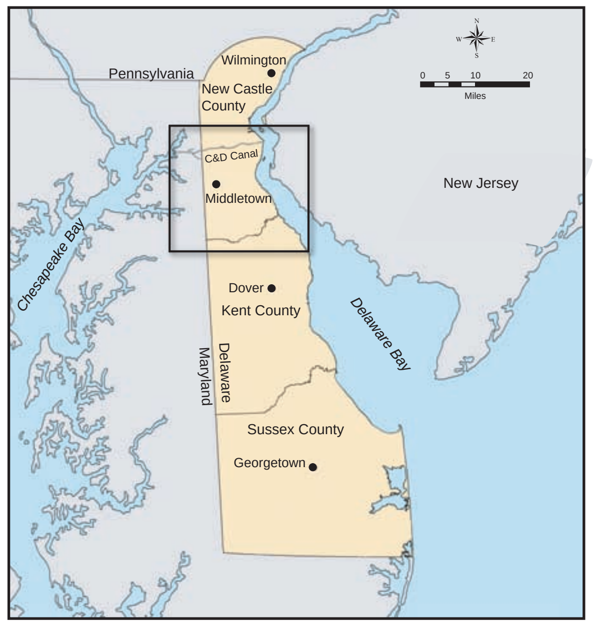

Location of study area. Boxed area indicates the location of the model domain.

Calibrated Hydraulic Conductivity (Figures 8a through 8g) Southern New Castle County, Delaware

The spatial distributions of horizontal hydraulic conductivity within model layers was determined by gridding observations and estimates of hydraulic conductivity (K), spatial averaging of results into zones of similar K values, and conditioning by calibration for all nine layers, which are illustrated in Figs. 8a - 8g. Two of the nine layers, 6 and 8, are not shown because hydraulic conductivity for these layers had a uniform value.

Sedimentary deposits typically exhibit anisotropic hydraulic properties – specifically, they are more permeable in the horizontal direction than they are in the vertical direction (Anderson and Woessner, 1992). The magnitude of anisotropy is poorly understood for the study area. As a result, an initial value of 10:1 was selected for the starting vertical anisotropy ratio of K (horizontal Kx : vertical Kz). This initial anisotropy value was adjusted during the calibration process.

Hydraulic conductivity for layers representing confining units (layers 2 and 4) vary from very low values in the southeast to higher values in the northwest. Areas with lower K values represent locations where confining units are thick; areas with higher K values represent locations where an individual confining unit is missing due to erosional truncation or stratigraphic pinch out. To avoid numerical instability due to sharp changes of K, several transition zones were added in which K values vary gradually (Figs. 8b, 8d).

Groupings of lithostratigraphic units for groundwater model layers, layer thicknesses, and elevations of layer bottoms. Confining unit names are those proposed by Dugan et al. (2008). Hydraulic properties of the Potomac aquifers are adapted from USACE (2007).
(a) = aquifer; (cu) = confining unit

Lithostratigraphic Units (Delaware nomenclature)	Hydrostratigraphic Function	Model Layer
Scotts Corners, Lynch Heights, Columbia	Columbia (a)	1
Calvert, Shark River, Manasquan	Blackbird (cu)	2
(Manasquan), Vincentown, (Hornerstown)	Rancocas (a)	3
Hornerstown, Navesink	Armstrong (cu)	4
Mt. Laurel, (Marshalltown)	Mt. Laurel (a)	5
Marshalltown, Englishtown, Merchantville	Summit (cu)	6
Magothy/upper Potomac	Magothy/Potomac A (a)	7
middle Potomac	Potomac B (a)	8
lower Potomac	Potomac C (a)	9

