National Pollutant Discharge Elimination System
Municipal Separate Storm Sewer System
Permit No. 11-DP-3313 MD0068276
Permit Term: October 9, 2015 to October 8, 2020

Eighth Annual Report
Fiscal Year 2023

Submitted on November 1, 2023

to:

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MDOT
MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

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Introduction

The Maryland State Highway Administration (SHA) prepared this annual progress report to the Maryland Department of Environment (MDE) for State fiscal year 2023 (FY23) from July 1, 2022 to June 30, 2023 in accordance with conditions in Part V.A.1 of National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) discharge permit number 11-DP-3313 MD0068276 (referred to hereafter as the "MS4 Permit"). Geographic Information System (GIS) data is provided with this FY23 MS4 annual report ("MS4 Geodatabase – Part 1") in accordance with conditions in Part V.A.2 of the MS4 Permit and with the MDE November 2021 draft supplement to its *NPDES MS4 Geodatabase Design and User's Guide* (Version 1.2).

Two supplemental geodatabases are provided with this FY23 MS4 annual report. The first ("MS4 Geodatabase – Part 2") reports SHA implementation of inlet cleaning and street sweeping Best Management Practices (BMPs) and the second ("NPDES 2023 Geodatabase") provides the inventory of SHA storm drain infrastructure.

MDE supplied SHA comments, dated May 10, 2023, related to the FY22 MS4 annual report and data submittal. In accordance with conditions in Part V.A.3 of the MS4 Permit, SHA responses addressing the May 10, 2023 MDE comments are submitted in tandem to this FY23 MS4 annual report.

Permit Administration and Legal Authority

The MS4 Permit was administered during FY23 by the SHA Office of Environmental Design (OED) with Ryan Cole, Water Programs Division Chief, serving as the MS4 Permit Manager and liaison to MDE. In accordance with conditions in Part IV.A of the MS4 Permit, SHA has provided contact information in the *PermitInfo* table of the MS4 Geodatabase – Part 1 and an updated organizational chart detailing personnel and groups responsible for major NPDES program tasks in **Appendix A**.

In accordance with conditions in Part IV.B of the MS4 Permit relative to 40 Code of Federal Regulations 122.26, SHA maintained adequate legal authority for compliance with MS4 Permit conditions during the FY23 reporting period and carried out inspections, surveillance, and monitoring procedures necessary to demonstrate compliance with MS4 Permit conditions. SHA has provided associated information in **Appendices B and C**.

Status of Implementing the Stormwater Management Program

In the following subsections, SHA has provided the status of implementing the components of its stormwater management (SWM) program that are established as MS4 Permit conditions. SWM program components reported in this FY23 MS4 annual report in accordance with conditions in Part V.A.1.a of the MS4 Permit include:

- Source Identification
- Stormwater Management
- Erosion and Sediment Control
- Illicit Discharge Detection and Elimination
- Trash and Litter
- Property Management and Maintenance
- Public Education
- Watershed Assessment
- Restoration Plans
- TMDL Compliance
- Assessment of Controls
- Program Funding

Source Identification

During FY23, the SHA Office of Highway Development (OHD) Highway Hydraulics Division (HHD) continued to maintain the inventory of SHA owned storm drain infrastructure (a.k.a., the stormwater systems inventory) that includes conveyances, major outfalls, inlets, and associated drainage areas in accordance with conditions in Part IV.C.1 of the MS4 Permit. HHD continued to confirm or update the stormwater systems inventory information during permit reviews, as-built document reviews, incidental drainage investigations, SWM facility inspections, outfall inspections, and video pipe inspections. SHA has reported information for storm drain infrastructure other than outfalls and SWM facilities (a.k.a., upland BMPs) in the supplemental NPDES 2023 Geodatabase provided with this FY23 MS4 annual report. SHA has provided outfall structure information in the *Outfall* and *Outfall Drainage Area* feature classes, and upland BMP information in the *BMP* and *BMP Drainage Area* feature classes, of the MS4 Geodatabase – Part 1. 154 new upland BMP records are reported for SWM facilities built in FY23.

SHA continued innovation of new technologies and strategies in FY23 to improve stormwater systems inventory data. An electronic application was developed to facilitate collection of stormwater systems inventory information in the field by SHA staff and contractors. Corresponding training materials were developed for use beginning in FY24. The Outfall Inspection tool referenced in the *Source Identification* section of the FY21 MS4 annual report was piloted in FY23 for inspection of 414 outfalls and testing will continue in FY24. A 'video pipe inspection' program was also piloted during FY23 and inspected 34 pipes for failures in joints, invert corrosion, and other potential damage, utilizing remote controlled 'crawlers' with attached video cameras. The crawlers can more efficiently access difficult to reach drainage infrastructure types and improve worker safety by eliminating the need for humans to access such places for inspections.

In accordance with conditions in Part IV.C.2 of the MS4 Permit, SHA has identified industrial sites within SHA right-of-way (ROW) that have the potential to contribute significant pollutants to SHA storm drain systems. These include SHA-owned facilities covered under the NPDES General Permit (number 20-SW) for Discharges from Stormwater Associated with Industrial Activities but also non-permitted facilities requested by MDE, such as salt storage areas, parking lots, rest areas, and other highly trafficked or material storage areas. The inventory of non-permitted industrial sites was evaluated and verified during FY23. No new industrial sites completed construction in FY23 but two facilities were removed by a redevelopment project. There are no commercial sites located on SHA properties. SHA has provided location and other information for NPDES 20-SW permitted and non-permitted industrial sites in the *Municipal Facilities* feature class of the MS4 Geodatabase – Part 1.

As described in Section C.3 of the FY19 MS4 annual report, SHA revised baseline analysis submitted to MDE in June 2018 that included GIS data for impervious surfaces owned by SHA in its MS4 permitted areas. MDE found it acceptable that this information is not resubmitted, beginning with the FY19 MS4 annual report, so SHA has excluded it from subsequent MS4 annual report submittals. SHA has updated the total impervious acres restored during the MS4 Permit term and the total impervious acres planned for restoration activities in the *Impervious Surface* table of the MS4 Geodatabase – Part 1.

Monitoring site locations established to meet conditions described in Part IV.F of the MS4 Permit did not change during FY23. SHA has provided information for its monitoring sites in the *Monitoring Site* and *Monitoring Drainage Area* feature classes of the MS4 Geodatabase – Part 1.

Information for SHA water quality improvement projects proposed, in construction, or completed through June 30, 2023 is provided in the *BMP*, *AltBMPLine*, and *AltBMPPoly* feature classes and the *Stream Restoration Protocols* table of the MS4 Geodatabase – Part 1. SHA progressed design for 4 new water quality improvement projects during FY23 and added corresponding records to the MS4 Geodatabase – Part 1. Information for inlet cleaning and street sweeping BMPs is provided in the *AltBMPPoly* feature class of the MS4 Geodatabase – Part 2.

Stormwater Management

SHA continued to comply with State and federal laws and regulations in FY23 regarding SWM and MDE permit requirements. SHA also continued to implement the practices established in the 2000 Maryland Stormwater Design Manual and remains in compliance with the SWM Act of 2007 and the revised Chapter 5 of the 2000 Maryland Stormwater Design Manual by implementing environmental site design to the maximum extent practicable (MEP) for all new development and redevelopment projects.

The OHD Plan Review Division (PRD) is the delegated approving authority for both erosion and sediment control (ESC) and SWM plans for all SHA projects. PRD submitted progress reports to MDE during FY23 in accordance with the July 8th, 2014 Memorandum of Understanding between SHA and MDE (designated SHA as an approving authority for ESC and SWM). PRD continues to coordinate with MDE to update the *PRD Sediment and Stormwater Guidelines and Procedures* as necessary. Additional information can be found in the SHA *Annual Report for Delegation of Sediment and Stormwater Approval Authority* submitted to MDE on October 6, 2023.

SHA maintained SWM and construction inspection information during FY23 utilizing the processes described in the *Stormwater Management* section of the FY19 MS4 annual report. In accordance with conditions in Part IV.B of the MS4 Permit, a summary of construction inspections, non-compliance findings, and the actions taken by SHA Districts is referenced in Section 1.11 of, and is provided as electronic data with, the SHA *Annual Report for Delegation of Sediment and Stormwater Approval Authority* that was submitted to MDE on October 6, 2023. Information for the SHA SWM program; including required documentation in accordance with conditions in Parts IV.D.1.b, IV.D.1.c, and IV.D.1.d of the MS4 Permit; is provided in the *SWM* table of MS4 Geodatabase – Part 1.

During the FY23 reporting period, SHA conducted 4,767 preventative maintenance inspections of SWM facilities statewide in accordance with COMAR 26.17.02. Of those, 2,242 inspections were completed in MS4 permitted areas in accordance with conditions in Part IV.D.1.d of the MS4 Permit. SHA continued to use small Unmanned Aerial Systems (sUAS) for efficient and safer inspection of linear SWM facilities (e.g., grass swales) throughout FY23. With this approach, field crews were able to perform many inspections on a given workday under improved safety conditions due to less time spent in high speed/volume traffic areas. During FY23, 493 inspections were completed via sUAS with multiple instances where a single inspection crew completed more than 40 inspections in a single workday. The guidance developed during FY22 for performing inspections via sUAS technology was refined during FY23 based on feedback from inspection crews. SHA also made improvements to the underground facility inspection process by streamlining and updating the corresponding inspection forms to more efficiently capture potential issues unique to underground facilities. SHA inspected 44 underground facilities in FY23 using the new forms.

FY23 inspection activities addressed all SWM facilities due for a preventative maintenance inspection in FY23 with the exception of 3 facilities where SHA inspection crews attempted but were unable to access the site due to vegetation. These sites have been assigned a failing rating for their FY23 inspection but are prioritized for clearing and grubbing activities and another inspection during FY24. Due to the large number of inspections completed over the past two fiscal years, few SWM facilities are due for inspection in FY24. SHA plans to advance the inspection schedule for some SWM facilities, otherwise not yet due for an inspection, into FY24 in order to begin balancing, over time, the number of inspections due each fiscal year. SWM facilities will have their inspection schedules advanced to consolidate them by area/corridor over time so SWM facilities in close proximity to one another receive their respective, triennial, preventative maintenance inspection on the same FY. Performing inspections in tighter groupings improves efficiency by reducing travel time between facilities for inspection crews and by increasing the number of continuous inspection corridors that can utilize the SHA sUAS inspection protocols. SHA has provided the inspection program information in the *BMPInspections* and *AltBMPInspections* tables of the MS4 Geodatabase – Part 1.

During FY23, SHA performed 154 initial inspections statewide for SWM facilities. Of those, 125 initial inspections were performed in MS4 permitted areas. Initial inspections were performed using processes described in the *Stormwater Management* section of the FY20 and FY21 MS4 annual reports and are reported in the *SWM* table of the MS4 Geodatabase – Part 1. During the FY23 reporting period, 14 initial inspections were flagged for follow-up activities that can include additional inspections or repair, remediation, and/or retrofit/reconstruction activities. SWM facilities that were flagged for follow-up activities by FY22 initial inspections were determined to be functioning as designed during FY23.

SHA continued to perform routine maintenance on SWM facilities during FY23. 1,912 roadside swales received the highest possible rating from both their last and recent triennial, preventative maintenance inspections as a result of routine mowing and litter removal activities implemented by SHA District maintenance staff. In an effort to improve SHA capacity to maintain alternative surface SWM facilities, such as permeable pavements, the SHA Office of Maintenance (OOM) began a process during FY23 to assess and test sweeping and vacuuming equipment for their relative efficacy. HHD continued working with the SHA Asset Management Office (AMO) during FY23 to identify and fund "state-of-good-repair" projects associated with preventative maintenance milestones established for long term management of SHA storm drain infrastructure assets. The interoffice team presented the most critical projects within each SHA District to both the corresponding District Office and the SHA Administrator's Office during FY23. District-specific guidance developed by SHA for routine maintenance of SWM facilities can be found online at the following SHA webpage:

https://www.roads.maryland.gov/mdotsha/pages/Index.aspx?PageId=363

SHA guidelines for SWM rehabilitation were updated during FY23 to incorporate current maintenance action ratings (used to sort facilities by level of maintenance needed), rehabilitation templates (facilitate consistency between designers developing rehabilitation work orders), and common problems affecting functionality of SWM facilities. In accordance with the 69 SHA 'maintenance enforcements' reported for non-functioning SWM facilities in the *Stormwater Management* section of the FY22 MS4 annual report, SHA contracted construction for 9 SWM facility rehabilitations and initiated or continued rehabilitation/retrofit design activities for the remaining 60 SWM facilities during FY23. 8 of the 9 contracted SWM facility rehabilitations completed construction and their associated rehabilitation follow-up inspections during the reporting period. Construction was delayed for the 9th SWM facility rehabilitation due to permitting challenges. SHA performed an additional 4 rehabilitation follow-up inspections during FY23 for SWM facilities that completed construction during previous fiscal years.

In the *SWM* table of the MS4 Geodatabase – Part 1, SHA has reported 67 'maintenance enforcements' during FY23 for non-functioning SWM facilities in the MS4 permitted areas. Captured in this total are 57 SWM facilities added to rehabilitation/retrofit design contracts in FY23 and planned for construction in FY24 as well as 10 SWM facilities to be contracted for rehabilitation/retrofit design during FY24. During the current MS4 Permit term, a total of 59 SWM facilities in the MS4 permitted areas have been rehabilitated by SHA. At the end of FY23, 222 SWM facilities in the MS4 permitted areas still required rehabilitation. In accordance with conditions in Part IV.B of the MS4 Permit, SHA has provided a 'resolution schedule' for SWM facility rehabilitations in Appendix B (see **Table IV.D.1.d)**.

SHA launched its "SWMFAC Editor Tool" in FY23 that, among other benefits, helps track SWM facility abandonment and removal applications. During FY23, 32 SWM facilities were identified for removal or abandonment. As SWM facilities are approved for abandonment, any loss of water quality/quantity will be accounted for and mitigated by SHA. For abandonments and removals that are not being accounted as a loss of water quality treatment associated with a new development or redevelopment project, HHD and PRD will review and comment on justifications provided, water quality/quantity losses, and appropriate mitigation requirements.

Erosion and Sediment Control

During the FY23 reporting period, SHA maintained compliance with State and federal laws and regulations for ESC as well as MDE requirements for permitting, including compliance with the General Permit for Stormwater Associated with Construction Activity (NPDES-CA) for projects that disturb at least one acre of land. During FY23, a total of 22 SHA construction projects receiving Notice to Proceed required coverage under an NPDES-CA permit. SHA continued to submit applications for coverage under the NPDES-CA State discharge permit number GP-14 (effective January 1, 2015 and expired December 31, 2019) but also began submitting applications for coverage under the NPDES-CA State discharge permit number 20-CP (issued December 31, 2022; effective April 1, 2023; and expires March 31, 2028) for applicable projects. SHA will apply for coverage under permit number 20-CP for all projects previously approved for coverage under permit number GP-14 that will continue construction activity beyond September 30, 2023. In accordance with conditions in Part IV.D.2.c of the MS4 Permit, SHA has provided the ESC program information in the *Erosion and Sediment Control* table, and the grading permit program information in the *Quarterly Grading Permit* feature class, of the MS4 Geodatabase – Part 1.

In accordance with conditions in Part IV.D.2.b of the MS4 Permit, and in cooperation with the Maryland Transportation Builders and Materials Association, SHA continued to offer updated ESC training and issued 398 ESC (a.k.a., "Yellow Card") certifications and 211 re-certifications during the FY23 reporting period. Responsible Personnel Certification training was administered through the MDE online Responsible Personnel Course. More information regarding ESC certification is available at the following SHA webpage:

https://www.roads.maryland.gov/mdotsha/pages/Index.aspx?PageId=56

Illicit Discharge Detection and Elimination

In accordance with conditions in Part IV.D.3.a of the MS4 Permit, SHA completed 163 Illicit Discharge Detection and Elimination (IDDE) field screenings during FY23. Whenever possible in FY23, SHA selected IDDE screening sites that had the greatest potential for illicit discharge pollution, such as those located in or adjacent to commercial and industrial areas. Sites that drain stormwater from SHA owned facilities not already inspected as a condition of the NPDES 20-SW general permit, such as SHA park-and-rides facilities, were prioritized. SHA assessed the relative distribution of sites screened over the MS4 Permit term and selected FY23 IDDE screening sites from Frederick, Howard, and Baltimore Counties due to the relatively lower concentration of screenings accomplished in those permitted areas.

Additional IDDE investigation and tracking activities were conducted during FY23 for illicit discharge (ID) sites reported as "open" in Appendix C to the FY22 MS4 annual report. There were no incidental reports of IDs during FY23, from either the general public or from SHA staff/contractors working within SHA ROW. As part of its overarching program to respond to illegal discharges, dumping, and spills, SHA coordinated with MDE, surrounding jurisdictions, and property owners during FY23 to address and respond to IDs, spills, and dumping. In accordance with conditions in Parts IV.B, IV.D.3.d, and IV.D.3.e of the MS4 Permit, a summary of outfalls screened and potential IDs, with associated jurisdictional contacts/resolution schedules for each, is provided in **Tables IV.D.3.a and IV.D.3.d** located in Appendix C. In the MS4 Geodatabase – Part 1, SHA has provided the IDDE program information in the *IDDE Screening* table.

In accordance with conditions in Part IV.D.3.b of the MS4 Permit, the OED Environmental Compliance Division (ECD) completed multimedia facility inspections during FY23 at SHA-owned industrial areas identified in accordance with Part IV.C.2 of the MS4 Permit. ECD inspected 32 NPDES 20-SW permitted facilities during the reporting period. 20 of those facilities inspected were located in the MS4 permitted areas. A total of 128 stormwater related findings were generated from statewide inspections at NPDES 20-SW permitted facilities during FY23. Of those findings, 95 were resolved and 33 remained unresolved at the end of FY23. SHA will address unresolved findings during FY24 through continued communication with maintenance managers and additional tracking for confirmation. In accordance with conditions in Part IV.B of the MS4 Permit, a summary of the most recent quarterly inspection for each NPDES 20-SW permitted facility within the MS4 permitted areas is provided in **Table IV.D.3.b** located in Appendix C.

ECD and SHA District maintenance crews collectively performed annual visual surveys at 148 non-permitted industrial areas during FY23. The MDE geodatabase structure does not support reporting annual visual survey information, so SHA has provided a Microsoft Excel workbook with this FY23 MS4 annual to report the date, issues identified, and status of issue resolutions associated with the most recent annual visual survey conducted at each non-permitted facility within the MS4 permitted areas.

Trash and Litter

The SHA 'multi-pronged' approach to trash/litter reduction continued in FY23 supported by SHA employees, contractors, correctional services, the Sponsor-A-Highway (SAH) program and partnerships, and labor donated through Adopt-A-Highway (AAH) volunteers. In accordance with conditions in Part IV.D.4.d of the MS4 Permit, trash/litter removed by SHA trash reduction strategies during FY23 is documented in **Table IV.D.4.d** Implementation of the AAH and SAH programs in FY23 resulted in 126 highway miles adopted and 300 miles sponsored. Relative to FY22, this is a decrease of 5 and 8 miles respectively for the two programs.

In February of FY23, SHA launched "Operation Clean Sweep" to increase roadside mowing, trimming, litter pick-up, and debris pick-up activities statewide. As a result of Operation Clean Sweep, SHA removed significantly more trash and litter during FY23 than was reported for the FY22 compliance period.

In accordance with conditions in Parts IV.D.4.b and V.A.1.d of the MS4 Permit, public education and outreach activities implemented by SHA during FY23 to reduce littering are incorporated into the summary describing public education programs in **Appendix D**. Throughout FY23, SHA provided information related to proper litter/trash disposal and stopping roadside dumping on its “Educational Outreach” webpage located at the following address:

https://www.roads.maryland.gov/mdotsha/pages/index.aspx?PageId=48https://www.mdot.maryland.gov/tso/pages/Index.aspx?PageId=170

Table IV.D.4.d: Trash and Litter Removed During FY23 by SHA Trash Reduction Strategies

Jurisdiction	Truckloads	Conversion to Pounds
Anne Arundel	581	320,911
Baltimore	2,240	1,236,226
Carroll	103	56,657
Cecil	152	84,075
Charles	170	93,713
Frederick	285	157,452
Harford	251	138,403
Howard	672	370,834
Montgomery	597	329,340
Prince George’s	1,281	706,897
Washington	107	59,020
Salisbury*	0*	0*
Totals	**6,439**	**3,553,528**

***** SHA was unable to separate trash/litter removal activities conducted within the City of Salisbury boundary from the countywide data collected for Wicomico County, wherein 67 truckloads (or 37,001 pounds) of trash/litter was removed by SHA during FY23.

Property Management and Maintenance

All SHA sites previously covered under the NPDES general permit number 12-SW for discharges from stormwater associated with industrial activities are now covered under the newly issued permit number 20-SW. During FY23, SHA continued to monitor the need to update Storm Water Pollution Prevention Plans (SWPPPs) and maps following site changes and renovations and continued providing annual SWPPP training to its maintenance personnel. SHA District maintenance facility staff and ECD District Environmental Coordinators implemented inspections during FY23 at all SHA facilities covered under the NPDES 20-SW permit in accordance with applicable SWPPPs.

For each municipal facility within the MS4 permitted areas and covered under the NPDES 20-SW discharge permit, SHA has provided, in **Table IV.D.5.a**, a summary of updates to facility SWPPPs and associated trainings for staff in accordance with conditions in Parts IV.D.5.a and IV.D.5.b.v of the MS4 Permit. SHA employed fewer road maintenance staff statewide during FY23 when compared to preceding fiscal years. This implicitly contributed to SHA reporting fewer staff members attending SWPPP training during the FY23 compliance period. As previously reported, the Thurmont facility remains designated as a "satellite" site of the Frederick maintenance facility. The Thurmont facility is a NPDES 20-SW permitted site and consequently requires an associated SWPPP; however, the staff training is accounted for within the Frederick facility’s staff training totals in Table IV.D.5.a below. In the *Municipal Facilities* feature class of the MS4 Geodatabase – Part 1, SHA has provided information for NPDES 20-SW permitted facilities located in the MS4 permitted areas.

Table IV.D.5.a: Summary of SWPPP Status and Training for SHA Municipal Facilities

District	Maintenance Facility	20 SW Permit Type	Date of Most Recent SWPPP Update (Month YR)	Date of Most Recent SWPPP Training (Month YR)	Number of Individuals Trained
1	Cambridge	General	April-23	October-22	17
	Salisbury	General	April-23	October-22	25
2	Elkton	General	April-23	November-22 & December-22	28
3	Fairland	General	April-23	September-22	10
	Gaithersburg	General	April-23	September-22 & October-22	28
	Laurel	General	April-23	October-22	27
	Marlboro	General	April-23	October-22	22
4	Churchville	General	April-23	March-23	38
	Golden Ring	General	April-23	March-23	27
	Hereford	General	April-23	March-23	28
	Owings Mills	General	April-23	March-23	34
5	Annapolis	General	April-23	December-22	31
	Glen Burnie	General	April-23	September-22 & October-22	20
	La Plata	General	April-23	October-22	27
	Hanover Auto Shop	General	April-23	March-23	5
6	Hagerstown	General	April-23	March-23	36
7	Dayton	General	April-23	March-23	9
	Frederick	General	April-23	March-23	44
	Thurmont	General	April-23	-	-
	Westminster	General	April-23	March-23	28
				Total	**484**

In accordance with conditions in Part IV.D.5.b of the MS4 Permit, SHA continued implementation of its programs to minimize use of pollutants associated with maintenance activities at SHA-owned facilities. SHA has provided its statewide usage for herbicide, fertilizer, and deicing chemicals during FY23, including percent change for each chemical type relative to amounts reported for the FY22 period in the *Chemical Application* table of the MS4 Geodatabase – Part 1.

Throughout FY23, SHA performed inlet cleaning, storm drain vacuuming, and street sweeping along SHA roadways. Information for FY23 implementation of inlet cleaning and storm drain vacuuming operations is provided in **Table IV.D.5.b** and both street sweeping and inlet cleaning are reported further in the MS4 Geodatabase – Part 2.

SHA continued to promote reduced use of glyphosate by minimizing use of non-selective herbicides on guardrails during FY23. To reduce mowing costs and fuel use, SHA also promoted use of plant growth regulators (e.g., trinexapac-ethyl and mefluidide) and selective herbicides to preserve desirable vegetation. SHA applied a greater variety of herbicides in FY23 as a result of efforts to apply glyphosate alternatives. SHA uses purchasing records and estimates contractor application usage from contract documents to report statewide application of vegetation management chemicals.

In the August 2022 and March 2023 sessions of SHA's "ENV 100" classes, SHA educated 81 participants and gave them the opportunity to become aRegistered Pesticide Applicator with the

Maryland Department of Agriculture. The SHA "ENV 200" class, that historically would provide MDA Pesticide Applicator recertification credit, was not offered by SHA in FY23 but eligible SHA staff attended equivalent training provided by MDA. There were 11 participants in the September 2022 session, and 43 in the March 2023 session, of the SHA "ENV 210" training for MDA Pesticide Applicator Core and ROW tests.

Table IV.D.5.b: Tons Collected in FY23 from Inlet Cleaning and Storm Drain Vacuuming

County	SHA Maintenance Shop	Total Number of Inlets Cleaned	Tons Collected[1]	Tons Collected from Storm Drain Vacuuming
Anne Arundel	Annapolis	7	0.7	10.7
	Glen Burnie	62	6.5	16.7
Baltimore	Golden Ring	115	12.1	4.8
	Hereford	56	5.9	2.1
	Owings Mills	96	10.1	3.5
Carroll	Westminster	22	2.3	26.8
Cecil	Elkton	50	5.3	8.5
Charles	La Plata	0	0	10.5
Frederick	Frederick	30	3.2	22.8
Harford	Churchville	10	1.1	0.5
Howard	Dayton	34	3.6	11.1
Montgomery	Fairland	361	37.9	20.5
	Gaithersburg	127	13.3	5.3
Prince George's	Laurel	32	3.4	13.0
	Upper Marlboro	37	3.9	9.5
Washington	Hagerstown	0	0	0
Wicomico[2]	Salisbury	32	3.4	24.4
	Totals	**1,071**	**112.7**	**190.7**

[1] Assumes 300 lbs. of wet weight cleaned from each inlet. Calculated wet weight was multiplied by 0.7 to estimate dry weight that was then converted to tons.
[2] The City of Salisbury is a Phase I MS4 jurisdiction, not Wicomico County as a whole. SHA was unable to quantify data for activities performed within the City of Salisbury limits. 30 inlets were cleaned in Wicomico County in FY23.

SHA covers earthen slopes disturbed by new construction activities with topsoil, a fertilizer blend, seeded turfgrass, and straw to reduce erosion through vegetative establishment and growth. Fertilizer application amounts were modeled based on the square footage of the seeding SHA applied in FY23 and are reported in pounds of Nitrogen and Phosphorus applied within the *Chemical Application* table of the MS4 Geodatabase – Part 1. SHA continued to use slow-release nitrogen and low-phosphorus or no-phosphorus fertilizers when establishing and maintaining turf, meadows, and other vegetation in FY23. Topsoil was sampled and tested for major and minor plant nutrients. Topsoil producer stockpiles were tested every six months and test results are used to develop Nutrient Management Plans to ensure optimal nutrient levels while avoiding excess fertilizer application.

There is a growing interest in incorporating compost into topsoil on highway slopes and little is known about the performance of these compost-amended topsoil (CAT) blends in such applications. Results from a research project by the University of Maryland (UMD) titled, *Effect of Geotechnical and Environmental Properties of Maryland Compost and Compost Amended Topsoils on Vegetation Establishment & Growth*, were used during the FY23 reporting period to develop updates to SHA Standard Specifications. As part of these pending updates, 'Type B' (plant based) compost will continue to be specified as a soil amendment during construction, but 'Type A' (biosolids) compost will not be specified to reduce the possibility of excess loading of nitrogen and phosphorus in construction soils and loss of nutrients to surface water or groundwater.

SHA will continue efforts to minimize reliance on chemical fertilizers. While the range of slow-release nitrogen fertilizers will be expanded, the typical nitrogen application rate will be reduced from 0.9 pounds of nitrogen per 1,000 square feet to 0.7 pounds of nitrogen per 1,000 square feet. This will reduce the total nitrogen application rate on SHA property and further reduce losses.

SHA continued to test and evaluate new equipment and strategies during FY23 in an on-going effort to improve the level of service provided to motorists during winter storms while minimizing the impact of its operations on the environment. SHA continued to minimize to the MEP the use of winter deicing materials using previously reported practices like "anti-icing" before storm events and continuation of the "Snow College" training for State and hired equipment operators. A description of SHA winter operations and a link to the current version of the SHA Salt Management Plan, most recently updated in November 2022, is publicly accessible at the following web address:

https://www.roads.maryland.gov/mdotsha/pages/index.aspx?PageId=352

SHA continued applying solid (e.g., rock salt, solar salt) and liquid (e.g., salt brine) deicing chemicals to roadways statewide during the 2022-2023 winter season to protect the safety of motorists. FY23 application amounts show a significant decrease in the use of solid deicing chemicals and a similarly significant increase in the use of liquid chemicals when compared to the amounts of each reported for FY22. Reduced use of solid deicing chemicals is attributed to Maryland's record low snow accumulation in FY23. Temperatures were still low enough for precipitation to freeze on the roadways and usage of liquid deicing chemicals increased during the reporting period because they are more effective than solid chemicals for removing frozen precipitation. SHA uses a metric of pounds of road salt per total lane miles per inch of snow (lbs/lm/inch) in its year-to-year comparisons of road salt usage. For the FY23 reporting period, the value for this metric was 643 lbs/lm/inch which is a decrease of 24 lbs/lm/inch relative to the FY22 period.

In accordance with conditions in Part IV.D.5.b.v of the MS4 Permit, SHA implemented its *Annual Snow College* statewide and trained 90 operators in snow removal and salt management, including new hires and refresher trainees. SHA also continued to provide hired equipment operator trainings during FY23, with annual outreach estimated at 2,200 operators. The scale of outreach for these trainings is variable year-to-year depending on active contracts, State employee vacancies and new-hires, and equipment acquisitions.

Public Education

In accordance with conditions in Part IV.D.6 of the MS4 Permit, SHA maintained its public education webpage throughout FY23 to provide information to the transportation community for reduction of stormwater pollutants. SHA organized internal trainings and participated in various educational opportunities throughout FY23 as described further in Appendix D.

SHA also continued to operate its Customer Care Management System throughout FY23 for the general public to submit complaints and concerns. SHA received approximately 24,237 service requests (89% were closed/resolved in FY23) and approximately 4,255 of those were related to either littering, dumping, spills, drainage, or water quality related issues (94% of this subset were closed/resolved in FY23). The Customer Care Management System can be accessed at the following web address:

https://mdotsha.my.salesforce-sites.com/customercare/request_for_service

Watershed Assessment

In accordance with conditions in Part IV.E.1 of the MS4 Permit, SHA continued to reference County watershed assessments to identify specific watershed issues and restoration project opportunities. SHA referenced watershed assessments prepared by Anne Arundel County (*Patapsco Tidal and Bodkin Creek Watershed Assessment*) and Baltimore County (*Bear Creek/Old Road Bay Small Watershed Action Plan*) during development of its Non-Tidal Baltimore Harbor watershed sediment Total Maximum Daily Load (TMDL) implementation plan, discussed further in the "TMDL Compliance" section of this FY23 MS4 annual report.

Throughout the current permit term, SHA committed resources to advocating for, drafting, negotiating, executing, and amending long-term Memorandums of Understanding/Agreement with 15 different county, State, and federal government agencies in order to facilitate collaborative watershed restoration and monitoring activities. These interagency partnerships have facilitated:

- Data exchanges
- ROW/easement acquisition and access
- Monitoring and research for stormwater management and restoration practices
- Design and construction of restoration BMPs including:
    - SWM facilities
    - Forest planting
    - Outfall stabilization
    - Impervious area removal
    - Stream restoration

SHA met with interagency partners throughout FY23 to share and discuss watershed restoration strategies, plans, and opportunities for collaborative projects.

Restoration Plans

Per the special conditions in Part VI of the MS4 Permit, MDE aligned the restoration requirement established for SHA in the current MS4 Permit term with strategies described in the *Maryland Watershed Implementation Plan (WIP) to Restore the Chesapeake Bay by 2025*. The U.S. Environmental Protection Agency (EPA) initially accepted Maryland's Phase I WIP on December 29, 2010 and the most current version, the Phase III WIP, was published on August 23, 2019. Appendix B to Maryland's Phase III WIP presented the State's strategies for restoration by jurisdictions issued individual MS4 permits and stated "recent MS4 implementation and trend analysis indicates that permittees (nine counties, Baltimore City, and the State Highway Administration) should be capable of annually restoring two percent of their impervious surface areas that currently have little or no stormwater treatment." The twenty percent restoration requirement established for SHA in the current MS4 Permit aligns with the Maryland Phase III WIP as it represents a two percent restoration of untreated SHA impervious surfaces per year beginning with the EPA acceptance of Maryland's Phase I WIP in 2010 and ending with the 2020 expiration date of the current MS4 Permit (i.e., 2% each year for 10 years sums to 20% restoration to be achieved by 2020).

In accordance with conditions in Part IV.E.2.a of the MS4 Permit and the MDE 2014 MS4 Accounting Guidance, SHA submitted impervious surface area assessments and implemented restoration BMPs for more than 4,621 equivalent impervious acres (EIA) required by end of the MS4 Permit term. In accordance with conditions in Part IV.E.3 of the MS4 Permit, SHA has provided its EIA achieved in **Table IV.E.3**. EIA achieved during both the preceding MS4 permit term (applicable to discharge permit number 99-DP-3313 MD0068276 that expired October 21, 2010 and was administratively continued through October 8, 2015) and the current MS4 Permit term is accounted toward the current MS4 Permit restoration goal (i.e., 4,621 EIA) in accordance with MDE guidance and the EIA computation rules established in the MDE 2014 MS4 Accounting Guidance.

EIA must be permanently removed from SHA restoration progress accounting when the water quality treatment function of any given BMP is directly reduced or eliminated by new development or redevelopment projects (whether by SHA or external agents) or when access or credit claiming rights for any given 'offsite BMP' (i.e., BMPs built on property not owned by SHA) become uncertain. For FY23, SHA has permanently removed 1,344.23 EIA from its restoration progress accounting presented in Table IV.E.3. Despite the EIA permanently removed in FY23, SHA achieved 6,126.45 EIA by October 8, 2020 and remains in compliance with the current MS4 Permit restoration goal to achieve at least 4,621 EIA by the MS4 Permit expiration date.

In comments dated July 30, 2021, MDE stated that SHA may not claim non-functioning restoration BMPs for compliance with the MS4 Permit restoration conditions. SHA has expanded on the MDE guidance since 2021 and temporarily removes EIA credits from SHA progress accounting if any given BMP's EIA credit cannot be verified, such as when a credit verification inspection is not completed in accordance with the schedules established in the MDE 2014 MS4 Accounting Guidance or when inspection information collected in the field has data

Table IV.E.3: EIA Credits Achieved During the MS4 Permit Compliance Period

	MS4 Permit Number 99-DP-3313 MD0068276 Administratively Continued Period	MS4 Permit Number 11-DP-3313 MD0068276 Term							MS4 Permit Number 11-DP-3313 MD0068276 Administratively Continued Period				
BMP Type	***Total EIA Achieved this Period***	**FY 2016**	**FY 2017**	**FY 2018**	**FY 2019**	**FY 2020**	**FY 2021 July 1, 2020 to Oct. 8, 2020**	***Total EIA Achieved this Period***	**FY 2021 Oct. 9, 2020 to June 30, 2021**	**FY 2022**	**FY 2023**	***Total EIA Achieved this Period*** [1]	**Total EIA Claimed for Compliance**[2]
Impervious Urban to Pervious	*0.00*	0.00	1.83	0.02	0.11	0.49	0.00	*2.45*	0.00	0.00	0.00	*0.00*	***0.13***
Reforestation on Pervious Urban	*468.31*	56.98	19.69	76.39	71.43	24.10	0.00	*248.59*	26.74	0.00	0.00	*26.74*	***453.59***
New Stormwater Control Structures	*85.44*	60.49	45.09	51.29	33.35	0.00	0.00	*190.22*	0.89	0.00	0.00	*0.89*	***272.28***
Retrofit Existing Stormwater Control Structures	*0.00*	100.80	6.33	70.79	56.94	15.99	12.59	*263.44*	31.69	0.00	0.00	*31.69*	***234.82***
Outfall Stabilization	*0.00*	11.83	9.20	165.26	53.24	160.18	0.00	*399.71*	299.74	0.00	0.00	*299.74*	***699.45***
Stream Restoration	*350.13*	48.72	22.27	6.84	169.31	3,450.75	420.27	*4,118.16*	302.07	0.00	0.00	*302.07*	***4,770.36***
Built BMP Totals =	***903.88***	**278.82**	**104.41**	**370.59**	**384.38**	**3,651.51**	**432.86**	***5,222.57***	**661.13**	**0.00**	**0.00**	***661.13***	***6,430.63***
Percent Restored of SHA Baseline Untreated Impervious Acres[3] **=**	***3.91%***	**1.21%**	**0.45%**	**1.60%**	**1.66%**	**15.80%**	**1.87%**	***22.60%***	**2.86%**	**0.00%**	**0.00%**	***2.86%***	***27.83%***
Inlet Cleaning[4]	164												
Street Sweeping[4]	29												
Credit Acquisition	0												

Note: EIA achieved during the MS4 permit number 99-DP-3313 MD0067276 administratively continued period is accountable toward the 4,621 EIA (20%) restoration requirement established in the MS4 permit number 11-DP-3313 MD0068276. As such, 6,126.45 EIA (26.51%) was achieved and is accountable by SHA against the MDE-approved 4,621 (20%) MS4 Permit restoration requirement by October 8, 2020.

[1] EIA achieved after the expiration date of the current MS4 Permit on October 8, 2020 is accounted in accordance with the EIA computation rules established in the MDE 2021 MS4 Accounting Guidance.

[2] Total EIA claimed for compliance after temporary removal of 356.95 EIA associated with BMP credit that could not be verified at the end of FY23.

[3] In MDE comments dated September 16, 2019, MDE established 23,104.8 as the SHA baseline for untreated impervious acres within the MS4 permitted areas.

[4] Total EIA achieved for inlet cleaning and street sweeping annual BMPs is presented here as the average annual implementation through FY20 as finalized in MDE comments dated July 30, 2021. SHA street sweeping and inlet cleaning operations since the end of the current MS4 Permit term have not met the minimum qualifications for restoration credit established in the MDE 2021 MS4 Accounting Guidance so SHA implementation of these BMP types beyond October 8, 2020 is not claimed for restoration credit.

quality/accuracy issues. The total EIA claimed for compliance by SHA, as presented in the last column of Table IV.E.3, has been discounted for 356.95 EIA that have been temporarily removed from SHA's restoration progress accounting.

Within the *GEN_COMMENTS* attribute field for applicable BMP records in the *AltBMPPoly*, *AltBMPLine*, and *BMP* features classes of the MS4 Geodatabase – Part 1, SHA has provided reasons for temporary or permanent credit removal and has reduced its credit 'claimed' information. **Appendix E** provides additional information regarding SHA adaptive management programs that work to address temporary and permanent EIA credit removals over time and ensure SHA remains in compliance with conditions in Part IV.E of the MS4 Permit.

During FY23, SHA submitted its EIA credit computations for stream restoration and outfall stabilization BMPs to MDE for review/confirmation. Following its review, MDE provided guidance to SHA on February 17, 2023 for corrections needed and SHA adjusted its computations accordingly for this FY23 MS4 annual report. The restoration progress accounted in Table IV.E.3 has been discounted to reflect a permanent reduction of 806.26 EIA credits resultant from the corrections. Additional information regarding this one-time adjustment to SHA EIA credit computations is provided in **Appendix G**.

All restoration planning by SHA for future MS4 permit terms has been based on the '2% restoration per year' pace established for the stormwater sector in Maryland's Phase I, II, and III WIPs and the restoration requirements and associated justifications presented in documents released to the public by MDE related to its issuance of next generation MS4 permits to the other large and medium Phase I MS4 permittees.

In its December 30, 2022 document, "Basis for Final Determinations to Issue NPDES MS4 Permits" associated with reissuance of the Carroll, Charles, Frederick, Harford, and Howard County MS4 permits; MDE stated:

> The Department has determined that Maryland's two percent per year goal identified in the Phase III WIP to achieve pollution reduction targets will be met cumulatively by all Phase I MS4 permittees. This strategy, along with the local data that show restoration capacity for individual jurisdictions, was used to determine the collective load reductions achieved under the Final Permits for the Phase I jurisdictions. This ensures consistency with the State's goals established in the Phase III WIP. Collectively, the level of restoration for the reissued Phase I Medium MS4 permits will exceed the Phase III WIP goal, resulting in cumulative restoration of 2.4% per year of all Phase I Medium jurisdictions' untreated impervious area.

It is reasonable to assume that SHA will not be assigned a restoration goal in its next generation MS4 permit that exceeds a '2% restoration per year' implementation pace for the 5-year permit term because a greater pace by SHA is not warranted to achieve the MDE goal for all Phase I MS4 permittees to cumulatively achieve the '2% restoration per year'.

In its May 11, 2022 comments following review of the SHA impervious acre assessment submitted for Phase II areas, MDE stated the new 'untreated' impervious area baseline applicable to the next generation MS4 permit term for SHA is 27,278 acres. SHA began planning during the current, administratively continued MS4 Permit term for the '2% restoration per year' requirement anticipated for the next 5-year SHA MS4 permit term. This equates to 2,728 new EIA achieved by the end of the next generation SHA MS4 permit term.

EIA achieved in Table IV.E.3 suggests proactive SHA planning and BMP implementation during the current MS4 Permit term has achieved approximately 6.6% of a 10% restoration goal. In order to achieve a total of 10% new restoration by the end of its next generation MS4 permit term, SHA will implement new BMPs for an additional 3.4% restoration of the MDE-approved baseline but will also have to successfully grow the capacity and efficacy of SHA adaptive management programs to ensure that all of the 20% restoration achieved during the current MS4 Permit term as well as the additional 6.6% restoration achieved since the current MS4 Permit expired is maintained and any losses are replaced with additional, new BMP implementation completed before the end of the next generation MS4 permit term. The costs and strategies necessary to expand SHA adaptive management programs in this way are unprecedented and undefined for SHA and present unique challenges for achieving 10% new restoration by the end of the next MS4 permit term without any backsliding of previous achieved restoration progress.

TMDL Compliance

A TMDL for sediment was approved for the non-tidal Baltimore Harbor watershed (MD 8-digit code: 02130903) by the EPA on January 27, 2022 that established a stormwater wasteload allocation (WLA) for the SHA-owned MS4. In accordance with Part IV.E.2.b of the MS4 Permit, SHA developed and submitted an associated TMDL implementation plan to MDE by the January 27, 2023 due date. On December 12, 2022, SHA advertised a 30-day public comment period in the Baltimore Sun and Washington Post and posted the draft TMDL implementation plan to SHA's website for public access in accordance with conditions in Part IV.E.4.c of the MS4 Permit. As of the date of this FY23 MS4 annual report, SHA has received zero comments on this TMDL implementation plan.

In accordance with conditions in Part IV.E.5 of the MS4 Permit, SHA has provided its TMDL Assessment Report in Appendix E. SHA has also provided Chesapeake Bay and local TMDL compliance information in the *Chesapeake Bay Progress* and *Local TMDL Progress* tables of the MS4 Geodatabase – Part 1.

