in accordance with the following water supply principles:

Figure 3.1. Public water supply franchise areas in southern New Castle County.



- *Compact and contiguous service areas:* Water supply service areas would be awarded to purveyors that have compact and contiguous regional service areas providing efficient delivery of drinking water without redundancy in infrastructure.
- *Consistency with resource management:* CPCN certification would be based upon a regional network that enables utilities to prepare long range plans to serve growing areas.
- *Reasonableness:* The request for a utility CPCN certification would be evaluated on the basis of past customer performance and approval from the vast majority of the property owners.

Figure 3.2. Delaware Water Supply Certificates of Public Convenience and Necessity.



4. Ground-Water Availability

Because ground-water occurs in the subsurface, techniques for estimating ground-water availability rely on observations made in scattered wells and test borings and scientific methods that predict subsurface conditions between points of observation. In addition, estimates of the maximum amount of water available in southern New Castle County are limited by other conditions that are protective of the long-term viability of water resources, such as limiting drawdown of pumping-well water levels, limiting potential for saltwater intrusion, and limiting reduction of streamflow. On the basis of the two most recent assessments of ground-water availability done by Groot and others (1983) and Baxter and Talley (1996), the current estimate of ground-water availability ranges between 20 and 30 mgd. These values represent rough estimates of availability that should be sustainable over the long term (multiple years), amounts of water available for short duration peak demands (days to months) are greater, though an estimate of the amount of water available for peak demands has not been made.

Table 4.1. Estimated ground-water availability in southern New Castle County.

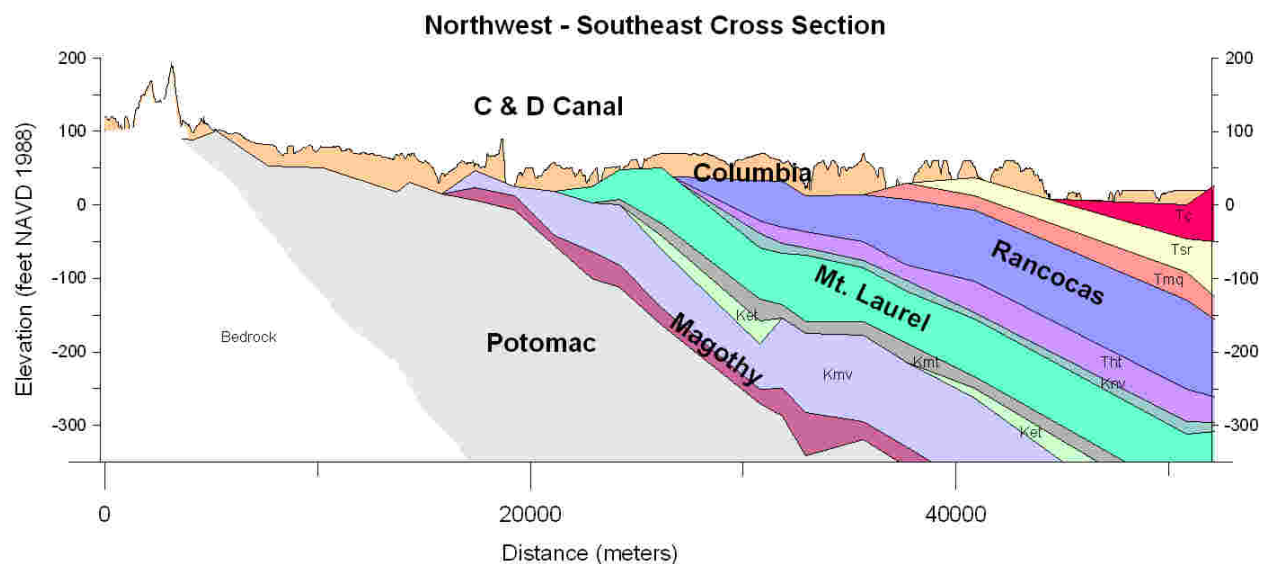
<i>ID</i>	<i>Aquifer</i>	<i>Availability (mgd)</i>
PT	Potomac	6.9
MAG	Magothy	2.3
ML	Mt. Laurel	4.2
RNG	Rancocas	5.2
CLG	Columbia	1.4 – 10.0
Subtotal		20 – 30

Aquifers in the Potomac Formation and near-surface geologic units (Columbia aquifer) contain the largest quantities of ground-water (Table 4.1). Because of its near-surface location, highly variable thickness, and importance to streamflow, over most of the area the Columbia aquifer is not a viable source of water for higher-capacity (>100 gpm) public water supply wells for the long term. However, over much of the area, the Columbia aquifer is capable of supporting many small capacity (<20 gpm) water supply wells. Staffs of the DGS and DNREC are currently working on revising these estimates of available water including developing information and tools to predict the amount of ground-water available to meet short term peak demands.

Ground-water and Aquifers

Ground-water – water pumped by wells – is the sole source of potable water in southern New Castle County. Ground-water in the Columbia formation is also the source of all fair weather flow in streams, which in this area, is a majority of total stream flow. The aquifers that yield this water and the intervening non-water bearing confining beds occur within a southeasterly dipping and thickening section or wedge of unconsolidated to weakly consolidated sediments of the Atlantic Coastal Plain (Figure 4.1). Within the Coastal Plain sediments, only those aquifers occurring at the bottom of the wedge are present throughout the area. Multiple aquifers become available towards the southeast, and individual aquifers occur at greater depths towards the southeast. The shallowest aquifer (Columbia) occurs within a sheet-like body of sandy sediment that overlies the sediments of the wedge. It is important to note that significant quantities of treated wastewater are discharged into the Columbia aquifer. This water will discharge to streams or recharge deeper aquifers. Future estimates of water availability should include the amount of water that is recycled by land based wastewater disposal.

Figure 4.1. Generalized cross section extending from near Newark to southeastern New Castle County.



Major aquifer names are shown (Potomac, Magothy, Mt. Laurel, Rancocas, and Columbia). Geologic units forming confining beds are Merchantville Formation (Kmv), Englishtown Formation (Ket), Marshalltown Formation (Kmt), Navesink Formation (Kns), Hornerstown Formation (Tht), Manasquan Formation (Tmq), Shark River Formation (Tsr), and Calvert Formation (Tc).

Ground-water is present throughout the area but the amount of water available and chemical quality of the available water varies within aquifers and with location and depth. Reliable assessment of ground-water availability requires accurate information on the compositions of aquifers and confining beds, the locations and construction details of water supply wells, and the chemical composition of water. Assessments of ground-water availability continue to be refined and improved by state agencies as new information becomes available and scientific techniques for understanding and predicting the water-bearing characteristics of subsurface sediments improve. Because the cost of well installation increases with depth, most wells are drilled to shallowest practical depth. One direct result of this is that less information is available for aquifers occurring at greater depths.

5. Water Supply

Existing water supplies in southern New Castle County are divided between: 1) potable water supplies from public community wells, self-supplied non-community wells, and residential individual wells, and 2) non-potable water supplies from farm, nursery and golf course irrigation wells. Table 5.1 summarizes current water allocations from wells in southern New Castle County.

Table 5.1. Current allocated ground-water supplies in southern New Castle County.