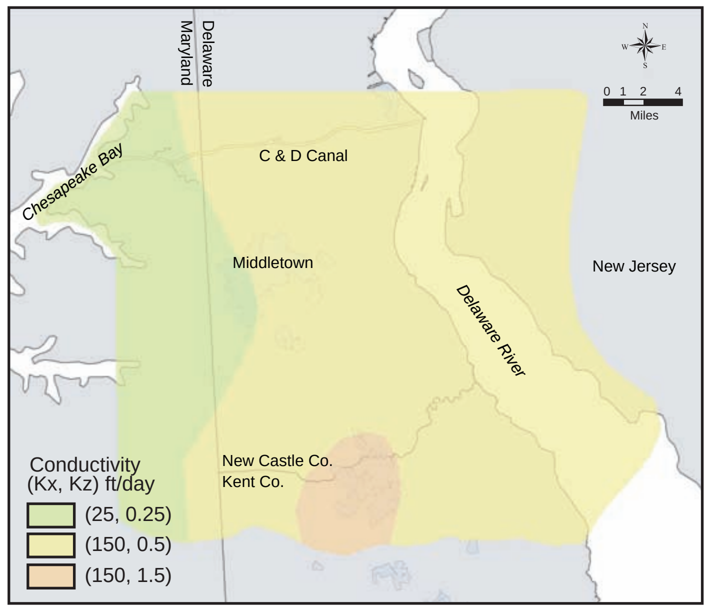

Figure 8a. Calibrated hydraulic conductivity for layer 1 (Columbia aquifer).

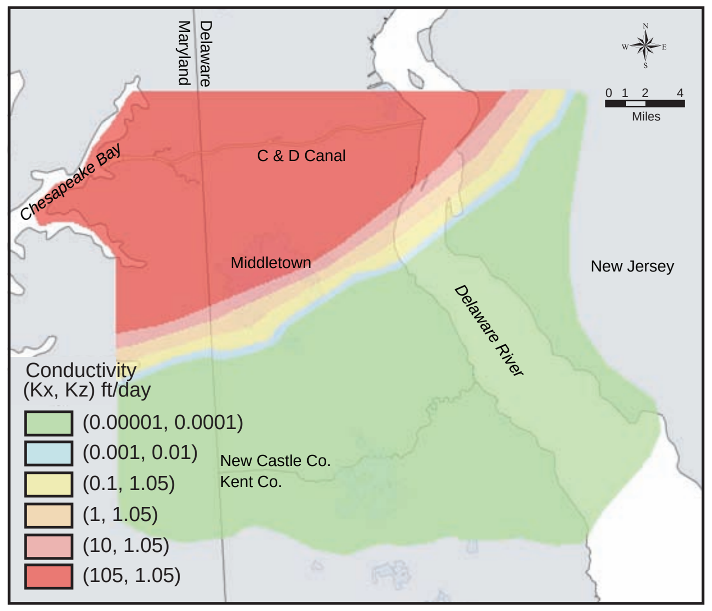

Figure 8b. Calibrated hydraulic conductivity for layer 2 (Blackbird confining unit).

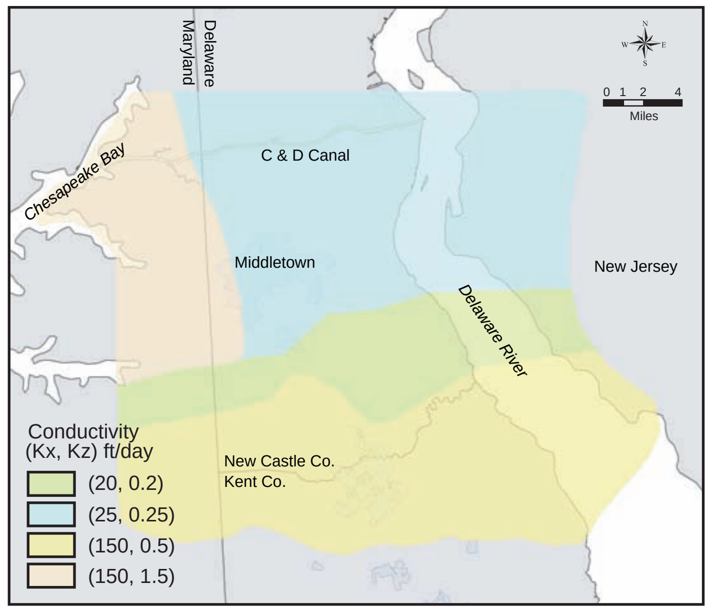

Figure 8c. Calibrated hydraulic conductivity for layer 3 (Rancocas aquifer).

