Water Resources

Overview

The goals of the Water Resources Chapter are listed below:

- Protect the water supply from pollution and encroachment of developments.
- Provide an adequate and safe drinking water supply to serve the existing and future residents of the City of Frederick.
- Provide an adequate capacity of wastewater treatment with effluent meeting all necessary regulatory requirements for existing and future residents of the City.
- Restore and protect water quality ~~and contribute toward meeting the water quality~~by striving to meet or exceed regulatory requirements~~.~~ for water quality. This will ~~require addressing~~include current water quality impacts as well as future impacts from land development and population growth.
- Develop adequate stormwater management.
- Protect the habitat value of the local and regional rivers and streams.
- Efficiently use public dollars for infrastructure that ensures sustainable, safe, and adequate supply of water for all residents.

The City is committed to ensuring water and wastewater ~~(sewer)~~ capacity for both existing and new developments ~~and~~while minimizing the negative impacts of stormwater runoff. In 2002, the City established the Water and Sewer Allocation System to make certain that adequate treatment capacity for potable water and wastewater is in place for new growth prior to approval. In 2012, Ordinance G-12-13 was adopted which updated the allocation process and combined it with ~~it~~ the Impact Fees payable for water and sewer service.

The City adopted an Adequate Public Facilities Ordinance (APFO) in 2007 that allows development to proceed only after it has been demonstrated that sufficient infrastructure exists or will be created in the water and wastewater systems. In addition, Chapter 4 of the City Code establishes the criteria and process for the City's APFO, which not only regulates water and wastewater but also roads and schools.

In 2019, after 10 years of implementation, the City began reviewing the APFO process to ensure its intent to consistently manage development and the availability of public facilities. Among the revisions, the capacity of water and wastewater treatment facilities has been moved to the time of allocation at building permit approval. The completion timeline of development projects within the City is difficult to predict, making it more accurate to manage both water and sewer treatment capacity later in the process.

With an allocation process in place, the City has a reliable and predictable growth rate, which historically has been 440 dwelling units each year. The City currently has about ~~11~~7,000 dwelling units in the pipeline. These units ~~have~~will require some ~~type~~level of approval (master plan, preliminary plat or site plan) from the Planning Commission. Historically, the majority of growth has occurred in newly annexed areas, however a goal of this plan is to encourage development in strategic areas within the City's current jurisdictional boundary.

Since the 2010 Comprehensive Plan, the City has also dedicated significant resources and funding to the study, planning, and upgrade of its water resources and assets that is summarized here. The City's dedication to its assets and the environment will be evident throughout the Water Resources Chapter.

The Municipal Growth Chapter compares population and housing projections against the ability to provide safe and adequate ~~and safe~~ services such as sources of water supply and wastewater treatment.

To decide upon an appropriate land use plan, the City used a growth model to conduct a series of analyses based on the tenets mentioned above, historical growth trends, and natural resource limitations, ~~and focused~~while focusing on the Maryland Planning Visions Law of 2009.

The City has historically been the growth center for Frederick County, and it is anticipated ~~that this trend will continue~~to remain as such. The land use policy of the City supports this trend by concentrating capital improvement projects where ~~the growth is either~~ existing or projected growth is concentrated and maximizing the use of existing infrastructure.

Land Use Pattern

Growth within the City, as detailed throughout this plan, is expected to occur through development or redevelopment within the current City boundary and the Potomac River Water Service Agreement (PRWSA) area. According to MWCOG's "Round 9.1 Growth Trends to 2045", the City's population is projected to increase by around 17,500 new residents in more than 8,200 households between 2018 and 2030, creating an average annual population growth rate of 1.8%. Looking to 2045, it is expected that the City's population growth rate will slow to 0.3%, adding just 3,500 new residents and 1,500 new households between 2030 and 2045 (See ~~tables~~Tables 2-5 and 2-6). The emphasis of the land use plan is on creating community spaces appropriate to the desired character of an area or neighborhood. This is coupled with efforts to improve environmental conditions ~~with~~through a variety of environmentally- friendly policies for site and building design as noted in the ~~environmental chapter of this comprehensive plan~~Environmental Sustainability Chapter.

Inter-~~jurisdictional~~Jurisdictional Cooperation

In 2006, the City entered into the Potomac River Water Supply Agreement (PRWSA) with Frederick County to secure additional potable water supply. This is one of the fundamental documents that will help determine the amount of water ~~that will be~~ available to the City in the future. The quantitative attachment to the agreement, Exhibit 4, is updated annually to ensure current and future demands do not exceed capacity levels.

It is important to note that the assumptions that are used to calculate the available water supply is conservative to ensure demands ~~to~~ do not exceed the capacity levels. With improvements to technology, such as low flow

~~devises~~devices, leak detection and education, water usage has not been as significant as anticipated nationwide.

In 2010, the City and County had several meetings to work through the complex issues of water supply and wastewater treatment in the community. At that time, the top three issues identified as facing the City, as related to the County's Municipal Survey, were:

- Reliable quantities of water supply and wastewater treatment.
- Lack of available public water supply and wastewater services.
- Potential expansion of public water supply and wastewater services.

The City and County also have a joint capacity sharing agreement for wastewater treatment. With the Central Frederick Service Area Agreement (CFSSAA 2014), the City has procured 1.36 MGD (million gallons per day) of sewer treatment capacity at the County's Ballenger McKinney Wastewater Treatment Plant (WWTP) with the option to add 0.51 MGD when the plant is expanded in the future. In June 2020, The County completed the construction of a pumping station and force main to divert the flow of northern sewer customers around the City's WWTP and into the County's Monocacy Interceptor.

Watersheds

The City is comprised of two watersheds, the Lower Monocacy River watershed and the Upper Monocacy River watershed. The two ~~comprise~~encompass 350,724 acres and drain to the Upper Potomac watershed and ultimately, the Chesapeake Bay. The breakdown of the land use in the two Monocacy River watersheds can be reviewed in the table below. Also shown in Table ~~WRE~~5-1 are City sub-watersheds identified in a 2016 study performed by Straughan Environmental: the Tuscarora Creek watershed, which drains to the Upper Monocacy, and the Carroll Creek and Rock Creek watersheds, which drain ~~to~~into the Lower Monocacy.