<i>Water System</i>	<i>Potable Maximum Daily Supply (mgd)</i>	<i>Potable Maximum Monthly Supply (mgd)</i>	<i>Potable Maximum Yearly Supply (mgd)</i>	<i>Nonpotable Maximum Daily Supply (mgd)</i>
Artesian Water Company	8.8	7.3	6.7	
AWC: DE Correctional Center	2.1	2.1	2.1	
Tidewater Utilities, Inc.	2.7	2.5	1.3	
Town of Middletown	1.7	1.7	1.5	
Mt. Pleasant Trailer Park	0.02	0.02	0.01	
Cantwell Water Company	0.04	0.03	0.02	
Self-Supplied Non-Community Wells	<i>0.3</i>	<i>0.2</i>	<i>0.1</i>	
Public Water Supply	15.7	13.9	11.7	
<i>Residential Individual Wells</i>	<i>1.4</i>	<i>1.4</i>	<i>1.4</i>	
Farms, Nurseries				9.7
Golf Courses				0.3
Total	17.1	15.3	13.1	10.0

Public Water Supply

The existing public water supply in southern New Castle County is 15.7 mgd based on DNREC wellfield maximum daily water allocations. Appendix C contains a summary of DNREC water allocations for public water supply wells in southern New Castle County.

Individual Wells

GIS analysis of 2002 land use data indicates there are approximately 4,600 residential units with individual wells in southern New Castle County. Because these residences are not within the boundaries of public water supply service areas, their source of water supply is assumed to be individual wells. Approximately two-thirds of individual wells draw from the confined aquifer; the remaining third pump from the water table (unconfined aquifer). Assuming a daily average pumping rate of 300 gpd per dwelling unit, the supply from individual wells is computed to be 1.4 mgd.

To corroborate these estimates, IPA-WRA reviewed other references. The 1992 *Wastewater Needs Evaluation for Southern New Castle County* by Weston reported more than 2,800 private domestic wells in southern New Castle County based on 1980 U.S. Census Bureau estimates. DNREC reports that 505 domestic wells were drilled in the study area between 1999 and 2003 (101 wells per year). A

review of DNREC well permit records indicate that 75% of these wells are for new residences. Therefore 75 new wells per year are drilled in the study area, while the remainder are replacements for existing residential wells. Adding 75 new individual wells per year increases the total number of wells from 2,800 in 1980 to 4,450 by 2002. For purposes of this analysis, 4,600 residential wells are estimated in southern New Castle County.

Irrigation

As of May 2006, farms and nurseries have DNREC maximum daily allocations to pump 9.7 mgd from irrigation wells in southern New Castle County (Appendix D). The database of existing irrigation wells was verified using the DNREC water allocation database, the DGS well database, and the records of the USDA Natural Resource Conservation Service regarding existing farms in southern New Castle County. The number of agriculture irrigation wells is expected to decline in the future due to the conversion of agricultural land to urban and suburban uses.

There are three golf courses in southern New Castle County: Back Creek (192 acres), Frog Hollow (164 acres), and Vandegrift (31 acres). Irrigation wells provide up to 0.3 mgd to water these courses.

The total irrigation supply from allocated wells for agriculture (9.7 mgd) and golf courses (0.3 mgd) is 10.0 mgd.

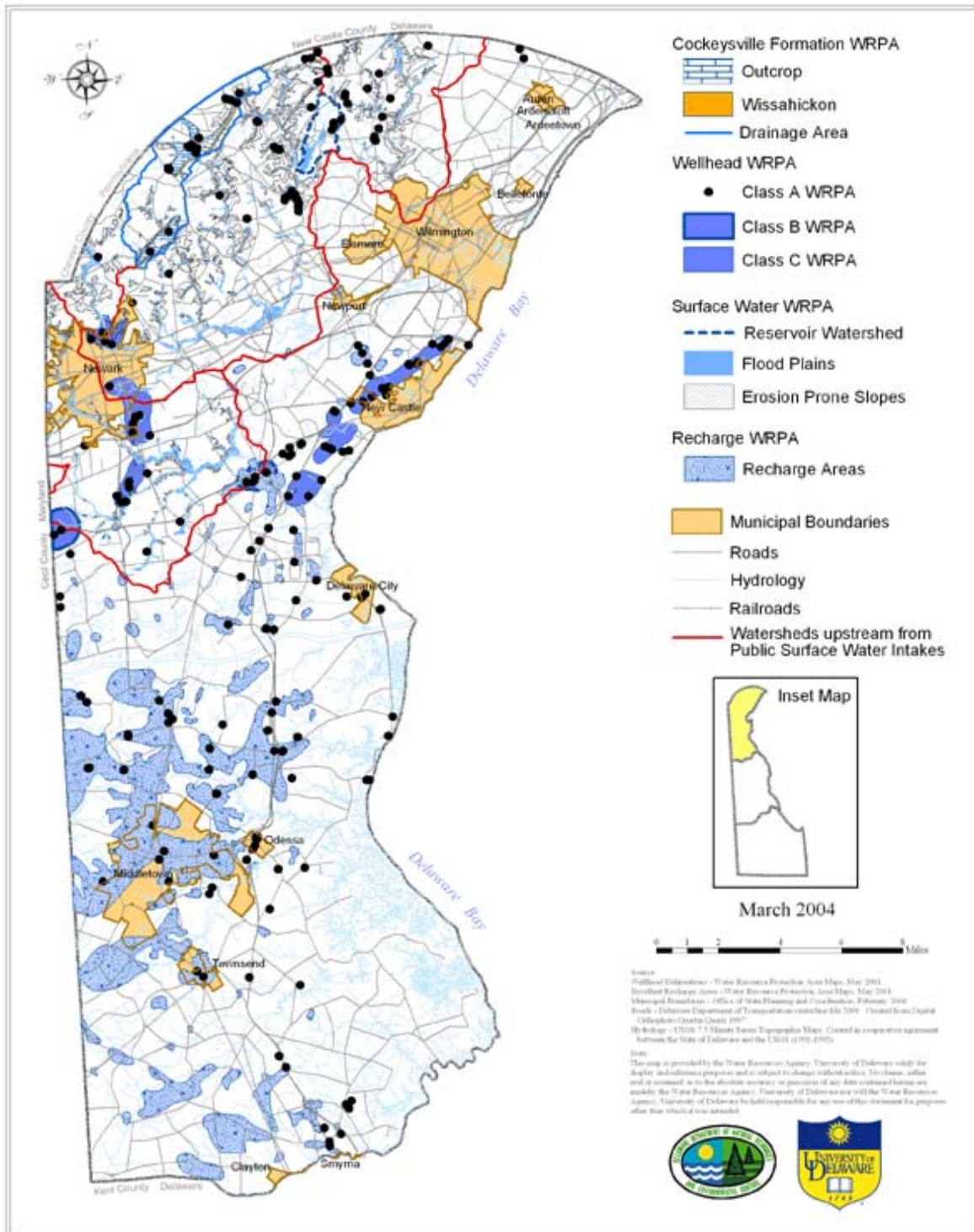
Table 5.2 compares ground-water availability with current allocated supplies on an aquifer by aquifer basis. The availability listed in the table is a long term yield for each aquifer expressed as a daily average. The maximum daily supply values are the daily limits of all water allocation permits totaled for each aquifer for potable and non-potable uses. These values represent the uppermost amount of water that can be pumped in a single day. Simultaneous peaking among water systems rarely, if ever, occurs. Moreover, the daily average for all water withdrawals, if computed on an annual basis, will be substantially less than the peak day, typically by 30 percent or more. Therefore, the allocated annualized daily average supplies for the aquifers are well within the estimated groundwater availability

Table 5.2. Ground-water availability and supply by aquifer in southern New Castle County.

