

Northern Shenandoah Valley Regional Solid Waste Management Plan

Prepared by the Northern Shenandoah Valley Regional Commission **2022-2045**

This photo was taken by Hallaton Environment Linings and shows Phase A construction of Cell 3 at the Frederick County Landfill

Northern Shenandoah Valley Regional Solid Waste Management Plan

Authorization for this Plan:

Under 9 VAC 20-130-30, the Code of Virginia requires each region (designated in Section 130-180 through 220) and each city, county and town not part of such a region, prepare a comprehensive solid waste management plan that addresses the following: source reduction; reuse; recycling; resource recovery (waste-to-energy); incineration; and landfilling.

The Virginia Department of Environmental Quality (DEQ) is the regulating authority reviewing Solid Waste Management Plans requiring how solid waste will be managed for the next 20 years for a locality or region. On July 24, 2007, the DEQ approved the Northern Shenandoah Valley Regional Commission (NSVRC) submission on behalf of its twenty jurisdictions. On June 28, 2012, the Board of Commissioners of the NSVRC adopted the Plan's 2012 update, which was accepted by the DEQ on May 22, 2013. On July 20, 2017 the Board of Commissioners adopted the 2017 Plan update. DEQ accepted this update on October 20, 2021. This Solid Waste Management Plan serves as an update to the 2017 Plan and includes an analysis of and strategy for solid waste management activities in the Northern Shenandoah Valley Region for the next 20 years. It also includes a discussion of how the jurisdictions plan to continue to meet or exceed the Commonwealth's 25% recycling mandate. Statutory Authority for this Plan is found in § 10.1-1411 of the Code of Virginia; 42 USC § 6942(b), 40 CFR Parts 255 and 256.

Discussion:

In 2007, the twenty jurisdictions of the Northern Shenandoah Valley Regional Commission planning area, herein referred to as the "Region," submitted a solid waste management plan on behalf of the planning area to the DEQ. These communities include the City of Winchester; the five counties of Clarke, Frederick, Page, Shenandoah, and Warren; and fourteen towns of Berryville, Boyce, Edinburg, Front Royal, Luray, Middletown, Mount Jackson, New Market, Shenandoah, Stanley, Strasburg, Stephens City, Toms Brook, and Woodstock. The 2007 Northern Shenandoah Valley Solid Waste Management Plan was prepared by the regional Solid Waste Management Technical Committee, administered by the Northern Shenandoah Valley Regional Commission (NSVRC) and on July 24, 2007 was approved by the DEQ. Subsequent 5-year updates were submitted in 2012 and 2017 in accordance with 9 VAC 20-130-173.

NSVRC
NORTHERN SHENANDOAH VALLEY
REGIONAL COMMISSION

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Solid Waste Planning Unit

The Northern Shenandoah Valley Region represents the counties of Clarke, Warren, Page, Frederick, and Shenandoah, the City of Winchester, and the fourteen towns located within the Counties. Through the Solid Waste Management Technical Committee, these localities cooperate at a regional scale to identify needs for Solid Waste Management and develop the strategies and plans necessary to meet those needs. Representatives from each County and the City of Winchester form the Solid Waste Management Technical Committee. A visual representation of the Planning Unit can be found page 2.

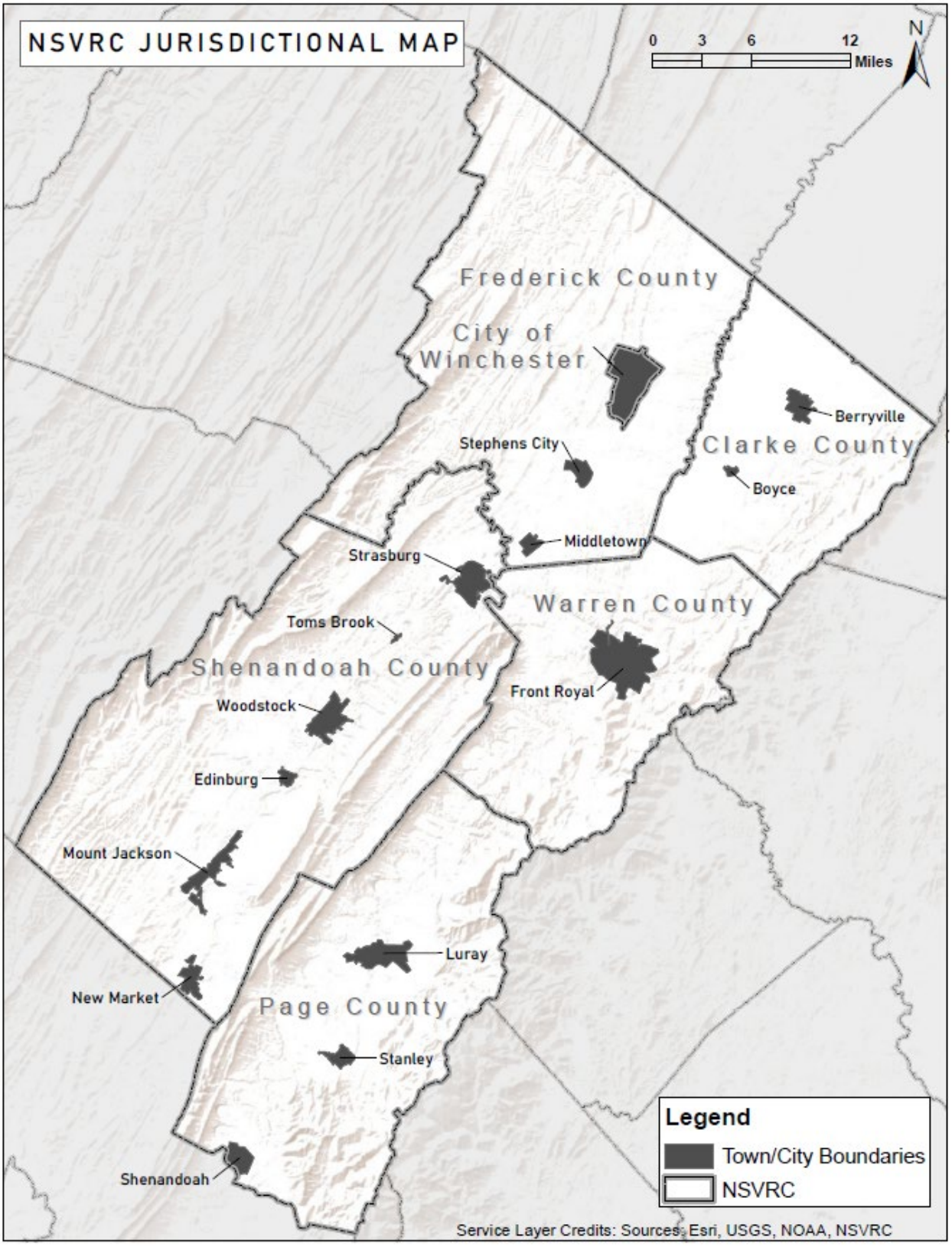
Goals and Objectives

This document addresses how solid waste is managed throughout the Planning Unit through the elements laid out in disposal options, recycling efforts, waste reduction, and reuse. These principles form the basis for future solid waste management decisions promoting greater cooperation and efficiency, controlled costs of services, and better protection of human health and the environment. A breakdown of overarching goals and clearly defined objectives to achieve those goals are listed below in Table 1. Objectives may be listed to support an individual goal, however many of these objectives may support additional goals outlined in the table.

Table 1: Goals and Objectives

Goal	Objectives
Continued Regional Cooperation	Maintain quarterly Solid Waste Technical Committee meeting schedule Identify programming opportunities that would be viable across multiple localities Encourage development of State level strategies to assist the region in recycling and solid waste management
Maintain long-term landfilling capacity at a 40-year horizon	Review waste generation and recycling rates annually to assess remaining capacity Identify future opportunities for permit expansion where needed Monitor planned and approved development across localities
Control costs of services	Identify local options for recycling or reuse to control hauling costs Identify export opportunities for recycled materials through the Virginia Inland Port for their environmental and economic benefits.
Maintain and enhance efficiency	Continue transfer station operation between Warren and Page Counties
Maintain or exceed recycling rate	Work with local haulers to reestablish curbside pickup in Towns Conduct a study to identify new recycling or reuse streams for tire chips Continue to identify educational strategies to promote proper recycling methods and reuse options
Protect human health and environment	Identify opportunities to keep hazardous household waste and other non-solid-waste materials out of landfills Meet all applicable Federal and State Laws governing solid waste management

Map 1: NSVRC Planning Unit



Solid Waste Hierarchy

This Plan will address how solid waste in the Northern Shenandoah Valley Region is managed through the six components of the hierarchy laid out in 9VA20-130-30 of the Virginia Code. This hierarchy is designed to assist the Technical Committee in developing and implementing plans and programs for solid waste disposal and reuse. Table 2 provides an overview of programming by hierarchy category. More in-depth information on recycling and reuse related programming can be found in the recycling section of this plan.

In addition to the programming listed below, all localities provide a variety of information regarding source reduction, reuse, and recycling. This information is disseminated at public events, in schools, on locality websites and social media platforms. Localities also utilize grant monies to buy materials and create special programs to promote public awareness and recycling opportunities.

For additional information regarding solid waste or recycling programming for each locality please visit:

City of Winchester: winchesterva.gov/public-works/refuse

Frederick County: fcva.us/departments/public-works/landfill-and-solid-waste or fcrecycles.net

Clarke County: clarkecounty.gov/residents/trash-recycling

Warren County: warrencountyva.net/solid-waste or warrencountyrecycles.org/

Shenandoah County: shenandoahcountyva.us/landfill/

Page County: pagecounty.virginia.gov/191/Solid-Waste

Table 2: Solid Waste Programming Hierarchy Overview

Hierarchy Component	Locality	Program
Source Reduction	**Frederick County**	Regional Tire Operations Program supports tire shredding for all NSVRC localities Yard waste diversion and mulching Diversion of usable asphalt and concrete as road base at landfill
	City of Winchester	Recently acquired glass pulverizer
	Shenandoah County	Diversion of usable asphalt and concrete as road base at landfill
	Page County	Diversion of usable asphalt and concrete as road base at landfill
Reuse	**Frederick County**	TreeCycle Program Save-a-Sole, ReThreads Provides non-profit information for item donation Distributes reusable shopping totes
	Shenandoah County	Crushed glass and mulch used for alternative daily cover
Recycling	**Frederick County**	Christmas Wrap-Up Program eCycling Days Plastic bag receptacles at grocery stores and retailers Distribution of Recycling bins
	City of Winchester	Curbside Recycling
	Clarke County	Curbside Recycling in the Town of Berryville
	Warren County	Curbside Recycling in the Town of Front Royal Front Royal/Warren County Anti-Litter Council
	Shenandoah County	Curbside Recycling in the Town of Edinburg
	Page County	Event-ready recycling trailers for County based festivals or events
Resource Recovery	**Frederick County**	Gas to energy facility at Frederick County Landfill
	City of Winchester	Waste to energy facility at Opequon Water Reclamation Facility
	Shenandoah County	Gas to energy facility at Shenandoah County Landfill

Incineration		Currently no incineration operations
Landfilling	**Frederick County**	Municipal Solid Waste Landfill Construction, Demolition, and Debris Landfill
	Shenandoah County	Municipal Solid Waste Landfill
	Page County	Municipal Solid Waste Landfill

Implementation

In accordance with Virginia Code, the Solid Waste Management Technical Committee will revise and adopt an updated version of the region's Solid Waste Management Plan every five years. The Committee will update solid waste generation data and estimates within the planning unit, review goals and objectives, and update solid waste hierarchy programming. If necessary, the Committee will include major amendments to the Plan and conduct the corresponding public engagement as landfilling capacity or regional needs change.

A brief implementation schedule and a comprehensive list of implementation milestones can be found below. A timeline for milestone tasks has not been established. The Technical Committee will review and prioritize these tasks at their quarterly meetings. As tasks are prioritized and resources become available, the Committee will work with Staff to initiate these projects.

Implementation Schedule

- June 2022 – Resolution to adopt updated Solid Waste Management Plan by NSVRC Board
- July 2022 – Submittal of 2022-2045 Solid Waste Manage Plan to DEQ
- Annually – Review Solid Waste Generation and Recycling Rates for the Region in order to analyze remaining capacity

Implementation Milestones

In order to ensure Solid Waste Management practices and programming are consistent with the goals and objectives outlined in this Plan, the Technical Committee has established the following actionable implementation milestones that will take place over the next five years:

- Annual review of solid waste collection tonnages, recycling rates, and programming in order to identify changes in solid waste management trends. The Committee will adjust strategies and operations if needed, based on annual data.
- The Technical Committee and staff will work with consultants to conduct a study to identify new reuse streams and markets for tire chips from the Regional Tire Operations Program, as an effort to increase source reduction and maintain or exceed recycling rates.
- The Technical Committee will work with all localities to review and enhance strategies for public education and programming related to reuse, recycling and source reduction. Additionally, the

Committee will identify potential partnerships with private entities in order to establish new communication channels and creates opportunities for enhanced public education.

- Landfill operators and Committee members will review remaining landfill capacity on an annual basis in order to plan for future permit expansions. Once operators have identified and developed expansion plans, staff will initiate the permitting and Plan update process with DEQ.
- Staff will review per capita solid waste tonnage on an annual basis in order to assess growth rates and solid waste generation projections, and ensure remaining landfilling capacity.
- Initiate conversations with local private haulers in order to establish cost-effective curbside recycling pick-up within the Towns.

Funding

The Frederick County Landfill is operated as an Enterprise Fund. The landfill is self-supporting. The major portion of revenue is generated through tipping fees for landfill disposal. Revenues that exceed expenditures at the end of the fiscal year are allocated to the landfill fund as retained earnings in order to support future landfill activities. Funding for other solid waste activities including operation of citizens convenience sites, recycling, and education are supported through the County's general fund and select grant programming.

Shenandoah, Warren and Page Counties receive an annual budget from their respective County Boards and collect tipping fees from localities and private haulers in order to fund landfilling operations and waste transfer stations. Grant funding is also used to support educational programs throughout the counties.

The City of Winchester funds trash and recycling services through general fund taxes and service collection fees.

Public Education and Participation

Public Education

Jurisdictions across the region have implemented a variety of public education programs in order to promote awareness of recycling opportunities and best practices, source reduction methods, and reuse programming available in their area.

Education and awareness campaigns for recycling, of both traditional and specialized materials, are advertised via radio, home mailers, on websites, etc. Additionally, localities utilize grant funding to create special programs and new opportunities to provide resources and education to students and residents. All localities take advantage of DEQ's noncompetitive litter grant program, based on population and road miles, to implement, continue, and/or expand litter prevention and recycling programming. Additional information can be found in the recycling section of this report. Examples of this public education include:

- Recycle Right – ongoing public outreach campaign
- Programs to raise awareness about rechargeable battery management
- Funding from DEQ for the 'Secure Your Load' campaign raises awareness about the dangers of roadside litter, including environmental impacts and traffic hazard. This program includes

three videos in cooperation with the Sheriff's Office, outreach and distribution of tarps and work gloves

- Department of Conservation and Recreation funds the Chesapeake Bay Critters program for environmental education at the middle school level; funding brought a marine biologist and educator to conduct presentations
- Keep Virginia Beautiful Organization and VDOT funds the 'Virginia is for Lovers, Not Litter' program. In cooperation with the Handley Regional Library System and Parks and Recreation Department, this program provided cigarette butt receptacles at the Bowman Library and Bowman Trail. It also funded outreach on the county's website and at message kiosks at the various convenience sites concerning the negative impacts of cigarette butt litter
- The Shenandoah County Landfill partnered with the nonprofit group Sustainability Matters to establish "Making Trash Bloom," a program that turns previously landfilled cells into Wildflower Fields into pollinator-friendly habitats. The project planted a second field in 2022.



Image 1: Making Trash Bloom

- The Clarke County Litter Committee has a mission to educate, inspire, and empower the community to improve the environment through beautification and litter prevention. The committee is committed to better understanding the opportunities and limitations for recycling programs, with the intention of informing the County and educating the public about issues such as waste products that contaminate recycling streams and the economics of the recycling market.