Assessment of Controls

The MDE-approved monitoring plans developed by SHA to satisfy conditions in Part IV.F of the MS4 Permit were appended to the FY16 and FY17 MS4 annual reports. A summary of the MDE-approved monitoring schedules and SHA progress is provided below in **Table IV.F**.

Table IV.F: Assessment of Controls Monitoring Schedules and Progress

Monitoring Phase	Proposed Dates	Actual Dates	Construction Phase	Comments
Part IV.F.1 - Watershed Restoration Assessment				
CHEM 1	October 2016 to October 2017	September 2016 to December 2017	Pre-construction	Upstream station installed September 2016 and downstream station installed December 2016. Results and analysis reported in FY17 MS4 annual report.
BIO 1	March 2016	April 2016 to September 2017	Pre-construction	Monitoring performed annually in 2016 and 2017 to establish range for baseline. Results and analysis reported in FY17 MS4 annual report.
PHYS 1	April 2015	September 2017 to February 2018	Pre-construction	Monitoring performed annually in 2017 and 2018 to establish range for baseline. Results and analysis reported in FY17 MS4 annual report.
CHEM 2	October 2017 to October 2018	January 2018 to March 2019	Construction	Monitoring work extended and performed throughout the construction phase. Results and analysis reported in FY18 and FY19 MS4 annual reports.
BIO 2	N/A	N/A	Construction	Activity not to be performed during construction
PHYS 2	N/A	N/A	Construction	Activity not to be performed during construction but supplementary surveys conducted in July/August 2018 to evaluate changes resulting from severe flood event. Results and analysis reported in FY18 MS4 annual report.
CHEM 3	October 2018 to October 2019	April 2019 to April 2020	Post-construction	CHEM 3 completed April 2020; results and analysis reported with FY20 MS4 annual report.
BIO 3	March 2018 to March 2019	April 2019 to April 2020	Post-construction	BIO 3 completed in (spring & summer) 2019. Results and analysis reported with FY20 MS4 annual report.
PHYS 3	March 2018 to March 2019	April 2019 to June 2019	Post-construction	PHYS 3 completed in (spring) 2019. Results and analysis reported with the FY19 MS4 annual report.
CHEM 4	October 2019 to October 2020	April 2020 to June 2020; May 2022 (ongoing)	Post-construction	CHEM 4 partially completed until work stopped in June 2020. CHEM 4 resumed in June 2022 and monitoring will continue as long as the current permit remains in effect. FY23 results and analysis reported with FY23 MS4 annual report.
BIO 4	March 2019 to March 2020	April 2020 to June 2020; June 2022	Post-construction	BIO 4 completed in FY22. BIO 4 fish, physical habitat assessment, and supplementary crayfish, mussel, reptile, and amphibian sampling were completed during the summer 2022 sampling index period. Results and analysis reported with FY22 MS4 annual report.
PHYS 4	March 2019 to March 2020	April 2020 to June 2020	Post-construction	PHYS 4 completed in 2020. Results and analysis, including the required hydraulic model, submitted with FY20 MS4 annual report.
Part IV.F.2 - Stormwater Management Assessment				
Year 1	January 2018 to October 2018	May 2018 to June 2018	Pre-construction	Monitoring completed with results and analysis reported in FY18 MS4 annual report.

Table IV.F: Assessment of Controls Monitoring Schedules and Progress

Monitoring Phase	Proposed Dates	Actual Dates	Construction Phase	Comments
Year 2	November 2018 to October 2019	July 2018 to June 2019	Pre-construction	Monitoring completed with results and analysis reported in FY19 MS4 annual report.
Year 3	November 2019 to October 2020	July 2019 to June 2020	Pre-construction	Monitoring completed with results and analysis reported in FY20 MS4 annual report.
Year 4	November 2020 to October 2021	Deferred	Post-construction	**Construction delayed until at least 2025**. Post-construction monitoring deferred accordingly.

In accordance with conditions in Part IV.F.1 of the MS4 Permit, SHA continued the 'CHEM 4' monitoring phase, described in the MDE-approved monitoring plan for the Little Catoctin Creek stream restoration, throughout FY23 and chemical monitoring activities will continue until SHA is issued its next generation MS4 permit. SHA has provided chemical monitoring data collected during FY23 in the *Chemical Monitoring* table of the MS4 Geodatabase – Part 1. SHA has not collected or reported any information for monitoring parameters not required in the current, administratively continued MS4 Permit. In accordance with conditions in Part V.A.1.b of the MS4 Permit, a detailed discussion of chemical monitoring activities and monitoring results is provided in **Appendix F**.

The construction schedule for restoration SWM BMPs referenced in the MDE-approved monitoring plan for SWM Assessment is integrated with, and dependent on, the construction schedule for a Howard County bridge replacement project. The County and SHA resumed their partnership for construction of the SWM BMPs in conjunction with the County bridge project in January 2022 and the SWM BMPs are currently at the 90% design milestone and expected to complete design during FY24. Howard County requested funding to construct their bridge project in FY25.

SHA has fulfilled its SWM Assessment monitoring obligations by monitoring for at least two full years during the pre-construction period and consequently, did not perform any further pre-construction monitoring activities during FY23. SHA did not commit to any construction phase monitoring activities in the MDE-approved monitoring plan for SWM Assessment. Hydrologic and/or hydraulic modeling was not performed in the fourth year of the MS4 Permit term, in accordance with conditions in Part IV.F.2.c, because the pre-requisite SWM BMP construction has not yet been initiated.

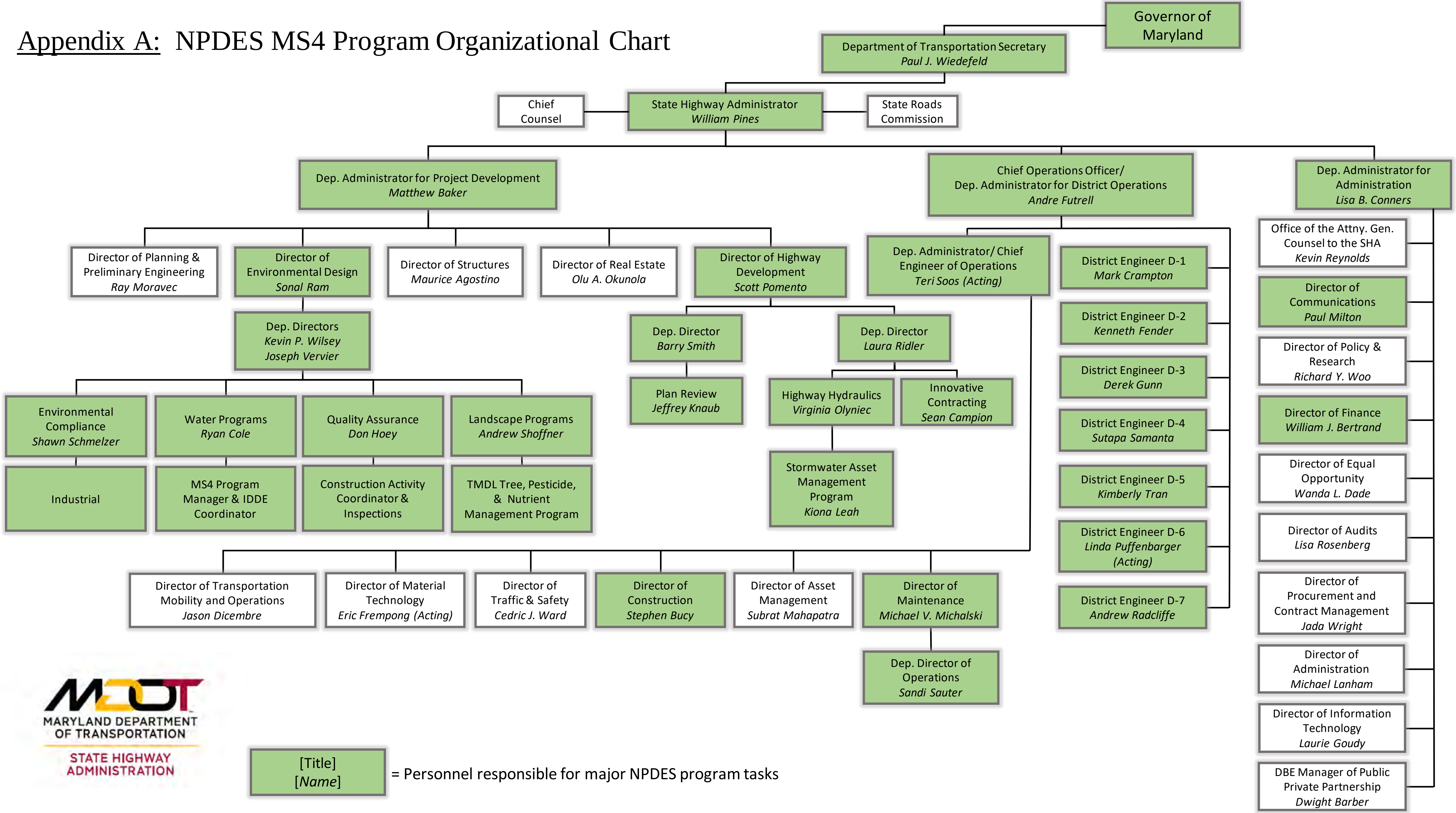
Program Funding

In accordance with conditions in Parts IV.G.1 and V.A.1.c of the MS4 Permit, SHA has provided program funding information in the *Fiscal Analyses* table of the MS4 Geodatabase – Part 1. **Table V.A.1.c** below contains a supplemental summary of this information.

Table V.A.1.c: MS4 Expenditures for FY23 and Proposed Budget for FY24

Fund	FY23 Expenditures (Millions*)	FY24 Budget (Millions*)
Fund 82 – TMDL Compliance & MS4 Program Management	$10.6	$15.9
Fund 74 – Drainage	$16.9	$14.2
Fund 49 – Industrial	$0.28	$0.33
Fund 14 – Operations/Maintenance	$12.6	$12.3
Totals:	**$40.4**	**42.7**
*Funding numbers are rounded to nearest $0.1 million with the exception of Fund 49 which is rounded to the nearest $0.01 million		

Appendix A: NPDES MS4 Program Organizational Chart



MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

<u>Appendix B:</u> Rehabilitation Report for Stormwater Controls

In FY19 and FY20, SHA began changing its processes for creating rehabilitation work orders (formally known as “remediation work orders”) to repair failing SWM facilities. Inspection and CADD standards were created and the process for designing work order plan sets was streamlined. These templates were distributed in FY21 and included standard sheets for erosion and sediment control, sequences of construction, and documentation for “Rehabilitation Verification.” Multiple facilities completed the cycle of design to construction in FY23 using the templates.

The risk and criticality analysis model developed in FY22 and described in Appendix B of the FY22 MS4 annual report was further refined and implemented in FY23 to prioritize facilities in need of rehabilitation. The model increased contract efficiency by facilitating geographically based grouping for rehabilitation sites. The risk and criticality analysis was also applied to embankment classifications for SHA ponds and dams to aid prioritization for sites requiring classification. Numerous facilities underwent embankment analysis and the resultant data determined that all the facilities analyzed were low-hazard embankments. Final embankment classifications are tracked by SHA and embankment analysis of existing facilities will continue during FY24.

Throughout FY23, HHD updated internal guidance documents for engineering assessments and rehabilitation work order planning and development. Sections detailing engineering assessments performed after the preventative maintenance inspections were expanded and a supplemental appendix was added to incorporate examples of these assessments as a training tool for staff and to ensure consistency for the assessments. Rehabilitation work order sections were updated based on feedback from contractors, inspectors, and other stakeholders considering field planning and operations, common problems and recommended solutions, and the work order plan development process. The plan development process description was expanded to address each aspect of the standard template with its associated purpose along with information that should be included on each plan sheet, the benefits of providing construction-friendly access points and maintenance of traffic details, and new plan requirements for limit of disturbance and environmental resource stakeout to ensure sensitive resources are protected during construction. Standards for file management were also documented to aid designers in navigating the templates and supporting information.

During FY24, HHD plans to update the work order CADD standards, for compliance with the general NPDES discharge permit number 20-CP, and to develop internal guidance for extending the service life of corrugated metal pipe (CMP) control structures without full replacement.

In accordance with conditions in Part IV.B of the MS4 Permit, SHA has provided **Table IV.D.1.d** below to summarize the current resolution schedule for SWM facilities requiring rehabilitation or retrofit. Information provided includes identification of applicable rehabilitation contracts, commitments for dates of completion, and comments on the status of work.

Table IV.D.1.d: SHA SWM Facilities for Rehabilitation Work Orders

SWM Facility Number	Facility Type	MDE Pass / Fail	Contract	Completion Commitment Date	Rehabilitation Comments
020013	Wet Pond	Pass	AA0225274	6/30/2023	**FY23 Construction Complete, As-Builts Approved**
020026	Wet Pond	Fail	XX1725174[1]	9/30/2028	Recommended for Retrofit.
020048	Infiltration Basin	Pass	XX1725174[1]	6/30/2027	Work Order Approved, Construction Pending Funding. Per Latest Inspection, BMP is Functioning as Designed.
020052	Infiltration Basin	Fail		6/30/2028	
020061	Infiltration Basin	Fail		9/30/2028	
020088	Surface Sand Filter	Fail		6/30/2028	**BMP Added to List in FY23.**
020092	Infiltration Trench	Fail	AZ044A11[2]	9/30/2027	In Design and Permitting Process
020093	Infiltration Trench	Pass	XX1725174[1]	6/30/2020	FY20 Construction Complete, **FY23 As-Builts Approved**
020094	Infiltration Trench	Pass	XX1725174	6/30/2020	FY20 Construction Complete, **FY23 As-Builts Approved**
020103	Wet Pond	Fail	XX1725174[1]	6/30/2027	In Design and Permitting Process
020110	Wet Pond	Pass	AA0225174	6/30/2023	**FY23 Construction Complete, As-Builts Approved**
020113	Wet Pond	Pass		6/30/2028	Per Latest Inspection, BMP is Functioning as Designed.
020114	Wet Pond	Fail	XX1725174[1]	6/30/2027	In Design and Permitting Process
020120	Micropool Extended Detention Pond	Pass		6/30/2027	In Design and Permitting Process
020121	Surface Sand Filter	Pass		6/30/2027	Work Order Approved – Construction Pending Funding
020122	Surface Sand Filter	Pass		6/30/2027	Per Latest Inspection, BMP is Functioning as Designed.
020124	Wet Pond	Fail	AX9295482[1]	6/30/2027	Work Order Approved – Construction Pending Funding
020167	Dry Pond	Fail		9/30/2028	

Table IV.D.1.d: SHA SWM Facilities for Rehabilitation Work Orders

SWM Facility Number	Facility Type	MDE Pass / Fail	Contract	Completion Commitment Date	Rehabilitation Comments
020177	Dry Swale	Fail		9/30/2028	
020231	Infiltration Trench	Fail		6/30/2028	
020244	Infiltration Trench	Fail	XX1965574	6/30/2026	In Design and Permitting Process
020258	Infiltration Basin	Fail	AA8225174	6/30/2021	**FY20 Construction Complete**, As-Builts Under Review
020260	Infiltration Basin	Fail	AA8225174	6/30/2021	**FY20 Construction Complete**, As-Builts Under Review
020268	Infiltration Basin	Pass	AA8225174	6/30/2021	**FY21 Construction Complete,** As-Builts Under Review
020271	Infiltration Basin	Fail	AZ044A11[2]	6/30/2027	In Design and Permitting Process
020272	Wet Pond	Fail	XX1965574	6/30/2026	In Design and Permitting Process
020273	Dry Pond	Fail		6/30/2028	
020338	Infiltration Basin	Fail		9/30/2028	
020339	Infiltration Basin	Fail		6/30/2028	
020343	Infiltration Trench	Pass		6/30/2027	In Design and Permitting Process
020355	Infiltration Trench	Pass		6/30/2027	In Design and Permitting Process
020357	Infiltration Trench	Fail	AX9295482[1]	6/30/2027	Work Order Approved – Construction Pending Funding
020358	Infiltration Trench	Pass		6/30/2027	In Design and Permitting Process
020363	Infiltration Basin	Fail		9/30/2028	
020388	Infiltration Basin	Fail		9/30/2028	
020393	Infiltration Basin	Fail		6/30/2028	
020394	Infiltration Basin	Fail		9/30/2028	
020396	Infiltration Basin	Fail	XX1725174[1]	6/30/2027	Work Order Approved – Construction Pending Funding
020399	Infiltration Basin	Fail		6/30/2028	
020403	Infiltration Trench	Fail	XX1725174[1]	6/30/2027	Work Order Approved – Construction Pending Funding
020406	Dry Pond	Fail	XX1725174[1]	6/30/2027	Recommended for Retrofit
020409	Infiltration Trench	Fail	AZ044A11[2]	6/30/2027	Recommended for Retrofit

Table IV.D.1.d: SHA SWM Facilities for Rehabilitation Work Orders

SWM Facility Number	Facility Type	MDE Pass / Fail	Contract	Completion Commitment Date	Rehabilitation Comments
020410	Infiltration Trench	Fail	AZ044A11[2]	6/30/2027	Recommended for Retrofit
020429	Infiltration Trench	Fail	XX1965574	6/30/2026	In Design and Permitting Process
020440	Infiltration Trench	Pass		6/30/2027	In Design and Permitting Process
020480	Wet Pond	Fail		6/30/2028	
020484	Infiltration Trench	Fail	XX1725174[1]	6/30/2027	Work Order Approved – Construction Pending Funding
020486	Wet Pond	Fail	XX1725174[1]	6/30/2027	Work Order Approved – Construction Pending Funding
020489	Infiltration Basin	Fail	AZ044A11[2]	9/30/2027	In Design and Permitting Process
020490	Infiltration Trench	Fail	AX7665D82[2]	6/30/2028	
020494	Infiltration Basin	Fail	XX1965574	6/30/2026	In Design and Permitting Process
020500	Infiltration Trench	Pass	XX1725174[1]	6/30/2020	FY20 Construction Complete, **FY23 As-Builts Approved**
020505	Infiltration Trench	Pass	XX1725174[1]	6/30/2020	FY20 Construction Complete, **FY23 As-Builts Approved**
020514	Infiltration Basin	Fail		6/30/2028	
020516	Infiltration Trench	Fail	XX1725174[1]	6/30/2027	Work Order Approved – Construction Pending Funding
020517	Infiltration Trench	Fail		6/30/2028	
020520	Infiltration Trench	Pass	AZ044A11[2]	6/30/2027	Work Order Approved – Construction Pending Funding. Per Latest Inspection, BMP is Functioning as Designed.
020522	Wet Pond	Fail		6/30/2028	
020528	Infiltration Trench	Fail		6/30/2028	BMP Added to List in FY23
020532	Infiltration Trench	Fail		6/30/2028	
020544	Wet Pond	Fail		6/30/2028	
020559	Infiltration Basin	Fail		6/30/2028	BMP Added to List in FY23
020560	Infiltration Basin	Fail		6/30/2028	BMP Added to List in FY23
020561	Infiltration Basin	Fail		6/30/2028	
020565	Infiltration Trench	Fail	AX3565274[2]	6/30/2027	In Design and Permitting Process

Table IV.D.1.d: SHA SWM Facilities for Rehabilitation Work Orders

SWM Facility Number	Facility Type	MDE Pass / Fail	Contract	Completion Commitment Date	Rehabilitation Comments
020584	Wet Extended Detention Pond	Fail		6/30/2028	
020603	Bioretention	Fail		6/30/2028	
020608	Bioretention	Fail		6/30/2028	
020747	Grass Swale	Pass	AZ044A11[2]	6/30/2027	In Design and Permitting Process. Per Latest Inspection, BMP is Functioning as Designed.
020760	Infiltration Basin	Fail	AZ044A11[2]	6/30/2027	In Design and Permitting Process
020761	Infiltration Basin	Fail		6/30/2028	
020774	Infiltration Trench	Fail	XX1725174[1]	6/30/2027	In Design and Permitting Process
020782	Infiltration Trench	Fail	XX1965574	6/30/2026	In Design and Permitting Process
020787	Infiltration Trench	Fail	AZ044A11[2]	6/30/2027	In Design and Permitting Process
020795	Infiltration Trench	Fail	AX3565274[2]	6/30/2027	In Design and Permitting Process
020810	Infiltration Trench	Fail		6/30/2028	
020811	Infiltration Trench	Fail	AZ044A11[2]	6/30/2027	In Design and Permitting Process
020817	Surface Sand Filter	Fail		6/30/2028	
020820	Surface Sand Filter	Fail		6/30/2028	
020827	Wet Pond	Fail	AZ044A11[2]	6/30/2027	Recommended for Retrofit
020845	Infiltration Basin	Fail	XX1725174[1]	6/30/2027	In Design and Permitting Process
020850	Infiltration Basin	Fail		9/30/2028	
020868	Infiltration Trench	Pass		6/30/2027	Work Order Approved – Construction Pending Funding
020875	Infiltration Basin	Fail	XX1725174[1]	6/30/2027	In Design and Permitting Process
020880	Infiltration Trench	Fail	AZ044A11[2]	6/30/2027	In Design and Permitting Process
020896	Grass Swale	Pass		6/30/2028	Per Latest Inspection, BMP is Functioning as Designed.
021012	Micropool Extended Detention Pond	Fail		6/30/2028	
021018	Infiltration Basin	Fail		6/30/2028	
021472	Bio-Swale	Fail		6/30/2028	
021473	Bio-Swale	Fail		6/30/2028	
021796	2A Grass Swale	Pass		6/30/2028	Per Latest Inspection, BMP is Functioning as Designed.

Table IV.D.1.d: SHA SWM Facilities for Rehabilitation Work Orders

SWM Facility Number	Facility Type	MDE Pass / Fail	Contract	Completion Commitment Date	Rehabilitation Comments
030001	Grass Channel Credit	Fail	XX1965474	6/30/2026	In Design and Permitting Process
030005	Grass Swale	Fail	AZ044A11[2]	6/30/2027	In Design and Permitting Process
030011	Wet Pond	Fail	AZ044A11[2]	6/30/2027	In Design and Permitting Process
030113	Infiltration Trench	Fail		6/30/2028	
030116	Infiltration Basin	Fail	AZ044A11[2]	6/30/2027	In Design and Permitting Process
030124	Infiltration Trench	Fail	AZ044A11[2]	6/30/2027	In Design and Permitting Process
030136	Infiltration Basin	Pass		6/30/2028	Per Latest Inspection, BMP is Functioning as Designed
030137	Infiltration Basin	Pass		9/30/2028	Per Latest Inspection, BMP is Functioning as Designed
030175	Dry Pond	Fail	XX1965474	6/30/2026	In Design and Permitting Process
030183	Infiltration Basin	Fail		6/30/2028	
030189	Infiltration Basin	Fail		9/30/2028	
030198	Infiltration Trench	Pass		6/30/2028	Per Latest Inspection, BMP is Functioning as Designed
030200	Infiltration Basin	Fail	AZ044A11[2]	6/30/2027	In Design and Permitting Process
030214	Infiltration Basin	Fail		9/30/2028	
030215	Infiltration Basin	Fail	AZ044A11[2]	6/30/2027	In Design and Permitting Process
030220	Infiltration Trench	Fail	AZ044A11[2]	6/30/2027	In Design and Permitting Process
030245	Infiltration Trench	Fail	AZ044A11[2]	6/30/2027	In Design and Permitting Process
030252	Infiltration Trench	Fail	AZ044A11[2]	6/30/2027	In Design and Permitting Process
030253	Infiltration Trench	Fail	AZ044A11[2]	6/30/2027	In Design and Permitting Process
030256	Infiltration Trench	Fail	AX3565274[2]	6/30/2027	In Design and Permitting Process.
030269	Dry Pond	Fail		6/30/2028	
030274	Infiltration Trench	Fail		6/30/2028	
030284	Bioretention	Fail		6/30/2028	
030333	Infiltration Trench	Fail	AZ044A11[2]	6/30/2027	In Design and Permitting Process
030385	Surface Sand Filter	Fail	XX1965474	6/30/2026	In Design and Permitting Process
030505	Micro-Bioretention	Pass		6/30/2028	Per Latest Inspection, BMP is Functioning as Designed

Table IV.D.1.d: SHA SWM Facilities for Rehabilitation Work Orders

SWM Facility Number	Facility Type	MDE Pass / Fail	Contract	Completion Commitment Date	Rehabilitation Comments
030936	2A Grass Swale	Fail		6/30/2028	BMP Added to List in FY23
040001	Bioretention	Fail		6/30/2028	BMP Added to List in FY23
040016	Dry Swale	Fail		6/30/2028	BMP Added to List in FY23
040036	Dry Pond	Fail		6/30/2028	BMP Added to List in FY23
040118	Infiltration Trench	Fail		6/30/2028	BMP Added to List in FY23
060106	Dry Pond	Fail		6/30/2028	
070003	Infiltration Basin	Fail	AZ044A11[2]	6/30/2027	In Design and Permitting Process
070004	Infiltration Basin	Fail	AZ044A11[2]	6/30/2027	In Design and Permitting Process
080004	Wet Pond	Fail		6/30/2028	BMP Added to List in FY23
080007	Wet Pond	Pass		6/30/2028	Per Latest Inspection, BMP is Functioning as Designed
080019	Infiltration Basin	Fail		6/30/2028	
080027	Wet Swale	Pass		6/30/2028	Per Latest Inspection, BMP is Functioning as Designed
080028	Wet Swale	Pass		6/30/2028	Per Latest Inspection, BMP is Functioning as Designed
080069	Wet Pond	Fail		6/30/2028	
080070	Wet Pond	Fail		6/30/2028	
080071	Wet Pond	Fail		6/30/2028	
080074	Wet Pond	Fail		6/30/2028	
082187	Underground Detention	Fail		6/30/2028	
092591	Wet Pond Fail	Fail		6/30/2028	BMP Added to List in FY23
100001	Bioretention	Fail		6/30/2028	
100004	Surface Sand Filter	Fail	AZ044A11[2]	6/30/2027	In Design and Permitting Process
100060	Infiltration Basin	Fail	AX7665D82[2]	6/30/2027	In Design and Permitting Process
100061	Infiltration Basin	Pass	AZ044A11[2]	6/30/2027	In Design and Permitting Process. Per Latest Inspection, BMP is Functioning as Designed
100065	Dry Pond	Fail	AX9295482[1]	6/30/2027	Work Order Approved - Construction Pending Funding
100099	Wet Pond	Fail	AZ044A11[2]	6/30/2027	In Design and Permitting Process

Table IV.D.1.d: SHA SWM Facilities for Rehabilitation Work Orders

SWM Facility Number	Facility Type	MDE Pass / Fail	Contract	Completion Commitment Date	Rehabilitation Comments
100126	Grass Swale	Pass	AZ044A11[2]	6/30/2027	Work Order Approved – Construction Pending Funding. Per Latest Inspection, BMP is Functioning as Designed
100129	Wet Swale	Fail		6/30/2028	
100143	Dry Swale	Pass		6/30/2028	Per Latest Inspection, BMP is Functioning as Designed
100310	Bio-Swale	Fail		6/30/2028	
120008	Dry Pond	Fail	AX7665D82[2]	6/30/2027	In Design and Permitting Process
120009	Dry Pond	Fail		6/30/2028	
120017	Infiltration Trench	Pass	XX1965474	6/30/2026	In Design and Permitting Process. Per Latest Inspection, BMP is Functioning as Designed
120019	Infiltration Trench	Fail		6/30/2028	
120039	Infiltration Trench	Fail	HA4285174[2]	9/30/2027	In Design and Permitting Process
120042	Infiltration Trench	Fail	HA4285174[2]	9/30/2027	In Design and Permitting Process
120063	Infiltration Trench	Fail	XX1965474	6/30/2026	In Design and Permitting Process
120066	Infiltration Trench	Fail	AZ044A11[2]	6/30/2027	In Design and Permitting Process
120095	Infiltration Basin	Fail	XX1965474	6/30/2026	In Design and Permitting Process
120105	Dry Extended Detention Pond	Fail		9/30/2028	
120106	Infiltration Trench	Fail		6/30/2028	BMP removed by SHA Contract (HA3415187). Removal verified in FY23
120108	Infiltration Basin	Fail		6/30/2028	BMP Added to List in FY23
120112	Infiltration Trench	Fail	XX1965474	6/30/2026	In Design and Permitting Process
120133	Infiltration Basin	Fail		9/30/2028	
120203	Wet Extended Detention Pond	Pass	AZ044A11[2]	6/30/2027	In Design and Permitting Process. Per Latest Inspection, BMP is Functioning as Designed
120208	Surface Sand Filter	Fail	AZ044A11[2]	6/30/2027	In Design and Permitting Process
120291	Wet Pond	Fail	AZ044A11[2]	6/30/2027	In Design and Permitting Process
130013	Dry Extended Detention Pond	Fail	XX1965774	6/30/2026	In Design and Permitting Process
130027	Dry Extended Detention Pond	Pass		9/30/2028	Per Latest Inspection, BMP is Functioning as Designed
130050	Infiltration Basin	Fail		6/30/2028	

Table IV.D.1.d: SHA SWM Facilities for Rehabilitation Work Orders

SWM Facility Number	Facility Type	MDE Pass / Fail	Contract	Completion Commitment Date	Rehabilitation Comments
130072	Dry Extended Detention Pond	Fail		9/30/2028	
130073	Wet Pond	Pass	AX7665282	9/30/2021	**FY23 Construction Complete, Awaiting As-Builts**
130074	Micropool Extended Detention Pond	Fail	AX9295482[1]	9/30/2027	Recommended for Retrofit
130077	Wet Pond	Fail		9/30/2028	
130078	Dry Pond	Fail	XX1965774	6/30/2026	In Design and Permitting Process
130134	Wet Pond	Fail		6/30/2028	
130136	Infiltration Trench	Pass		6/30/2028	Per Latest Inspection, BMP is Functioning as Designed
130167	Infiltration Basin	Pass	HO5165274	6/30/2023	**FY23 Construction Complete, As-Builts Approved**
130175	Infiltration Basin	Pass	HO5165374	06/30/2023	**FY23 Construction Complete, As-Builts Approved**
130178	Infiltration Basin	Pass	HO5165374	06/30/2023	**FY23 Construction Complete, As-Builts Approved**
130180	Grass Swale	Fail		6/30/2028	
130204	Infiltration Basin	Fail	HO5165174	6/30/2025	**In Design and Permitting Process**
130206	Wet Pond	Fail		9/30/2028	
130208	Infiltration Trench	Fail	AX9295482[1]	6/30/2027	Recommended for Retrofit
130210	Wet Pond	Pass		6/30/2028	Per Latest Inspection, BMP is Functioning as Designed
130237	Infiltration Trench	Fail	AZ044A11[2]	6/30/2027	In Design and Permitting Process
130251	Surface Sand Filter	Fail	AZ044A11[2]	6/30/2027	In Design and Permitting Process
130259	Surface Sand Filter	Fail	AZ044A11[2]	6/30/2027	In Design and Permitting Process
130263	Surface Sand Filter	Fail		6/30/2028	
130267	Dry Pond	Pass	HO5165274	06/30/2023	**FY23 Construction Complete, As-Builts Approved**
130268	Shallow Wetland	Pass	HO5165274	06/30/2023	**FY23 Construction Complete, As-Builts Approved**
130271	Dry Pond	Fail	AX7665D82[2]	6/30/2027	In Design and Permitting Process

Table IV.D.1.d: SHA SWM Facilities for Rehabilitation Work Orders

SWM Facility Number	Facility Type	MDE Pass / Fail	Contract	Completion Commitment Date	Rehabilitation Comments
130292	Other Infiltration	Fail	AX9295482[1]	6/30/2027	Work Order Approved - Construction Pending Funding
130293	Other Infiltration	Pass		6/30/2027	Work Order Approved – Construction Pending Funding
130294	Other Infiltration	Fail	AX9295482[1]	6/30/2027	Work Order Approved - Construction Pending Funding
130317	Infiltration Trench	Fail		6/30/2028	
130319	Infiltration Trench	Fail		6/30/2028	
130332	Infiltration Trench	Fail		6/30/2028	
130341	Infiltration Trench	Pass		6/30/2028	Per Latest Inspection, BMP is Functioning as Designed
130366	Infiltration Trench	Fail		6/30/2028	BMP Failed Post Rehabilitation, Recommended for Retrofit
130369	Shallow Marsh	Pass	AX9295482[1]	6/30/2027	Work Order Approved - Construction Pending Funding. Per Latest Inspection, BMP is Functioning as Designed
130417	Grass Swale	Pass	HO5165374	6/30/2023	**FY23 Construction Complete, As-Builts Approved**
130421	Wet Pond	Fail		6/30/2028	
132056	Micro-Bioretention	Pass	AZ044A11[2]	6/30/2027	In Design and Permitting Process. Per Latest Inspection, BMP is Functioning as Designed
132097	Micro-Bioretention	Fail		6/30/2028	BMP Added List in FY23
150066	Dry Pond	Fail		6/30/2028	
150081	Infiltration Basin	Pass	XX1965374	6/30/2026	In Design and Permitting Process. Per Latest Inspection, BMP is Functioning as Designed
150201	Infiltration Trench	Fail		6/30/2028	
150232	Infiltration Trench	Fail	AZ044A11[2]	6/30/2027	In Design and Permitting Process
150285	Dry Pond	Fail	XX1965374	6/30/2026	In Design and Permitting Process
150295	Bioretention	Pass	XX1965374	6/30/2026	In Design and Permitting Process. Per Latest Inspection, BMP is Functioning as Designed
150304	Surface Sand Filter	Fail	XX1965374	6/30/2026	In Design and Permitting Process
150312	Dry Extended Detention Pond	Fail		9/30/2028	

Table IV.D.1.d: SHA SWM Facilities for Rehabilitation Work Orders

SWM Facility Number	Facility Type	MDE Pass / Fail	Contract	Completion Commitment Date	Rehabilitation Comments
150348	Wet Pond	Pass		6/30/2028	Per Latest Inspection, BMP is Functioning as Designed
150355	Wet Pond	Pass		6/30/2028	Per Latest Inspection, BMP is Functioning as Designed
150680	Infiltration Trench	Fail	XX1965374	6/30/2026	In Design and Permitting Process
150706	Infiltration Trench	Fail	XX1965374	6/30/2026	In Design and Permitting Process
150749	Other	Fail		6/30/2028	
150750	Other	Fail		6/30/2028	
160012	Infiltration Trench	Fail		6/30/2028	
160061	Wet Pond	Pass	XX1965374	6/30/2026	In Design and Permitting Process. Per Latest Inspection, BMP is Functioning as Designed
160126	Infiltration Trench	Fail		6/30/2028	
160127	Wet Extended Detention Pond	Fail		6/30/2028	
160129	Infiltration Basin	Fail		6/30/2028	BMP Added to List in FY23
160131	Infiltration Trench	Fail	XX1965374	6/30/2026	In Design and Permitting Process
160136	Infiltration Trench	Fail		6/30/2028	
160176	Dry Extended Detention Pond	Fail		6/30/2028	
160181	Infiltration Trench	Fail		6/30/2028	
160187	Wet Swale	Fail	AZ044A11[2]	6/30/2027	In Design and Permitting Process
160197	Infiltration Trench	Fail	AZ044A11[2]	6/30/2027	In Design and Permitting Process
160203	Shallow Marsh	Fail		6/30/2028	
160211	Infiltration Trench	Fail		6/30/2028	
160218	Dry Pond	Fail		6/30/2028	
160224	Infiltration Trench	Fail	AZ044A11[2]	6/30/2027	In Design and Permitting Process
160225	Infiltration Trench	Fail	AZ044A11[2]	9/30/2027	In Design and Permitting Process
160230	Infiltration Trench	Fail	XX1965374	6/30/2026	In Design and Permitting Process
160232	Infiltration Trench	Fail	XX1965374	6/30/2026	In Design and Permitting Process
160246	Infiltration Trench	Fail		6/30/2028	
160247	Infiltration Trench	Fail		6/30/2028	
160250	Infiltration Trench	Fail		6/30/2028	
160301	Dry Pond	Fail		6/30/2028	

Table IV.D.1.d: SHA SWM Facilities for Rehabilitation Work Orders

SWM Facility Number	Facility Type	MDE Pass / Fail	Contract	Completion Commitment Date	Rehabilitation Comments
160305	Wet Pond	Fail	XX1965374	6/30/2026	In Design and Permitting Process
160378	Dry Pond	Fail	XX1965374	6/30/2026	In Design and Permitting Process
160402	Infiltration Trench	Fail		6/30/2028	
160408	Infiltration Trench	Fail	XX1965374	6/30/2026	In Design and Permitting Process
160427	Infiltration Trench	Fail	AZ044A11[2]	6/30/2027	In Design and Permitting Process
160429	Infiltration Trench	Fail	AZ044A11[2]	6/30/2027	In Design and Permitting Process
160505	Wet Pond	Fail	XX1965374	6/30/2026	In Design and Permitting Process
160662	Wet Pond	Fail		6/30/2028	
160732	Wet Pond	Fail	XX1965374	6/30/2026	In Design and Permitting Process
160747	Wet Extended Detention Pond	Fail	AZ044A11[2]	6/30/2027	In Design and Permitting Process
160748	Infiltration Basin	Fail		6/30/2028	BMP Added to List in FY23
160801	Wet Extended Detention Pond	Fail		6/30/2028	BMP Added to List in FY23
160806	Wet Pond	Fail		6/30/2028	
170048	Grass Swale	Fail		6/30/2028	BMP Added to List in FY23
170056	Infiltration Trench	Fail		6/30/2028	BMP Added to List in FY23
170061	Grass Swale	Fail		6/30/2028	BMP Added to List in FY23
170090	Infiltration Trench	Fail		6/30/2028	BMP Added to List in FY23
170096	Infiltration Basin	Fail		6/30/2028	BMP Added to List in FY23
180076	Dry Pond	Fail		6/30/2028	BMP Added to List in FY23
210003	Dry Swale	Fail	XY1695174[1]	6/30/2027	In Design and Permitting Process
210009	Infiltration Basin	Fail	XY1695174[1]	6/30/2027	In Design and Permitting Process
210233	Dry Pond	Pass	XX1695174[1]	6/30/2027	In Design and Permitting Process. Per Latest Inspection, BMP is Functioning as Designed
210938	Bio-Swale	Fail		6/30/2028	
220162	Infiltration Trench	Fail		6/30/2028	BMP Added to List in FY23
220163	Infiltration Trench	Fail		6/30/2028	BMP Added to List in FY23
220164	Infiltration Trench	Fail		6/30/2028	BMP Added to List in FY23
220166	Infiltration Trench	Fail		6/30/2028	BMP Added to List in FY23

Table IV.D.1.d: SHA SWM Facilities for Rehabilitation Work Orders

SWM Facility Number	Facility Type	MDE Pass / Fail	Contract	Completion Commitment Date	Rehabilitation Comments
220167	Infiltration Trench	Fail		6/30/2028	BMP Added to List in FY23
220174	Infiltration Trench	Fail		6/30/2028	BMP Added to List in FY23
220182	Infiltration Trench	Fail		6/30/2028	BMP Added to List in FY23
220183	Infiltration Trench	Fail		6/30/2028	BMP Added to List in FY23
220184	Infiltration Trench	Fail		6/30/2028	BMP Added to List in FY23

[1] Refers to a contract that went to construction during FY19 or FY20 that had to be cancelled due to budgetary impacts. These facilities will be prioritized first when resources are allocated for construction.

[2] Refers to a charge number created during FY20 for which work began for design and permitting only. These facilities will be prioritized second when resources are allocated for construction.

Appendix C: Illicit Discharge Detection and Elimination Program Summaries

Table IV.D.3.a below summarizes primary field screening efforts for the FY23 reporting period. In the MS4 geodatabase submitted with this FY23 MS4 annual report, SHA has provided the applicable IDDE program information in the *IDDE* associated table.

Table IV.D.3.a: Primary Field Screening Summary

County	Number of Outfalls Field Screened FY23
Baltimore	39
Frederick	80
Howard	43
Montgomery	1
Totals	**163**

Table IV.D.3.b below summarizes information from the most recent quarterly facility inspection performed at each of the NPDES 20-SW permitted sites within the SHA MS4 Permit area. Included in the summary is a description of each issue identified during those inspections and the associated resolutions made by SHA during the FY23 reporting period.

Table IV.D.3.b: Summary of the Most Recent Quarterly Inspection for NPDES 20-SW Permitted Facilities

Facility Name	Quarter Number and Fiscal Year for Last Inspection	Date of Last Quarterly Inspection	Number of Issues Identified During QTR	Uploaded to Web based Tracking (Yes or No)	Issue Details	Resolved? (Yes or No)	Comments
Cambridge	4th QTR 2023	4/10/2023	0	N/A	N/A	N/A	N/A
Salisbury	4th QTR 2023	4/11/2023	2	Yes	Storm Water/Material Storage- Storm Water Management Facilities Need Repair/ Maintenance - On the south side of the facility, the stormwater inlet grate has structural issues and is beginning to collapse. This stormwater issue was brought to the attention of the Resident Maintenance Engineer for correction.	No	Correction coordination of this incident and resulting compliance issue is being managed by District 1 & site management. Issue remains open at the end of FY23 and will be tracked into FY24.

Table IV.D.3.b: Summary of the Most Recent Quarterly Inspection for NPDES 20-SW Permitted Facilities

Facility Name	Quarter Number and Fiscal Year for Last Inspection	Date of Last Quarterly Inspection	Number of Issues Identified During QTR	Uploaded to Web based Tracking (Yes or No)	Issue Details	Resolved? (Yes or No)	Comments
	4th QTR 2023	4/11/2023		Yes	Storm Water/Material Storage- Erosion and Sediment Controls Not Adequate - The area behind the solar salt building and trailer is not draining properly. This area needs to be reconstructed with rip-rap stone to resume proper drainage.	No	Correction coordination of this incident and resulting compliance issue is being managed by District 1 & site management. Issue remains open at the end of FY23 and will be tracked into FY24.
Elkton	4th QTR 2023	4/3/2023	1	Yes	Storm Water/Material Storage- Storage Pile Management Issue - There was a small pile of uncovered soil identified in the back lot. Soil is an erodible material and needs to be tarped/covered.	Yes	Identified soil pile removed by facility following inspection.
Fairland	4th QTR 2023	4/24/2023	2	Yes	Storm Water/Material Storage- Storage Pile Management Problems - Storm Water/Material Storage- Storage Pile Management Issue - Uncovered/protected sand stockpile was observed. Sand is an erodible material and needs to be tarped/covered.	No	Correction coordination of this incident and resulting compliance issue is being managed by District 3 & site management. Issue remains open at the end of FY23 and will be tracked into FY24.
	4th QTR 2023	4/24/2023		Yes	Storm Water/Material Storage- Brine Tank and/or Maker Problems - Brine tank's fittings found to be slowly leaking; needs to be addressed.	Yes	Leaking fitting resealed by the facility and is now liquid tight.
Gaithersburg	4th QTR 2023	4/20/2023	2	Yes	Storm Water/Material Storage- Storage Pile Management Problems - There are new piles of dumped topsoil that have been placed near but outside of the stabilized pile. This new topsoil does not have any stormwater controls in place.	Yes	The identified pile of topsoil was utilized by the facility to complete a roadway project prior. The flagged topsoil has been removed from the site.
	4th QTR 2023	4/20/2023		Yes	Storm Water/Material Storage- Storage Pile Management Issue - Beside the material stockpiles is a load of material from the district sweeper truck that was mistakenly dumped in the yard. The dumped material has no stormwater controls.	Yes	Identified sweeper waste that was mistakenly dumped at the Gaithersburg lot was reloaded and transported to the Metro Yard Vacuum Truck Dewatering Facility for disposal.