[INSERT WATERSHED MAP]

The Upper and Lower Monocacy River watersheds ~~extend~~cover over 80% of Frederick County and into Pennsylvania. These combined watersheds extend from Gettysburg to the north, the Catoctin Mountains to the west, the Potomac River to the south and Westminster to the east. The only area of Frederick County that does not drain into the Monocacy River watershed is the area to the west ~~that~~of the Catoctin Mountain range, which drains into the Catoctin Creek watershed.

The City is one of many municipalities that are within these watersheds. The other municipalities that drain into these watersheds include Lewistown; Thurmont; Emmitsburg; Taneytown; Gettysburg, Pennsylvania, and Littlestown, Pennsylvania.

[INSERT TABLE WRE-1]
Table WRE-1
Watershed Characteristics

Watershed	Sub-watersheds*	Urban Acres	Agricultural Acres	Forest Acres	Wetland Acres	Barren Acres	Total Acres	Impervious
Upper Monocacy		9,500	89,910	56,917	0	0	156,327	-
	Tuscarora Creek	36.49%	43.36%	19.53%	-	-	12,000	11%
Lower Monocacy		28,746	115,420	106,977	33	138	194,397	-
	Carroll Creek	63.49%	26.92%	7.67%	-	-	15,000	26%
	Rock Creek	60.09%	12.77%	24.57%	-	-	2,900	24%
Totals		38,246	205,330	106,977	33	138	350,24	

*Sub-watersheds as identified in the Baseline Conditions Assessment Report for the Rock Creek, Carroll Creek and Tuscarora Creek prepared by Straughan Environmental, June, 2016.

The Monocacy watershed has a high prevalence of karst formations, which ~~raises~~creates additional ~~issues~~challenges when planning for future growth and development. These karst formations are prone to developing sinkholes due to both natural causes and urban development activities and can provide a source for groundwater pollution from stormwater runoff in addition to other damaging effects.

As part of its watershed protection strategy, the City owns what is known as the Frederick Municipal Watershed outside of the municipal boundary to the northwest. This 7,000+ acre tract of land, which is the largest tract of public land in Frederick County, is ~~jointly~~ maintained in joint collaboration with the Maryland Department of Natural Resources and serves as protection for the Fishing Creek Reservoir.

[INSERT MUNICIPAL FOREST MAP]

As with any other basin, the Monocacy River basin is subject not only to the discharge from the City and Frederick County, but also from sources upstream. While the City, County, and State work to improve water quality, it will take a regional effort to improve the Monocacy River, Potomac River and the Chesapeake Bay.

Water Treatment Capacity

The City receives its raw water from four available sources: Lake Linganore, the Monocacy River, the Fishing Creek Reservoir, and the Potomac River.

[INSERT TABLE WRE-2]

Table WRE-2

Potable Water Capacity

Source/Plant	Treated Water Capacity, MGD[1]	Safe Yield, MGD
Linganore	6.00	6.00
Monocacy	3.00	0
Lester Dingle	1.70	0.89
Potomac River , Current	5.00	8.0[2]
Subtotal	15.70	14.89
Potomac River, Future	2.50	4.00
Total	18.20	18.89

[1]Capacity values shown are for Average Daily Demand (ADD)

[2] Potomac River Safe Yield value equals Max Day dilvered amount

The City operates three water treatment plants that provide potable drinking water for residents of the City. The Linganore and the L.R. Dingle (Fishing Creek) treatment plants have a combined allocable capacity of 6.89 MGD. The Monocacy River Water Treatment Plant can produce up to 3.0 MGD, but has a flow-by requirement and therefore, cannot be guaranteed as a reliable source of water supply and, as such, is not allocable.

The water capacity for the City was further enhanced with the PRWSA, which was signed March 16, 2006. Through the PRWSA, the County provides to the City, and the City pays for, 5.0 MGD ADD (Average Daily Demand) and 8.0 MGD MDD (Maximum Daily Demand, equal to 1.6 times the ADD) of potable water for projected needs. In the future, the agreement may be reevaluated for an additional amount of potable water of up to 2.5 MGD ADD (4.0 MGD MDD). The additional amount of water required from the Potomac River will be dependent upon projected build-out needs and available capacity at the time of re-evaluation. At that time, the City will have a potential capacity of 11.806 MGD ADD (18.89 MGD MDD).

Since the adoption of the PRWSA, the City has been taking steps to decommission wells that once contributed to the available water capacity. As the City moves through the permitting process to cancel withdrawal from the wells, the current Wellhead Protection Overlay (WHO) should be reviewed to streamline appropriate development proposals while ensuring surface and groundwater protection as well as stormwater management is accomplished through the proper regulatory measures.

Wastewater Treatment Capacity

The City operates a wastewater treatment plant (WWTP) with a rated capacity of 8.0 MGD on Gas House Pike (GHP) at the confluence of Carroll Creek and the Monocacy River. The plant

presently serves an estimated population of 72,481 people and receives an average of 9.0 MGD at the headworks, the point of receiving wastewater flow. Approximately 2.5 MGD of this flow originates within the County service area (see area of blue in map below) and is transferred by pumps to the County's Ballenger/McKinney WWTP after primary treatment. As a result, the effluent flow monitoring of GHPWWTP is a more accurate estimate of the flow which has averaged 6.5 MGD over the last 10 years.