<i>Aquifer</i>	<i>Long-term* Availability (yield) Expressed as Daily Average (mgd)</i>	<i>Potable** Public Maximum Daily Supply (mgd)</i>	<i>Non-potable** Irrigation Maximum Daily Supply (mgd)</i>
Potomac	6.9	9.3	0.0
Magothy	2.3	2.1	0.3
Mt. Laurel	4.2	2.6	0.9
Rancocas	5.2	1.6	1.5
Columbia	1.4 – 10.0	1.5	7.2
Subtotal	20 – 30	17.1	9.9

* DGS, 1983 and 1996 ** DNREC water supply allocations, 2006

Figure 5.1. Public water supply wells and surface intake watersheds in New Castle County.



6. Water Demand

The WSCC calculated existing and future water demands in southern New Castle County using the following methods to verify and corroborate the estimates.

2005 Summer Demands

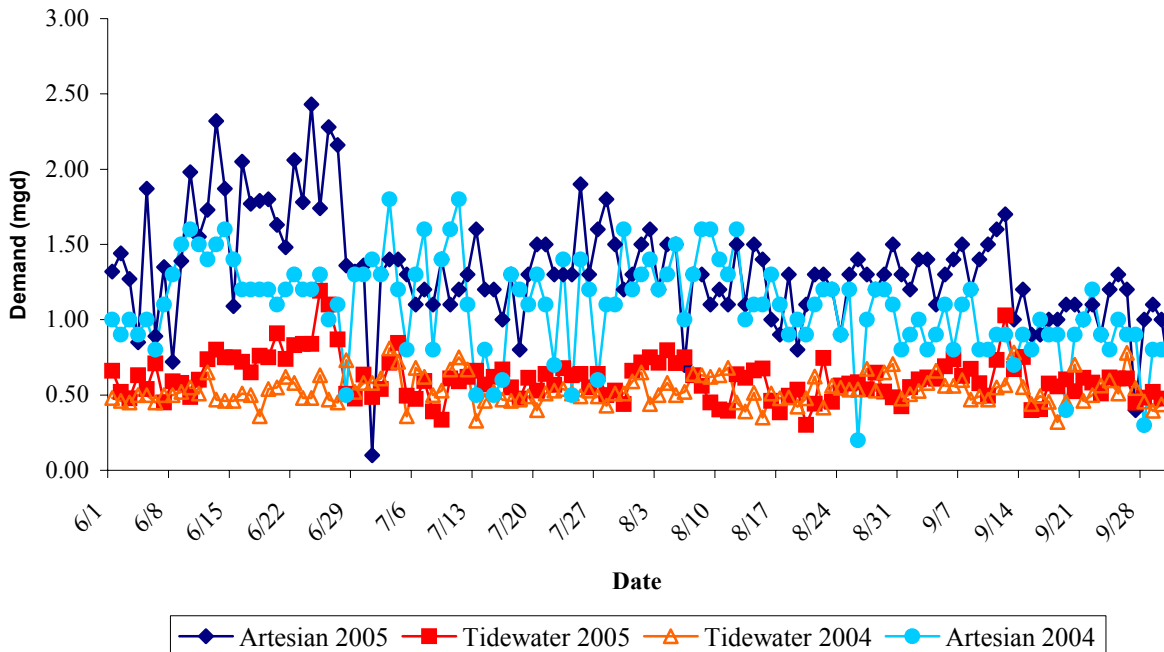
IPA-WRA compiled daily water demand data submitted (via e-mail) by the three public water purveyors (Artesian Water, Middletown, and Tidewater Utilities) during the summers of 2004 and 2005 (June 1 through September 30). Table 6.1 summarizes public water demand from the three purveyors in southern New Castle County. Average annual demand is calculated as the mean demand for the period of October 1 through September 30. Maximum monthly demand is calculated as the mean for July 2005. Peak daily demands are tabulated for the actual day of peak demand for each purveyor.

Table 6.1. Public water demand in southern New Castle County as recorded during 2005.

<i>Purveyor</i>	<i>Average Annual Demand (mgd)</i>	<i>Max Monthly Demand (mgd)</i>	<i>Peak Daily Demand (mgd)</i>	<i>Peaking Factor*</i>
Artesian Water Co.	0.8	1.3	1.6	2.0
Tidewater Utilities	0.6	0.6	1.2	2.0
Town of Middletown	0.6	0.8	1.2	2.0
TOTAL	2.0	2.7	4.0	2.0

* Ratio of peak daily to average annual demand

Figure 6.1. Daily water demand data for Artesian Water Company and Tidewater Utilities, 2004 and 2005.



Note: Artesian's water demand in June 2005 included water supplied to Middletown while the Town's water plant was out of service.

Population Consortium Estimates and U.S. Census Block Data

IPA-WRA calculated water demands by political jurisdiction using 2000 population data from the Delaware Population Consortium and United States Census Block Data (Table 6.2). Public water demands are computed by first subtracting the population served by the 4,600 individual wells from the total population (the 13,800 residents on individual wells do not receive water from public systems and then multiplying the remaining population by normal and peak per capita water use Table 6.3). Normal water demands are computed using water use of 75 gallons per capita per day (gpcd). Peak daily demands are computed assuming 150 gpcd based on a peaking factor of 2.0. The peaking factor measured from summer 2005 demand data used by the water purveyors was 2.0. The peaking factor is the ratio of peak daily to normal water demand. Peak daily demand, rather than peak month, is a conservative assumption used for planning purposes at this stage of development in southern New Castle County.

Table 6.2. Water demand in southern New Castle County by political jurisdiction, 2000.

<i>Political Jurisdiction</i>	<i>Census Population 2000</i>	<i>Individual Well Population</i>	<i>Public Water Supply Population</i>	<i>Normal Demand (x 75 gpc/d)</i>	<i>Peak Daily Demand (x 150 gpc/d)</i>
	<i>(1)</i>	<i>(2)</i>	<i>(1) – (2)</i>	<i>mgd</i>	<i>mgd</i>
Unincorporated Southern NCC	20,981	13,800	7,181	0.54	1.08
Middletown	6,442	0	6,442	0.48	0.96
Odessa	278	0	278	0.02	0.04
Townsend	353	0	353	0.03	0.06
AWC: DE Correctional Center	1,653	0	1,653	0.12	0.24
TOTAL	29,707	13,800	15,907	1.19	2.38

Figure 6.2. Southern New Castle County Census Block population, 2000.