Public Participation

The regional Solid Waste Management Technical Committee is summarized on the planning district's webpage: nsvregion.org. The committee meetings are announced on the NSVRC webpage monthly events calendar. The regional Solid Waste Management Plan, once recommended by the Solid Waste Committee and adopted by the NSVRC Board, will be posted on the NSVRC webpage and made available to the public. If any major amendments or permit modifications are required, the locality proposing the amendment will conduct a public engagement process including but not limited to, public meetings, opportunities to comment, and advertisement of proposed modification through traditional and social media platforms. the plan between five-year updates will be available for public comment prior to adoption by the Committee.

In addition to participation in major changes to solid waste management practices, each locality also offers different ways for the public to participate in and gain a better understanding of solid waste practices:



Image 2: Tour at Frederick County Landfill

- All regional landfills offer tours for groups, including schools, universities and community groups as a tool for better understanding of solid waste management recycling and conservation.
- The Frederick County Landfill has a landfill exploration video posted on the County's website and was featured on the County's public access channel. The County also hosted a well-attended community event, "Waste Forum -- The Path of Trash" in 2019.

Public/Private Partnerships

In 2020, NSVRC engaged local jurisdictions to study the feasibility of collaborative recycling. Working with the Solid Waste Management Technical Committee, staff hired SCS Engineers to assess the feasibility of regional recycling. SCS reviewed six years of regional recycling rate report data, and assessed the viability of a number of regional options aimed at stabilizing local recycling operations. SCS reached out to partners throughout the region and the state. The findings were presented to the steering committee, chief administrative officers of the region, and the NSVRC Board of Commissioners. The analysis determined that in fact a regional recycling facility could feasibly be sustainable within the region. However, such a development would require significant public investment.

While work to implement the strategies of the plan were being led by the Solid Waste Management Technical Committee, a private sector partner began working to develop a facility within the region. The strategy then shifted from evaluating a public option to facilitating cooperation with the private sector so that private investments met the needs of not only industrial and commercial clients, but also the region's local governments. Ridgerunner Container Services (RCS) has developed the facility, and has faithfully engaged the region's solid waste managers to keep them briefed on the progress, to build relationships, and ensure that the facility is developed in a way that would allow municipal participation, should the opportunity arise.

Recently, Frederick County executed the first formal contract with RCS. However, private haulers like Republic Services and WMI, and the City of Winchester and Town of Front Royal have been using RCS's services for OCC, co-mingled recycling and mixed paper for some time.

With equipment failure at the County's hauling destination for recyclables in Hagerstown, RCS agreed to accept materials from the County in order to avoid a disruption of services to local residents. Clarke

County also acted accordingly. Since this incident in March of 2022, RCS has been accepting, processing and marketing the County's recyclables, allowing the County to realize a significant savings in transportation costs. In May of 2022, RCS won the competitive bid and will be under contract with the County for the next two years. Clarke intends to ride this contract.

Having a local outlet for the area's recyclables not only benefits the local economy through savings in transportation costs and time-savings for haulers, but also reduces gas emissions. RCS is planning to add automated equipment to process plastic film for the region and continues to look ahead for other advancements which will benefit localities and the commercial sector.

An additional example of public/private partnership in the region is taking place in Clarke County. In the Spring of 2022, a local resident worked with the County government to organize a pilot glass recycling program. The resident collected clean glass bottles and jars at the Clarke County Convenience Center on Quarry Road. After sorting by color and removing metal rings and lids, glass was processed at the resident's home using an Expleco glass bottle crusher. The machine is capable of grinding the glass into a range of sizes, including a fine sand that can be used in various ways. The volunteer-based pilot program was funded privately and managed to prevent the landfilling of approximately one ton of glass over the course of four weekends of glass collection. Clarke County continues to evaluate the logistical components of the pilot program and is optimistic that it will continue in the future.

Image 3: Glass Recycling Pilot Program in Clarke County



Clarke County resident Christi McMullen is volunteering her time and using a bottle-crushing machine she purchased to help reduce the amount of glass that ends up in landfills. The county approved a glass recycling pilot program in May 2022. McMullen's Expleco glass bottle crusher can produce a range of ground materials from course to fine. It takes 160 bottles to fill a 5-gallon bucket with fine sand. Photo by Cathy Kuehner of Clarke County.

Recycling



Image 4: Recycling Guidance at Frederick County Landfill – convenience site

A minimum recycling rate as specified in § 10.1-1411 of the Code of Virginia for total municipal solid waste generated annually in each solid waste planning unit shall be met and maintained. Because the Region's population is over 100,000, the minimum recycling rate for the Northern Shenandoah Valley Region is 25% and is reported annually to DEQ. Historically, the Region has maintained a rate well over the 25% threshold. However, in recent years that rate has begun to decline due to external influences such as the cost of service at the Town level, changes in recycling markets, difficulty in tracking materials collected by private haulers, and the impacts of COVID-19. Table 3 depicts the Regional Recycling Rate 2017-2021.

Table 3: Regional Recycling Rate 2017-2021

Calendar Year	Recorded Recycling Rate
2017	56.6%
2018	49.4%
2019	44.1%
2020	37.0%
***2021**	41.0%

**Calendar Year 2021 has not yet been accepted and recorded by DEQ at the time of this adoption*

A primary goal of this plan in to continue to meet or exceed the minimum recycling rate. Additionally, the SWMTC would like to see Region's recycling rate return to 2017/2018 numbers. In order to achieve this goal, the Committee will work with the Region's Towns and local haulers to identify where curbside service can be reestablished in a cost-effective manner. A map of the localities offering curbside pick-up can be found on page 17. A comprehensive list of the region's local haulers can be found in Appendix C.

The Committee will also review localities' current efforts to promote and educate the public on where, when, and how they can properly recycle materials. Through effective communication, public engagement and promotion efforts can positively impact the way materials are recycled throughout the region.

Description of how recycling rate is achieved

In order achieve the minimum recycling rate, each locality manages and promotes their own recycling programs. This section will provide an overview of recycling and reuse focused programming in each locality.

Tire Shredding



Image 5: RTOP Operation at Frederick County Landfill

Localities in the region support recycling, reuse, and source reductions efforts through the Regional Tire-Shredding Operations Program. All member jurisdictions may utilize the regional tire operations program by transporting clean waste tires to the Frederick County Landfill and paying a nominal fee per ton. The jurisdictions within the planning region have signed a memorandum of understanding with the NSVRC documenting the terms and conditions of tire shredding, should they elect to use the regional tire shredder. The tire shredder is titled to the NSVRC as the neutral party on behalf of the member jurisdictions and is housed, maintained, and operated by the Frederick County Regional Landfill.

Historically, tire chips were used as alternative daily cover and in engineering projects on the landfill. While the Frederick County Landfill continues to use tire chips as daily cover in a limited capacity, the quantity of tire chips significantly exceeds the need for the application of tire chips onsite. Additionally, reuse and recycling markets for tire chips have been in decline with one of the East Coast's largest recyclers discontinuing operations. A primary objective of this plan is to identify potential reuse option for the region's recycled tires. The Technical Committee will work with staff to identify a consultant that can assist the region in finding a sustainable end-use for tire chips.



Image 7: RTOP Operation at Frederick County Landfill



Image 6: RTOP Operation at Frederick County Landfill

City of Winchester



Image 8: Curbside Recycling in City of Winchester

Curbside recycling service is offered, including select days throughout the year for yard waste. The fee for recycling is included in utility billing and bins are available to residents at no cost. The City's webpage provides a thorough overview of recycling best practices and available services.

- Schools and grocery stores have plastic bag recycling bins. Annually, schools have a competition to see who can collect the most recycled bags.
- NexTrex recycling program that takes recycled plastics to reuse in the fabrication of marketable materials.
- City website provides a comprehensive list of local business and non-profits that accept unwanted items that can be reused or recycled
- Glass pulverization operations. Pulverized material will be used in local engineering and construction projects.
- The City conducts regular Community Clean-Up events

Frederick County

Currently no Towns within Frederick County offer curbside recycling. While Clarke County recently opened its first citizen's convenience center, Clarke County residents do have access to three select Frederick County based convenience centers and the regional Landfill. They also have access to special programming provided by Frederick County.

Frederick County continues to expand its recycling program using a combination of local and grant funds. Such efforts have included community outreach, resources and special assemblies provided to public schools, distribution of recycling bins, and upgrades and expansion of the used textile and shoe recycling program.

- The County promotes a 'Christmas Wrap-Up' program that emphasizes the importance of recycling holiday related waste. Cut trees can be dropped off at convenience sites through January 31st and will be reused as ground mulch as part of the TreeCycle Program. A recycling day is held the fourth Wednesday of January to collect old electronics, including holiday lights and extension cords. Save-a-Sole and ReThreads collection containers are also available at convenience sites and the landfill for the drop-off of shoes, backpacks, luggage, gently-used textiles, etc. to be recycled. Reminders and methods for the recycling of wrapping paper and cardboard is included in the promotion of this event.



Image 9: TreeCycle Program

- Additional eCycling days are held at the regional landfill location from 7am-11am the fourth Wednesday of each month.

- Household hazardous waste can be taken to the landfill of the third Wednesday of every month from noon-6pm.

- Frederick County Green promotes conservation through backyard composting; capturing of rainwater; installation of pollinator gardens; habitat enhancement; reduction of food waste, etc.



Image 10: Save-a-Sole drop-off

  - The Save-a-Sole program has drop off locations throughout the County. Save-a-Sole collects shoes, sneakers, luggage, handbags, etc. in any condition to cleaned, repaired, and redistributed in impoverished countries creating jobs and supplying goods to those in need.

  - Similar to Save-a-Sole, the ReThreads program accepts gently used textiles that will be distributed to impoverished areas at home and abroad for reuse.

  - Recycling receptacles for plastic bags are located at grocery stores and other retailers throughout the County.

- The county promotes reuse of items on their website by providing contact information for non-profit organizations and shelters that assist those in need.

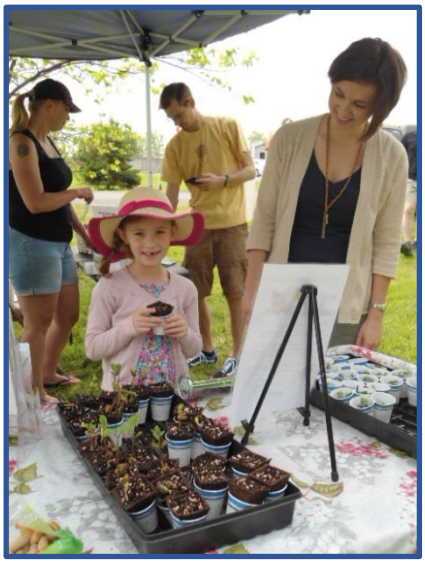


Image 12: Community Outreach



Image 11: Community Outreach

- The County has established outreach programs to educate students, residents, and organizations on recycling and conservation. The County also hosts tours of the landfill to promote recycling, diversion, and conservation.

- The Frederick County Landfill hosts the tire shredder used for the Regional Tire Operations Program.

- Frederick County Clean Sweep partners with the Community Inmate Workforce Programs and VDOT to perform litter cleanup along county roads. Clean Sweep regularly distributes free supplies to litter volunteers.

- Distribution of Reusable shopping totes

- Annual sale of at-cost compost bins and rain barrels

- Scrap metal, motor oil, antifreeze and cooking oil recycling



Image 13: Rain Barrel Sale

- Distribution of premium items at community events and in-school presentations programs

Clarke County

The Town of Berryville currently contracts within Republic Services to provide curbside recycling pick-up.

- The Clarke County Litter Committee – the Litter Committee's mission is to "educate, inspire, and empower our community to improve the environment through beautification, litter prevention, and recycling". The Litter Committee plans and oversees volunteer litter removal events throughout the county, including a partnership with other organizations on efforts to pick up litter from Shenandoah River access points. Future activities of the Litter Committee will focus on improving recycling success at county schools and other public places as well as educating county citizens on the importance of keeping non-recyclables out of the recycling stream.

Warren County

The Town of Front Royal offers curbside recycling. Currently, all recyclables collected in the County are hauled to Manassas for processing, with the exception of glass. Warren has a standing contract with Page County to haul all solid waste and glass from the Bentonville Transfer Station to the Battle Creek Landfill.

In addition to the recycling and disposal services available daily at convenience sites and the Bentonville Transfer Station, the County hosts an annual special clean-up event for the disposal of hazardous household waste. For this event, drop-off locations for different types of items are set up across the County.

Front Royal/Warren County Anti-Litter Council (ALC) – The goal of the ALC is to educate, motivate and participate in the prevention of litter and assist the citizens of Front Royal and Warren County to become better stewards of our environment. The ALC offers a variety of programs that focus on waste reduction and reuse, and recycling:

- Clean-Up Days: These events occur regularly throughout the year in order to address local litter problem areas.
- Cargo nets for pick-up trucks and trailers are provided to assist residents in complying with County ordinance requiring that contents are covered to prevent roadside litter.



Image 14: Litter Clean-Up Event

- The ALC will loan community clean-up supplies such as bags, safety vests, and grabbers to local organizations or citizens looking to host their own clean-up event.
- Backpacks, coloring books, and stickers are handed to school aged kids throughout the year to provide educational material promoting recycling, the effects of littering, and clean water habits.
- The ALC hosts and annual awards program for Community and Youth Service Organizations and for classroom projects related to keeping the community free of litter and education individuals about the Three R's.
- The ALC awards grant funding in order to purchase trash bins, recycle bins, and dog waste receptacles for local parks.
- ALC members are available to give educational talks and presentations to organizations throughout the Town and County.

Shenandoah County



Image 15: Annual Paper Shredding Event

The Town of Edinburg offers curbside recycling. The County has two dedicated recycling locations in the Towns of New Market and Woodstock in addition to the recycling available at the landfill and 11 other convenience sites. The County also provides and supports the following programming to increase recycling awareness and efforts:

- During the months of March, April, and May the landfill supports the annual litter pick up drive. Local non-profit groups can obtain materials like bags, gloves, grabbers, and safety vests and gather litter in places of their choosing. The landfill accepts the litter without charging any tipping, including up to 20 tires per group. This program includes a River clean-up organized by the Friends of the North Fork and Shen Co. Troutfitters.



Image 16: Recycling Bin Sale

- An annual paper shredding event is held at the Shenandoah County Government Complex.
- The Landfill hosts local organizations and school groups for tours
- The landfill accepts hazardous household, including electronics and batteries, items six days a week.

Page County

Currently, there no Towns within Page County offering curbside recycling. In addition to accepting solid waste and glass from Warren County, Page County contracts with Rappahannock County to accept both solid waste and recycling. The landfill also has agreement with Hyattsville, Maryland to accept their solid waste, in return Hyattsville hauls the landfill's construction and demolition debris and recycling, excluding glass and tires. The County coordinates with the Towns and local organizations to promote numerous events and assist with clean-ups throughout the year:



Image 17: Stanley Elementary Recycling Club

- Battle Creek landfill hosts an annual household hazardous waste event during the Spring to promote the safe recycling and disposal of chemicals.
- The County provides clean-up boxes and hauling services for Town sponsored Spring-Cleaning Events.



Image 18: Earth Day Run 2022

- Local residents can check out litter pick-up kits from the Landfill or at libraries that contain bags, gloves, and pickers. The kits also contain safety guidelines and information. The landfill will coordinate bag pick-up if necessary.

- Local canoe companies coordinate with local residents and hunting groups to host river clean-up events. The county will often provide supplies if needed and waive tipping fees for all debris that is collects.

- Landfill operators promote recycling at the Girl Scouts' Earth Day event.