Table IV.D.3.b: Summary of the Most Recent Quarterly Inspection for NPDES 20-SW Permitted Facilities

Facility Name	Quarter Number and Fiscal Year for Last Inspection	Date of Last Quarterly Inspection	Number of Issues Identified During QTR	Uploaded to Web based Tracking (Yes or No)	Issue Details	Resolved? (Yes or No)	Comments
Laurel	4th QTR 2023	5/11/2023	0	N/A	N/A	N/A	N/A
Upper Marlboro	4th QTR 2023	4/25/2023	5	Yes	Storm Water/Material Storage - Materials Not Stored Under Cover/Contained - A pallet on the asphalt parking lot with several bags of cold patch sitting on it was identified. This material is stored in a manner likely to pollute and needs to be covered or placed inside.	Yes	Pallet of cold patch material moved indoors and out of contact with stormwater.
	4th QTR 2023	4/25/2023		Yes	Storm Water/Material Storage- Storage Pile Management Problems - Sand was identified in the parking lot in front of the material storage areas. There is also a mound of unsegregated topsoil mistakenly dumped in the solid waste collection area.	No	Correction coordination of this incident and resulting compliance issue is being managed by District 3 & site management. Issue remains open at the end of FY23 and will be tracked into FY24.
	4th QTR 2023	4/25/2023		Yes	Storm Water/Material Storage- Brine Tank and/or Maker Problems - Fittings at brine tank #1 show evidence of past leaking; there was chalking around the fitting and moisture on the concrete slab. These issues require troubleshooting and repair by the contractual plumber.	No	Correction coordination of this incident and resulting compliance issue is being managed by District 3 & site management. Issue remains open at the end of FY23 and will be tracked into FY24.
Upper Marlboro (cont.)	4th QTR 2023	4/25/2023	5	Yes	Storm Water/Material Storage- Storm Water Management Facilities Not Properly Maintained - Stormwater structure 160748 is failing and rated as a "D" by Highway Hydraulics Division (HHD) during CY 2020. Because the structure is not draining as designed, 20-SW quarterly visual monitoring sampling location #2 was slightly shifted to capture sheet flow drainage from the structure during qualifying rain/snow events.	No	HHD has added the identified failing structural SWMFAC to the que for upcoming repair.

Table IV.D.3.b: Summary of the Most Recent Quarterly Inspection for NPDES 20-SW Permitted Facilities

Facility Name	Quarter Number and Fiscal Year for Last Inspection	Date of Last Quarterly Inspection	Number of Issues Identified During QTR	Uploaded to Web based Tracking (Yes or No)	Issue Details	Resolved? (Yes or No)	Comments
	4th QTR 2023	4/25/2023		Yes	Storm Water/Material Storage- Floatable Debris Not Properly Contained - Significant trash was identified behind the water storage building and it has become scattered around the lot. Facility personnel must clean up this debris to prevent it from leaving the site.	No	Correction coordination of this incident and resulting compliance issue is being managed by District 3 & site management. Issue remains open at the end of FY23 and will be tracked into FY24.
Golden Ring	4th QTR 2023	4/24/2023	0	N/A	N/A	N/A	N/A
Hereford	4th QTR 2023	4/11/2023	2	Yes	Storm Water/Material Storage- Brine Tank and/or Maker Problems - Minor leak identified on brine tank #1.	Yes	Leaking fitting resealed by the Shop Chief and is now liquid tight.
	4th QTR 2023	4/11/2023		Yes	Storm Water/Material Storage- Floatable Debris Not Properly Contained - Significant trash identified in front of team leader bay that requires clean up.	Yes	Identified trash cleaned up by facility personnel.
Owings Mills	4th QTR 2023	4/27/2023	1	Yes	Storm Water/Material Storage- Storage Pile Management Problems - Street Sweeper dumpster needs to be tarped/covered when not in use.	Yes	Dumpster covered with a tarp by facility staff.
Churchville	4th QTR 2023	4/4/2023	0	N/A	N/A	N/A	N/A
Annapolis	4th QTR 2023	4/6/2023	1	Yes	Storm Water/Material Storage- Salt Storage Not Appropriate - Salt outside the threshold of the storage barn. Facility must sweep or use backpack blower to recover salt no longer protected from contact with stormwater.	Yes	Area outside of salt storage barn was swept by facility staff.
Glen Burnie	4th QTR 2023	4/17/2023	5	Yes	Storm Water/Material Storage- Materials Not Stored Under Cover/Contained - cold patch bucket next to brine maker. Bottle of antifreeze outside shop bay 9.	Yes	Identified cold patch and antifreeze containers moved indoors and under cover by facility staff.

Table IV.D.3.b: Summary of the Most Recent Quarterly Inspection for NPDES 20-SW Permitted Facilities

Facility Name	**Quarter Number and Fiscal Year for Last Inspection**	**Date of Last Quarterly Inspection**	**Number of Issues Identified** During QTR	**Uploaded to Web based Tracking (Yes or No)**	**Issue Details**	**Resolved? (Yes or No)**	**Comments**
	4th QTR 2023	4/17/2023		Yes	Storm Water/Material Storage- Storage Pile Management Problems - Soil and sand in yard. Large amounts of soil piled up around truck next to old brine maker near drainage swale.	Yes	Assistant Resident Maintenance Engineer and facility team addressed all erodible materials that were improperly stored near the brine maker.
	4th QTR 2023	4/17/2023		Yes	Storm Water/Material Storage- Salt Storage Not Appropriate - Some salt outside of dome near swale. Facility must sweep or use backpack blower to recover salt no longer protected from contact with stormwater.	Yes	Salt identified outside the storage dome was addressed by the facility through sweeping operations.
	4th QTR 2023	4/17/2023		Yes	Storm Water/Material Storage- Brine Tank and/or Maker Problems - Brine maker has a leak.	Yes	Spilled material swept up and brine maker drained. Plumbing repairs to brine maker are anticipated in FY24.
	4th QTR 2023	4/17/2023		Yes	Storm Water/Material Storage- Floatable Debris Not Properly Contained - Pick up debris in lower yard.	Yes	Trash removed by facility prior to follow up inspection by the District Environmental Coordinator.
Hanover	4th QTR 2023	5/11/2023	0	N/A	N/A	N/A	N/A
LaPlata	4th QTR 2023	4/10/2023	2	Yes	Storm Water/Material Storage- Salt Storage Not Appropriate - Salt flowing outside of the salt dome threshold. Facility must sweep or use backpack blower to recover salt no longer protected from contact with stormwater.	Yes	Parking lot in front of salt dome swept by facility staff and new straw bales added to the building threshold to keep salt in the dome.
	4th QTR 2023	4/10/2023		Yes	Storm Water/Material Storage- Brine Tank and/or Maker Problems - Brine storage tank fitting identified as having a slow leak.	Yes	Fitting resealed by the Shop Chief and is now liquid tight.
Hagerstown	4th QTR 2023	4/14/2023	0	N/A	N/A	N/A	N/A

Table IV.D.3.b: Summary of the Most Recent Quarterly Inspection for NPDES 20-SW Permitted Facilities

Facility Name	Quarter Number and Fiscal Year for Last Inspection	Date of Last Quarterly Inspection	Number of Issues Identified During QTR	Uploaded to Web based Tracking (Yes or No)	Issue Details	Resolved? (Yes or No)	Comments
Frederick	4th QTR 2023	4/4/2023	3	Yes	Storm Water/Material Storage- Storage Pile Management Problems - Anti skid material being improperly stored outside of the designated area.	Yes	Mechanical sweeping of area was performed by facility personnel to remove all identified erodible materials. Anti-skid material moved undercover and no longer in contact with stormwater.
	4th QTR 2023	4/4/2023		Yes	Storm Water/Material Storage- Vehicle Parking Areas Not Properly Maintained - Oil puddle identified on the ground under frame of the Osh Skosh manufactured plow.	Yes	Identified oil spill from Osh Skosh manufactured equipment storage cleaned up with pelletized absorbent by facility personnel.
	4th QTR 2023	4/4/2023		Yes	Storm Water/Material Storage- Floatable Debris Not Properly Contained - Trash & debris was found around the dumpster and in the scrap tire bin that needs to be properly disposed of.	Yes	Identified debris cleaned up by facility staff.
Thurmont	4th QTR 2023	4/11/2023	0	N/A	N/A	N/A	N/A
Dayton	4th QTR 2023	4/7/2023	1	Yes	Storm Water/Material Storage - Materials Not Stored Under Cover/Contained - 5-gallon pail of used oil found improperly stored next to the battery disposal bin and is impacting stormwater.	Yes	Identified 5-gallon pail of oil moved into the shop and properly drained to the collection tank.
Westminster	4th QTR 2023	4/19/2023	0	N/A	N/A	N/A	N/A

Table IV.D.3.d below summarizes the illicit discharges (IDs) that required follow-up investigations during the FY22 and FY23 periods. SHA performs a follow-up investigation only if dry weather flow is observed during the primary field screening and a subsequent follow-up testing confirms that one or more pollutant parameters were exceeded during both testing events. FY23 primary field screenings did not identify any IDs that required further investigations and there were no new illicit discharges identified and reported by the general public or SHA staff via the SHA Customer Care Management System during the FY23 reporting period.

Table IV.D.3.d: Illicit Discharges Requiring Further Investigation During Reporting Period

Reference No.	County	SHA Structure or BMP#	Date of ID	Potential Pollutant	Status
12 – From FY22	Montgomery	1501582.001	6/7/2022	Copper	Investigation initiated in FY22. Screened again on 2/20/2023 and lab sample analyzed on 2/24/2023. Results from lab showed no indicators of copper. The site will be re-inspected during FY24.

The following updates summarize the inter-jurisdictional contacts made and resolution schedules for IDs whose status was designated as "open" or "reopened" in previously submitted MS4 Permit annual reports. Updates below are numbered in alignment with the "Reference No." field of Table IV.D.3.d above.

12 - From FY22. During FY22 primary screenings, structure #1501582.001; located along Connecticut Avenue southbound in Kensington, Maryland; was determined to have an ID. This structure discharges into Rock Creek, a Use III waterway impaired by nutrients (1996 listing), suspended sediments (1996 listing), fecal bacteria (2002 listing) and evidence of impacts to biological communities (2002 listing). A significant amount of dry weather flow was found to be discharging from the structure at the time of inspection. Field testing performed on June 2, 2022 determined the concentration of copper to be 0.31 mg/l which exceeds the established limit of 0.21 mg/l. Inspectors intended to return to the site to perform a follow up inspection on June 3, 2022. However, a significant rain event occurred during the early morning hours on June 3, 2022, preventing the required follow up confirmatory inspection which must be conducted during dry weather. Another initial primary screening occurred on June 7, 2022. Field testing yielded another elevated copper concentration (0.23 mg/l) that exceeded the established limit. The follow up confirmatory inspection which must be conducted during dry weather was again prevented by an unforeseen rain event immediately following primary screening on June 7, 2022. Because two copper limit exceedances were recorded during separate primary inspections, a decision was made to manage this site as an ID. Structure #1501582.001 was revisited by Maryland Environmental Service (MES) field inspectors on June 22, 2022. Field staff again found high flow during dry weather conditions with copper levels exceeding established program limits at the outfall. State stormwater asset information was gathered and sent to MES staff to facilitate upstream inspection of multiple stormwater collection line segments. MES field inspectors began isolating segments of this large stormwater collection system through structure inspections. MES identified two structures that directly linked to the upstream structure during dry flow conditions with an active flow at the downstream structure. Closed Circuit Television (CCTV) investigations were performed through the upstream storm drain conveyance system to identify the source of the dry weather flow. Review of the CCTV confirmed the source of the dry weather flow to be groundwater infiltration through the concrete pipe section and at the connections with storm drain manholes. SHA screened the site again on February 20, 2023 and found dry weather flow conditions with a concentration of copper to be 0.27 mg/l which exceeds the established limit. A grab sample was submitted to a lab for analysis on February 20, 2023. Lab analysis results from February 24, 2023 indicated zero concentrations of copper. SHA believes the elevated copper levels are isolated to the ground water infiltration. The ID site will be re-inspected during FY24.

To ensure the SHA IDDE program meets the current industry practices, SHA performed an evaluation of its current IDDE program during FY23 to identify opportunities for improvement. The following activities were performed during FY23 in support of, and in response to, the SHA self-evaluation of its IDDE program:

1. SHA researched IDDE programs administered by other MS4 permitted jurisdictions to identify areas of SHA's program that can be enhanced. SHA concluded that its IDDE program and practices are either equivalent or more advanced than other jurisdictions. SHA feels that their IDDE program is meeting industry best practices and workflows.

2. SHA reviewed current and anticipated annual reporting IDDE requirements. SHA determined that its IDDE program is meeting current annual reporting requirements. Based on the anticipated annual report requirements for the next permit term, SHA is planning enhancements to the program related to site selection and prioritization of IDDE sites.

3. SHA enhanced its IDDE inspection and screening standard operating procedures based on current practices and to account for requirements expected to be established in the next generation MS4 permit to be issued to SHA by MDE. SHA reviewed and updated the IDDE database schema to align with the November 2021 *Draft Supplement to the Geodatabase Design and User's Guide* and with current SHA IDDE Program standard operating procedure and workflow documentation.

4. SHA migrated the field inspection data collection solution from 'Collector' to 'Field Maps' to align with ESRI's transition to Field Maps. Field Maps was tested and was successfully implemented for field use in FY23.

5. SHA enhanced the IDDE site selection criteria with the goal of selecting sites with most potential for pollutants. Site selection criteria enhancements included:

    a. Selecting and prioritizing sites that drain SHA NPDES 20-SW industrial permitted sites such as State vehicle maintenance shops

b. Selecting and prioritizing sites that drain SHA-owned properties designated as ‘industrial areas’, in accordance with conditions in Part IV.C of the MS4 Permit, but do not require coverage under the NPDES 20-SW industrial (e.g., park and rides)
c. Selecting sites that have the potential to receive flow and runoff from adjacent commercial and industrial land uses
d. Selecting sites that receive storm drain flow from an adjacent jurisdiction’s connecting storm drain systems
e. Efforts were made to exclude storm drain system assets from site selection if they only collect SHA roadway/highway runoff and have no commercial or industrial sources. SHA roadway with no commercial or industrial activity were considered to have less potential for illicit discharge versus roadways that did contain, or were adjacent to, commercial and industrial land uses.

6. SHA performed an initial statewide IDDE site selection. Storm drain systems in Phase I and Phase II counties were manually reviewed and selected based on the current site selection criteria and selection criteria enhancements related to prioritization of sites that have the most potential for pollution. SHA drafted a prioritization plan and 5-year schedule for sites to be inspected and screened during the next generation MS4 permit term.

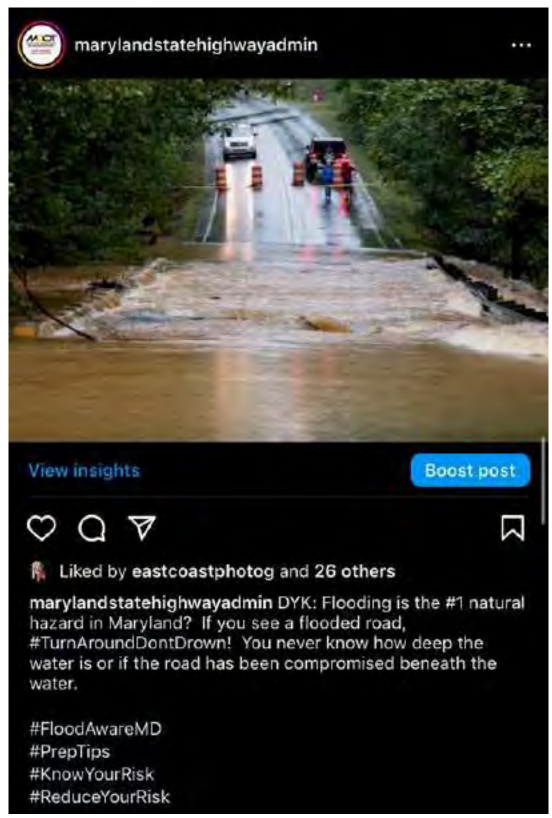
7. SHA enhanced the hardware used to detect copper, chlorine, detergents, and phenols during IDDE screenings. The enhancements included utilizing multiparameter portable colorimeters and digital photometers.

<u>Appendix D:</u> Public Education and Outreach Program Report

In accordance with Part V.A.1.d of the MS4 Permit, SHA prepared the following summary describing its public education programs implemented during the FY23 reporting period in accordance with conditions in Parts IV.D.4 and IV.D.6 of the MS4 Permit.

Social Media

SHA leveraged social media platforms Facebook, Twitter, and Instagram in FY23 to promote and encourage participation in SHA's various environmental education initiatives. Posts included, but were not limited to, information about SHA's litter clean-ups, flood awareness, and stormwater management efforts. Examples of SHA FY23 social media posts are provided below.



Keep Maryland Beautiful Grant Program

Maryland Environmental Trust awarded 31 *Keep Maryland Beautiful* (KMB) grants in 2023 to support environmental education, community cleanup, and beautification projects throughout Maryland. Three different grants were offered to help volunteer and nonprofit groups, communities, and land trusts to support their environmental education, litter removal, citizen stewardship, and natural resource management projects in urban and rural areas. Funding for the KMB grants program is provided by the Forever Maryland Foundation in partnership with the Maryland Department of Transportation (MDOT), Maryland Department of Housing and Community Development, and Maryland Environmental Trust. SHA pledged $50,000 a year to the program for five years (starting in FY18) totaling $250,000. In FY23, KMB Grants totaling $92,000 were awarded to twelve counties and the City of Baltimore. More information regarding KMB grants and the FY23 projects can be found online at the following web addresses:

- *https://news.maryland.gov/dnr/2023/03/20/forever-maryland-awards-2023-keep-maryland-beautiful-grants-totaling-92000/*
- *https://dnr.maryland.gov/met/Documents/KMB-2023-Award-Recipients-List.pdf*

Operation Clean Sweep

In an effort to increase the frequency of litter pickup and mowing efforts along Maryland roads, SHA launched its 'Operation Clean Sweep Maryland' on February 24, 2023. To support this initiative and increase public awareness, SHA administered press releases and a social media campaign. To prevent litter from destroying the beauty of Maryland's communities and threatening the safety of citizens and the environment, SHA coordinated additional cleanup efforts and increased its annual maintenance budget by more than 30% to accommodate the additional litter removal and mowing workloads. SHA also hired additional state employees, purchased additional mowing equipment, and developed contracts to maintain additional mowing and litter removal cycles. Due to a mild winter in FY23, SHA crews were able to begin these efforts earlier than anticipated. Within the SHA press releases and social media content, citizens were encouraged to help by reporting issues of litter and high grass along state roads. This program was highlighted by many news outlets such as WTOP Radio and WJZ-TV 13 (Eyewitness News) as shown below in the sample list of media coverage.

- NBC4 Washington: Maryland Highway Crews Ramp Up Litter Removal
  - *https://www.nbcwashington.com/news/local/transportation/maryland-highway-crews-ramp-up-litter-removal/3295322/*
- WJZ: 'Operation Clean Sweep Maryland' set up to increase litter removal efforts along state roads
  - *https://www.cbsnews.com/baltimore/news/operation-clean-sweep-maryland-set-up-to-increase-litter-removal-efforts-along-state-roads/*
- WTOP: 'Operation Clean Sweep' aims to tackle litter along Maryland roadways
  - *https://wtop.com/maryland/2023/02/operation-clean-sweep-aims-to-tackle-litter-along-maryland-roadways/*

Bike to Work Day/Week

For the first time since the COVID-19 pandemic, SHA conducted 'Bike to Work Week' from May 15 through May 21, 2023 with May 19, 2023 designated as 'Bike to Work Day.' This program seeks to promote bicycling as a healthy commuting option and to improve public awareness of associated safety and environmental benefits. Pit stops along the designated bicycle paths, including one outside SHA Headquarters in Baltimore City, offered refreshments and water bottles. Participants were able to sign up to receive notifications for Bike to Work Week and to receive updates on future active transportation opportunities in the Baltimore Region via the following website: https://biketoworkmd.com/

Secretary of Transportation at the SHA Headquarters pit stop.

MTA Administrator (right) and staff at the SHA Headquarters pit stop.

Single Stream Recycling

Beginning in December 2023, SHA contracted with a new recycling vendor to allow for single stream recycling at SHA facilities. This shift encourages more robust recycling for all SHA employees by making it easier to recycle all paper, plastic, glass, aluminum/metal, and cardboard. All SHA employees were notified of this change via email.

Trainings and Education Activities

Various divisions within SHA organized trainings and presented at conferences on topics related to stormwater pollution. Below is a list of some of those trainings and conferences with corresponding descriptions and dates.

- TUgis Conference 2022. On August 4, 2022, SHA collaborated with the Maryland Environmental Service and consultant partners to present the results the SHA pilot study for linear SWM facility inspections via sUAS (a.k.a., drone) technology (additional information about this technology is provided in the *Stormwater Management* section of the FY23 MS4 annual report)

- Penn State Asset Management Conference. On October 17, 2022, SHA presented details about its Stormwater Systems Asset Management Program

- Video Pipe Inspection and Field Training. On March 22, 2023, SHA administered training to consultants and SHA staff for newly developed video pipe inspection mobile application tools and conducted associated field training

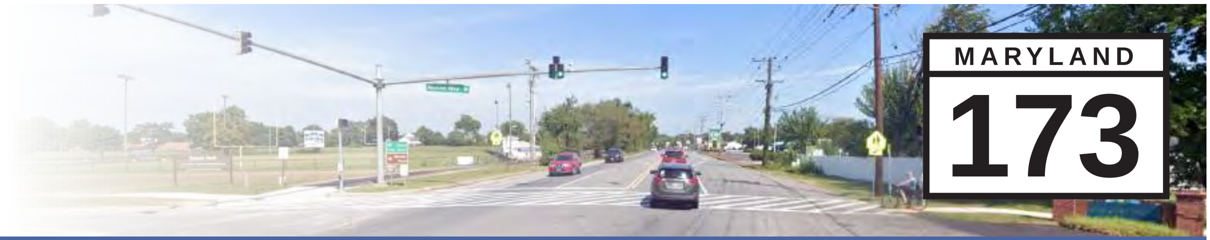
- ACEC/MD Environmental Spring Forum. On May 18, 2023, SHA presented to attending engineering consultants and State employees the priorities and challenges in delivering environmental programs such TMDL compliance, pollinator habitat creation, and mitigation banking

- Underground Inspection Field Tool Demonstration. On June 21, 2023, SHA presented a training to consultant inspection crews on the new underground SWM inspection mobile application forms

Community Outreach

During FY23, SHA launched numerous projects to support its mission/goals such as enhancing safety and accessibility for motorists, pedestrians, and bicyclists and delivering stormwater management facility and drainage improvements. To inform the public and engage stakeholders during project planning and construction, SHA reached out to individual communities to communicate details of the upcoming work in their areas and to solicit their feedback. Attached to this Appendix D are three examples of the project information community outreach fliers SHA distributed in FY23.

MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION



MD 173 Sidewalk Improvement Project

MD 173 Design Phase Continues for Sidewalk Improvements in Riviera Beach

The Maryland Department of Transportation State Highway Administration (SHA), in partnership with Anne Arundel County, is designing sidewalk improvements along southbound MD 173 (Fort Smallwood Road) from Duvall Highway to Kenton Road in Riviera Beach, Anne Arundel County. The sidewalk project features pedestrian safety improvements along the corridor. The design phase is anticipated to be complete by spring 2024.

Project Background

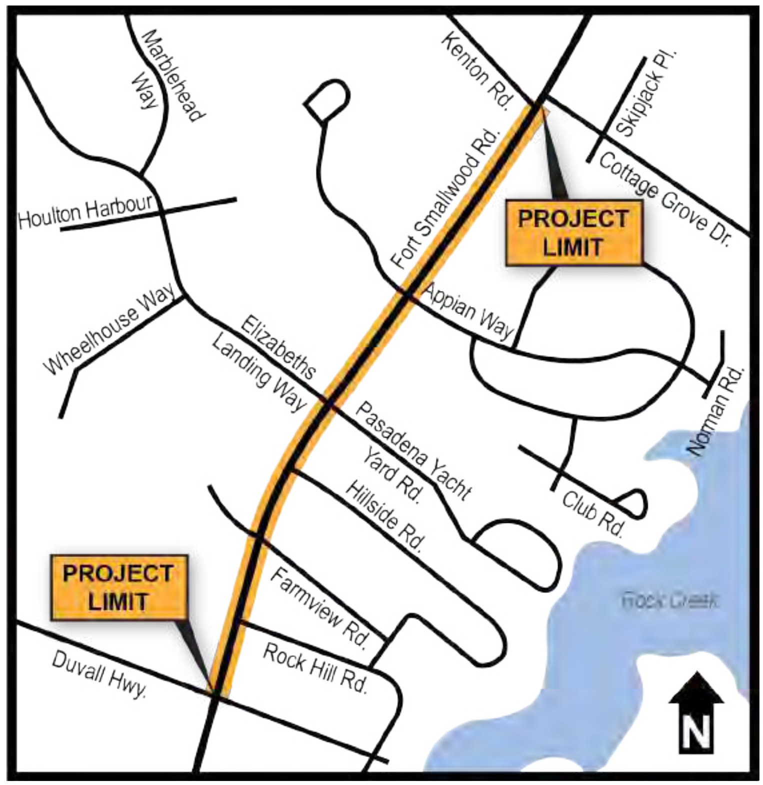
The purpose of this project is to improve pedestrian safety along approximately a 0.7 mile-section of southbound MD 173 between Duvall Highway and Kenton Road. Presently, sidewalk access is only available at the northern end of the project area. This project is designed to enhance pedestrian connectivity along the corridor to area amenities such as schools, recreational spaces, businesses, places of worship and residences.

The scope of the MD 173 Sidewalk Improvement Project includes:

- constructing a five-foot-wide sidewalk along southbound MD 173 that will comply with Americans with Disabilities Act requirements;
- installing stormwater management facilities to manage water runoff;
- installing drainage improvements along MD 173;
- installing crosswalks and pedestrian signals along southbound MD 173 at Duvall Highway, Elizabeths Landing Way, and Appian Way and
- upgrading crosswalks and pedestrian signals crossing MD 173 at Duvall Highway and Appian Way.

What to Expect

Contractor crews will work onsite during the day this summer to prepare for utility relocation work in late 2023. Any service interruptions will be communicated in advance to impacted property owners.



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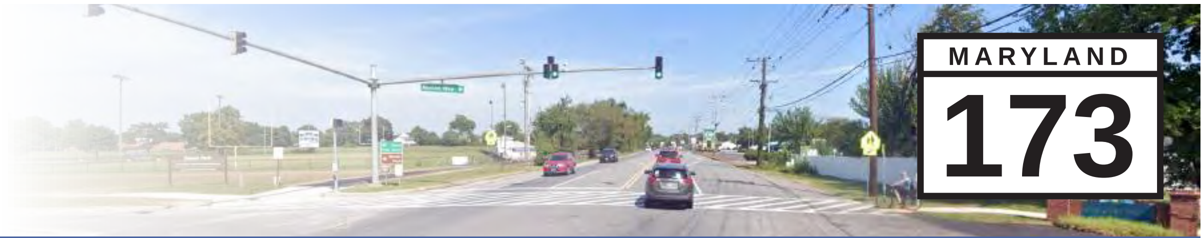
STATE HIGHWAY ADMINISTRATION



MD 173 Sidewalk Improvement Project

SEE INSIDE FOR MORE DETAILS!

Find Us on the Web

For information on other State Highway Administration projects, please visit **www.roads.maryland.gov** and go to the Project Portal.

@MDOTSHA

MarylandStateHighwayAdmin

@MDSHA

MDStateHighwayAdmin

For More Information

Ms. Gina Goettler, Project Manager
Maryland Department of Transportation
State Highway Administration, District 5 Office
138 Defense Highway
Annapolis, Maryland 21401
Phone: 410-841-1047
Toll-Free: 1-800-331-5603
Email: ggoettler@mdot.maryland.gov

Ms. Kellie Boulware, Community Relations Manager
Maryland Department of Transportation
State Highway Administration, District 5 Office
138 Defense Highway
Annapolis, Maryland 21401
Phone: 410-841-1020
Toll-Free: 1-800-331-5603
Email: kboulware1@mdot.maryland.gov

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MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

District 5 Office
138 Defense Highway
Annapolis, Maryland 21401

MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

US 13 Sidewalk Improvement Project

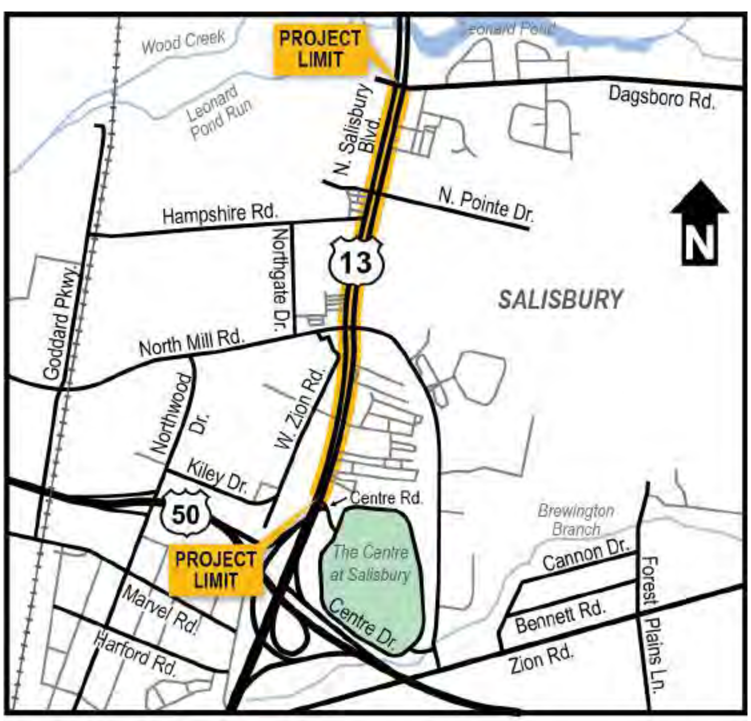
MDOT SHA Initiates Design Phase of US 13 Sidewalk Improvements in Salisbury

The Maryland Department of Transportation State Highway Administration (MDOT SHA) is initiating a sidewalk improvement project along US 13 (N. Salisbury Boulevard) from Centre Road to Dagsboro Road in Salisbury. The project features safety and intersection improvements along the corridor for pedestrians. The design phase is anticipated to be complete by spring 2025.

Project Background

The purpose of the project is to improve pedestrian safety along approximately 1.3 miles of US 13. There are currently no sidewalks or crosswalks throughout the study area limits. Pedestrians are required to walk in the grass adjacent to the travel lanes. The scope of the project includes:

- constructing a five-foot-wide sidewalk along both sides of the road,
- installing pedestrian-activated signals,
- installing crosswalks at the intersections, and
- installing stormwater management facilities to manage water runoff.



What to Expect

MDOT SHA representatives will be in the area during the next few months to collect survey data. The study team anticipates staying within existing MDOT SHA right-of-way. MDOT SHA will provide information to the public through project website updates and public meetings. If you would like to be added to the mailing list for updates, please email the Project Manager at **apincus@mdot.maryland.gov**.

Find Us on the Web

For additional information about the US 13 Sidewalk Improvement Project, please visit the Project Portal at: https://bit.ly/MDOTSHA-US13-Centre-Rd-to-Dagsboro-Rd-Sidewalk-Improvements. You may also use the QR code shown below.

@MDOTSHA
@MDSHA
MarylandStateHighwayAdmin
MDStateHighwayAdmin

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MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

Office of Highway Development
707 North Calvert Street, C-102
Baltimore, Maryland 21202

MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

US 13 Sidewalk Improvement Project

For More Information

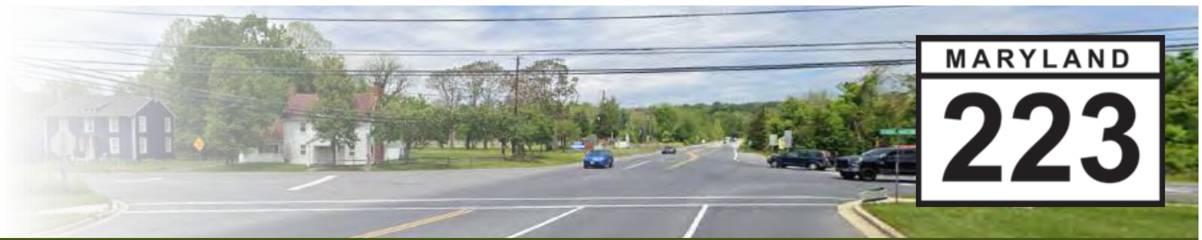
For more information of if you have questions about the project, please contact:

Ms. Alexis Pincus, Project Manager
MDOT SHA Office of Highway Development
707 North Calvert Street, C-102
Baltimore, Maryland 21202
Phone: 410-545-2845
Toll-Free: 888-228-6971
Email: apincus@mdot.maryland.gov

SEE INSIDE FOR DETAILS!

MDOT MARYLAND DEPARTMENT OF TRANSPORTATION

STATE HIGHWAY ADMINISTRATION



MD 223 and Floral Park Road Roundabout Project

Intersection Improvements Moving Forward; Virtual Public Meeting Scheduled for April 26, 2023

The Maryland Department of Transportation State Highway Administration (SHA) is moving forward with the design of intersection improvements at MD 223 (Piscataway Road) and Floral Park Road in Prince George's County. The project aims to improve traffic operations and safety for motorists, pedestrians and bicyclists through the installation of a roundabout.

Project Overview

The project will improve safety and accessibility for motorists, pedestrians and bicyclists at the MD 223/Floral Park Road intersection and will include:

- construction of a single-lane roundabout at the MD 223/ Floral Park Road intersection, with right-turn lanes approaching northbound Piscataway Road and westbound Floral Park Road;
- the addition of 10-foot-wide pedestrian/bicyclist crosswalks across the roundabout approaches;
- the addition of bicycle ramps along the MD 223 approaches tying into the existing multi-use path south of the intersection;
- installation of storm drain and stormwater management improvements;
- the addition of landscaping and
- resurfacing the roadway.

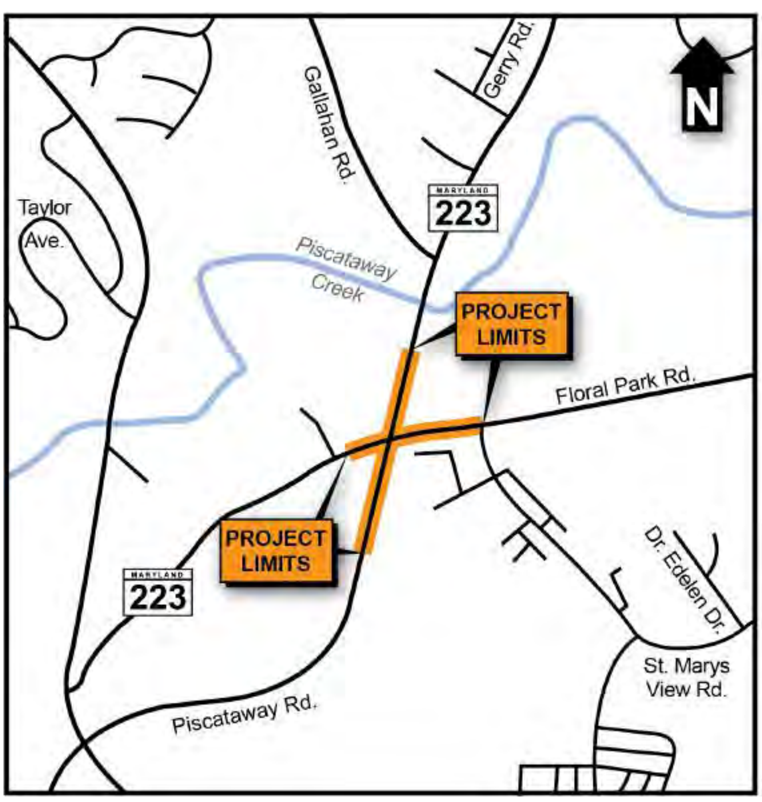
Project Schedule

The project is funded through final design and construction, which includes right-of-way acquisition and utility relocation costs. Final design should be complete by fall 2023 and construction is scheduled to begin in spring/summer 2024.

You are Invited to Attend a Virtual Public Meeting.

The virtual meeting will be held on **Wednesday, April 26, 2023, from 6:30 to 8 p.m.** Details are available on the Project Portal Page at: **https://bit.ly/MDOTSHA-MD223-Floral- Park-Rd-Roundabout** or by using the QR code below. You may attend by using **Microsoft Teams Live or by calling 1-443-409-5228, Conference ID: 247 524 911#** on your phone. Those calling in will be able to hear the presenters and discussion, but will be unable to see the presentation. We encourage you to use the meeting link posted on the Project Portal Page to view all meeting materials.

During the meeting, the team will present the findings and recommendations from the project, as well as the next steps. State Highway Administration representatives will be available to answer project-related questions. The public is encouraged to leave comments and ask questions before, during and after the meeting by using the on-line comment form, located under Community Outreach and Newsletters on the **Project Portal Page**. Sending questions and comments in advance allows the project team to address them during the meeting. Attendees also will be able to send written questions and comments through the Q&A feature during the meeting.



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For More Information

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Find Us on the Web

For additional information about the MD 223 and Floral Park Road Roundabout Project, please visit the Project Portal at: **https://bit.ly/MDOTSHA-MD223-Floral-Park-Rd-Roundabout.** You may also use the QR code shown below.

@MDOTSHA
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MDStateHighwayAdmin

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MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

MD 223 and Floral Park Road Roundabout Project

VIRTUAL PUBLIC MEETING ON APRIL 26, 2023

DETAILS INSIDE!

For additional information about the MD 223 and Floral Park Road Roundabout Project, please visit the Project Portal at: https://bit.ly/MDOTSHA-MD223-Floral-Park-Rd-Roundabout. You also may use the QR code shown here:

Appendix E: TMDL Assessment Report

SHA has prepared this FY23 TMDL Assessment Report with tables in accordance with conditions in Part IV.E.5 of the MS4 Permit. **Table V.A.1.e, Parts 1** and **2,** are provided below in accordance with conditions in Parts IV.E.5.a, IV.E.5.b, and V.A.1.e of the MS4 Permit. These tables present adjusted pollutant load reduction targets and FY23 progress toward attainment of stormwater wasteload allocations (WLAs) for all nutrient, sediment, and trash TMDLs. Progress toward attainment of benchmarks and applicable WLAs developed under EPA approved TMDLs is also documented in the *Chesapeake Bay Progress* and *Local TMDL Progress* tables of the MS4 Geodatabase – Part 1 submitted with the FY23 MS4 annual report.

SHA adaptively manages its Coordinated TMDL Implementation Plan through prompt review and incorporation of new regulatory guidance and progress modeling tools, rigorous tracking of restoration needs by watershed, and continuous investigation for new opportunities to implement effective BMPs and to collaborate with private and public sector partners. The plan is accessible online at the following web address:

https://roads.maryland.gov/mdotsha/pages/index.aspx?PageId=336

Nutrient and Sediment TMDLs

MDE is requiring jurisdictions to remodel all baseline loads and restoration progress for nutrient and sediment TMDL implementation plans using the MDE-developed TMDL Implementation Progress and Planning (TIPP) Tool. The TIPP spreadsheet tool was developed by the MDE Water and Science Administration (WSA) using loading rates derived from the Chesapeake Bay Program (CBP) watershed model (WM) Phase 6 (CBP WM P6). SHA updated its Automated Modeling Tool (P6 AMT) to Phase 6 in FY23 to produce modeling outputs that are identical to the TIPP. SHA met with MDE on August 17, 2023 to discuss the transition to CBP WM P6 modeling and SHA alternative modeling methods. MDE verbally approved use of the SHA P6 AMT to model loads and load reductions for all nutrient and sediment TMDLs with WLA requirements. As such, nutrient and sediment loads presented here and within applicable reporting tables of the MS4 Geodatabase – Part 1 were modelled using the SHA P6 AMT. The current version of the SHA *Restoration Modeling Protocol* was developed under CBP WM P5.3.2 and will be updated to reflect the transition to CBP WM P6, TIPP models, and crediting methods established in the MDE November 2021 guidance document, *Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated – Guidance for National Pollutant Discharge Elimination System Stormwater Permits* (MDE 2021 Accounting Guidance).

Beginning with the FY23 MS4 annual report, SHA has removed all pollutant load reductions associated with past and present implementation of street sweeping, inlet cleaning, and pipe cleaning BMPs from its modeling for nutrient and sediment TMDL WLA progress. Current SHA operational levels and methods for these practices do not meet the new, minimum qualifications established in the MDE 2021 Accounting Guidance for TMDL pollutant load reduction credit. It is not clear if/when SHA will be able to implement improvements to these annual practices necessary for them to qualify for TMDL pollutant load reduction credit.

Target and progress load reduction amounts reported by SHA in this Appendix E to the FY23 MS4 annual report and in the associated MS4 Geodatabase – Part 1 comply with guidance provided by MDE in its July 30, 2021 comments that stated credit must be temporarily removed for any 'failed' BMPs until proper performance is attained and verified. Credit for 572 restoration BMPs was temporarily or permanently removed from SHA credit accounting in FY23. Given that SHA modelled load reduction targets are discounted for treatment provided by BMPs that were built prior to the 'baseline year' established for a given 8-digit watershed TMDL, SHA has also temporarily or permanently removed load reduction credit (a.k.a., existing treatment) associated with 2 stream restoration BMPs, 337 SWM facilities, and 129 tree planting BMPs from its TMDL WLA target load reduction modeling. Lastly, the restoration progress reported in this Appendix E has accounted for the one-time adjustment for stream restoration and outfall stabilization BMPs associated with credit computation corrections, as described in the *Restoration Plans* section of the FY23 MS4 annual report and described further in its **Appendix G**.

SHA load reduction progress reported for FY23 in **Table V.A.1.e – Part 1** decreased for many TMDLs relative to progress reported in Appendix E to the FY22 MS4 annual report. The decrease is partly due to the permanent removal of TMDL pollutant load reductions yielded from street sweeping, inlet cleaning, and pipe cleaning BMPs implemented to date and to the new temporary and permanent credit adjustments required per the MDE July 30, 2021 guidance, described in the *Restoration Plans* section of the FY23 MS4 annual report. The transition from the CBP WM P5.3.2 to CBP WM P6 was the primary factor contributing to the decline in SHA pollutant load reduction progress between FY22 and FY23. The CBP WM P6 significantly increased SHA baseline pollutant loads and only nominally increased BMP pollutant load reduction efficiencies by comparison. Due to the significantly increased reduction targets resultant from the transition to CBP WM P6, SHA is reevaluating and revising its MDE-approved WLA progress benchmark and attainment dates. Revised benchmark/attainment dates will be submitted to MDE for review and approval.

