Carroll County
225 North Center St. • Westminster, MD 21157

Carroll County Wastewater Limitations

May 29, 2009

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6531-001

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Acronyms Used in the Report

BLI	Buildable Land Inventory
BNR	Biological Nitrogen Removal
BOD5	Five-Day Biological Oxygen Demand
DGA	Designated Growth Area
DNR	Department of Natural Resources
ENR	Enhanced Nutrient Removal
GIS	Geographic Information System
HUC	Hydrologic Unit Code
I/I	Infiltration/Inflow
LUD	Land Use Designation
MDA	Maryland Department of Agriculture
MDE	Maryland Department of the Environment
MDP	Maryland Department of Planning
MES	Maryland Environmental Service
OSDS	On-Site Disposal System
PCS	Permit Compliance System
POTW	Publically Owned Treatment Works
SSA	Sewer Service Area
TKN	Total Kjeldahl Nitrogen
TMDL	Total Maximum Daily Load
WRE	Water Resources Element
WSA	Water Service Area
WWTP	Wastewater Treatment Plant

Units Used in the Report

lb/yr	pounds per year
mgd	million gallons per day

1. Introduction

1.1. Background

As part of its present Comprehensive Plan update, Carroll County is in the process of evaluating its water resources through the 2006 state-mandated Water Resources Element (WRE). The WRE is an important piece of the County's Comprehensive Plan and is meant to assess the adequacy of its present and future water supply, wastewater infrastructure, and potential impact on water resources. A required element of the WRE is a wastewater assessment, intended to evaluate wastewater treatment capacity and limitations in the County. At the County's request, Malcolm Pirnie, Inc. performed an evaluation of wastewater treatment capacity and limitations in Carroll County based on existing and future conditions.

1.2. Purpose and Scope

The purpose of the wastewater assessment is to evaluate the availability of suitable receiving waters and land areas in Carroll County to meet wastewater treatment and disposal needs. The primary focus of the evaluation was on the major sewer service areas (SSAs) and associated publicly-owned treatment works (POTWs). The capacity of other wastewater treatment plants (WWTPs) were tabulated and evaluated in the context of meeting future wastewater treatment and disposal needs. Existing and future septic system loads were also evaluated. Specific wastewater limitations that were considered include:

- WWTP design capacity
- Chesapeake Bay-related nutrient loading caps
- Loading caps based on local water quality or total maximum daily loads (TMDLs)
- Antidegradation (Tier II waters)
- WWTP-specific treatment limitations

Each of these categories was evaluated to determine if it was likely to represent a controlling limitation on the amount of wastewater that could be disposed from each sewer service area. Potentially-controlling limitations were compared to wastewater demands associated with priority+future SSAs and buildout of the entire designated growth area (DGA). Various methods for overcoming wastewater limitations are evaluated, including WWTP upgrades, onsite disposal system (OSDS) credits, nutrient trading, and effluent reuse.

This report is organized into sections that address methods and information sources (Section 2), facility-specific wastewater demands and limitations (Section 3), a countywide evaluation of strategies to overcome limitations (Section 4), and a brief summary (Section 5).

2. Methods and Information Sources

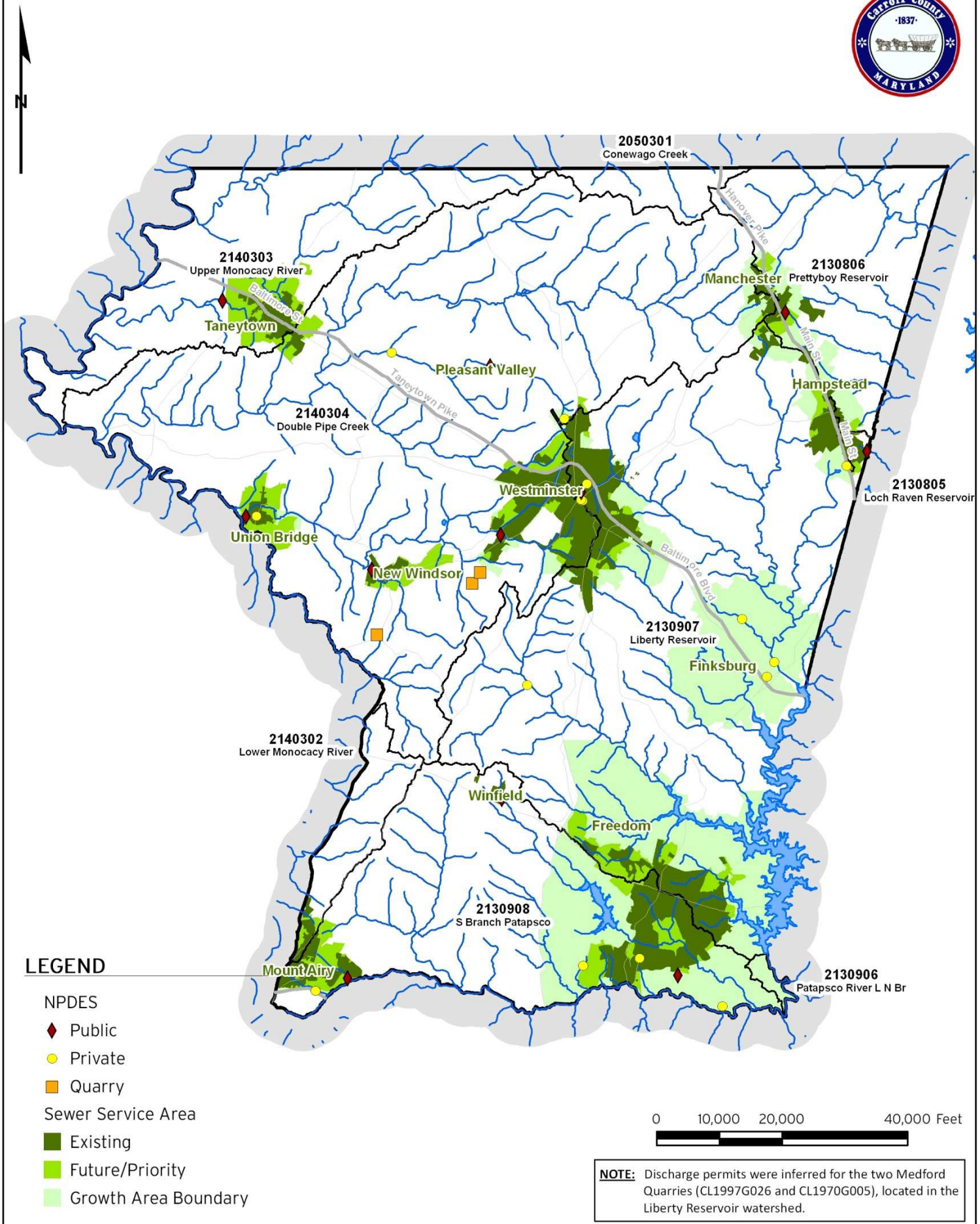
The wastewater evaluation described in this report was conducted in accordance with the State of Maryland guidance[1] for preparing the WRE. It addresses steps 5-7 of the WRE analytical framework as described in the guidance document:

- Step 5: Identify WWTP Demands
- Step 6: Identify WWTP Limitations
- Step 7: Identify Septic System Locations & Loads

The WRE is developed using a watershed approach. For the purposes of this study, individual watersheds were defined using MDE eight-digit hydrologic unit code (HUC) boundaries. There are nine such watersheds in Carroll County (Figure 2-1; Table 2-1). Most SSAs in Carroll County lie in more than one eight-digit HUC. Therefore, for the purpose of this evaluation, SSAs were categorized by HUC using the location of the WWTP outfall.

Table 2-1.
Sewer Service Area WWTP Discharge Locations by Watershed

MDE 8-Digit HUC	Sewer Service Area WWTP
Conewago Creek (02050301)	*None*
Double Pipe Creek (02140304)	• New Windsor WWTP • Pleasant Valley WWTP • Union Bridge WWTP • Westminster WWTP
Liberty Reservoir (02130907)	*None*
Loch Raven Reservoir (02130805)	• Hampstead WWTP
Lower Monocacy River (02140302)	*None*
Patapsco River Lower North Branch (02130906)	*None*
Prettyboy Reservoir (02130806)	• Manchester WWTP
South Branch of the Patapsco River (02130908)	• Freedom District WWTP • Mount Airy WWTP • Winfield/So. Carroll HS WWTP
Upper Monocacy River (02140303)	• Taneytown WWTP



MALCOLM PIRNIE	CARROLL COUNTY, MD WASTEWATER LIMITATIONS	Sewer Service Areas & NPDES Permit Locations	May 2009 Figure 2-1

Various information sources were used to identify wastewater demands, treatment capacities, and potential limitations. The following subsections identify methods and information sources that were used to address the requirements of the wastewater evaluation.

2.1. Wastewater Treatment Plant Capacity and Flow

The locations of NPDES discharges were identified using the US Environmental Protection Agency (EPA) Permit Compliance System (PCS) database as obtained through the USEPA's Better Assessment Science Integrating Point and Nonpoint Sources (BASINS) shapefiles. Carroll County has approximately 20 active NPDES-permitted dischargers, counting both public and private facilities (Table 2-2; Figure 2-1) but not including quarries. Most are very small facilities with design capacities less than 0.05 mgd. This wastewater evaluation focused on the eight largest POTWs (shaded on Table 2-2) that serve SSAs and represent >95 percent of the total wastewater treatment capacity in the County. All of these facilities have design capacities close to or greater than 0.1 mgd. Selected industrial WWTPs (specifically, BTR-Hampstead and Congoleum Corp.) were also evaluated for potential roles in overcoming wastewater limitations.

Information on the boundaries of SSAs was derived from a Geographic Information System (GIS) shapefile provided by the County. This 2008 shapefile shows boundaries of existing, priority, and (expected) future service areas. Similarly, County staff also provided shapefiles of the designated growth areas (DGAs) associated with each town/service area (Figure 2-1). The area within the DGA but outside of the future service area was identified as the "no planned service" area of each DGA. However, because the future service areas are generally based on a 6-10 year forecast, some of the "no planned service" area might actually become part of an SSA under buildout conditions. Additional information related to individual WWTPs and service areas was obtained from the following sources:

- The 2007 *Carroll County Master Plan for Water and Sewerage*[2] was consulted for a general overview of each WWTP, existing capacity, and planned upgrade/expansion projects.
- *NPDES permit fact sheets* (Appendix B) for each major WWTP were obtained from the Maryland Department of the Environment (MDE), and were reviewed to identify technology-based and water-quality-based limits on effluent loads and concentrations.
- A tabular summary[3] of Chesapeake Bay-related nutrient loading caps for each facility was obtained from MDE (Table 2-3). Each WWTP's nutrient loading cap was converted to a hypothetical discharge limitation by calculating the maximum wastewater flow associated with the loading cap, assuming treatment by enhanced nutrient removal (3.0 mg/L total nitrogen and 0.3 mg/L total phosphorus).

Table 2-2.
Active NPDES Permitted Facilities in Carroll County
[does not include general permits or quarry discharges; shaded rows indicate the larger SSA-associated dischargers that were the focus of the wastewater evaluation]

NPDES Permit	Facility Name	Design Capacity (mgd)	MDE 8-Digit HUC	Receiving Stream
MD0021831	Westminster WWTP	5.00	2140304	Little Pipe Creek
MD0021512	Freedom District WWTP	3.50	2130908	So. Br. Patapsco R.
MD0022527	Mount Airy WWTP	1.20	2130908	So. Br. Patapsco R.
MD0020672	Taneytown WWTP	1.10	2140303	Piney Creek
MD0022446	Hampstead WWTP	0.90	2130805	North Piney Run
MD0022578	Manchester WWTP	0.5	2130806	George's Run
MD0022454	Union Bridge	0.2	2140304	Little Pipe Cr.
MD0022586	New Windsor WWTP	0.094	2140304	Dickerson Run
MD0066745	Pleasant Valley WWTP	0.019	2140304	Bear Branch
MD0065927	Runnymede WWTP	0.02	2140304	Bear Branch
MD0024546	Pheasant Ridge WWTP	0.125	2130908	Trib. to So. Br. Patapsco R.
MD0022845	Gaither Manor Apts WWTP	0.045	2130908	Trib. to So. Br. Patapsco R.
MD0024589	So. Carroll High School WWTP	0.02	2130908	So. Br. Patapsco R.
MD0001384	Congoleum Corp.	0.227	2130907	No. Br. Patapsco R.
MD0001881	BTR-Hampstead	0.222	2130907	Trib. to Deep Run
MD0067571	Bowling Brook Prep. School	<0.02	2140304	Big Pipe Cr.

- The December 2008 versions of the *Capacity Management Planning Worksheets*[4] (Appendix A) for each major WWTP were reviewed to determine existing flows, wastewater flows, infiltration/inflow (I/I) estimates, and anticipated wastewater demands for the following conditions:
  - Priority+ future service areas, representing potential wastewater demands 6-10 years in the future.
  - Buildout wastewater demands, based on the assumption of service to the entire DGA, including areas currently designated as "no planned service" areas.
- Interviews were conducted with representatives of each major WWTP in February-March 2009, to gain additional recent information on WWTP performance, upgrade/expansion plans, compliance issues, and other potential limitations.