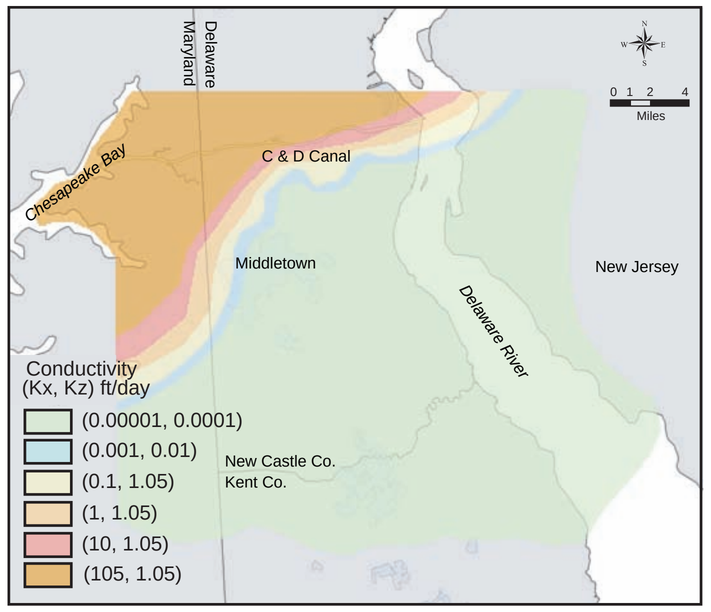

Figure 8d. Calibrated hydraulic conductivity for layer 4 (Armstrong confining unit).

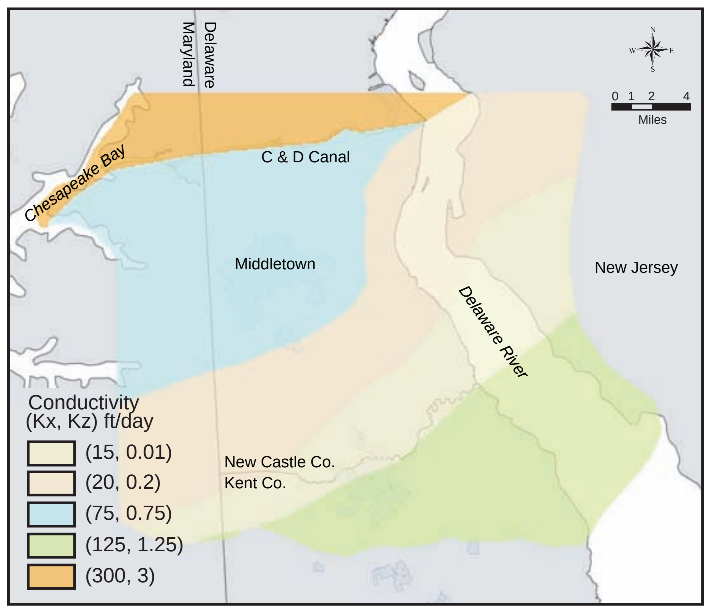

Figure 8e. Calibrated hydraulic conductivity for layer 5 (Mt. Laurel aquifer).