Insert GIS sewer system map

In June of 2020, the County began operation of a new wastewater pump station (WWPS). This pump station diverts the 2.5 MGD that originates from the County directly to the Ballenger Creek/McKinney WWTP. As a result, the most recent agreement reached in 2014, the Central Frederick Sewer Service Area Agreement (CFSSAA) between Frederick County and the City to provide preliminary treatment for approximately 2.5 MGD of wastewater is only utilized for emergency conditions. The County's sewer system to the north transfers directly to the County's Ballenger/McKinney WWTP via an extension to the Monocacy Interceptor. This basin includes County sewer customers within the City and other County customers as highlighted in the blue area of the map above. Once the City's GHPWWTP exceeds an influent of 8.0 MGD, the CFSSAA also provides for a diversion of 1.36 MGD to the County BMWWTP ~~immediately~~as needed. Once the BMWWTP is upgraded to 15 MGD, the City will receive another 0.51 MGD diversion to the County plant. In a study ~~entitled~~ titled "*Monocacy Sewershed Wastewater Utility Study"* by Whitman Requardt and Associates in 2013, wastewater treatment for build-out is accounted for through 2040~~.~~ and is considered as a very conservative estimate of future needs.

In 2020, an upgrade ~~has been~~was also completed for treatment improvements for GHPWWTP to meet the requirements of the Enhanced Nutrient Removal (ENR) regulations as mandated by the EPA. At present, the upgraded plant is performing at 65% of loading capacity. If this continues, the City may request an increase in its flow limit above the 8.0 MGD which will provide additional capacity for future development~~.~~, if and when it is required.

To further reduce the need for additional treatment capacity, the City has already begun to control peak flows by the reduction of inflow and infiltration (I&I) into the sewage collection system. The City presently manages a multi-year contract spending approximately $2,000,000 annually on Cured-In-Place Pipe (CIPP) lining sanitary sewers that were identified through closed-circuit television (CCTV) as experiencing high I&I.

Stormwater Management

FACILITIES

The City is served by storm sewers for the collection of stormwater runoff from impervious surfaces. The urban areas' stormwater runoff discharges into buffers, streams, creeks, and rivers. Retention and detention facilities are integrated with the City's drainage system and are both publicly and privately owned. This infrastructure is required to be maintained by the private property owner and inspected by the City triennially per a schedule and after large storm events.

The development of impervious surfaces increases the amount of pollutants discharged ~~to~~into the environment. This occurs through the buildup of these pollutants on urban surfaces that is then collected with runoff. In addition, the increase of impervious areas reduces the opportunities for pollutants to be filtered prior to entering rivers and streams. Ideally, these pollutants are reduced by stormwater management (SWM) practices implemented at the time of site development. These SWM practices are designed and constructed in accordance with Best Management Practices (BMP) recommended and required by MDE and in accordance with the City's stormwater management ordinance. However, many of the BMPs in the City were installed prior to current regulations and do not provide ~~stormwater runoff~~ water quality treatment for stormwater runoff, but instead focus solely on flood control.~~:~~ Areas of major localized flooding in the City are currently under analysis by the United States Army Corp of Engineers (USACE) to develop mitigation of existing infrastructure to relieve flooding issues. New stormwater BMPs will be installed where untreated impervious area discharges to creeks and streams. Existing stormwater BMPs are targeted for ~~retrofit~~retrofitting to provide better water quality treatment of existing impervious area.

As an operator of a small municipal separate storm sewer system (MS4), the City's stormwater discharge is permitted through the National Pollutant Discharge Elimination System (NPDES) phase II general permit. Small MS4s are regulated under this permit by the federal Environmental Protection Agency (EPA) in order to comply with the Clean Water Act. Permits for small MS4s in Maryland are facilitated by MDE's Water Management Administration (WMA). The City is required to implement the following six minimum control measures:

1. Public education and outreach;
2. Public participation and involvement;
3. Illicit discharge detection and elimination;
4. Construction site runoff control;
5. Post-construction runoff control; and
6. Provide pollution prevention/good housekeeping.

Implementation of these minimum control measures fosters the improvement of the quality of Maryland's streams, rivers, and the Chesapeake Bay through the continued improvement of stormwater management and erosion and sediment control programs; the reduction of illicit discharges; and increased public education and outreach.

FLOOD RESILIENCY

Property owners within the City have experienced substantial flooding during larger storm events, such as the event that occurred in May 2018, when extensive damage occurred as a result of inadequate stormwater infrastructure. Much of the areas of the City that were flooded occurred prior to the enactment of modern stormwater management regulations. Runoff generated from impervious surfaces during intense storm events has the potential to overwhelm existing infrastructure, causing flooding resulting in loss of property and injury or death. In addition, during the May 2018 flood, several primary roadways were inaccessible due to flooding, which caused significant issues for first responders trying to assist those in need.

The City entered into an agreement in September 2018 with the USACE to provide assistance in completing a flood resiliency study for areas prone to stormwater and urban riverine flooding. This study will provide the City with a plan for reducing the risk of flooding to property owners and critical roadways. The four areas of study included Motter Avenue, Kline Avenue, Detrick Branch at North Market Street, and Tributary No. 6 to Carroll Creek at West Patrick Street. Since the initial draft of the Comprehensive Plan was submitted, a fifth area has been added to the study to include the Downtown Area.

[insert area maps and flood forecast diagrams]

As of the adoption of this Comprehensive Plan, the USACE has completed data gathering and modeling development and calibration for each area and have begun to identify likely causes of the flooding experienced during these major types of storm events. The City has not received the final recommendations from the USACE and so has not been able to prioritize or estimate the funding to address these problems. Policies of this Plan promote using the data and recommendations of the study to strategically invest in the infrastructure and public outreach to prevent devastating damage in the future.

EROSION AND SEDIMENT CONTROL

Erosion and sediment control is provided on all development sites greater than 5,000 sf or 100 cy of disturbance where exposed soils can be impacted by rainfall. The Maryland Department of the Environment established the 2011 Standards and Specifications for Soil Erosion and Sediment Control, the official guide for development sites with the main goal of protecting water quality and ultimately reducing sediment deposit in streams. Post-construction runoff control at ~~site's~~sites currently implementing ESD practices, collect and treat stormwater runoff in multiple localized BMPs, preferably non-structural practices, and treat for water quality prior to bypassing flows through downstream conveyance systems. More emphasis has been placed on the treatment of runoff in smaller on-site BMPs and a reduction in post-development runoff characteristics to mimic predevelopment runoff characteristics as closely as possible.