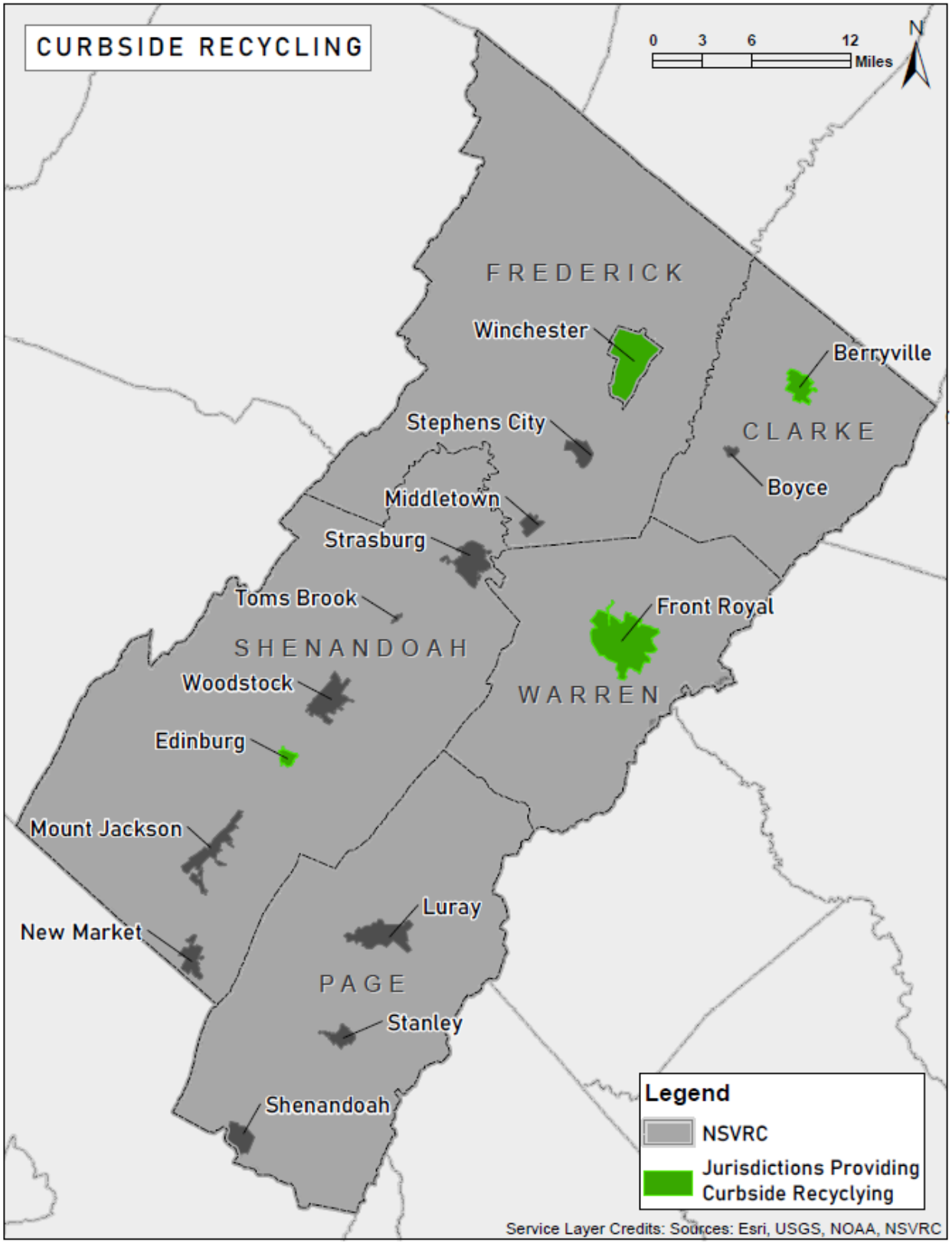
- Battle Creek operates a clean-up box rental program for local business and residents. Drop-off and pick-up of these 30-yard containers is included in the rental agreement.

Additionally, the County recently acquired event-ready recycling trailers. These trailers are already partitioned in order to separate recycling waste streams. The trailers are available, at no cost, for local event use such as fairs and festivals, bike races, triathlons, etc. In 2022, the landfill was able to provide these receptacles at the Page Alliance for Community Action and Page County Public Schools 5K and 1K Runs.

Action Plan

In the event the recycling rate for the planning region were to fall below the mandated 25 percent, the regional Solid Waste Technical Management Committee would provide technical support to jurisdictions with low recycling rates to encourage and help raise their recycling and improve reporting. The NSVRC would be directed through the Committee to assist with recycling marketing efforts and support the locality not complying with the recycling rate by identifying a variety of recycling opportunities including partnering with other jurisdictions to obtain regional rates and identifying other recycling markets. In the event the additional supportive efforts still resulted in insufficient recycling (rate falls below the recycling minimum) then the regional Solid Waste Management Technical Committee would turn to the DEQ for guidance and advice on how to best achieve the mandated recycling rate.

Map 2: Curbside Recycling



Regional Data

This section will provide an overview of the Region's population, including a breakdown of population by locality and insight into urban concentration areas. Additionally, a characterization of transportation networks and physical geography will provide insight into the make-up of the Region.

Population

Residential, commercial, and industrial development through the year 2045 will result in a corresponding increase in the magnitude of solid waste requiring disposal. These population and business growth patterns will impact solid waste management practices throughout the region. In addition to rising populations in growing counties like Frederick, Shenandoah, and Warren, commercial and industrial development will continue to increase in order to create new jobs and support new residents. Maintaining long term landfill capacity and cost-effective transfer station operations where they are a solution, now and in the future, is a core goal of this plan. In order to achieve this goal, regular conversations with locality's planning and development departments regarding planned and approved development will be necessary.

Table 4 provides population and population projections for the 23-year planning period, 2022-2045. Population information was obtained from the University of Virginia's Weldon Cooper Center for Public Service. Population information is based on 2020 Census data with projections performed by the Weldon Cooper Center's own methodology. For more information on the projection methodology visit the website at https://coopercenter.org/services/research-analysis.

Characterization

The Northern Shenandoah Valley planning area lies about 70 miles west of Washington DC, with Clarke County located in the northeast and Frederick County in the northwest. The City of Winchester is surrounded by Frederick County. Warren County and Page County are located in the southeast of the planning region and Shenandoah County is located in the southwest. The total area of the planning region covers a total of 1646.1 square miles (1,053,504 acres) of land. Over half the land use in the planning region is agriculture.

Urban Concentration Area

The fourteen Towns located within the five Counties and the City of Winchester, are areas of urban concentration in the region. The patterns of growth are estimated to continue to be concentrated in and around the City and Town urban areas throughout the 23-year planning period to 2045. The surrounding Counties are anticipated to continue to grow at a slower pace with smaller subdivisions and agriculture as the ongoing predominant land use in the outlying areas.

The majority of the population in the region is distributed in clusters along the major transportation routes of I-81 and I-66, and along Routes 7, 50, 522, 11, and 340. There is little change in the use of those two corridors over the past 20 years and the future transportation routes will likely be the same. More trucks travel Interstate 81 rather than the narrow State Route 340. Commerce and industry are distributed among the Counties in proportion to population, with the highest concentrations in Winchester and the surrounding portions of Frederick County. More of the population resides on the western side of the Massanutten Ridge, with less population residing on the eastern portion of the planning region (east of the Massanutten Ridge).

Table 4: Population and Projections to 2045

Northern Shenandoah Valley Regional Commission				
Population Profile	2020	2030	2040	2045
Clarke County	14,783	15,279	15,842	16,123
Berryville	4,574	4,727	4,886	4,973
Boyce	749	774	800	814
Frederick County	91,419	104,608	117,452	123,874
Middletown	1,355	1,550	1,774	1,871
Stephens City	2,016	2,307	2,640	2,784
Page County	23,709	23,888	23,643	23,521
Luray	4,831	4,867	4,904	4,879
Shenandoah	2,486	2,505	2,524	2,511
Stanley	1,703	1,716	1,729	1,720
Shenandoah County	44,186	46,984	50,064	51,603
Edinburg	1,178	1,253	1,332	1,373
Mount Jackson	1,961	2,085	2,217	2,285
New Market	2,155	2,291	2,437	2,511
Strasburg	7,083	7,532	8,008	8,255
Toms Brook	276	293	312	322
Woodstock	5,807	6,175	6,175	6,365
Warren County	40,727	44,053	47,305	48,930
Front Royal	15,011	16,237	17,563	18,166
City of Winchester	28,120	31,005	32,770	33,652

*University of Virginia Weldon Cooper Center, Demographics Research Group. (2019). Virginia Population Projections. Retrieved from https://demographics.coopercenter.org/virginia-population-projections. Town population projections were estimated at the same rate of growth at the County level.

Transportation

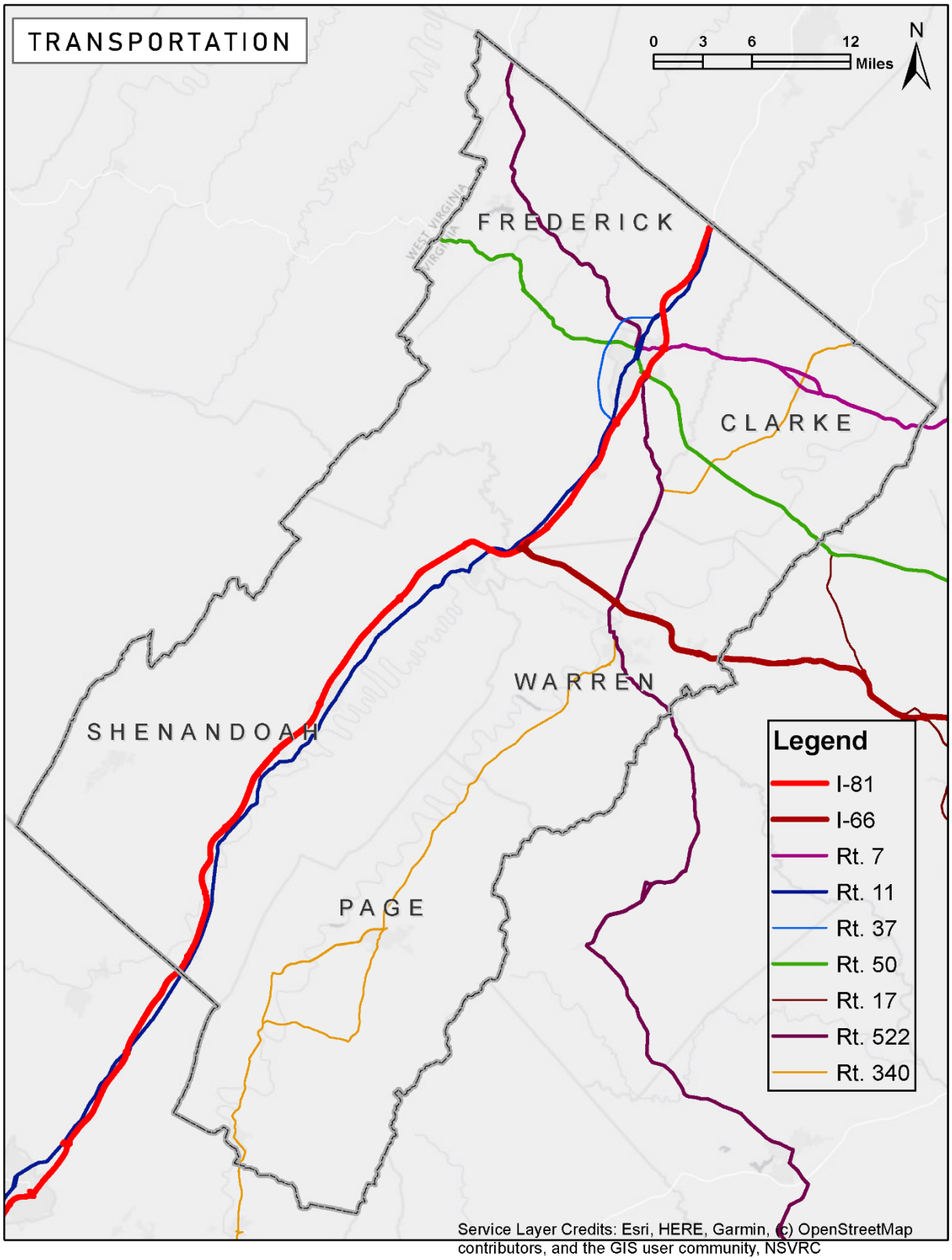
The two main transportation arteries in the region include Interstate 81, running north / south through the Shenandoah Valley and I-66 which enters the region on the west and intersects I-81 in Strasburg, 66 miles west of Washington, DC. The planning region serves as a transportation hub and provides overnight access to 60 percent of U.S. industrial activities; is within 500 miles of 50 percent of the population; and offers direct access to Canadian markets via I-81. The Virginia Inland Port provides intermodal ocean shipping and customs clearance, offering local industry worldwide trade reaches. The region is located next to the Washington-Arlington-Alexandria Metropolitan Areas, lies approximately 35 miles west of the Dulles International Airport, and 55 miles west of Washington, D.C., at the closest points.

Other prominent roadways in the Shenandoah Valley both run north/south through the planning region and include State Route 340 running approximately 20 miles east of I-81, and State Route 11. Route 340 connects many town centers in Warren, Page, and Clarke Counties along the eastern part of the planning area. The historic Route 11 parallels I-81 on the western part of the Shenandoah Valley, which runs through town centers in Shenandoah and Frederick Counties. Virginia Routes 7, 37, 42, 55, 263, and 277 all interconnect with the main roads. Historic railway lines run predominantly in north/south directions in both the western and eastern portions of the Valley. In addition, the region participates in a Commuter Ride Share program. This network of transportation connects population centers and results in a large population passing through the planning area. A map on page 22 depicts the Region's transportation network.