Table 2-3.
Chesapeake Bay-Related Nutrient Loading Caps in Carroll County

Facility Name	TN Load Cap (lbs/yr)	TP Load Cap (lbs/yr)	TN Conc. Basis (mg/L)	TP Conc. Basis (mg/L)
Westminster WWTP	60,911	4,568	4.0	0.3
Freedom District WWTP	42,638	3,198	4.0	0.3
Mount Airy WWTP	14,619	1,096	4.0	0.3
Taneytown WWTP	13,400	1,005	4.0	0.3
Hampstead WWTP	10,964	822	4.0	0.3
Manchester WWTP	6,921	192	18.0	0.5
Union Bridge WWTP	6,140	1,023	18.0	3.0
New Windsor WWTP	3,178	530	18.0	3.0
Pheasant Ridge WWTP	1,487	248	18.0	3.0
Gaither Manor Apts. WWTP	1,345	224	18.0	3.0
So. Carroll High School WWTP	382	64	18.0	3.0
Runnymede WWTP	187	31	18.0	3.0
Pleasant Valley WWTP	556	93	18.0	3.0
Congoleum Corp.	4,005	160	5.0	0.2

2.2. Septic System Locations and Loads

Existing septic system locations and numbers were estimated using a GIS analysis of the County's address location database joined with spatial information on land use. Septic system nitrogen loads were estimated for existing, priority+future, and DGA buildout conditions. The load calculation methodology followed the recommended MDE methodology[1], as described below. The resulting septic system numbers and loads are tabulated by watershed in Appendix C.

2.2.1. Residential Systems

Residential parcels outside of the SSAs were assumed to have a single septic system with an average flow and loading rate. Nitrogen loads associated with residential septic systems were estimated using the following formula:

> Annual nitrogen loads for each watershed = the number of individual systems × 3.0 persons/household × 9.5 lbs nitrogen/person/yr × a transport loss factor of 0.4.

Under the existing scenario, the number of individual residential systems was estimated from the number of residential address locations and the assumption that each residential address location included a single family dwelling. Under the priority+future scenario, the number of residential systems was estimated by (1) adding the estimated number of new households outside of the existing, priority, and future service areas as determined in

the County's Buildable Land Inventory (BLI) analysis to the number of existing systems located outside of the existing, priority, and future service areas; and (2) subtracting the number of existing households outside of the existing service area but within the priority+future service area. Under the buildout scenario, the number of residential systems was estimated by subtracting the number of existing households outside of the priority + future service areas but within the DGA from the number of systems estimated for the priority+future scenario.

2.2.2. Non-Residential Systems

Non-residential entities outside of the SSAs, such as churches, schools, and small businesses outside of the SSAs (without NPDES permits) were assumed to have a septic system with a flow rate based on the acreage of the parcel and an average annual nitrogen loading rate. Nitrogen loads associated with non-residential septic systems were estimated using the following formula:

> Annual nitrogen loads for non-residential septic systems = the acreage of non-residential parcels × average flow per acre per day × 40 mg/L × 8.34 liters per gallon × a transport loss factor of 0.4 × 365days/year × 1/1,000,000 MGD/gpd

Average septic flow rates for commercial land uses were assumed to be 1,300 gpd/acre and 500 gpd/acre for light industrial uses, in accordance with MDE guidance[1]. For the priority+future and buildout scenarios, non-residential acreages were adjusted using the assumed scenario service area boundaries as discussed above in Section 2.2.1. A growth rate of 25 percent was assumed for both the priority+future and buildout scenarios.

2.2.3. Potential Septic System Hookups to ENR Facilities

In order to calculate potential onsite disposal system (OSDS) hookup credits, it was necessary to estimate the number of septic systems that could be removed and hooked up to WWTPs that will eventually install ENR technology. The number of systems to be potentially hooked up under the priority+future conditions was estimated as the number of existing residential address locations outside of the existing SSA but within the priority+future growth areas. Similarly, the number of systems to be potentially hooked up under the buildout conditions was estimated as the number of existing residential address locations outside of the existing SSA but within the DGA. The USGS National Hydrography Database shapefiles were used in a GIS analysis to determine which of the septic systems are likely to be within 1,000 feet of a perennial stream, based on parcel centroids. Septic systems within 1,000 feet of a perennial stream which are replaced with a connection to a wastewater treatment plant may receive more receive credits under Maryland's nutrient trading policy, as discussed in Section 4 below.

2.3. Impaired Water Bodies and TMDLs

Maryland's 2008 combined 305(b)/303(d) report[5] was reviewed to determine the location of impaired streams and impoundments in Carroll County (Table 2-4; Figure 2-2). For certain types of impairments, it is MDE's policy to list the entire watershed or all 1st through 4th order streams within a watershed as impaired. Table 2-4 lists the major SSAs and WWTPs that are within or upstream of these segments and watersheds.

In addition to these 303(d)-listed segments that require future TMDLs, TMDLs have already been finalized for the following water bodies downstream of WWTPs in Carroll County:

- Prettyboy Reservoir (downstream of Manchester WWTP) has approved TMDLs for methylmercury and total phosphorus.
- Loch Raven Reservoir (downstream of Hampstead WWTP) has approved TMDLs for total phosphorus, methylmercury, and sedimentation/siltation.
- Double Pipe Creek (downstream of New Windsor, Union Bridge, and Westminster WWTPs) has an approved TMDL for sediment/siltation.
- The Lower Monocacy River (downstream of Taneytown, New Windsor, Union Bridge, and Westminster WWTPs) has an approved TMDL for sediment/siltation.

MDE has prepared draft TMDLs for fecal coliform bacteria in Double Pipe Creek, Liberty Reservoir, and Prettyboy Reservoir, which are awaiting USEPA approval.

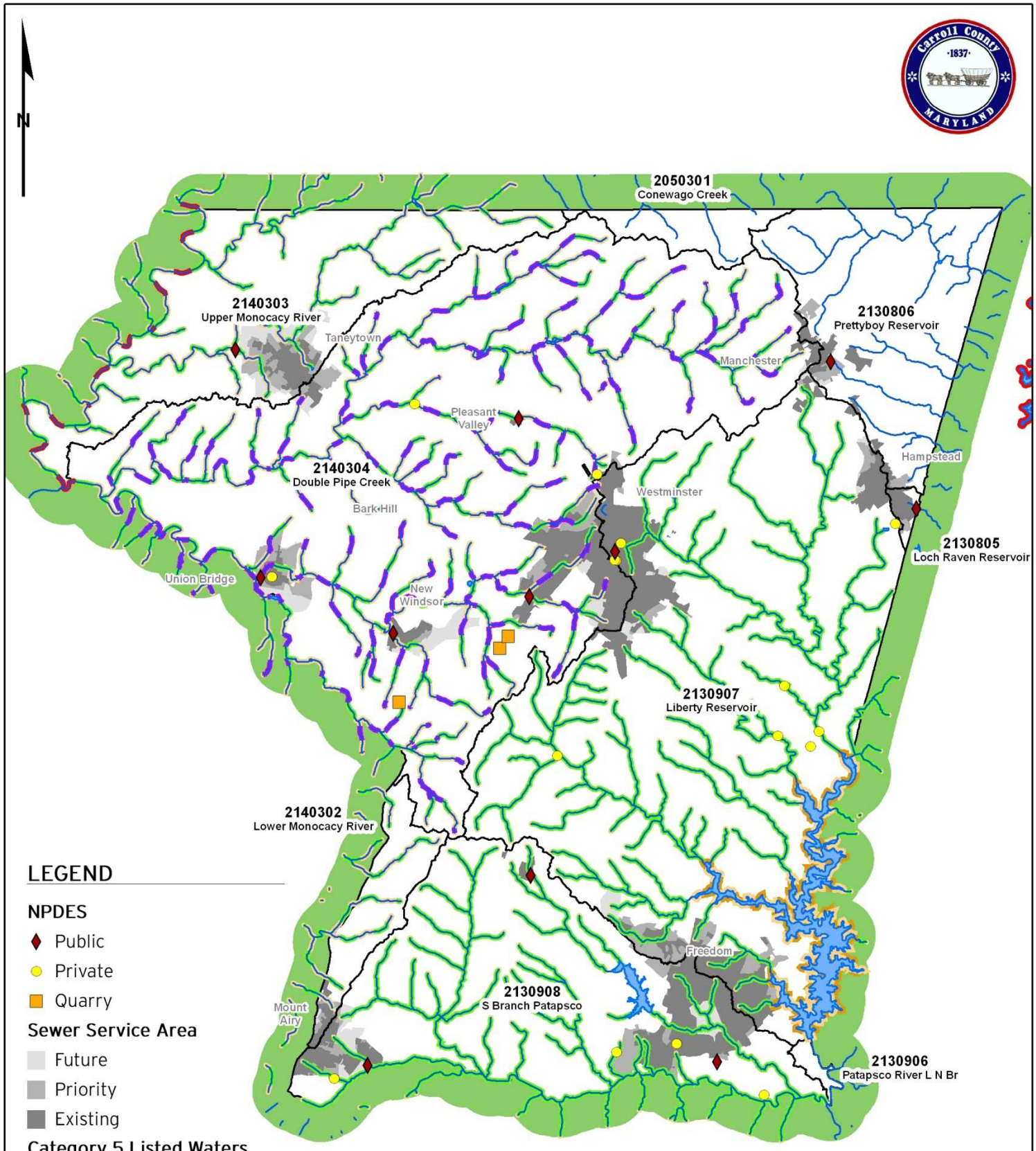
Each 303(d) listing and TMDL-based NPDES permit limits were examined to determine if they were likely to serve as the limiting factor to discharges of upstream WWTPs. The Manchester and Hampstead WWTPs already have total phosphorus limits of 1.0 and 0.3 mg/L, respectively, based on existing TMDLs established to protect downstream reservoirs. However, Malcolm Pirnie concluded that plant design capacity and/or the Bay-related nutrient load caps are likely to represent more important long-term limitations to wastewater discharges than any existing or future local TMDL, because:

- Most of the current 303(d) listings and local TMDLs are for constituents for which loading is dominated by nonpoint sources (*e.g.*, fecal coliform, sediment/siltation), and for which WWTPs are capable of treating without experiencing major limitations;
- WWTPs in compliance with permit limits are not expected to be major contributors to aquatic life impairments in receiving streams, with the possible exception of contributions to nutrient-related impairments; and
- Even if future TMDLs require additional nutrient limits for WWTPs , these limits are not expected to be more stringent than those associated with Bay-related nutrient

caps. This expectation has been confirmed with MDE (Yen-Der Cheng, MDE, pers. comm., 16 Mar 2009).

Table 2-4.
2008 303(d)-Listed Water Bodies in Carroll County

MDE 8-Digit HUC	Water Type	Designated Use	Cause	POTW/SSAs in or upstream of HUC
Double Pipe Creek	River Mainstem	Water Contact	Fecal Coliform	New Windsor Union Bridge Westminster
	1st thru 4th order streams	Aq. Life & Wildlife	Bioassessments	
	8-digit watershed	Aq. Life & Wildlife	Total Suspended Solids	
	8-digit watershed	Fishing	PCB in Fish Tissue	
	8-digit watershed	Aq. Life & Wildlife	Phosphorus (Total)	
Liberty Reservoir	Impoundment	Fishing	Methylmercury	None
	Impoundment	Aq. Life & Wildlife	Sedimentation/siltation	
	River Mainstem	Water Contact	Fecal Coliform	
	Impoundment	Aq. Life & Wildlife	Phosphorus (Total)	
	1st thru 4th order streams	Aq. Life & Wildlife	Bioassessments	
Lower Monocacy River	1st thru 4th order streams	Aq. Life & Wildlife	Bioassessments	New Windsor Union Bridge Taneytown Westminster
	8-digit watershed	Aq. Life & Wildlife	Phosphorus (Total)	
	8-digit watershed	Aq. Life & Wildlife	Total Suspended Solids	
	River Mainstem	Water Contact	Fecal Coliform	
Prettyboy Reservoir	River Mainstem	Water Contact Sports	Fecal Coliform	Manchester
South Branch Patapsco River	1st thru 4th order streams	Aq. Life & Wildlife	Bioassessments	Freedom Mt. Airy
Upper Monocacy River	1st thru 4th order streams	Aq. Life & Wildlife	Bioassessments	New Windsor Union Bridge Taneytown Westminster
	8-digit watershed	Aq. Life & Wildlife	Total Suspended Solids	
	8-digit watershed	Aq. Life & Wildlife	Phosphorus (Total)	
	River Mainstem	Water Contact	Fecal Coliform	



NOTE: - Discharge permits were inferred for the two Medford Quarries (CL1997G026 and CL1970G005), located in the Liberty Reservoir watershed.
- MDE/EPA Category 5 Waters (303d Listed) based on 2008 Integrated Report

MALCOLM PIRNIE	CARROLL COUNTY, MD WASTEWATER LIMITATIONS	2008 EPA/MDE Category 5 Listed Waters & NPDES Permit Locations	May 2009 Figure 2-2