[Insert bumpout: nonstructural BMP definition]

Point and ~~Nonpoint~~Non-point Source Loading Status and Remediation

The City continually works with Frederick County, the Maryland Department of Planning (MDP), and the Maryland Department of the Environment (MDE) to assess the impacts of both point source and ~~nonpoint~~non-point source loadings to the surrounding receiving waters.

POINT SOURCE

Point source pollution is primarily associated with wastewater treatment plant outfalls. The City of Frederick has one outfall to the Monocacy River located at 100 Treatment Plant Road (latitude 39°25'31.4"N longitude 77°22'52.8"W). The Monocacy River is designated as a Use IV-P water, which is protected for holding and supporting adult trout for put-and-take fishing and as a public water supply ~~and is located as~~. The location of this outfall is shown on the map below.

The City WWTF has been in operation since 1937 and has gone through several upgrades and expansions and currently has a treatment capacity of 8.0 million gallons per day (MGD). In 2002, the facility went through ~~an upgrade~~upgrades to achieve Biological Nutrient Removal (BNR) effluent limits for Total Nitrogen (TN) and Total Phosphorus (TP). ~~It just~~In 2019, it finished its ~~most recent~~newest upgrade ~~in 2019~~ to achieve Enhanced Biological Nutrient Removal to an average effluent level of 7.2 mg/l Nitrogen and 0.5 mg/l Phosphorous. To date, the plant is providing an average effluent at a level of 2.84mg/l Nitrogen and 0.21 mg/l phosphorous, 68% of its ~~permit~~permitted limit.

4.1.2020 Final SRFS 26.pdf

4.1.2020 Final SRFS 26.pdf

NON-POINT SOURCE

~~Nonpoint~~Non-point source pollution is created when rainfall, snowmelt, or irrigation runs over land or through the ground, picks up pollutants, and deposits them into rivers, lakes, and coastal waters or introduces them into groundwater.

The introduction of sediment, nutrients, chemicals, and fertilizers into storm sewers and waterways is destructive to the biological balance of receiving streams and rivers. ~~These~~ Since the 2010 Comprehensive Plan, these streams and rivers have been studied to establish an existing condition baseline and ~~are described as part of the following watersheds~~long-term monitoring plan. These studies include:

1- City of Frederick Watershed Management Plan, August 2016 – DewberryBaseline
2- Conditions Assessment Report for the Rock Creek, Carroll Creek, and Tuscarora Creek, City of Frederick, Maryland, June 2016 – Straughan Environmental
3- Long Term Monitoring Plan for the Carroll and Tuscarora and Subwatersheds, City of Frederick, Maryland, May 2016 – Straughan Environemental.

Excerpts from these reports follow:

Carroll Creek Watershed Description

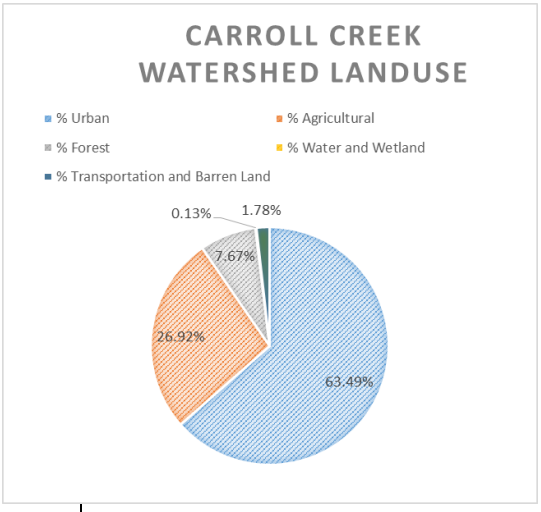
[SJ1][RG2]The Carroll Creek watershed encompasses 13.5 square miles within the City limits (excluding the 4.5 square mile Rock Creek sub-watershed) and drains to the Monocacy River just east of downtown Frederick. Land use in the Carroll Creek watershed is approximately 63 ~~percent~~% urban with 26 ~~percent~~% impervious cover. About 27 ~~percent~~% is farm or agricultural land, 8 ~~percent~~% forest cover, and the remaining 2 ~~percent~~% is ~~in~~occupied by other types of land use. There are about 13 stream miles in the Carroll Creek basin within the City of Frederick (excluding Rock Creek sub-watershed). The streams in Carroll Creek west of Route 15 are designated by MDE as Use IV-P, Recreational Trout Waters and Public Water Supply. Carrol Creek is divided into six sub-watersheds.