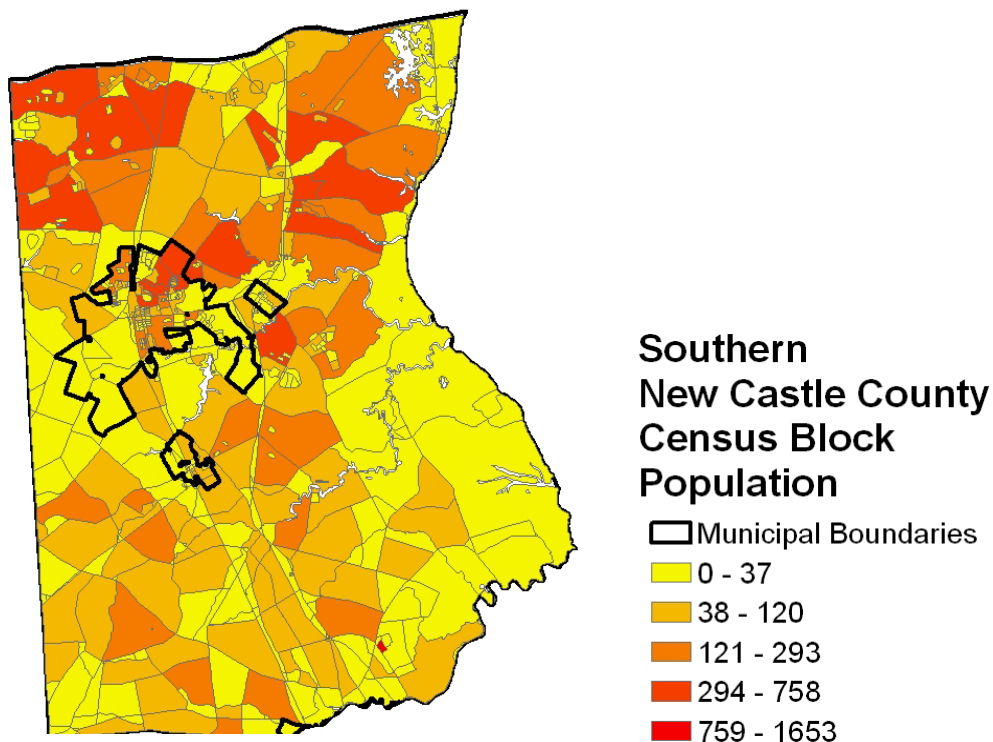


Table 6.3. Estimates of individual well water demand in southern New Castle County.

	<i>Individual Well Demand (mgd)</i>
Residential Parcels 2002	4,610
Normal Demand (150 gal/du)	0.69
Peak Demand (300 gal/du)	1.38

Wastewater Needs 2006

The 2006 Southern Sewer Area Wastewater Program Evaluation for southern New Castle County provides population and wastewater flow estimates for the area south of the C&D Canal (Red Oak Consulting, 2006). The plan estimates peak wastewater flow of 4.5 mgd in 2006 and 12.1 mgd by 2030 (Table 6.4). This projection assumes an additional 25,244 dwelling units will be constructed in southern

New Castle County at 1.0 du per acre. Wastewater flow is approximately 90 percent of water demand. Spray irrigation is a wastewater treatment technique where water is reused and recharged into the aquifer. The supply estimates in this report are conservative as they do not include aquifer recharge from spray irrigation systems in southern New Castle County.

Table 6.4. Summary of wastewater flow in southern New Castle County.

<i>Sector</i>	<i>Wastewater Flow: Initial 2006 (mgd)</i>	<i>Wastewater Flow: Buildout 2030 (mgd)</i>
Residential	--	9.2
Employer	--	1.1
Process	--	0.7
TOTAL	4.5 mgd	12.1 mgd

1998 Merna Hurd Report

In 1998, consultant Merna Hurd prepared a report for DNREC that summarized water supply and demand in northern and southern New Castle County through 2020. The report indicated that normal public water demand in southern New Castle County in 2005 would be 2.4 mgd and peak would be 4.8 mgd. By 2020, the normal demand would be 6.1 mgd and peak would be 12.2 mgd. Peak agriculture/irrigation demand was expected to decline from 14.8 mgd in 2005 to 11.1 mgd by 2020 (Table 6.5).

Table 6.5. Estimates of water demand in southern New Castle County from 1998 Merna Hurd Report.

<i>User (UDC Plan)</i>	<i>2005 Demand (mgd)</i>	<i>2020 Demand (mgd)</i>
Residential/Commercial	2.4	5.1
Industrial	0.0	1.0
Subtotal	2.4 normal / 4.8 peak	6.1 normal / 12.2 peak
Agriculture/Irrigation	14.8	11.1

Irrigation Water Demand

According to the 2002 Census of Agriculture as reported by the University of Delaware Cooperative Extension, irrigated farmland in southern New Castle County totaled 2,862 acres in 1997 and 2,637 acres in 2002, a decline of 30 acres per year. Based on an increasing rate of farmland loss by 2005 we assume there are approximately 2,000 acres of irrigated cropland remaining (primarily corn and soybean and grain) in southern New Castle County.

Research conducted by the University of Delaware Cooperative Extension recommends optimum moisture for a high-yield bushel of corn is 20 to 25 inches over a 92-day growing season from June through August. UD irrigation and agronomy extension specialists indicate that a crop might need 30

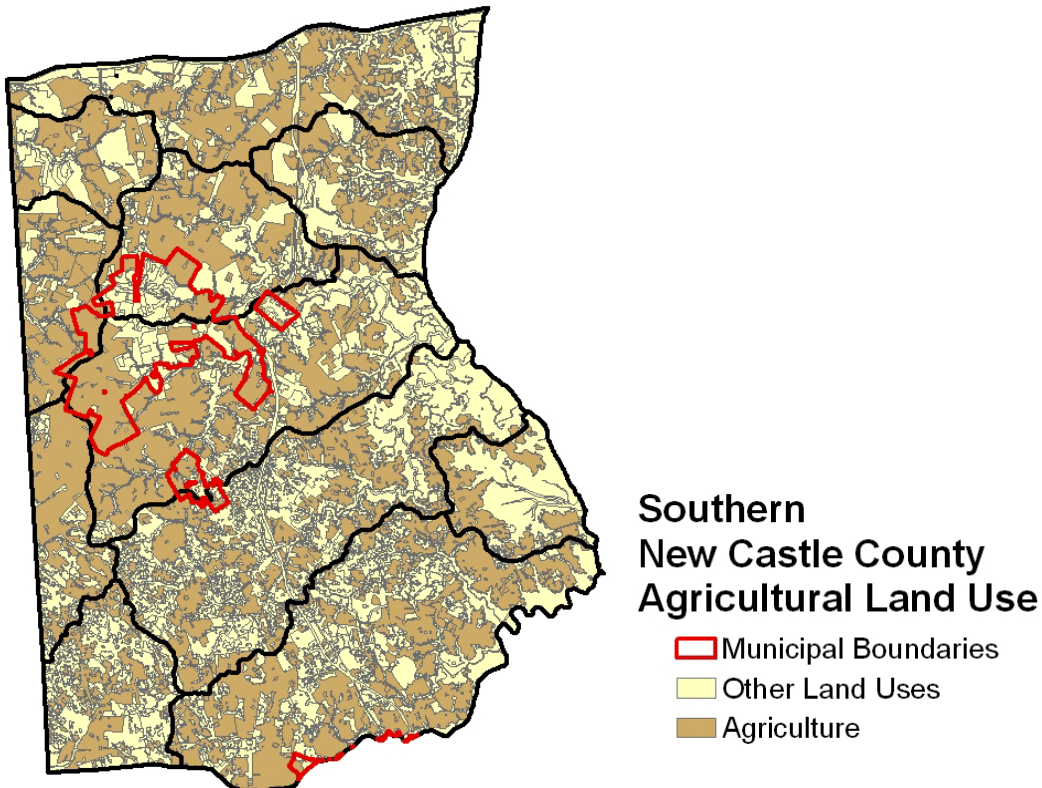
to 40 inches of combined irrigation plus rain to get the moisture needed for optimal yield of 200 bushels per acre for corn. According to Delaware Statute Title 7, Del. C., Section 6010 as amended by House Bill 320, signed into law August 2003, the maximum yearly irrigation rate is 20 acre-inches and the maximum monthly rate is 10 acre-inches.