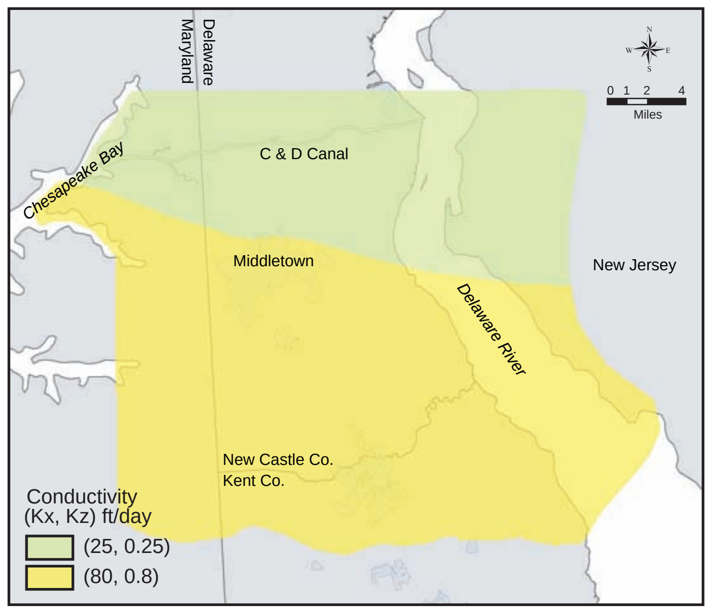

Figure 8f. Calibrated hydraulic conductivity for layer 7 (Magothy/Potomac A aquifer).

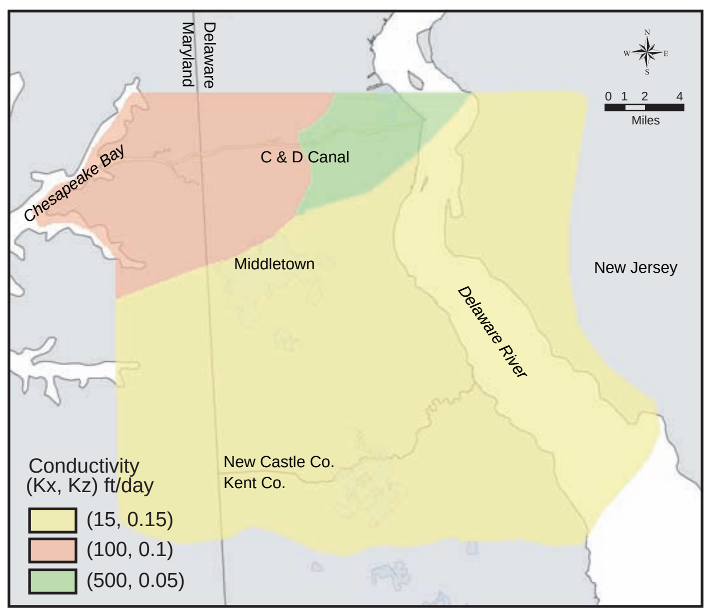

Figure 8g. Calibrated hydraulic conductivity for layer 9 (Potomac C aquifer).

Change in Head Due to Increased Pumping (Figures 17a through 17e) Southern New Castle County, Delaware

The Delaware Water Supply Coordinating Council (Delaware WSCC, 2006) projected that the demand for public water supply in southern New Castle County will increase by approximately 170 percent between 2006 and 2030.

To understand how this increased pumping may affect groundwater flow and water budgets, we assumed that this increased demand will be supplied by existing wells and simulated the increased water demand by increasing concurrently the pumping rate for all current production wells by 170 percent (Table 3 of accompanying report). Because it is certain that new wells will be installed to meet the increased demand, and because the locations of these new wells cannot be predicted, the results are highly speculative. General head boundary conditions for the northern boundary were not changed for this simulation.

Comparison of predicted water levels during increased pumping to previous model-simulated results (Figs. 17a-17e) indicates that the maximum head decline in the Rancocas aquifer will be approximately 2.5 meters (8.2 ft) (Fig. 17a), which occurs at the wells serving the James T. Vaughn Correctional Center located northeast of Smyrna. The maximum head decline (about 4 meters or 13.1 ft) in the Mt. Laurel aquifer (Fig. 17b) occurs between Middletown and Odessa, with additional areas of decline coincident with the wells serving the James T. Vaughn Correctional Center and an additional area west of Clayton.

