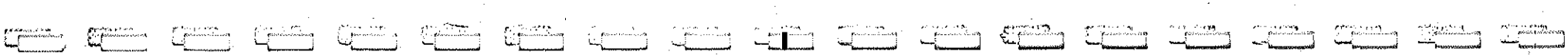
APPENDIX 6

AMITY TOWNSHIP
GROUNDWATER RECHARGE



AMITY TOWNSHIP GROUNDWATER RECHARGE

There are numerous factors that can influence the amount of water that an aquifer receives as recharge. Groundwater recharge is directly connected to the hydrologic cycle. In a very simple form, the hydrologic cycle can be described of as water being transported from the ocean to the atmosphere by evaporation; then from the atmosphere to land surface by precipitation; from the land, water can take several routes, but eventually the water returns to the ocean. Due to the finite quantity of water that is present on our planet, the hydrologic cycle is considered a closed system. Once precipitation reaches land surface by rainfall or snowfall, numerous factors control its eventual migration back to the ocean. Basically, the precipitation will follow three routes; storage in surface depressions such as lakes, overland runoff to streams or subsurface infiltration (groundwater recharge). This section of the plan investigates the amount of groundwater recharge (subsurface infiltration) that is available in Amity Township.

Once the water infiltrates the earth's surface, some of the water will replenish the soil moisture, some will be utilized to sustain vegetation and the remaining amount will percolate downward to replenish the groundwater aquifer(s). Numerous factors can influence the amount of precipitation that will recharge the groundwater supply. Some of these factors include soil type, soil moisture content, duration and intensity of the precipitation event, temperature, time of year, slopes and man-made impacts. Of these numerous factors, groundwater recharge is most directly controlled by the frequency of the precipitation events and the soil conditions. The underlying rock type largely derives the soil conditions. Due to the complexities involved, groundwater recharge cannot be directly measured.

Although direct measurement options for groundwater recharge are not available, recharge can be estimated by the natural groundwater discharge to a stream (baseflow of a stream). The assumption utilized for calculating the groundwater recharge of an extended area is that the long-term stream baseflow equals the long-term rate of groundwater recharge. The stream baseflow separation method is considered a conservative approach for obtaining groundwater recharge values. Modified groundwater recharge values from a 1996 U.S. Geological Survey (USGS) Study of the Neshaminy Creek Basin (Schreffler 1996: 12) were utilized for calculating the available recharge for Amity Township. Conservative (1 in 10 year) recharge rates were used that reflect dry conditions. Basically, the recharge rates used for this study will be exceeded during 90 percent of the years.

Spatially, Amity Township covers 18.41 square miles. The quantity of groundwater recharge for the study area is calculated by multiplying the geologic recharge rate by the surface area of each type of geologic rock unit. The USGS recharge rates are subdivided into the following four categories: Brunswick and Lockatong Formations, Stockton

- The remainder of the population, 4,439 was multiplied by 100 gpd/person, which equates to 443,900 gpd. The 100 gpd/person figure is a very conservative approach that takes into account residential wells along with commercial and industrial water users. Citizens Utilities Water Company averages 88 gallons of water per person per day.

Based on the public water system expanding by 150 connections per year over the next 10 years, the estimated population served by public water in 2010 is 8,478. Utilizing the current 88 gallons per person per day, the estimated groundwater withdrawal of the water system is 0.8 mgd. If the Amity population served by on-lot water expands by 10 percent, the estimated water withdrawal is 0.4 mgd. The total estimated groundwater withdrawal in Amity Township for the year 2010 is 1.2 mgd.

Based on a groundwater recharge estimate of 6.3 mgd and a year 2010 groundwater withdrawal of 1.2 mgd, Amity Township has sufficient groundwater resources to support the projected populations. Even with the available groundwater supply, it does not eliminate well pumping interference issues, particularly during dry periods. These well interference issues may be more evident in areas underlain by diabase such as Monocacy Hill. The diabase generally is a poor aquifer with the majority of the stored water contained in the shallow weathered zones of the bedrock. Also, the Brunswick Formation produces an anisotrophic cone-of-depression with preferential groundwater flow along geologic strike. Wells located along strike are more likely to be impacted by pumping than wells located perpendicular to strike.