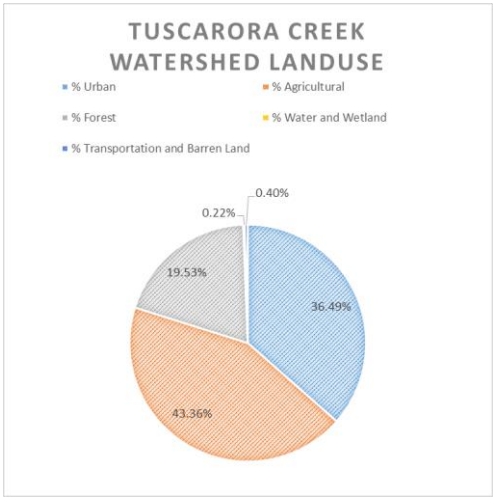
Rock Creek Watershed Description

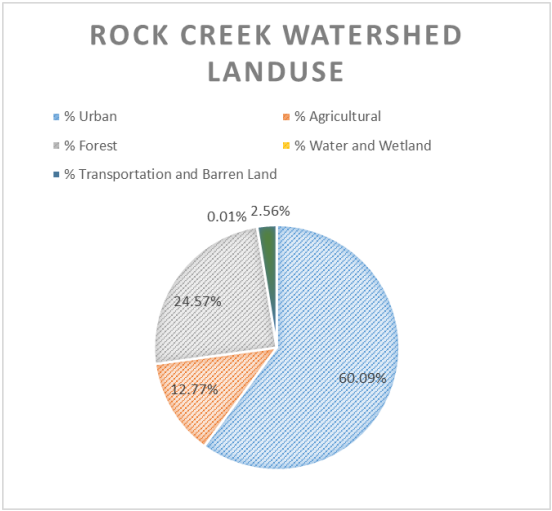
The Rock Creek watershed is a 4.5 square mile sub-watershed that ~~drainsto~~drains to Carroll Creek just west of Route 15 and downtown Frederick. Land use within the Rock Creek watershed is about 60 ~~percent~~% urban with 24 ~~percent~~% impervious cover. About 13 ~~percent~~% of the ~~landuse~~land use is farm or agricultural land, about 25 ~~percent~~% forest cover, and the remaining 2 ~~percent~~% is in other types of land use. Within the City of Frederick there are about 3.6 stream miles in the Rock Creek basin. The streams in the Rock Creek basin are designated by MDE as Use IV-P, Recreational Trout Waters and Public Water Supply.

Tuscarora Creek Watershed Description

The Tuscarora Creek watershed encompasses 12 square miles within Frederick City limits and drains directly to the Monocacy River. Land use within the watershed is approximately 36 ~~percent~~% urban with 11 ~~percent~~% impervious cover. About 43 ~~percent~~% is farm or agricultural land, about 20 ~~percent~~% is forest cover, and the remaining 1 ~~percent~~% is in other types of land use. There are about 10 stream miles in the Tuscarora Creek basin within the City. The streams in the Tuscarora watershed are designated by MDE as Use III-P for Naturally Reproducing Trout and Public Water Supply.







Similarly, water sources within the watersheds were studied and are described as follows:

The Monocacy River~~:~~
The Monocacy River is the largest Maryland tributary to the Potomac River, the area above the City of Frederick's intake and encompasses approximately 700 sq. miles (448,000 acres) of mixed land use with over 60% ~~of~~being cropland and pasture. About 75% of the source protection area is located in Frederick and Carroll counties of Maryland and 25% of the watershed is located in Adams County, Pennsylvania. Potential sources of contamination to the Monocacy River upstream of the City's intake are agricultural land, including crops and pasture, discharges from three major and several minor wastewater treatment plants, spills and runoffs from roads and railroads, as well as existing and future housing developments in the watershed. ~~Review~~Reviews of available water quality data ~~available~~ for the Monocacy River ~~indicates~~indicate that nutrient enrichment, sedimentation and contamination by pathogenic organisms are the major concerns.

~~The Monocacy watershed, a sub-basin of the Middle Potomac River basin, encompasses 774 square miles (476,200 acres), 75% of which is in the state of Maryland and 25% is in the state of Pennsylvania. The area of watershed above the City of Frederick's intake encompasses approximately 700 sq. miles (448,000 acres).~~ The major tributaries of the Monocacy River above the City's intake are: Tom's Creek, Marsh Creek, Tuscarora Creek, Fishing Creek, Big Pipe, Little Pipe Creek, Piney Alloway Creek, and Israel Creek.

The Monocacy River, which meanders through the Frederick Valley in a wide, shallow riverbed, is a slow flowing river with an average drop of 2.8 feet/mile from the Maryland-Pennsylvania border to its mouth.

The Monocacy River watershed is located in Piedmont and Blue Ridge Provinces. The rock formation that influences the river basin's geological history is intensely metamorphosed, or highly compact and crystalline. Three rock types are found in the western division: the Frederick Valley Region, the Triassic Upland Region and the Piedmont Upland Region. The lower part of the basin, the Frederick Valley Region, is characterized by easily erodible sedimentary rocks that have deep soils, shallow banked streams and gently rolling topography. Piedmont Upland Region contains more metamorphic material. In the river's upper watershed, the Triassic Upland Region has harder rock materials overlaying the softer limestones. This latter geological phenomenon has created some shallow, highly erodible soils

Linganore Creek
Linganore Creek, a major tributary of the Monocacy River, is another source of the City's surface water supply. At the point of intake, Linganore Creek drains approximately 85 square miles (54,000 acres) of land. Lake Linganore is the largest impoundment in Frederick County, storing over 800 million gallons of water, located approximately 1.5 miles upstream of the City's intake. The Lake Linganore Association owns and operates the lake that was constructed for recreational use and water supply. Frederick County
also withdraws water directly from the lake for their water treatment plant located at ~~thevicinity~~the vicinity of the reservoir. In addition to potential sources of contamination discussed above for the Monocacy River intake, 3,730 acres of land surrounding the lake with an ultimate potential of 3,200 housing units, swimming beaches and boat access ramps, is another

major ~~challenge~~area that could adversely affecting the water quality of Lake Linganore for water supply. Development of this land from forest to housing units will cause more nutrients to Lake Linganore and further degrade water quality through eutrophication.

Fishing Creek

Fishing Creek Reservoir was developed as a water supply source for the City in 1897 after the Tuscarora receiver was constructed in 1870. The intake on Tuscarora Creek is abandoned and no longer in use. Fishing Creek Reservoir watershed lies mostly within the City of Frederick's forest that encompasses 7.4 square miles (4,775 acres) with almost 99% ~~of~~being forested land. Because of its protected watershed, the potential for large quantities of ~~many~~ contaminants to reach the reservoir is ~~minimum~~minimal. Fishing Creek Reservoir, like any other surface water, is subject to high turbidity during heavy storms and snow melts and susceptible to contamination by *giardia*~~-~~, *cryptosporidium* and other pathogens.

The Fishing Creek Reservoir watershed lies mostly within the City of Frederick's forest at the intersection of Mountaindale Road and Gambrill Park Road. Soils in the watershed are predominantly Edgemont Chandler Series, a very stony loam, ~~and~~with slopes ranging from 20 to 60 ~~percent.~~%.