Effects of increased pumping in the Potomac aquifers indicate maximum additional drawdown to be in the range of a few meters (Figs. 17c-17e). Given that there are little field data with which to evaluate how reasonable these predictions are, and that new wells are likely to be installed by water utilities at additional locations, these results are useful only for illustrative and discussion purposes, rather than planning purposes.

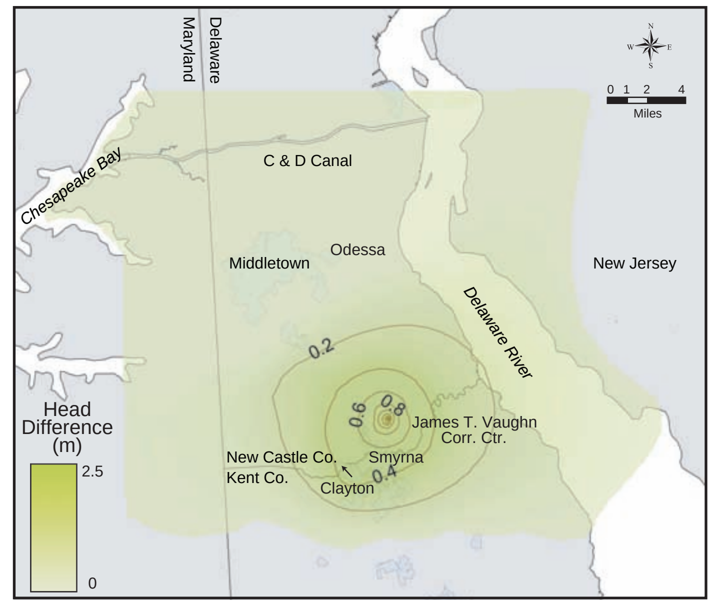

Figure 17a. Change in head in layer 3 (Rancocas aquifer) due to increased pumping.

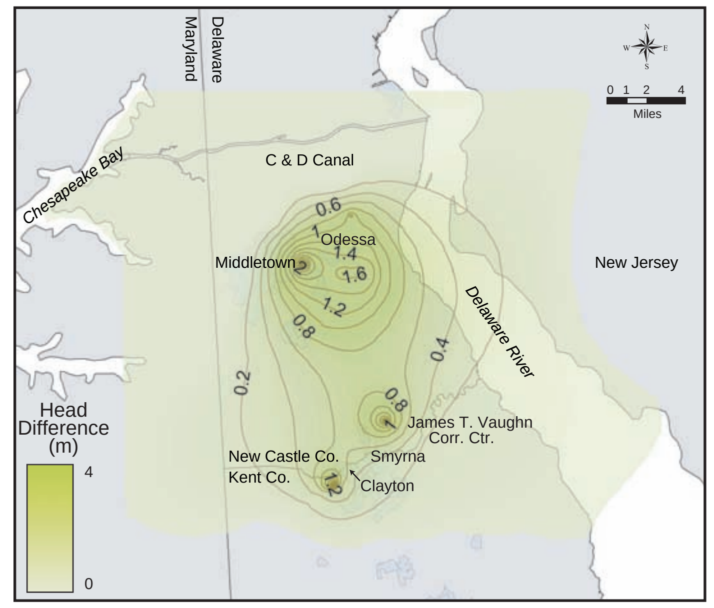

Figure 17b. Change in head in layer 5 (Mt. Laurel aquifer) due to increased pumping.

