

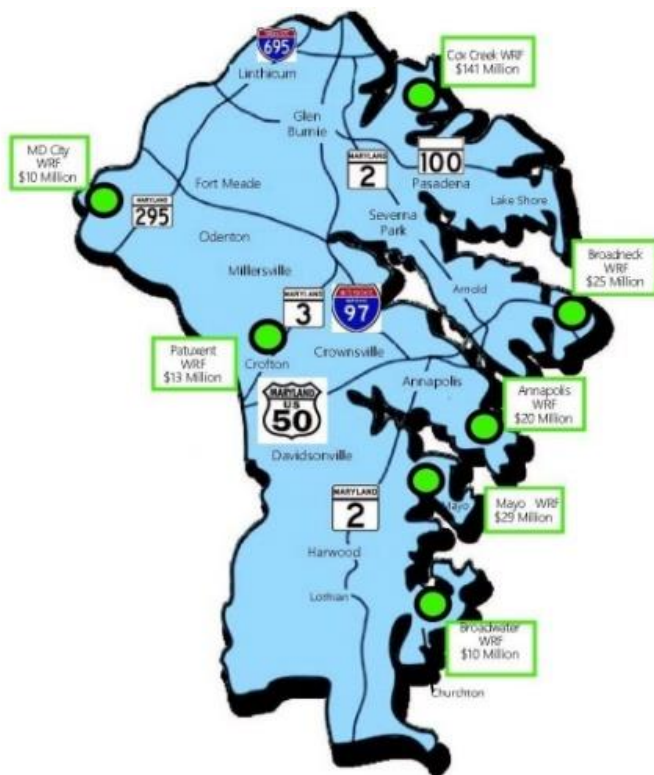
ENHANCED NUTRIENT REMOVAL (ENR) IN AAC

By Bill Klepczynski



Effluent from wastewater treatment plants is one of the top three contributors of damaging nutrients entering the Bay (urban and agricultural runoffs are the other two). Excess nutrients like nitrogen and phosphorous are two of the leading causes of our waterways' poor health. In 2013, we had 677K lbs. (7.09 mg/l) of Total Nitrogen (TN) from the seven wastewater treatment plants (see Figure) from Anne Arundel County (AAC) going into the Bay. In 2018, we had 207K lbs. (2.06 mg/l) of TN. This is a dramatic reduction. How did AAC Public Works Department do this?

In 2004, the Bay Restoration Fund of 2004 was created to upgrade Maryland's wastewater treatment plants with [enhanced nutrient removal \(ENR\) technology](#). [This fund was](#) financed by wastewater treatment plant users. The goal was to achieve wastewater effluent quality of 3 mg/l total nitrogen and 0.3 mg/l total phosphorus.



Wastewater is treated through several physical, chemical and biological processes that remove the solids and separate the water. A biological nutrient removal process in combination with extended anoxic zones and biological filters is where high concentrations of nutrients like nitrogen and phosphorous are removed from the wastewater. The removal is usually done through a three-step treatment process:

1: Primary Treatment

At first, wastewater treatment plants had to only achieve a 45% to 50% reduction of pollutants by removing settleable and other easily removable materials using screens and grit removal units and settling tanks (primary clarifiers).

2: Secondary Treatment

Secondary treatment introduced a biological process such as activated sludge, trickling filter, rotating biological contractor, or other biological treatment technologies. Biological treatment systems are living systems that rely on mixed biological cultures to break down waste (that could not be removed by the physical treatment) and

allow it to settle in the final clarifier achieving 85 to 90% reduction in pollutants. As early as 1957, communities in Maryland received federal and state grants to upgrade their facilities with secondary treatment systems. However, secondary treatment was not required for most plants until the inception of the National Pollutant Discharge Elimination (NPDES) permit in 1972.

3: Biological Nutrient Removal (BNR)

The Chesapeake Bay has experienced a decline in water quality due to the over enrichment of nutrients (mainly phosphorus and nitrogen). The Maryland Department of the Environment, in support of Maryland's commitment to reduce the amount of nutrients being discharged to the Bay, developed a strategy for achieving the desired reduction by the upgrade of the major 66 wastewater treatment plants to remove nitrogen through a process known as biological nutrient removal (BNR). Using the BNR process, more than 90% of pollutants are removed, while achieving nitrogen concentration below 8 mg/l total nitrogen.

4: Enhanced Nutrient Removal (ENR):

Recognizing that more needs to be done, the Chesapeake Bay 2000 Agreement required further reduction in nitrogen and phosphorus entering the Bay by about 20 million pounds and 1 million pounds per year respectively. Thus, a fourth step was added to the removal of nutrients from wastewater called "Enhanced Nutrient Removal".

The Maryland Department of the Environment is using the Bay Restoration Fund to upgrade the 66 major wastewater treatment plants within the State that discharge to the Chesapeake Bay with enhanced nutrient removal (ENR) technologies. Once upgraded, these plants are expected to reduce nitrogen and phosphorus in the wastewater down to 3 mg/l total nitrogen and 0.3 mg/l total phosphorus, achieving approximately one-third of the needed reduction under the Chesapeake Bay 2000 Agreement. Other pollutants will continue to be reduced by more than 90%.

Anne Arundel County (AAC) currently operates 7 of the 66 Water Reclamation Facilities (WRF), see Figure. They are: Maryland City; Cox Creek; Broadneck; Annapolis; Piney Orchard; Broadwater; and Patuxent WRFs. As a part of the ENR Upgrade Program the Mayo WRF was closed and converted to a pumping station. This pump station transfers sewage from the Mayo Service Area to the Annapolis WRF. Anne Arundel County Public Works division has completed the upgrades on their seven WRFs.

Their work in this area has been recognized by the *National Association of Clean Water Associations (NACWA)* in 2018 by bestowing a GOLD Award for Perfect NDPS Permit Compliance at all WRF plants and received a PLATINUM Award for 5 consecutive years of compliance at the Broadwater and Maryland City WRFs. In fact, the Broadwater WRF had 22 consecutive years of perfect compliance and Maryland City had a PLATINUM Award for 6 consecutive years of compliance. AAC Dept. of Public Works has and continues to do an exemplary job in helping to maintain the health of the Bay.

For more info, do a Google search on:

1. The Evolution to Enhanced Nutrient Removal Technology
2. Bay Restoration Fund
3. Anne Arundel County Earns National Award for Wastewater Treatment Excellence