Table V.A.1.e - Part 1: Progress Toward Attainment of Applicable Nutrient and Sediment WLAs Developed Under EPA Approved TMDLs

Watershed Name	County	Pollutant	FY23 Progress CBP WM P6		
			SHA Reduction Target	Reduction Achieved	% Total Reduction Target Achieved
Chesapeake Bay Watershed TMDL WLAs					
Chesapeake Bay	MS4-Wide	Nitrogen	N/A[1]	34,392	N/A[1]
		Phosphorus	N/A[1]	11,504	N/A[1]
Local 8-digit Watershed TMDL WLAs					
Anacostia River – Nontidal[2]	MO, PG	Nitrogen	34,784	794	2.3%
		Phosphorus	4,452	302	6.8%

Table V.A.1.e - Part 1: Progress Toward Attainment of Applicable Nutrient and Sediment WLAs Developed Under EPA Approved TMDLs

Watershed Name	County	Pollutant	FY23 Progress CBP WM P6 SHA Reduction Target	FY23 Progress CBP WM P6 Reduction Achieved	FY23 Progress CBP WM P6 % Total Reduction Target Achieved
		Sediment	13,436,042	508,230	3.8%
Anacostia River – Tidal[2]	PG	Nitrogen	2,009	0	0.0%
		Phosphorus	255	0	0.0%
		Sediment	845,678	0	0.0%
Antietam Creek	WA	Phosphorus	801	152	18.9%
		Sediment	4,299,183	275,098	6.4%
Baltimore Harbor Non-Tidal[3]	AA, BA	Sediment	2,437,635	221,494	9.1%
Bynum Run	HA	Sediment	301,858	56,053	18.6%
Cabin John Creek	MO	Sediment	887,589	1,917,172	216.0%
Catoctin Creek	FR	Phosphorus	198	459	231.6%
		Sediment	2,367,249	973,723	41.1%
Conococheague Creek	WA	Sediment	1,040,641	61,056	5.9%
Double Pipe Creek	CL, FR	Phosphorus	1,093	45	4.1%
		Sediment	1,438,291	44,753	3.1%
Gwynns Falls	BA	Sediment	1,742,178	50,525	2.9%
Jones Falls	BA	Sediment	956,886	5,819	0.6%
Liberty Reservoir	BA, CL	Phosphorus	1,287	248	19.3%
		Sediment	3,690,152	619,533	16.8%
Little Patuxent River	AA, HO	Sediment	4,286,090	3,638,558	84.9%
Loch Raven Reservoir	BA, CL, HA	Phosphorus	374	840	224.6%
Lower Gunpowder Falls	BA	Sediment	907,610	1,324,983	146.0%
Lower Monocacy River	CL, FR, MO	Phosphorus	1,803	1,643	91.1%
Lower Monocacy River[2]	FR, MO	Sediment	7,617,491	1,927,723	25.3%
Marsh Run	WA	Sediment	298,755	27,648	9.3%
Mattawoman Creek	CH, PG	Nitrogen	7,656	855	11.2%
		Phosphorus	1,171	178	15.2%
Non-Tidal Back River	BA	Nitrogen	2,010	322	16.0%
		Phosphorus	382	117	30.7%
		Sediment	3,150,529	254,770	8.1%

Table V.A.1.e - Part 1: Progress Toward Attainment of Applicable Nutrient and Sediment WLAs Developed Under EPA Approved TMDLs

Watershed Name	County	Pollutant	FY23 Progress CBP WM P6		
			SHA Reduction Target	Reduction Achieved	% Total Reduction Target Achieved
Other West Chesapeake	AA	Sediment	380,751	0	0.0%
Patapsco River LN Branch	AA, BA, HO	Sediment	2,776,764	1,531,925	55.2%
Patuxent River Lower	AA, CH, PG	Sediment	1,145,035	40,169	3.5%
Patuxent River Middle	AA, PG	Sediment	1,615,191	84,502	5.2%
Patuxent River Upper	AA, HO, PG	Sediment	661,217	75,455	11.4%
Piscataway Creek	PG	Sediment	1,687,527	368,723	21.8%
Port Tobacco River	CH	Sediment	599,225	37,407	6.2%
Potomac River MO County	MO	Sediment	2,113,478	84,627	4.0%
Potomac River WA County	WA	Sediment	559,109	156,976	28.1%
Prettyboy Reservoir	BA, CL	Phosphorus	37	395	1,063.6%
Rock Creek	MO	Phosphorus	418	22	5.2%
		Sediment	1,279,985	37,026	2.9%
Rocky Gorge Reservoir	HO, MO, PG	Phosphorus	100	5	5.2%
Seneca Creek	MO	Sediment	2,679,759	428,869	16.0%
South River	AA	Sediment	799,697	3,095,155	387.0%
Swan Creek	HA	Sediment	221,069	2,290	1.0%
Triadelphia Reservoir (Brighton Dam)	HO, MO	Phosphorus	105	0	0.0%
Upper Monocacy River	CL, FR	Phosphorus	67	178	265.8%
		Sediment	2,260,266	309,959	13.7%
West River	AA	Sediment	161,331	0	0.0%

Note: All reduction targets and achievements are in Edge-of-Stream (EOS) pounds per year. "%Total Reduction Target Achieved" is on a scale of 0% to 100%, where 100% indicates the TMDL reduction target was achieved and a value over 100% indicates SHA implementation is exceeding the reduction target.

1. MDE has not established a percent reduction requirement for SHA related to the Chesapeake Bay TMDL pollutants. In accordance with conditions in Part III of the MS4 Permit, SHA maintaining compliance with all conditions of the MS4 Permit constitutes adequate progress toward compliance with Maryland's receiving water quality standards and any EPA approved stormwater WLAs for the MS4 Permit term.
2. Nutrient and sediment local TMDLs for Anacostia River and the sediment local TMDL for Lower Monocacy River are at the subwatershed scale.
3. The Baltimore Harbor Non-Tidal Sediment TMDL implementation plan was developed using CB WM P6/TIPP modeling and submitted to MDE after the FY22 MS4 annual report was submitted by SHA to MDE; therefore, a comparison to previous P5.3.2 modeling is not applicable.

PCB and Bacteria TMDLs

MDE stated in its 2022 guidance document, *General Guidance for Local TMDL Maximum Daily Load Stormwater Wasteload Allocation Watershed Implementation Plans*, that significant uncertainty remains surrounding associated load reductions and source contributions for bacteria and polychlorinated biphenyl (PCB) impairments. In February and August 2022, MDE published updated guidance documents for developing bacteria and PCB TMDL implementation plans. MDE is not requiring progress modeling for bacteria and PCB local TMDLs, so SHA has excluded associated WLAs from all parts of Table V.A.1.e. SHA has allocated funding in FY24 to update its implementation plans for bacteria and PCB TMDLs in accordance with requirements established in the 2022 MDE guidance documents.

Trash TMDLs

Before this FY23 MS4 annual report, SHA restoration progress reporting for trash TMDL WLAs has assumed that the amount of trash removed annually by SHA maintenance staff and contractor cleanups is relatively consistent year-to-year in the TMDL WLA watersheds. Per this assumption, SHA had exclusively accounted trash removed from inlet cleaning activities and routine maintenance of SWM facilities for its progress toward the annual trash reduction goal established for SHA. During FY23, SHA evaluated its data sources used for reporting SHA annual trash reductions from SHA maintenance staff and contractor cleanups as well as the data sources used for reporting trash removed from SHA inlet/pipe cleaning and routine maintenance of SWM facilities.

Results of the evaluation suggested that data tracking procedures for routine maintenance of SWM facilities were not designed for the purpose of documenting and reporting those activities for restoration credit/progress toward attainment of trash TMDL WLAs. Programmatic improvements are required to capture sufficient information to credit this activity for TMDL compliance. Annual trash reduction amounts from SHA maintenance staff and contractor cleanups statewide have been relatively constant year-to-year over the course of the MS4 Permit term; however, there was significant variance in the year-to-year implementation levels of these activities within the specific watersheds where SHA has established trash TMDL WLAs. To improve the accuracy of SHA progress reported for trash TMDL WLAs in **Table V.A.1.e – Part 2** below, SHA has excluded trash reductions associated with FY23 routine maintenance of SWM facilities and included historic and current trash reductions from SHA maintenance staff and contractor cleanups. To adaptively manage SHA attainment of its trash TMDL WLAs, SHA will work during FY24 to develop a plan to capture sufficient information to reliably report activities contributing towards trash TMDL compliance in targeted watersheds. In FY24, SHA will continue to assess its data sources used for accounting and reporting trash reduction progress and will work to identify methods that can quantify the subset of trash removed annually by the SHA Sponsor-a-Highway (SAH) and Adopt-a-highway (AAH) programs within trash impaired watersheds.

Table V.A.1.e – Part 2: Progress Toward Attainment of Applicable Trash WLAs Developed Under EPA Approved Local TMDLs

Watershed	TMDL Baseline Year	County	Modelled Target			Modelled FY23 Progress					SHA Annual Reduction Achieved	% Total Annual Reduction Target Achieved
			SHA Annual Reduction Requirement[1]	Annual Reduction Level to Maintain[2]	SHA Annual Reduction Target[3]	[4]State Forces Inlet Cleaning	[4]Contract Inlet Cleaning	Contract Inmate Pickups	[5]Sponsor A Highway	[5]Adopt A Highway		
Anacostia	2009	MO	6,044	99,788	105,832	769	0.0	71,978	TBD	TBD	72,747	69%
		PG	14,134	271,119	285,253	125	0.0	202,066	TBD	TBD	202,191	71%
Patapsco River Mesohaline – Jones Falls	2011	BA	1,419	63,749	65,168	145	0.0	102,528	TBD	TBD	102,673	158%
Patapsco River Mesohaline - Gwynns Falls	2011	BA	2,300	126,614	128,914	119	0.0	244,284	TBD	TBD	244,403	190%

Note: All reduction targets and achievements are in pounds per year. "%Total Annual Reduction Target Achieved" is on a scale of 0% to 100%, where 100% indicates the TMDL reduction target was achieved and a value over 100% indicates SHA implementation is exceeding the reduction target.

1. Required trash reduction amount established in the applicable EPA-approved trash TMDL document.
2. The trash reduction amount achieved by SHA maintenance staff and contractor clean ups during the TMDL Baseline Year established in the applicable EPA-approved trash TMDL document. Only annual reductions by SHA that exceed this amount should be accounted as progress toward trash TMDL WLAs established for SHA.
3. SHA annual reduction target modeling assumes SHA must first reduce trash annually in an amount equal to trash removed by SHA during the TMDL Baseline Year and then exceed that amount by no less than the annual reduction requirement established for SHA in the applicable EPA-approved trash TMDL document.
4. It is estimated that approximately 5 pounds of trash is removed from an inlet during cleaning based on a literature review of inlet cleaning characterization studies.
5. Data is not collected for this program at the 8-digit watershed scale so SHA cannot yet claim associated trash reductions as progress toward its established trash TMDL WLAs.

Adaptive Management

As described in the *Restoration Plans* section of the FY22 and FY23 MS4 annual reports, there are many scenarios that can temporarily or permanently decrease the creditability of, or credit yield from, a given BMP claimed for TMDL restoration compliance. These scenarios have been identified in recent fiscal years as recurring and potentially predictable. In accordance with conditions in Parts IV.E.2.b.iv and IV.E.5.e of the MS4 Permit, SHA has worked to develop adaptive management programs that can reduce, over time, the impact of said recurring/predictable scenarios on annual variances observed in the BMP and credit amounts SHA reports as verified MS4 Permit and TMDL restoration progress in each MS4 Permit annual report.

SHA adaptive management programs seek to:

- Improve communication and collaboration with SHA partners and stakeholders to identify new BMP implementation opportunities and to improve the security of perpetual access and credit claiming rights for existing, offsite alternative BMPs
- Identify new/emerging scenarios that can impact the creditability of BMPs for MS4 Permit and TMDL compliance, assess associated impacts, and then develop adaptive management programs to avoid, minimize, or mitigate credit/progress losses over time
- Evaluate the standards and procedures used for, and the quality of data from, BMP inspections to identify opportunities for programmatic improvement
- Define triggers for, and specific kinds of, preventative maintenance activities that can proactively address degrading alternative BMP functionality before the asset has reached the threshold for 'failure'
- Improve estimates for, and incorporate into budget requests and projections, the costs needed to adaptively manage preventative and remediation maintenance needs for alternative BMPs at increasing scale over time

Management of SWM facilities is well-established, but alternative BMPs are being managed in response to issues as they arise. SHA is exploring approaches to build a robust adaptive management program for alternative BMPs that is proactive and cohesive to ensure long-term sustained compliance.

As a component of its continuous restoration program during FY23, SHA continued to fulfill its partnership commitments to the Maryland Department of Natural Resources, the City of Rockville, and the United States Fish and Wildlife Service for shared design and construction projects for new BMP implementation. SHA advanced design for 4 proposed stream restoration BMPs that will provide pollutant load reductions for the Patuxent River Upper (HUC: 02131104) and Potomac River Montgomery County (HUC: 02140202) local TMDL watersheds.

Information for these ‘proposed’ BMPs is provided in the *BMP*, *AltBMPLine*, and *AltBMPPoly* feature classes of the MS4 Geodatabase – Part 1 submitted with the FY23 MS4 annual report.

Program Funding

In accordance with conditions in Part IV.E.5.c of the MS4 Permit, SHA has provided with the FY23 MS4 annual report a Microsoft Excel workbook containing a summary table and comprehensive list of restoration BMPs completed from 2011 to June 30, 2023, separated by contract number. **Table IV.E.5.d** is provided in accordance with conditions in Part IV.E.5.d of the MS4 Permit and shows the anticipated levels of capital funding allocated for TMDL compliance activities through State fiscal year 2029. This information is publicly accessible in the MDOT *Draft Consolidated Transportation Program* for fiscal years 2024 to 2029, published on September 1, 2023, at the following web address:

https://mdot.maryland.gov/tso/Pages/Index.aspx?PageId=27

Table IV.E.5.d: TMDL Compliance Funding Levels

Fiscal Year	Funding Level (Millions)
2024	$15.9
2025	$21.8
2026	$40.0
2027	$35.0
2028	$38.2
2029	$38.3
Total	**$189.2**

Appendix F: Little Catoctin Creek Watershed Monitoring Implementation Document

MARYLAND DEPARTMENT OF TRANSPORTATION

STATE HIGHWAY ADMINISTRATION

October 2023

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1 Introduction

The Maryland Department of Transportation State Highway Administration (MDOT SHA) Water Programs Division (WPD) has completed a stream restoration project on Little Catoctin Creek (LCC). The restoration extents originate at MDOT SHA bridge structure number 10081 along MD 180 (Jefferson Pike) and continues downstream approximately 3,100 LF of the existing channel. The floodplain restoration project consisted of stabilization and relocation of approximately 3,000 linear feet of Little Catoctin Creek, south of MD-180. The goals of the stream and floodplain restoration were to restore impaired vital ecosystems, and return hydrology, geomorphic, and hydraulic stream functions back to pre-development conditions within the 100-year floodplain. Construction of the Little Catoctin Creek stream restoration project was completed in April 2019.

MDOT SHA is in the process of monitoring the Stream Restoration of Little Catoctin Creek at U.S. 340 project per the NPDES/MS4 Assessment of Controls requirement. This report documents the findings from the fifth year of monitoring. The following sections of this yearly report include activities for monitoring activities performed between March 2022 and June 2023 with discussions of monitoring results from earlier phases of the stream restoration project.

2 Study Area

The Little Catoctin Creek watershed occupies 17.72 square miles (11,340.3 acres) in the southwestern corner of Frederick County in the Blue Ridge physiographic province. It flows 8.5 stream-miles southeast from its headwaters on the eastern side of South Mountain to the mouth east of the town of Brunswick and drains directly into the Potomac River. Land use in the watershed is primarily agricultural. Approximately 20 percent of the watershed draining to the study reach is forested. Impervious surface comprises less than 3 percent of the watershed (SHA 2016).

The study area is located north of the town of Rosemont between US-340 at the upstream end and Petersville Road (MD-79) at the downstream end. Within the study area, Little Catoctin Creek flows through active and old pasture. Prior to restoration, much of the riparian area (especially in reaches adjacent to MD-180) contained few trees – leaving much of the stream open to direct sunlight. Stream banks within the open pasture were steep and heavily eroded. Riffle and run habitats within the creek were predominantly cobble and gravel. Heavy deposits of fine silt and sand were found in pools and depositional areas.

3 Chemical Monitoring

Chemical monitoring of Little Catoctin Creek was performed per the chemical monitoring methodology specified in the NPDES/MS4 Assessment of Controls monitoring plan for the following monitoring efforts:

- Pre-construction phase (CHEM 1): January 3, 2017 to January 31, 2018
- Construction phase (CHEM 2): February 1, 2018 to April 15, 2019
- Post-construction phase Year 1 (CHEM 3): April 16, 2019 to April 30, 2020
- Post-construction phase Year 2 (CHEM 4): May 1, 2020 to June 30, 2020

Discharge, velocity, continuous water quality measurements, and discrete water quality sample analyses made during these efforts are available through the U.S. Geological Survey's National Water Information Service (NWIS) online at: https://www.waterqualitydata.us/.

Due to impacts to available resources that began in FY20 and persisted in FY21 as a result of the COVID-19 pandemic, MDOT SHA deferred CHEM 4 and BIO 4 monitoring activities at the LCC stream restoration site until FY22. In February of 2022, EA Engineering, Science and Technology, Inc., PBC (EA) received notice to proceed from the Maryland Department of Transportation State Highway Administration (SHA) for monitoring activities in the Little Catoctin Creek, including re-establishing monitoring stations that had been removed in June 2020 during the COVID-19 pandemic. Due to manufacturer supply chain issues, the ISCO and HOBO monitoring equipment orders were delayed approximately 8 weeks from the order date, which resulted in limited recording of continuous velocity and discharge data at the upstream and downstream chemical monitoring stations during the FY22 reporting period. During the time between when EA received Notice to Proceed from The State Highway Administration and waiting to receive the shipment of the continuous monitoring equipment EA performed a cross section elevation survey and two velocity surveys at the upstream and downstream chemical monitoring stations. In June of 2022 while waiting for the ISCO monitoring equipment to arrive HOBO KIT-D-U20-1 temperature and depth loggers were installed at both chemical monitoring locations, A baseflow sample was collected on June 6, 2022. On June 27, 2022, EA collected six discrete storm event subsamples, it should be noted that the storm tracked over the National Weather Service Emmitsburg MD weather station and did not track over the Hagerstown Airport weather station. It is possible that an event may be labeled as being a "storm" although precipitation did not occur at the weather station – isolated summer thunderstorms may have impacted only the LCC basin but did not impact the weather station, in February of 2023 EA installed a Onset rain gauge onsite to assist with tracking precipitation due to the distance of weather stations from the monitoring locations and possibility that scattered storms may not be represented in the weather station data but may still be present within the area of the monitoring location. Since continuous monitoring equipment was not installed for this storm event the existing stage discharge relationship was relied on to calculate velocity and discharge for this event. Additionally, there was no expected observed response in stream over the course of this storm event. Future storm events will rely on the area velocity meter installed at the upstream chemical monitoring station to calculate discharge. The ISCO 2150 area velocity meter was installed on June 29, 2022 and began collecting continuous velocity data in 5-minute intervals.

In June of 2022, EA began collecting continuous discharge, velocity, depth, and discrete water quality sample data at the chemical monitoring stations. The monitoring efforts through June 30, 2022 were conducted as part of the FY22 post-construction phase Year 2 (CHEM 4) first quarter chemical and flow monitoring activity, to evaluate post-construction conditions. EA collected samples for one storm event and one baseflow event during the FY22 reporting period. **Figure 1** shows Little Catoctin Creek and the locations of the two USGS stream gages used for monitoring.

In July of 2022 EA began collecting storm event samples for the FY 23 reporting period. Eleven storm event samples and two baseflow samples were collected from July 2022 through June 2023.

Figure 1. Chemical Monitoring Locations (USGS Stream Gages)

3.1 Surface Water Stage/Discharge/Velocity

In September 2016, U.S. Geological Survey established Site 01636845 (**Figure 1**, Little Catoctin Creek Near Rosemont, MD; upstream). This station was equipped with a radar level sensor and acoustic doppler velocity meter (ADVM) for measuring stage and velocity, respectively. In the pre-construction and construction phases of the study, 82 discrete discharge measurements were made for the purpose of calibrating these instruments, covering a range of 0.49 cubic feet per second (ft^3/s) to 307 ft^3/s. These measurements establish the relation between stage-velocity and discharge. Thirty-six manual calibration measurements were made between July 1, 2018 – June 30, 2019, which includes the period when the gage was decommissioned following the historic flood in 2018 and again at the start of the stream reconstruction work (January 18, 2019 – May 23, 2019). The gage was rebuilt using a radar water-level measuring system mounted aside the Rte. 180 Bridge and began operating in April 2019. Since then, 39 additional discharge measurements were made through July 2020 to recalibrate the stage-discharge relation. Because of the construction of the pond directly downstream of the bridge, the ADVM equipment could not be reinstalled at the upstream station, so water velocity entering at the upstream station (the pond) is not available for the post-construction during this period.

In December 2016, U.S. Geological Survey established the downstream site 01636846 (Little Catoctin Creek at Rosemont, MD). This site was instrumented with an ADVM to measure stream velocity. In September 2017, a bubbler-style gage unit was installed at this site to record stage needed for the computing discharge. Current and historic observations can be found at: *https://waterdata.usgs.gov/nwis/inventory/?site_no=01636846&agency_cd=USGS*

Discharge at the downstream station was deemed necessary because of the possibility that construction would enhance groundwater flow into the stream through the channel bottom. In addition, numerous springs and seeps were observed along the banks of the Little Catoctin Creek that likely contribute to the stream flow. Measurement of volumetric discharge concurrently at both the upstream and downstream stations allow quantification of the changes through the reach, and changes that may be attributed to the restoration effort. Methods used in this work follow USGS procedures in USGS Techniques of Water-Resources Investigations (Book 3, Chapter A8) available at https://pubs.usgs.gov/tm/tm3-a7/tm3a7.pdf and https://pubs.usgs.gov/twri/twri3a8/.

During the study, 284 and 261 discrete discharge measurements were made at the upstream and downstream sites, respectively, ranging from 0.54 ft^3/s to 824 ft^3/s at the upstream site, and 0.49 to 2,100 ft^3/s at the downstream site. The difference in ranges due to the disruption the upstream station caused by the 2018 flood. These discrete measurements help ensure the accuracy of the continuous discharge measurements required for evaluating the rehabilitation.

In June of 2022, with guidance from SHA, EA proposed and established an alternate downstream chemical monitoring station (**Figure 3**) due to safety and accessibility concerns of collecting storm samples via wading into the stream at the original downstream monitoring station. A HOBO KIT-D-U20-1 logger and stream gage are installed at the new downstream chemical monitoring station (**Figure 4**). This alternate downstream chemical monitoring station is located downstream of the previous station at coordinates Northing 185568.226199999 and Easting 346207.164300002 (Maryland North American Datum 1983 (NAD 83)).

In June 2022, EA began collecting continuous velocity and flow data in 15-minute intervals with an ISCO 2150 area velocity flow module mounted to the Jefferson Pike Route 180 bridge at the upstream chemical monitoring station 01636845 (**Figure 5**). EA also began collecting continuous temperature and depth data in five-minute intervals using HOBO KIT-D-U20-1 loggers installed at the upstream 01636845 (**Figure 5**) and downstream 01636846 (**Figure 4**) chemical monitoring stations beginning in June 2022. Pre- and post-restoration historic observations can be found online at: *https://nwis.waterdata.usgs.gov/md/nwis/uv/?site_no=01636845*

Figure 2. Upstream chemical monitoring station 01636845

Figure 3. Re-located downstream monitoring station 01636846

Figure 4. FY23 relocated downstream station (Site ID 01636846) on Little Catoctin Creek near Rosemont, MD. The photo shows the HOBO logger and stream gage.

Figure 5. FY23 upstream station (Site ID 01636845) on Little Catoctin Creek near Rosemont, MD. The photo shows the ISCO velocity and area flow module.

As part of continued post-construction monitoring, a stream geomorphic survey was conducted at the upstream monitoring location on May 19, 2022, and at the re-located downstream monitoring location on June 16, 2022. Between May 2022 and March 2023, EA conducted 7 stream velocity surveys at the upstream monitoring location, and 5 stream velocity surveys at the downstream monitoring location. The velocity surveys were used to determine stream flow and stage during a range of different flow conditions in order to verify if the pre-construction USGS rating curves needed to be updated for post-construction monitoring. As shown in **Figure 6** and **Figure 7**, the USGS rating curves do not reflect the post-construction stream hydrodynamics, so a new rating curve was developed for both the upstream and downstream stations. The updated rating curves were fit to the paired stage-discharge data using the following equation:

$$Q = a \times (WSE - e)^b$$

where

Q = discharge in ft^3/s,
WSE = water surface elevation in NAVD88 feet,
e = ineffective flow elevation in NAVD88 feet, and
a and b = rating curve coefficients.

The revised rating curves provide a reasonable fit to available stage-discharge data and were therefore used to compute EMCs and flow volumes.

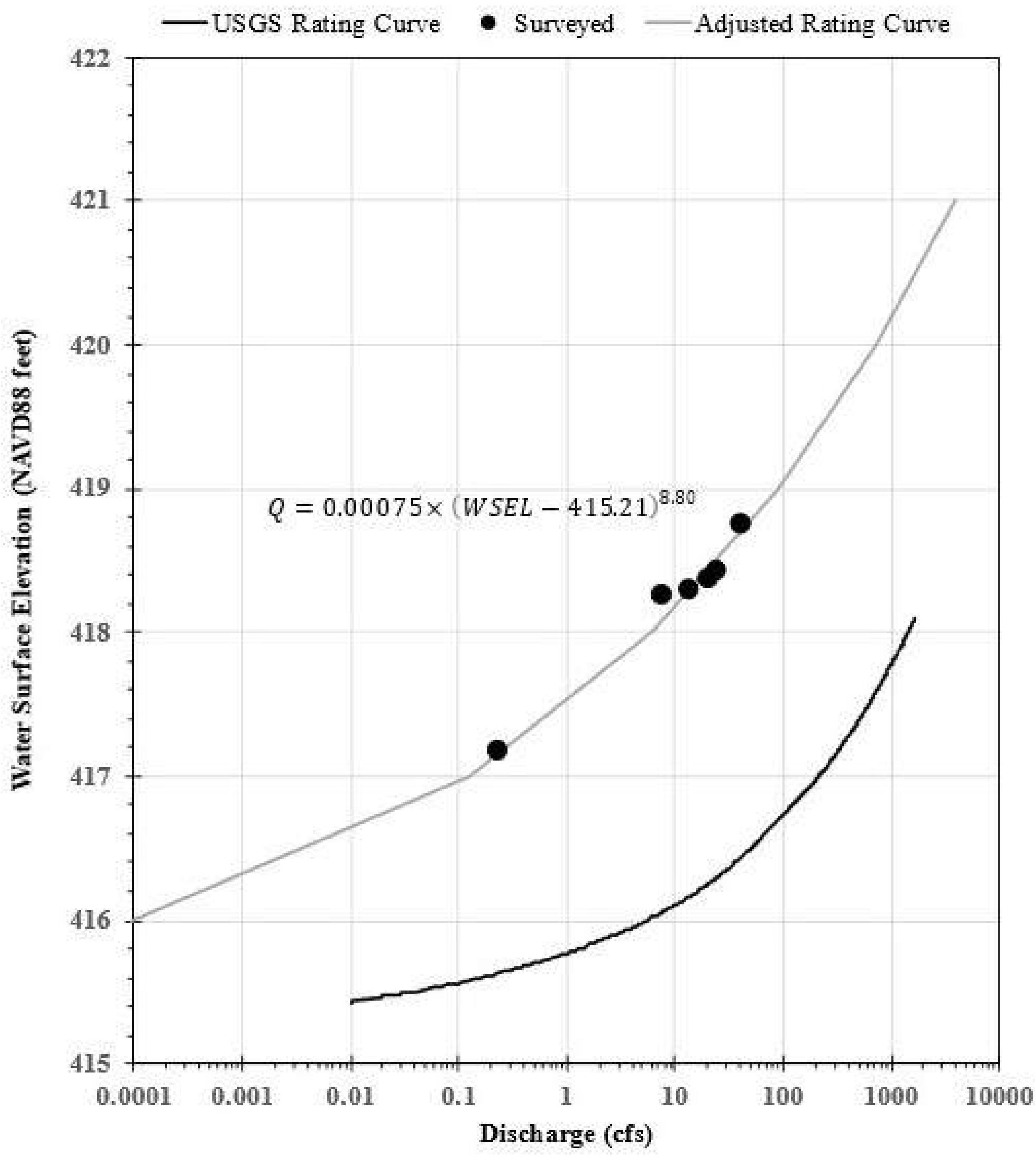

Figure 6. Comparison of USGS rating curve to measured discharge from three field surveys and four storm events at the upstream monitoring station..

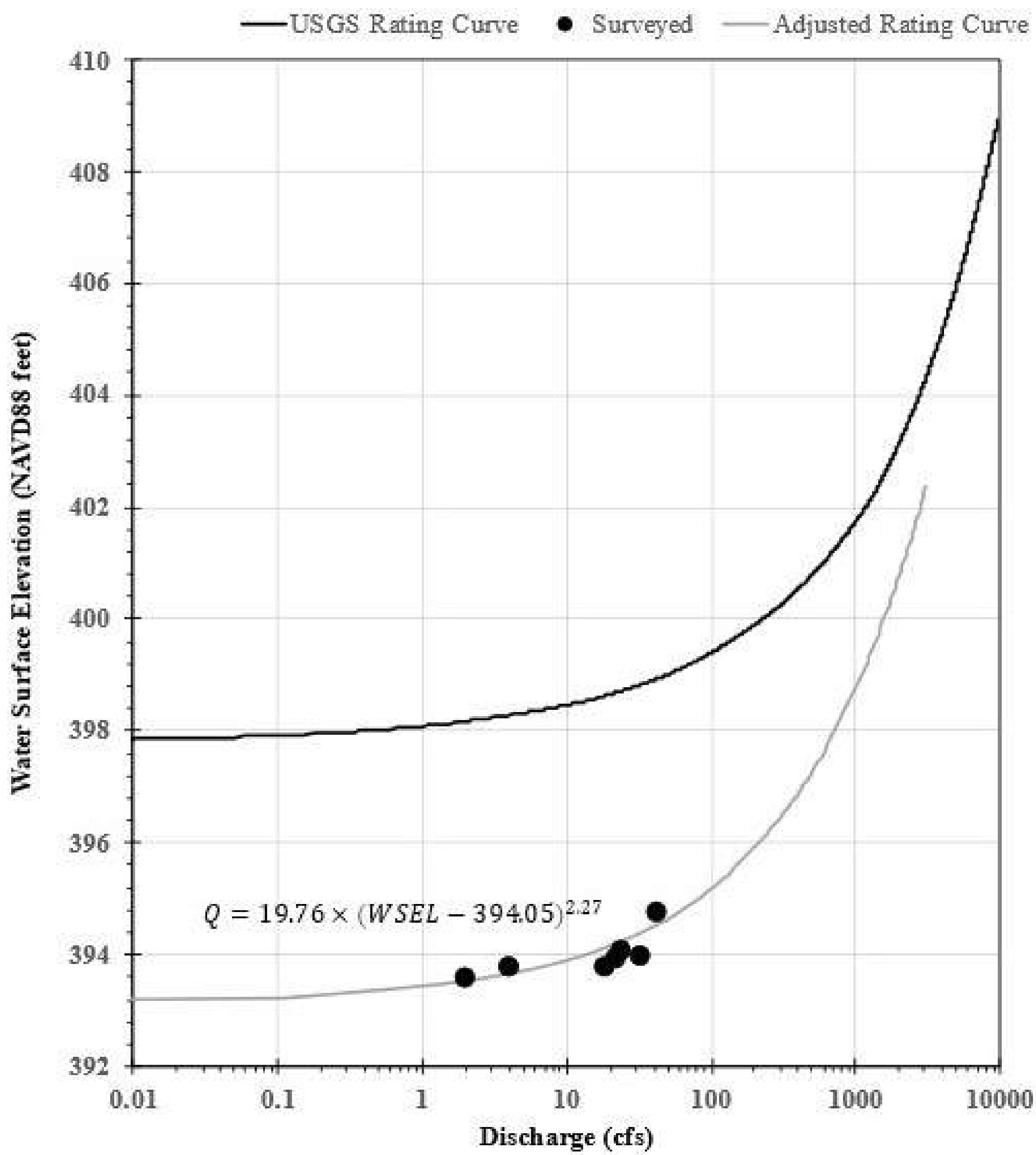

Figure 7. Comparison of USGS rating curve to measured discharge from field surveys at the downstream station (USGS 01636846 + 760 feet downstream).

3.1.1 Summary of Discharge and Velocity Data

The continuous discharge and water velocity data were downloaded, tabulated, and inspected for completeness, where completeness is defined as the percent of time when measurements were recorded compared to the total time of gage operation. Completeness is an important consideration when attempting to compare hydrologic and chemical parameters among time periods. For example, extended periods of missing data will greatly hinder the ability to compare volumes and loadings among pre- and post-construction periods. Data loss is the result of equipment failures, icing, or other unforeseen incidents such as major floods. Another factor is the percentage of data "approved" by the USGS for use. Hydrologic data collected by the USGS undergoes a rigorous review process before becoming "approved", with data classified as "provisional" being subject to change upon USGS review.

A summary of the continuous hydrologic data is presented in **Table 1** for the entire study period (October 1, 2017, through June 1, 2020). The data are divided into four intervals as follows:

- Pre-construction period from the initiation of sampling (January 3, 2017) until construction started on January 31, 2018
- Construction period from February 1, 2018 to April 15, 2019; and
- Post-construction period from April 16, 2019 to June 30, 2020 when the study was suspended.
- FY22 - FY23 post-construction period from June 29, 2022 to June 30, 2023.

As previously discussed, the gaging equipment at the upstream station was removed for 126 days (beginning on January 18, 2019) because of the floodplain restoration work. The gage was reinstalled and began operating again at the end of the construction work. This explains the low percentage of the discharge record in **Table 3.1** for the construction period. Recording of continuous velocity and discharge data for the post-construction monitoring period resumed on June 29, 2022.

As was the case in the pre- and construction phases, discharge and gage heights during the post-construction phase are higher at the downstream station than in the upstream station – indicating the Catoctin Creek study is a gaining reach. Median discharges for post- construction are 2.86 ft^3/s (maximum of 842 ft^3/s) upstream and 3.53 ft^3/s (maximum 918 ft^3/s) downstream. The difference in medians between upstream and downstream (downstream minus upstream = 0.67 ft^3/s) can be interpreted as the yearly groundwater input to the stream over this period. A smaller difference, 0.14 ft^3/s, existed between the medians of the upstream and downstream stations during the pre-construction period.

Comparing discharge measured concurrently at the upstream and downstream stations indicates that discharge increases by approximately 15% through the stream reach (8% difference for the pre-construction phase, and 21% for the post construction phase). Any "missing" discharge values, such as occurred at the upstream station during the construction period, can be estimated as being roughly 80% of the discharge measured downstream.

Table 2 is a summary of precipitation data for the site during the project study. The rain gage at the site began operation on February 25, 2018, so precipitation data were not available the pre-construction monitoring period. The precipitation record is sporadic through the construction and post-construction period due to problems with the rain collection equipment. To maintain consistency, the precipitation record from the Hagerstown Regional Airport, retrieved from NOAA website (https://www.ncdc.noaa.gov/data-access) was used to calculate precipitation totals and intensities for the sampled storm events. As is evident in this table, total precipitation varied considerably during the pre-, construction, and post-construction periods. During FY20, 32.25 inches of precipitation fell over the 367 days (start and end dates inclusive) in the year. During the construction period, several very large storms occurred, including the 100-year record storm, resulting in over 2 times more precipitation than was measured in the pre- and post-construction periods. Roughly 1.5 inches more precipitation fell in the post-construction interval than in the pre-construction. During FY22 EA retrieved precipitation data from the National Weather Service NOAA online weather data web site (https://www.weather.gov/wrh/climate?wfo=lwx) from the Emmitsburg, MD weather station. All precipitation data was recorded from Emmitsburg NWS weather station unless otherwise noted. Due to rapid changes in the paths of isolated summer thunderstorms that impact the LCC basin Emmitsburg, MD NWS weather station may not have recorded precipitation for every storm event even though precipitation was observed by field teams onsite. In this scenario precipitation data was recorded from the Hagerstown Regional Airport. Precipitation for the FY22 reporting period was recorded for the months of May and June totaling 10.51 inches of rainfall over 61 days. Precipitation for the FY23 reporting period was recorded for the months of July 2022 through June of 2023 totaling 43.43 inches over 365 days.

Table 1. Summary statistics of gage height, discharge, water velocity and precipitation measured during the construction phases at the upstream (01636845) and downstream (01636846) stations on Little Catoctin Creek, Md.

[ft, feet; ft3/s, cubic feet per second; ft/s, feet per second; in, inches; min, minutes; --, not available]

	Gage height (ft)	Discharge (ft^3/s)	[2]Velocity (ft/s)	[1]Precipitation (in. per 5 min.)
UPSTREAM (01636845)				
Pre-construction 1/3/17 – 2/1/18				
Maximum	5.59	454	2.92	na
Minimum	0.16	0.36	0.0	na
Median	1.12	1.74	0.10	na
Construction 2/2/18 – 4/15/19				
Maximum	8.96	9050	7.28	0.30
Minimum	0.88	1.08	0.00	0.00
Median	1.75	5.78	0.20	<0.01
Post-construction 4/16/19 to 6/30/20				
Maximum	4.51	842	na	0.48
Minimum	1.93	0.32	na	0.00
Median	2.58	2.86	na	<0.01
FY22-FY23 Post-construction 6/29/22 to 6/30/23				
Maximum	3.64	365	1.65	na
Minimum	1.59	1.53	0.04	na
Median	1.86	3.92	0.4	na

[1] Statistics are for precipitation recorded at the upstream USGS station, which began operation on 2/25/18. Precipitation is collected at 5-minute intervals.

Table 1. Summary statistics of gage height, discharge, water velocity and precipitation measured during the construction phases at the upstream (01636845) and downstream (01636846) stations on Little Catoctin Creek, Md. - continued

[ft, feet; ft3/s, cubic feet per second; ft/s, feet per second; in, inches; min, minutes; --, not available]

	Gage height (ft)	Discharge (ft^3/s)	[2]Velocity (ft/s)
	DOWNSTREAM (01636846)		
	Pre-construction 1/3/17 – 2/1/18		
Maximum	5.03	562	2.92
Minimum	1.32	0.38	-0.23
Median	1.44	1.88	0.11
	Construction 2/1/18 – 4/15/19		
Maximum	12.1	9,630	7.28
Minimum	1.22	0.33	-0.64
Median	1.65	6.95	0.20
	Post-construction 4/16/19 to 6/30/20		
Maximum	4.82	918	7.34
Minimum	1.32	0.46	0.001
Median	1.40	3.53	0.235
	FY22-FY23 Post-construction 6/29/22 to 6/30/23		
Maximum	4.66	401	na
Minimum	0.32	2.42	na
Median	1.43	4.84	na

[1] Statistics are for precipitation recorded at the upstream USGS station, which began operation on 2/25/18. Precipitation is collected at 5-minute intervals.

Table 2. Summary of monthly precipitation at Hagerstown Regional Airport during the pre-construction, construction, and post construction phases of the study.

Pre-construction 1/3/18 to 2/1/18		Construction 2/2/18 to 7/15/19		Post construction 4/16/19 to 6/1/20		[1]FY22-FY23 5/1/22 to 6/30/23	
Month and year	Total ppt. inches	Month and year	Total ppt. inches	Month and year	Total ppt. inches	Month and year	Total ppt. inches
Jan-17	2.75	Feb-18	3.88	Apr-19	3.14	May-22	7.22
Feb-17	1.35	Mar-18	1.96	May-19	5.73	Jun-22	3.34
Mar-17	2.83	Apr-18	4.12	Jun-19	2.12	July-22	5.27
Apr-17	2.37	May-18	4.64	Jul-19	4.37	Aug-22	3.06
May-17	5.32	Jun-18	4.97	Aug-19	2.4	Sep-22	3.66
Jun-17	2.74	Jul-18	5.96	Sep-19	0.48	Oct-22	3.27
Jul-17	5.35	Aug-18	6.24	Oct-19	5.25	Nov-22	3.44
Aug-17	2.9	Sep-18	9.31	Nov-19	0.8	Dec-22	5.27
Sep-17	1.45	Oct-18	1.63	Dec-19	3.05	Jan-23	1.58
Oct-17	3.54	Nov-18	2.46	Jan-20	2.75	Feb-23	1.74
Nov-17	1.62	Dec-18	4.87	Feb-20	1.71	Mar-23	2.99
Dec-17	0.81	Jan-19	3.43	Mar-20	2.57	Apr-23	3.27
Jan-18	2.62	Feb-19	2.97	Apr-20	4.53	May-23	7.22
		Mar-19	4.21	May-20	1.55	Jun-23	2.66
		4/16/2019 end	0.99				
Total precipitation	35.65		61.64		40.45		53.99
Total days	395		438		413		426

[1] FY22-FY23 data retrieved from NOAA Emmitsburg weather station.

3.2 Water Quality Measurements

In November and December 2016, multiparameter water quality sondes (YSI EXO-2) were installed at site 01636845 and 01636846, respectively (**Figure 8** and **Figure 9).** These sondes measured temperature, specific conductivity, pH, and turbidity at 5-minute intervals, and data are available on the NWIS website listed above. As mentioned previously, due to the restoration activities, the upstream data sonde was removed January18, 2019 and returned to operation on April 4, 2019. The sondes were permanently removed on June 30, 2020 when the sampling activities were suspended.

Figure 8. U.S. Geological Survey downstream station (Site ID 01636846) on Little Catoctin Creek near Rosemont, MD.

Figure 9. U.S. Geological Survey the downstream station (Site ID 01636846) on Little Catoctin Creek near Rosemont, MD. The photo shows the temporary gage station and the discharge and water-quality sonde installed in the river.

3.2.1 Summary of Discrete Water Quality Measurements

Discrete water quality data was measured using a YSI DSS PRO sonde unit before the rising, peak and falling limb sub-samples were collected. The average of temperature, specific conductance, pH, dissolved oxygen and turbidity data are presented in **Table 3**.

Table 3. Average discrete water quality data of three sub-samples recorded during the FY22-FY23 post-construction monitoring at the upstream (01636845) and downstream (01636846) monitoring stations on Little Catoctin Creek, Md.

[NTU, nephelometric turbidity units; µS/cm, micro-siemens per centimeter; degrees Fahrenheit, mg/L milligrams per liter]

Date and Time	Average Water Temperature (ºF)	Average Specific Conductance (µS/cm)	Average Turbidity (NTU)	Average pH(standard Units)	Average Dissolved Oxygen (mg/L)
UPSTREAM (01636845)					
6/6/22 – 6/30/23					
6/6/2022 10:15	66.2	322.1	3.39	7.25	8.77
6/27/2022 10:25	73.2	324.6	4.91	7.27	7.68
7/18/2022 15:45	76.6	333.3	7.99	7.55	8.31
8/30/22 15:30	78.3	464.2	30.65	7.79	9.77
9/22/22 09:24	68.9	398.5	6.65	7.40	7.30
10/1/23 08:15	57.4	273.0	18.9	7.28	9.16
10/13/22 15:07	59.9	381.3	17.40	7.21	7.39
11/11/22 08:45	56.3	255.8	41.62	7.06	5.98
1/31/23 11:20	42.3	253.3	8.40	7.46	7.35
2/16/23 12:38	48.4	211.6	56.87	7.54	9.52
3/10/23 11:00	44.6	396.7	10.90	7.58	10.20
3/24/23 09:00	52.5	264.0	17.17	7.42	8.85
4/28/23 09:00	55.2	246.3	14.55	7.54	8.48
6/12/23 12:45	68.9	369.5	78.24	7.39	8.02
6/30/23 08:55	68.9	362.5	4.36	7.34	5.56

Table 3. Average discrete water quality data of three sub-samples recorded during the FY22-FY23 post-construction monitoring at the monitoring station on Little Catoctin Creek, Md. - continued

[NTU, nephelometric turbidity units; µS/cm, micro-siemens per centimeter; degrees Fahrenheit, mg/L milligrams per liter]

Date and Time	Average Water Temperature (ºF)	Average Specific Conductance (µS/cm)	Average Turbidity (NTU)	Average pH (standard Units)	Average Dissolved Oxygen (mg/L)
Downstream (01636846)					
6/6/22 – 6/30/23					
6/6/2022 11:45	66.2	379.9	7.41	7.67	9.21
6/27/2022 11:15	73.9	338.4	4.34	7.38	8.44
7/18/22 16:20	76.1	342.2	5.16	7.58	8.02
8/30/22 16:05	76.8	445.3	14.87	7.54	7.77
9/22/22 10:29	68.7	325.6	8.10	7.63	8.48
10/1/22 09:04	57.6	330.0	10.48	7.26	9.12
10/13/22 15:59	60.1	412.6	1.97	7.33	8.18
11/11/22 09:24	56.3	273.2	31.07	7.11	6.60
1/31/23 13:30	42.3	245.0	0	7.82	10.19
2/16/23 13:00	48.2	226.2	54.04	7.44	9.19
3/10/23 11:30	44.1	397.9	9.76	7.60	9.90
3/24/23 09:30	52.0	288.0	14.00	7.39	8.77
4/28/23 09:30	55.4	239.0	12.50	7.57	8.70
6/12/23 13:15	68.5	348.2	16.97	7.48	8.38

3.3 Water Quality Sampling

The goals of the water-quality sampling are: (1) to fulfill monitoring requirements outlined in the NPDES/MS4 assessment of controls permit; (2) to facilitate calculation of nutrient and sediment loads or yields; and (3) to document the changes in loads of sediment and nutrients caused by the floodplain restoration. Water-quality sampling was also used to verify cross-channel homogeneity in suspended sediment (SS) and dissolved species, and to provide data for generating relationships between turbidity and suspended-sediment concentration (SSC).