The Edgemont Series soils consist of moderately deep, well developed well drained soils derived from materials weathered from quartz schist, quartzitic sandstone and some fairly pure quartzite. Nearly all of the gravelly Edgemont soils in Frederick County occupy elevated areas or ridges in the Piedmont Plateau. The soils are generally low in fertility and not very productive. Most of the acreage, especially that on the mountains, is in forest that is dominated by oaks and contains some short leaf pine, hickory, dogwood and other trees (U.S. Department of Agriculture, Soil Survey of Frederick County, 1960).

Frederick County's location in two physiographic regions (Piedmont and Blue Ridge) ~~–~~provides a topography which ranges from ~~the~~ gently rolling to rugged and mountainous. This contrast creates a variety of local climates. Fishing Creek Reservoir is located in the Catoctin Mountain range of the Blue Ridge Region, with an average annual temperature of 50° F and average precipitation ranges between 44 and 46 inches.

All of the ~~above~~ City's aforementioned surface water sources are vulnerable to land use activities occurring within the watershed. Continuous monitoring of contaminants is important to understand changes in raw water quality to assure delivery of safe drinking water to the City's customers. Furthermore, in order to maintain and/or improve the quality of water supply, ~~the~~The City of Frederick has been implementing the recommendations for an active source water protection plan provided in the previous reports and has adopted regulations as summarized below.

REMEDIATION

Stormwater management and Erosion Control Best Management Practices required by the City's ordinances address pollutants from new and redeveloped sites. There are several policies in this ~~chapter~~Chapter that address the manner of reducing the impact of stormwater runoff on the environment.

In an effort to regulate pollutants with stormwater BMPs, the MDE requires facilities to provide water quality volume for the treatment of stormwater runoff. The water quality volume is sized for the drainage area and the percent of a site covered by impervious surfaces. A functional BMP is designed to remove 80% of the total suspended solids (TSS) and 40% of the total phosphorus (TP) collected from stormwater runoff. These are small solid particles and minerals which remain in suspension in water due to the motion of the water. This is a principal indicator of water quality. MDE also recognizes that a BMP facility must have longevity of service in order to be effective.

The quality of a watershed's streams and rivers deteriorate as impervious surfaces are built. Currently, approximately 35% of the City is covered by impervious surfaces, according to a study performed by Dewberry in 2016, with additional impervious surfaces planned as infill development, redevelopment, and greenfield development occur. While new development is required to meet stringent stormwater management requirements that reduce or negate the potential harmful effects of impervious area on the environment to the maximum extent possible, existing development, which accounts for the majority of the impervious area in the City, is not. As part of the conditions of coverage under the NPDES Phase II permit, the City is required to provide treatment for 20% of the currently untreated impervious area through retrofitting existing facilities or creating new facilities. Until the existing impervious areas in the City that were created prior to the adoption of the current era stormwater management regulations are retrofitted to meet these regulations, the quality of the City's streams and rivers will not improve. In order to gain a better understanding of what areas of the City's watershed have been most impacted by impervious surfaces, the City has taken steps to assess the environmental impacts on watersheds within the City limits. This assessment will be used to prioritize degraded areas and establish Capital Improvement Projects to improve the City's waterways including stream restoration, buffer plantings, and stormwater management retrofits.

Water and Sewer Land Use Implications

The purpose of this section is to outline the estimated water and sewer service increases in both capacity and cost due to future growth, including the possible addition of annexation areas.

As the City determines future water and sewer needs, along with the potential for annexation, the implications of each scenario need to be considered. These implications are summarized as follows:

TIERED GROWTH

Water Treatment

At the time of the signing of the original PRWSA in 2006, the average daily water requirements for the PRWSA at build-out was estimated to be 11.11 MGD which is 17.77 MGD for Max Day Demand utilizing best estimates from the 2006 Water Master Plan and considering only a 12-year planning period. The safe yield capacity of 18.89 MGD provides for this future need. The City revisited the PRWSA in 2013 and decided to update the Water and Sewer Allocation Ordinance (-Frederick City Code, Chapter 25, Article 1X) to lessen the need for the additional

source water by the way it manages future development in the City and may be best explained as a direct quote of the 1st amendment to the PRWSA:

Exhibit 4 relates to the City's assessment of its future water needs. Specifically, Exhibit 4 shows the service areas planned to be served by the City from the water capacity available pursuant to the PRWSA, and the projected water demand associated with such service areas. The original Exhibit 4 was based on the best information available as of the effective date of the PRWSA; it is attached hereto for informational purposes~~,~~ but does not form a part of the PRWSA.

Through the application of its Water and Sewer Allocation Ordinance (Frederick City Code, Chapter 25, Article IX), the City will ensure that water supply is not over allocated, and that sufficient water is available prior to issuance of building permits for any ~~City~~ properties within the City. Furthermore, the City will evaluate all annexation requests and Frederick County Water and Sewerage Plan classification amendment requests for conformity with the City's future needs assessment. The City shall not annex properties outside ~~of~~ the service boundary as delineated in original exhibit 4 of the PRWSA if the updated projected max day demand water usage exceeds 12 MGD.

On an annual basis in September, the City will submit to the County an updated Exhibit 4 describing the City's planned service areas and projected water demand~~, and~~ while detailing any changes that have occurred since the execution of the PRWSA. These revisions shall be consistent with the Municipal Growth ~~Element~~Chapter and Future Growth Areas as depicted in the latest version of the City Comprehensive Plan. Additionally, the City shall also provide an update to Exhibit 4 as part of any annexation request submitted to the County, or at the time of any update to the City's Comprehensive Plan. Such revisions to Exhibit 4 do not constitute amendments to the PRWSA and thus do not require approval by the County.

If needed, the most likely source of additional water supply at that time will be the purchase of potable water from the County system. The 2006 Water Master Plan conservatively projected that the Max Day Demand shortfall would occur in the year 2031. The next update to the WMP may determine that this eventuality will occur beyond 2035.