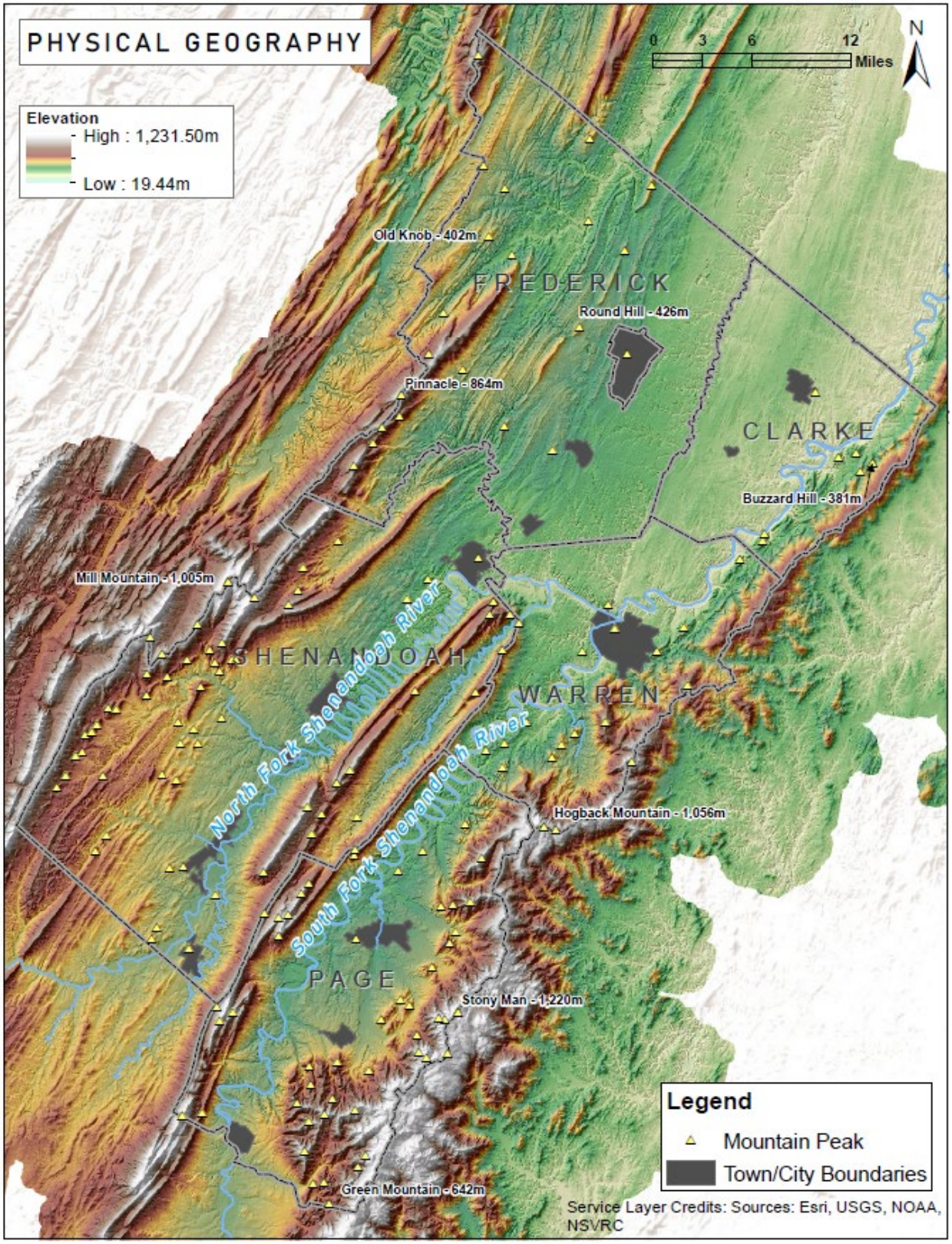
Physical Geography

The North Fork of the Shenandoah River catchment on the western portion of the region joins the South Fork of Shenandoah River catchment at the river's confluence in Front Royal, Virginia. The entire region is located within the Shenandoah River and Potomac watersheds that drain into the Chesapeake Bay and ultimately the Atlantic Ocean. As seen in the map on page 23, the planning region is located within Ridge and Valley geologic province, bounded by the Appalachian Mountains on the west and the Blue Ridge Mountains on the east. The Massanutten Mountain Range in the center divides the area into two major sub-valleys. There are four major geologic belts underlying the region: Appalachian Sandstone/Shale; the Valley Carbonates, which contain mostly limestones and dolomites; Central Valley Shale; and the Blue Ridge Complex, which predominantly contains granite, gneiss, and greenstone. The limestone, carbonates, and dolomite contain numerous karst features including seeps, springs, caves, caverns, and disappearing streams. Elevations vary from less than 400 feet above sea level to over 4,000 feet in the Blue Ridge Mountains. Annual precipitation varies from 35 to 50 inches, and the average annual temperature is slightly less than 60 degrees Fahrenheit. There are 20 major soil associations in the planning district. According to available local studies, approximately 55 percent of the total land area has severe limitations for development as landfill operations because of slow permeability, shallow depth to bedrock, steep slopes, seasonally high-water table, and other factors. Due to the constraints of slope, karst, and soil types, areas of generalized development are restricted to the Valley floor along the main roadways.

Map 3: Regional Transportation Networks



Map 4: Regional Geography



Collection Facilities

Currently no new solid waste facilities are planned over the next 20 years based on waste load predictions. In order to meet the goal of maintaining long-term capacity and cost-effective operations, the Technical Committee has set goal to look beyond the 20 threshold and plan for a 40-year capacity horizon. The Committee will assess waste loads received on an annual basis between 5-year updates in order to monitor landfilling capacities. This goal does not result in immediate modifications to existing permits; however, it does mean that landfill operators will begin identifying opportunities for future expansions where it makes sense in preparation for future solid waste disposal needs. A map of all the active collection facilities is on page 26. An assessment of remaining airspace through 2045 can be found in table 11.

The sections below provide information on collection facilities across the region at the locality level including the number and type of available convenience centers, landfilling operations, and anticipated permit expansion plans.

Frederick County, Clarke County, City of Winchester

The City of Winchester has no convenience sites within City limits. City residents are permitted to use facilities located at the Frederick County Landfill.

In addition to the select Frederick County convenience centers that Clarke County residents are permitted to use, Clarke County opened its own convenience center in 2019. All waste from that facility is hauled to the Frederick County Landfill.

Frederick County operates 10 citizen convenience centers that accept solid waste and recycling in addition to the convenience center located at the landfilling site – 11 in total. The County also operates both a Municipal Solid Waste and a Construction, Demolition, and Debris Landfill. The CDD landfill accepts waste generated during construction, remodeling, demolition/destruction of structures and during land clearing activities.

Frederick County is nearing completion of the permitting process to expand its CDD Landfill under Solid Waste Permit No. 591. The expansion will add approximately 14.71 acres and 2,371,000 cubic yards of disposal capacity, extending the landfill's projected operating life by approximately 12 years and supporting the region's long-term disposal needs.

Warren County

Warren County operates four convenience sites in addition to the site located at the Bentonville Transfer Station – five in total. Household waste and recycling are accepted at all convenience centers, with the exception of the Shenandoah Farms Compactor site which does not accept recycling. All waste and recycled glass from the Bentonville Transfer Station is hauled to the Battle Creek Landfill in Page County. Recycling is hauled out of the Region.

Shenandoah County

In addition to the Landfill, Shenandoah County also operates 11 convenience center locations that accept both household waste and recycling. The Towns of Woodstock and New Market also host two additional centers dedicated to recycling.

While the Shenandoah County Landfill has an expected remaining capacity beyond the 20-year threshold, the County has identified a future expansion option in order to prepare for long-term needs. Adjacent to the active landfill there is a completed (and unlined) landfill cell (see photo). The active phases could be expanded by 'piggybacking' onto the old cells, thereby expanding landfill life by a decade or more.

Image 19: Shenandoah County 'piggyback' expansion



The completed (and unlined) cell 8 & 9 stand to the far right, with the active landfill left of them. A lined 'piggyback' could fill the gap, and extend the life of the landfill.

Page County

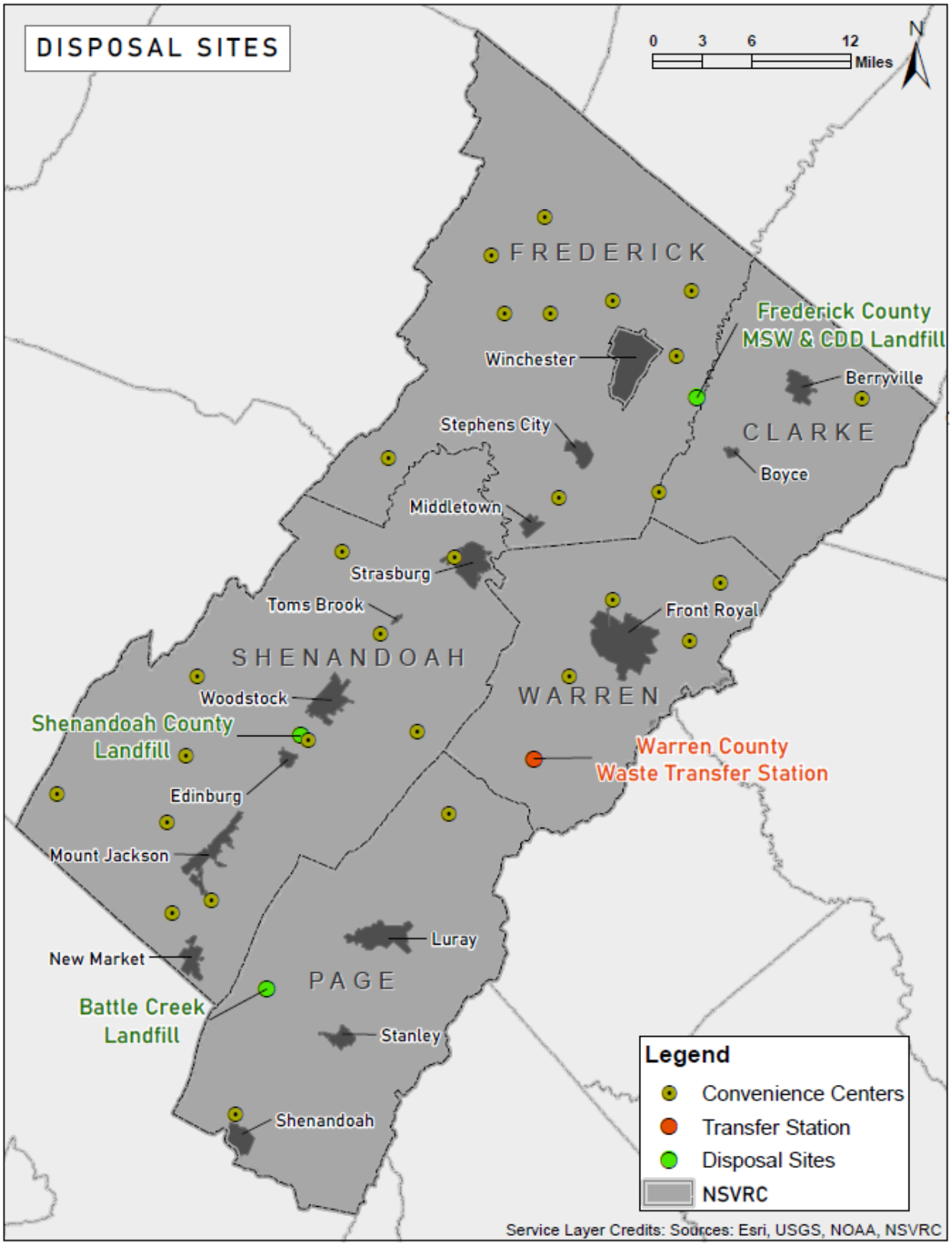
Page County accepts household waste and recycling and two convenience sites and the Battle Creek Landfill.

In addition to accepting solid waste and glass from the Warren County based transfer station, Battle Creek Landfill also accepts solid waste and recycling from Rappahannock County and solid waste from the City of Hyattsville, Maryland.

In order to preserve future capacity, Battle Creek operators are also identifying viable options for future expansion. Page County purchased a property adjacent to the current landfill in hopes of future expansion. However, the expansion is not slated for development for 30 years.

The solid waste collection data in Table 5 reflects totals landfilled within the Planning Unit only. In addition to waste generated within Page County, these totals include waste from Warren County and other local haulers.

Map 5: Regional Disposal Sites



Solid Waste Collection Data

This section provides an overview of the current and projected landfill conditions within the Planning Unit.

Waste Collected 2017-2021

Table 5 provides data for the type and amount of waste collected at each landfill from 2017 to 2021. As previously stated, the Frederick County Landfill accepts Solid waste from Clarke County and the City of Winchester. Waste loads received are reflective of all three localities solid waste generation. Page County Battle Creek Landfill accepts all solid waste from Warren County. In 2020, Page County also began accepting waste from Rappahannock County and added Hyattsville, Maryland in 2021. Table 5 reflects only waste generated within the planning unit and does not included waste accepted from Rappahannock County or Hyattsville. Table 6 provides the total amount of waste received at the Page County Battle Creek Landfill in 2020 and 2021.

Table 5: Waste Loads 2017-2021

Waste Received (in Tons)						
Locality	2017	2018	2019	2020	2021	Percent Change 2017-2021
Frederick County CDD						
Landfilled Tons	41,017	50,309	52,706	48,627	51,178	24.8%
Total Waste Received	41,017	50,309	52,706	48,627	51,178	24.8%
Frederick County MSW						
Recycled Offsite	1,679	1,533	1,554	1,807	1,544	(8.0%)
Landfilled Tons	121,801	126,515	118,443	125,333	131,420	7.9%
Total Waste Received	131,961	137,663	131,576	139,436	143,551	8.8%
Page County Battle Creek						
Recycled Onsite	542	1,235	928	1,328	1,271	134.6%
Recycled Offsite	846	848	619	897	898	6.1%
Landfilled Tons	48,619	50,572	54,875	58,101*	62,004*	27.5%
Total Waste Received	55,659	63,956	65,725	60,327*	64,172*	15.3%**
Shenandoah County Landfill						
Recycled Onsite	183	192	205	192	153	(16.4%)
Recycled Offsite	2,180	2,005	1,700	2,081	1,892	(13.2%)
Landfilled Tons	47,161	46,748	46,872	48,939	51,991	10.2%
Total Waste Received	52,954	52,588	52,863	54,959	58,062	9.6%

* These numbers do not include tonnage accepted from localities outside of the planning unit.

** This percentage reflects the increase in waste received within the planning unit.

Table 6: Page County - Total Waste Loads

Page County - Total Waste Received (in Tons)			
Locality	2020	2021	Percent Change 2020-2021
Landfilled Tons	63,468.55	82,441.92	29.9%
Total Waste Received	68,686.63	90,790.92	32.2%

Current Landfill Conditions

Table 7 provides an overview of the total permitted capacity and remaining expected life as of December 2021 at each landfill within the region.

Table 7: Current Landfill Conditions

Current Landfill Conditions			
Landfill (Permit #)	TOTAL Permitted Capacity (Cubic Yards)	Remaining Permitted Capacity as of December 2021 (cubic yards)	Expected Remaining Permitted Life as of December 2021 (years)
Page County Battle Creek (SWP579)	7,970,000	5,310,434	36
Frederick County CDD (SWP591)*	7,071,000*	4,730,3208*	23*
Frederick County MSW (SWP529)	16,630,563	11,815,000	32
Shenandoah County (SWP469)	4,848,000	3,548,210	30

*SWMP 591: *Total permitted capacity includes the 2,371,000-cubic-yard expansion. Remaining capacity reflects the expansion and 2024 Remaining Landfill Life Report; estimated remaining life is based on the DEQ permit application's Demonstration of Need.*

Future Waste Estimates

The future waste stream anticipated to be generated through 2045 includes waste from various sectors including residential, commercial, institutional, industrial, construction, demolition, debris and other sources. Future waste tonnage was estimated to have the same proportion of wastes from each of the main sectors (residential, commercial, institutional, construction, etc.) as those sectors' contributions to the current waste stream.

The estimated increase in waste was based on a rate of growth associated with the population increase calculated for each County and the City based on 2020 Census data along with 2030, 2040 and 2045 population estimate from the UVA Weldon Cooper Center.

The highest concentrations of population, commercial, and industrial growth are expected to occur in or around major population and transportations centers. These areas include the City of Winchester and Frederick County, The Town of Strasburg and northeastern portions of Shenandoah County, and the I-66 corridor in Warren County. The proximity to northern Virginia and Washington D.C., and transportation corridors of Route 7 and I-66 make these areas prime for continued growth and development.

The impact of this growth on regional solid waste management will be proportionate to the rate at which growth occurs. In order to manage growth, the Solid Waste Technical Committee and staff will work regularly with local planning and development departments to keep track of approved and planned residential, commercial, and industrial development around the region. Additionally, the Committee and staff will review solid waste generation increases to ensure that remaining landfilling capacity is within appropriate limits.

If the expected life of a landfill falls below 20 years, operators will begin to take action to expand their permitted capacity. The Technical Committee has set a goal to begin identifying future expansion options once a landfill's permitted life falls below 40 years. While no action may be taken at that time, such as a major plan amendment or filing for a permit expansion, operators will begin to identify and assess viable options for the future needs of the landfill.

To estimate projected waste generation through 2045, a per capita rate was developed for each landfill for the years 2010-2021 and then averaged. In order to calculate the most accurate projections possible, the populations for Rappahannock County and Hyattsville, Maryland were included in the Page County Battle Creek Landfill projections with the assumption that Page County will continue to collect solid waste from outside of the Planning Unit through 2045.

A per capita rate was also used in the projections for the Frederick County CDD Landfill. The per capita rate is the most readily used method for calculating future waste estimates, however this method is not the most accurate way to project future waste tonnage for a CDD Landfill operation. Please note that the methodology does not take into account the planned or anticipated future growth of commercial or industrial use construction, particularly in Frederick County. Operators at the CDD landfill anticipate higher levels of waste generation over the next 23 years than what is projected in the tables below.

In order to more accurately depict projected remaining airspace, this report does not use the same estimate methodology used in the 2017 report. Instead, the Technical Committee agreed to report the projections provided in the annual capacity surveys conducted at each landfill in 2021. These remaining airspace estimates were conducted by professional engineers and provide the most accurate prediction of estimated remaining life. Table 11 provides projections on remaining capacity in 2045 for each landfill. The full survey from each locality is provided in Appendix B.