During storm events, it was planned that samples were to be collected during the rise, peak, and falling stages of the hydrograph. These three samples, termed sub-samples, are weighted using the stream discharge at the time of sampling, and then summed to determine the mean concentration for the event, termed EMC:

$$\text{EMC} = \sum_{1}^{n} \left(\frac{\text{Qt}}{\text{QTotal}}\right) * \text{Ct}$$

Where:

EMC = the event mean concentration
Qt = the instantaneous discharge at the time (t) of sub-sample was collected
QTotal = the sum of the instantaneous discharges at times the sub-samples were collected
Ct = the concentration of component measured in sub-sample collected at time t
n = the number of sub-samples collected (2 to 5)

During most storm events, three sub-samples were obtained at each station; however, on some occasions, fewer sub-samples were obtained because of equipment failure or other unavoidable conditions. A few events multiple sub-samples, up to 5, were collected to provide replicate data needed to evaluate variability and precision. When available, replicate samples were included in the calculation of EMC.

Sub-samples were collected either manually by wading or by using automatic samplers. When the stream was wadable (during low-flow and sometimes during the falling stage), composite samples were prepared from 10 vertically depth-integrated grab samples obtained at equally spaced intervals across the stream. These grab samples are composited in a plastic churn, mixed, and sub-sampled for the various analytic protocols. During storm events when wading is not possible (typically the rising and cresting stages), the autosamplers are used to collect discrete samples for nutrient and sediment (either suspended-sediment concentration SSC, or total suspended solids (TSS) and bacteriological constituents. In contrast to wading, automatic samplers collect a sample from a point in the stream. Total petroleum hydrocarbon (TPH) samples were always collected manually (whenever possible), resulting in fewer sub-samples for this constituent.

Over the course of the study, the autosamplers were calibrated by making cross-sectional measurements of turbidity and specific conductance (SC) while the autosampler was collecting point samples for SSC, conductivity, and turbidity. Cross-channel turbidity is used to evaluate the distribution of suspended materials across the channel, while SC is used to evaluate the cross-channel mixing of dissolved constituents by turbulence. SSC can be related to turbidity (and possibly also to discharge), thereby allowing the continuous turbidity record to be used as a surrogate of SSC. The data collected to date show the stream is well mixed with respect to suspended and dissolved materials, and therefore, samples collected by autosamplers are comparable to those collected manually and are considered to accurately represent conditions in the stream. Calibration sampling was re-initiated at this station after sampling equipment was re-installed in April 2019.

Samples collected during times of low-flow are used to represent baseflow chemistry - these may not represent “baseflow” in the strict hydrologic sense; that is, baseflow being the groundwater contribution of the channel flow. Baseflow sampling was conducted only if precipitation had not occurred within 7 days prior to sampling and the stage was low and steady. As discussed below, baseflow discharge ranged from 0.60 to 1.63 ft^3/s, with higher values generally in winter months and during the construction period.

Samples for analysis of constituents that make up TPH were collected manually as grab samples (during both storm and baseflow) and were not composited across the stream. TPH samples are collected using a stainless-steel weighted sampler that holds multiple VOC vials. Because samples for TPH were collected manually, some storm events are represented by only 1 or 2 sub-samples (because of non-wadable conditions). During storms, samples for bacteriological analysis were collected into sterilized plastic bottles by the autosamplers.

Table 4 summarizes the number of storm and baseflow events, and the discrete sub-samples collected for nutrients, bacteriological, and TPH constituents. In total, 75 events were sampled at the upstream site, and 78 at the downstream site. Baseflow was sampled 16 times at the upstream site and 19 times at the downstream station. A total of 201 sub-samples were collected at the upstream station for chemical analysis, 72% were obtained using an autosampler. At the downstream site, of the 193 sub-samples collected for chemical analysis, 71% were obtained using the autosampler. A total of 327 samples have been collected at the upstream and 309 at the downstream for SSC; fewer samples were collected for TSS (196 and 189, respectively). Bacteriological samples were collected during all of the storms, totaling 198 and 194 samples at the upstream and downstream stations, respectively. TPH sub-samples totaled 145 and 140 at the upstream and downstream stations, respectively. As mentioned earlier, fewer samples for TPH constituents were collected because of the need to use manual collection methods. As shown in **Table 4**, the number of samples for which EMCs were calculated was identical (20) in the pre- and post-construction period. Almost two-times as many samples for SSC were collected in the pre- than in the post-construction phase, which is due to the calibration of the autosamplers.

Upon completion of analyses, results are uploaded into the U.S. Geological Survey's NWIS and are made available at https://water.usgs.gov/owq/data.html#USGS. In addition to the storm and baseflow events, a variety of field and equipment blanks were prepared and analyzed for quality assurance purposes. These data can also be available from the USGS-Md Water Science Center.

In June of FY22, EA resumed collecting baseflow and storm event samples at the upstream and downstream chemical monitoring stations. Three discrete sub-samples were collected during each storm event at each chemical monitoring station. Discrete storm samples were collected manually by wading into the stream during the rising, peak, and falling stages of the hydrograph. In total, 78 discrete sub-samples were analyzed at Eurofins Lancaster Laboratories, Inc. in Leola PA, for Biochemical Oxygen Demand, Total Kjeldahl Nitrogen, Nitrate plus Nitrite, Total Suspended Solids, Total Petroleum Hydrocarbons, Total Lead, Total Copper, Total Zinc, Total Phosphorus and Hardness. In addition, 78 discrete sub-samples for *E. Coli* were analyzed at Fountain Valley Analytical Lab located in Westminster, MD.

Table 4. Summary of samples collected during construction phases at the upstream (01636845) and downstream (01636846) stations on Little Catoctin Creek, Md.

	Total number of samples for EMC calculation	**No. of sample sets collected during storms (2 or 3 sub-samples)**	**No. of sample sets collected during baseflow (1 sample)**	**No. of sub-samples collected for chemical analyses**	**No. of sub-samples collected for SSC**	**No. of sub-samples collected for TSS**	**No. of sub-samples collected for bacteria**	**No. of sub-samples collected for TPH**
UPSTREAM 01636845								
All samples 1/3/17 to 6/30/23	75	62	16	201	327	196	198	145
Samples collected during preconstruction 1/23/17 to 1/31/18	20	14	7	52	127	49	50	39
Samples collected during construction 2/1/18 to 4/15/19	21	18	4	56	147	54	54	40
Samples collected during post-construction 4/16/19 to 6/30/20	19	18	2	54	53	54	55	27
Samples collected during FY22 – FY23 post-construction FY23 6/1/22 to 6/30/23	15	12	3	39	NA	39	39	39
DOWNSTREAM 01636846								
All samples 1/3/17 to 6/30/23	78	59	19	193	309	189	194	140
Samples collected during preconstruction 1/23/17 to 1/31/18	19	11	8	46	115	43	46	37
Samples collected during construction 2/1/18 to 4/15/19	24	19	5	55	144	54	56	39
Samples collected during post-construction 4/16/19 to 6/30/20	20	17	3	53	50	53	53	25
Samples collected duringFY22 - FY23 6/1/22 to 6/30/23	15	12	3	39	NA	39	39	39

3.3.1 Conditions During Sampled Storms and Low-flow

The discharge and precipitation during each event were tabulated and inspected for completeness. To calculate the total discharge for an event, the volume of water passing the gage during each 5-minute interval between measurement was calculated and then summed for the period of interest:

$$Q_{total} = \sum_{start}^{finish} \Delta t * Qt * K$$

Where

Qt = the total volume of water in liters

Δt = the time step between measurements, typically 5 minutes

Qt = the instantaneous discharge measured at time t

K = a constant to change ft^3/s to liters/minute (1699)

It is important to standardize the time over which discharge volumes were calculated for an event. Summation of discharge started at 0:00 on the day when the stream gage height first responded to precipitation and continued to 23:55 on the day the gage height returned to (or near) pre-storm heights. For some events, precipitation occurred again after sampling was completed but before the stage returned to its original pre-storm level. In these cases, the volume summation was ended at the time when the lowest post-storm gage height was reached. Volumes for baseflow samples were calculated for the 24-hours (0:00 to 23:55) of the sampling date, which results in volumes in units of L/day.

As mentioned above, the precipitation record at the upstream site was sporadic, so it was necessary to use precipitation data collected at the Frederick Airport. Data are recorded at the airport station every time 0.01-in of rain was collected. In FY23, EA retrieved precipitation data from the NWS Emmitsburg, MD weather station. Rainfall amount and intensity was determined by summing the precipitation volume that occurred over the defined interval of the event. Intensity was then calculated by dividing the total precipitation by the minutes between the times when the first and the final precipitation were recorded. Storm events were tracked by the EA project manager via forecasting by the National Weather Service. During storm event sampling, EA personnel arrived on-site prior the start of precipitation and remained on-site until the end of precipitation. Stream stages were estimated by visual observations of the stream gages on-site, and precipitation was measured via on-site rain gages during storm events. The precipitation record at the site was sporadic, so it was necessary to use precipitation data collected at the Emmitsburg, MD weather station.

A summary of the conditions at LCC during the storm and baseflow events is provided in **Table 5** and includes the date the first sample of the event was collected, the phase of the study (pre-construction, construction, and post-construction), whether upstream or downstream samples were collected, the rainfall amount and intensity, the maximum discharge reached at the upper sampling station, and the total volumes of water passing the two stations. Because the precipitation data listed in this table is from either the Hagerstown Regional Airport or Emmitsburg National Weather Service station, it is possible that an event may be labeled as being a “storm” even though precipitation did not occur at the weather station – isolated summer thunderstorms may have impacted only the LCC basin but not the weather stations.

To evaluate how the sampling effort represented the flow regimes that occur in LCC, discharge recorded at the upstream station at the time each sub-sample was collected was compared with the percentile rankings of discharge in the river for the period October 1, 2016, through June 30, 2023 (**Table 6**). The percentile discharges at the downstream station (not shown) are slightly greater than those at the upstream station, again indicating this is a gaining reach of the stream. The largest number of sub-samples were collected during times when the discharge was at or above the 99^{th} percentile (>75.7 ft^3/s) – the highest flow, followed by samples collected at moderate flows (4.64-8.89 ft^3/s). Thus, the sampling effort produced data that provides a good representation of the water-quality during moderate and high flow regimes. Almost equal numbers of samples were collected in the pre- and post-construction phases when discharge was very low, in the 10^{th} percentile range <1.33 ft^3/s.

3.3.2 Event Mean Concentrations

Event Mean Concentrations (EMCs) for all samples collected in this study (January 3, 2017 through June 30, 2023) are summarized in T**able 7**. Except for TPH, the EMCs values presented in this table are calculated with "non-detect" concentration in a sub-sample replaced with the corresponding MDL concentration. For the TPH, the EMC values were calculated with 'non-detected' values replaced with a null concentration (not considered in the EMC calculation). Samples with TPH reported as "nd" indicates that all components of TPH were below their respective MDLs. EMCs for the sampled events are presented in **Table 8.** The following points summarize and help desribe how EMCs were calculated.

Concentrations of all compounds except TPH in sub-samples that were reported as less-than the method detection level (MDL) were ***replaced with the MDL for the purpose of calculating EMCs***. Few sub-samples had inorganic species reported below their MDL; only BOD, zinc and total suspended solids (TSS) had multiple analyses reported below the MDLs. Because MDL values were used, any load calculated using these EMCs should be considered to be estimated maximum loads.

Event mean concentrations were also calculated by replacing non-detected (below MDL) concentrations with 0. These EMCs are not discussed in this report, and any load calculated with these EMCs should be considered a minimum.

Total Kjeldahl nitrogen was calculated as the sum of the dissolved organic nitrogen and dissolved ammonia.

The Total Kjeldahl Nitrogen result from the June 6, 2022 baseflow sample produced a result of 200 mg/L which is approximately 50 times higher than TKN results from previous studies. EA requested that the analytical laboratory verify this result and rerun the analysis. Unfortunately, no additional sample remained after the initial analysis and this value could not be verified. Due to these circumstances this result is suspected to be attributed to laboratory error due to a miscalculation of the dilution factor. EA and the SHA consultant removed this result from the data set.

Because EMCs were calculated as sums of sub-sample concentrations weighted by discharge, some EMCs are below the MDL for the constituent. This occurred in only a few cases and are noted in tables.

TPH. Several analytic methods are available for measuring TPH in water samples; different methods may produce different TPH depending on the analytes included in the method. In this work, five organic compounds were summed to obtain a TPH value, these compounds are: toluene (before 9/2018 MDL = 0.05 µg/L; then increased to 0.20 ug/L); benzene (MDL=0.026 µg/L); ethylbenzene (MDL=0.036 µg/L); o-xylene (MDL=0.032 µg/L); and methyl tert-butyl ether (MTBE, MDL = 0.1). Note the detection levels for toluene changed over the study. Because the TPH is calculated by summing various constituent compounds, the MDL for TPH cannot be lower than the highest MDL for any one constituent – in this case, the MDL for TPH is set by the toluene MDL of 0.1 or 0.2 ug/L (depending upon date of sample).

However, if one component was found at a quantifiable concentration (that is, above its individual MDL) in only 1 of the sub-samples collected for a storm, and was below the toluene MDL, then the TPH_EMC0 concentration was reported as the quantifiable concentration. In other words, the toluene concentration is considered to actually be 0. When the TPH_EMC0 value was calculated and no individual component of the TPH was found quantifiable in any sub-sample, then the concentration is reported as 0 with the MDL for toluene of 0.1 or 0.2 ug/L used for TPH. It should be noted that although an EMC is provided for TPH (set by the MDL of toluene), ***in most sub-samples none of the TPH constituents were found in a quantifiable concentration; there is no evidence that TPH was present in the stream water during these events.***

A few noteworthy observations can be made regarding TPH in the LCC samples from either the upstream or downstream sampling stations.

A. In FY20 samples, compounds that comprise TPH were found at quantifiable concentrations in only 3 sub-samples at the upstream station, that being for benzene (0.01 ug/L sampled on 10/7/19 and 0.02 ug/L sampled on 10/22/19 and 0.02 for the sample collected on 11/24/19). For FY20 samples from the downstream station, quantifiable concentrations were found in three samples: 0.02 ug/L for benzene in the sample from 10/22/19; 0.02 ug/L for benzene in the sample from 10/30/19; and 0.02 ug/L for xylene in the 4/30/20 sample.
B. Prior to FY20, quantifiable concentrations of organic constituents in the sub-samples were found in samples collected on 1/23/17 (both stations), 3/1/17 (upstream), 3/31/17 (both), 4/6/17 (both), 5/5/17 (both), 5/25/17 (both), 6/19/17 (both), 7/6/17 (both), 2/7/18 (upstream), 2/11/18 (both), 3/23/18 (both), 4/6/18 (upstream), 12/15/18 (both) and 3/21/19 (both).
C. Toluene was the only compound detected prior to 3/21/18, after which date only benzene was detected (samples collected on 3/23/18, 12/15/18, and 3/21/19).
D. The highest quantifiable TPH concentration was 0.95 µg/L in one sub-sample collected at the upstream station during the 3/1/17 event, which produced an EMC of 0.49 µg/L for this event.
E. At the downstream station the highest TPH concentration was 0.17 µg/L for a subsample collected during the 1/23/17 event (producing an EMC of 0.16 µg/L).
F. There appears to be no seasonal relation in the presence of the toluene or benzene, as "hits" were observed in samples collected during both winter and summer, and "hits" were observed in both upstream and downstream samples.
G. It should be noted that any quantifiable concentration was very-much lower than would be expected if "free-product" such as gasoline or diesel fuel were in the creek. While the data might be interpreted to indicate that petroleum is occasionally present in the stream, it is more likely these "hits" are random low-level contamination introduced either from sampling equipment or laboratory equipment.
H. In FY22 and FY23, TPH data were analyzed using EPA method 1664A, which has a higher detection limit. Therefore, current TPH data may not be directly comparable to previous TPH data.

Table 5. Summary of precipitation, maximum discharge reached, and total discharge during sampling events at upstream (01636845) and downstream (01636846) stations on Little Catoctin Creek, Md.

[in, inches; in/hr, inches per hour; ft3/s, cubic feet per second; L, liters]

Date	Stream status	Sample collected downstream	Sample collected upstream	Event type	Precipitation amount (in)	Rainfall intensity (in/hr)	**UPSTREAM** maximum discharge reached (ft3/s)	**UPSTREAM** total volume (L)	**DOWNSTREAM** total volume (L)	**Percent difference upstream to downstream**
1/3/17	Pre	N	Y	Storm	0.06	0.011	84.9	8.403E+07	9.191E+07	9.0
1/23/17	Pre	Y	Y	Storm	0.09	0.009	198	1.420E+08	1.552E+08	8.9
2/23/17	Pre	Y	Y	Base	0	--	1.85	4.430E+06	4.844E+06	8.9
3/1/17	Pre	Y	Y	Storm	0.19	0.095	7.53	1.419E+07	1.552E+07	9.0
3/31/17	Pre	Y	Y	Storm	0.08	0.137	73.7	6.365E+07	6.962E+07	9.0
4/6/17	Pre	Y	Y	Storm	0.00	--	181	1.350E+08	1.475E+08	8.9
5/5/17	Pre	Y	Y	Storm	1.23	0.049	90.9	6.587E+07	7.205E+07	9.0
5/25/17	Pre	Y	Y	Storm	1.15	0.052	123	1.383E+08	1.512E+08	8.9
6/19/17	Pre	Y	Y	Storm	0.00	--	22.0	1.439E+07	1.574E+07	9.0
7/6/17	Pre	Y	Y	Storm	0.30	0.033	303	1.117E+08	1.222E+08	9.0
8/7/17	Pre	Y	Y	Base[1]	0.00	--	2.07	7.257E+06	7.902E+06	8.5
8/24/17	Pre	Y	Y	Base	0	--	0.79	1.682E+06	1.781E+06	5.7
9/26/17	Pre	Y	Y	Base	0	--	0.60	1.371E+06	1.212E+06	-12
10/9/17	Pre	Y	Y	Storm	0.73	0.090	7.7	8.743E+06	1.294E+07	39
10/24/17	Pre	Y	Y	storm	0.45	0.064	4.99	7.490E+06	9.203E+06	21
10/29/17	Pre	Y	Y	Storm	0.46	0.060	122	9.983E+07	9.641E+07	-3.5
11/29/17	Pre	Y	Y	Base	0	--	1.11	2.635E+06	2.981E+06	12
12/20/17	Pre	Y	N	Base	0	--	0.91	2.101E+06	2.871E+06	31
12/24/17	Pre	N	Y	Base	0	--	2.6	4.095E+06	5.124E+06	22
1/12/18	Pre	Y	Y	Storm	1.16	0.048	454	1.748E+08	2.359E+08	30
1/26/18	Pre	Y	Y	Base	0	--	2.5	5.735E+06	6.087E+06	6.0

Note: Light shaded dates represent storm or baseflow events when only 1 station was sampled

1. On 8/7/17 0.02-in of precipitation was recorded at Frederick Airport.

Table 5. Summary of precipitation, maximum discharge reached, and total discharge during sampling events at upstream (01636845) and downstream (01636846) stations on Little Catoctin Creek, Md. - continued

[in, inches; in/hr, inches per hour; ft3/s, cubic feet per second; L, liters]

Date	Stream status	Sample collected downstream	Sample collected upstream	Event type	Precipitation amount (in)	Rainfall intensity (in/hr)	**UPSTREAM** maximum discharge reached (ft3/s)	**UPSTREAM** total volume (L)	**DOWNSTREAM** total volume (L)	**Percent difference upstream to downstream**
2/7/18	Const.	Y	Y	Storm	0.03	0.040	88.5	7.209E+07	8.542E+07	17
2/11/18	Const.	Y	Y	Storm	0.52	0.047	48.3	6.619E+07	7.914E+07	18
2/23/18	Const.	Y	Y	Storm	0.17	0.039	26.0	9.864E+07	9.660E+07	-2.1
3/1/18	Const.	Y	N	Storm	0.53	0.169	19.6	2.806E+07	1.312E+08	129
3/23/18	Const.	Y	Y	Base	0	--	12.0	2.502E+07	3.025E+07	19
4/15/18	Const.	Y	Y	Storm	2.69	0.336	235	2.392E+08	2.555E+08	6.6
4/27/18	Const.	Y	Y	Storm	0.34	0.132	7.51	1.157E+07	1.402E+07	19
5/6/18	Const.	N	Y	Base	0.28	0.070	5.99	1.651E+07	2.799E+07	52
5/13/18	Const.	Y	Y	Storm[2]	7.7	0.052	9,050	2.623E+09	1.506E+09	-54
5/22/18	Const.	Y	Y	Storm	0	--	397	1.180E+08	1.208E+08	2.4
6/2/18	Const.	Y	N	Storm	1.4	0.030	1,820	3.351E+08	3.912E+08	15
6/20/18	Const.	Y	N	Storm	0.01	0.002	62.2	2.146E+07	2.790E+07	26
7/16/18	Const.	Y	Y	Base	0	--	1.86	4.068E+06	5.038E+06	21
8/21/18	Const.	Y	N	Storm	0.98	0.363	327	9.671E+07	1.191E+08	21
9/9/18	Const.	N	Y	Storm	1.55	0.049	471	4.279E+08	4.932E+08	14
9/17/18	Const.	Y	Y	Storm	0.36	0.360	410	1.399E+08	1.616E+08	14
10/26/18	Const.	Y	Y	Storm	0.63	0.067	32.8	6.899E+07	8.426E+07	20

Note: Light shaded dates represent storm or baseflow events when only 1 station was sampled

2. Rainfall between 5/13/18 @7:15am on 5/13/18 and 10:45 am on 5/19/18 (147.75 hours) totaled 7.7-inches, however, this precipitation occurred in 7 distinct intervals. The maximum precipitation was 1.9 inches that occurred over 8 minutes at 0:55 am on 5/16/18.

Table 5. Summary of precipitation, maximum discharge reached, and total discharge during sampling events at upstream (01636845) and downstream (01636846) stations on Little Catoctin Creek, Md. - continued

[in, inches; in/hr, inches per hour; ft3/s, cubic feet per second; L, liters]

Date	Stream status	Sample collected downstream	Sample collected upstream	Event type	Precipitation amount (in)	Rainfall intensity (in/hr)	**UPSTREAM** maximum discharge reached (ft^3/s)	**UPSTREAM** total volume (L)	**DOWNSTREAM** total volume (L)	**Percent difference upstream to downstream**
11/9/18	Const.	Y	Y	Storm	0	--	94.4	7.334E+07	8.221E+07	11
11/29/18	Const.	Y	Y	Base	0	--	6.3	1.486E+07	1.876E+07	23
12/15/18	Const.	Y	Y	Storm	1.24	0.037	308	3.823E+08	4.644E+08	19
12/20/18	Const.	Y	Y	Storm	0.48	0.051	81.5	7.403E+07	8.169E+07	9.8
2/3/19	Const.	Y	Y	Base	0	--	9.1	3.36E+07	3.951E+07	15
2/6/19	Const.	Y	Y	Storm	0	--	8.8	3.54E+07	4.168E+07	15
2/11/19	Const.	Y	Y	Storm	0.45	0.014	168	1.77E+08	2.088E+08	15
2/21/19	Const.	Y	Y	Storm	0.03	0.007	53.5	7.08E+07	8.335E+07	15
3/21/19	Const.	Y	Y	Storm	0.24	0.012	739	5.32E+08	6.257E+08	15

Table 5. Summary of precipitation, maximum discharge reached, and total discharge during sampling events at upstream (01636845) and downstream (01636846) stations on Little Catoctin Creek, Md. - continued

[in, inches; in/hr, inches per hour; ft3/s, cubic feet per second; L, liters]

Date	Stream status	Sample collected downstream	Sample collected upstream	Event type	Precipitation amount (in)	Rainfall intensity (in/hr)	**UPSTREAM** maximum discharge reached (ft^3/s)	**UPSTREAM** total volume (L)	**DOWNSTREAM** total volume (L)	**Percent difference upstream to downstream**
4/19/19	Post	Y	Y	Storm	0.82	0.154	41.5	5.445E+07	5.954E+07	8.9
4/26/19	Post	Y	Y	Storm	0.3	0.039	7.28	4.768E+07	5.218E+07	9.0
5/23/19	Post	Y	Y	Storm	0	--	38.6	3.879E+07	4.685E+07	19
5/30/19	Post	Y	Y	Base	0	--	4.43	9.970E+06	1.122E+07	12
6/13/19	Post	Y	Y	Storm	0.800	0.069	35.7	3.491E+07	4.692E+07	29
6/27/19	Post	Y	Y	Base	0.75	0.900	16.0	9.105E+06	1.166E+07	25
6/29/19	Post	Y	Y	Storm	0.07	0.030	6.11	1.834E+07	2.243E+07	20
7/31/2019	Post	Y	Y	Base	0.00	0.000	1.58	3.649E+06	4.236E+06	15
8/18/2019	Post	Y	Y	Storm	1.07	1.834	30.7	1.814E+07	1.917E+07	5.5
9/30/2019	Post	Y	Y	Storm	0.22	0.115	0.94	3.333E+06	3.927E+06	16
10/7/2019	Post	Y	Y	Storm	0.19	0.019	3.23	7.516E+06	9.642E+06	25
10/22/2019	Post	Y	Y	Storm	0.34	0.047	5.13	8.385E+06	1.190E+07	35
10/30/2019	Post	Y	Y	Storm	0.27	0.030	206	1.227E+08	1.996E+08	48
11/24/2019	Post	Y	Y	Storm	0.50	0.058	5.69	1.638E+07	1.975E+07	19
1/25/2020	Post	Y	Y	Storm	1.08	0.139	369	1.463E+08	1.782E+08	20
2/6/2020	Post	Y	Y	Storm	0.55	0.079	289	2.231E+08	2.928E+08	27
3/13/2020	Post	Y	Y	Storm	0.21	0.079	704	4.130E+07	4.686E+07	13
4/13/2020	Post	Y	Y	Storm	0.68	0.073	31.9	3.769E+07	4.493E+07	18
4/24/2020	Post	Y	Y	Storm	0.29	0.040	21.7	6.585E+07	7.921E+07	18
4/30/2020	Post	Y	Y	Storm	0.21	0.011	302	2.493E+08	3.433E+08	32
6/6/2022	Post	Y	Y	Base	0	--	5.20	1.273E+07	1.885E+07	38.8
6/27/2022	Post	Y	Y	Storm	0.06	0.015	0.629	1.018E+06	1.079E+06	5.8
7/18/22	Post	Y	Y	Storm	0.18	0.045	11.5	9.844E+06	8.815E+06	44.8
8/30/22	Post	Y	Y	Storm	0.65*	0.163	1.83	4.217E+06	6.422E+06	32.8
9/22/22	Post	Y	Y	Storm	0.09*	0.045	1.91	4.526E+06	7.031E+06	32.2
10/1/22	Post	Y	Y	Storm	0.6	0.025	9.47	1.703E+08	7.751E+07	109
10/13/22	Post	Y	Y	Storm	0.25	0.017	2.5	1.180E+07	2.282E+07	25.9

Table 5. Summary of precipitation, maximum discharge reached, and total discharge during sampling events at upstream (01636845) and downstream (01636846) stations on Little Catoctin Creek, Md. - continued

[in, inches; in/hr, inches per hour; ft3/s, cubic feet per second; L, liters]

Date	Stream status	Sample collected downstream	Sample collected upstream	Event type	Precipi tation amount (in)	Rainfall intensity (in/hr)	**UPSTREAM** maximum discharge reached (ft^3/s)	**UPSTREAM** total volume (L)	**DOWNSTREAM** total volume (L)	**Percent difference upstream to downstream**
11/11/22	Post	Y	Y	Storm	1.69	0.070	54.79	8.582E+07	5.325E+07	80.6
1/31/23	Post	Y	Y	Base	0	--	0.14	1.634E+07	1.678E+07	10
2/16/23	Post	Y	Y	Storm	0.64	0.27	39.42	5.929E+07	6.259E+07	47.4
3/10/23	Post	Y	Y	Storm	0.05*	0.023	6.19	1.532E+07	1.628E+07	47.0
3/24/23	Post	Y	Y	Storm	0.29	0.012	7.76	5.327E+07	5.117E+07	52.1
4/28/23	Post	Y	Y	Storm	2.06	0.089	9.85	4.829E+07	4.774E+07	50.6
6/12/23	Post	Y	Y	Storm	0.29*	0.073	4.47	1.044E+07	1.217E+07	42.9
6/30/23	Post	Y	Y	Base	0	--	0.16	3.757E+06	4.294E+06	43.8

Note: Light shaded dates represent storm or baseflow events when only 1 station was sampled

Dark shaded volumes at upstream station were estimated from discharge measured at downstream station

* Rainfall data recorded from Hagerstown Regional Airport

Table 6. Number of sub-samples collected at the upper station (1636845) under different flow-regimes and construction phases on Little Catoctin Creek, Md from 2016-2023. [ft3/s; cubic feet per second]

Percentile range	Upstream station discharge 10/1/16 to 6/30/23 (ft^3/s)	Discharge range (ft^3/s)	Pre-Construction Number of subsamples [1] collected at upstream station during indicated flow range during pre-construction phase	Construction Number of subsamples [1] collected at upstream station during indicated flow range during construction phase	Post-Construction Number of subsamples [1] collected at upstream station during indicated flow range during post-construction phase
99	75.7	>75.7	51	56	54
95	8.89	8.89--75.7	8	12	7
75	4.64	4.64--8.89	20	30	18
50	2.44	2.44--4.64	3	11	16
25	1.33	1.33--2.44	9	2	13
10	0.81	0.81--1.33	7	1	5
		0--0.81	1	0	4

[1.] Storm events when 2-3 subsamples were collected, or baseflow events when 1 sub-sample was collected.

Table 7. Summary of event mean concentrations calculated for samples collected from upstream (01636845) and downstream (01636846) stations on Little Catoctin Creek, Md.

[EMC, event mean concentration; kg/L, kilograms per liter; mg/L, milligrams per liter; µg/L, micrograms per liter; MPN, most probable number; MDL, method detection level]

	Average [1] temperature C	Avg. pH (stnd. Units)	BOD-5 (mg/L)	Total Kjeldahl Nitrogen (mg/L)	Nitrite + Nitrate (mg/L)	Total phosphorous (mg/L)	Suspended sediment (mg/L)	TSS (mg/L)	Total copper (µg/L)
UPSTREAM									
Count	61	59	66	74	74	74	58	73	72
Maximum	81	7.9	39.8	3.63	5.10	3.435	1,828	1,460	52.2
Minimum	33.8	7.1	0.01	0.06	0.37	0.048	3	4	0.7
Median	53.5	7.4	7.9	0.93	2.78	0.434	53	48	7.4
# of EMCs below MDL	0	0	2	2	0	0	0	13	0
DOWNSTREAM									
Count	63	63	68	76	76	76	61	75	75
Maximum	77.6	8.8	41.3	4.01	4.91	3.459	1376	1197	48.3
Minimum	34.7	6.7	0.8	0.01	0.03	0.033	1	1	0.30
Median	56.4	7.5	5.5	0.76	2.60	0.314	46	40	7.6
# of EMCs below MDL	0	0	1	3	0	0	0	16	0

	Total lead (µg/L)	Total zinc (µg/L)	Hardness (mg/L)	*Enterococcus* (MPN)	*E. coli* (MPN)	[2,6]TPH (µg/L)
UPSTREAM						
Count	72	70	72	59	72	30
Maximum	32.3	124	163.7	1,000,000	16,500,000	1700
Minimum	0.07	2	37	51	1,100	0.01
Median	1.10	11	86	1,920	207,000	0.09
# of EMCs below MDL	0	7	0	0	0	52
DOWNSTREAM						
Count	74	73	75	63	76	27
Maximum	288	107	172.1	1,710,000	5,180,000	1633
Minimum	0.05	1	29	21	819	0.01
Median	1.07	8	90	23,700	79,900	0.05
# of EMCs below MDL	0	13	0	0	0	43

1. Summary statistics for all constituents except TPH were calculated after replacing non-detected concentrations with respective MDLs.
2. EMC's for TPH were calculated with non-quantifiable measurements (below MDL) replaced with null values.
3. FY22 and FY23 results for TPH analyzed by EPA method 1664A.

Table 8. Event mean concentrations measured in samples collected during storms and low-flow at the upstream (01636845) and downstream (01636846) stations on Little Catoctin Creek, Md.

[kg/L, kilograms per liter; mg/L, milligrams per liter; µg/L, micrograms per liter; MDL, method detection level; MPN, most probable number; -- not measured; nd, not detected above MDL]

UPSTREAM (01636845)

Event date	Stream condition	Average temperature (ºF)	Average pH (stnd. units)	BOD-5 (mg/L)	Total Kjeldahl nitrogen (mg/L)	Nitrite + Nitrate (mg/L)	Total phosphorous (mg/L)
MDL	--	--	--	2	0.5	0.04	0.05
Pre-Construction Samples							
1/3/17	Storm	43	7.6	--	1.8	1.88	1.43
1/23/17	Storm	38	7.4	18	1.3	1.18	3.08
2/23/17	Baseflow	54	7.5	2.0	0.49	4.38	0.048
3/1/17	Storm	55	7.4	13	0.78	2.91	0.590
3/31/17	Storm	48	7.5	12	2.6	1.81	2.18
4/6/17	Storm	54	7.4	18	1.7	0.92	2.40
5/5/17	Storm	62	7.3	15	2.5	2.02	1.38
5/25/17	Storm	70	7.2	11	1.9	3.14	1.83
6/19/17	Storm	75	7.3	40	1.8	2.09	1.24
7/6/17	Storm	75	7.1	8.0	2.0	3.43	1.63
8/7/17	Baseflow	69	7.1	26	3.0	3.36	0.558
8/24/17	Baseflow	70	7.5	1.2	0.38	3.30	0.098
9/26/17	Baseflow	73	7.6	--	0.26	2.36	0.102
10/9/17	Storm	71	7.2	30	1.2	2.13	0.990
10/24/17	Storm	63	7.2	--	3.6	2.57	1.28
10/29/17	Storm	51	7.4	29	1.7	2.89	3.44
11/29/17	Baseflow	46	7.6	1.7	0.22	4.41	0.050
12/24/17	Baseflow	43	7.4	--	1.0	3.55	0.212
1/12/18	Storm	42	7.3	0.4	1.78	3.10	2.43
1/26/18	Baseflow	37	7.3	2.5	0.73	5.10	0.067

Notes: The EMCs presented here for all species except TPH were calculated by replacing 'non-detects" with respective MDL.

EMC for TPH were calculated by replacing non-detected values with null (0) concentration. Values reported as nd (not detected) indicates that all components of TPH were below their respective MDL

Shaded values had one or more sub-samples with a concentration reported below the MDL.

Table 8. Event mean concentrations measured in samples collected during storms and low-flow at the upstream (01636845) and downstream (01636846) stations on Little Catoctin Creek, Md. - continued

[kg/L, kilograms per liter; mg/L, milligrams per liter; µg/L, micrograms per liter; MDL, method detection level; MPN, most probable number; -- not measured; nd, not detected above MDL]

UPSTREAM (01636845)							
Event date	Stream condition	Average temperature (ºF)	Average pH (stnd. units)	BOD-5 (mg/L)	Total Kjeldahl nitrogen (mg/L)	Nitrite + Nitrate (mg/L)	Total phosphorous (mg/L)
MDL	--	--	--	2	0.5	0.04	0.05
Construction samples							
2/7/18	Storm	33	7.3	--	1.0	2.37	0.594
2/11/18	Storm	38	7.4	--	1.4	3.06	0.759
2/23/18	Storm	47	7.4	--	0.95	3.07	0.339
3/23/18	Baseflow	41	7.6	6.4	0.40	4.35	0.095
4/15/18	Storm	48	7.1	4.6	1.5	1.65	1.42
4/27/18	Storm	55	7.4	8.6	0.82	2.84	0.170
5/6/18	Baseflow	60	7.5	--	2.1	2.69	0.434
5/14/18	Storm	65	7.3	3.1	1.47	2.25	2.59
5/22/18	Storm	71	7.3	11	1.5	1.45	1.25
7/16/18	Baseflow	81	7.8	2.3	0.11	3.75	0.085
9/9/18	Storm	65	7.0	6.5	0.74	0.66	1.21
9/17/18	Storm	71	7.4	6.7	0.86	2.62	0.497
10/26/18	Storm	50	7.5	7.9	0.93	2.84	0.521
11/9/18	Storm	48	7.2	--	0.68	2.04	0.733
11/29/18	Baseflow	40	7.4	2.7	0.51	4.96	0.051
12/15/18	Storm	43	7.5	23	1.8	1.60	2.18
12/20/18	Storm	45	7.4	9.6	0.86	2.56	0.345
2/3/19	Baseflow	40	7.3	22	0.72	4.62	0.096
2/6/19	Storm	45	7.4	3.7	0.47	3.90	0.070
2/11/19	Storm	35	7.4	7.0	0.63	1.71	0.881
2/21/19	Storm	43	7.4	6.9	0.78	2.82	0.390
3/21/19	Storm	44	7.3	15	1.4	1.96	2.86

Notes: The EMCs presented here for all species except TPH were calculated by replacing 'non-detects" with respective MDL. EMC for TPH were calculated by replacing non-detected values with null (0) concentration. Values reported as nd (not detected) indicates that all components of TPH were below their respective MDL

Shaded values had one or more sub-samples with a concentration reported below the MDL.

Table 8. Event mean concentrations measured in samples collected during storms and low-flow at the upstream (01636845) and downstream (01636846) stations on Little Catoctin Creek, Md. - continued

[kg/L, kilograms per liter; mg/L, milligrams per liter; µg/L, micrograms per liter; MDL, method detection level; MPN, most probable number; -- not measured; nd, not detected above MDL]

UPSTREAM (01636845)							
Event date	Stream condition	Average temperature (ºF)	Average pH (stnd. units)	BOD-5 (mg/L)	Total Kjeldahl nitrogen (mg/L)	Nitrite + Nitrate (mg/L)	Total phosphorous (mg/L)
MDL	--	--	--	2	0.5	0.04	0.05
Post construction samples							
4/19/2019	Storm	62	7.5	2.4	0.56	1.50	0.156
4/26/2019	Storm	64	7.5	12	0.93	3.08	0.182
5/23/2019	Storm	70	7.6	13	0.72	3.20	0.522
5/30/2019	Baseflow	75	7.6	1.6	0.56	3.62	0.085
6/13/2019	Storm	66	7.7	5.4	0.73	2.95	0.178
6/27/2019	Baseflow	74	7.7	2.7	0.43	3.41	0.109
6/29/2019	Storm	78	7.5	8.0	0.06	2.82	0.240
7/31/2019	Baseflow	75	7.8	2.9	0.46	3.53	0.104
8/18/2019	Storm	75	7.3	19	1.28	2.49	1.595
9/30/2019	Storm	69	7.6	1.5	0.42	2.59	0.104
10/7/2019	Storm	63	7.5	8.5	0.79	2.78	0.396
10/22/2019	Storm	58	7.5	5.6	0.62	2.34	0.263
10/30/2019	Storm	60	7.4	13	1.74	2.00	0.463
11/24/2019	Storm	43	7.5	12	1.30	3.25	0.412
1/25/2020	Storm	40	7.6	7.2	0.88	1.10	2.111
2/6/2020	Storm	43	7.5	6.0	2.38	0.98	0.389
3/13/2020	Storm	53	7.5	3.8	0.69	3.61	0.085
4/13/2020	Storm	56	7.5	6.3	1.00	1.72	0.416
4/24/2020	Storm	52	7.4	13	0.98	2.08	0.280
4/30/2020	Storm	57	7.2	15	1.05	0.37	1.330
6/6/2022	Baseflow	66.2	7.3	2.0	*	2.7	0.093
6/27/2022	Storm	73.2	7.7	2.0	1.18	2.02	0.196
7/18/22	Storm	76.6	7.5	39.3	5.14	2.03	1.36
8/30/22	Storm	78.3	7.8	2.0	0.725	0.906	0.143
9/22/22	Storm	68.9	7.4	2.3	0.666	1.03	0.140
10/1/22	Storm	57.4	7.2	10.4	2.72	1.90	0.769
10/13/22	Storm	59.9	7.1	3.2	1.21	2.23	0.153
11/11/22	Storm	56.3	7.5	22.8	2.00	2.20	0.871
1/31/23	Baseflow	42.26	7.46	2.0	0.5	4.4	0.05
2/16/23	Storm	48.4	7.6	8.1	1.80	2.07	0.253
3/10/23	Storm	44.6	7.4	13.3	1.22	4.30	0.176
3/24/23	Storm	52.5	7.5	14.9	2.59	3.47	0.399
4/28/23	Storm	55.2	7.4	7.4	1.72	1.69	0.234
6/12/23	Storm	68.9	7.3	3.5	0.892	0.27	0.155
6/30/23	Baseflow	68.9	7.5	1.5	1.2	0.22	0.061

Notes: The EMCs presented here for all species except TPH were calculated by replacing 'non-detects" with respective MDL.

EMC for TPH were calculated by replacing non-detected values with null (0) concentration. Values reported as nd (not detected) indicates that all components of TPH were below their respective MDL

Shaded values had one or more sub-samples with a concentration reported below the MDL.

*TKN result was suspected to be laboratory dilution error by EA and SHA.

Table 8. Event mean concentrations measured in samples collected during storms and low-flow at the upstream (01636845) and downstream (01636846) stations on Little Catoctin Creek, Md. - continued

[kg/L, kilograms per liter; mg/L, milligrams per liter; µg/L, micrograms per liter; MDL, method detection level; MPN, most probable number; -- not measured; nd, not detected above MDL]

UPSTREAM (01636845)						
Event date	Stream condition	Suspended sediment (mg/L)	Total suspended solids (mg/L)	Total copper (µg/L)	Total lead (µg/L)	Total zinc (µg/L)
MDL	--	0.5	1	0.36	0.071	4
Pre-construction samples						
1/3/17	Storm	264	217	15	5.1	30
1/23/17	Storm	1,250	1,250	35	25	109
2/23/17	Baseflow	4	15	0.9	0.07	2
3/1/17	Storm	102	77	4.8	2.4	17
3/31/17	Storm	583	497	20	11	54
4/6/17	Storm	833	618	26	17	78
5/5/17	Storm	202	162	12	3.7	21
5/25/17	Storm	402	381	29	8.3	46
6/19/17	Storm	147	141	9.6	4.1	32
7/6/17	Storm	396	354	19	7.6	37
8/7/17	Baseflow	15	16	3.1	0.31	7.0
8/24/17	Baseflow	5	15	1.3	0.09	2.0
9/26/17	Baseflow	6	15	1.5	0.19	2.0
10/9/17	Storm	57	43	5.8	0.78	11
10/24/17	Storm	29	31	6.2	0.57	12
10/29/17	Storm	723	525	26	13	85
11/29/17	Baseflow	1	15	1.2	0.07	2.0
12/24/17	Baseflow	12	15	3.8	0.29	4.0
1/12/18	Storm	861	660	26.4	13.0	77
1/26/18	Baseflow	4	15	0.8	0.12	2.0

Notes: The EMCs presented here for all species except TPH were calculated by replacing ‘non-detects” with respective MDL.