Normal summer irrigation demands are calculated for normal monthly rain equal to about 4 inches per month based on 42 years of records from the rain gage at the Wills Passmore Farm near Odessa. Dry summer irrigation demands are calculated for monthly rain equal to 2 inches below normal or a 6-inch deficit over a growing season. The sum of rain and irrigation moisture should equal 20 inches over the 92-day growing season to provide optimal yield of corn per bushel in accordance with the state law described above. One inch of moisture over 2,000 acres of irrigated cropland equates to 0.6 mgd over a 92-day growing season. Irrigation demands for normal and dry summers are estimated at 4.8 mgd and 8.4 mgd, respectively for 2000 acres of irrigated land in southern New Castle County (Table 6.6).

Table 6.6. Irrigation demands in southern New Castle County for normal and dry summers.

<i>Irrigation Month</i>	<i>Optimum Moisture (in)</i>	<i>Normal Summer Precipitation (in)</i>	<i>Normal Summer Irrigation (in)</i>	<i>Dry Summer Precipitation (in)</i>	<i>Dry Summer Irrigation (in)</i>
June	7	4	3	2	5
July	7	4	3	2	5
Aug	6	4	2	2	4
TOTAL	20	12	8	6	14
<i>Irrigation Demand for 2,000 acres</i>			<i>4.8 mgd</i>		<i>8.4 mgd</i>

Figure 6.3. Agricultural land use in southern New Castle County, 2002.



Finished Water Storage and Fire Flow Demands

Finished water storage and fire flow demands are critical components of water system planning and design. Form 40.05.310, Water Capacity Certification, in the *New Castle County Unified Development Code* (UDC) requires new water service providers to certify that they have adequate service and storage in accordance with Chapter 6 of the *Delaware State Fire Prevention Regulations* by the Office of the Delaware State Fire Marshal. Table 6.7 summarizes these requirements for fire flow from Chapter 40 of the UDC.

Table 6.7. Water capacity certification standards for fire flow set by the New Castle County UDC.

	<i>Residential</i>	<i>Commercial</i>	<i>Office</i>	<i>Industrial</i>
Daily Peak: Lots less than 1 acre	400 gpd / detached 250 gpd / attached	0.5 gpd/sf	0.3 gpd/sf	0.5 gpd/sf or actual whichever is more
Daily Peak: Lots more than 1 acre	500 gpd/du	0.5 gpd/sf	0.3 gpd/sf	0.5 gpd/sf or actual whichever is more
Fire Flows (gpm)	500-1,000 gpm	1,000 gpm	1,000 gpm	1,500 gpm
Minimum Residual Pressure	20 psi	20 psi	20 psi	20 psi
Minimum Service Pressure	25 psi	25 psi	25 psi	25 psi

7. Future Water Demands

Future Public Water Demands

The Delaware Population Consortium projects that the total population in southern New Castle County will increase from 29,682 in 2000 to 95,666 in 2030 (223%). The WSCC agreed to utilize these population projections to estimate future water demands in southern New Castle County.

Table 7.1 summarizes public water demands through 2030, assuming that increases in demands will coincide with population growth. The total population of 29,682 in 2000 included 13,830 people who drew water from individual wells and 1,653 in the population at the Delaware Correctional Center near Smyrna. The population of individual wells and the Delaware Correctional Center are subtracted from the total population to calculate the population who depend on public water systems. Under current zoning, new communities with 15 homes or more will be served by public water systems. Consequently, there will be little increase in the number of individual wells in southern New Castle County. Individual wells are projected to increase at 0.5%

Table 7.1. Daily water demand in southern New Castle County by water purveyor, 2000-2030.

<i>Year</i>	<i>2000</i>	<i>2005</i>	<i>2010</i>	<i>2015</i>	<i>2020</i>	<i>2025</i>	<i>2030</i>
% Increase in population	--	39 %	29 %	22 %	22 %	11 %	8 %
Total Population	29,682	41,243	53,060	65,021	79,501	88,651	95,996
Less population individual wells	13,830	14,176	14,530	14,893	15,266	15,647	16,039
Less pop. in DE Correctional	1,653	1,653	1,653	1,653	1,653	1,653	1,653
Population public water supply	14,199	25,414	36,877	48,475	62,582	71,351	78,304
% Increase public water supply	--	79%	45%	31%	29%	14%	10%
<i>Purveyor</i>	<i>Peak Demand (mgd)</i>						
Artesian Water Co.	1.1	1.6	2.3	3.0	3.9	4.5	5.9
Tidewater Utilities	0.5	1.2	1.7	2.3	2.9	3.4	3.7
Middletown	0.8	1.2	1.7	2.3	3.0	3.4	3.7
Self-Supplied Non-Community Wells	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Peak Daily Public Water Demand	2.7	4.3	6.0	7.9	10.1	11.6	12.7
AWC: DE Correctional Center	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Individual Wells (0.5% /year)	1.3	1.4	1.5	1.6	1.7	1.8	1.9
Potable Peak Daily Demand	3.9	5.9	7.7	9.7	12.0	13.6	14.8

Table 7.2. Daily water demand in southern New Castle County by local governments, 2000-2030.

<i>Year</i>	<i>2000</i>	<i>2005</i>	<i>2010</i>	<i>2015</i>	<i>2020</i>	<i>2025</i>	<i>2030</i>
% Increase Total Population	0 %	39 %	29 %	22 %	22 %	11 %	8 %
Total Population	29,682	41,243	53,060	65,021	79,501	88,651	95,996
Less population individual wells	13,830	14,176	14,530	14,893	15,266	15,647	16,039
Less pop. in DE Correctional	1,653	1,653	1,653	1,653	1,653	1,653	1,653
Population public water supply	14,199	25,414	36,877	48,475	62,582	71,351	78,304
% Increase public water supply	0%	79%	45%	31%	29%	14%	10%
<i>Government</i>	<i>Peak Demand (mgd)</i>						
Unincorporated New Castle Co.	1.1	1.6	2.3	3.0	3.9	4.5	4.9
Middletown	1.0	1.8	2.6	3.4	4.4	5.0	5.5
Odessa	0.1	0.2	0.3	0.4	0.5	0.5	0.6
Townsend	0.2	0.4	0.5	0.7	0.9	1.0	1.1
Self-Supplied Non-Community Wells	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Public Peak Daily Water Demand	2.7	4.3	6.0	7.8	10.0	11.3	12.4
Individual Wells	1.3	1.4	1.5	1.6	1.7	1.8	1.9
DE Correctional Facility	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Potable Peak Daily Demand	3.9	5.9	7.7	9.6	11.9	13.3	14.5

Table 7.3 estimates existing and future public water demand in southern New Castle County using different methods. The first two methods estimate public peak daily water demands to reach 12.7 or 12.4 mgd by 2030. At first glance, the 2006 *Wastewater Needs Report* appears to underestimate future demand. However, wastewater flow is usually 90 percent of water demand. Applying this ratio, a 2030 wastewater flow of 12.1 mgd computes to 13.4 mgd of public water demand. The 1998 *Hurd* report projected 2020 demand at 12.2 mgd, which compares favorably to the 2020 demand of 10.0 mgd forecasted using the population census block method. Based on these different methods, a projected peak public daily water demand of 12.7 mgd by 2030 seems to be a reliable estimate.