Table 8: Estimated Future Waste by Landfill (Tons)

Estimated Future Waste Generation (Tons)			
Year	**Population**	**Waste Tonnage**	**Average Per Capita Rate**
Frederick County CDD (Frederick, Clarke, Winchester)			
2015	124,344	36,416	0.30
2020	134,322	48,627	
2030	150,892	44,719	
2040	166,064	49,215	
2045	173,650	51,464	
Frederick County MSW (Frederick, Clarke, Winchester)			
2015	124,344	124,736	1.02
2020	134,322	139,436	
2030	150,892	153,526	
2040	166,064	168,963	
2045	173,650	176,681	
Page County Battle Creek (Page, Warren, Rappahannock, Hyattsville)			
2015	46,428	46,428	0.85
2020	68,687	60,327	
2030	100,751	85,759	
2040	108,998	92,779	
2045	113,654	96,742	
Shenandoah County Landfill			
2015	42,228	49,229	1.17
2020	44,186	54,959	
2030	46,984	54,921	
2040	50,064	58,521	
2045	51,603	60,320	

Waste Generation Estimates 2022-2045 (Tons)	
Landfill	Waste Generation
Frederick County CDD	1,378,865
Frederick County MSW	3,964,824
Page County Battle Creek	2,682,082
Shenandoah County Landfill	1,504,488

Table 9: Waste Generation 2022-2045

Table 9 provides an overview of estimated total waste generation between 2022-2045 at each landfill.

Estimated Future Waste for Planning Unit (Tons)		
Year	Population	Waste Tonnage
2030	265,817	338,925
2040	287,076	369,479
2045	297,705	385,207

Table 10: Estimated Future Waste for Planning Unit

Table 10 depicts the total amount of estimated waste generation for the Planning Unit in the years 2030, 2040, and 2045.

Projected Remaining Airspace:

Table 11 depicts the estimated remaining space in each landfill in the year 2045. Appendix B provides supplemental information on the methodology used by the survey companies contracted to conduct flyover surveys at each landfill. Data for Shenandoah and Page Counties required additional extrapolation for consistency in reporting, as detailed in Appendix A. The permitted expansion of the Frederick County CDD Landfill is projected to extend the facility's remaining operating life by approximately 12 years beyond the previously estimated closure date of 2037.

Table 11: Projected Remaining Airspace

Projected Remaining Airspace		
Landfill (Permit#)	Projected Remaining Capacity in 2045 (Cubic Yards)	Remaining Landfill Life in 2045 (Years)
Frederick County CDD (SWP591)	366,600*	4*
Frederick County MSW (SWP529)	4,896,600	8
Page County Battle Creek (SWP579)**		
Shenandoah County Landfill (SWP469)	827,916	7

*Numbers updated to reflect permitted increase of 2,371,000 CY

** Data for Page County is forthcoming as a survey was recently conducted in May 2022. Data will be included in the table once available.

Needs Assessment

As an extension of the goals and objectives outlined in the first section of this plan, is it important to identify and prioritize specific needs to maintain effective, efficient, and compliant solid waste management practices throughout the region. Table 12 reviews the primary needs of the Northern Shenandoah Valley Region over the next 20 years to ensure the continuance of effective solid waste management in the long-term. Specific action plans were established in order to meet these needs, the achievement of which will meet the overarching goals of regional cooperation, maintain long-term landfilling capacity, controlling costs of service, and exceeding the Region's required recycling rate.

Table 12: Regional Needs Assessment

Regional Needs Assessment			
Need	Current Status	Action Plan	Responsible Parties
Tire-shred recycling stream	Surplus of recycled and processed tires at the Frederick County Landfill due to lack of viable reuse or recycling options.	Identify funding source and consultant to conduct a study that will identify potential reuse options and/or steady recycling streams.	NSVRC Staff, Locality Public Works Directors, Frederick County Landfill Manager
Educational recycling programming	While there are a variety of educational materials and programming, finding new ways to reach and train residents on proper recycling practices could greatly impact recycling in the region.	Work with private sector recycling operators and utilize grant funding to create new and diverse recycling education materials and programming. Committee and staff will also review established programming in other localities.	NSVRC Staff and Locality Recycling Managers
Expansion at Frederick County CDD Landfill	The CDD landfill has a current remaining life expectancy of 16 years. As growth and development in the area is expected to increase, so will waste tonnage in the near future.	Initiate the major plan amendment and permit amendment process with DEQ in the next 3-5 years.	NSVRC Staff and Frederick County Public Works Director and Landfill Manager
Establish curbside recycling pick-up in Town	Over the past 5 years Towns have had to discontinue curbside recycling services to cost and service availability.	Work with local haulers and private recycling services to re-establish regional, cost-effective curbside recycling services.	NSVRC Staff and Town Managers/Public Works Directors

Evaluation

On an annual basis, the Solid Waste Technical Committee will review the previous year's waste generation and recycling rates and compare them to the previous year. Additionally, the Committee will review programming within the Solid Waste Hierarchy in order to identify any deficits that can be addressed and remedied. As with any type of programming of this magnitude, needs, funding sources, growth and development, and behavior patterns are likely to change and fluctuate. The Committee, with assistance from staff, will assess all of the relevant information in order to develop a work plan for the upcoming year that will address the needs and priorities identified through the evaluation process. Additionally, staff will consult local planning and development departments to stay current on planned development throughout the region.

By assessing waste tonnage, recycling rates, programming and expected growth on an annual basis, the Committee will be able to address changes in solid waste management quickly, including the expected useful life remaining on landfills in the region.

Appendix A: Methodology

Future Waste Estimates

Per Capita

To estimate future waste generation within the planning unit, a per capita rate of tonnage to population was calculated for from the years 2010-2021. Then, an average of the per capita rates for those years was established. For future waste generation estimates in Table 8, the average per capita rate was multiplied by the estimated population in the years 2030, 2040, and 2045. These calculations were completed for each landfill.

Average Annual Increase

In order to estimate the total amount of waste generated during the planning period (Table 9), an annual average increase was calculated and then added to every year from 2022-2045. In order to calculate the annual average increase, the total amount of waste from 2015 was subtracted from the estimated waste generated in 2045, then divided by the number of years between 2015-2045. This calculation was done for all the landfills within the planning unit with tons as the unit of measurement.

(Estimated Waste in 2045 – Waste Generated in 2015) / 30yrs = Average Annual Increase

Projected Remaining Airspace

The Shenandoah County Remaining Permitted Capacity Evaluation presents similar information to the Frederick County Survey. Both were conducted by SCS Engineers. In order to get the information presented in the Shenandoah Survey to the same level as the estimates in the Frederick County Survey, staff had to conduct an additional layer of projections to find the estimated cubic yards and years of remaining life in the year 2045.

First, staff took the total remaining permitted capacity (in cubic yards) and divided by the expected remaining years of life in order to find an annual rate of landfilled waste in cubic yards. Then, the annual rate was multiplied by the number of years in the planning horizon in order to calculate the total amount of cubic yards filled by 2045. Finally, the total amount of cubic yards filled by 2045 was subtracted from the total remaining permitted capacity to find the expected remaining capacity in cubic yards in 2045.

As reported in the Capacity Evaluation, the Shenandoah County Landfill will reach capacity in the year 2052. A simple subtraction of the year 2045 from 2052 equals an expected remaining capacity of 7 years in the year 2045.

An overview of these calculations is provided below:

(3,458,210cy/30yrs) * 23yrs = 2,720,294cy filled by 2045

3,458,210cy – 2,720,294cy = 827,916cy remaining in 2045

2052 – 2045 = 7yrs of life remaining in 2045

Appendix B: Annual Landfill Survey

SCS ENGINEERS Environmental Consulting & Contracting

March 18, 2022
File No. 02197017.30

JengHwa Lyang, Ph.D., P.E.
Solid Waste Permit Writer
Virginia Department of Environmental Quality
Valley Regional Office
4411 Early Road
P.O. Box 3000
Harrisonburg, Virginia 22801

Subject: Permit 591 Remaining Landfill Life

Dear Dr. Lyang,

SCS Engineers is providing this report on behalf of Frederick County to meet the requirements as specified in the Frederick County Regional Landfill SWP591 permit.

As part of the requirements in this letter, the following is summarized herein:

1. The capacity used during the year
2. The remaining permitted capacity
3. The projected remaining site life

ANNUAL CAPACITY

The capacity used during the year was calculated based on comparison of the topography performed on December 15, 2020 to the topography performed on December 14, 2021. Certified surveyors Marsh and Legge performed the topographies. During this period (12 months), approximately 108,400 cubic yards were filled (Refer to Drawing 1).

REMAINING PERMITTED CAPACITY

The remaining permitted capacity was calculated based on comparison of the existing grade in the active areas (Area 1) and the engineering modified grades in the undeveloped areas (Area 2) to the permitted top of intermediate cover grade.

The existing grade for Area 1 was based on the most recent topography performed on December 14, 2021. The Area 1 permitted final grade come from Sheet 3 of the Minor Permit Amendment Area 1 Final Grade Modifications dated April 2016. The permitted top of intermediate cover grade is equivalent to the permitted final grade minus 2.5 ft, according to Phase 2 perimeter cap system terminus detail on Sheet 5 of the Minor Permit Amendment Area 1 Final Grade Modifications.

The Area 2 engineering modified (EM) grade and the permitted final grade were retrieved from Sheet LF-001-6A of Part B Permit Application for Construction Demolition Debris Landfill dated February 2002. Again, the permitted top of intermediate cover grade is equivalent to the permitted final grade

11260 Roger Bacon Dr., Ste. 300 Reston, VA 20190 | 703-471-6150 | eFax 703-471-6676

minus 2.5 ft, according to Phase 2 perimeter cap system terminus detail on Sheet 5 of the Minor Permit Amendment Area 1 Final Grade Modifications.

As presented in Drawing 2, the remaining permitted capacity of Area 1 is approximately 613,400 cubic yards and of Area 2 is approximately 2,127,000 cubic yards. The total remaining permitted capacity of Permit 591 is thus approximately 2,740,400 cubic yards.

PROJECTED REMAINING SITE LIFE

Refer to Table 1. A projected remaining site life is estimated to be 16 years based on the following approach:

1. The recent 11 years of annual tonnages were plotted to include a linear trendline. The trendline indicates an annual tonnage increase of 2,904, or about 6 percent increase from 2020 to 2021.
2. Assuming the same 6 percent increase, the annual volume is anticipated to increase by 6,800 cubic yards per year.
3. Based on a remaining permitted capacity of 2,740,400 cubic yards, the averaged 2020/2021 fill rate of 112,700 cubic yards, and a 6,800 cubic yard per year increase, the remaining site life is estimated to be 16 years.

Note this projected remaining site life calculation is solely an estimation based on the trends from the prior 11 years. This estimated calculation does not include factors that may affect site life (i.e., settlement effects, population changes, or other fluctuations in annual waste volumes).

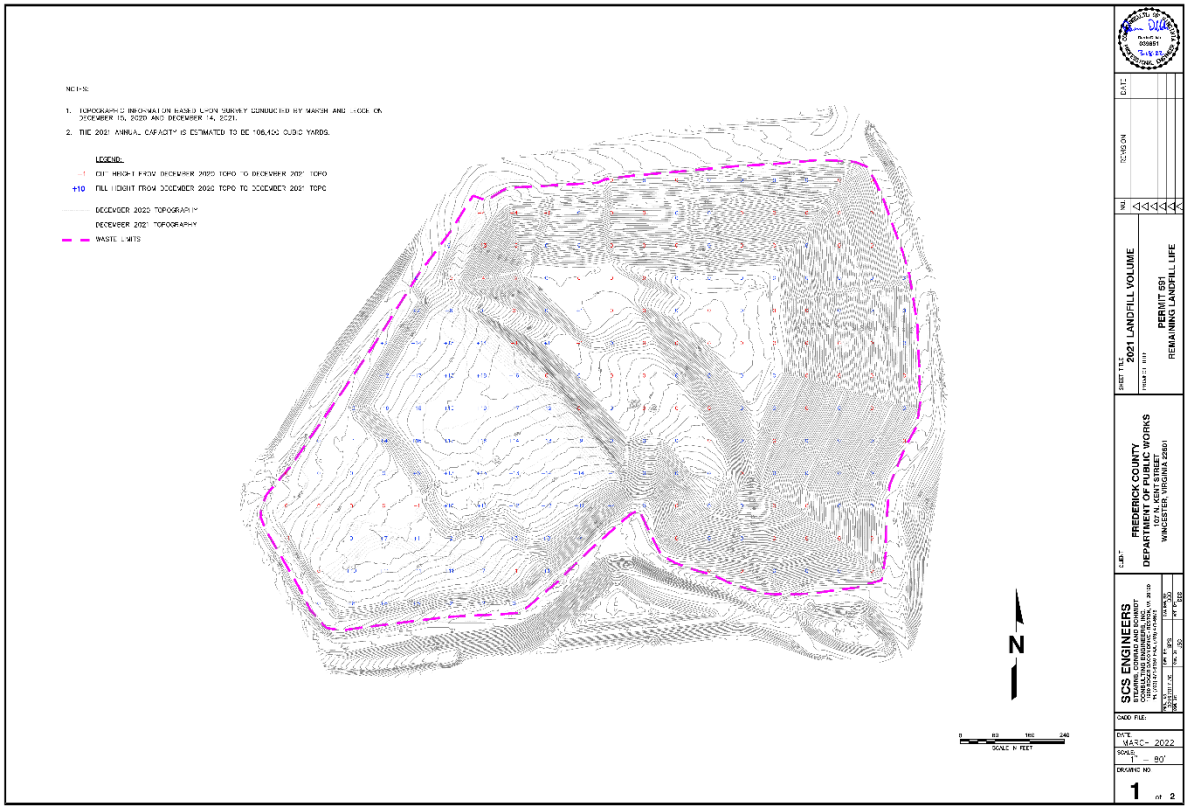
Please let us know if you have any questions.