EMC for TPH were calculated by replacing non-detected values with null (0) concentration. Values reported as nd (not detected) indicates that all components of TPH were below their respective MDL

Shaded values had one or more sub-samples with a concentration reported below the MDL.

Table 8. Event mean concentrations measured in samples collected during storms and low-flow at the upstream (01636845) and downstream (01636846) stations on Little Catoctin Creek, Md. - continued

[kg/L, kilograms per liter; mg/L, milligrams per liter; µg/L, micrograms per liter; MDL, method detection level; MPN, most probable number; -- not measured; nd, not detected above MDL]

			UPSTREAM (01636845)			
Event date	Stream condition	Suspended sediment (mg/L)	Total suspended solids (mg/L)	Total copper (µg/L)	Total lead (µg/L)	Total zinc (µg/L)
MDL	--	1	1	0.36	0.071	4
			Construction samples			
2/7/18	Storm	132	100	7.4	2.4	12
2/11/18	Storm	141	128	8.2	3.4	17
2/23/18	Storm	38	25	--	--	--
3/23/18	Baseflow	3	15	1.3	0.08	2.0
4/15/18	Storm	440	328	8.5	2.3	13
4/27/18	Storm	16	16	2.1	0.37	5.4
5/6/18	Baseflow	21	15	4.1	0.32	10
5/22/18	Storm	351	356	11	8.2	31
7/16/18	Baseflow	7	15	1.1	0.12	2.0
9/9/18	Storm	59	318	13	6.7	29
9/17/18	Storm	80	83	6.7	1.8	10
10/26/18	Storm	50	56	5.2	1.1	8.1
11/9/18	Storm	146	116	6.4	3.0	17
11/29/18	Baseflow	4	15	0.7	0.10	2.0
12/15/18	Storm	942	616	34	18	82
12/20/18	Storm	62	50	10	1.4	11
2/3/19	Baseflow	7	--	--	--	--
2/6/19	Storm	6	15	2.4	0.18	2.7
2/11/19	Storm	539	467	14	11	42
2/21/19	Storm	159	138	5.3	3.0	19
3/21/19	Storm	1,440	1,300	41	29	120

Notes: The EMCs presented here for all species except TPH were calculated by replacing 'non-detects" with respective MDL.

EMC for TPH were calculated by replacing non-detected values with null (0) concentration. Values reported as nd (not detected) indicates that all components of TPH were below their respective MDL

Shaded values had one or more sub-samples with a concentration reported below the MDL.

Table 8. Event mean concentrations measured in samples collected during storms and low-flow at the upstream (01636845) and downstream (01636846) stations on Little Catoctin Creek, Md. - continued

[kg/L, kilograms per liter; mg/L, milligrams per liter; µg/L, micrograms per liter; MDL, method detection level; MPN, most probable number; -- not measured; nd, not detected above MDL]

			UPSTREAM (01636845)			
Event date	Stream condition	Suspended sediment (mg/L)	Total suspended solids (mg/L)	Total copper (µg/L)	Total lead (µg/L)	Total zinc (µg/L)
MDL	--	1	1	0.36	0.071	4
Post-construction Samples						
4/19/2019	Storm	7	32	7.6	1.10	7
4/26/2019	Storm	19	16	1.7	0.48	5
5/23/2019	Storm	113	133	10.8	3.33	20
5/30/2019	Baseflow	11	15	1.3	0.27	3
6/13/2019	Storm	20	21	2.3	0.51	4
6/27/2019	Baseflow	10	15	1.3	0.24	2
6/29/2019	Storm	8	46	7.4	1.09	9
7/31/2019	Baseflow	6	15	1.4	0.15	2
8/18/2019	Storm	446	415	22.7	9.68	57
9/30/2019	Storm	10	16	3.9	0.27	3
10/7/2019	Storm	28	31	12.7	0.78	9
10/22/2019	Storm	29	30	5.4	0.76	6
10/30/2019	Storm	15	15	16.3	0.46	8
11/24/2019	Storm	25	19	6.6	0.60	8
1/25/2020	Storm	1,850	1,480	52.8	32.6	126
2/6/2020	Storm	55	53	17.0	1.52	14
3/13/2020	Storm	13	15	12.2	0.31	5
4/13/2020	Storm	66	65	15.2	1.63	12
4/24/2020	Storm	29	23	11.2	0.80	9
4/30/2020	Storm	962	877	25.9	18.5	76
6/6/2022	Baseflow	--	3	0.7	0.1	4
6/27/2022	Storm	--	5.09	1.29	0.54	4.8
7/18/22	Storm	--	129	10.3	3.19	28.5
8/30/22	Storm	--	6.86	0.87	0.187	4
9/22/22	Storm	--	5.39	0.87	0.139	4
10/1/22	Storm	--	145	6.30	1.26	10.6
10/13/22	Storm	--	5.34	1.06	0.140	4
11/11/22	Storm	--	72	9.28	0.707	6.52
1/31/23	Baseflow	--	3.3	0.59	0.071	4
2/16/23	Storm	--	64	6.60	2.06	11.8
3/10/23	Storm	--	4.14	0.88	0.104	4
3/24/23	Storm	--	21	4.03	1.23	13.1
4/28/23	Storm	--	10	2.61	0.376	5.16
6/12/23	Storm	--	10	0.89	0.148	4
6/30/23	Baseflow	--	3.4	0.56	0.15	4

Notes: The EMCs presented here for all species except TPH were calculated by replacing ‘non-detects” with respective MDL.

EMC for TPH were calculated by replacing non-detected values with null (0) concentration. Values reported as nd (not detected) indicates that all components of TPH were below their respective MDL

Shaded values had one or more sub-samples with a concentration reported below the MDL.

Table 8. Event mean concentrations measured in samples collected during storms and low-flow at the upstream (01636845) and downstream (01636846) stations on Little Catoctin Creek, Md. - continued

[kg/L, kilograms per liter; mg/L, milligrams per liter; µg/L, micrograms per liter; MDL, method detection level; MPN, most probable number; -- not measured; nd, not detected above MDL]

UPSTREAM (01636845)					
Event date	Stream condition	Hardness (mg/L)	*Enterococcus* (MPN)	*E. coli* (MPN)	TPH (µg/L)
MDL	--	15	--	--	1500
Pre-construction samples					
1/3/17	Storm	73	23,500	207,000	0.04
1/23/17	Storm	52	43,400	230,000	0.14
2/23/17	Baseflow	106	1,300	1,900	nd
3/1/17	Storm	107	45,000	120,000	0.49
3/31/17	Storm	62	37,400	203,000	0.15
4/6/17	Storm	50	62,200	231,000	0.15
5/5/17	Storm	73	155,000	240,000	0.09
5/25/17	Storm	64	175,000	2,240,000	0.10
6/19/17	Storm	91	192,000	1,630,000	0.11
7/6/17	Storm	48	105,000	4,180,000	0.12
8/7/17	Baseflow	127	26,000	240,000	nd
8/24/17	Baseflow	129	2,400	31,000	nd
9/26/17	Baseflow	128	1,300	31,000	nd
10/9/17	Storm	109	1,000,000	2,400,000	0.22
10/24/17	Storm	114	274,000	6,510,000	nd
10/29/17	Storm	70	712,000	16,500,000	nd
11/29/17	Baseflow	107	930	14,000	nd
12/24/17	Baseflow	95	--	--	nd
1/12/18	Storm	60	19,200	240,000	nd
1/26/18	Baseflow	110	63	2,900	nd

Notes: The EMCs presented here for all species except TPH were calculated by replacing ‘non-detects” with respective MDL.

EMC for TPH were calculated by replacing non-detected values with null (0) concentration. Values reported as nd (not detected) indicates that all components of TPH were below their respective MDL

Shaded values had one or more sub-samples with a concentration reported below the MDL.

Table 8. Event mean concentrations measured in samples collected during storms and low-flow at the upstream (01636845) and downstream (01636846) stations on Little Catoctin Creek, Md. - continued

[kg/L, kilograms per liter; mg/L, milligrams per liter; µg/L, micrograms per liter; MDL, method detection level; MPN, most probable number; -- not measured; nd, not detected above MDL]

UPSTREAM (01636845)					
Event date	Stream condition	Hardness (mg/L)	*Enterococcus* (MPN)	*E. coli* (MPN)	[1]TPH (µg/L)
MDL	--	15	--	--	1500
Construction samples					
2/7/18	Storm	59	2,200	69,800	0.09
2/11/18	Storm	81	2,600	194,000	0.01
2/23/18	Storm	--	--	--	nd
3/23/18	Baseflow	122	350	3,000	0.01
4/15/18	Storm	49	22,800	188,000	nd
4/27/18	Storm	88	8,820	54,800	nd
5/6/18	Baseflow	102	33,000	170,000	nd
5/22/18	Storm	50	65,700	2,290,000	nd
7/16/18	Baseflow	99	1,400	17,000	nd
9/9/18	Storm	38	42,500	2,330,000	nd
9/17/18	Storm	95	97,900	2,370,000	nd
10/26/18	Storm	89	55,400	2,210,000	nd
11/9/18	Storm	73	38,000	702,000	nd
11/29/18	Baseflow	88	580	3,100	nd
12/15/18	Storm	54	26,700	601,000	0.01
12/20/18	Storm	74	7,930	130,000	nd
2/3/19	Baseflow	--	51	1,100	nd
2/6/19	Storm	86	338	8,820	nd
2/11/19	Storm	49	1,930	24,900	nd
2/21/19	Storm	91	2,900	10,200	nd
3/21/19	Storm	48	17,400	665,400	0.01

Notes: The EMCs presented here for all species except TPH were calculated by replacing 'non-detects" with respective MDL.

EMC for TPH were calculated by replacing non-detected values with null (0) concentration. Values reported as nd (not detected) indicates that all components of TPH were below their respective MDL

Shaded values had one or more sub-samples with a concentration reported below the MDL.

Table 8. Event mean concentrations measured in samples collected during storms and low-flow at the upstream (01636845) and downstream (01636846) stations on Little Catoctin Creek, Md. - continued

[kg/L, kilograms per liter; mg/L, milligrams per liter; µg/L, micrograms per liter; MDL, method detection level; MPN, most probable number; -- not measured; nd, not detected above MDL]

		UPSTREAM (01636845)			
Event date	Stream condition	Hardness (mg/L)	*Enterococcus* (MPN)	*E. coli* (MPN)	TPH (µg/L)
MDL	--	15	--	--	1500
Post- construction samples					
4/19/2019	Storm	80	14,200	680,000	nd
4/26/2019	Storm	86	47,200	98,800	nd
5/23/2019	Storm	81	83,700	576,000	nd
5/30/2019	Baseflow	105	5,200	19,000	nd
6/13/2019	Storm	90	17,200	240,000	nd
6/27/2019	Baseflow	96	1,400	19,000	nd
6/29/2019	Storm	96	8,520	313,000	nd
7/31/2019	Baseflow	105	860	28,000	nd
8/18/2019	Storm	70	128,000	240,000	nd
9/30/2019	Storm	118	3,860	54,800	nd
10/7/2019	Storm	107	47,400	240,000	0.02
10/22/2019	Storm	104	46,800	214,000	0.01
10/30/2019	Storm	113	239,000	1,400,000	nd
11/24/2019	Storm	103	16,300	178,000	nd
1/25/2020	Storm	48	9,740	230,000	nd
2/6/2020	Storm	77	12,200	53,700	nd
3/13/2020	Storm	89	6,400	11,500	nd
4/13/2020	Storm	71	52,800	206,000	nd
4/24/2020	Storm	80	19,100	125,000	nd
4/30/2020	Storm	37	72,100	226,000	nd
6/6/2022	Baseflow	110	--	3,255	nd
6/27/2022	Storm	126	--	14,507	600
7/18/22	Storm	110	--	241,960	2.05
8/30/22	Storm	163	--	2,020	1.63
9/22/22	Storm	153	--	1,736	1.63
10/1/22	Storm	94	--	126,148	1.6
10/13/22	Storm	133	--	18402	1.63
11/11/22	Storm	106	--	183283	2.04
1/31/23	Baseflow	120	--	200	1.6
2/16/23	Storm	94	--	8819	1.56
3/10/23	Storm	107	--	734	1.56
3/24/23	Storm	101	--	14646	1.55
4/28/23	Storm	73	--	31877	1.55
6/12/23	Storm	114	--	3751	1.93
6/30/23	Baseflow	99	--	934	1.5

Notes: The EMCs presented here for all species except TPH were calculated by replacing ‘non-detects” with respective MDL.

EMC for TPH were calculated by replacing non-detected values with null (0) concentration. Values reported as nd (not detected) indicates that all components of TPH were below their respective MDL

Shaded values had one or more sub-samples with a concentration reported below the MDL.

Table 8. Event mean concentrations measured in samples collected during storms and low-flow at the upstream (01636845) and downstream (01636846) stations on Little Catoctin Creek, Md. - continued

[kg/L, kilograms per liter; mg/L, milligrams per liter; µg/L, micrograms per liter; MDL, method detection level; MPN, most probable number; -- not measured; nd, not detected above MDL]

DOWNSTREAM (01636846)							
Event date	Stream condition	Average temperature (ºF)	pH (standard units)	BOD-5 (mg/L)	Total Kjeldahl nitrogen (mg/L)	Nitrite + Nitrate (mg/L)	Total phosphorous (mg/L)
MDL	--	--	--	2	0.5	0.04	0.05
Pre-construction samples							
1/23/17	Storm	40	7.5	5.4	1.34	1.3	3.459
2/23/17	Baseflow	51	7.6	1.1	0.12	4.2	0.046
3/1/17	Storm	54	7.6	1.9	0.48	3.0	0.138
3/31/17	Storm	47	7.4	9.2	3.09	1.8	2.126
4/6/17	Storm	55	7.5	22	1.45	1.3	3.057
5/5/17	Storm	57	7.2	18	2.40	2.1	1.738
5/25/17	Storm	58	7.4	11	1.91	2.4	1.573
6/19/17	Storm	76	7.3	27	1.42	1.9	1.120
7/6/17	Storm	73	7.2	7.9	1.72	3.2	1.663
8/7/17	Baseflow	69	7.4	1.0	0.40	3.1	0.093
8/24/17	Baseflow	73	7.5	1.0	0.38	2.7	0.102
9/26/17	Baseflow	70	7.5	1.0	0.46	2.1	0.081
10/9/17	Storm	71	7.3	9.0	0.73	2.0	0.546
10/24/17	Storm	63	7.4	0.0	0.45	1.2	0.216
10/29/17	Storm	52	7.3	41	1.65	2.5	2.075
11/29/17	Baseflow	43	7.8	1.9	0.09	4.0	0.039
12/20/17	Storm	43	7.6	1.7	4.01	0.0	0.033
1/12/18	Storm	33	7.3	8.6	1.08	3.1	0.363
1/26/18	Baseflow	33	7.4	2.2	0.60	4.83	0.067

Notes: The EMCs presented here for all species except TPH were calculated by replacing 'non-detects" with respective MDL.

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Table 8. Event mean concentrations measured in samples collected during storms and low-flow at the upstream (01636845) and downstream (01636846) stations on Little Catoctin Creek, Md. - continued

[kg/L, kilograms per liter; mg/L, milligrams per liter; µg/L, micrograms per liter; MDL, method detection level; MPN, most probable number; -- not measured; nd, not detected above MDL]

DOWNSTREAM (01636846)							
Event date	Stream condition	Average temperature (ºF)	pH (standard units)	BOD-5 (mg/L)	Total Kjeldahl nitrogen (mg/L)	Nitrite + Nitrate (mg/L)	Total phosphorous (mg/L)
MDL	--	--	--	2	0.5	0.04	0.05
Construction samples							
2/7/18	Storm	35	7.4	--	0.61	4.3	0.134
2/11/18	Storm	38	7.4	--	1.15	3.0	0.743
2/23/18	Storm	45	7.5	--	0.92	2.6	0.930
3/2/18	Storm	44	7.5	5.5	0.57	2.7	0.314
3/23/18	Baseflow	37	8.1	2.9	0.01	4.2	0.036
4/16/18	Storm	47	7.3	10.1	1.25	1.7	1.458
4/27/18	Storm	56	7.7	4.3	0.63	2.8	0.097
5/14/18	Storm	67	7.1	3.6	0.76	2.2	0.451
5/22/18	Storm	70	7.5	16	0.87	2.0	5.13
6/2/18	Storm	74	6.7	13.1	1.45	1.3	1.960
6/20/18	Storm	75	8.5	--	1.60	3.2	0.934
7/16/18	Baseflow	77	7.7	--	0.36	3.4	0.079
8/21/18	Storm	72	7.2	11	1.05	1.3	1.68
9/17/18	Storm	72	7.6	6.9	0.68	3.2	0.508
10/26/18	Storm	51	7.6	6.8	0.85	2.7	0.586
11/9/18	Storm	--	--	0.0	0.68	2.6	0.847
11/29/18	Baseflow	40	7.6	2.3	0.37	4.9	0.049
12/15/18	Storm	43	7.6	17	1.73	2.4	2.529
12/21/18	Storm	46	7.6	8.0	0.85	1.7	0.500
2/3/19	Baseflow	39	7.5	22	0.81	4.4	0.090
2/6/19	Storm	45	7.7	5.3	0.57	3.9	0.129
2/11/19	Storm	35	7.5	6.6	0.64	1.7	0.908
2/21/19	Storm	45	7.5	6.3	0.68	3.1	0.249
3/21/19	Storm	44	7.4	13	1.40	2.0	2.396

Notes: The EMCs presented here for all species except TPH were calculated by replacing 'non-detects" with respective MDL.

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Shaded values had one or more sub-samples with a concentration reported below the MDL.

Table 8. Event mean concentrations measured in samples collected during storms and low-flow at the upstream (01636845) and downstream (01636846) stations on Little Catoctin Creek, Md. - continued

[kg/L, kilograms per liter; mg/L, milligrams per liter; µg/L, micrograms per liter; MDL, method detection level; MPN, most probable number; -- not measured; nd, not detected above MDL]

DOWNSTREAM (01636846)							
Event date	Stream condition	Average temperature (ºF)	pH (standard units)	BOD-5 (mg/L)	Total Kjeldahl nitrogen (mg/L)	Nitrite + Nitrate (mg/L)	Total phosphorous (mg/L)
MDL	--	--	--	2	0.5	0.04	0.05
Post-construction samples							
4/19/19	Storm	64	7.8	2.8	0.60	2.70	0.118
4/26/19	Storm	64	7.8	8.7	0.76	2.99	0.128
5/23/19	Storm	73	7.6	10	0.80	3.14	0.393
5/30/19	Baseflow	76	8.0	1.8	0.60	3.50	0.075
6/13/19	Storm	65	7.5	3.8	0.71	2.95	0.543
6/27/19	Baseflow	77	8.8	3.1	0.43	2.93	0.091
6/29/19	Storm	78	7.7	15	0.65	2.60	0.206
7/31/2019	Baseflow	75	7.8	2.4	0.51	2.76	0.092
8/18/2019	Storm	75	7.2	14	0.93	2.31	0.920
9/30/2019	Storm	69	7.3	2.8	0.44	2.01	0.106
10/7/2019	Storm	63	7.2	4.7	0.63	2.21	0.287
10/22/2019	Storm	57	7.4	2.6	0.46	2.02	0.201
10/30/2019	Storm	60	7.5	3.1	0.69	1.86	0.221
11/24/2019	Storm	42	7.4	7.6	0.92	2.70	0.325
1/25/2020	Storm	38	7.5	14	1.02	1.80	1.713
2/6/2020	Storm	43	7.5	3.9	2.25	0.97	0.230
3/13/2020	Storm	52	7.7	1.9	0.61	3.30	0.068
4/13/2020	Storm	57	7.5	5.3	0.89	1.51	0.300
4/23/2020	Storm	52	7.4	12	0.91	2.03	0.254
4/30/2020	Storm	57	7.2	15	0.98	1.14	1.034
6/6/2022	Baseflow	66	7.7	2.0	0.64	2.4	0.092
6/27/2022	Storm	74	7.4	2.0	0.857	1.85	0.168
7/18/22	Storm	56.47	7.6	2.3	0.80	1.13	0.119
8/30/22	Storm	56.90	7.5	2.0	0.38	0.69	0.086
9/22/22	Storm	52.43	7.6	2.0	0.51	0.81	0.110
10/1/22	Storm	46.17	7.3	6.14	1.7	1.5	0.357
10/13/22	Storm	47.63	7.3	4.1	1.00	1.69	0.086
11/11/22	Storm	45.50	7.1	15.4	1.74	1.50	0.745
1/31/23	Baseflow	42.3	7.8	2.0	0.5	4.1	0.05
2/16/23	Storm	41.03	7.4	5.7	1.63	1.59	0.323
3/10/23	Storm	38.73	7.6	7.6	0.84	4.27	0.082
3/24/23	Storm	43.10	7.4	4.2	1.63	2.88	0.149
4/28/23	Storm	44.97	7.6	5.7	1.45	1.50	0.198
6/12/23	Storm	52.33	7.5	2.0	0.75	1.00	0.128
6/30/23	Baseflow	52.50	7.6	1.5	0.81	0.46	0.05

Notes: The EMCs presented here for all species except TPH were calculated by replacing ‘non-detects” with respective MDL.

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Shaded values had one or more sub-samples with a concentration reported below the MDL.

Table 8. Event mean concentrations measured in samples collected during storms and low-flow at the upstream (01636845) and downstream (01636846) stations on Little Catoctin Creek, Md. - continued

[kg/L, kilograms per liter; mg/L, milligrams per liter; µg/L, micrograms per liter; MDL, method detection level; MPN, most probable number; -- not measured; nd, not detected above MDL]

DOWNSTREAM (01636846)						
Event date	Stream condition	Suspended sediment (mg/L)	Total suspended solids (mg/L)	Dissolved copper (µg/L)	Dissolved lead (µg/L)	Dissolved zinc (µg/L)
MDL		1	1	0.36	0.071	4
Pre-construction samples						
1/23/17	Storm	1,380	1,110	31.7	22.9	107
2/23/17	Baseflow	4	15	0.9	0.1	2
3/1/17	Storm	23	18	2.2	0.5	2
3/31/17	Storm	543	332	16.6	8.0	37
4/6/17	Storm	1,250	901	30.3	22.0	95
5/5/17	Storm	375	271	14.9	6.2	32
5/25/17	Storm	398	356	20.9	8.2	44
6/19/17	Storm	147	162	9.3	3.5	24
7/6/17	Storm	518	477	20.7	10.5	49
8/7/17	Baseflow	7	15	1.1	0.2	2
8/24/17	Baseflow	8	15	1.2	0.1	2
9/26/17	Baseflow	3	15	1.5	0.1	2
10/9/17	Storm	27	26	4.4	0.5	4
10/24/17	Storm	15	15	1.7	0.1	1
10/29/17	Storm	364	321	15.7	7.0	41
11/29/17	Baseflow	1	15	1.4	0.1	2
12/20/17	Storm	3	15	3.2	0.1	2
1/12/18	Storm	37	35	3.5	0.7	4
1/26/18	Baseflow	2	18	0.3	--	2

Notes: The EMCs presented here for all species except TPH were calculated by replacing 'non-detects" with respective MDL.

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Table 8. Event mean concentrations measured in samples collected during storms and low-flow at the upstream (01636845) and downstream (01636846) stations on Little Catoctin Creek, Md. - continued

[kg/L, kilograms per liter; mg/L, milligrams per liter; µg/L, micrograms per liter; MDL, method detection level; MPN, most probable number; -- not measured; nd, not detected above MDL]

DOWNSTREAM (01636846)						
Event date	Stream condition	Suspended sediment (mg/L)	Total suspended solids (mg/L)	Dissolved copper (µg/L)	Dissolved lead (µg/L)	Dissolved zinc (µg/L)
MDL		1	1	0.36	0.071	4
Construction samples						
2/7/18	Storm	9	15	1.7	0.3	2
2/11/18	Storm	145	130	7.5	3.3	16
2/23/18	Storm	294	280	15.8	7.9	31
3/2/18	Storm	46	43	5.8	1.3	6
3/23/18	Baseflow	5	15	1.0	0.1	2
4/16/18	Storm	480	361	21.7	6.6	36
4/27/18	Storm	11	16	1.7	0.3	2
5/14/18	Storm	127	78	6.0	2.4	12
5/22/18	Storm	564	530	16.0	11.8	48
6/2/18	Storm	812	696	22.9	14.9	64
6/20/18	Storm	337	254	10.1	6.3	33
7/16/18	Baseflow	10	15	2.5	0.2	2
8/21/18	Storm	1,000	812	26.4	16.9	79
9/17/18	Storm	155	150	7.3	3.0	15
10/26/18	Storm	182	176	8.4	3.7	19
11/9/18	Storm	246	201	9.9	6.3	29
11/29/18	Baseflow	9	15	1.0	0.1	2
12/15/18	Storm	1178	771	36.4	20.6	93
12/21/18	Storm	110	85	8.6	2.4	14
2/3/19	Baseflow	--	--	--	--	--
2/6/19	Storm	107	26	3.8	0.7	6
2/11/19	Storm	537	435	13.4	10.3	41
2/21/19	Storm	85	73	3.2	1.5	12
3/21/19	Storm	1,310	1,160	35.5	23.4	103

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Table 8. Event mean concentrations measured in samples collected during storms and low-flow at the upstream (01636845) and downstream (01636846) stations on Little Catoctin Creek, Md. - continued

[kg/L, kilograms per liter; mg/L, milligrams per liter; µg/L, micrograms per liter; MDL, method detection level; MPN, most probable number; -- not measured; nd, not detected above MDL]

DOWNSTREAM (01636846)						
Event date	Stream condition	Suspended sediment (mg/L)	Total suspended solids (mg/L)	Dissolved copper (µg/L)	Dissolved lead (µg/L)	Dissolved zinc (µg/L)
MDL	--	1	1	0.36	0.071	4
			Post-construction samples			
4/19/19	Storm	82	24	2.6	0.62	4
4/26/19	Storm	15	15	1.6	0.38	4
5/23/19	Storm	68	90	11.0	2.36	14
5/30/19	Baseflow	12	15	1.4	0.24	2
6/13/19	Storm	81	108	6.0	2.00	12
6/27/19	Baseflow	8	15	1.0	0.16	2
6/29/19	Storm	4	15	8.7	0.27	8
7/31/2019	Baseflow	6	15	1.5	0.14	2
8/18/2019	Storm	169	152	12.7	3.29	21
9/30/2019	Storm	6	18	5.7	0.14	3
10/7/2019	Storm	24	23	7.6	0.43	4
10/22/2019	Storm	12	15	3.6	0.23	11
10/30/2019	Storm	14	15	8.9	0.27	4
11/24/2019	Storm	42	36	6.6	0.84	7
1/25/2020	Storm	1,210	1,005	48.3	20.6	104
2/6/2020	Storm	28	26	11.2	0.76	6
3/13/2020	Storm	15	15	7.8	0.33	4
4/13/2020	Storm	46	45	11.7	1.07	9
4/23/2020	Storm	308	28	13.9	0.78	9
4/30/2020	Storm	641	648	18.1	288	60
6/6/2022	Baseflow	--	8.1	0.7	0.1	4
6/27/2022	Storm	--	5.7	0.997	0.209	4
7/18/22	Storm	--	1.0	1.1	0.31	4
8/30/22	Storm	--	2.6	0.75	0.074	4.5
9/22/22	Storm	--	4.8	1.0	0.39	4
10/1/22	Storm	--	11	3.2	0.292	4
10/13/22	Storm	--	5.2	1.6	0.12	4
11/11/22	Storm	--	38.1	5.7	0.93	9
1/31/23	Baseflow	--	1.2	0.65	0.071	4
2/16/23	Storm	--	56.4	4.4	1.47	8
3/10/23	Storm	--	4.3	0.7	0.07	4
3/24/23	Storm	--	8.8	2.5	0.41	4
4/28/23	Storm	--	16.3	3.0	0.53	5
6/12/23	Storm	--	21	1.2	0.31	4
6/30/23	Baseflow	--	10	0.83	0.3	4

Notes: The EMCs presented here for all species except TPH were calculated by replacing ‘non-detects” with respective MDL.

EMC for TPH were calculated by replacing non-detected values with null (0) concentration. Values reported as nd (not detected) indicates that all components of TPH were below their respective MDL

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Table 8. Event mean concentrations measured in samples collected during storms and low-flow at the upstream (01636845) and downstream (01636846) stations on Little Catoctin Creek, Md. - continued

[kg/L, kilograms per liter; mg/L, milligrams per liter; µg/L, micrograms per liter; MDL, method detection level; MPN, most probable number; -- not measured; nd, not detected above MDL]

DOWNSTREAM (01636846)					
Event date	Stream condition	Hardness (mg/L)	*Enterococcus* (MPN)	*E. coli* (MPN)	TPH (µg/L)
MDL		15	--	--	1500
Pre-construction samples					
1/23/17	Storm	62	46,100	216,000	0.15
2/23/17	Baseflow	105	640	1,400	nd
3/1/17	Storm	102	2,390	18,800	nd
3/31/17	Storm	54	41,700	228,000	0.06
4/6/17	Storm	61	50,500	212,000	0.12
5/5/17	Storm	70	129,000	240,000	nd
5/25/17	Storm	63	132,000	1,720,000	0.08
6/19/17	Storm	95	994,000	2,070,000	0.05
7/6/17	Storm	51	83,800	2,770,000	0.12
8/7/17	Baseflow	116	2,200	80,000	nd
8/24/17	Baseflow	124	830	61,000	nd
9/26/17	Baseflow	133	590	41,000	nd
10/9/17	Storm	116	699,000	2,090,000	0.03
10/24/17	Storm	44	126,000	3,230,000	nd
10/29/17	Storm	62	365,000	5,180,000	nd
11/29/17	Baseflow	114	980	17,000	nd
12/20/17	Storm	103	310	16,000	nd
1/12/18	Storm	78	3,490	214,000	nd
1/26/18	Baseflow	39	21	4,500	nd

Notes: The EMCs presented here for all species except TPH were calculated by replacing 'non-detects" with respective MDL.

EMC for TPH were calculated by replacing non-detected values with null (0) concentration. Values reported as nd (not detected) indicates that all components of TPH were below their respective MDL

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Table 8. Event mean concentrations measured in samples collected during storms and low-flow at the upstream (01636845) and downstream (01636846) stations on Little Catoctin Creek, Md. - continued

[kg/L, kilograms per liter; mg/L, milligrams per liter; µg/L, micrograms per liter; MDL, method detection level; MPN, most probable number; -- not measured; nd, not detected above MDL]

DOWNSTREAM (01636846)					
Event date	Stream condition	Hardness (mg/L)	*Enterococcus* (MPN)	*E. coli* (MPN)	TPH (µg/L)
MDL	--	15	--	--	1500
Construction samples					
2/7/18	Storm	92	310	34,000	nd
2/11/18	Storm	82	3,240	115,000	0.01
2/23/18	Storm	85	9,100	82,000	nd
3/2/18	Storm	94	2,600	39,000	nd
3/23/18	Baseflow	120	300	3,700	0.01
4/16/18	Storm	46	11,100	227,000	nd
4/27/18	Storm	91	8,020	60,200	nd
5/14/18	Storm	63	19,600	305,000	nd
5/22/18	Storm	54	40,000	2,250,000	nd
6/2/18	Storm	54	38,000	2,400,000	nd
6/20/18	Storm	101	79,000	2,400,000	nd
7/16/18	Baseflow	104	590	25,000	nd
8/21/18	Storm	58	307,000	2,400,000	nd
9/17/18	Storm	99	130,000	2,600,000	nd
10/26/18	Storm	90	23,700	1,920,000	nd
11/9/18	Storm	77	--	--	nd
11/29/18	Baseflow	91	210	3,500	nd
12/15/18	Storm	62	22,200	533,000	0.01
12/21/18	Storm	57	6,740	174,000	nd
2/3/19	Baseflow	--	52	2,500	nd
2/6/19	Storm	89	1,070	12,600	nd
2/11/19	Storm	52	1,660	24,900	nd
2/21/19	Storm	98	3,750	12,800	nd
3/21/19	Storm	52	13,600	57,700	0.01

Notes: The EMCs presented here for all species except TPH were calculated by replacing ‘non-detects” with respective MDL.

EMC for TPH were calculated by replacing non-detected values with null (0) concentration. Values reported as nd (not detected) indicates that all components of TPH were below their respective MDL

Shaded values had one or more sub-samples with a concentration reported below the MDL.

Table 8. Event mean concentrations measured in samples collected during storms and low-flow at the upstream (01636845) and downstream (01636846) stations on Little Catoctin Creek, Md. - continued

[kg/L, kilograms per liter; mg/L, milligrams per liter; µg/L, micrograms per liter; MDL, method detection level; MPN, most probable number; -- not measured; nd, not detected above MDL]

DOWNSTREAM (01636846)					
Event date	Stream condition	Hardness (mg/L)	*Enterococcus* (MPN)	*E. coli* (MPN)	TPH (µg/L)
MDL	--	15	--	--	1500
Post-construction samples					
4/19/19	Storm	90	2,770	19,400	nd
4/26/19	Storm	90	34,800	127,000	nd
5/23/19	Storm	84	62,700	539,000	nd
5/30/19	Baseflow	90	1,500	20,000	nd
6/13/19	Storm	94	60,100	240,000	nd
6/27/19	Baseflow	96	2,500	18,000	nd
6/29/19	Storm	100	9,460	1,190,000	nd
7/31/2019	Baseflow	110	39,000	990	nd
8/18/2019	Storm	79	1,710,000	12,3000	nd
9/30/2019	Storm	113	125,000	3,440	nd
10/7/2019	Storm	119	240,000	172,000	nd
10/22/2019	Storm	121	172,000	7,320	nd
10/30/2019	Storm	116	132,000	14,800	0.02
11/24/2019	Storm	106	161,000	7,020	nd
1/25/2020	Storm	58	217,000	21,800	nd
2/6/2020	Storm	83	35,400	3,540	nd
3/13/2020	Storm	95	6,400	1,650	nd
4/13/2020	Storm	71	163,000	19,000	nd
4/23/2020	Storm	82	198,000	19,700	nd
4/30/2020	Storm	29	90,800	79,900	0.19
6/6/2022	Baseflow	140	--	908	nd
6/27/2022	Storm	127	--	798	600
7/18/22	Storm	124	--	42,388	1.63
8/30/22	Storm	163	--	9,474	1.43
9/22/22	Storm	172	--	3,443	1.60
10/1/22	Storm	163	--	9,476	1.93
10/13/22	Storm	110	--	78,162	0.431
11/11/22	Storm	131	--	138,440	2.74
1/31/23	Baseflow	120	--	100	1.6
2/16/23	Storm	102	--	5,510	1.56
3/10/23	Storm	107	--	320	1.53
3/24/23	Storm	110	--	4,181	1.57
4/28/23	Storm	113	--	18,335	1.90
6/12/23	Storm	121	--	8,225	1.68
6/30/23	Baseflow	130	--	842	1.60

Notes: The EMCs presented here for all species except TPH were calculated by replacing 'non-detects" with respective MDL.

EMC for TPH were calculated by replacing non-detected values with null (0) concentration. Values reported as nd (not detected) indicates that all components of TPH were below their respective MDL

Shaded values had one or more sub-samples with a concentration reported below the MDL.

ATTACHMENT A: CHEMICAL MONITORING DATA

Station	Event_ID	Sample_Name	Analyte_Group	Chemical_Name	Sample_Date	WSEL_NAVD 88feet	FlowCFS	Result (ND=0)	Result (ND=MDL)	Unit	MDL
Upstream	5	LCC22-RI-02-U	BOD	Biochemical Oxygen Demand	7/18/2022 15:45	418.13	9.19	29	29	MG/L	2
Upstream	5	LCC22-P-02-U	BOD	Biochemical Oxygen Demand	7/18/2022 17:00	418.14	9.47	45	45	MG/L	2
Upstream	5	LCC22-RE-02-U	BOD	Biochemical Oxygen Demand	7/18/2022 17:30	418.06	7.52	45	45	MG/L	2
Upstream	5	LCC22-RI-02-U	E. coli	E. coli	7/18/2022 15:45	418.13	9.19	241960	241960	MPN/100 ML	100
Upstream	5	LCC22-P-02-U	E. coli	E. coli	7/18/2022 17:00	418.14	9.47	241960	241960	MPN/100 ML	100
Upstream	5	LCC22-RE-02-U	E. coli	E. coli	7/18/2022 17:30	418.06	7.52	241960	241960	MPN/100 ML	100
Upstream	5	LCC22-RI-02-U	Inorganics	Hardness as calcium carbonate	7/18/2022 15:45	418.13	9.19	110	110	MG/L	30
Upstream	5	LCC22-P-02-U	Inorganics	Hardness as calcium carbonate	7/18/2022 17:00	418.14	9.47	110	110	MG/L	30
Upstream	5	LCC22-RE-02-U	Inorganics	Hardness as calcium carbonate	7/18/2022 17:30	418.06	7.52	110	110	MG/L	30
Upstream	5	LCC22-RI-02-U	Inorganics	Nitrate Nitrite as N	7/18/2022 15:45	418.13	9.19	2.1	2.1	MG/L	0.04
Upstream	5	LCC22-P-02-U	Inorganics	Nitrate Nitrite as N	7/18/2022 17:00	418.14	9.47	2	2	MG/L	0.04
Upstream	5	LCC22-RE-02-U	Inorganics	Nitrate Nitrite as N	7/18/2022 17:30	418.06	7.52	2	2	MG/L	0.04
Upstream	5	LCC22-RI-02-U	Inorganics	Total Kjeldahl Nitrogen	7/18/2022 15:45	418.13	9.19	3.4	3.4	MG/L	0.5
Upstream	5	LCC22-P-02-U	Inorganics	Total Kjeldahl Nitrogen	7/18/2022 17:00	418.14	9.47	6.9	6.9	MG/L	0.5
Upstream	5	LCC22-RE-02-U	Inorganics	Total Kjeldahl Nitrogen	7/18/2022 17:30	418.06	7.52	5.1	5.1	MG/L	0.5
Upstream	5	LCC22-RI-02-U	Inorganics	Total Phosphorus as P	7/18/2022 15:45	418.13	9.19	1.3	1.3	MG/L	0.05
Upstream	5	LCC22-P-02-U	Inorganics	Total Phosphorus as P	7/18/2022 17:00	418.14	9.47	1.4	1.4	MG/L	0.05
Upstream	5	LCC22-RE-02-U	Inorganics	Total Phosphorus as P	7/18/2022 17:30	418.06	7.52	1.4	1.4	MG/L	0.05
Upstream	5	LCC22-RI-02-U	Inorganics	Total Suspended Solids	7/18/2022 15:45	418.13	9.19	160	160	MG/L	10
Upstream	5	LCC22-P-02-U	Inorganics	Total Suspended Solids	7/18/2022 17:00	418.14	9.47	150	150	MG/L	10
Upstream	5	LCC22-RE-02-U	Inorganics	Total Suspended Solids	7/18/2022 17:30	418.06	7.52	65	65	MG/L	4
Upstream	5	LCC22-RI-02-U	Metals	Copper	7/18/2022 15:45	418.13	9.19	13	13	UG/L	0.36
Upstream	5	LCC22-P-02-U	Metals	Copper	7/18/2022 17:00	418.14	9.47	9.1	9.1	UG/L	0.36
Upstream	5	LCC22-RE-02-U	Metals	Copper	7/18/2022 17:30	418.06	7.52	8.5	8.5	UG/L	0.36
Upstream	5	LCC22-RI-02-U	Metals	Lead	7/18/2022 15:45	418.13	9.19	6.2	6.2	UG/L	0.071
Upstream	5	LCC22-P-02-U	Metals	Lead	7/18/2022 17:00	418.14	9.47	1.7	1.7	UG/L	0.071
Upstream	5	LCC22-RE-02-U	Metals	Lead	7/18/2022 17:30	418.06	7.52	1.4	1.4	UG/L	0.071
Upstream	5	LCC22-RI-02-U	Metals	Zinc	7/18/2022 15:45	418.13	9.19	43	43	UG/L	4
Upstream	5	LCC22-P-02-U	Metals	Zinc	7/18/2022 17:00	418.14	9.47	22	22	UG/L	4
Upstream	5	LCC22-RE-02-U	Metals	Zinc	7/18/2022 17:30	418.06	7.52	19	19	UG/L	4
Upstream	5	LCC22-RI-02-U	Oil & Grease	SGT-HEM (TPH)	7/18/2022 15:45	418.13	9.19	2.8	2.8	MG/L	1.7
Upstream	5	LCC22-P-02-U	Oil & Grease	SGT-HEM (TPH)	7/18/2022 17:00	418.14	9.47	0	1.7	MG/L	1.7
Upstream	5	LCC22-RE-02-U	Oil & Grease	SGT-HEM (TPH)	7/18/2022 17:30	418.06	7.52	0	1.6	MG/L	1.6
Upstream	6	LCC22-RI-03-U	BOD	Biochemical Oxygen Demand	8/30/2022 15:30	417.63	1.77	0	2	MG/L	2