Table 7.3. Comparison of public water demands in southern New Castle County.

<i>Method</i>	<i>Existing</i>		<i>Future</i>	
	<i>Normal (mgd)</i>	<i>Peak (mgd)</i>	<i>Normal (mgd)</i>	<i>Peak (mgd)</i>
Summer 2005 Demands	2.2	4.3 (2005)	7.4	12.7 (2030)
Population Census Block	1.4	2.7 (2000)	7.2	12.4 (2030)
<i>Wastewater Needs 2006</i>	-	4.5 (2006)	-	12.1 (2030)
<i>Merna Hurd 1998</i>	2.4	4.8 (2005)	6.1	12.2 (2020)

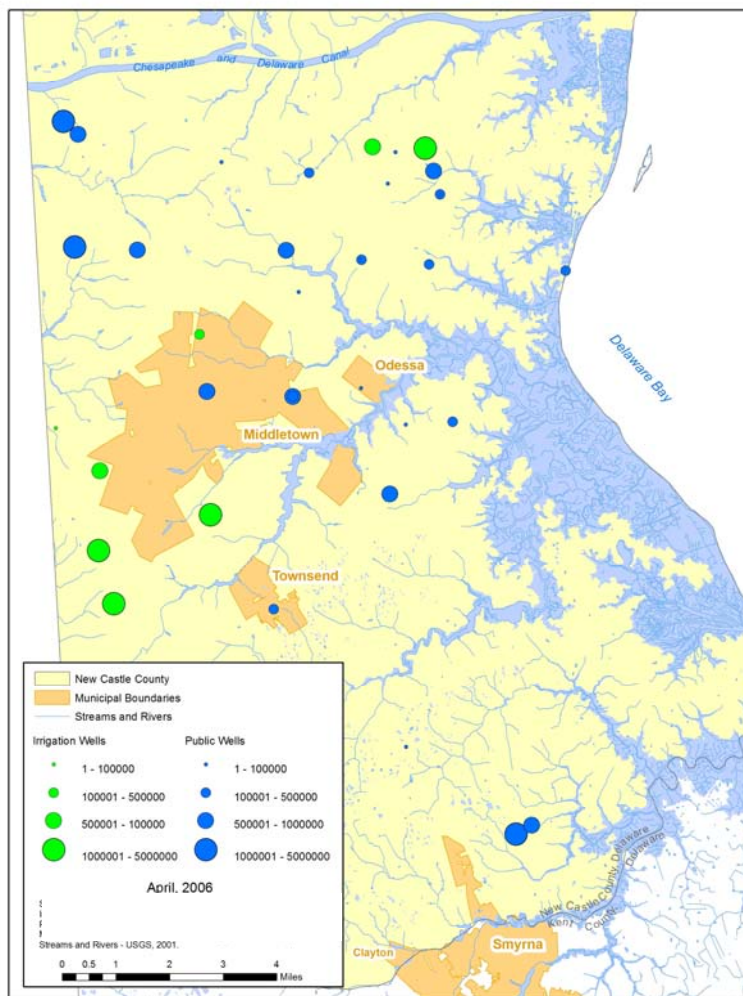
Future Irrigation Demand

Agriculture irrigation demands are projected to decline with decreased agriculture use over the next 25 years in southern New Castle County. If an expected 20,000 new residential dwellings are constructed over the next 25 years, agricultural land will decrease from 96 square miles in 2000 to 65 square miles by 2030 (a 32 percent decrease). Irrigation needs would decrease at a rate similar to the decline in

agricultural land. At this same rate agriculture irrigation demand for a dry summer would decrease from 8.4 mgd currently to 5.7 mgd by 2030. Golf course irrigation demands are assumed to double from 0.3 mgd currently to 0.6 mgd by 2030. Therefore total irrigation demand would decline from 8.7 mgd in 2005 to 6.3 mgd by 2030. Figure 7.1 plots public water supply and irrigation withdrawals in southern New Castle County.

The University of Delaware Cooperative Extension has commented that agriculture irrigation needs may remain steady and possibly even increase over the next 25 years. There is the possibility that as the agricultural land base continues to decrease, those producers choosing to continue to operate will consider irrigating additional acres to remain competitive and profitable. As the landscape changes and local customer bases develop, some currently non-irrigated acres may convert from the predominate crops of corn, soybeans and small grains to smaller acreage, higher value crops that require more irrigation. Thus, this scenario suggests that the net effect would be more rather than less irrigated agriculture acres. Should well allocation data indicate that agricultural irrigation demand is increasing in future years, the WSCC will revisit these demand projections.

Figure 7.1. Public water supply and irrigation withdrawals in southern New Castle County (gallons per day).



References

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Appendix A

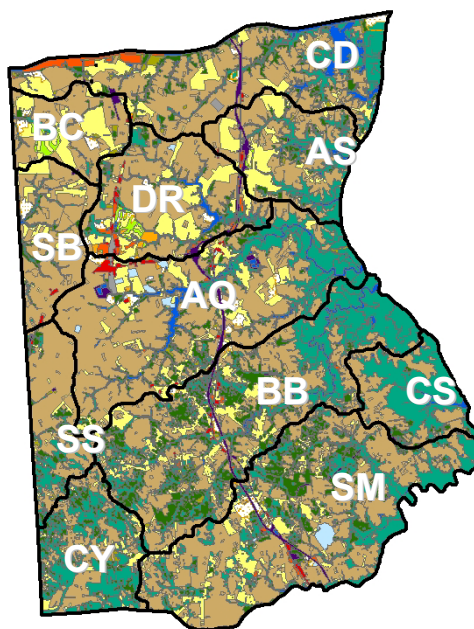
Delaware Population Consortium estimates as of October 2005