Sincerely,



Darrin Dillah, PhD, PE
Vice President/Project Director
SCS Engineers

Jacob Gaither
Staff Professional
SCS Engineers


NOTES:
1. TOPOGRAPHIC INFORMATION BASED UPON SURVEY CONDUCTED BY MARSH AND LODE ON DECEMBER 15, 2020 AND DECEMBER 14, 2021.
2. THE 2021 ANNUAL CAPACITY IS ESTIMATED TO BE 106,400 CUBIC YARDS.
LEGEND:
CUT HEIGHT FROM DECEMBER 2020 TOPO TO DECEMBER 2021 TOPO
+10 FILL HEIGHT FROM DECEMBER 2020 TOPO TO DECEMBER 2021 TOPO
DECEMBER 2020 TOPOGRAPHY
DECEMBER 2021 TOPOGRAPHY
WASTE LIMITS
N
0 80 160 240
SCALE IN FEET
SCS ENGINEERS
FREDERICK COUNTY
DEPARTMENT OF PUBLIC WORKS
107 N. KENT STREET
WINCHESTER, VIRGINIA 22601
SHEET TITLE: 2021 LANDFILL VOLUME
PERMIT 501
REMAINING LANDFILL LIFE
DATE: MARCH 2022
SCALE: 1" = 80'
DRAWING NO 1 of 2

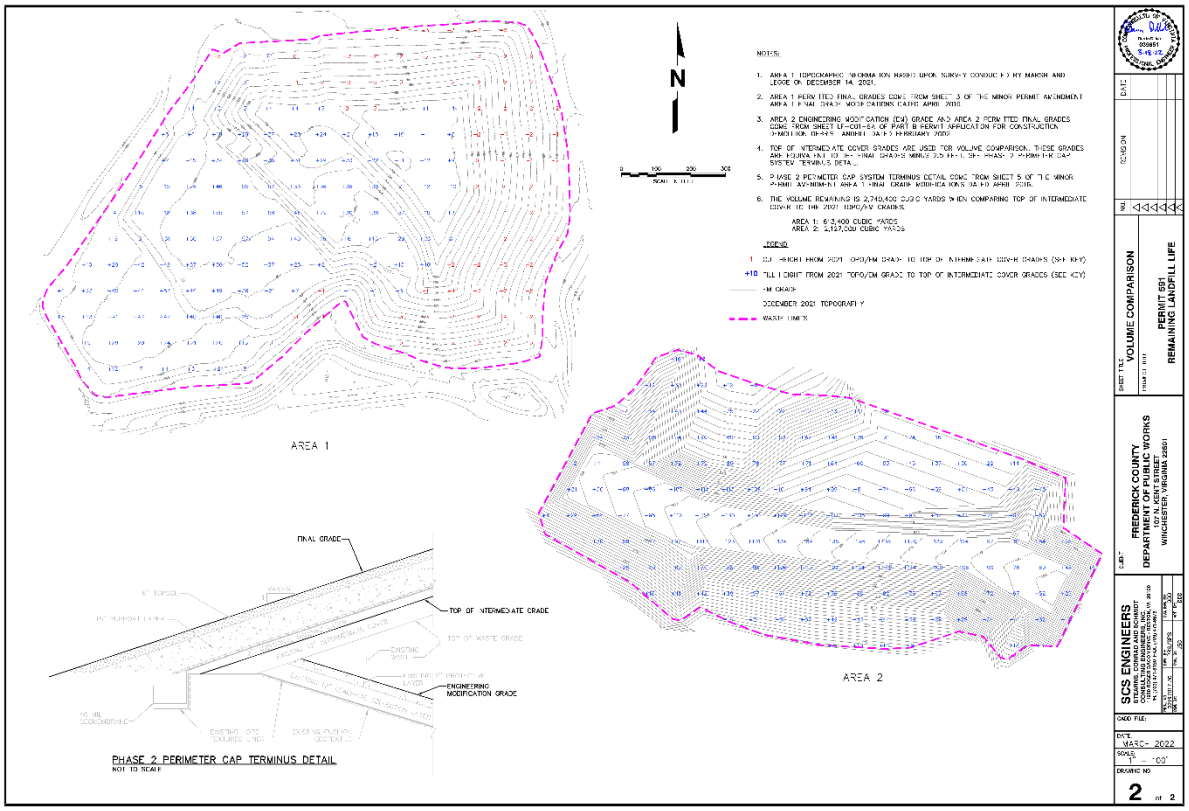

AREA 1
AREA 2
N
0 100 200 300
NOTES:
1. AREA 1 TOPOGRAPHIC INFORMATION BASED UPON SURVEY CONDUCTED BY MARSH AND LODE ON DECEMBER 14, 2021.
2. AREA 1 PERMITTED FINAL GRADES COME FROM SHEET 3 OF THE MINOR PERMIT AMENDMENT AREA 1 FINAL GRADE MODIFICATIONS DATED APRIL 2016.
3. AREA 2 ENGINEERING MODIFICATION (EM) GRADE AND AREA 2 PERMITTED FINAL GRADES COME FROM SHEET EF-001-SA OF PART B PERMIT APPLICATION FOR CONSTRUCTION ENGINEERING DRAWINGS DATED FEBRUARY 2020.
4. TOP OF INTERMEDIATE COVER GRADES ARE USED FOR VOLUME COMPARISON. THESE GRADES ARE EQUIVALENT TO THE FINAL GRADES MINUS 2.5 FT. (SEE PHASE 2 PERIMETER CAP SYSTEM TERMINUS DETAIL).
5. PHASE 2 PERIMETER CAP SYSTEM TERMINUS DETAIL COME FROM SHEET 5 OF THE MINOR PERMIT AMENDMENT AREA 1 FINAL GRADE MODIFICATIONS DATED APRIL 2016.
6. THE VOLUME REMAINING IS 2,740,400 CUBIC YARDS WHEN COMPARING TOP OF INTERMEDIATE COVER TO THE 2021 TOPOGRAPHY.
AREA 1: 613,400 CUBIC YARDS
AREA 2: 2,127,000 CUBIC YARDS
LEGEND
CUT HEIGHT FROM 2021 TOPO/EM GRADE TO TOP OF INTERMEDIATE COVER GRADES (SEE KEY)
+10 FILL HEIGHT FROM 2021 TOPO/EM GRADE TO TOP OF INTERMEDIATE COVER GRADES (SEE KEY)
EM GRADE
DECEMBER 2021 TOPOGRAPHY
WASTE LIMITS
FINAL GRADE
TOP OF INTERMEDIATE GRADE
ENGINEERING MODIFICATION GRADE
PHASE 2 PERIMETER CAP TERMINUS DETAIL
NOT TO SCALE
SCS ENGINEERS
FREDERICK COUNTY
DEPARTMENT OF PUBLIC WORKS
107 N. KENT STREET
WINCHESTER, VIRGINIA 22601
SHEET TITLE: VOLUME COMPARISON
PERMIT 501
REMAINING LANDFILL LIFE
DATE: MARCH 2022
SCALE: 1" = 100'
DRAWING NO 2 of 2

Table 1. Remaining Landfill Life

Year Ending	Actual Tons Landfilled	Volume Landfilled (cy)	Projected Volume Landfilled (cy) assuming increase of	Remaining Capacity (cy)	Year Count	Remaining Landfill Life (years)	Notes
			6,800			16	
2011	23,956						
2012	30,367						
2013	30,561						
2014	30,654						
2015	36,416						
2016	42,540	112,700					
2017	41,017						
2018	50,309						
2019	52,706						From trendline slope, increase from 2020 to 2021 is 6 percent. This equates to about a 6,800 cy increase.
2020	48,627	117,000					Volume Landfilled from aerial topographies; Remaining Capacity from comparing permitted TOI contours to aerial
2021	51,178	108,400		2,740,400		16	topography.
2022			119,500	2,620,900	1	15	
2023			126,300	2,494,600	1	14	
2024			133,100	2,361,500	1	13	
2025			139,900	2,221,600	1	12	
2026			146,700	2,074,900	1	11	
2027			153,500	1,921,400	1	10	
2028			160,300	1,761,100	1	9	
2029			167,100	1,594,000	1	8	
2030			173,900	1,420,100	1	7	
2031			180,700	1,239,400	1	6	
2032			187,500	1,051,900	1	5	
2033			194,300	857,600	1	4	
2034			201,100	656,500	1	3	
2035			207,900	448,600	1	2	
2036			214,700	233,900	1	1	
2037			221,500	12,400	1	0	
2038			228,300	(215,900)	0	-1	
2039			235,100	(451,000)	0	-2	
2040			241,900	(692,900)	0	-3	
2041			248,700	(941,600)	0	-4	

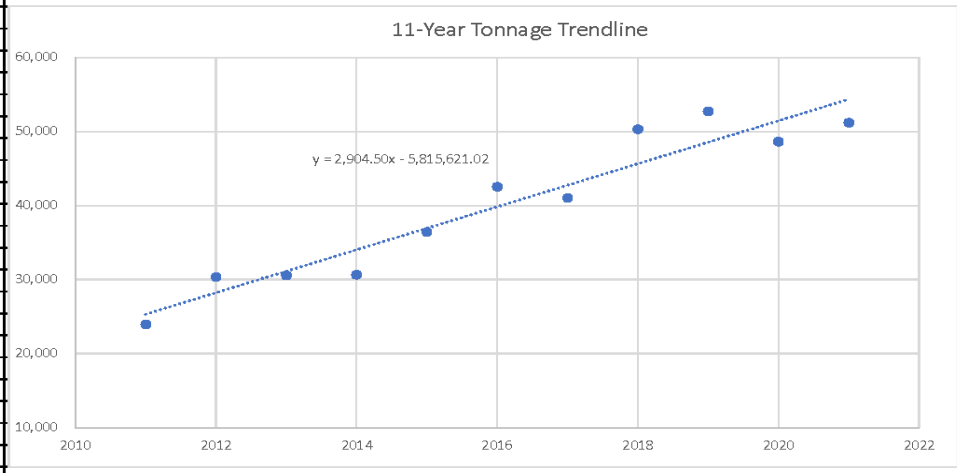


Table 1. Remaining Landfill Life

2042			255,500	(1,197,100)	0	-5	
2043			262,300	(1,459,400)	0	-6	
2044			269,100	(1,728,500)	0	-7	
2045			275,900	(2,004,400)	0	-8	
2046			282,700	(2,287,100)	0	-9	P591 permit limit is 600 tpd or 300,000 cy per year assuming 1,200 lb/cy and 300 days per year
2047			289,500	(2,576,600)	0	-10	
2048			296,300	(2,872,900)	0	-11	
2049			303,100	(3,176,000)	0	-12	
2050			309,900	(3,485,900)	0	-13	

SCS ENGINEERS Environmental Consulting & Contracting

March 18, 2022
File No. 02197017.30

JengHwa Lyang, Ph.D., P.E.
Solid Waste Permit Writer
Virginia Department of Environmental Quality
Valley Regional Office
4411 Early Road
P.O. Box 3000
Harrisonburg, Virginia 22801

Subject: Permit 529 Remaining Landfill Life
Frederick County Regional Landfill, SWP529

Dear Dr. Lyang,

SCS Engineers is providing this report on behalf of Frederick County to meet the requirements as specified under Section I.F.3. of the Frederick County Regional Landfill SWP529 Minor Modification No. 12 Letter dated February 11, 2020.

As part of the requirements in this minor permit modification letter, the following is summarized herein:

1. The capacity used during the year
2. The remaining permitted capacity
3. The projected remaining site life

ANNUAL CAPACITY

The capacity used during the year was calculated based on comparison of the topography performed on December 15, 2020 to the topography performed on December 14, 2021. Certified surveyors Marsh and Legge performed the aerial topographies. During this period, portions of the side slopes that were overfilled were relocated. The cut volume was approximately 72,350 cubic yards. The fill volume was approximately 197,350 cubic yards. The annual capacity (net volume) during this period (12 months) was approximately 125,000 cubic yards (Refer to Drawing 1).

REMAINING PERMITTED CAPACITY

The remaining permitted capacity was calculated based on comparison of the existing grade in the active areas (Phases 1 and 2) and the engineering modified grades in the undeveloped areas (Phases 3 and 4) to the permitted top of intermediate cover grade (assuming cap system option 1 is implemented upon closure).

The existing grade was based on the most recent topography performed on December 14, 2021.

The engineering modification (EM) grade was based on Sheet 4 of the Construction of Cutoff Flap Plan prepared by SCS Engineers dated August 22, 2019.

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The top of intermediate cover grades are equivalent to the revised design final grades (Sheet 5 of the Construction of Cutoff Flap Plan) minus 2 feet, based on cap system option 1 from Sheet 2 of the Construction of Cutoff Flap Plan.

As presented in Drawing 2 attached, the remaining permitted capacity of Permit 529 is approximately 11,815,000 cubic yards.

PROJECTED REMAINING SITE LIFE

Refer to Table 1. A projected remaining site life is estimated to be 32 years based on the following approach:

1. The recent 11 years of annual tonnages were plotted to include a linear trendline. The trendline indicates an annual tonnage increase of 2,399, or about 2 percent increase from 2020 to 2021.
2. Assuming the same 2 percent increase, the annual volume is anticipated to increase by 3,300 cubic yards per year.
3. P591 is estimated to close in 2037. The CDD waste going to P591 will then be diverted to P529. The CDD waste amount is anticipated to increase by 6,800 cubic yard per year, based on recent 11 year annual amounts. Refer to P591 Remaining Landfill Life letter for further details, dated March 15, 2022, prepared by SCS Engineers.
4. Based on a remaining permitted capacity of 11,815,000 cubic yards, the averaged 2020/2021 fill rate of 163,500 cubic yards, a 3,300 cubic yard per year increase, and the CDD waste amounts diverted to P529 beginning in 2037, the remaining site life is estimated to be 32 years.

Note this projected remaining site life calculation is solely an estimation based on the trends from the prior 11 years. This estimated calculation does not include factors that may affect site life (i.e., settlement effects, population changes, or other fluctuations in annual waste volumes).

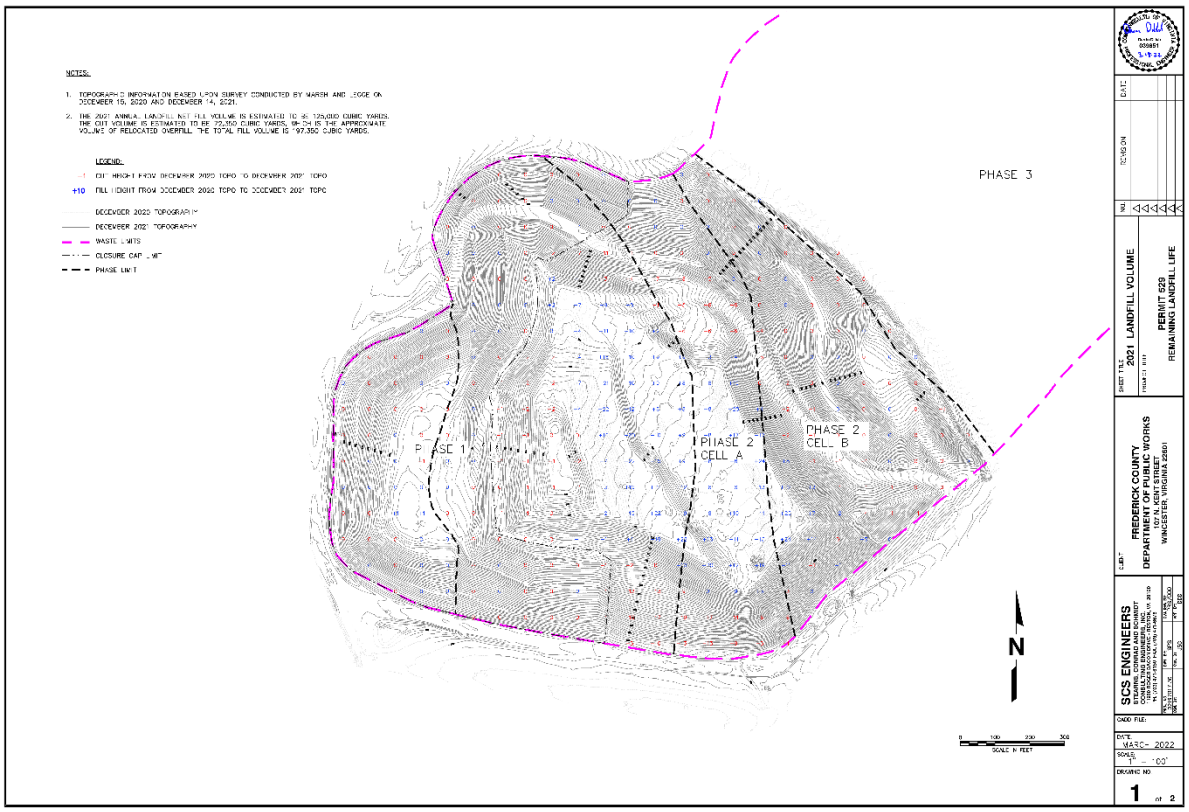
Please let us know if you have any questions.