Station	Event_ID	Sample_Name	Analyte_Group	Chemical_Name	Sample_Date	WSEL_NAVD 88feet	FlowCFS	Result (ND=0)	Result (ND=MDL)	Unit	MDL
Upstream	6	LCC22-P-03-U	BOD	Biochemical Oxygen Demand	8/30/2022 17:30	417.64	1.87	0	2	MG/L	2
Upstream	6	LCC22-RE-03-U	BOD	Biochemical Oxygen Demand	8/30/2022 17:50	417.65	1.90	0	2	MG/L	2
Upstream	6	LCC22-RI-03-U	E. coli	E. coli	8/30/2022 15:30	417.63	1.77	1750	1750	MPN/100 ML	100
Upstream	6	LCC22-P-03-U	E. coli	E. coli	8/30/2022 17:30	417.64	1.87	1730	1730	MPN/100 ML	100
Upstream	6	LCC22-RE-03-U	E. coli	E. coli	8/30/2022 17:50	417.65	1.90	2560	2560	MPN/100 ML	100
Upstream	6	LCC22-RI-03-U	Inorganics	Hardness as calcium carbonate	8/30/2022 15:30	417.63	1.77	150	150	MG/L	30
Upstream	6	LCC22-P-03-U	Inorganics	Hardness as calcium carbonate	8/30/2022 17:30	417.64	1.87	150	150	MG/L	30
Upstream	6	LCC22-RE-03-U	Inorganics	Hardness as calcium carbonate	8/30/2022 17:50	417.65	1.90	190	190	MG/L	30
Upstream	6	LCC22-RI-03-U	Inorganics	Nitrate Nitrite as N	8/30/2022 15:30	417.63	1.77	0.95	0.95	MG/L	0.04
Upstream	6	LCC22-P-03-U	Inorganics	Nitrate Nitrite as N	8/30/2022 17:30	417.64	1.87	0.91	0.91	MG/L	0.04
Upstream	6	LCC22-RE-03-U	Inorganics	Nitrate Nitrite as N	8/30/2022 17:50	417.65	1.90	0.86	0.86	MG/L	0.04
Upstream	6	LCC22-RI-03-U	Inorganics	Total Kjeldahl Nitrogen	8/30/2022 15:30	417.63	1.77	0.8	0.8	MG/L	0.5
Upstream	6	LCC22-P-03-U	Inorganics	Total Kjeldahl Nitrogen	8/30/2022 17:30	417.64	1.87	0.66	0.66	MG/L	0.5
Upstream	6	LCC22-RE-03-U	Inorganics	Total Kjeldahl Nitrogen	8/30/2022 17:50	417.65	1.90	0.72	0.72	MG/L	0.5
Upstream	6	LCC22-RI-03-U	Inorganics	Total Phosphorus as P	8/30/2022 15:30	417.63	1.77	0.14	0.14	MG/L	0.05
Upstream	6	LCC22-P-03-U	Inorganics	Total Phosphorus as P	8/30/2022 17:30	417.64	1.87	0.13	0.13	MG/L	0.05
Upstream	6	LCC22-RE-03-U	Inorganics	Total Phosphorus as P	8/30/2022 17:50	417.65	1.90	0.16	0.16	MG/L	0.05
Upstream	6	LCC22-RI-03-U	Inorganics	Total Suspended Solids	8/30/2022 15:30	417.63	1.77	5.8	5.8	MG/L	1
Upstream	6	LCC22-P-03-U	Inorganics	Total Suspended Solids	8/30/2022 17:30	417.64	1.87	8.4	8.4	MG/L	1.2
Upstream	6	LCC22-RE-03-U	Inorganics	Total Suspended Solids	8/30/2022 17:50	417.65	1.90	6.3	6.3	MG/L	1
Upstream	6	LCC22-RI-03-U	Metals	Copper	8/30/2022 15:30	417.63	1.77	0.9	0.9	UG/L	0.36
Upstream	6	LCC22-P-03-U	Metals	Copper	8/30/2022 17:30	417.64	1.87	0.81	0.81	UG/L	0.36
Upstream	6	LCC22-RE-03-U	Metals	Copper	8/30/2022 17:50	417.65	1.90	0.9	0.9	UG/L	0.36
Upstream	6	LCC22-RI-03-U	Metals	Lead	8/30/2022 15:30	417.63	1.77	0.17	0.17	UG/L	0.071
Upstream	6	LCC22-P-03-U	Metals	Lead	8/30/2022 17:30	417.64	1.87	0.2	0.2	UG/L	0.071
Upstream	6	LCC22-RE-03-U	Metals	Lead	8/30/2022 17:50	417.65	1.90	0.19	0.19	UG/L	0.071
Upstream	6	LCC22-RI-03-U	Metals	Zinc	8/30/2022 15:30	417.63	1.77	0	4	UG/L	4
Upstream	6	LCC22-P-03-U	Metals	Zinc	8/30/2022 17:30	417.64	1.87	0	4	UG/L	4
Upstream	6	LCC22-RE-03-U	Metals	Zinc	8/30/2022 17:50	417.65	1.90	0	4	UG/L	4
Upstream	6	LCC22-RI-03-U	Oil & Grease	SGT-HEM (TPH)	8/30/2022 15:30	417.63	1.77	0	1.6	MG/L	1.6
Upstream	6	LCC22-P-03-U	Oil & Grease	SGT-HEM (TPH)	8/30/2022 17:30	417.64	1.87	0	1.7	MG/L	1.7
Upstream	6	LCC22-RE-03-U	Oil & Grease	SGT-HEM (TPH)	8/30/2022 17:50	417.65	1.90	0	1.6	MG/L	1.6
Upstream	19	LCC22-RI-04-U	BOD	Biochemical Oxygen Demand	9/22/2022 9:24	417.63	1.81	2.8	2.8	MG/L	2
Upstream	19	LCC22-P-04-U	BOD	Biochemical Oxygen Demand	9/22/2022 11:01	417.65	1.90	0	2	MG/L	2

Station	Event_ID	Sample_Name	Analyte_Group	Chemical_Name	Sample_Date	WSEL_NAVD 88feet	FlowCFS	Result (ND=0)	Result (ND=MDL)	Unit	MDL
Upstream	19	LCC22-RE-04-U	BOD	Biochemical Oxygen Demand	9/22/2022 12:33	417.66	1.99	0	2	MG/L	2
Upstream	19	LCC22-RI-04-U	E. coli	E. coli	9/22/2022 9:24	417.63	1.81	988	988	MPN/100 ML	10
Upstream	19	LCC22-P-04-U	E. coli	E. coli	9/22/2022 11:01	417.65	1.90	1850	1850	MPN/100 ML	10
Upstream	19	LCC22-RE-04-U	E. coli	E. coli	9/22/2022 12:33	417.66	1.99	2310	2310	MPN/100 ML	10
Upstream	19	LCC22-RI-04-U	Inorganics	Hardness as calcium carbonate	9/22/2022 9:24	417.63	1.81	140	140	MG/L	15
Upstream	19	LCC22-P-04-U	Inorganics	Hardness as calcium carbonate	9/22/2022 11:01	417.65	1.90	160	160	MG/L	15
Upstream	19	LCC22-RE-04-U	Inorganics	Hardness as calcium carbonate	9/22/2022 12:33	417.66	1.99	160	160	MG/L	15
Upstream	19	LCC22-RI-04-U	Inorganics	Nitrate Nitrite as N	9/22/2022 9:24	417.63	1.81	1	1	MG/L	0.04
Upstream	19	LCC22-P-04-U	Inorganics	Nitrate Nitrite as N	9/22/2022 11:01	417.65	1.90	0.99	0.99	MG/L	0.04
Upstream	19	LCC22-RE-04-U	Inorganics	Nitrate Nitrite as N	9/22/2022 12:33	417.66	1.99	1.1	1.1	MG/L	0.04
Upstream	19	LCC22-RI-04-U	Inorganics	Total Kjeldahl Nitrogen	9/22/2022 9:24	417.63	1.81	0	0.5	MG/L	0.5
Upstream	19	LCC22-P-04-U	Inorganics	Total Kjeldahl Nitrogen	9/22/2022 11:01	417.65	1.90	0.78	0.78	MG/L	0.5
Upstream	19	LCC22-RE-04-U	Inorganics	Total Kjeldahl Nitrogen	9/22/2022 12:33	417.66	1.99	0.71	0.71	MG/L	0.5
Upstream	19	LCC22-RI-04-U	Inorganics	Total Phosphorus as P	9/22/2022 9:24	417.63	1.81	0.12	0.12	MG/L	0.05
Upstream	19	LCC22-P-04-U	Inorganics	Total Phosphorus as P	9/22/2022 11:01	417.65	1.90	0.17	0.17	MG/L	0.05
Upstream	19	LCC22-RE-04-U	Inorganics	Total Phosphorus as P	9/22/2022 12:33	417.66	1.99	0.13	0.13	MG/L	0.05
Upstream	19	LCC22-RI-04-U	Inorganics	Total Suspended Solids	9/22/2022 9:24	417.63	1.81	4.3	4.3	MG/L	1
Upstream	19	LCC22-P-04-U	Inorganics	Total Suspended Solids	9/22/2022 11:01	417.65	1.90	5.4	5.4	MG/L	1
Upstream	19	LCC22-RE-04-U	Inorganics	Total Suspended Solids	9/22/2022 12:33	417.66	1.99	6.4	6.4	MG/L	1.2
Upstream	19	LCC22-RI-04-U	Metals	Copper	9/22/2022 9:24	417.63	1.81	0.87	0.87	UG/L	0.36
Upstream	19	LCC22-P-04-U	Metals	Copper	9/22/2022 11:01	417.65	1.90	0.92	0.92	UG/L	0.36
Upstream	19	LCC22-RE-04-U	Metals	Copper	9/22/2022 12:33	417.66	1.99	0.82	0.82	UG/L	0.36
Upstream	19	LCC22-RI-04-U	Metals	Lead	9/22/2022 9:24	417.63	1.81	0.13	0.13	UG/L	0.071
Upstream	19	LCC22-P-04-U	Metals	Lead	9/22/2022 11:01	417.65	1.90	0.22	0.22	UG/L	0.071
Upstream	19	LCC22-RE-04-U	Metals	Lead	9/22/2022 12:33	417.66	1.99	0	0.071	UG/L	0.071
Upstream	19	LCC22-RI-04-U	Metals	Zinc	9/22/2022 9:24	417.63	1.81	0	4	UG/L	4
Upstream	19	LCC22-P-04-U	Metals	Zinc	9/22/2022 11:01	417.65	1.90	0	4	UG/L	4
Upstream	19	LCC22-RE-04-U	Metals	Zinc	9/22/2022 12:33	417.66	1.99	0	4	UG/L	4
Upstream	19	LCC22-RI-04-U	Oil & Grease	SGT-HEM (TPH)	9/22/2022 9:24	417.63	1.81	0	1.6	MG/L	1.6
Upstream	19	LCC22-P-04-U	Oil & Grease	SGT-HEM (TPH)	9/22/2022 11:01	417.65	1.90	0	1.7	MG/L	1.7
Upstream	19	LCC22-RE-04-U	Oil & Grease	SGT-HEM (TPH)	9/22/2022 12:33	417.66	1.99	0	1.6	MG/L	1.6
Upstream	21	LCC22-RI-05-U	BOD	Biochemical Oxygen Demand	10/1/2022 8:15	418.17	10.34	23	23	MG/L	2
Upstream	21	LCC22-P-05-U	BOD	Biochemical Oxygen Demand	10/2/2022 11:15	418.89	71.81	9.2	9.2	MG/L	2
Upstream	21	LCC22-RE-05-U	BOD	Biochemical Oxygen Demand	10/3/2022 13:05	418.09	8.16	4.5	4.5	MG/L	2

Station	Event_ID	Sample_Name	Analyte_Group	Chemical_Name	Sample_Date	WSEL_NAVD 88feet	FlowCFS	Result (ND=0)	Result (ND=MDL)	Unit	MDL
Upstream	21	LCC22-RI-05-U	E. coli	E. coli	10/1/2022 8:15	418.17	10.34	111990	111990	MPN/100 ML	100
Upstream	21	LCC22-P-05-U	E. coli	E. coli	10/2/2022 11:15	418.89	71.81	141360	141360	MPN/100 ML	100
Upstream	21	LCC22-RE-05-U	E. coli	E. coli	10/3/2022 13:05	418.09	8.16	10170	10170	MPN/100 ML	100
Upstream	21	LCC22-RI-05-U	Inorganics	Hardness as calcium carbonate	10/1/2022 8:15	418.17	10.34	120	120	MG/L	15
Upstream	21	LCC22-P-05-U	Inorganics	Hardness as calcium carbonate	10/2/2022 11:15	418.89	71.81	89	89	MG/L	30
Upstream	21	LCC22-RE-05-U	Inorganics	Hardness as calcium carbonate	10/3/2022 13:05	418.09	8.16	110	110	MG/L	30
Upstream	21	LCC22-RI-05-U	Inorganics	Nitrate Nitrite as N	10/1/2022 8:15	418.17	10.34	1.6	1.6	MG/L	0.04
Upstream	21	LCC22-P-05-U	Inorganics	Nitrate Nitrite as N	10/2/2022 11:15	418.89	71.81	1.9	1.9	MG/L	0.04
Upstream	21	LCC22-RE-05-U	Inorganics	Nitrate Nitrite as N	10/3/2022 13:05	418.09	8.16	2.3	2.3	MG/L	0.04
Upstream	21	LCC22-RI-05-U	Inorganics	Total Kjeldahl Nitrogen	10/1/2022 8:15	418.17	10.34	2.7	2.7	MG/L	0.5
Upstream	21	LCC22-P-05-U	Inorganics	Total Kjeldahl Nitrogen	10/2/2022 11:15	418.89	71.81	2.9	2.9	MG/L	0.5
Upstream	21	LCC22-RE-05-U	Inorganics	Total Kjeldahl Nitrogen	10/3/2022 13:05	418.09	8.16	1.2	1.2	MG/L	0.5
Upstream	21	LCC22-RI-05-U	Inorganics	Total Phosphorus as P	10/1/2022 8:15	418.17	10.34	0.76	0.76	MG/L	0.05
Upstream	21	LCC22-P-05-U	Inorganics	Total Phosphorus as P	10/2/2022 11:15	418.89	71.81	0.83	0.83	MG/L	0.05
Upstream	21	LCC22-RE-05-U	Inorganics	Total Phosphorus as P	10/3/2022 13:05	418.09	8.16	0.25	0.25	MG/L	0.05
Upstream	21	LCC22-RI-05-U	Inorganics	Total Suspended Solids	10/1/2022 8:15	418.17	10.34	15	15	MG/L	1
Upstream	21	LCC22-P-05-U	Inorganics	Total Suspended Solids	10/2/2022 11:15	418.89	71.81	180	180	MG/L	6.3
Upstream	21	LCC22-RE-05-U	Inorganics	Total Suspended Solids	10/3/2022 13:05	418.09	8.16	8.1	8.1	MG/L	1
Upstream	21	LCC22-RI-05-U	Metals	Copper	10/1/2022 8:15	418.17	10.34	3.5	3.5	UG/L	0.36
Upstream	21	LCC22-P-05-U	Metals	Copper	10/2/2022 11:15	418.89	71.81	7.2	7.2	UG/L	0.36
Upstream	21	LCC22-RE-05-U	Metals	Copper	10/3/2022 13:05	418.09	8.16	2.8	2.8	UG/L	0.36
Upstream	21	LCC22-RI-05-U	Metals	Lead	10/1/2022 8:15	418.17	10.34	0.46	0.46	UG/L	0.071
Upstream	21	LCC22-P-05-U	Metals	Lead	10/2/2022 11:15	418.89	71.81	1.5	1.5	UG/L	0.071
Upstream	21	LCC22-RE-05-U	Metals	Lead	10/3/2022 13:05	418.09	8.16	0.19	0.19	UG/L	0.071
Upstream	21	LCC22-RI-05-U	Metals	Zinc	10/1/2022 8:15	418.17	10.34	9.9	9.9	UG/L	4
Upstream	21	LCC22-P-05-U	Metals	Zinc	10/2/2022 11:15	418.89	71.81	12	12	UG/L	4
Upstream	21	LCC22-RE-05-U	Metals	Zinc	10/3/2022 13:05	418.09	8.16	0	4	UG/L	4
Upstream	21	LCC22-RI-05-U	Oil & Grease	SGT-HEM (TPH)	10/1/2022 8:15	418.17	10.34	0	1.6	MG/L	1.6
Upstream	21	LCC22-P-05-U	Oil & Grease	SGT-HEM (TPH)	10/2/2022 11:15	418.89	71.81	0	1.6	MG/L	1.6
Upstream	21	LCC22-RE-05-U	Oil & Grease	SGT-HEM (TPH)	10/3/2022 13:05	418.09	8.16	0	1.6	MG/L	1.6
Upstream	23	LCC22-RI-06-U	BOD	Biochemical Oxygen Demand	10/13/2022 15:25	417.73	2.54	3.3	3.3	MG/L	2.5
Upstream	23	LCC22-P-06-U	BOD	Biochemical Oxygen Demand	10/13/2022 17:14	417.72	2.48	0	2.5	MG/L	2.5
Upstream	23	LCC22-RE-06-U	BOD	Biochemical Oxygen Demand	10/14/2022 8:35	417.73	2.51	3.7	3.7	MG/L	2.5
Upstream	23	LCC22-RI-06-U	E. coli	E. coli	10/13/2022 15:25	417.73	2.54	19863	19863	MPN/100 ML	10

Station	Event_ID	Sample_Name	Analyte_Group	Chemical_Name	Sample_Date	WSEL_NAVD 88feet	FlowCFS	Result (ND=0)	Result (ND=MDL)	Unit	MDL
Upstream	23	LCC22-P-06-U	E. coli	E. coli	10/13/2022 17:14	417.72	2.48	24196	24196	MPN/100 ML	10
Upstream	23	LCC22-RE-06-U	E. coli	E. coli	10/14/2022 8:35	417.73	2.51	11199	11199	MPN/100 ML	10
Upstream	23	LCC22-RI-06-U	Inorganics	Hardness as calcium carbonate	10/13/2022 15:25	417.73	2.54	130	130	MG/L	15
Upstream	23	LCC22-P-06-U	Inorganics	Hardness as calcium carbonate	10/13/2022 17:14	417.72	2.48	130	130	MG/L	15
Upstream	23	LCC22-RE-06-U	Inorganics	Hardness as calcium carbonate	10/14/2022 8:35	417.73	2.51	140	140	MG/L	15
Upstream	23	LCC22-RI-06-U	Inorganics	Nitrate Nitrite as N	10/13/2022 15:25	417.73	2.54	2.6	2.6	MG/L	0.04
Upstream	23	LCC22-P-06-U	Inorganics	Nitrate Nitrite as N	10/13/2022 17:14	417.72	2.48	2.3	2.3	MG/L	0.04
Upstream	23	LCC22-RE-06-U	Inorganics	Nitrate Nitrite as N	10/14/2022 8:35	417.73	2.51	1.8	1.8	MG/L	0.04
Upstream	23	LCC22-RI-06-U	Inorganics	Total Kjeldahl Nitrogen	10/13/2022 15:25	417.73	2.54	1.2	1.2	MG/L	0.5
Upstream	23	LCC22-P-06-U	Inorganics	Total Kjeldahl Nitrogen	10/13/2022 17:14	417.72	2.48	0.85	0.85	MG/L	0.5
Upstream	23	LCC22-RE-06-U	Inorganics	Total Kjeldahl Nitrogen	10/14/2022 8:35	417.73	2.51	1.6	1.6	MG/L	0.5
Upstream	23	LCC22-RI-06-U	Inorganics	Total Phosphorus as P	10/13/2022 15:25	417.73	2.54	0.13	0.13	MG/L	0.05
Upstream	23	LCC22-P-06-U	Inorganics	Total Phosphorus as P	10/13/2022 17:14	417.72	2.48	0.11	0.11	MG/L	0.05
Upstream	23	LCC22-RE-06-U	Inorganics	Total Phosphorus as P	10/14/2022 8:35	417.73	2.51	0.22	0.22	MG/L	0.05
Upstream	23	LCC22-RI-06-U	Inorganics	Total Suspended Solids	10/13/2022 15:25	417.73	2.54	1.9	1.9	MG/L	1
Upstream	23	LCC22-P-06-U	Inorganics	Total Suspended Solids	10/13/2022 17:14	417.72	2.48	1.1	1.1	MG/L	1
Upstream	23	LCC22-RE-06-U	Inorganics	Total Suspended Solids	10/14/2022 8:35	417.73	2.51	13	13	MG/L	1
Upstream	23	LCC22-RI-06-U	Metals	Copper	10/13/2022 15:25	417.73	2.54	1.1	1.1	UG/L	0.36
Upstream	23	LCC22-P-06-U	Metals	Copper	10/13/2022 17:14	417.72	2.48	1	1	UG/L	0.36
Upstream	23	LCC22-RE-06-U	Metals	Copper	10/14/2022 8:35	417.73	2.51	1.1	1.1	UG/L	0.36
Upstream	23	LCC22-RI-06-U	Metals	Lead	10/13/2022 15:25	417.73	2.54	0.14	0.14	UG/L	0.071
Upstream	23	LCC22-P-06-U	Metals	Lead	10/13/2022 17:14	417.72	2.48	0.12	0.12	UG/L	0.071
Upstream	23	LCC22-RE-06-U	Metals	Lead	10/14/2022 8:35	417.73	2.51	0.16	0.16	UG/L	0.071
Upstream	23	LCC22-RI-06-U	Metals	Zinc	10/13/2022 15:25	417.73	2.54	0	4	UG/L	4
Upstream	23	LCC22-P-06-U	Metals	Zinc	10/13/2022 17:14	417.72	2.48	4	4	UG/L	4
Upstream	23	LCC22-RE-06-U	Metals	Zinc	10/14/2022 8:35	417.73	2.51	0	4	UG/L	4
Upstream	23	LCC22-RI-06-U	Oil & Grease	SGT-HEM (TPH)	10/13/2022 15:25	417.73	2.54	0	1.6	MG/L	1.6
Upstream	23	LCC22-P-06-U	Oil & Grease	SGT-HEM (TPH)	10/13/2022 17:14	417.72	2.48	0	1.7	MG/L	1.7
Upstream	23	LCC22-RE-06-U	Oil & Grease	SGT-HEM (TPH)	10/14/2022 8:35	417.73	2.51	1.6	1.6	MG/L	1.6
Upstream	25	LCC22-RI-07-U	BOD	Biochemical Oxygen Demand	11/11/2022 8:45	417.68	2.13	56	56	MG/L	2
Upstream	25	LCC22-P-07-U	BOD	Biochemical Oxygen Demand	11/11/2022 14:00	418.78	54.79	23	23	MG/L	2
Upstream	25	LCC22-RE-07-U	BOD	Biochemical Oxygen Demand	11/12/2022 8:20	418.43	22.06	19	19	MG/L	2
Upstream	25	LCC22-RI-07-U	E. coli	E. coli	11/11/2022 8:45	417.68	2.13	5172	5172	MPN/100 ML	10
Upstream	25	LCC22-P-07-U	E. coli	E. coli	11/11/2022 14:00	418.78	54.79	241960	241960	MPN/100 ML	100

Station	Event_ID	Sample_Name	Analyte_Group	Chemical_Name	Sample_Date	WSEL_NAVD 88feet	FlowCFS	Result (ND=0)	Result (ND=MDL)	Unit	MDL
Upstream	25	LCC22-RE-07-U	E. coli	E. coli	11/12/2022 8:20	418.43	22.06	54750	54750	MPN/100 ML	100
Upstream	25	LCC22-RI-07-U	Inorganics	Hardness as calcium carbonate	11/11/2022 8:45	417.68	2.13	140	140	MG/L	15
Upstream	25	LCC22-P-07-U	Inorganics	Hardness as calcium carbonate	11/11/2022 14:00	418.78	54.79	100	100	MG/L	6
Upstream	25	LCC22-RE-07-U	Inorganics	Hardness as calcium carbonate	11/12/2022 8:20	418.43	22.06	120	120	MG/L	30
Upstream	25	LCC22-RI-07-U	Inorganics	Nitrate Nitrite as N	11/11/2022 8:45	417.68	2.13	1.2	1.2	MG/L	0.04
Upstream	25	LCC22-P-07-U	Inorganics	Nitrate Nitrite as N	11/11/2022 14:00	418.78	54.79	2.4	2.4	MG/L	0.04
Upstream	25	LCC22-RE-07-U	Inorganics	Nitrate Nitrite as N	11/12/2022 8:20	418.43	22.06	1.8	1.8	MG/L	0.04
Upstream	25	LCC22-RI-07-U	Inorganics	Total Kjeldahl Nitrogen	11/11/2022 8:45	417.68	2.13	2	2	MG/L	0.5
Upstream	25	LCC22-P-07-U	Inorganics	Total Kjeldahl Nitrogen	11/11/2022 14:00	418.78	54.79	2	2	MG/L	0.5
Upstream	25	LCC22-RE-07-U	Inorganics	Total Kjeldahl Nitrogen	11/12/2022 8:20	418.43	22.06	2	2	MG/L	0.5
Upstream	25	LCC22-RI-07-U	Inorganics	Total Phosphorus as P	11/11/2022 8:45	417.68	2.13	0.73	0.73	MG/L	0.05
Upstream	25	LCC22-P-07-U	Inorganics	Total Phosphorus as P	11/11/2022 14:00	418.78	54.79	0.95	0.95	MG/L	0.05
Upstream	25	LCC22-RE-07-U	Inorganics	Total Phosphorus as P	11/12/2022 8:20	418.43	22.06	0.69	0.69	MG/L	0.05
Upstream	25	LCC22-RI-07-U	Inorganics	Total Suspended Solids	11/11/2022 8:45	417.68	2.13	33	33	MG/L	2
Upstream	25	LCC22-P-07-U	Inorganics	Total Suspended Solids	11/11/2022 14:00	418.78	54.79	91	91	MG/L	3.3
Upstream	25	LCC22-RE-07-U	Inorganics	Total Suspended Solids	11/12/2022 8:20	418.43	22.06	31	31	MG/L	1.8
Upstream	25	LCC22-RI-07-U	Metals	Copper	11/11/2022 8:45	417.68	2.13	2.5	2.5	UG/L	0.36
Upstream	25	LCC22-P-07-U	Metals	Copper	11/11/2022 14:00	418.78	54.79	9.7	9.7	UG/L	0.36
Upstream	25	LCC22-RE-07-U	Metals	Copper	11/12/2022 8:20	418.43	22.06	8.9	8.9	UG/L	0.36
Upstream	25	LCC22-RI-07-U	Metals	Lead	11/11/2022 8:45	417.68	2.13	0.98	0.98	UG/L	0.071
Upstream	25	LCC22-P-07-U	Metals	Lead	11/11/2022 14:00	418.78	54.79	0.72	0.72	UG/L	0.071
Upstream	25	LCC22-RE-07-U	Metals	Lead	11/12/2022 8:20	418.43	22.06	0.65	0.65	UG/L	0.071
Upstream	25	LCC22-RI-07-U	Metals	Zinc	11/11/2022 8:45	417.68	2.13	9.6	9.6	UG/L	4
Upstream	25	LCC22-P-07-U	Metals	Zinc	11/11/2022 14:00	418.78	54.79	6.7	6.7	UG/L	4
Upstream	25	LCC22-RE-07-U	Metals	Zinc	11/12/2022 8:20	418.43	22.06	5.8	5.8	UG/L	4
Upstream	25	LCC22-RI-07-U	Oil & Grease	SGT-HEM (TPH)	11/11/2022 8:45	417.68	2.13	0	1.8	MG/L	1.8
Upstream	25	LCC22-P-07-U	Oil & Grease	SGT-HEM (TPH)	11/11/2022 14:00	418.78	54.79	2.2	2.2	MG/L	1.6
Upstream	25	LCC22-RE-07-U	Oil & Grease	SGT-HEM (TPH)	11/12/2022 8:20	418.43	22.06	0	1.7	MG/L	1.7
Upstream	29	RI-08-U	BOD	Biochemical Oxygen Demand	2/16/2023 12:38	417.92	4.87	0	2	MG/L	2
Upstream	29	LCC22-P-08-U	BOD	Biochemical Oxygen Demand	2/17/2023 10:30	418.65	39.42	10	10	MG/L	2
Upstream	29	LCC22-RE-08-U	BOD	Biochemical Oxygen Demand	2/17/2023 12:50	418.53	28.74	6.6	6.6	MG/L	2
Upstream	29	RI-08-U	E. coli	E. coli	2/16/2023 12:38	417.92	4.87	602	602	MPN/100 ML	10
Upstream	29	LCC22-P-08-U	E. coli	E. coli	2/17/2023 10:30	418.65	39.42	12590	12590	MPN/100 ML	100
Upstream	29	LCC22-RE-08-U	E. coli	E. coli	2/17/2023 12:50	418.53	28.74	5040	5040	MPN/100 ML	100

Station	Event_ID	Sample_Name	Analyte_Group	Chemical_Name	Sample_Date	WSEL_NAVD 88feet	FlowCFS	Result (ND=0)	Result (ND=MDL)	Unit	MDL
Upstream	29	RI-08-U	Inorganics	Hardness as calcium carbonate	2/16/2023 12:38	417.92	4.87	120	120	MG/L	15
Upstream	29	LCC22-P-08-U	Inorganics	Hardness as calcium carbonate	2/17/2023 10:30	418.65	39.42	91	91	MG/L	15
Upstream	29	LCC22-RE-08-U	Inorganics	Hardness as calcium carbonate	2/17/2023 12:50	418.53	28.74	94	94	MG/L	15
Upstream	29	RI-08-U	Inorganics	Nitrate Nitrite as N	2/16/2023 12:38	417.92	4.87	3.5	3.5	MG/L	0.08
Upstream	29	LCC22-P-08-U	Inorganics	Nitrate Nitrite as N	2/17/2023 10:30	418.65	39.42	2.1	2.1	MG/L	0.04
Upstream	29	LCC22-RE-08-U	Inorganics	Nitrate Nitrite as N	2/17/2023 12:50	418.53	28.74	1.8	1.8	MG/L	0.04
Upstream	29	RI-08-U	Inorganics	Total Kjeldahl Nitrogen	2/16/2023 12:38	417.92	4.87	0.85	0.85	MG/L	0.5
Upstream	29	LCC22-P-08-U	Inorganics	Total Kjeldahl Nitrogen	2/17/2023 10:30	418.65	39.42	1.7	1.7	MG/L	0.5
Upstream	29	LCC22-RE-08-U	Inorganics	Total Kjeldahl Nitrogen	2/17/2023 12:50	418.53	28.74	2.1	2.1	MG/L	0.5
Upstream	29	RI-08-U	Inorganics	Total Phosphorus as P	2/16/2023 12:38	417.92	4.87	0	0.05	MG/L	0.05
Upstream	29	LCC22-P-08-U	Inorganics	Total Phosphorus as P	2/17/2023 10:30	418.65	39.42	0.31	0.31	MG/L	0.05
Upstream	29	LCC22-RE-08-U	Inorganics	Total Phosphorus as P	2/17/2023 12:50	418.53	28.74	0.21	0.21	MG/L	0.05
Upstream	29	RI-08-U	Inorganics	Total Suspended Solids	2/16/2023 12:38	417.92	4.87	5.5	5.5	MG/L	1
Upstream	29	LCC22-P-08-U	Inorganics	Total Suspended Solids	2/17/2023 10:30	418.65	39.42	95	95	MG/L	4
Upstream	29	LCC22-RE-08-U	Inorganics	Total Suspended Solids	2/17/2023 12:50	418.53	28.74	32	32	MG/L	2
Upstream	29	RI-08-U	Metals	Copper	2/16/2023 12:38	417.92	4.87	0.59	0.59	UG/L	0.36
Upstream	29	LCC22-P-08-U	Metals	Copper	2/17/2023 10:30	418.65	39.42	7.5	7.5	UG/L	0.36
Upstream	29	LCC22-RE-08-U	Metals	Copper	2/17/2023 12:50	418.53	28.74	6.4	6.4	UG/L	0.36
Upstream	29	RI-08-U	Metals	Lead	2/16/2023 12:38	417.92	4.87	0.13	0.13	UG/L	0.071
Upstream	29	LCC22-P-08-U	Metals	Lead	2/17/2023 10:30	418.65	39.42	2.7	2.7	UG/L	0.071
Upstream	29	LCC22-RE-08-U	Metals	Lead	2/17/2023 12:50	418.53	28.74	1.5	1.5	UG/L	0.071
Upstream	29	RI-08-U	Metals	Zinc	2/16/2023 12:38	417.92	4.87	0	4	UG/L	4
Upstream	29	LCC22-P-08-U	Metals	Zinc	2/17/2023 10:30	418.65	39.42	14	14	UG/L	4
Upstream	29	LCC22-RE-08-U	Metals	Zinc	2/17/2023 12:50	418.53	28.74	10	10	UG/L	4
Upstream	29	RI-08-U	Oil & Grease	SGT-HEM (TPH)	2/16/2023 12:38	417.92	4.87	0	1.6	MG/L	1.6
Upstream	29	LCC22-P-08-U	Oil & Grease	SGT-HEM (TPH)	2/17/2023 10:30	418.65	39.42	0	1.6	MG/L	1.6
Upstream	29	LCC22-RE-08-U	Oil & Grease	SGT-HEM (TPH)	2/17/2023 12:50	418.53	28.74	0	1.5	MG/L	1.5
Upstream	31	LCC22-RI-09-U	BOD	Biochemical Oxygen Demand	3/10/2023 11:00	417.99	6.13	11	11	MG/L	1.5
Upstream	31	LCC22-P-09-U	BOD	Biochemical Oxygen Demand	3/10/2023 12:30	418.00	6.19	11	11	MG/L	1.5
Upstream	31	LCC22-RE-09-U	BOD	Biochemical Oxygen Demand	3/10/2023 13:45	418.00	6.19	18	18	MG/L	1.5
Upstream	31	LCC22-RI-09-U	E. coli	E. coli	3/10/2023 11:00	417.99	6.13	512	512	MPN/100 ML	10
Upstream	31	LCC22-P-09-U	E. coli	E. coli	3/10/2023 12:30	418.00	6.19	850	850	MPN/100 ML	100
Upstream	31	LCC22-RE-09-U	E. coli	E. coli	3/10/2023 13:45	418.00	6.19	840	840	MPN/100 ML	100
Upstream	31	LCC22-RI-09-U	Inorganics	Hardness as calcium carbonate	3/10/2023 11:00	417.99	6.13	93	93	MG/L	15

Station	Event_ID	Sample_Name	Analyte_Group	Chemical_Name	Sample_Date	WSEL_NAVD 88feet	FlowCFS	Result (ND=0)	Result (ND=MDL)	Unit	MDL
Upstream	31	LCC22-P-09-U	Inorganics	Hardness as calcium carbonate	3/10/2023 12:30	418.00	6.19	130	130	MG/L	15
Upstream	31	LCC22-RE-09-U	Inorganics	Hardness as calcium carbonate	3/10/2023 13:45	418.00	6.19	98	98	MG/L	15
Upstream	31	LCC22-RI-09-U	Inorganics	Nitrate Nitrite as N	3/10/2023 11:00	417.99	6.13	4.2	4.2	MG/L	0.08
Upstream	31	LCC22-P-09-U	Inorganics	Nitrate Nitrite as N	3/10/2023 12:30	418.00	6.19	4.1	4.1	MG/L	0.08
Upstream	31	LCC22-RE-09-U	Inorganics	Nitrate Nitrite as N	3/10/2023 13:45	418.00	6.19	4.6	4.6	MG/L	0.08
Upstream	31	LCC22-RI-09-U	Inorganics	Total Kjeldahl Nitrogen	3/10/2023 11:00	417.99	6.13	0.87	0.87	MG/L	0.5
Upstream	31	LCC22-P-09-U	Inorganics	Total Kjeldahl Nitrogen	3/10/2023 12:30	418.00	6.19	1.3	1.3	MG/L	0.5
Upstream	31	LCC22-RE-09-U	Inorganics	Total Kjeldahl Nitrogen	3/10/2023 13:45	418.00	6.19	1.5	1.5	MG/L	0.5
Upstream	31	LCC22-RI-09-U	Inorganics	Total Phosphorus as P	3/10/2023 11:00	417.99	6.13	0.16	0.16	MG/L	0.05
Upstream	31	LCC22-P-09-U	Inorganics	Total Phosphorus as P	3/10/2023 12:30	418.00	6.19	0.2	0.2	MG/L	0.05
Upstream	31	LCC22-RE-09-U	Inorganics	Total Phosphorus as P	3/10/2023 13:45	418.00	6.19	0.17	0.17	MG/L	0.05
Upstream	31	LCC22-RI-09-U	Inorganics	Total Suspended Solids	3/10/2023 11:00	417.99	6.13	2.5	2.5	MG/L	1
Upstream	31	LCC22-P-09-U	Inorganics	Total Suspended Solids	3/10/2023 12:30	418.00	6.19	2.3	2.3	MG/L	1
Upstream	31	LCC22-RE-09-U	Inorganics	Total Suspended Solids	3/10/2023 13:45	418.00	6.19	7.6	7.6	MG/L	1
Upstream	31	LCC22-RI-09-U	Metals	Copper	3/10/2023 11:00	417.99	6.13	0.69	0.69	UG/L	0.36
Upstream	31	LCC22-P-09-U	Metals	Copper	3/10/2023 12:30	418.00	6.19	0.74	0.74	UG/L	0.36
Upstream	31	LCC22-RE-09-U	Metals	Copper	3/10/2023 13:45	418.00	6.19	1.2	1.2	UG/L	0.36
Upstream	31	LCC22-RI-09-U	Metals	Lead	3/10/2023 11:00	417.99	6.13	0	0.071	UG/L	0.071
Upstream	31	LCC22-P-09-U	Metals	Lead	3/10/2023 12:30	418.00	6.19	0	0.071	UG/L	0.071
Upstream	31	LCC22-RE-09-U	Metals	Lead	3/10/2023 13:45	418.00	6.19	0.17	0.17	UG/L	0.071
Upstream	31	LCC22-RI-09-U	Metals	Zinc	3/10/2023 11:00	417.99	6.13	0	4	UG/L	4
Upstream	31	LCC22-P-09-U	Metals	Zinc	3/10/2023 12:30	418.00	6.19	0	4	UG/L	4
Upstream	31	LCC22-RE-09-U	Metals	Zinc	3/10/2023 13:45	418.00	6.19	0	4	UG/L	4
Upstream	31	LCC22-RI-09-U	Oil & Grease	SGT-HEM (TPH)	3/10/2023 11:00	417.99	6.13	0	1.6	MG/L	1.6
Upstream	31	LCC22-P-09-U	Oil & Grease	SGT-HEM (TPH)	3/10/2023 12:30	418.00	6.19	0	1.5	MG/L	1.5
Upstream	31	LCC22-RE-09-U	Oil & Grease	SGT-HEM (TPH)	3/10/2023 13:45	418.00	6.19	0	1.6	MG/L	1.6
Upstream	33	LCC23-RI-10-U	BOD	Biochemical Oxygen Demand	3/24/2023 9:00	418.07	7.76	14	14	MG/L	2
Upstream	33	LCC23-P-10-U	BOD	Biochemical Oxygen Demand	3/25/2023 8:30	418.06	7.45	4.9	4.9	MG/L	2
Upstream	33	LCC23-RE-10-U	BOD	Biochemical Oxygen Demand	3/25/2023 9:30	418.26	13.67	21	21	MG/L	2
Upstream	33	LCC23-RI-10-U	E. coli	E. coli	3/24/2023 9:00	418.07	7.76	8164	8164	MPN/100 ML	10
Upstream	33	LCC23-P-10-U	E. coli	E. coli	3/25/2023 8:30	418.06	7.45	3873	3873	MPN/100 ML	10
Upstream	33	LCC23-RE-10-U	E. coli	E. coli	3/25/2023 9:30	418.26	13.67	24196	24196	MPN/100 ML	10
Upstream	33	LCC23-RI-10-U	Inorganics	Hardness as calcium carbonate	3/24/2023 9:00	418.07	7.76	110	110	MG/L	6
Upstream	33	LCC23-P-10-U	Inorganics	Hardness as calcium carbonate	3/25/2023 8:30	418.06	7.45	110	110	MG/L	6

Station	Event_ID	Sample_Name	Analyte_Group	Chemical_Name	Sample_Date	WSEL_NAVD 88feet	FlowCFS	Result (ND=0)	Result (ND=MDL)	Unit	MDL
Upstream	33	LCC23-RE-10-U	Inorganics	Hardness as calcium carbonate	3/25/2023 9:30	418.26	13.67	91	91	MG/L	15
Upstream	33	LCC23-RI-10-U	Inorganics	Nitrate Nitrite as N	3/24/2023 9:00	418.07	7.76	5	5	MG/L	0.08
Upstream	33	LCC23-P-10-U	Inorganics	Nitrate Nitrite as N	3/25/2023 8:30	418.06	7.45	4.4	4.4	MG/L	0.08
Upstream	33	LCC23-RE-10-U	Inorganics	Nitrate Nitrite as N	3/25/2023 9:30	418.26	13.67	2.1	2.1	MG/L	0.04
Upstream	33	LCC23-RI-10-U	Inorganics	Total Kjeldahl Nitrogen	3/24/2023 9:00	418.07	7.76	2	2	MG/L	0.5
Upstream	33	LCC23-P-10-U	Inorganics	Total Kjeldahl Nitrogen	3/25/2023 8:30	418.06	7.45	2.3	2.3	MG/L	0.5
Upstream	33	LCC23-RE-10-U	Inorganics	Total Kjeldahl Nitrogen	3/25/2023 9:30	418.26	13.67	3.1	3.1	MG/L	0.5
Upstream	33	LCC23-RI-10-U	Inorganics	Total Phosphorus as P	3/24/2023 9:00	418.07	7.76	0.32	0.32	MG/L	0.05
Upstream	33	LCC23-P-10-U	Inorganics	Total Phosphorus as P	3/25/2023 8:30	418.06	7.45	0.13	0.13	MG/L	0.05
Upstream	33	LCC23-RE-10-U	Inorganics	Total Phosphorus as P	3/25/2023 9:30	418.26	13.67	0.59	0.59	MG/L	0.05
Upstream	33	LCC23-RI-10-U	Inorganics	Total Suspended Solids	3/24/2023 9:00	418.07	7.76	9.4	9.4	MG/L	2
Upstream	33	LCC23-P-10-U	Inorganics	Total Suspended Solids	3/25/2023 8:30	418.06	7.45	6.4	6.4	MG/L	1
Upstream	33	LCC23-RE-10-U	Inorganics	Total Suspended Solids	3/25/2023 9:30	418.26	13.67	37	37	MG/L	2
Upstream	33	LCC23-RI-10-U	Metals	Copper	3/24/2023 9:00	418.07	7.76	2.5	2.5	UG/L	0.36
Upstream	33	LCC23-P-10-U	Metals	Copper	3/25/2023 8:30	418.06	7.45	2.4	2.4	UG/L	0.36
Upstream	33	LCC23-RE-10-U	Metals	Copper	3/25/2023 9:30	418.26	13.67	5.8	5.8	UG/L	0.36
Upstream	33	LCC23-RI-10-U	Metals	Lead	3/24/2023 9:00	418.07	7.76	0.48	0.48	UG/L	0.071
Upstream	33	LCC23-P-10-U	Metals	Lead	3/25/2023 8:30	418.06	7.45	0.26	0.26	UG/L	0.071
Upstream	33	LCC23-RE-10-U	Metals	Lead	3/25/2023 9:30	418.26	13.67	2.2	2.2	UG/L	0.071
Upstream	33	LCC23-RI-10-U	Metals	Zinc	3/24/2023 9:00	418.07	7.76	4.5	4.5	UG/L	4
Upstream	33	LCC23-P-10-U	Metals	Zinc	3/25/2023 8:30	418.06	7.45	5.8	5.8	UG/L	4
Upstream	33	LCC23-RE-10-U	Metals	Zinc	3/25/2023 9:30	418.26	13.67	22	22	UG/L	4
Upstream	33	LCC23-RI-10-U	Oil & Grease	SGT-HEM (TPH)	3/24/2023 9:00	418.07	7.76	0	1.5	MG/L	1.5
Upstream	33	LCC23-P-10-U	Oil & Grease	SGT-HEM (TPH)	3/25/2023 8:30	418.06	7.45	0	1.5	MG/L	1.5
Upstream	33	LCC23-RE-10-U	Oil & Grease	SGT-HEM (TPH)	3/25/2023 9:30	418.26	13.67	0	1.6	MG/L	1.6
Upstream	35	LCC23-RI-11-U	BOD	Biochemical Oxygen Demand	4/28/2023 9:00	417.89	4.37	7.4	7.4	MG/L	2
Upstream	35	LCC23-P-11-U	BOD	Biochemical Oxygen Demand	4/28/2023 15:15	418.15	9.85	9.6	9.6	MG/L	2
Upstream	35	LCC23-RE-11-U	BOD	Biochemical Oxygen Demand	4/29/2023 7:10	418.11	8.66	5	5	MG/L	2
Upstream	35	LCC23-RI-11-U	E. coli	E. coli	4/28/2023 9:00	417.89	4.37	3873	3873	MPN/100 ML	10
Upstream	35	LCC23-P-11-U	E. coli	E. coli	4/28/2023 15:15	418.15	9.85	24196	24196	MPN/100 ML	10
Upstream	35	LCC23-RE-11-U	E. coli	E. coli	4/29/2023 7:10	418.11	8.66	54750	54750	MPN/100 ML	100
Upstream	35	LCC23-RI-11-U	Inorganics	Hardness as calcium carbonate	4/28/2023 9:00	417.89	4.37	79	79	MG/L	15
Upstream	35	LCC23-P-11-U	Inorganics	Hardness as calcium carbonate	4/28/2023 15:15	418.15	9.85	69	69	MG/L	15
Upstream	35	LCC23-RE-11-U	Inorganics	Hardness as calcium carbonate	4/29/2023 7:10	418.11	8.66	77	77	MG/L	15