2.4. Tier II Water Bodies

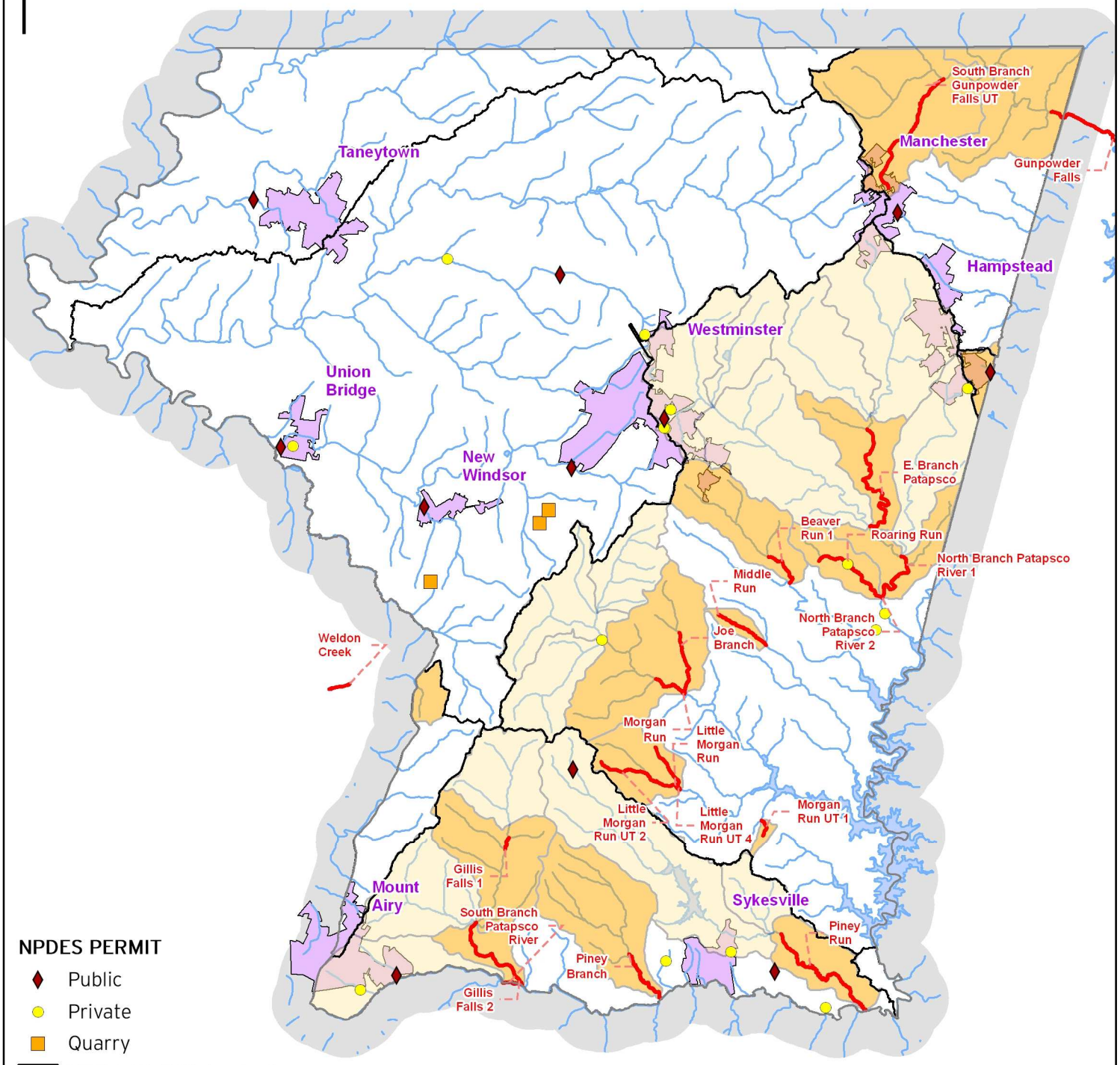
Under Maryland's antidegradation policy, certain water bodies are designated "high quality" or "Tier II" water bodies if they have water quality that is better than needed to meet designated uses. Under MDE regulations, the proposal of a new or expanded discharge to a Tier II water triggers an antidegradation review to determine if the high water quality can be maintained without adverse socioeconomic consequences. Tier II water bodies in Carroll County and adjacent areas are shown on Figure 2-3.

MDE currently bases most Tier II water designations on bioassessment results rather than on individual water quality constituent results. As such, it is not possible at this time to calculate specific wastewater flow limitations that would be driven by Tier II water designations. For this wastewater evaluation, each Tier II water body was identified and qualitatively evaluated with respect to proximity to upstream WWTPs and whether the Tier II designations were likely to serve as the limiting factors for new or expanded wastewater discharges.

None of the major WWTPs in Carroll County discharges directly to a Tier II water body, and only two major WWTPs discharge upstream of a Tier II water body:

- The Mount Airy WWTP discharges approximately 3 river miles upstream of a Tier II segment of the South Branch of the Patapsco River.
- The Hampstead WWTP discharges into Piney Run approximately 8 river miles upstream of its confluence with a Tier II segment of Western Run in Baltimore County.

The distance between these outfalls and the Tier II segments provide opportunity for mixing and assimilation of the effluent, prior to reaching the Tier II segments. Also, any new or expanded discharge upstream of a Tier II segment might require an anti-degradation review by MDE on a case-by-case basis. The review would consider such factors as the distance from the Tier II segment and the magnitude and nature of the discharge (John Backus, MDE, pers. comm., May 26, 2009). Regardless, modern wastewater treatment technology is capable of producing effluents that are fully protective of in-stream biota. As such, Tier II water designations were not deemed to represent the controlling discharge limitation for any major facility in the Carroll County.



SOURCE: - MDE http://www.mde.state.md.us/assets/document/hb1141/carroll/Carroll_County.pdf [Jan, 2009]

MALCOLM PIRNIE	**CARROLL COUNTY, MD** **WASTEWATER LIMITATIONS**	Tier II Waters in Carroll County	May 2009 Figure 2-3

3. Facility-Specific Wastewater Limitation Evaluation

This section draws upon the information sources identified in Section 2 to summarize the existing treatment capacity, future treatment capacity, and potential wastewater limitations of the eight large POTWs in Carroll County. The discussion is organized by MDE 8-digit watersheds in the County and limitations are summarized in Table 3-1. However, there are no major WWTP discharges in the Conewago Creek, Liberty Reservoir, Lower Monocacy River, or Patapsco River Lower North Branch watersheds.

3.1. Double Pipe Creek

3.1.1. Westminster WWTP

The WWTP serving the Westminster area is owned and operated by the City of Westminster. The 5.0-mgd plant is an activated sludge facility consisting of bar screens, grit and grease removal facility, aeration tanks with anaerobic, aerobic, and switch zones, secondary clarifiers, and liquid chlorination/dechlorination. Nutrient removal is provided by biological nutrient removal, and phosphorus is also removed by chemical addition. The plant discharges to Little Pipe Creek which flows into Double Pipe Creek. The City of Westminster has plans to expand the plant to 6.5 mgd and simultaneously upgrade the plant to enhanced nutrient removal (ENR) (Jeff Glass, Director, City of Westminster Department of Public Works, pers. comm., 26 Mar 2009).

Limitations based on design capacity: The 5.0-mgd facility must undergo expansion in order to accommodate the projected priority+future wastewater demand (Table 3-1, Figure 3-1). However, the expanded 6.5-mgd facility will be capable of accommodating all projected wastewater flows under both priority+future and buildout conditions. Even under buildout conditions, the 6.5-mgd facility is projected to have an excess treatment capacity of about 0.8 mgd.

According to the CMP worksheets, I/I flows averaged about 1.7 mgd in 2003, which represented over a third of the total average plant influent at that time. The City has an ongoing program to identify locations of high I/I and to reduce I/I by pipe replacement or slip-lining. As I/I is reduced over time, estimates of future excess capacity will be even higher.

Table 3-1.
Summary of Projected Wastewater Flows, Excess Capacity, and Nutrient Cap Based Limitations

				Projected Flow s From CMP Worksheets				Excess Capacity			Flow Limit Based on Nutrient Cap w/ ENR		Nitrogen Cap Limits Discharge Even with ENR?		
Wastewater Treatment Plant	Exist. Des. Cap.	Plan. Des. Cap.	2008 Ave. Flow	2002-03 I/I Est.	Existing + S1 Flow	Priority + Future Flow	DGA Build-out Flow	Existing + S1 Flow	Priority + Future Flow	DGA Build-out Flow	Capa. Based On 3 mg/L TN	Capa. Based On 0.3 mg/L TP	Existing + S1 Flow	Priority + Future Flow	DGA Build-out Flow
	(mgd)	(mgd)	(mgd)	(mgd)	(mgd)	(mgd)	(mgd)	(mgd)	(mgd)	(mgd)	(mgd)	(mgd)	(mgd)	(mgd)	(mgd)
Freedom	3.50	3.50	2.08	0.630	2.654	3.731	5.395	0.846	(0.231)	(1.895)	4.666	3.499	NO	NO	YES
Hampstead	0.90	0.90	0.58	0.231	0.667	0.926	1.553	0.233	(0.026)	(0.653)	1.200	0.899	NO	NO	YES
Manchester	0.50	0.50	0.43	0.022	0.373	0.467	0.838	0.127	0.033	(0.338)	2.303	0.639	NO	NO	NO
Mount Airy	1.20	1.20	0.92	0.237	1.008	1.398	1.399	0.192	(0.198)	(0.199)	1.600	1.199	NO	NO	NO
New Windsor	0.094	0.115	0.06	0.025	0.70	0.302	0.305	0.105	(0.127)	(0.130)	0.310	0.580	NO	NO	NO
Taneytown	1.10	1.10	0.83	0.351	0.922	1.744	1.744	0.178	(0.644)	(0.644)	1.466	1.100	NO	YES	YES
Union Bridge	0.20	0.20	0.14	0.051	0.280	0.890	0.928	(0.080)	(0.690)	(0.728)	0.672	1.120	NO	YES	YES
Westminster	5.00	6.5	4.44	1.743	4.827	5.032	5.706	1.673	1.468	0.794	6.665	4.998	NO	NO	NO

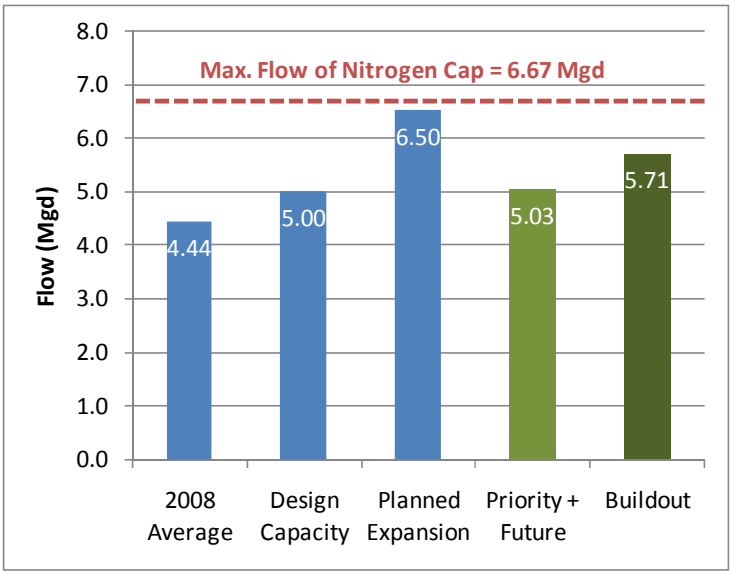


Figure 3-1: Westminster WWTP wastewater flow projections relative to design capacity and nutrient cap-based flow limits.

Limitations based on local water quality: The Westminster WWTP NPDES permit includes limits for conventional pollutants and parameters such as five-day biological oxygen demand (BOD5), fecal coliform, pH, total suspended solids, and dissolved oxygen. These limits are standard limits for secondary treatment facilities, and the most recent NPDES permit factsheet for the facility states that they are fully protective of receiving waters. Limits for parameters such as ammonia and total Kjeldahl nitrogen (TKN) were derived for local water quality protection and are expected to remain achievable even under projected buildout flows.

Because the Westminster WWTP can readily comply with fecal coliform and TSS limits, the TMDLs for Double Pipe Creek for fecal coliform and TSS will not represent the controlling limitations to discharge. The most recent NPDES permit fact sheet for the facility states that "the evaluation of the recent water quality data collected upstream and downstream of the discharge point showed no significant impact of the effluent discharge to the receiving waters." MDE recognizes that the WWTPs usually contribute a minuscule proportion of the total loading of non-point source dominated constituents, such as fecal coliform and TSS, and, when requested, typically grants administrative adjustments to waste load allocations to reflect expanded plant design flows and technology-based concentrations (Jim George, MDE, pers. comm., May 26, 2009). Therefore, the future TMDL for biological impairments in the Double Pipe Creek watershed is also not expected to impose the controlling limitation on discharge rates. The future phosphorus TMDL for Double Pipe Creek is unlikely to impose phosphorus limits that are more stringent than the Bay-related nutrient caps. The Westminster WWTP is not upstream of a Tier II stream segment.

Limitations based on Bay nutrient caps: The Westminster WWTP's NPDES permit already has a total phosphorus concentration limit of 2.0 mg/L (monthly average) based on Maryland's tributary strategy for nutrient reductions for the Chesapeake Bay. More importantly for long-term planning, the WWTP is considered a "major" facility under Maryland's Tributary Strategy Statewide Implementation Plan and has been assigned nutrient loading caps for both total nitrogen and total phosphorus (Table 2-3). The nutrient caps were based on a design capacity of 5.0 mgd, a total nitrogen concentration of 4.0 mg/L, and a total phosphorus concentration of 0.3 mg/L. As with other major facilities, these nutrient caps will become enforceable NPDES permit limits in the future.

The City's planned ENR upgrade project will be designed to achieve 3.0 mg/L total nitrogen and at least 0.3 mg/L total phosphorus. At these concentrations, the total phosphorus loading limits would be more controlling than the nitrogen limit, and would limit discharge to approximately 5.0 mgd. However, it is expected that the WWTP will be able to achieve lower effluent phosphorus concentrations, such that the nitrogen cap will be represent a more controlling limitation. At 3.0 mg/L total nitrogen, the Westminster WWTP would be limited to discharging approximately 6.67 mgd, which is more than the planned expansion to 6.5 mgd.

Summary of wastewater limitations: By expanding to 6.5 mgd and upgrading to ENR, the Westminster WWTP will be able to accommodate all wastewater demands to buildout, and still have excess capacity. The planned design capacity of the plant represents the controlling limitation. The secondary limitation of the plant is controlled by the total nitrogen waste load allocation which would limit the plant to 6.67 mgd.

3.1.2. Union Bridge WWTP

The Union Bridge WWTP is owned and operated by the Town of Union Bridge. The 0.2-mgd plant consists of a rotary screen, activated sludge processing with two extended aeration basins, settling basins, secondary clarifiers, aerated chlorine contact chamber, and a sulfur dioxide gas feeder system for dechlorination. The plant discharges to Little Pipe Creek which flows into Double Pipe Creek. The Town of Union Bridge currently has no immediate plans to expand the WWTP, nor to upgrade to ENR (Jeff Glass, pers. comm., 26 Mar 2009). Although future development could greatly increase the wastewater demand, plant expansions would likely be contingent upon the agreement by developers to fund the majority of the expansion costs (Bret Grossnickle, Mayor, Town of Union Bridge, pers. comm., 30 Mar 2009).