New Castle County Draft CCD Households 10/08/05										
<i>CCD</i>	<i>1970</i>	<i>1980</i>	<i>1990</i>	<i>2000</i>	<i>2005</i>	<i>2010</i>	<i>2015</i>	<i>2020</i>	<i>2025</i>	<i>2030</i>
Brandywine	26379	30276	31337	32292	32513	32736	32960	33186	33413	33642
Central Pencader	602	2899	6140	11316	12895	14599	16339	17215	18045	18739
Greater Newark	13105	17304	20215	23151	23561	24009	24521	24757	24946	25261
Lower Christina	14341	14254	14304	14496	14589	14682	14776	14871	14966	15062
MOT	2970	3816	5881	9549	13272	17280	21535	26733	30159	32913
New Castle	14125	18799	24557	30309	31133	31980	32850	33744	34661	35604
Piedmont	4200	5608	8313	10654	11178	12037	12970	13450	14382	14633
Pike Creek	8811	11255	15182	17173	17328	17484	17641	17800	17960	18121
Red Lion	1003	1137	1316	1906	2388	2725	3042	3253	3584	3657
Upper Christina	2673	5274	7841	9472	9741	10055	10398	10530	10697	10810
Wilmington	27565	26092	28444	28617	28885	29104	29279	29409	29656	29844
New Castle County	115774	136714	163530	188935	197482	206692	216312	224945	232469	238287
New Castle County Draft CCD Population Allocations 10/08/05										
<i>CCD</i>	<i>1970</i>	<i>1980</i>	<i>1990</i>	<i>2000</i>	<i>2005</i>	<i>2010</i>	<i>2015</i>	<i>2020</i>	<i>2025</i>	<i>2030</i>
Brandywine	87753	84766	80434	78620	79135	78731	77948	77302	76928	76854
Central Pencader	2091	8605	17719	32096	36562	40905	45016	46717	48400	49872
Greater Newark	48727	57475	61003	67114	68281	68756	69048	68665	68386	68713
Lower Christina	46741	39280	36543	36250	36471	36269	35892	35579	35391	35341
MOT	10040	13187	18578	29682	41243	53060	65021	79501	88651	95996
New Castle	51635	56139	67798	82021	84226	85491	86351	87366	88701	90407
Piedmont	14163	17295	24402	29388	30823	32798	34752	35495	37514	37873
Pike Creek	30791	31519	38733	42312	42680	42553	42220	41959	41845	41895
Red Lion	3623	3930	4033	5589	6999	7895	8665	9125	9938	10062
Upper Christina	9906	15724	21177	24529	25219	25723	26157	26089	26195	26267
Wilmington	80386	70195	71526	72664	72213	71727	71214	70445	69699	69097
New Castle County	385856	398115	441946	500265	523852	543907	562284	578242	591649	602377

Appendix B

Ground-water availability in southern New Castle County

<i>ID</i>	<i>Watershed</i>	<i>Area (sq. mi.)</i>
CD	C & D Canal	31
AS	Augustine Creek/Silver Run	12
DR	Drawyers Creek	15
AQ	Appoquinimink River	32
BB	Blackbird Creek	32
CS	Cedar Swamp	8
SM	Smyrna River	34
CY	Cypress Branch/Chester River	11
SS	Sassafras River	8
SB	Sandy Branch/Great Bohemia Creek	9
BC	Back Creek	7
	TOTAL	199



<i>ID1</i>	<i>Watershed</i>	<i>Potomac (mgd)</i>	<i>Magothy (mgd)</i>	<i>Mt. Laurel (mgd)</i>	<i>Rancocas (mgd)</i>	<i>Columbia (mgd)</i>	<i>Subtotal (mgd)</i>
CD AS	C&D Canal/ Augustine Cr.	1.58	0.19	0.85			2.62
DR AQ	Drawyer Creek / Appoquinimink	2.61	0.81	1.48		0.83	5.73
BB	Blackbird Creek	0.91	0.59	0.62	1.82		3.94
CS	Cedar Swamp		0.02	0.07	0.22		0.31
SM	Smyrna River			0.72	2.11		2.83
CY	Cypress Branch/ Chester River	0.28	0.24	0.26	0.76		1.54
SS	Sassafras River	0.48	0.18	0.16	0.27	0.28	1.37
SB	Great Bohemia Creek	0.59	0.18	0.08		0.33	1.18
BC	Back Creek	0.44	0.11				0.55
	Subtotal	6.89	2.32	4.24	5.18	1.44	20.07**
	Water Table					10.0	10.0*

* DGS, 1983 ** DGS, 1996

Appendix C

DNREC water allocations of public water supply wells in southern New Castle County

AQUIFER⁰

COMMUNITY WATER SYSTEMS	DNRECID	CLG ¹	M ²	MAG ³	ML ⁴	PGR ⁵	RNG ⁵	UNK ⁷	WELLFIELD ALLOCATIONS*			
									MAX. DAY	MAX. MONTH	MAX. YEAR	
Artesian Water Co. Commodore Estates #1	109874					350	c			430,000	12,900,000	156,950,000
Artesian Water Co. Commodore Estates #2	171838				70	c				12,000	360,000	4,380,000.00
Artesian Water Co. Chestnut Grove #1	96841					600	c			650,000	19,500,000	237,250,000
Artesian Water Co. Willow Grove #1	111065					450	c			720,000	21,600,000	289,080,000
Artesian Water Co. Willow Grove #3	188292					500	c					
Artesian Water Co. Willow Grove #2	111968				100	c				144,000	4,320,000	51,840,000
Artesian Water Co. Stonefield PW #1	99806					450	c			580,000	17,400,000	211,700,000
Artesian Water Co. Thomas Cove #1	110612				250	c				290,000	8,700,000	105,850,000
Artesian Water Co. Thomas Cove #2	185186				250	c						
Artesian Water Co. Hyetts Corner Toll Plaza	156288					50	c			1,100	33,000	401,500
Artesian Water Co. Augustine Creek #1	105156					250	c			290,000	8,700,000	105,850,000
Artesian Water Co. Augustine Creek #2	105157					250	c					
Artesian Water Co. Augustine Creek #3	162618				60	c				72,000	2,160,000	25,900,000
Artesian Water Co. Bayview 1R	209566				25	c				432,000	12,900,000	156,950,000
Artesian Water Co. Bayview 2R	182792				100	c						
Artesian Water Co. Bayview 3	96840				300	c						
Artesian Water Co. Choptank #1	106954					250	c			2,376,000	26,280,000	71,280,000
Artesian Water Co. Choptank #2	106955					400	c					
Artesian Water Co. Choptank #3	157658					1000	c					
Artesian Water Co. Townsend 1	30148							225	c	500,000	15,000,000	182,500,000
Artesian Water Co. Townsend 2R	187348							225	c			
Artesian Water Co. Lester 1	99469					500	c			1,000,000	30,000,000	365,000,000
Artesian Water Co. Lester 2	101153					350	c					
Artesian Water Co. Emerson	98112					250	c			290,000	8,700,000	105,850,000
Artesian Water Co. Millwood 1	155731					550	c			1,000,000	30,000,000	365,000,000
Artesian Water Co. Millwood 2	178995						c					
										8,787,100	218,553,000	2,435,781,500
											7,285,100	6,673,374
Artesian Water Co. DCC 1	10497							180	c	979,000	29,380,000	357,408,000
Artesian Water Co. DCC 2	10496							500	c			
Artesian Water Co. DCC 3	157664				400	c				1,152,000	34,560,000	420,480,000
Artesian Water Co. DCC 4	176352				400	c						
										2,131,000	63,940,000	777,888,000
											2,131,333	2,131,200