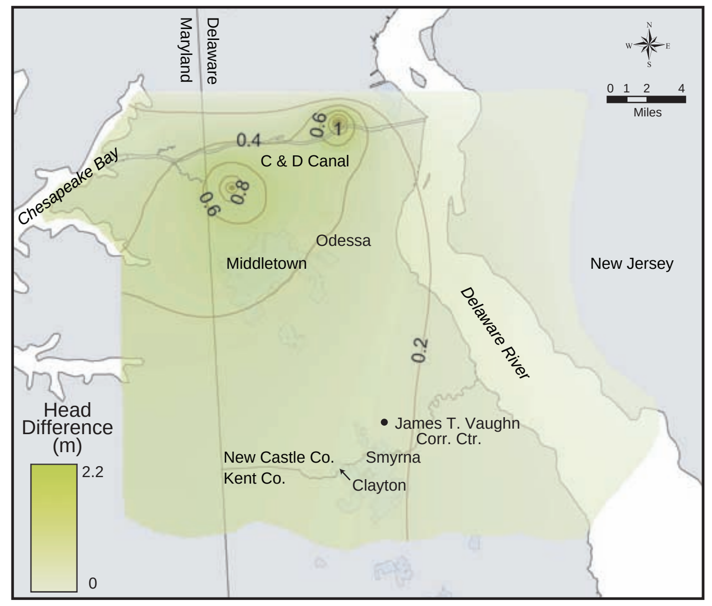

Figure 17c. Change in head in layer 7 (Magothy/Potomac A aquifer) due to increased pumping.

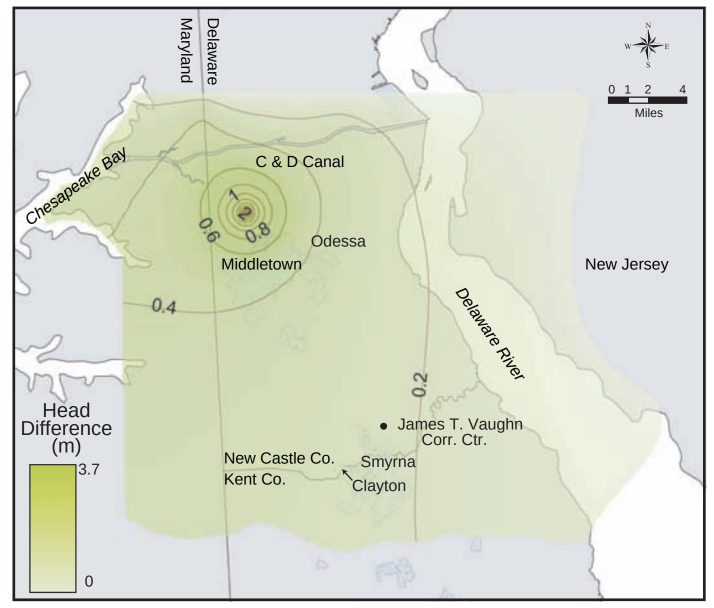

Figure 17d. Change in head in layer 8 (Potomac B aquifer) due to increased pumping.

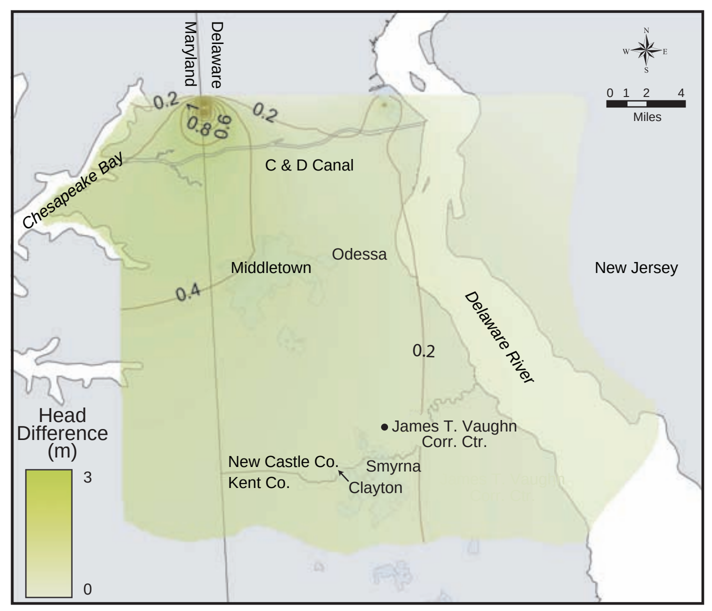

Figure 17e. Change in head in layer 9 (Potomac C aquifer) due to increased pumping.

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