Limitations based on design capacity: The 0.2-mgd facility would have to more than quadruple the current design capacity in order to accommodate the projected priority+future and buildout wastewater demands, as tabulated on CMP worksheets (Table 3-1, Figure 3-2). Given the age of the current plant and its location on the Little Pipe Creek floodplain, preliminary engineering studies have indicated that it would be

most cost-effective to build a new plant at another nearby location rather than expand the current plant (Jeff Glass, pers. comm., 26 Mar 2009).

According to the CMP worksheets, I/I flows averaged about 0.05 mgd in 2003, which represented about a third of the total average plant influent at that time. At this time, the Town is resource-limited with regard to reducing I/I.

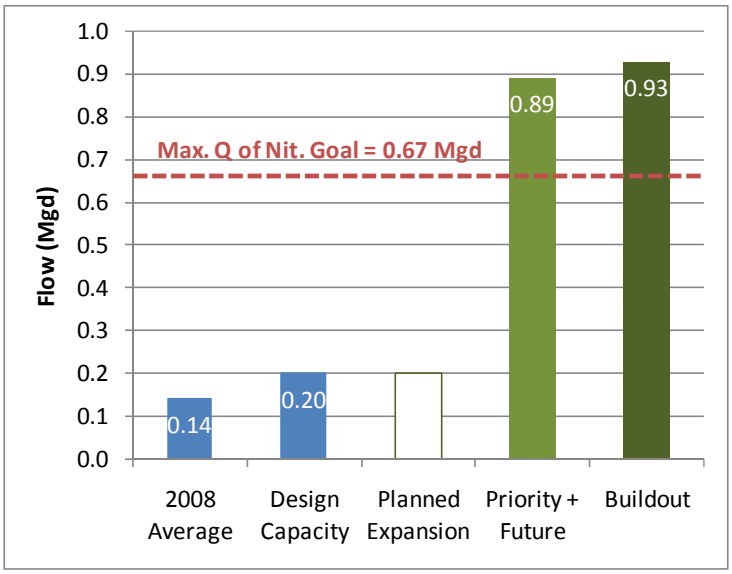


Figure 3-2: Union Bridge WWTP wastewater flow projections relative to design capacity and nutrient cap-based flow limits

Limitations based on local water quality: The Union Bridge WWTP NPDES permit includes limits for conventional pollutants and parameters such as BOD5, fecal coliform, pH, total suspended solids, and dissolved oxygen. These limits are standard limits for secondary treatment facilities, and MDE has determined that they are fully protective of receiving waters. Limits for parameters such as ammonia were derived for local water quality protection and will be achievable with nitrification even at high flow rates.

Because the Union Bridge WWTP can readily comply with fecal coliform and TSS limits, the TMDLs for Double Pipe Creek for fecal coliform and TSS will not represent the controlling limitations to discharge. Similarly, the future TMDL for biological impairments in the Double Pipe Creek watershed is also not expected to impose the controlling limitation on discharge rates. MDE recognizes that the WWTPs usually contribute a minuscule proportion of the total loading of non-point source dominated constituents, such as fecal coliform and TSS, and, when requested, typically grants administrative adjustments to waste load allocations to reflect expanded plant design flows and technology-based concentrations (Jim George, MDE, pers. comm., May 26,

2009). The future phosphorus TMDL for Double Pipe Creek is unlikely to impose phosphorus limits that are more stringent than the Bay-related nutrient caps, but could result in a phosphorus limit in the NPDES permit. The Union Bridge WWTP is not upstream of a Tier II stream segment.

Limitations based on Bay nutrient caps: The Union Bridge WWTP's NPDES permit does not have limits for total nitrogen nor total phosphorus. However, the WWTP has been assigned nutrient loading caps as goals for both total nitrogen and total phosphorus (Table 2-3) under Maryland's Tributary Strategy Statewide Implementation Plan. The nutrient caps were based on a projected 2020 flow of 0.112 mgd, a total nitrogen concentration of 18.0 mg/L, and a total phosphorus concentration of 3.0 mg/L. As with most other minor facilities, these nutrient caps will remain as goals rather than permit limits, until/unless the WWTP expands or elects to trade nutrient credits to another point source facility.

If the Union Bridge WWTP expanded and upgraded to ENR, the total nitrogen cap would represent a controlling limitation to the maximum discharge rate. At 3.0 mg/L total nitrogen, the Union Bridge WWTP would be limited to discharging approximately 0.67 mgd, which is less than the priority+ future and buildout wastewater demands. Discharges above this level would require the Town to obtain nutrient offsets/credits or to pursue no-discharge options such as land application or effluent recycle/reuse. These options are discussed further in Section 4 of this report.

Summary of wastewater limitations: The existing design capacity (0.2 mgd) of the Union Bridge WWTP represents the controlling limitation under current conditions. Longer-term, the Bay-related nitrogen loading cap represents a 0.67-mgd limit to surface water discharges. This is less than the projected priority+future and buildout wastewater demands.

3.1.3. New Windsor WWTP

The New Windsor WWTP is owned and operated by the Town of New Windsor. The plant is currently rated as a 0.094-mgd facility, and consists of an aerated lagoon, chlorine disinfection, and cascade aeration. The plant discharges to Dickerson Run which flows into Little Pipe Creek. The Town is currently designing an upgrade and expansion of the WWTP using sequencing batch reactor technology with nutrient removal, and hopes to be in construction by the end of 2009 or early 2010. The expansion would increase the rated capacity of the WWTP to 0.115 mgd (Wally Brown, New Windsor Town Manager, pers. comm., 30 Mar 2009).

Limitations based on design capacity: The CMP worksheets indicate that the priority+future and buildout wastewater demands would be approximately 0.3 mgd, which is greater than the planned WWTP capacity of 0.175 mgd (Table 3-1; Figure 3-3).

According to the Town, the wastewater demand projections are unlikely to exceed 0.25 mgd (Wally Brown, pers. comm., 30 Mar 2009). According to the CMP worksheets, I/I flows averaged about 0.025 mgd in 2003, which represented about a quarter of the total average plant influent at that time. The Town has performed some smoke-testing but has no formal program for reducing I/I at this time.

Limitations based on local water quality: The New Windsor WWTP NPDES permit includes limits for conventional pollutants and parameters such as BOD5, fecal coliform, pH, total suspended solids, and dissolved oxygen. These limits are standard limits for secondary treatment facilities, and MDE has determined that they are fully protective of receiving waters. Limits for parameters such as ammonia were derived for local water quality protection and will be achievable with nitrification even at expanded flows, after the plant expansion is complete.

Because the New Windsor WWTP can readily comply with fecal coliform and TSS limits, the TMDLs for Double Pipe Creek for fecal coliform and TSS will not represent the controlling limitations to discharge. Similarly, the future TMDL for biological impairments in the Double Pipe Creek watershed is also not expected to impose the controlling limitation on discharge rates. MDE recognizes that the WWTPs usually contribute a minuscule proportion of the total loading of non-point source dominated constituents, such as fecal coliform and TSS, and, when requested, typically grants administrative adjustments to waste load allocations to reflect expanded plant design flows and technology-based concentrations (Jim George, MDE, pers. comm., May 26, 2009). The future phosphorus TMDL for Double Pipe Creek is unlikely to impose phosphorus limits that are more stringent than the Bay-related nutrient caps. The New Windsor WWTP is not upstream of a Tier II stream segment.

Limitations based on Bay nutrient caps: The New Windsor WWTP has been assigned nutrient loading caps as goals for both total nitrogen and total phosphorus (Table 2-3) under Maryland's Tributary Strategy Statewide Implementation Plan. These nutrient caps were based on a projected 2020 flow of 0.058 mgd, a total nitrogen concentration of 18.0 mg/L, and a total phosphorus concentration of 3.0 mg/L. Because the plant is expanding to a treatment capacity of more than 0.1 mgd, these loading caps will become enforceable permit limits upon completion of the expansion.

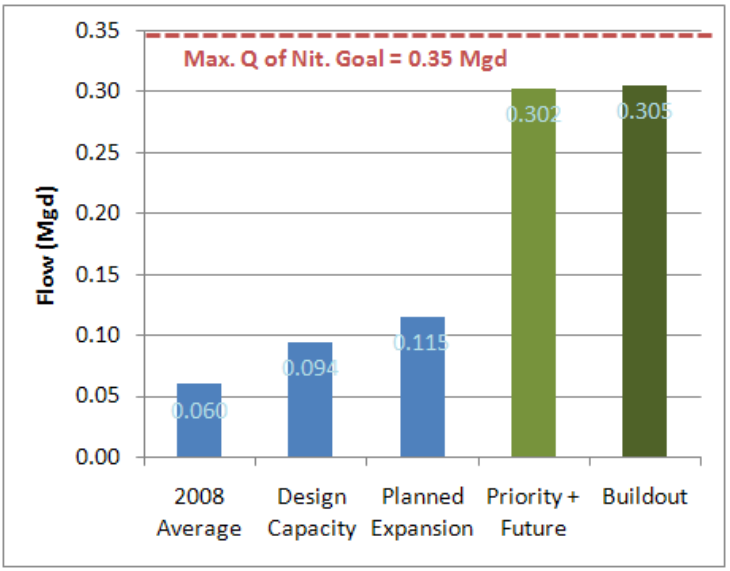


Figure 3-3: New Windsor WWTP wastewater flow projections relative to design capacity and nutrient cap-based flow limits

At a flow of 0.175 mgd, the New Windsor WWTP could meet its nutrient loading caps by attaining effluent concentrations of approximate 6.0 mg/L total nitrogen and 1.0 mg/L total phosphorus, which are achievable with the technology selected for the upgrade. If the plant ultimately upgraded to full ENR (3.0 mg/L total nitrogen and 0.3 mg/L total phosphorus), it could attain its nutrient loading limits even at the 0.3 mgd flow projected for full buildout on the CMP worksheets (Figure 3-3).

Summary of wastewater limitations: The existing design capacity (0.094 mgd) of the New Windsor WWTP represents the controlling limitation under current conditions. As the plant expands and upgrades, the rated design capacity is likely to remain the controlling limitation to discharge as long as advanced nutrient removal technology is employed. The secondary limitation based on a 3 mg/l nitrogen waste load allocation is approximately 0.310, which is larger than the priority+future and growth scenario demands.

3.2. Loch Raven Reservoir

3.2.1. Hampstead WWTP

The WWTP serving the Hampstead area is owned and operated by Carroll County. The 0.9-mgd plant is an advanced secondary level treatment facility that uses an activated sludge treatment process. The treatment plant consists of bar screen with a grinder and screw conveyor system, oxidation ditches, secondary clarifiers, sand filters, and an ultraviolet disinfection system. The plant discharges to North Piney Run upstream of the Loch Raven Reservoir. Phosphorus is removed by chemical addition.

The Hampstead WWTP NPDES is currently being operated under a Consent Judgment Agreement, pending resolution of a regulatory controversy related to the effluent temperature limit, as discussed further below. Any future expansion or ENR upgrade would be dependent upon resolution of this issue (Joe Barrington, Chief, Bureau of Utilities, Carroll County Department of Public works, pers. comm., 25 Mar 2009).

Limitations based on design capacity: The 0.9-mgd design capacity of the Hampstead WWTP is only slightly lower than the 0.93 mgd wastewater demand that was projected for priority+future conditions (Table 3-1; Figure 3-4). However, the plant would need to be expanded to approximately 1.5 mgd in order to meet the projected buildout wastewater demand. According to the CMP worksheets, I/I flows averaged about 0.23 mgd in 2003, which represented almost a third of the total average plant influent at that time. The County has an ongoing program to identify and reduce I/I.

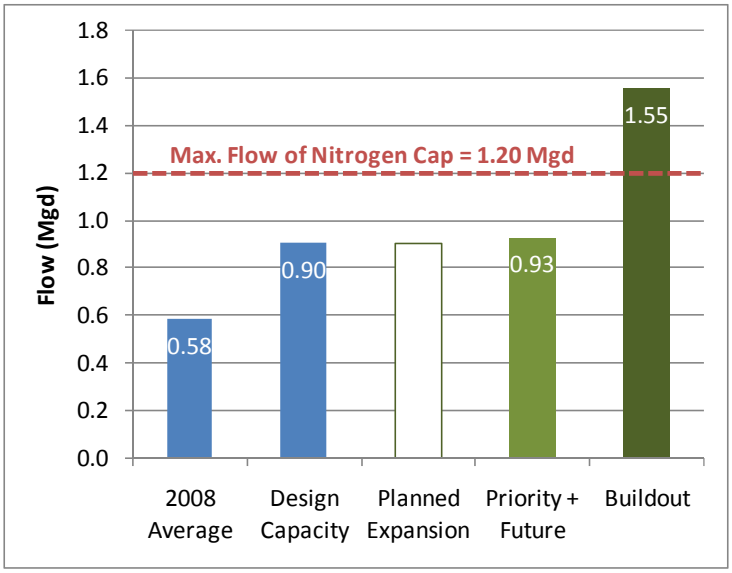


Figure 3-4: Hampstead WWTP wastewater flow projections relative to design capacity and nutrient cap-based flow limits

Limitations based on local water quality: Like other POTWs in Carroll County, the Hampstead WWTP is fully capable of meeting technology-based limits for conventional pollutants and water quality-based limits for constituents such as ammonia. The plant is successfully meeting a 0.3 mg/L total phosphorus limit required by the Loch Raven Reservoir phosphorus TMDL. However, during summer months this facility is not capable of meeting a very stringent effluent temperature limit, expressed as the higher of 20°C or the upstream ambient stream temperature. Installation and operation of chillers to reduce the effluent temperature would be very costly, energy-intensive, and may

complicate environmental management. The County has performed studies that demonstrate that current effluent temperature is protective of the aquatic life uses of the receiving stream and that the Piney Run supports a balanced indigenous aquatic population. However, because the plant's NPDES cannot be finalized until the temperature issue is resolved, it represents a pending controlling wastewater limitation.