Sincerely,



Darrin Dillah, PhD, PE
Vice President/Project Director
SCS Engineers

Jacob Gaither
Staff Professional
SCS Engineers


NOTES:
1. TOPOGRAPHIC INFORMATION BASED UPON SURVEY CONDUCTED BY MARSH AND EDGE ON DECEMBER 15, 2020 AND DECEMBER 14, 2021.
2. THE 2021 ANNUAL LANDFILL AIRSPACE UTILIZATION VOLUME IS ESTIMATED TO BE 125,000 CUBIC YARDS. THE CUT VOLUME IS ESTIMATED TO BE 72,150 CUBIC YARDS, OR 24% IS THE APPROXIMATE VOLUME OF RELOCATED OVERFILL. THE TOTAL FILL VOLUME IS 97,350 CUBIC YARDS.
LEGEND:
CUT HEIGHT FROM DECEMBER 2020 TOPO TO DECEMBER 2021 TOPO
+10 FILL HEIGHT FROM DECEMBER 2020 TOPO TO DECEMBER 2021 TOPO
DECEMBER 2020 TOPOGRAPHY
DECEMBER 2021 TOPOGRAPHY
WASTE LIMITS
CLOSURE CAP LIMIT
PHASE LIMIT
PHASE 3
PHASE 1
PHASE 2 CELL A
PHASE 2 CELL B
N
0 100 200 300
SCALE IN FEET
SHEET TITLE: 2021 LANDFILL VOLUME
PERMIT 520 REMAINING LANDFILL LIFE
FREDERICK COUNTY DEPARTMENT OF PUBLIC WORKS 107 N. KENT STREET WINCESTER, VIRGINIA 22601
SCS ENGINEERS
DATE: MARCH 2022
SCALE: 1" = 100'
DRAWING NO 1 of 2

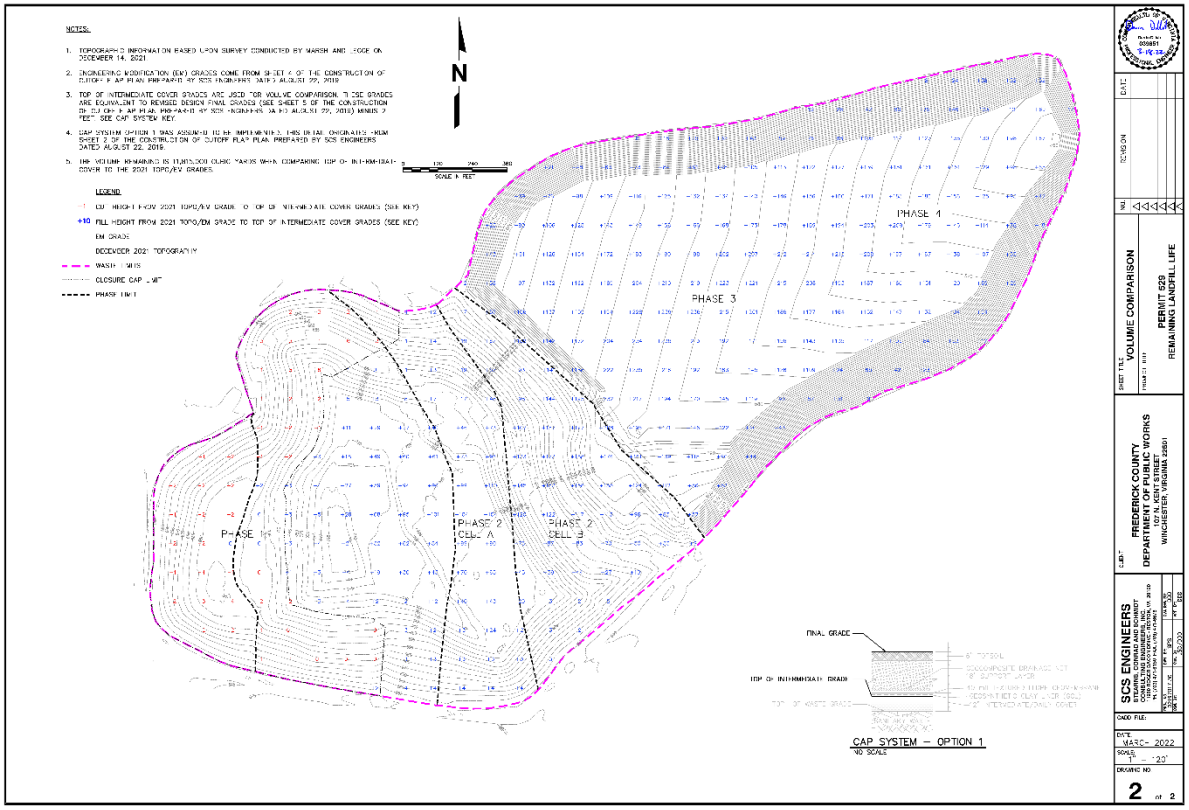

NOTES:
1. TOPOGRAPHIC INFORMATION BASED UPON SURVEY CONDUCTED BY MARSH AND EDGE ON DECEMBER 14, 2021.
2. ENGINEERING MODIFICATION (EM) GRADES COME FROM SHEET 4 OF THE CONSTRUCTION OF CUTOFF PLAN PREPARED BY SCS ENGINEERS DATED AUGUST 29, 2018.
3. TOP OF INTERMEDIATE COVER GRADES ARE USED FOR VOLUME COMPARISON. THESE GRADES ARE EQUIVALENT TO REVISED DESIGN FINAL GRADES (SEE SHEET 5 OF THE CONSTRUCTION PLANS ON CUTOFF PLAN PREPARED BY SCS ENGINEERS DATED AUGUST 29, 2018) MINUS 2 FEET. SEE CAP SYSTEM KEY.
4. CAP SYSTEM OPTION 1 WAS ASSUMED TO BE IMPLEMENTED. THIS GRADE ORIGINATES FROM SHEET 2 OF THE CONSTRUCTION OF CUTOFF PLAN PLAN PREPARED BY SCS ENGINEERS DATED AUGUST 22, 2016.
5. THE VOLUME REMAINING IS 11,810,000 CUBIC YARDS WHEN COMPARING TOP OF INTERMEDIATE COVER TO THE 2021 TOPO/EM GRADES.
LEGEND
CUT HEIGHT FROM 2021 TOPO/EM GRADE TO TOP OF INTERMEDIATE COVER GRADES (SEE KEY)
+10 FILL HEIGHT FROM 2021 TOPO/EM GRADE TO TOP OF INTERMEDIATE COVER GRADES (SEE KEY)
EM GRADE
DECEMBER 2021 TOPOGRAPHY
WASTE LIMITS
CLOSURE CAP LIMIT
PHASE LIMIT
N
SCALE IN FEET
PHASE 1
PHASE 3
PHASE 2 CELL A
PHASE 2 CELL B
FINAL GRADE
TOP OF INTERMEDIATE GRADE
CAP SYSTEM – OPTION 1
NO SCALE
SHEET TITLE: VOLUME COMPARISON
PERMIT 520 REMAINING LANDFILL LIFE
FREDERICK COUNTY DEPARTMENT OF PUBLIC WORKS 107 N. KENT STREET WINCESTER, VIRGINIA 22601
SCS ENGINEERS
DATE: MARCH 2022
SCALE: 1" = 100'
DRAWING NO 2 of 2

Table 1. Remaining Landfill Life

Year Ending	Actual Tons Landfilled	Volume Landfilled (cy)	Projected MSW Volume Landfilled (cy) assuming increase of	Projected CDD Volume (cy) to P529 after P591 Closes	Remaining Capacity (cy)	Year Count	Remaining Landfill Life (years)	CDD	Notes
			3,300				32		
2011	115,094								
2012	105,579								
2013	108,523								
2014	112,053								
2015	115,585								
2016	116,022								
2017	121,801								
2018	126,515								
2019	118,443								From trendline slope, increase from 2020 to 2021 is 2 percent. This equates to about a 3,300 cy increase.
2020	134,920	202,000							Volume Landfilled from aerial topographies; Remaining Capacity from comparing permitted TOI contours to aerial topography
2021	131,420	125,000			11,815,000		32		
2022			166,800		11,648,200	1	31		
2023			170,100		11,478,100	1	30		
2024			173,400		11,304,700	1	29		
2025			176,700		11,128,000	1	28		
2026			180,000		10,948,000	1	27		
2027			183,300		10,764,700	1	26		
2028			186,600		10,578,100	1	25		
2029			189,900		10,388,200	1	24		
2030			193,200		10,195,000	1	23		
2031			196,500		9,998,500	1	22		
2032			199,800		9,798,700	1	21		
2033			203,100		9,595,600	1	20		
2034			206,400		9,389,200	1	19		
2035			209,700		9,179,500	1	18		
2036			213,000		8,966,500	1	17		
2037			216,300		8,750,200	1	16		P591 closes; CDD waste goes to P529
2038			219,600	215,900	8,314,700	1	15		
2039			222,900	235,100	7,856,700	1	14		
2040			226,200	241,900	7,388,600	1	13		
2041			229,500	248,700	6,910,400	1	12		
2042			232,800	255,500	6,422,100	1	11		
2043			236,100	262,300	5,923,700	1	10		
2044			239,400	269,100	5,415,200	1	9		
2045			242,700	275,900	4,896,600	1	8		
2046			246,000	282,700	4,367,900	1	7		
2047			249,300	289,500	3,829,100	1	6		
2048			252,600	296,300	3,280,200	1	5		
2049			255,900	303,100	2,721,200	1	4		

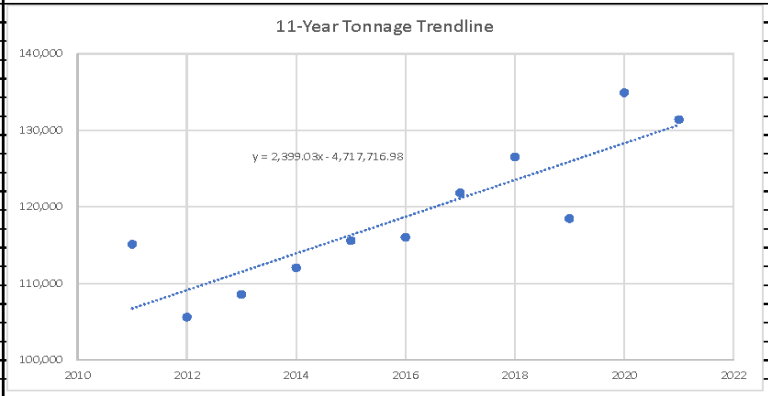


Table 1. Remaining Landfill Life

2050			259,200	309,900	2,152,100	1	3		
2051			262,500	316,700	1,572,900	1	2		
2052			265,800	323,500	983,600	1	1		
2053			269,100	330,300	384,200	1	0		
2054			272,400	337,100	(225,300)	0	-1		
2055			275,700	343,900	(844,900)	0	-2		
2056			279,000	350,700	(1,474,600)	0	-3		
2057			282,300	357,500	(2,114,400)	0	-4		
2058			285,600	364,300	(2,764,300)	0	-5		
2059			288,900	371,100	(3,424,300)	0	-6		
2060			292,200	377,900	(4,094,400)	0	-7		
2061			295,500	384,700	(4,774,600)	0	-8		
2062			298,800	391,500	(5,464,900)	0	-9		
2063			302,100	398,300	(6,165,300)	0	-10		Facility permit limit is 1,600 tpd or 800,000 cy per year assuming 1,200 lb/cy and 300 days per year

SCS ENGINEERS Environmental Consultants & Contractors

April 5, 2022 **via email**
File No. 02201010.02

Jenghwa Lyang, Ph.D., P.E.
Solid Waste Permit Writer
Virginia Department of Environmental Quality
Valley Regional Office
4411 Early Road
PO Box 3000
Harrisonburg, Virginia 22801

Subject: Estimated Remaining Permitted Capacity Evaluation
Shenandoah County Landfill Permit #469

Dear Dr. Lyang:

On behalf of Shenandoah County, SCS Engineers is pleased to submit the estimated remaining permitted capacity evaluation for the Shenandoah County #469 landfill. We have estimated the remaining capacity in Phases 1 through 7 of the Shenandoah County Landfill using recent topographic data and applying our *Remaining Capacity Method (RCM)*. This letter summarizes the evaluation and results.

PHASES 1 THROUGH 7 FILLING AND CAPACITY

Waste disposal operations in Phases 1 through 4 of the operating landfill began in 2003 with the completion of Phase 1 and a Part of Phase 2 in May of 2003. Phase 1 covers a footprint of 6.56 acres, Phase 2 covers an area of 6.57 acres, Phases 3 covers an area of 5.56 acres and Phase 4 covers an area of 5.51 acres. Waste filling is actively occurring in Phase 4, which received a certificate-to-operate from the Virginia DEQ in May 2021. Based on the Part B Permit, the total landfill disposal capacity is estimated to be 4,848,000 cubic yards, which includes Phases 1 through 7. Future cells 5, 6, and 7 provide an approximate total of 1,699,261 cubic yards of capacity.

WASTE FILLING FROM JANUARY 2020 TO OCTOBER 2021

On October 10, 2021 an aerial drone survey of the landfill was completed. **Figure 1** show a comparison of the January 2020 topography to the October 2021 topography. The fill tick marks, indicated with a "+" sign, show where waste or other fill material was placed since January 2020. Areas with a "-" sign show where the grades are lower than the January 2020 topography, which is most likely due to waste settlement. Based on the comparison of the two surfaces, approximately 152,047 cubic yards of waste capacity was consumed through landfilling between the two surveys, but this volume difference does not necessarily equal the amount of material landfilled since it does not account for on-going settlement of the waste during that time.

OCTOBER 2021 REMAINING CAPACITY

Figure 2 shows a comparison of the October 10, 2021 topography to the top of waste grades (currently permitted Phase 1-7 closure plan with 3.5 feet of cap thickness over the fill area subtracted to account for the final cover volume). The "+" fill tick marks indicate where there is

airspace remaining to be filled to reach closure grades. We estimate that Phases 1 through 4 have 1,767,799 cubic yards of remaining permitted capacity. The remaining permitted capacity in the yet-to-be constructed Phases 5-7 is estimated to be 1,699,261 cubic yards as noted above. This was determined by comparing Phase 5-7 Engineering Modification Grades to the estimated top of waste grades. Including Phases 5-7, the site-wide remaining permitted capacity is approximately 3,467,060 cubic yards. The remaining permitted capacity estimates consider (deduct) the volume of waste in areas that are currently above the permitted grades (overfill), which is estimated at approximately 18,411 CY. We expect that settlement from on-going waste degradation will bring these areas closer to, or below, permitted grades prior to commencing final closure.

REMAINING CAPACITY METHOD

The remaining capacity and lifespan of the landfill were calculated using a method developed by SCS known as the "Remaining Capacity Method", or simply as RCM. The RCM method involves plotting waste tonnage disposed (from weigh scale data) against remaining airspace taken from topographic mapping of the site for at least three timeframes.

Table 1 below summarizes the historical disposal tonnages, remaining permitted capacity, volume used, and airspace utilization factors.

Table 1. Shenandoah County Landfill Phases 1-7

Survey Date	Per Year			Cumulative		
	Volume Used Between Air Surveys (cy)	Waste Disposed Between Air Surveys (tons)	Airspace Utilization Factor Between Air Surveys (pcy)	Remaining Permitted Capacity (cy)[1]	Waste Disposed (tons)	Airspace Utilization Factor (pcy)
July 2017	1,090,798	652,679	1,197	3,757,202	652,679	
January 1, 2020	146,945	116,620	1,587	3,610,257	769,299	1,587
October 10, 2021	152,047	92,369	1,215	**3,458,210**	861,668	1,398

[1]The volumes remaining were derived from comparing each aerial topography to the final closure plan grades less the cap thickness of 3.5 feet.

The RCM plot of cumulative tonnage disposed and remaining airspace data was used to generate a best-fit line, or volume/tonnage trend line. The slope of the line is the "effective density" being achieved in Phase 1-4, which is estimated at approximately 1,215 pounds per cubic yard.

Using this best-fit linear relationship, it was calculated that the landfill has approximately 2,100,862 tons of remaining capacity and at a rate of approximately 70,000 tons per year, the remaining permitted life of the Shenandoah County Landfill is estimated to be 30.01 years. This calculation is as follows:

$$Remaining\ Lifespan = \frac{2{,}100{,}862\ tons}{70{,}000 \frac{tons}{year}} = 30.01\ years$$

Therefore, we estimate the Permit #469 landfill will be filled by October 2051, assuming an average annual waste disposal of 70,000 tons.

CHECK USING DENSITY-BASED CALCULATION METHOD

The RCM approach was manually checked using a density-based computation method using an estimated waste density. Using a conservative average annual flow rate of 70,000 tons per year was assumed. The annual waste density was taken as the Per Year Airspace Utilization Factor between the last two surveys, which is equal to about 1,215 pounds per cubic yard. The volume of daily cover is already factored into the effective density value and does not have to be deducted from the available airspace. By direct calculation, the remaining permitted life in Phases 1 through 7 is estimated to be as follows:

$$Remaining\ Lifespan = \frac{(3{,}458{,}210\ yd^3) * \left(1215 \frac{lbs}{yd^3}\right) * \left(\frac{1\ ton}{2{,}000\ lbs}\right)}{70{,}000 \frac{tons}{year}} = 30.01\ years$$

CONCLUSIONS

Based on the information above, it is concluded that Phase 1-7 has approximately 30.01 years of remaining permitted life at an average disposal rate of 70,000 tons per year and will reach capacity in October 2052, give or take several months.