Wastewater Treatment

The wastewater treatment requirement for the average daily flow for the PRWSA area at build-out (year 2040) is estimated to be 14.6 MGD as modeled in the Monocacy Sewershed Wastewater Utility Study (MSWUS), Phase II, August 2013**.** This figure would exceed the combined available capacity of the City's GHP WWTP (8.0 MGD), the purchased County WWTP capacity through the CFSSAA,1.36 MGD initially, and another 0.51 MGD after the County has upgraded it BMWWTP to 18 MGD of 9.36 MGD by 5.24 MGD. As presented in the MSWUS report, the City and County are planning to be able to revert back to the County transfer as shown in the table below:

Table 3-1: SLAT Summary – Average Flow Rates[1] versus Time

Timestep	Ceresville PS	City WWTF Treated[2]	Bypass Flow[2,3]	Ballenger-McKinney WWTP[3]
Existing[4]	1.90	6.64	2.18	5.43
Allocated[5]	2.01	6.97	2.36	6.28
2015	2.40	7.50	2.76	8.92
2020	3.43	8.00	4.14	12.61
2024	4.04	8.00	5.17	14.63
2030	4.67	8.00	6.36	17.41
Treatment Capacity[6]	4.70	8.00	6.39	17.64
Buildout[7]	4.91	8.00	6.61	19.71

Notes:

1. *Flows are in MGD.*
2. *The City WWTF Treated flow is the flow that is discharged from the City WWTF. Bypass Flow enters the City WWTF headworks, but is pumped around to be sent to the Ballenger-McKinney WWTP. The City WWTF total influent flow (not shown) is the sum of the City WWTF Treated flow and the Bypass Flow.*
3. *Bypass flow is included in the Ballenger-McKinney WWTP flow rate.*
4. *Existing flow rate is actual measured flow at the indicated facility.*
5. *Allocated flow rate includes existing flow plus undeveloped lots that have been approved and allocated for development.*
6. *Treatment Capacity is the maximum allowable treatment flow rate as defined by the TMDL (8 MGD at the City WWTF and 18 MGD at Ballenger-McKinney WWTP). This occurs in approximately 2031 based on the SLAT.*
7. *Buildout is the ultimate buildout as defined in the SLAT. This occurs in approximately 2040.*

It should be noted that assumed timing shown is independent of the flow rates used in the model. Actual timing will likely vary from the information shown and will be verified by the flow metering program. Planning for capital improvements will be made based on actual flow triggers and not necessarily based on the timing shown in the table.

For actual build-out in 2040, another upgrade to the BMWWTP is planned to ~~25 MGD~~accommodate 25 MGD but is considered a very conservative estimate and will most likely not be required.

Prior to requesting additional capacity from the County, the City will strive to provide more treatment capacity in the following three ways:

1- Similar to the water system, the Water and Sewer Allocation Ordinance will help the City better manage wastewater treatment capacity due to future development.

2- The City is managing a multi-year contract for up to $2,000,000 a year to reduce the amount of inflow and infiltration (I&I) into the sewer piping network by lining the existing system with Cured- In -Place Pipe (CIPP). This will show a related and corresponding decrease in the need for treatment capacity.

3- The City has one WWTP discharge location on the Monocacy River ~~(lat and long~~. By continuously upgrading the wastewater treatment processes, the City does not expect the point source capacity to be exceeded. To date the City has completed an Enhanced Nutrient Removal upgrade ~~which~~that has resulted in effluent quality much lower than predicted, which will theoretically allow ~~us~~the City to treat more wastewater, if approved by MDE.

The tiered growth opportunities can be served with the construction of infrastructure improvements found in the 2006 Water Master Plan and the upcoming Sewer Master Plan Update (the sewer portion of the plan is scheduled to be updated in the near future).

The tiered growth opportunity is predominantly within the PRWSA boundary. The tier 3 growth area, which is outside of the City's current Service Area (PRWSA), consists of property located to the north at Biggs Ford Road and to the east of the Monocacy River from Route 26 south to Interstate 70. The geographical location of these properties is such that utility service can most likely be provided with the addition of significant infrastructure improvements and additional treatment capacity.

Water Resources Policies and Implementation

DRINKING WATER:

WR POLICY 1

Protect and conserve the existing drinking water supply and distribution systems.

IMPLEMENTATION

1. Increase efforts throughout the water system to promote wise use of water resources such as potable water with conservation efforts through education and systems designed to reward water conservation and wise use practices.

2. Continue to meet requirements for regulated discharge into waterways serving as, or tributary to, the public water supply. Work with Frederick County, the State of Maryland, and the State of Pennsylvania to work on regional issues such as point and non-point pollution, withdrawal agreements, and environmental protection.

3. Control the amount of water unaccounted for in the water distribution system by locating and repairing leaks found in the Water Loss Reduction Program.

WR POLICY 2

Provide an adequate and safe drinking water supply to serve the existing and future residents of the City.

IMPLEMENTATION

1. Continue to ensure that development adheres to the requirements of the City's APFO and Water/Sewer Allocation program.

2. Continue to collaborate with Frederick County officials to provide for the future water capacity needs through negotiated purchase of drinking water per the re-evaluation of the Potomac River Water Supply Agreement (PRWSA).

3. Implement the recommendations contained within the 2006 Water Master Plan for improvements to the water system to serve existing and future customer base. Update the Water Master Plan as necessary.

4. Explore the advantages and disadvantages of creating a regional authority to handle future water capacity issues.

5. Explore opportunities to provide or credit the use of graywater to businesses that may not require potable water for operations.

WR POLICY 3

Provide adequate wastewater treatment and conveyance capacity to serve the existing and future residents of the City.

IMPLEMENTATION

1. Continue to ensure that development adheres to the requirements of the City's APFO and Water/Sewer Allocation program.

2. Continue to collaborate with Frederick County officials to provide for future sewer needs through negotiated purchase of capacity.

3. Study alternatives for obtaining additional wastewater treatment and conveyance to the respective treatment plants.

4. Implement the recommendations of the updated Sewer Master Plan.

5. Explore the advantages and disadvantages of creating a regional authority to handle future sewer capacity issues.

WR POLICY 4

Enhance the wastewater collection and treatment systems.