The Hampstead WWTP discharges into Piney Run approximately 8 river miles upstream of its confluence with a Tier II segment of Western Run in Baltimore County. Given the high levels of treatment and large distance to the segment, the Hampstead WWTP is not expected to have a measurable effect on the water quality of this segment. Therefore, the Tier II designation is not expected to represent a controlling limitation of the Hampstead WWTP discharge.

Limitations based on Bay nutrient caps: The Hampstead WWTP is considered a "major" facility under Maryland's Tributary Strategy Statewide Implementation Plan and has been assigned nutrient loading caps for both total nitrogen and total phosphorus (Table 2-3). The nutrient caps were based on a design capacity of 0.9 mgd, a total nitrogen concentration of 4.0 mg/L, and a total phosphorus concentration of 0.3 mg/L.

As with plant expansion, no ENR upgrade is planned pending resolution of the temperature issue. However, the Hampstead WWTP has been added to the list of facilities eligible for Bay Restoration Funds. If the Hampstead WWTP does eventually upgrade to achieve 3.0 mg/L total nitrogen, it could discharge up to 1.2 mgd without exceeding the nitrogen cap. This would allow accommodation of priority+future flows, but not the full 1.55-mgd wastewater demand projected at full DGA buildout (Figure 3-4). Discharges above 1.2 mgd would require the County to obtain nutrient offsets/credits or to pursue no-discharge options such as land application or effluent recycle/reuse. These options are discussed further in Section 4 of this report.

Limitations based on the 2005 Watershed Management Agreement: a watershed management agreement (WMA) was enacted in 2005 between Carroll County, Baltimore County, the City of Baltimore, and several state and local agencies. The purpose of this agreement is to protect water quality in Baltimore's three major sources of water: Loch Raven, Liberty and Prettyboy Reservoirs. Point source management provisions pertaining to the Hampstead WWTP are currently tied to limitations set through the plant's NPDES permit and existing MDE programs, including limiting phosphorus effluent concentrations below 0.3 mg/l and capping total phosphorus loads using the TMDL programs. The WMA, by itself, is not a limiting factor on the operation of the Hampstead WWTP.

Summary of wastewater limitations: Until the temperature issue is resolved, the current design capacity of 0.9 mgd will remain the controlling limitation. Longer-term, the Bay-related nitrogen loading cap represents a 1.2-mgd limit to surface water discharges.

3.3. Prettyboy Reservoir

3.3.1. Manchester WWTP

The Manchester WWTP is owned and operated by the Town of Manchester. The 0.5-mgd plant provides advanced secondary level treatment using activated sludge treatment process consisting of mechanical screens, grit removal, two stabilization tanks, and an ultraviolet disinfection system. Phosphorus is removed by chemical addition. The plant effluent is pumped to a 5-million gallon storage lagoon. Most of the year (March-November), the effluent is spray-irrigated to approximately 70 acres of farmland growing reed canary grass. From December to February, the effluent is discharged to George's Run, a tributary of Prettyboy Reservoir. Manchester's NPDES permit allows discharge to George's Run in March as well, but this would normally only be done if the soil conditions were unsuitable for spray irrigation. The Town currently has no plans to expand the WWTP, but has applied to MDE for funding to install ENR technology (Steve Miller, Town Manager, Town of Manchester, pers. comm., 20 Mar 2009).

Limitations based on design capacity: The CMP worksheets indicate that the priority+future wastewater demands would be approximately 0.47 mgd, which could be met by the current plant without expansion (Table 3-1; Figure 3-5). However, the plant would need to be expanded in order to meet the projected buildout wastewater demand of 0.84 mgd. According to the Town, the buildout wastewater demand is unlikely to exceed 0.5 mgd (Steve Miller, pers. comm., 20 Mar 2009). There is limited land area to expand the plant, and regardless, the Town reports that the land area available for spray irrigation would not allow treatment of more than about 0.6 mgd. Previous studies by the Town have indicated that low soil infiltration capacities prevent most other nearby parcels in the region from being suitable for spray irrigation of effluent (Steve Miller, pers. comm., 20 Mar 2009).

According to the CMP worksheets, I/I flows averaged only about 0.022 mgd in 2003, which represented less than a tenth of the total average plant influent at that time. The Town has an ongoing program to identify and reduce I/I.

Limitations based on local water quality: The Manchester WWTP NPDES permit includes limits for conventional pollutants and parameters such as BOD5, fecal coliform, pH, total suspended solids, and dissolved oxygen. These limits are standard limits for secondary treatment facilities, and MDE has determined that they are fully protective of receiving waters. Limits for parameters such as ammonia were derived for local water quality protection and will be achievable with nitrification even at expanded flows, after the plant expansion is complete. The plant can successfully comply with a 1.0 mg/L total phosphorus limit related to the Prettyboy Reservoir phosphorus TMDL. The Manchester WWTP is not upstream of a Tier II stream segment.

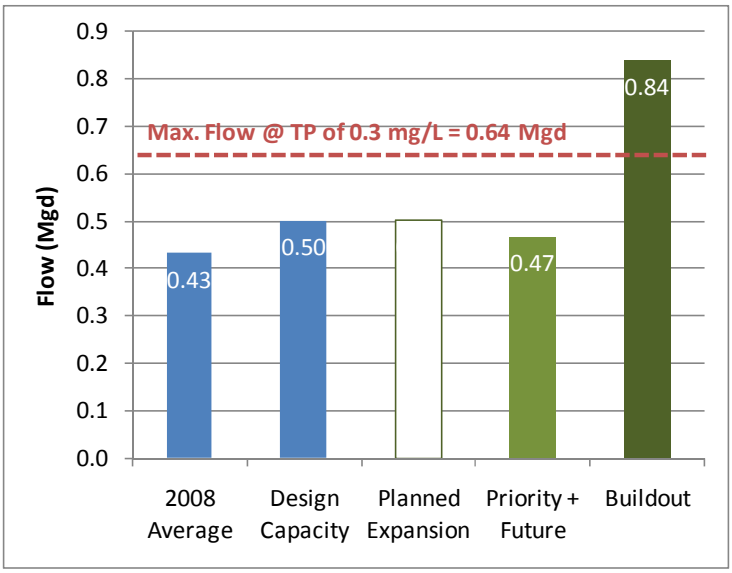


Figure 3-5: Manchester WWTP wastewater flow projections relative to design capacity and nutrient cap-based flow limits

Limitations based on Bay nutrient caps: The Manchester WWTP is considered a "minor" facility under Maryland's Tributary Strategy Statewide Implementation Plan, and has been assigned nutrient loading caps as goals for both total nitrogen and total phosphorus (Table 2-3). These nutrient caps were based on a projected 2020 flow of 0.384 mgd for 120 days/year, a total nitrogen concentration of 18.0 mg/L, and a total phosphorus concentration of 0.5 mg/L. These caps will remain as goals rather than permit limits until/unless the WWTP expands or elects to trade nutrient credits to another point source facility.

At the design capacity flow of 0.5 mgd and assuming discharge for 120 days/year, the Manchester WWTP could meet its nutrient loading goals by attaining effluent concentrations of approximately 13.8 mg/L total nitrogen and 0.38 mg/L total phosphorus. Meeting these concentrations would require the plant to increase nutrient removal relative to the existing operation. Although the phosphorus goal could probably be achieved by increasing chemical addition, achieving the nitrogen goal at full design capacity would probably require additional nitrification/denitrification capability. However, if March discharges to surface water were relatively rare, the facility could achieve the loading goals without a major technology upgrade in most years.

If the Manchester WWTP plant expanded, the nutrient caps would become enforceable permit limits. The buildout wastewater demand listed in the CMP worksheet (0.84 mgd)

would require that the Manchester WWTP meet effluent concentrations of approximately 8 mg/L total nitrogen and 0.23 mg/L total phosphorus. These limits would be achievable with the installation of biological nutrient removal or ENR technology. However, unless MDE would allow year-round discharge to Prettyboy Reservoir, treating this amount of flow would also require that sufficient land area be identified to spray irrigate the projected buildout wastewater demand during March-November.

Limitations based on the 2005 Watershed Management Agreement: point source management provisions pertaining to the Manchester WWTP are currently tied to limitations set through the plant's NPDES permit and existing MDE programs, including limiting total phosphorus loads using the TMDL for Prettyboy Reservoir. The WMA, by itself, is not a limiting factor on the operation of the Hampstead WWTP.

Summary of wastewater limitations: Given the limited land area to expand the plant and to spray irrigate, the existing design capacity (0.5 mgd) of the Manchester WWTP represents the effective wastewater limitation. The approximate nitrogen based capacity limitation of 0.23 mdg is larger than the projected buildout scenario demand of 0.83 mgd and is not anticipated to be a controlling limitation.

3.4. South Branch of the Patapsco River

3.4.1. Freedom District WWTP

The WWTP serving the Freedom/Sykesville area is owned by the State of Maryland and operated by the Maryland Environmental Service (MES). The 3.5-mgd plant uses an activated sludge treatment process with biological nitrogen removal (BNR) and phosphorus removal. The plant consists of a screen and grit removal facility, an equalization basin, primary clarifier, aeration basins with aerobic and anoxic units, secondary clarifiers, filters, ultraviolet disinfection, and cascade aeration. Effluent is discharged to the South Branch of the Patapsco River.

Of the 3.5 mgd design capacity, MES is allocated 0.9 mgd for use by State institutions (primarily the Springfield Complex), and Carroll County is allocated the remaining 2.6 mgd. No expansions are currently planned. However, the State does plan to upgrade the plant to ENR (Joe Barrington, pers. comm., 25 Mar 2009).

Limitations based on design capacity: Wastewater flows in 2008 (about 2.1 mgd) were well below the 3.5-mgd design capacity of the Freedom District WWTP (Table 3-1; Figure 3-6). However, the facility would have to expand in order to accommodate the projected priority+future and buildout wastewater demands of 3.7 and 5.4 mgd, respectively.

Expansion of the Freedom District WWTP presents engineering and regulatory challenges due to space constraints, wetlands on site, and the low strength of influent wastewater (Joe Barrington, pers. comm., 25 Mar 2009). As an alternative to expansion, a larger plant could be built at another location. The State also has raised the possibility of pumping wastewater to a collection line in the Patapsco River drainage basin owned by the City of Baltimore, to take advantage of Baltimore's excess treatment capacity (Frank Schaeffer, pers. comm., 27 March 2009).

According to the CMP worksheets, I/I flows averaged about 0.67 mgd in 2003, which represented almost a quarter of the total average plant influent at that time. The County, which owns and operates the collection system outside of the state-owned Springfield Complex, has an ongoing program to identify and reduce I/I.

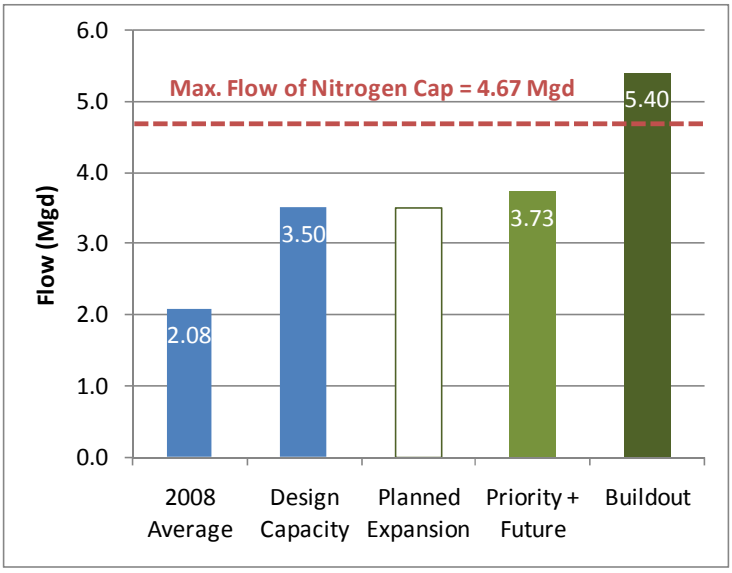


Figure 3-6: Freedom District WWTP wastewater flow projections relative to design capacity and nutrient cap-based flow limits

Limitations based on local water quality: The Freedom District WWTP NPDES permit includes limits for conventional pollutants and parameters such as BOD5, fecal coliform, pH, total suspended solids, and dissolved oxygen. These limits are standard limits for secondary treatment facilities, and are fully protective of receiving waters. Limits for parameters such as ammonia were derived for local water quality protection and are expected to remain achievable even under higher effluent flows.

Maryland's 2008 303(d) list cites "1st through 4th order streams" in the South Branch of the Patapsco River watershed as impaired based on combined fish/macroinvertebrate bioassessments. The source is cited as "unknown", and a TMDL is not expected within

two years. As long it stays in compliance with water-quality based permit limits, the Freedom District is not expected to be a cause of biological impairments in the receiving stream.

Limitations based on Bay nutrient caps: The Freedom District WWTP's NPDES permit already has a total phosphorus concentration limit of 2.0 mg/L (monthly average) based on Maryland's tributary strategy for nutrient reductions for the Chesapeake Bay. The WWTP is considered a "major" facility under Maryland's Tributary Strategy Statewide Implementation Plan and has been assigned nutrient loading caps for both total nitrogen and total phosphorus (Table 2-3). The nutrient caps were based on a design capacity of 3.5 mgd, a total nitrogen concentration of 4.0 mg/L, and a total phosphorus concentration of 0.3 mg/L. As with other major facilities, these nutrient caps will become enforceable NPDES permit limits in the future.