For Solid Waste Information and Assessment (SWIA) Form DEQ 50-25 reporting purposes, the remaining permitted capacity is 3,548,210 cubic yards and 30.01 years based on an average annual waste disposal rate of 70,000 tons per year.

Should the waste flow rate increase or decrease, or the waste utilization rate increase or decrease to due changes in compaction effectiveness, waste types, daily cover usage or other factors, the lifespan will change accordingly. We recommend that the County continue to obtain annual flyovers so that this analysis can continue to be updated and to institute a limited settlement monitoring program in areas of overfilling described above to assess the need for waste regrading.

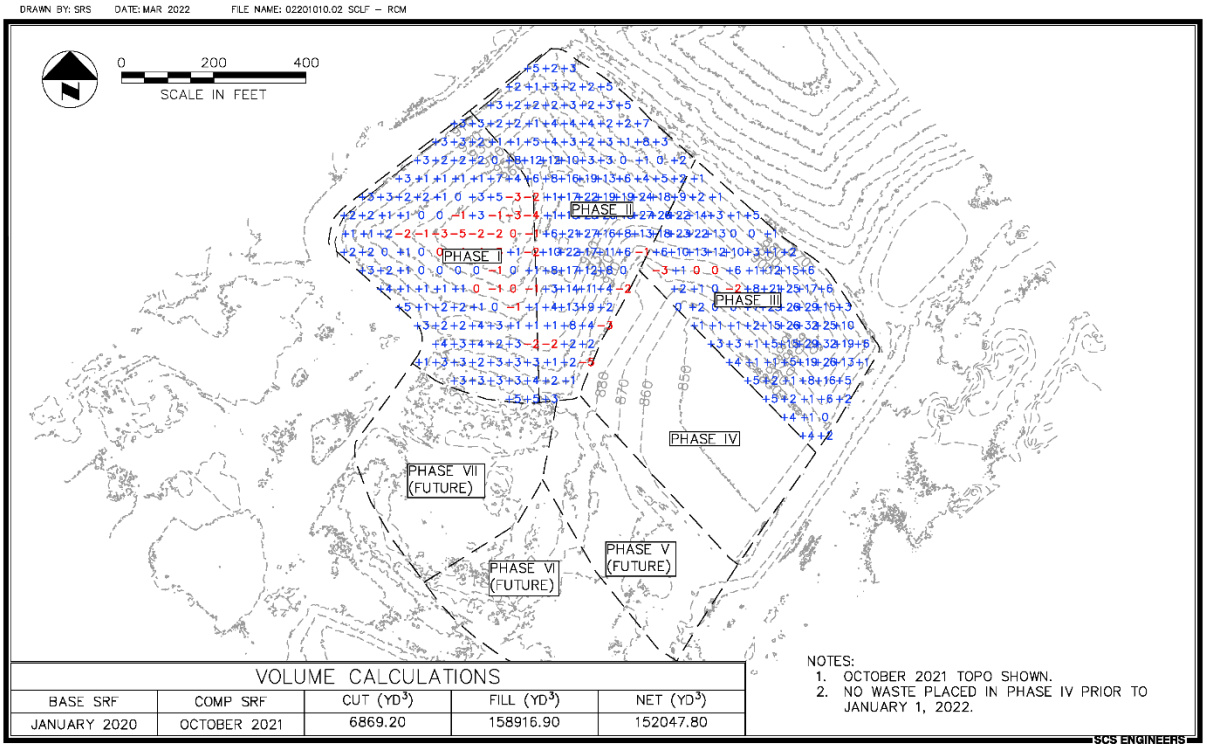
SCS Engineers has worked with the County to prepare and implement a test pitting program focused on areas of overfill along the toe of the landfill to gather more information about its source. The information will be used to determine whether overfill areas are either waste or soil fill.

If you have any questions on this report, please do not hesitate to contact either of the undersigned at 703-471-6150.

Sincerely,

Sean Sullivan, P.E.

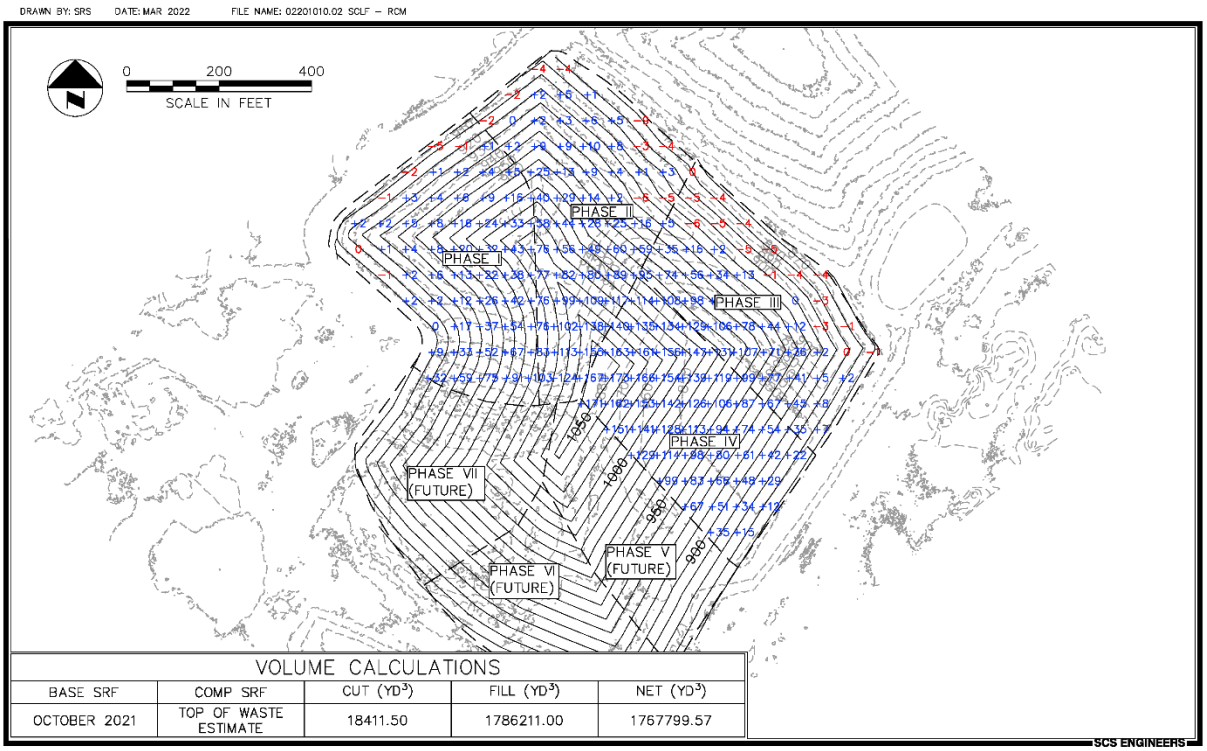
Ken Armentrout, P.E.



VOLUME CALCULATIONS

BASE SRF	COMP SRF	CUT (YD^3)	FILL (YD^3)	NET (YD^3)
JANUARY 2020	OCTOBER 2021	6869.20	158916.90	152047.80

FIGURE 1 - JANUARY 2020 TOPO VS OCTOBER 2021 TOPO



VOLUME CALCULATIONS

BASE SRF	COMP SRF	CUT (YD^3)	FILL (YD^3)	NET (YD^3)
OCTOBER 2021	TOP OF WASTE ESTIMATE	18411.50	1786211.00	1767799.57

FIGURE 2 - OCTOBER 2021 TOPO VS PERMITTED TOP OF WASTE GRADES

Appendix C: List of Local Haulers

RESIDENTIAL CURBSIDE

ACE Trash Removal
4 Weems Lane #320
Winchester, VA 22601
(540) 755-1455

Allied Waste Services -- Republic Services
CARTS - Recycling Services
Dean Burris, manager
403 Lenoir Drive
Winchester, VA 22603
(540) 667-7474

Apple Valley Waste Management
Recycling Services
1391 Senseny Road
Winchester, VA 22602
(540) 662-1603

D.F.I.
(540) 533-6337

Evolution Disposal
Refuse and Recycling
Victor Garcia, owner
1830 Roberts Street
Winchester, VA 22601
(703) 431-4851

Family Run Trash Service
Robert and Shirley LaFollette, owners
1056 E. Cork Street
Winchester, VA 22601
(540) 723-6697

Five Star Landscaping
Recycling Services
Tom Fink, owner
2813 Saratoga Drive
Winchester, VA 22602
(540) 773-3391

Hulk Haulers
(540) 860-0276

JaxHaul Trash Removal
(540) 664-0560

Panhandle Dumpsters
CARTS
142 N. Queen St.
Martinsburg, WV 25401
833-DUMP-STR
833-386-7787

Skyline Trash Services
(540) 636-1711

RWB Disposal
Refuse and Recycling
CARTS
Berryville, VA 22611
(540) 837-5593

Waste Management of West Virginia
CARTS
25 Bowling Lane
Martinsburg, WV 25401
(800) 593-9529

Valley Trash Service, LLC
(540) 987-0663

BULK ITEMS

304 Site Services
(304) 616-2685

ACE Trash Removal
4 Weems Lane #320
Winchester, VA 22601
(540) 755-1455

Allied Waste Services -- Republic Services
(540) 667-7474

BAC Dumpsters
(540) 724-6032

D&M Container Service
(540) 869-3899

Evolution Disposal
(703) 431-4851

JusJunk
(540) 587-5865

Haulin Trash LLC
(703) 995-2757
(571) 334-9494

Hulk Haulers
(540) 860-0276

Iron Bull Hauling
(540) 327-9805

Panhandle Dumpsters
833-DUMP-STR
833-386-7787

Ridgerunner Container Service
(540) 662-2005

Waste Management of Shenandoah Valley
(800) 593-9529

COMMERCIAL FRONTEND

Allied Waste Services -- Republic Services
(540) 667-7474

BAC Dumpsters
(540) 724-6032

Panhandle Dumpsters
833-DUMP-STR
833-386-7787

Ridgerunner Container Service
(540) 662-2005

BULK CLEANUP

Carried Away Junk Removal
(540) 877-5983

College Hunks Hauling Junk and Moving
1-888-689-5999
(540) 300-9744

Evolution Disposal
(703) 431-4851

Five Star Landscaping
(540) 773-3391

Heishman's Ace Hauling
(540) 869-3466

Junk Monster
(540) 550-5865

Valley Trash Service, LLC
(540) 987-0663

Appendix D: NSVRC Board of Commissioners

Northern Shenandoah Valley Regional Commission
400 Kendrick Lane, Ste. E
Front Royal Va. 22630
(540) 636-8800

Chair	Dennis M. Morris	Shenandoah County
Vice Chairman	Eric Lawrence	Frederick County
Secretary/Treasurer	Brandon Stidham	Clarke County
	Elected	**Non-Elected**
Berryville	Mayor Harry Lee Arnold, Jr. 111 West Main Street Berryville, VA 22611 540-539-5201 mayorarnold@berryvilleva.gov Term Expires: 6/30/2024	Christy Dunkle, Dir. Comm. Dev (Alt) 101 Chalmers Court Berryville, VA 22611 540-955-1099 planner@berryvilleva.gov
Clarke County	Bev McKay Board of Supervisors P.O. Box 1 Millwood, VA 22646 540-837-1331 bmckay@clarkecounty.gov Term Expires: 12/31/2023	Brandon Stidham* Planning Administrator 101 Chalmers Ct., Ste. B Berryville, VA 22611 540-955-5130 bstidham@clarkecounty.gov Term Expires: 12/31/2025
Frederick County	Blaine Dunn Board of Supervisors 115 Bedford Dr. Winchester, VA 22602 540-665-8006 bdunn@fcva.us Term Expires: 12/31/2025	Jay Tibbs County Administrator 107 N. Kent St. Winchester, VA 22601 540-665-5600 jtibbs@fcva.us Term Expires: 9/30/2024
	Shawn Graber Board of Supervisors PO Box 345 Middletown, VA 22645 540-607-0140 Shawn.graber@fcva.us Term Expires: 12/31/2023	Eric Lawrence* Sanitary Authority Director PO Box 1877 Winchester, VA 22604 540-868-1061 elawrence@fcsa-water.com Term Expires: 9/30/2024
		Wyatt Pearson (alt.) Planning Director, Frederick County 540-665-5651 Wyatt.pearson@fcva.us Term Expires: 9/30/2024

Front Royal	Letasha Thompson Council Member PO Box 1560 Front Royal, VA 22630 540-635-8007 thompson@frontroyalva.com Term Expires: 6/30/2023	Lauren Kopishke (alt.) Acting Planning Director P.O. Box 1560 Front Royal, VA 22630 cbrock@frontroyalva.com Term Expires: 6/30/2023
Luray	Ron Vickers Council Member PO Box 629 Luray, VA 22835 540-860-2807 vickersr@fcpsk12.net Term Expires: 12/31/2024	
Middletown	Carolyn Aliff Council Member 7875 Church St. Middletown, VA 22645 540-868-8070 califf@nxl.com Term Expires: 12/31/2024	
Page County	Keith Weakley Chairman of BOS 124 Meadow Lane Stanley, VA 22851 703-298-8428 kweakley@pagecounty.virginia.gov Term Expires: 12/31/2025	Morgan Phenix Board of Supervisors 432 Mountain View Rd. Stanley, VA 22851 540-742-2946 phenix@centurylink.net Term Expires: 12/31/2025
Shenandoah County	Steve Baker **District 2** Board of Supervisors 1341 Conicville Road. Mt. Jackson, VA 22842 540-477-3550 District2@shenandoahcountyva.us Term Expires: 12/31/2022	**Vacant (replacement Joe Lehnen)**
	Dennis Morris* Board of Supervisors 1685 Brook Creek Rd. Toms Brook, VA 22660 540-436-9149 dmorris@shentel.net Term Expires: 12/31/2025	Conrad Helsley 157 Ruth Ct. Strasburg, VA 22657 540-465-4145 chelsley@shentel.net Term Expires: 12/31/2023

Stephens City	Linden Fravel PO Box 250 Council Member Stephens City, VA 22655 540-869-4378 Term Expires: 12/31/2022	Mike Majher (Alternate) Town Manager PO Box 250 Stephens City, VA 22655 540-869-3087 mmajher@stephenscityva.us
Strasburg	Ashleigh Kimmons Council Member 286 Sharpe Street Strasburg, VA 22657 919-744-9508 akimmons@strasburgva.com Term Expires: 6/30/2022	
Warren County	Walt Mabe Board of Supervisors 224 Manassas Avenue . Front Royal, VA 22630 540-692-5801 wmabe@warrencountyva.net Term Expires: 12/31/2023 Delores Oates Board of Supervisors 170 Douglas Dr. Middletown, VA 22645 540-635-6205 doates@warrencountyva.net Term Expires: 12/31/2023	John E. Vance* 575 Totten Lane Front Royal, VA 22630 540-636-3540 j.e.vance@comcast.net Term Expires: 12/31/2024
Winchester	Kim Herbstritt 304 Parkway St. Winchester, VA 22601 540-509-0992 Kim.herbstritt@winchesterva.gov Term Expires: 12/31/2022 Evan H. Clark Council Member 529 Battle Ave. Winchester, VA 22601 540-722-2087 – Need a good number Evanclark1@yahoo.com Term Expires: 12/31/2022	Timothy A. Youmans* Planning Director 15 N. Cameron St. Winchester, VA 22601 540-667-1815 timothy.youmans@winchesterva.gov

Woodstock	Jacqueline Lambert Council Member PO Box 186 Woodstock, VA 22664 O: 540-459-3765/H: 540-459-4592 gandc@shentel.net Term Expires: 6/30/2024	Aaron Grisdale (Alternate) Town Manager 135 N. Main Street Woodstock, VA 22664 540-459-3621 aaron.grisdale@townofwoodstockva.gov