IMPLEMENTATION

1. Control the amount of excessive inflow and infiltration into the sewer piping system by locating and correcting sources of inflow and infiltration.

2. Install and maintain proper metering devices within the sewer piping system to determine peak flow rates and areas of concern.

STORMWATER MANAGEMENT:

WR POLICY 5

Coordinate with the United States Army Corp of Engineers (USACE) to complete the flood resiliency study and implement the findings and recommendations to manage stormwater.

IMPLEMENTATION

1. Educate the public about the findings of the study and methods to mitigate flooding to personal property with private improvements and best practices

2. Prioritize and fund the improvements necessary to mitigate local flooding to private properties and public roads.

3. In addition to the USACE recommendations, the City will implement the use of best management practices and approaches to manage regional and local stormwater.

    a. Preserve ecologically important land, such as wetlands, buffer zones, riparian corridors and floodplains to reduce, and slow runoff, absorb sediments and serve as flood control.

    b. Reduce additional stormwater runoff by encouraging development in already degraded areas such as infill, brownfield or grayfield sites.

    c. Encourage high density, mixed-use and transit-oriented development to reduce land consumption, the number of parking spaces and vehicle miles traveled.

    d. Include green street design in the Engineering Department's Manual of Standard details for Construction to allow for natural infiltration where possible and reduce impervious surface.

    e. Assess parking requirements to better balance parking demand and supply to reduce impervious surfaces and to provide better opportunities for infiltration within the lots as part of a green parking strategy.

    f. Integrate stormwater management facilities with local parks and amenities to reduce stress on the City infrastructure and allow natural filtration.

WR POLICY 6

Adopt revisions to the City Code and other Regulatory documents where the modification of the 2007 Stormwater Management Act and Code of Maryland Regulations (COMAR) 26.17.02 are applicable.

IMPLEMENTATION

1. Provide training to City employees associated with development review and maintenance on the Stormwater Management Act (Environmental Site Design to the Maximum Extent Practicable).

2. Adopt a City Ordinance to address illicit discharges as required by the NPDES Phase II MS4 General Permit.

3. Update City Codes as regulatory requirements are revised.

4. Continue efforts in maintenance and inspection of stormwater facilities within City limits.

WR POLICY 7

Develop a process for review of site development plans that incorporates Environmental Site Design (ESD) to Maximum Extent Practicable (MEP) and provide outreach and educational opportunities to the community to promote compliance with State and local stormwater management regulations.

IMPLEMENTATION

1. Use the 2016 citywide watershed environmental assessment to identify mitigation efforts to address watershed deterioration, stream restoration, buffer plantings, and stormwater management retrofits.

2. Develop Capital Projects to accomplish mitigation.

3. Ensure that owners/developers are made responsible for restoration efforts to streams and rivers, which may cross their properties through the land planning and development process.

WR POLICY 8

Ensure that portions of the watershed in critical need of attention are addressed through City, volunteer, and owner/developer efforts.

IMPLEMENTATION

1. Educate the public on topics pertaining to maintaining a healthy watershed.

2. Organize voluntary efforts to improve City watersheds.

3. Investigate incentives for private stormwater management owners to retrofit underperforming facilities.

4. Create and/or retrofit facilities to treat currently untreated impervious surface stormwater runoff in accordance with the NPDES Phase II permit.

WR POLICY 9

Limit impervious surfaces and suggest alternative surfaces for new development and redevelopment to reduce the overall runoff discharge; and explore new techniques and technologies to reduce development impacts to the watershed.

IMPLEMENTATION

1. Encourage Low Impact Development (LID) where appropriate.

2. Incorporate the use of non-structural BMPs.

3. Introduce regulations to limit impervious area in critical or sensitive areas.

WR POLICY 10

~~**Develop a monitoring program for policies 1-9 of the Water Resource Chapter.**~~
Include the impact of climate change on all City water assets.

IMPLEMENTATION

1. Review and assess the City climate resiliency (precipitation, temperature, and sea level rise/storm surge) via the U.S. Climate Resilience Toolkit.

2. Review and assess the City climate resiliency via Metropolitan Washington Council of Governments guidance documents.

3. City is presently studying water system through a contract with Launch Consulting (RFP 21-B): Risk and Resilience Assessment for the Water System, which includes all possible risks, not just those associated with Climate Change.

4. After review of recent climate studies, data and models, update design standards and design new projects to include or at least assess future flow projections, not just the historical summaries. For example, a 15-year storm is historically a 5.5" storm. It has been more recently projected to be a 6.8" storm in 2020's, 7.1" storm for 2050 and 8" storm in 2080.

~~IMPLEMENTATION~~

~~1. Develop a GIS database of stormwater management facilities to prioritize projects, provide a holistic stormwater management planning approach, and track progress towards treating currently untreated impervious areas.~~

~~2. Develop a database to track watershed improvement efforts.~~

~~3. Develop a monitoring system of local groundwater conditions, aquifer recharge, watersheds, and streams.~~

WR POLICY 11

Actively ~~incorporate the considerations of~~engage underrepresented communities and low-income residents ~~in~~into water resource policy decision-making processes.

IMPLEMENTATION

1. Coordinate with community groups active among minority communities and with low-income residents for public outreach to elevate and include those voices in public discourse and decision-making.

2. Actively recruit underrepresented populations to advisory boards, committees, and other volunteer positions.

3. Commission a comprehensive anti-racism plan with recommendations to ensure adequate water and wastewater supply as well as stormwater management protections.

WR POLICY 12

Develop a monitoring program for policies 1-11 of the Water Resource Chapter.

IMPLEMENTATION

1. Develop a GIS database of stormwater management facilities to prioritize projects, provide a holistic stormwater management planning approach, and track progress towards treating currently untreated impervious areas.

2. Develop a database to track watershed improvement efforts.

3. Develop a monitoring system of local groundwater conditions, aquifer recharge, watersheds, and streams.