The planned ENR upgrade project will be designed to achieve 3.0 mg/L total nitrogen and at least 0.3 mg/L total phosphorus. At these concentrations, the total phosphorus loading limits would be more controlling than the nitrogen limit, and would limit discharge to approximately 3.5 mgd. However, it is expected that the plant will be able achieve lower effluent phosphorus concentrations, such that the nitrogen cap will be represent a more controlling limitation. At 3.0 mg/L total nitrogen, the Freedom District WWTP would be limited to discharging approximately 4.67 mgd, which is more than the projected priority+buildout wastewater demand but less than the projected buildout demand (Figure 3-6). Discharges above 4.67 mgd would require the Freedom District WWTP to obtain nutrient offsets/credits or to pursue no-discharge options such effluent recycling/reuse. These options are discussed further in Section 4 of this report.

Summary of wastewater limitations: The existing design capacity (3.5 mgd) of the Freedom District WWTP represents the controlling limitation under current conditions. Longer-term, the Bay-related nitrogen loading cap represents a 4.67-mgd limit to surface water discharges.

3.4.2. Mount Airy WWTP

The WWTP serving the Mount Airy area is owned and operated by the Town of Mount Airy. The 1.2-mgd plant is an activated sludge treatment facility utilizing BNR and phosphorus removal by chemical addition. The plant discharges to the South Branch of the Patapsco River. No expansion is currently planned, but the Town does plan to upgrade the plant to ENR (Tom Roberson, Plant Supervisor, Town of Mount Airy, pers. comm., 25 Mar 2009).

Limitations based on design capacity: The existing wastewater flow (0.9-1.0 mgd) is approaching the 1.2-mgd design capacity of the Mount Airy WWTP (Table 3-1; Figure

3-7). The facility would have to expand in order to accommodate the projected priority+future and buildout wastewater demand of 1.4 mgd. Site constraints to expansion include a stream, floodplain, and a stormwater management facility. Therefore, land availability could represent a limitation to plant expansion (Tom Roberson, pers. comm., 25 Mar 2009). According to the CMP worksheets, I/I flows averaged about 0.24 mgd in 2003, which represented about a quarter of the total average plant influent at that time. The Town has an ongoing program to identify locations of high I/I and to reduce I/I by pipe replacement or slip-lining.

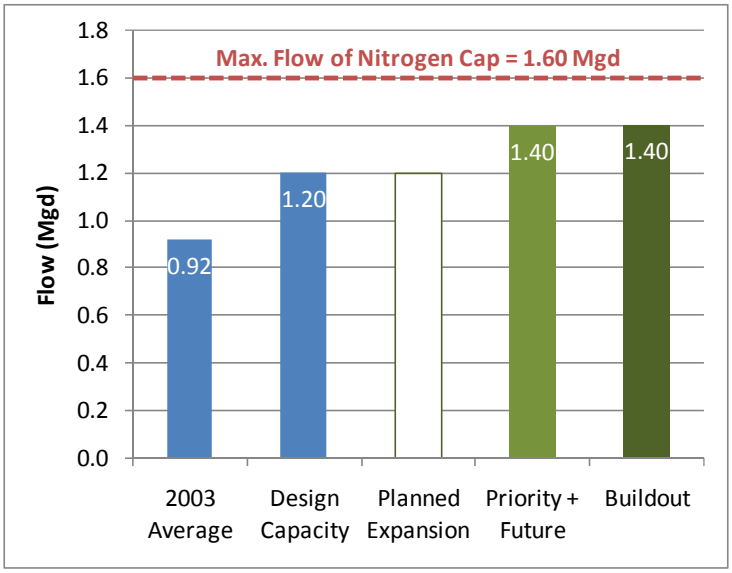


Figure 3-7: Mount Airy WWTP wastewater flow projections relative to design capacity and nutrient cap-based flow limits

Limitations based on local water quality: The Mount Airy WWTP NPDES permit includes limits for conventional pollutants and parameters such as BOD5, fecal coliform, pH, total suspended solids, and dissolved oxygen. These limits are standard limits for secondary treatment facilities, and are fully protective of receiving waters. Limits for parameters such as ammonia were derived for local water quality protection and are expected to remain achievable even under higher effluent flows.

The Mount Airy WWTP discharges approximately 3 river miles upstream of a Tier II segment of the South Branch of the Patapsco River. Given the high levels of treatment and large distance to the segment, the Tier II designation is not expected to represent a controlling limitation of the Mount Airy WWTP discharge.

Limitations based on Bay nutrient caps: The Mount Airy WWTP's NPDES permit already has a total phosphorus concentration limit of 2.0 mg/L (monthly average) based on Maryland's tributary strategy for nutrient reductions for the Chesapeake Bay. The WWTP is considered a "major" facility under Maryland's Tributary Strategy Statewide Implementation Plan and has been assigned nutrient loading caps for both total nitrogen and total phosphorus (Table 2-3). The nutrient caps were based on a design capacity of 1.2 mgd, a total nitrogen concentration of 4.0 mg/L, and a total phosphorus concentration of 0.3 mg/L. As with other major facilities, these nutrient caps will become enforceable NPDES permit limits in the future.

The planned ENR upgrade project will be designed to achieve 3.0 mg/L total nitrogen and at least 0.3 mg/L total phosphorus. At these concentrations, the total phosphorus loading limits would be more controlling than the nitrogen limit, and would limit discharge to approximately 1.2 mgd. However, it is expected that the plant will be able achieve lower effluent phosphorus concentrations, such that the nitrogen cap will be represent a more controlling limitation. At 3.0 mg/L total nitrogen, the Mount Airy WWTP would be limited to discharging approximately 1.6 mgd, which is more than the projected priority+buildout wastewater demand and the full DGA buildout demand (Figure 3-7). Therefore, expansion and upgrade to ENR would allow the facility to meet all projected future flows.

Summary of wastewater limitations: The existing design capacity (1.2 mgd) of the Mount Airy WWTP represents the controlling limitation under current conditions. Site constraints might present an engineering challenge to expansion, but considering that the maximum projected flows (1.4 mgd), are only slightly higher than the existing design capacity, the facility can probably expanded to 1.4 mgd if needed. The approximate nitrogen based capacity limitation of 1.6 mdg is larger than the maximum projected flows and is not anticipated to be a controlling limitation.

3.5. Upper Monocacy River

3.5.1. Taneytown WWTP

The WWTP serving the Taneytown area is owned and operated by City of Taneytown. The 1.1-mgd plant consists of coarse screens, fine screens, aerated grit removal, two sequential batch reactors with BNR capability, chlorination and dechlorination basins, and cascade aeration. The plant discharges to Piney Creek which flows into the Upper Monocacy River. No expansion is currently planned, but the City does plan to upgrade the plant to ENR in order to meet Bay-related nutrient caps (David Stewart, CDM, pers. comm., 30 Mar 2009).

Limitations based on design capacity: The existing wastewater flow (~0.8 mgd) is approaching the 1.1-mgd design capacity of the Taneytown WWTP (Table 3-1; Figure 3-8). The facility would have to expand in order to accommodate the projected priority+future and buildout wastewater demand of 1.74 mgd. The site has adequate land available for expansion if needed.

I/I is a major component of the existing influent flow. According to the CMP worksheets, I/I flows averaged about 0.35 mgd in 2003, which represented over a third of the total average plant influent at that time. The Town has an ongoing program to identify locations of high I/I and to reduce I/I by pipe replacement and lining.

Limitations based on local water quality: The Taneytown WWTP NPDES permit includes limits for conventional pollutants and parameters such as BOD5, fecal coliform, pH, total suspended solids, and dissolved oxygen. These limits are standard limits for secondary treatment facilities, and are fully protective of receiving waters. Limits for parameters such as ammonia were derived for local water quality protection and are expected to remain achievable even under higher effluent flows.

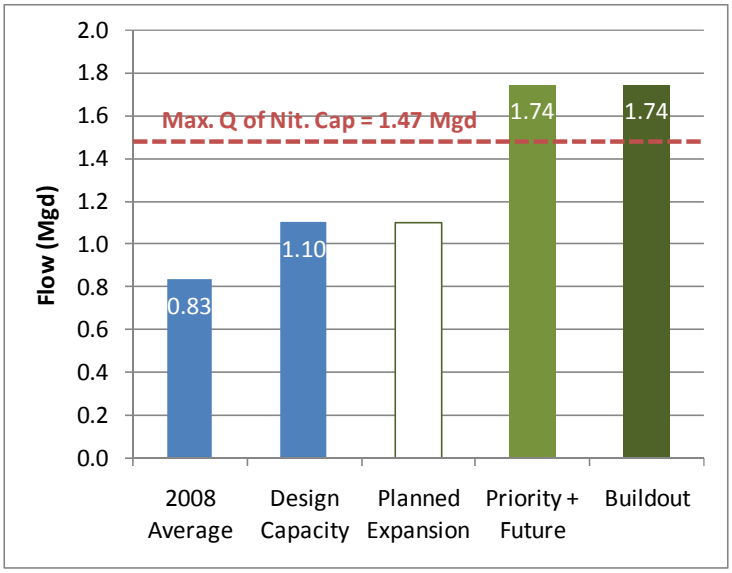


Figure 3-8: Taneytown WWTP wastewater flow projections relative to design capacity and nutrient cap-based flow limits

Limitations based on Bay nutrient caps: The Taneytown WWTP's NPDES permit already has a total phosphorus concentration limit of 2.0 mg/L (monthly average) based on Maryland's tributary strategy for nutrient reductions for the Chesapeake Bay. The WWTP is considered a "major" facility under Maryland's Tributary Strategy Statewide Implementation Plan and has been assigned nutrient loading caps for both total nitrogen and total phosphorus (Table 2-3). The nutrient caps were based on a design capacity of

1.1 mgd, a total nitrogen concentration of 4.0 mg/L, and a total phosphorus concentration of 0.3 mg/L. As with other major facilities, these nutrient caps will become enforceable NPDES permit limits in the future.

The planned ENR upgrade project will be designed to achieve 3.0 mg/L total nitrogen and at least 0.3 mg/L total phosphorus. At these concentrations, the total phosphorus loading limits would be more controlling than the nitrogen limit, and would limit discharge to approximately 1.1 mgd. However, it is expected that the plant will be able achieve lower effluent phosphorus concentrations, such that the nitrogen cap will be represent a more controlling limitation. At 3.0 mg/L total nitrogen, the Taneytown WWTP would be limited to discharging approximately 1.47 mgd, which is less than the projected priority+future and buildout wastewater demand of 1.74 mgd (Figure 3-8). Discharges above 1.47 mgd would require the Taneytown WWTP to obtain nutrient offsets/credits or to pursue no-discharge options such as land application or effluent recycle/reuse. These options are discussed further in Section 4 of this report.

Summary of wastewater limitations: The existing design capacity (1.1 mgd) of the Taneytown WWTP represents the controlling limitation under current conditions. Longer-term, the Bay-related nitrogen loading cap represents a 1.47-mgd limit to surface water discharges. Both of these limitations are lower than the maximum projected flows of 1.74 mgd.

4. Countywide Strategies for Reducing Wastewater Limitations

Most of the large POTWs in Carroll County are projected to experience limitations to wastewater discharges either under priority+future conditions or longer-term buildout of the DGAs. Many of the municipalities in the County are already performing or planning activities to address wastewater limitations, such as WWTP expansions, ENR upgrades, and I/I reduction. Effluent re-use (*e.g.*, spray irrigation) has been implemented by one municipality (Manchester) and considered by others. The *Maryland Policy for Nutrient Cap Management and Trading in Maryland's Chesapeake Bay Watershed*[6] presents several other options for reducing wastewater options, including nutrient trading and on-site disposal system (OSDS) hookup credits. This section describes the major options for reducing wastewater limitations, including:

- I/I reduction
- WWTP expansion
- ENR upgrade
- Nutrient trading
- OSDS hookup credits
- Effluent recycling and reuse
- Use of Industrial WWTPs

4.1. Infiltration/Inflow Reduction

Data from the CMP worksheets indicate that I/I is a major component of the total influent at most POTWs in Carroll County. Based on differences between 2002 (drought year) and 2003 (very wet year), I/I comprised a quarter to a third of the average influent flow at all of the larger POTWs except the Manchester WWTP, where it represented less than 10 percent. Representatives of municipalities such as Westminster, Freedom/Sykesville, Mount Airy, Taneytown, and Hampstead report ongoing programs to identify and reduce I/I. These programs include elements such as smoke testing, camera surveys, pipe replacement, lining of pipes, and identification of inappropriate routing of stormwater into the sanitary sewer systems. The smaller municipalities such as New Windsor and Union Bridge appear to be resource-limited with regard to I/I reduction.

In addition to preserving treatment capacity for sanitary wastewater, I/I reduction also prevents sanitary sewer overflows, protects public health, reduces WWTP O&M costs,

and improves the treatment process. I/I reduction programs should be considered a mainstay of collection system maintenance activities and a primary strategy for addressing wastewater limitations.

4.2. WWTP Expansion

Of the eight large POTWs in Carroll County, only two (Freedom District and Manchester) are projected to be able to accommodate priority+future wastewater demands without an expansion of treatment capacity, and none are projected to be able to accommodate DGA buildout wastewater demands without expansion (Table 3-1). WWTP expansion projects are currently being planned for the Westminster and New Windsor WWTPs. Other municipalities are likely to plan for WWTP expansions as wastewater demands increase and as funding becomes available.