Tidewater Utilities, Inc. Wheatland 1	158206		150	c															1,133,280	35,117,640	180,000,000
Tidewater Utilities, Inc. Wheatland 2	83639		65	c																	
Tidewater Utilities, Inc. Wheatland 3	190199		170	c																	
Tidewater Utilities, Inc. Dickerson Farms 1	80899		60	c																	
Tidewater Utilities, Inc. Dickerson Farms 3	86498		50	c																	
Tidewater Utilities, Inc. Nautical Cove 1	86813		85	c																	
Tidewater Utilities, Inc. Nautical Cove 2	100389		75	c																	
Tidewater Utilities Inc. Summit Pond 1R	190201		25	c																	
Tidewater Utilities Inc. Summit Pond 2	68944		25	c																	
Tidewater Utilities, Inc. Nautical Cove 3	156898							350	c										1,008,000	31,248,000	180,000,000
Tidewater Utilities, Inc. Dickerson Farms 4	161819							350	c												
Tidewater Utilities Inc. Drawyers Creek 1	84852						40	c											60,000	500,000	5,000,000
Tidewater Utilities Inc. Drawyers Creek 2	89852						55	c													
Tidewater Utilities Inc. Asbury Chase 1	82242						35	c											90,000	950,000	8,259,000
Tidewater Utilities Inc. Asbury Chase 3	82244						60	c													
Tidewater Utilities Inc. Misty Vale 1	96299		60	c															181,424	5,518,000	66,219,000
Tidewater Utilities Inc. Misty Vale 2	96300		70	c																	
Tidewater Utilities Inc. Vandergrift 1	78973		75	c																	
Tidewater Utilities Inc. Vandergrift 2	199537		75	c																	
Tidewater Utilities, Inc. Appoquin Farms 3	179292						85	c											192,000	2,377,500	22,812,000
Tidewater Utilities Inc. Appoquin Farms 4	185232						107	c													
Tidewater Utilities Inc. Appoquin Farms 1	97960						95	c													
Frederick Lodge 2 (Tidewater Utilities, Inc.)	10753									10	c								20,000	325,000	3,500,000
Frederick Lodge 1 (Tidewater Utilities, Inc.)	10754									15	c										
																			2,684,704	76,036,140	465,790,000
																				2,534,538	1,276,137
Middletown Water 8	39676								325	c									900,000	27,000,000	292,000,000
Middletown Water 9	39685								320	c											
Middletown Water 4	10453		256	c															800,000	24,000,000	262,000,000
Middletown Water 6	10454		300	c																	
																			1,700,000	51,000,000	554,000,000
																				1,700,000	1,517,808
Mount Pleasant T.P. 4	177737		18	c															22,000	495,000	4,015,000
Mount Pleasant T.P. 5	187979		18	c																	
																			22,000	495,000	4,015,000
																				16,500	11,000
Cantwell Water 1 (North)	10746						50	c											36,000	810,000	6,570,000
Cantwell Water 2 (South)	10745						30	c													
																			36,000	810,000	6,570,000
																				27,000	18,000
AQUIFER TOTALS (gpd)		0	2,136,704	0		2,480,000	9,245,100	1,499,000	0										15,360,804	834,525,751	8,493,128,519
																				13,694,471	11,627,519

NTNCWS & TNCWS**													
Green Acres Daycare	10817	20	uc										
Saint Andrews 1	10766							uk	c				
Saint Andrews 2	10767									105	c		
The Hearth Restaurant	10940											20	uk
Kimothy's Place	10931						20	c					
Odessa Campground	10818	uk	uc										
301 Travel Plaza	154221						50	c					
Augustine Inn	10818						20	c					
Children's Castle	10765						uk	c					
DE State Troop #9	41871						uk	c					
Kelly's Tavern	10932	10	uc										
St. Georges Shops	75810						10	c					
Summit Aviation	109620	10	uc										
Summit Village Shopping Center	89042						20	sc					
Break-A-Way Lounge	10819	uk	uc										
Helen's Sausage Shop	10939	20	uc										
Smyrna Rest Stop	10923	10	uc										
WAWA 830	96926						10	c		10	c		
Shoppes at Mt. Pleasant	194129						10	sc					
ChesDel Restaurant	41871						25	sc					
TOTAL (Gallons)													
											262,000	5,895,000	47,815,000
												196,500	131,000
											15,622,804	13,890,971	11,758,519

⁰ Values shown are maximum capacities in gpm

¹ Columbia Group

c = confined

² Magothy Formation

sc = semiconfined

³ Matawan Group

uc = unconfined

⁴ Mt. Laurel Formation

uk = unknown

⁵ Potomac Group

⁶ Rancocas Group

⁷ The source aquifer is not known

* = some allocations are pending

** = usage for all non-community water systems is estimated

Appendix D

Southern New Castle County allocated irrigation wells

	AQUIFER*										WELLFIELD ALLOCATION			ALLOCATION PERMIT No.	
	DNRECID	CLG ¹	M ²	MAG ³	ML ⁴	PTG ⁵	RNG ⁶	UNK ⁷	MAX. DAY	MAX. MONTH	MAX. YEAR				
AGRICULTURAL WATER SYSTEMS															
Floral Plant Growers 1	10330†				220	c						934,560	28,008,000	132,000,000	93-0002M
Floral Plant Growers 2	10328†				175	c									
Floral Plant Growers 3	10329†				150	c									
Floral Plant Growers 4	54629				30	c									
Floral Plant Growers 5	54630				30	c									
Floral plant Growers 6	55340				4	c									
Floral Plant Growers 7	55431				40	c									
Morgan Clay 1	60461	125	uc									900,000	17,000,000	34,000,000	00-0001
Morgan Clay 2	60462	125	uc												
Morgan Clay 3	60463	125	uc												
Morgan Clay 4	60464	125	uc												
Morgan Clay 5	60465	125	uc												
Frog Hollow (Town of Middletown) FH1	159824		150	C								216,000	6,480,000	26,784,000	05-0008
Ken Lester 1	154860	300										2,520,000	65,000,000	130,000,000	98-0009
Ken Lester 2	154861	250	uc												
Ken Lester 3	154863	200	uc												
Ken Lester \Lapham Farm	87368†	1000	uc												
Lawrence Jester 1	156525	250	uc								2,016,000	59,730,000	119,460,000	99-0020	
Lawrence Jester 2	157435	250	uc												
Lawrence Jester 3	167678	900	uc												
Delaware Egg Farm - Plant	158392		81	c							75,000	2,250,000	27,900,000	00-0015	
Delaware Egg Farm - West	160479		200	c											
Delaware Egg Farm - East	160478		200	c											
Ken Wicks 1	10130						600	c			1,512,000	45,240,000	85,108,000	00-0007B	
Ken Wicks 2	10131						450	c							
Gerald Zeh 1	10815	300	uc								1,728,000	19,500,000	38,000,000	01-0004	
Gerald Zeh 2	34072	900	uc												
AQUIFER TOTALS (GPD)		7,164,000	291,000	0	934,560	0	1,512,000								
												TOTALS (Gal.)	9,901,560	243,208,000	593,252,000

* Values listed are maximum well pump capacities

- ¹ Columbia Group
- ² Magothy Formation
- ³ Matawan Group
- ⁴ Mt. Laurel Formation
- ⁵ Potomac Group
- ⁶ Rancocas Group
- ⁷ The supply aquifer is not known

c = confined
 sc = semiconfined
 uc = unconfined
 uk = unknown

† out of operation, allocation is unadjusted