Several facilities face potential site limitations or other engineering challenges to expanding the plant at the current location, including the Mount Airy, Freedom District, and Manchester WWTPs. The Mount Airy WWTP probably has sufficient space to expand at its current location, when and if necessary. The Freedom District WWTP has sufficient capacity to accommodate both existing and priority+future flows, such that there is no near-term need to address the site constraints. Challenges with expanding the Manchester WWTP (see section 3.3.1) represent a practical limitation to enlargement of the Manchester SSA, unless additional area for land application could be identified, or a new WWTP were constructed outside of the Prettyboy Reservoir watershed. The Town currently does not plan to expand the SSA (Steve Miller, pers. comm., 20 Mar 2009), and thus expansion might not be necessary.

The Taneytown WWTP is approaching its design capacity and has sufficient room to expand at the current location. However, the City's near-term strategy is focused on I/I reduction rather than plant expansion. The Union Bridge WWTP would need a major expansion—or construction of a new WWTP—in order to accommodate priority+future flows. As described in section 3.1.2, such a project would likely be contingent upon the agreement by developers to fund the majority of the expansion costs (Bret Grossnickle, Mayor, Town of Union Bridge, pers. comm., 30 Mar 2009).

Regulatory Effect of Expansion on Minor Plants' Nutrient Allocations: Minor (<0.5 mgd) plants that expand to a treatment of capacity more than 0.1 mgd will have their nutrient loading cap converted from goals to enforceable permit limits. In addition, when a minor plant expands, its nutrient loading caps will be assessed for adjustment to *no more than* 6,100 lbs/yr total nitrogen and 457 lbs/yr total phosphorus. Under this policy, the Manchester, Union Bridge, and New Windsor WWTPs would be susceptible to losing a portion of their nutrient allocations upon expansion.

4.3. Upgrades to Enhanced Nutrient Removal

ENR upgrades are the primary strategy undertaken by Carroll County municipalities for complying with the Chesapeake Bay-related nutrient loading caps. Most of the cost of these projects can funded from Maryland's Bay Restoration Fund (BRF). All of the County's "major" (>0.5 mgd) facilities (Westminster, Freedom District, Mount Airy, Taneytown, and Hampstead WWTP) are likely to install ENR technology at some point in the future. Most of these projects are already being planned or designed, although the unresolved effluent temperature issue at the Hampstead WWTP is likely to delay an ENR upgrade relative to the other POTWs. The Town of Manchester has also applied for BRF funding of nutrient removal upgrades at the Manchester WWTP, primarily as a polishing step rather than a necessity for regulatory compliance. The expanded New Windsor WWTP will also use nutrient removal technology, although not necessarily at an ENR level.

The State of Maryland defines ENR as technology capable of achieving effluent concentrations of 3.0 mg/L total nitrogen and 0.3 mg/L total phosphorus. Although specific technologies differ, most ENR plants will employ a combination of biological nutrient removal and filtration. Phosphorus concentrations lower than 0.3 mg/L can often be achieved by chemical addition and filtration. However, many ENR plants cannot consistently achieve effluent total nitrogen concentrations that are significantly lower than 3.0 mg/L. Hence, the total nitrogen cap will be more limiting than the total phosphorus cap at most ENR facilities.

Of the County's five "major" WWTPs, four (Westminster, Freedom District, Mount Airy, and Taneytown) would be able to accommodate priority+future flows without exceeding nitrogen loading caps, assuming ENR upgrades were performed. However, the Taneytown WWTP could not discharge more than 1.47 mgd without exceeding the nitrogen cap. This flow is 0.28 mgd less than the projected priority+future flow of 1.74 mgd. All of the major WWTPs except the Westminster WWTP would exceed nitrogen load caps under DGA buildout conditions and, even at ENR, would require offsets or no-discharge options.

ENR upgrades are not currently required for regulatory compliance at the Manchester and Union Bridge WWTPs, for which the Bay-related nutrient caps are goals rather than enforceable limits. However, advanced nutrient removal capability at the Manchester WWTP would help attain nutrient loading goals and protect Prettyboy Reservoir. Improved nutrient removal capabilities are being designed for the New Windsor WWTP, for which the Bay-related nutrient caps will become enforceable permit limits upon completion of the planned expansion.

4.4. Bubble Permits and Point Source Nutrient Trading

The *Maryland Policy for Nutrient Cap Management and Trading in Maryland's Chesapeake Bay Watershed*[6] includes two related options by which nutrient loading allocations can be balanced between facilities that are above and below their respective nutrient load caps: (1) bubble permits; and (2) point source nutrient credit trading. Both of these options are discussed below.

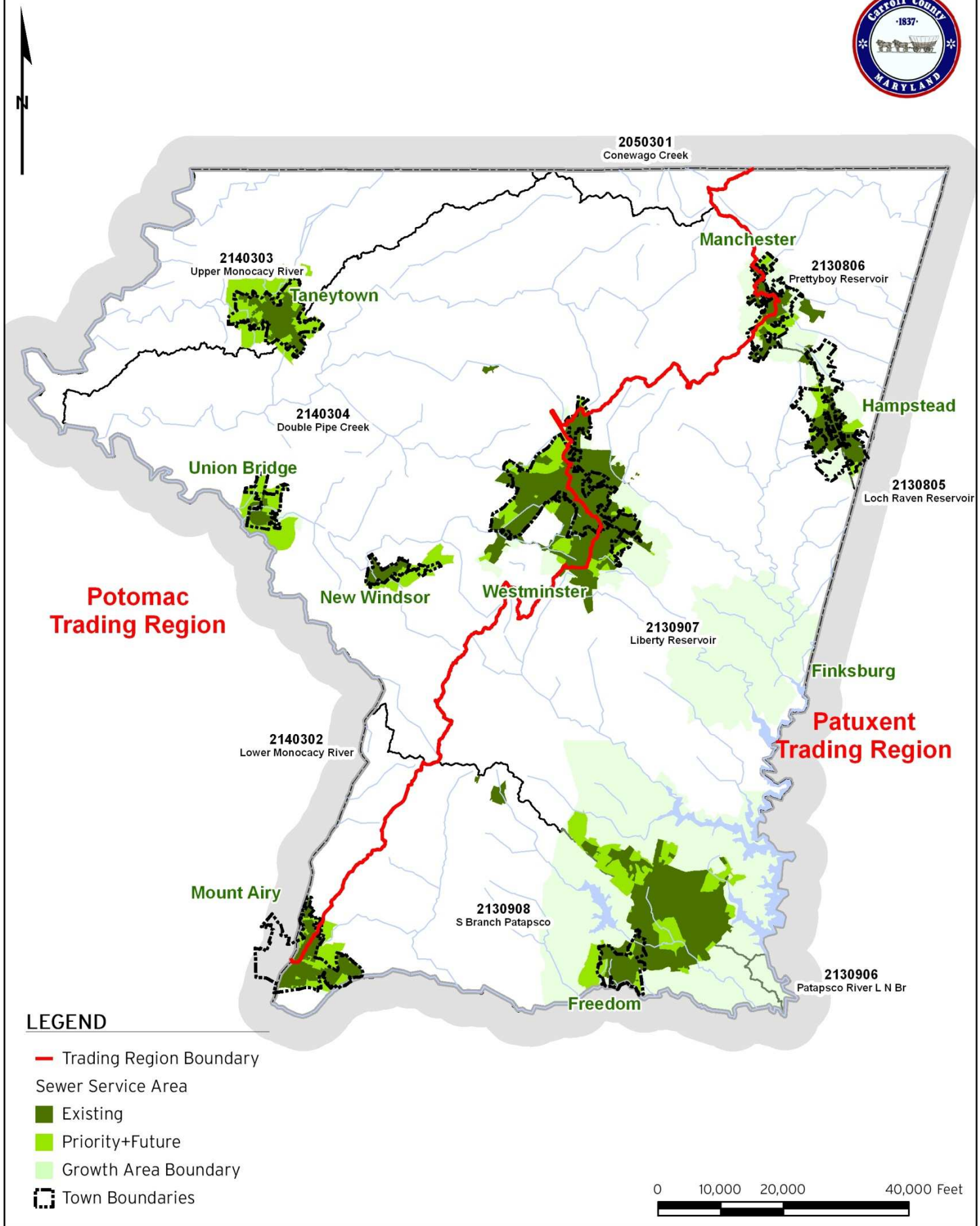
4.4.1. Bubble Permits

A bubble permit, also called an overlay permit, is an NPDES permit issued to two or more dischargers within a watershed and which establishes aggregate loading limits with respect to one or more constituents such nitrogen and/or phosphorus. Under a bubbled permit, all facilities are deemed in compliance as long as the combined load does not exceed the combined load allocation. A bubble permit can be issued to either a single association (formed by multiple individual permittees) or a group of "co-permittees". Bubbling can only be performed within three large trading regions, two of which include land area in Carroll County (Figure 4-1):

- Potomac trading region
- Patuxent trading region

Because different subwatersheds within these trading regions have different delivery factors (*i.e.*, the ratio of the load delivered to tidal waters to the end-of-pipe load), the aggregate nutrient cap may have to be adjusted to ensure that it does not cause an increase in the delivered load. Technology-based or local water-quality-based limits might still apply to individual facilities; *i.e.*, bubbling cannot create a local water quality impairment. Bubbling is not a substitute for ENR upgrades at any major facility.

In Carroll County, bubbling of nutrient permit limits would be a viable option for reducing wastewater limitations under buildout scenarios. Table 4 1 presents the results of a hypothetical scenario in which the WWTPs with enforceable nutrient caps in the Potomac and Patuxent trading regions were issued bubble permits for total nitrogen loads. The scenario assumes that all six facilities will operate at ENR (3 mg/L total nitrogen) and that wastewater flows will be at levels associated with either priority+future conditions or full DGA buildout. Calculated nutrient load surpluses and offset needs are based on delivered loads rather than end-of-pipe loads, to allow for the consideration of different delivery factors between watersheds.



MALCOLM PIRNIE	CARROLL COUNTY, MD WASTEWATER LIMITATIONS	Trading Regions in Carroll County	May 2009 Figure 4-1

Table 4-1:
Nutrient Load Offset Needs Under a Hypothetical Permit Bubble Scenario

Trading Region	WWTP	TN Load Cap-Edge-of-Stream (lb/yr)	Deliv. Factor	Max. Allow. Deliv. (lb/yr)	Priority+Future			DGA Buildout		
					TN Load Deliv. (lb/yr)	TN Surplus (lb/yr)	Total Offset Need (lb/yr)	TN Load Deliv. (lb/yr)	TN Surplus (lb/yr)	Total Offset Need (lb/yr)
Potomac	Westminster	60,911	0.73	44,465	33,547	10,372		38,039	6,426	
	Taneytown	13,400	0.73	9,782	11,625	(1,843)		11,630	(1,848)	
	New Windsor	3,178	0.73	3,178	2,011	55		2,036	284	
	SUM	**77,489**		**57,425**	**47,182**	**8,585**	**0**	**51,705**	**4,862**	**0**
Patuxent	Freedom	42,638	0.83	35,390	28,282	6,752		40,890	(5,501)	
	Mount Airy	14,619	0.83	12,134	10,596	1,461		10,603	1,530	
	Hampstead	10,964	0.58	6,359	4,904	1,382		8,225	(1,866)	
	SUM	**68,221**		**53,882**	**43,782**	**9,595**	**0**	**59,719**	**(5,836)**	**5,836**

Results of the hypothetical bubbling scenario indicate that Countywide nutrient load offset needs would be considerably less with permit bubbling than if each facility had to comply with its own load cap. For example, under priority+future flows, the Taneytown WWTP is projected to exceed its individual nitrogen cap by 1,843 lb/yr, which would normally require a commensurate offset (Table 4-1). By bubbling permits in the Potomac trading region, however, this deficit could be eliminated by nitrogen loads surpluses at the Westminster and New Windsor WWTPs. Under DGA buildout conditions, a combined offset of 5,836 lb/yr is still projected to be required in the Patuxent trading region, even with bubbling of the three largest WWTPs. However, this is less than the sum of the individual offsets (7,367 lb/yr) that would be required by the Freedom and Hampstead WWTPs exceeding their individual nitrogen caps under buildout conditions.

4.4.2. Point Source Nutrient Credit Trading

The *Maryland Policy for Nutrient Cap Management and Trading in Maryland's Chesapeake Bay Watershed*[6] establishes the principles by which discharges may obtain nutrient credits to offset loads above their nutrient caps. Nutrient credits may be generated by the following actions:

- Maintaining flow at ENR facilities at less than the design flow basis of its nutrient wasteload allocation (WLA).
- Optimizing operation of ENR facilities

- Upgrading an existing minor WWTP to BNR or ENR
- Retiring an existing minor WWTP after connecting its flow to BNR or ENR facility
- Retiring an existing OSDS by connecting to an ENR facility (discussed further in Section 4.5)
- Land application of wastewater with pre-treatment and nutrient management controls; or
- Implementing nonpoint source practices (discussed further in Section 4.6).

Nutrient credit trades are subject to many requirements and caveats, including the following:

- Trades are not a substitute for upgrading major facilities to ENR
- Trading may not cause local water quality impairments
- Trades may only be performed within three large trading regions, two of which include land area in Carroll County (Figure 4-1):
- Trades will be enforced through NPDES permits
- All trades will require a 5-percent retirement of nutrient credits to the State
- Nutrient credits are based on load delivered to tidal waters, not to the edge of stream. Hence, delivery factors must be applied in the credit calculation.
- Credits are must be calculated and verified on an annual basis, and cannot be banked for future years.

In Carroll County, trading of nutrient credits between point sources would be a viable option for reducing wastewater limitations under growth scenarios. Table 4-2 presents the results of a hypothetical scenario in which the WWTPs with enforceable nutrient caps in the Potomac and Patuxent trading regions were traded nutrient credits. The scenarios assume that all six facilities will operate at ENR (3 mg/L total nitrogen) and that wastewater flows will be at levels associated with either priority+future conditions or DGA buildout. Calculated nutrient load credits and offset needs are based on delivered loads rather than end-of-pipe loads, to allow for the consideration of different delivery factors between watersheds. Available credits were reduced by 5 percent to account for the mandatory retirement to the State.

Table 4-2:
Nutrient Load Offset Needs Under a Hypothetical Nutrient Credit Trading Scenario

Trading Region	WWTP	TN Load Cap-Edge-of-Stream (lb/yr)	Deliv. Factor	Max. Allow. Deliv. (lb/yr)	Priority+Future			DGA Buildout		
					TN Load Deliv. (lb/yr)	TN Credits Avail. (lb/yr)	Total Offset Need (lb/yr)	TN Load Deliv. (lb/yr)	TN Credits Avail. (lb/yr)	Total Offset Need (lb/yr)
Potomac	Westminster	60,911	0.73	44,465	33,547	10,372		38,039	6,105	
	Taneytown	13,400	0.73	9,782	11,625	(1,843)		11,630	(1,848)	
	New Windsor	3,178	0.73	3,178	2,011	55		2,036	269	
	SUM	**77,489**		**57,425**	**47,182**	**8,585**	**0**	**51,705**	**4,527**	**0**
Patuxent	Freedom	42,638	0.83	35,390	28,282	6,752		40,890	(5,501)	
	Mount Airy	14,619	0.83	12,134	10,596	1,461		10,603	1,454	
	Hampstead	10,964	0.58	6,359	4,904	1,382		8,225	(1,866)	
	SUM	**68,221**		**53,882**	**43,782**	**9,595**	**0**	**59,719**	**(5,913)**	**5,913**

Results of the hypothetical bubbling scenario indicate that the long-term Countywide nutrient load offset needs would be considerably less with nutrient credit trading than if each facility had to comply with its own load cap. Results are very similar to the bubble permit scenarios, with small differences arising from the 5-percent retirement of traded nitrogen credits. As with bubbling, nutrient credit trading could eliminate the need for nutrient load offsets under priority+future flows, and substantially reduce the required offsets that are projected for the Patuxent trading region under DGA buildout conditions.

4.5. Onsite Disposal System Hookup Credits

Under the *Maryland Policy for Nutrient Cap Management and Trading in Maryland's Chesapeake Bay Watershed*[6], nutrient credits can be generated by the removal of OSDSs and directing the flow to an ENR facility. In Carroll County, 7.5 lb/yr of credits would be generated by the hookup of an OSDS within 1,000 feet of a perennial stream, and 4.6 lb/yr of credit would be generated by the hookup of any other OSDS. As with point source nutrient credits, 5 percent of the credits would be retired to the State.

Potential OSDS hookup credits in Carroll County were estimated using the methodology described in Section 2.2.3, applying the credit factors above and subtracting 5 percent of the credits to account for the mandatory retirement to the State. OSDS hookup credits were only estimated for the major SSAs that are likely to install ENR technology. Results (Table 4-3) demonstrate that OSDS hookup credits can serve an important role in offsetting nutrient discharges above load caps under buildout conditions. Such credits could potentially meet most if not all of nutrient offset requirements. The large number

of potential hookup in the Freedom/Sykesville DGA represents an especially large potential source of nutrient credits.

Table 4-3:
Potential Onsite Disposal System Hookup Credits

Trading Region	Service Area	Priority+Future			DGA Buildout		
		OSDS within 1000' of Peren. Stream (count)	Other OSDS (count)	Potential TN Credits Avail. (lb/yr)	OSDS within 1000' of Peren. Stream (count)	Other OSDS (count)	Potential TN Credits Avail. (lb/yr)
Potomac	Westminster	53	95	793	261	487	3,988
	Taneytown	69	77	828	69	78	832
	SUM	**122**	**172**	**1,621**	**330**	**565**	**4,820**
Patuxent	Freedom	453	635	6,003	1,503	2,868	23,242
	Mount Airy	33	34	384	35	34	398
	Hampstead	2	58	268	111	367	2,395
	SUM	**488**	**727**	**6,654**	**1,649**	**3,269**	**26,035**

4.6. Nonpoint Source Nutrient Credits

In 2008, the Maryland Department of Agriculture (MDA) issued guidelines[7,8] for generation and exchange of nutrient credits from agricultural operations. Under these guidelines, farmers may generate credits by implementing nutrient reduction practices that are above and beyond a baseline level established by the State, or by converting land uses with high nutrient loads to those with lower nutrient loads. This program is in an early stage, and the degree to which nonpoint source credits will be available is currently unclear. Hypothetically, nonpoint source credits could be used to offset exceedances of point source nutrient caps. Given the challenges of meeting the baseline requirements of the Maryland's tributary strategies, few nonpoint source credits are expected to be available in the near term. Nonpoint source credits are also made less attractive by the greater complexity of identifying, obtaining, and documenting nonpoint source credits, and the application of "uncertainty ratios" which further decrease the credits available.

Urban and suburban stormwater management practices also have the potential to generate nonpoint credits. However, as with agriculture, credits would only be associated with practices that are above and beyond regulatory requirements and tributary strategy baselines. Given the stringent stormwater management requirements and high costs of stormwater management, it is not expected to be cost effective to offset excess point source loads by urban stormwater management. Such offsets might serve as a minor component of the Countywide nutrient credit balance.

The most viable scenario for generating nonpoint source credits is land conversion. If the County purchases and converts developed or agricultural land parcels, or obtains conservation easements on such lands, it might be beneficial to calculate and claim the associated nonpoint source offset credits. However, due to the limitations and uncertainties discussed above, it would be recommended that Carroll County explore point source nutrient credit trading and OSDS hookup credits before relying on nonpoint source credits.

4.7. Effluent Recycle/Reuse

The recycling and reuse of WWTP effluent (or "reclaimed water") is a viable long-term strategy for overcoming wastewater disposal limitations. In Maryland, the great majority of effluent reuse projects take the form of spray irrigation of cropland, as is practiced by the Town of Manchester. In States with a longer history of promoting effluent reuse (*e.g.*, Florida and California), many urban areas have separate distribution systems for reclaimed water, suitable for residential irrigation. There are also a growing number of examples nationwide of reclaimed water use by industries for process or cooling water. In areas such Carroll County that have a predominance of rural and suburban land uses, irrigation of cropland or turfgrass is expected to remain the most prevalent opportunity for effluent reuse. Turfgrass opportunities include irrigation of golf courses, athletic fields, park land, or other green space.

As the Manchester situation illustrates, use of reclaimed water for irrigation does not eliminate the need for a NPDES permit, because it will still be necessary to discharge to surface water during the winter or when soil conditions do not permit irrigation. Both a surface water discharge permit and a groundwater discharge permit are required for such projects. State requirements for effluent irrigation systems are documented in MDE's *Guidelines for Land Treatment of Municipal Wastewaters*[9]. Under these regulations, water used for irrigation must meet either Class I or Class II quality requirements, with associated buffer requirements (Table 4-4). Maryland has also proposed draft amendments to the land treatment guidelines, which include Class III requirements for systems to which the public would have access.

The slopes of land to be irrigation must less than 15 % on cultivated lands and less than 25 % for forested lands. Irrigation of Class I and Class effluent is limited to locations where the depth of groundwater is at least four feet.

Table 4-4:
Maryland's Class I and Class II Effluent Quality and Buffer Requirements

Class	Quality Requirements	Buffer Requirements
I	■ 5-day Biochemical Oxygen Demand (BOD5) <70 mg/l ■ Suspended solids <90 mg/l ■ pH: 6.5-8.5 ■ Fecal Coliform < 200 MPN/100 ml, or <3 MPN/100 ml for golf course irrigation	■ Minimum of 200 feet from the wetted perimeter to property lines, waterways and public roads in open areas. ■ Minimum of 500 feet from the wetted perimeter to houses or other occupied structures. ■ 50% reduction in distancewith tree buffers.
II	■ BOD5 <10 mg/l ■ Suspended solids <10 mg/l, pH: 6.5-8.5 ■ Fecal Coliform < 3 MPN/100 ml	■ Minimum of 25 feet from the wetted perimeter to property lines, housing structures, waterways and public roads. ■ Minimum of 50 feet to schools and playgrounds. ■ Minimum of 100 feet to potable wells and water intakes
III (proposed)	■ BOD-5 < 10 mg/L (30-day avg) ■ Turbidity < 2 NTU (daily avg) and 5 NTU (max) ■ Fecal Coliforms < 2.2 MPN per 100 mL (30-day geometric mean)	■ 50 ft for wells ■ 100 ft for outdoor public eating, drinking and bathing facilities

Under Maryland's policy, application rates for new systems are limited by the *most* restrictive of: (1) soil infiltration capacity; and (2) crop nitrogen requirements. Due to the prevalence of clay soils in the Piedmont, many parcels in Carroll County will not be suitable for reclaimed water irrigation. However, the restriction associated with the crop nitrogen requirement can actually be more limiting in many situations unless the WWTP employs nitrogen removal technology. Generally, application rates will be no greater than 2 inches per week, depending upon soil type, and can conservatively be estimated at 1.0 inch per week for planning purposes. This is equivalent to approximately 1.0 mgd per 260 acres of irrigated area, not including buffer zones.

Separate analysis by Malcolm Pirnie will involve a more detailed examination of parcels potentially available for irrigation near WWTPs in Carroll County. This analysis will also include a planning-level evaluation of storage requirements and potential wastewater application rates.

4.8. Use of Industrial WWTPs

Carroll County has two relatively large industrial WWTPs that were considered as potentially accepting municipal wastewater influent:

- *BTR-Hampstead, formerly Black & Decker*: A 0.222-mgd facility that operates a groundwater remediation system and uses the treated groundwater for cooling water sanitary purposes. The treated effluent is discharged to an unnamed tributary to Deep Run, which is a tributary to the North Branch of the Patapsco River upstream of Liberty Reservoir.
- *Congoleum Corp.*: A 0.227-mgd facility that discharges treated process water and boiler blowdown from the manufacture of flooring felts. Treated effluent is discharged to the North Branch of the Patapsco River upstream of Liberty Reservoir.

Based on the latest available NPDES factsheets, (dated 2001-02), the actual average discharges of the BTR-Hampstead and Congoleum WWTPs were 0.178 and 0.269 mgd, respectively. More recent NPDES permits fact sheets are in draft form and not yet available for public release. From the limited information available, the Congoleum, Inc. plant does not appear to be a viable candidate for accepting additional municipal wastewater influent. This plant has little to no excess treatment capacity and is not in close proximity to priority or future service areas.

The Hampstead-BTR WWTP merits additional investigation due to its proximity to the Town of Hampstead, and the possibility that it can treat a significantly larger flow than the 0.222-mgd listed in the NPDES database. The property also has a relatively large tract (~190 acres) of land that could potentially be suitable for land application. It is recommended that a more detailed investigation be made of the maximum treatment capacity of the Hampstead-BTR facility and the feasibility of directing municipal wastewater to this facility.

5. Summary and Conclusions

Design capacity and nutrient caps represents the most important long-term limitations to surface water discharges in Carroll County. Most of the POTWs are expected to be able to expand if and when needed to meet future projected flows. However, for several municipalities (e.g., Freedom, Taneytown, Union Bridge) nutrient load caps would prevent them from being able to expand to meet their projected wastewater demands unless nutrient load offsets or trades were obtained (Table 5-1). Under the priority+future SSA scenario, NPDES permit bubbling or point source nutrient trades would allow accommodation of the full projected wastewater demands in both the Potomac and Patuxent trading regions. Under the DGA buildout scenario, bubbling or trading would allow accommodation of all wastewater demands in the Potomac trading region, primarily due to future excess treatment capacity of the Westminster WWTP. But in the Patuxent trading region, even after bubbling/trading there would be a need to either offset excess nutrient loads or pursue no-discharge options such as spray irrigation. OSDS hookups represent an important source of nutrient credits for municipalities to pursue.

Table 5-1:
Summary of Long-Term Wastewater Limitations to Surface Water Discharge

WWTP	Long-Term Limitation to Surface Discharge (mgd)	Basis
Westminster	6.50	Design capacity after planned expansion; also close to nitrogen cap
Freedom District	4.70	Nitrogen cap, assuming eventual expansion
Mount Airy	1.40	Design capacity, assuming eventual expansion to meet future demand
Taneytown	1.46	Nitrogen cap, assuming eventual expansion
Hampstead	0.90	Design capacity, local water quality (temperature)
Manchester	0.50	Existing design capacity
Union Bridge	0.67	Nitrogen cap, assuming eventual expansion
New Windsor	0.25	Design capacity, assuming eventual expansion to meet future demand

6. References

[1] MDE, MDP, DNR, 2007. *Water Resources Element of the Comprehensive Plan Guidance Document*. Models & Guidelines Report #26. June 2007.

[2] Carroll County. 2007. *Carroll County Master Plan for Water and Sewerage*. 160 p. plus appendices.

[3] MDE. Date unknown. Summary of Chesapeake Bay-Related Nutrient Loading Caps in Carroll County. Excel spreadsheet provided by Yen-Der Chang of MDE on March 16, 2009.

[4] Carroll County. 2008. Capacity Management Planning (CMP) worksheets. Excel workbook files. December 2008.

[5] MDE. 2008. The 2008 Integrated Report of Surface Water Quality in Maryland. 186 p.

[6] MDE. 2008. Maryland Policy for Nutrient Cap Management and Trading in Maryland's Chesapeake Bay Watershed. 36 p.

[7] MDA. 2008. Maryland Policy for Nutrient Cap Management and Trading in Maryland's Chesapeake Bay Watershed Phase II-A: Guidelines for the Generation of Agricultural Nutrient Credits. 19 p.

[8] MDA. 2008. Maryland Policy for Nutrient Cap Management and Trading in Maryland's Chesapeake Bay Watershed Phase II-B: Guidelines for the Exchange of Nonpoint Credits. 15 p.

[9] MDE. 2003. *Guidelines for Land Treatment of Municipal Wastewaters*. 33 p.