Station	Event_ID	Sample_Name	Analyte_Group	Chemical_Name	Sample_Date	WSEL_NAVD 88feet	FlowCFS	Result (ND=0)	Result (ND=MDL)	Unit	MDL
Upstream	35	LCC23-RI-11-U	Inorganics	Nitrate Nitrite as N	4/28/2023 9:00	417.89	4.37	1.3	1.3	MG/L	0.04
Upstream	35	LCC23-P-11-U	Inorganics	Nitrate Nitrite as N	4/28/2023 15:15	418.15	9.85	1.7	1.7	MG/L	0.04
Upstream	35	LCC23-RE-11-U	Inorganics	Nitrate Nitrite as N	4/29/2023 7:10	418.11	8.66	1.9	1.9	MG/L	0.04
Upstream	35	LCC23-RI-11-U	Inorganics	Total Kjeldahl Nitrogen	4/28/2023 9:00	417.89	4.37	1	1	MG/L	0.5
Upstream	35	LCC23-P-11-U	Inorganics	Total Kjeldahl Nitrogen	4/28/2023 15:15	418.15	9.85	1.7	1.7	MG/L	0.5
Upstream	35	LCC23-RE-11-U	Inorganics	Total Kjeldahl Nitrogen	4/29/2023 7:10	418.11	8.66	2.1	2.1	MG/L	0.5
Upstream	35	LCC23-RI-11-U	Inorganics	Total Phosphorus as P	4/28/2023 9:00	417.89	4.37	0.11	0.11	MG/L	0.05
Upstream	35	LCC23-P-11-U	Inorganics	Total Phosphorus as P	4/28/2023 15:15	418.15	9.85	0.31	0.31	MG/L	0.05
Upstream	35	LCC23-RE-11-U	Inorganics	Total Phosphorus as P	4/29/2023 7:10	418.11	8.66	0.21	0.21	MG/L	0.05
Upstream	35	LCC23-RI-11-U	Inorganics	Total Suspended Solids	4/28/2023 9:00	417.89	4.37	9.4	9.4	MG/L	1
Upstream	35	LCC23-P-11-U	Inorganics	Total Suspended Solids	4/28/2023 15:15	418.15	9.85	10	10	MG/L	1
Upstream	35	LCC23-RE-11-U	Inorganics	Total Suspended Solids	4/29/2023 7:10	418.11	8.66	11	11	MG/L	1
Upstream	35	LCC23-RI-11-U	Metals	Copper	4/28/2023 9:00	417.89	4.37	1	1	UG/L	0.36
Upstream	35	LCC23-P-11-U	Metals	Copper	4/28/2023 15:15	418.15	9.85	2.9	2.9	UG/L	0.36
Upstream	35	LCC23-RE-11-U	Metals	Copper	4/29/2023 7:10	418.11	8.66	3.1	3.1	UG/L	0.36
Upstream	35	LCC23-RI-11-U	Metals	Lead	4/28/2023 9:00	417.89	4.37	0.12	0.12	UG/L	0.071
Upstream	35	LCC23-P-11-U	Metals	Lead	4/28/2023 15:15	418.15	9.85	0.46	0.46	UG/L	0.071
Upstream	35	LCC23-RE-11-U	Metals	Lead	4/29/2023 7:10	418.11	8.66	0.41	0.41	UG/L	0.071
Upstream	35	LCC23-RI-11-U	Metals	Zinc	4/28/2023 9:00	417.89	4.37	0	4	UG/L	4
Upstream	35	LCC23-P-11-U	Metals	Zinc	4/28/2023 15:15	418.15	9.85	6.7	6.7	UG/L	4
Upstream	35	LCC23-RE-11-U	Metals	Zinc	4/29/2023 7:10	418.11	8.66	0	4	UG/L	4
Upstream	35	LCC23-RI-11-U	Oil & Grease	SGT-HEM (TPH)	4/28/2023 9:00	417.89	4.37	0	1.5	MG/L	1.5
Upstream	35	LCC23-P-11-U	Oil & Grease	SGT-HEM (TPH)	4/28/2023 15:15	418.15	9.85	0	1.6	MG/L	1.6
Upstream	35	LCC23-RE-11-U	Oil & Grease	SGT-HEM (TPH)	4/29/2023 7:10	418.11	8.66	0	1.5	MG/L	1.5
Upstream	37	LCC23-RI-U-12	BOD	Biochemical Oxygen Demand	6/12/2023 12:45	417.83	3.55	5.9	5.9	MG/L	2
Upstream	37	LCC23-P-U-12	BOD	Biochemical Oxygen Demand	6/12/2023 15:50	417.92	4.81	0	2	MG/L	2
Upstream	37	LCC23-RE-U-12	BOD	Biochemical Oxygen Demand	6/12/2023 17:10	417.98	5.76	3.3	3.3	MG/L	2
Upstream	37	LCC23-RI-U-12	E. coli	E. coli	6/12/2023 12:45	417.83	3.55	908	908	MPN/100 ML	10
Upstream	37	LCC23-P-U-12	E. coli	E. coli	6/12/2023 15:50	417.92	4.81	573	573	MPN/100 ML	10
Upstream	37	LCC23-RE-U-12	E. coli	E. coli	6/12/2023 17:10	417.98	5.76	8164	8164	MPN/100 ML	10
Upstream	37	LCC23-RI-U-12	Inorganics	Hardness as calcium carbonate	6/12/2023 12:45	417.83	3.55	130	130	MG/L	15
Upstream	37	LCC23-P-U-12	Inorganics	Hardness as calcium carbonate	6/12/2023 15:50	417.92	4.81	130	130	MG/L	15
Upstream	37	LCC23-RE-U-12	Inorganics	Hardness as calcium carbonate	6/12/2023 17:10	417.98	5.76	92	92	MG/L	15
Upstream	37	LCC23-RI-U-12	Inorganics	Nitrate Nitrite as N	6/12/2023 12:45	417.83	3.55	0.28	0.28	MG/L	0.04

Station	Event_ID	Sample_Name	Analyte_Group	Chemical_Name	Sample_Date	WSEL_NAVD 88feet	FlowCFS	Result (ND=0)	Result (ND=MDL)	Unit	MDL
Upstream	37	LCC23-P-U-12	Inorganics	Nitrate Nitrite as N	6/12/2023 15:50	417.92	4.81	0.17	0.17	MG/L	0.04
Upstream	37	LCC23-RE-U-12	Inorganics	Nitrate Nitrite as N	6/12/2023 17:10	417.98	5.76	0.37	0.37	MG/L	0.04
Upstream	37	LCC23-RI-U-12	Inorganics	Total Kjeldahl Nitrogen	6/12/2023 12:45	417.83	3.55	1	1	MG/L	0.5
Upstream	37	LCC23-P-U-12	Inorganics	Total Kjeldahl Nitrogen	6/12/2023 15:50	417.92	4.81	0.72	0.72	MG/L	0.5
Upstream	37	LCC23-RE-U-12	Inorganics	Total Kjeldahl Nitrogen	6/12/2023 17:10	417.98	5.76	0.97	0.97	MG/L	0.5
Upstream	37	LCC23-RI-U-12	Inorganics	Total Phosphorus as P	6/12/2023 12:45	417.83	3.55	0.13	0.13	MG/L	0.05
Upstream	37	LCC23-P-U-12	Inorganics	Total Phosphorus as P	6/12/2023 15:50	417.92	4.81	0.18	0.18	MG/L	0.05
Upstream	37	LCC23-RE-U-12	Inorganics	Total Phosphorus as P	6/12/2023 17:10	417.98	5.76	0.15	0.15	MG/L	0.05
Upstream	37	LCC23-RI-U-12	Inorganics	Total Suspended Solids	6/12/2023 12:45	417.83	3.55	4.2	4.2	MG/L	1
Upstream	37	LCC23-P-U-12	Inorganics	Total Suspended Solids	6/12/2023 15:50	417.92	4.81	14	14	MG/L	1
Upstream	37	LCC23-RE-U-12	Inorganics	Total Suspended Solids	6/12/2023 17:10	417.98	5.76	11	11	MG/L	1
Upstream	37	LCC23-RI-U-12	Metals	Copper	6/12/2023 12:45	417.83	3.55	0.86	0.86	UG/L	0.36
Upstream	37	LCC23-P-U-12	Metals	Copper	6/12/2023 15:50	417.92	4.81	0.65	0.65	UG/L	0.36
Upstream	37	LCC23-RE-U-12	Metals	Copper	6/12/2023 17:10	417.98	5.76	1.1	1.1	UG/L	0.36
Upstream	37	LCC23-RI-U-12	Metals	Lead	6/12/2023 12:45	417.83	3.55	0.091	0.091	UG/L	0.071
Upstream	37	LCC23-P-U-12	Metals	Lead	6/12/2023 15:50	417.92	4.81	0.08	0.08	UG/L	0.071
Upstream	37	LCC23-RE-U-12	Metals	Lead	6/12/2023 17:10	417.98	5.76	0.24	0.24	UG/L	0.071
Upstream	37	LCC23-RI-U-12	Metals	Zinc	6/12/2023 12:45	417.83	3.55	0	4	UG/L	4
Upstream	37	LCC23-P-U-12	Metals	Zinc	6/12/2023 15:50	417.92	4.81	0	4	UG/L	4
Upstream	37	LCC23-RE-U-12	Metals	Zinc	6/12/2023 17:10	417.98	5.76	0	4	UG/L	4
Upstream	37	LCC23-RI-U-12	Oil & Grease	SGT-HEM (TPH)	6/12/2023 12:45	417.83	3.55	0	1.6	MG/L	1.6
Upstream	37	LCC23-P-U-12	Oil & Grease	SGT-HEM (TPH)	6/12/2023 15:50	417.92	4.81	0	1.6	MG/L	1.6
Upstream	37	LCC23-RE-U-12	Oil & Grease	SGT-HEM (TPH)	6/12/2023 17:10	417.98	5.76	2.4	2.4	MG/L	1.6

Station	Event_ID	Sample_Name	Analyte_Group	Chemical_Name	Sample_Date	WSEL_NAVD88feet	FlowCFS	Result (ND=0)	Result (ND=MDL)	Unit	MDL
Downstream	10	LCC22-RI-01-D	BOD	Biochemical Oxygen Demand	6/27/2022 11:15	394.41	3.41	0	2	MG/L	2
Downstream	10	LCC22-P-01-D	BOD	Biochemical Oxygen Demand	6/27/2022 14:40	394.43	3.78	0	2	MG/L	2
Downstream	10	LCC22-RE-01-D	BOD	Biochemical Oxygen Demand	6/27/2022 15:15	394.43	3.68	0	2	MG/L	2
Downstream	10	LCC22-RI-01-D	E. coli	E. coli	6/27/2022 11:15	394.41	3.41	959	959	MPN/100 ML	10
Downstream	10	LCC22-P-01-D	E. coli	E. coli	6/27/2022 14:40	394.43	3.78	776	776	MPN/100 ML	10
Downstream	10	LCC22-RE-01-D	E. coli	E. coli	6/27/2022 15:15	394.43	3.68	723	723	MPN/100 ML	10
Downstream	10	LCC22-RI-01-D	Inorganics	Hardness as calcium carbonate	6/27/2022 11:15	394.41	3.41	120	120	MG/L	15
Downstream	10	LCC22-P-01-D	Inorganics	Hardness as calcium carbonate	6/27/2022 14:40	394.43	3.78	130	130	MG/L	15
Downstream	10	LCC22-RE-01-D	Inorganics	Hardness as calcium carbonate	6/27/2022 15:15	394.43	3.68	130	130	MG/L	15
Downstream	10	LCC22-RI-01-D	Inorganics	Nitrate Nitrite as N	6/27/2022 11:15	394.41	3.41	1.7	1.7	MG/L	0.04
Downstream	10	LCC22-P-01-D	Inorganics	Nitrate Nitrite as N	6/27/2022 14:40	394.43	3.78	1.9	1.9	MG/L	0.04
Downstream	10	LCC22-RE-01-D	Inorganics	Nitrate Nitrite as N	6/27/2022 15:15	394.43	3.68	1.9	1.9	MG/L	0.04
Downstream	10	LCC22-RI-01-D	Inorganics	Total Kjeldahl Nitrogen	6/27/2022 11:15	394.41	3.41	0.7	0.7	MG/L	0.5
Downstream	10	LCC22-P-01-D	Inorganics	Total Kjeldahl Nitrogen	6/27/2022 14:40	394.43	3.78	0.93	0.93	MG/L	0.5
Downstream	10	LCC22-RE-01-D	Inorganics	Total Kjeldahl Nitrogen	6/27/2022 15:15	394.43	3.68	0.88	0.88	MG/L	0.5
Downstream	10	LCC22-RI-01-D	Inorganics	Total Phosphorus as P	6/27/2022 11:15	394.41	3.41	0.13	0.13	MG/L	0.05
Downstream	10	LCC22-P-01-D	Inorganics	Total Phosphorus as P	6/27/2022 14:40	394.43	3.78	0.23	0.23	MG/L	0.05
Downstream	10	LCC22-RE-01-D	Inorganics	Total Phosphorus as P	6/27/2022 15:15	394.43	3.68	0.13	0.13	MG/L	0.05
Downstream	10	LCC22-RI-01-D	Inorganics	Total Suspended Solids	6/27/2022 11:15	394.41	3.41	1.9	1.9	MG/L	1
Downstream	10	LCC22-P-01-D	Inorganics	Total Suspended Solids	6/27/2022 14:40	394.43	3.78	1.8	1.8	MG/L	1
Downstream	10	LCC22-RE-01-D	Inorganics	Total Suspended Solids	6/27/2022 15:15	394.43	3.68	12	12	MG/L	1
Downstream	10	LCC22-RI-01-D	Metals	Copper	6/27/2022 11:15	394.41	3.41	1.1	1.1	UG/L	0.36
Downstream	10	LCC22-P-01-D	Metals	Copper	6/27/2022 14:40	394.43	3.78	0.83	0.83	UG/L	0.36
Downstream	10	LCC22-RE-01-D	Metals	Copper	6/27/2022 15:15	394.43	3.68	1.1	1.1	UG/L	0.36
Downstream	10	LCC22-RI-01-D	Metals	Lead	6/27/2022 11:15	394.41	3.41	0.32	0.32	UG/L	0.071
Downstream	10	LCC22-P-01-D	Metals	Lead	6/27/2022 14:40	394.43	3.78	0	0.071	UG/L	0.071
Downstream	10	LCC22-RE-01-D	Metals	Lead	6/27/2022 15:15	394.43	3.68	0.28	0.28	UG/L	0.071
Downstream	10	LCC22-RI-01-D	Metals	Zinc	6/27/2022 11:15	394.41	3.41	0	4	UG/L	4
Downstream	10	LCC22-P-01-D	Metals	Zinc	6/27/2022 14:40	394.43	3.78	0	4	UG/L	4
Downstream	10	LCC22-RE-01-D	Metals	Zinc	6/27/2022 15:15	394.43	3.68	0	4	UG/L	4
Downstream	10	LCC22-RI-01-D	Oil & Grease	SGT-HEM (TPH)	6/27/2022 11:15	394.41	3.41	0	1.5	MG/L	1.5
Downstream	10	LCC22-P-01-D	Oil & Grease	SGT-HEM (TPH)	6/27/2022 14:40	394.43	3.78	0	1.6	MG/L	1.6
Downstream	10	LCC22-RE-01-D	Oil & Grease	SGT-HEM (TPH)	6/27/2022 15:15	394.43	3.68	1.8	1.8	MG/L	1.7
Downstream	11	LCC22-RI-02-D	BOD	Biochemical Oxygen Demand	7/18/2022 16:20	394.46	4.26	0	2	MG/L	2

Station	Event_ID	Sample_Name	Analyte_Group	Chemical_Name	Sample_Date	WSEL_NAVD88feet	FlowCFS	Result (ND=0)	Result (ND=MDL)	Unit	MDL
Downstream	11	LCC22-P-02-D	BOD	Biochemical Oxygen Demand	7/18/2022 16:40	394.46	4.22	0	2	MG/L	2
Downstream	11	LCC22-RE-02-D	BOD	Biochemical Oxygen Demand	7/18/2022 17:50	394.53	5.75	2.8	2.8	MG/L	2
Downstream	11	LCC22-RI-02-D	E. coli	E. coli	7/18/2022 16:20	394.46	4.26	34480	34480	MPN/100 ML	100
Downstream	11	LCC22-P-02-D	E. coli	E. coli	7/18/2022 16:40	394.46	4.22	48840	48840	MPN/100 ML	100
Downstream	11	LCC22-RE-02-D	E. coli	E. coli	7/18/2022 17:50	394.53	5.75	43520	43520	MPN/100 ML	100
Downstream	11	LCC22-RI-02-D	Inorganics	Hardness as calcium carbonate	7/18/2022 16:20	394.46	4.26	120	120	MG/L	30
Downstream	11	LCC22-P-02-D	Inorganics	Hardness as calcium carbonate	7/18/2022 16:40	394.46	4.22	120	120	MG/L	30
Downstream	11	LCC22-RE-02-D	Inorganics	Hardness as calcium carbonate	7/18/2022 17:50	394.53	5.75	130	130	MG/L	30
Downstream	11	LCC22-RI-02-D	Inorganics	Nitrate Nitrite as N	7/18/2022 16:20	394.46	4.26	1.1	1.1	MG/L	0.04
Downstream	11	LCC22-P-02-D	Inorganics	Nitrate Nitrite as N	7/18/2022 16:40	394.46	4.22	1.2	1.2	MG/L	0.04
Downstream	11	LCC22-RE-02-D	Inorganics	Nitrate Nitrite as N	7/18/2022 17:50	394.53	5.75	1.1	1.1	MG/L	0.04
Downstream	11	LCC22-RI-02-D	Inorganics	Total Kjeldahl Nitrogen	7/18/2022 16:20	394.46	4.26	0.56	0.56	MG/L	0.5
Downstream	11	LCC22-P-02-D	Inorganics	Total Kjeldahl Nitrogen	7/18/2022 16:40	394.46	4.22	0	0.5	MG/L	0.5
Downstream	11	LCC22-RE-02-D	Inorganics	Total Kjeldahl Nitrogen	7/18/2022 17:50	394.53	5.75	1.2	1.2	MG/L	0.5
Downstream	11	LCC22-RI-02-D	Inorganics	Total Phosphorus as P	7/18/2022 16:20	394.46	4.26	0.11	0.11	MG/L	0.05
Downstream	11	LCC22-P-02-D	Inorganics	Total Phosphorus as P	7/18/2022 16:40	394.46	4.22	0.1	0.1	MG/L	0.05
Downstream	11	LCC22-RE-02-D	Inorganics	Total Phosphorus as P	7/18/2022 17:50	394.53	5.75	0.14	0.14	MG/L	0.05
Downstream	11	LCC22-RI-02-D	Inorganics	Total Suspended Solids	7/18/2022 16:20	394.46	4.26	1.1	1.1	MG/L	1
Downstream	11	LCC22-P-02-D	Inorganics	Total Suspended Solids	7/18/2022 16:40	394.46	4.22	0	1	MG/L	1
Downstream	11	LCC22-RE-02-D	Inorganics	Total Suspended Solids	7/18/2022 17:50	394.53	5.75	0	1	MG/L	1
Downstream	11	LCC22-RI-02-D	Metals	Copper	7/18/2022 16:20	394.46	4.26	1.3	1.3	UG/L	0.36
Downstream	11	LCC22-P-02-D	Metals	Copper	7/18/2022 16:40	394.46	4.22	0.88	0.88	UG/L	0.36
Downstream	11	LCC22-RE-02-D	Metals	Copper	7/18/2022 17:50	394.53	5.75	1.2	1.2	UG/L	0.36
Downstream	11	LCC22-RI-02-D	Metals	Lead	7/18/2022 16:20	394.46	4.26	0.36	0.36	UG/L	0.071
Downstream	11	LCC22-P-02-D	Metals	Lead	7/18/2022 16:40	394.46	4.22	0.22	0.22	UG/L	0.071
Downstream	11	LCC22-RE-02-D	Metals	Lead	7/18/2022 17:50	394.53	5.75	0.34	0.34	UG/L	0.071
Downstream	11	LCC22-RI-02-D	Metals	Zinc	7/18/2022 16:20	394.46	4.26	0	4	UG/L	4
Downstream	11	LCC22-P-02-D	Metals	Zinc	7/18/2022 16:40	394.46	4.22	0	4	UG/L	4
Downstream	11	LCC22-RE-02-D	Metals	Zinc	7/18/2022 17:50	394.53	5.75	0	4	UG/L	4
Downstream	11	LCC22-RI-02-D	Oil & Grease	SGT-HEM (TPH)	7/18/2022 16:20	394.46	4.26	0	1.7	MG/L	1.7
Downstream	11	LCC22-P-02-D	Oil & Grease	SGT-HEM (TPH)	7/18/2022 16:40	394.46	4.22	0	1.6	MG/L	1.6
Downstream	11	LCC22-RE-02-D	Oil & Grease	SGT-HEM (TPH)	7/18/2022 17:50	394.53	5.75	0	1.6	MG/L	1.6
Downstream	12	LCC22-RI-03-D	BOD	Biochemical Oxygen Demand	8/30/2022 16:05	394.37	2.81	0	2	MG/L	2
Downstream	12	LCC22-P-03-D	BOD	Biochemical Oxygen Demand	8/30/2022 16:40	394.37	2.81	0	2	MG/L	2

Station	Event_ID	Sample_Name	Analyte_Group	Chemical_Name	Sample_Date	WSEL_NAVD88feet	FlowCFS	Result (ND=0)	Result (ND=MDL)	Unit	MDL
Downstream	12	LCC22-RE-03-D	BOD	Biochemical Oxygen Demand	8/30/2022 18:40	394.37	2.82	0	2	MG/L	2
Downstream	12	LCC22-RI-03-D	E. coli	E. coli	8/30/2022 16:05	394.37	2.81	9600	9600	MPN/100 ML	100
Downstream	12	LCC22-P-03-D	E. coli	E. coli	8/30/2022 16:40	394.37	2.81	10670	10670	MPN/100 ML	100
Downstream	12	LCC22-RE-03-D	E. coli	E. coli	8/30/2022 18:40	394.37	2.82	8160	8160	MPN/100 ML	100
Downstream	12	LCC22-RI-03-D	Inorganics	Hardness as calcium carbonate	8/30/2022 16:05	394.37	2.81	170	170	MG/L	30
Downstream	12	LCC22-P-03-D	Inorganics	Hardness as calcium carbonate	8/30/2022 16:40	394.37	2.81	160	160	MG/L	30
Downstream	12	LCC22-RE-03-D	Inorganics	Hardness as calcium carbonate	8/30/2022 18:40	394.37	2.82	160	160	MG/L	30
Downstream	12	LCC22-RI-03-D	Inorganics	Nitrate Nitrite as N	8/30/2022 16:05	394.37	2.81	0.72	0.72	MG/L	0.04
Downstream	12	LCC22-P-03-D	Inorganics	Nitrate Nitrite as N	8/30/2022 16:40	394.37	2.81	0.59	0.59	MG/L	0.04
Downstream	12	LCC22-RE-03-D	Inorganics	Nitrate Nitrite as N	8/30/2022 18:40	394.37	2.82	0.77	0.77	MG/L	0.04
Downstream	12	LCC22-RI-03-D	Inorganics	Total Kjeldahl Nitrogen	8/30/2022 16:05	394.37	2.81	0	0.5	MG/L	0.5
Downstream	12	LCC22-P-03-D	Inorganics	Total Kjeldahl Nitrogen	8/30/2022 16:40	394.37	2.81	0.59	0.59	MG/L	0.5
Downstream	12	LCC22-RE-03-D	Inorganics	Total Kjeldahl Nitrogen	8/30/2022 18:40	394.37	2.82	0.55	0.55	MG/L	0.5
Downstream	12	LCC22-RI-03-D	Inorganics	Total Phosphorus as P	8/30/2022 16:05	394.37	2.81	0.085	0.085	MG/L	0.05
Downstream	12	LCC22-P-03-D	Inorganics	Total Phosphorus as P	8/30/2022 16:40	394.37	2.81	0.091	0.091	MG/L	0.05
Downstream	12	LCC22-RE-03-D	Inorganics	Total Phosphorus as P	8/30/2022 18:40	394.37	2.82	0.082	0.082	MG/L	0.05
Downstream	12	LCC22-RI-03-D	Inorganics	Total Suspended Solids	8/30/2022 16:05	394.37	2.81	3.4	3.4	MG/L	1
Downstream	12	LCC22-P-03-D	Inorganics	Total Suspended Solids	8/30/2022 16:40	394.37	2.81	2.7	2.7	MG/L	1
Downstream	12	LCC22-RE-03-D	Inorganics	Total Suspended Solids	8/30/2022 18:40	394.37	2.82	1.8	1.8	MG/L	1
Downstream	12	LCC22-RI-03-D	Metals	Copper	8/30/2022 16:05	394.37	2.81	0.61	0.61	UG/L	0.36
Downstream	12	LCC22-P-03-D	Metals	Copper	8/30/2022 16:40	394.37	2.81	0.63	0.63	UG/L	0.36
Downstream	12	LCC22-RE-03-D	Metals	Copper	8/30/2022 18:40	394.37	2.82	1	1	UG/L	0.36
Downstream	12	LCC22-RI-03-D	Metals	Lead	8/30/2022 16:05	394.37	2.81	0.081	0.081	UG/L	0.071
Downstream	12	LCC22-P-03-D	Metals	Lead	8/30/2022 16:40	394.37	2.81	0	0.071	UG/L	0.071
Downstream	12	LCC22-RE-03-D	Metals	Lead	8/30/2022 18:40	394.37	2.82	0	0.071	UG/L	0.071
Downstream	12	LCC22-RI-03-D	Metals	Zinc	8/30/2022 16:05	394.37	2.81	0	4	UG/L	4
Downstream	12	LCC22-P-03-D	Metals	Zinc	8/30/2022 16:40	394.37	2.81	0	4	UG/L	4
Downstream	12	LCC22-RE-03-D	Metals	Zinc	8/30/2022 18:40	394.37	2.82	5.6	5.6	UG/L	4
Downstream	12	LCC22-RI-03-D	Oil & Grease	SGT-HEM (TPH)	8/30/2022 16:05	394.37	2.81	1.9	1.9	MG/L	1.5
Downstream	12	LCC22-P-03-D	Oil & Grease	SGT-HEM (TPH)	8/30/2022 16:40	394.37	2.81	0	1.5	MG/L	1.5
Downstream	12	LCC22-RE-03-D	Oil & Grease	SGT-HEM (TPH)	8/30/2022 18:40	394.37	2.82	2.4	2.4	MG/L	1.5
Downstream	20	LCC22-RI-04-D	BOD	Biochemical Oxygen Demand	9/22/2022 10:29	394.35	2.42	0	2	MG/L	2
Downstream	20	LCC22-P-04-D	BOD	Biochemical Oxygen Demand	9/22/2022 11:25	394.36	2.58	0	2	MG/L	2
Downstream	20	LCC22-RE-04-D	BOD	Biochemical Oxygen Demand	9/22/2022 12:14	394.39	3.00	0	2	MG/L	2

Station	Event_ID	Sample_Name	Analyte_Group	Chemical_Name	Sample_Date	WSEL_NAVD88feet	FlowCFS	Result (ND=0)	Result (ND=MDL)	Unit	MDL
Downstream	20	LCC22-RI-04-D	E. coli	E. coli	9/22/2022 10:29	394.35	2.42	4106	4106	MPN/100 ML	10
Downstream	20	LCC22-P-04-D	E. coli	E. coli	9/22/2022 11:25	394.36	2.58	3076	3076	MPN/100 ML	10
Downstream	20	LCC22-RE-04-D	E. coli	E. coli	9/22/2022 12:14	394.39	3.00	2909	2909	MPN/100 ML	10
Downstream	20	LCC22-RI-04-D	Inorganics	Hardness as calcium carbonate	9/22/2022 10:29	394.35	2.42	150	150	MG/L	15
Downstream	20	LCC22-P-04-D	Inorganics	Hardness as calcium carbonate	9/22/2022 11:25	394.36	2.58	140	140	MG/L	15
Downstream	20	LCC22-RE-04-D	Inorganics	Hardness as calcium carbonate	9/22/2022 12:14	394.39	3.00	190	190	MG/L	15
Downstream	20	LCC22-RI-04-D	Inorganics	Nitrate Nitrite as N	9/22/2022 10:29	394.35	2.42	0.93	0.93	MG/L	0.04
Downstream	20	LCC22-P-04-D	Inorganics	Nitrate Nitrite as N	9/22/2022 11:25	394.36	2.58	0.72	0.72	MG/L	0.04
Downstream	20	LCC22-RE-04-D	Inorganics	Nitrate Nitrite as N	9/22/2022 12:14	394.39	3.00	0.72	0.72	MG/L	0.04
Downstream	20	LCC22-RI-04-D	Inorganics	Total Kjeldahl Nitrogen	9/22/2022 10:29	394.35	2.42	0	0.5	MG/L	0.5
Downstream	20	LCC22-P-04-D	Inorganics	Total Kjeldahl Nitrogen	9/22/2022 11:25	394.36	2.58	0	0.5	MG/L	0.5
Downstream	20	LCC22-RE-04-D	Inorganics	Total Kjeldahl Nitrogen	9/22/2022 12:14	394.39	3.00	0.52	0.52	MG/L	0.5
Downstream	20	LCC22-RI-04-D	Inorganics	Total Phosphorus as P	9/22/2022 10:29	394.35	2.42	0.15	0.15	MG/L	0.05
Downstream	20	LCC22-P-04-D	Inorganics	Total Phosphorus as P	9/22/2022 11:25	394.36	2.58	0.076	0.076	MG/L	0.05
Downstream	20	LCC22-RE-04-D	Inorganics	Total Phosphorus as P	9/22/2022 12:14	394.39	3.00	0.077	0.077	MG/L	0.05
Downstream	20	LCC22-RI-04-D	Inorganics	Total Suspended Solids	9/22/2022 10:29	394.35	2.42	6.2	6.2	MG/L	1.2
Downstream	20	LCC22-P-04-D	Inorganics	Total Suspended Solids	9/22/2022 11:25	394.36	2.58	2.1	2.1	MG/L	1.2
Downstream	20	LCC22-RE-04-D	Inorganics	Total Suspended Solids	9/22/2022 12:14	394.39	3.00	3.6	3.6	MG/L	1.1
Downstream	20	LCC22-RI-04-D	Metals	Copper	9/22/2022 10:29	394.35	2.42	1.6	1.6	UG/L	0.36
Downstream	20	LCC22-P-04-D	Metals	Copper	9/22/2022 11:25	394.36	2.58	0.76	0.76	UG/L	0.36
Downstream	20	LCC22-RE-04-D	Metals	Copper	9/22/2022 12:14	394.39	3.00	0.6	0.6	UG/L	0.36
Downstream	20	LCC22-RI-04-D	Metals	Lead	9/22/2022 10:29	394.35	2.42	0.78	0.78	UG/L	0.071
Downstream	20	LCC22-P-04-D	Metals	Lead	9/22/2022 11:25	394.36	2.58	0	0.071	UG/L	0.071
Downstream	20	LCC22-RE-04-D	Metals	Lead	9/22/2022 12:14	394.39	3.00	0	0.071	UG/L	0.071
Downstream	20	LCC22-RI-04-D	Metals	Zinc	9/22/2022 10:29	394.35	2.42	0	4	UG/L	4
Downstream	20	LCC22-P-04-D	Metals	Zinc	9/22/2022 11:25	394.36	2.58	0	4	UG/L	4
Downstream	20	LCC22-RE-04-D	Metals	Zinc	9/22/2022 12:14	394.39	3.00	0	4	UG/L	4
Downstream	20	LCC22-RI-04-D	Oil & Grease	SGT-HEM (TPH)	9/22/2022 10:29	394.35	2.42	0	1.6	MG/L	1.6
Downstream	20	LCC22-P-04-D	Oil & Grease	SGT-HEM (TPH)	9/22/2022 11:25	394.36	2.58	0	1.6	MG/L	1.6
Downstream	20	LCC22-RE-04-D	Oil & Grease	SGT-HEM (TPH)	9/22/2022 12:14	394.39	3.00	0	1.6	MG/L	1.6
Downstream	22	LCC22-RI-05-D	BOD	Biochemical Oxygen Demand	10/1/2022 9:05	394.52	5.55	14	14	MG/L	2
Downstream	22	LCC22-P-05-D	BOD	Biochemical Oxygen Demand	10/2/2022 12:00	394.51	5.40	3.7	3.7	MG/L	2
Downstream	22	LCC22-RE-05-D	BOD	Biochemical Oxygen Demand	10/3/2022 13:40	394.70	10.35	3.2	3.2	MG/L	2
Downstream	22	LCC22-RI-05-D	E. coli	E. coli	10/1/2022 9:05	394.52	5.55	241960	241960	MPN/100 ML	100

Station	Event_ID	Sample_Name	Analyte_Group	Chemical_Name	Sample_Date	WSEL_NAVD88feet	FlowCFS	Result (ND=0)	Result (ND=MDL)	Unit	MDL
Downstream	22	LCC22-P-05-D	E. coli	E. coli	10/2/2022 12:00	394.51	5.40	51720	51720	MPN/100 ML	100
Downstream	22	LCC22-RE-05-D	E. coli	E. coli	10/3/2022 13:40	394.70	10.35	4110	4110	MPN/100 ML	100
Downstream	22	LCC22-RI-05-D	Inorganics	Hardness as calcium carbonate	10/1/2022 9:05	394.52	5.55	150	150	MG/L	15
Downstream	22	LCC22-P-05-D	Inorganics	Hardness as calcium carbonate	10/2/2022 12:00	394.51	5.40	91	91	MG/L	30
Downstream	22	LCC22-RE-05-D	Inorganics	Hardness as calcium carbonate	10/3/2022 13:40	394.70	10.35	100	100	MG/L	15
Downstream	22	LCC22-RI-05-D	Inorganics	Nitrate Nitrite as N	10/1/2022 9:05	394.52	5.55	1.3	1.3	MG/L	0.04
Downstream	22	LCC22-P-05-D	Inorganics	Nitrate Nitrite as N	10/2/2022 12:00	394.51	5.40	1.3	1.3	MG/L	0.04
Downstream	22	LCC22-RE-05-D	Inorganics	Nitrate Nitrite as N	10/3/2022 13:40	394.70	10.35	1.9	1.9	MG/L	0.04
Downstream	22	LCC22-RI-05-D	Inorganics	Total Kjeldahl Nitrogen	10/1/2022 9:05	394.52	5.55	2	2	MG/L	0.5
Downstream	22	LCC22-P-05-D	Inorganics	Total Kjeldahl Nitrogen	10/2/2022 12:00	394.51	5.40	1.7	1.7	MG/L	0.5
Downstream	22	LCC22-RE-05-D	Inorganics	Total Kjeldahl Nitrogen	10/3/2022 13:40	394.70	10.35	1.4	1.4	MG/L	0.5
Downstream	22	LCC22-RI-05-D	Inorganics	Total Phosphorus as P	10/1/2022 9:05	394.52	5.55	0.42	0.42	MG/L	0.05
Downstream	22	LCC22-P-05-D	Inorganics	Total Phosphorus as P	10/2/2022 12:00	394.51	5.40	0.44	0.44	MG/L	0.05
Downstream	22	LCC22-RE-05-D	Inorganics	Total Phosphorus as P	10/3/2022 13:40	394.70	10.35	0.21	0.21	MG/L	0.05
Downstream	22	LCC22-RI-05-D	Inorganics	Total Suspended Solids	10/1/2022 9:05	394.52	5.55	15	15	MG/L	1
Downstream	22	LCC22-P-05-D	Inorganics	Total Suspended Solids	10/2/2022 12:00	394.51	5.40	20	20	MG/L	1
Downstream	22	LCC22-RE-05-D	Inorganics	Total Suspended Solids	10/3/2022 13:40	394.70	10.35	4.2	4.2	MG/L	1
Downstream	22	LCC22-RI-05-D	Metals	Copper	10/1/2022 9:05	394.52	5.55	2.8	2.8	UG/L	0.36
Downstream	22	LCC22-P-05-D	Metals	Copper	10/2/2022 12:00	394.51	5.40	4	4	UG/L	0.36
Downstream	22	LCC22-RE-05-D	Metals	Copper	10/3/2022 13:40	394.70	10.35	3	3	UG/L	0.36
Downstream	22	LCC22-RI-05-D	Metals	Lead	10/1/2022 9:05	394.52	5.55	0.23	0.23	UG/L	0.071
Downstream	22	LCC22-P-05-D	Metals	Lead	10/2/2022 12:00	394.51	5.40	0.42	0.42	UG/L	0.071
Downstream	22	LCC22-RE-05-D	Metals	Lead	10/3/2022 13:40	394.70	10.35	0.26	0.26	UG/L	0.071
Downstream	22	LCC22-RI-05-D	Metals	Zinc	10/1/2022 9:05	394.52	5.55	0	4	UG/L	4
Downstream	22	LCC22-P-05-D	Metals	Zinc	10/2/2022 12:00	394.51	5.40	0	4	UG/L	4
Downstream	22	LCC22-RE-05-D	Metals	Zinc	10/3/2022 13:40	394.70	10.35	0	4	UG/L	4
Downstream	22	LCC22-RI-05-D	Oil & Grease	SGT-HEM (TPH)	10/1/2022 9:05	394.52	5.55	0	1.6	MG/L	1.6
Downstream	22	LCC22-P-05-D	Oil & Grease	SGT-HEM (TPH)	10/2/2022 12:00	394.51	5.40	1.7	1.7	MG/L	1.6
Downstream	22	LCC22-RE-05-D	Oil & Grease	SGT-HEM (TPH)	10/3/2022 13:40	394.70	10.35	0	1.6	MG/L	1.6
Downstream	24	LCC22-RI-06-D	BOD	Biochemical Oxygen Demand	10/13/2022 16:00	394.46	4.24	3.4	3.4	MG/L	2.5
Downstream	24	LCC22-P-06-D	BOD	Biochemical Oxygen Demand	10/13/2022 17:51	394.47	4.58	0	2.5	MG/L	2.5
Downstream	24	LCC22-RE-06-D	BOD	Biochemical Oxygen Demand	10/14/2022 9:15	394.47	4.56	6.5	6.5	MG/L	2.5
Downstream	24	LCC22-RI-06-D	E. coli	E. coli	10/13/2022 16:00	394.46	4.24	10462	10462	MPN/100 ML	10
Downstream	24	LCC22-P-06-D	E. coli	E. coli	10/13/2022 17:51	394.47	4.58	9804	9804	MPN/100 ML	10

Station	Event_ID	Sample_Name	Analyte_Group	Chemical_Name	Sample_Date	WSEL_NAVD88feet	FlowCFS	Result (ND=0)	Result (ND=MDL)	Unit	MDL
Downstream	24	LCC22-RE-06-D	E. coli	E. coli	10/14/2022 9:15	394.47	4.56	57940	57940	MPN/100 ML	100
Downstream	24	LCC22-RI-06-D	Inorganics	Hardness as calcium carbonate	10/13/2022 16:00	394.46	4.24	150	150	MG/L	15
Downstream	24	LCC22-P-06-D	Inorganics	Hardness as calcium carbonate	10/13/2022 17:51	394.47	4.58	150	150	MG/L	15
Downstream	24	LCC22-RE-06-D	Inorganics	Hardness as calcium carbonate	10/14/2022 9:15	394.47	4.56	160	160	MG/L	15
Downstream	24	LCC22-RI-06-D	Inorganics	Nitrate Nitrite as N	10/13/2022 16:00	394.46	4.24	2.1	2.1	MG/L	0.04
Downstream	24	LCC22-P-06-D	Inorganics	Nitrate Nitrite as N	10/13/2022 17:51	394.47	4.58	1.9	1.9	MG/L	0.04
Downstream	24	LCC22-RE-06-D	Inorganics	Nitrate Nitrite as N	10/14/2022 9:15	394.47	4.56	1.1	1.1	MG/L	0.04
Downstream	24	LCC22-RI-06-D	Inorganics	Total Kjeldahl Nitrogen	10/13/2022 16:00	394.46	4.24	0.86	0.86	MG/L	0.5
Downstream	24	LCC22-P-06-D	Inorganics	Total Kjeldahl Nitrogen	10/13/2022 17:51	394.47	4.58	0.73	0.73	MG/L	0.5
Downstream	24	LCC22-RE-06-D	Inorganics	Total Kjeldahl Nitrogen	10/14/2022 9:15	394.47	4.56	1.4	1.4	MG/L	0.5
Downstream	24	LCC22-RI-06-D	Inorganics	Total Phosphorus as P	10/13/2022 16:00	394.46	4.24	0.066	0.066	MG/L	0.05
Downstream	24	LCC22-P-06-D	Inorganics	Total Phosphorus as P	10/13/2022 17:51	394.47	4.58	0.061	0.061	MG/L	0.05
Downstream	24	LCC22-RE-06-D	Inorganics	Total Phosphorus as P	10/14/2022 9:15	394.47	4.56	0.13	0.13	MG/L	0.05
Downstream	24	LCC22-RI-06-D	Inorganics	Total Suspended Solids	10/13/2022 16:00	394.46	4.24	7.7	7.7	MG/L	1
Downstream	24	LCC22-P-06-D	Inorganics	Total Suspended Solids	10/13/2022 17:51	394.47	4.58	6	6	MG/L	1
Downstream	24	LCC22-RE-06-D	Inorganics	Total Suspended Solids	10/14/2022 9:15	394.47	4.56	2	2	MG/L	1
Downstream	24	LCC22-RI-06-D	Metals	Copper	10/13/2022 16:00	394.46	4.24	1.3	1.3	UG/L	0.36
Downstream	24	LCC22-P-06-D	Metals	Copper	10/13/2022 17:51	394.47	4.58	1.6	1.6	UG/L	0.36
Downstream	24	LCC22-RE-06-D	Metals	Copper	10/14/2022 9:15	394.47	4.56	1.8	1.8	UG/L	0.36
Downstream	24	LCC22-RI-06-D	Metals	Lead	10/13/2022 16:00	394.46	4.24	0.11	0.11	UG/L	0.071
Downstream	24	LCC22-P-06-D	Metals	Lead	10/13/2022 17:51	394.47	4.58	0.16	0.16	UG/L	0.071
Downstream	24	LCC22-RE-06-D	Metals	Lead	10/14/2022 9:15	394.47	4.56	0.1	0.1	UG/L	0.071
Downstream	24	LCC22-RI-06-D	Metals	Zinc	10/13/2022 16:00	394.46	4.24	0	4	UG/L	4
Downstream	24	LCC22-P-06-D	Metals	Zinc	10/13/2022 17:51	394.47	4.58	0	4	UG/L	4
Downstream	24	LCC22-RE-06-D	Metals	Zinc	10/14/2022 9:15	394.47	4.56	0	4	UG/L	4
Downstream	24	LCC22-RI-06-D	Oil & Grease	SGT-HEM (TPH)	10/13/2022 16:00	394.46	4.24	0	1.6	MG/L	1.6
Downstream	24	LCC22-P-06-D	Oil & Grease	SGT-HEM (TPH)	10/13/2022 17:51	394.47	4.58	0	1.6	MG/L	1.6
Downstream	24	LCC22-RE-06-D	Oil & Grease	SGT-HEM (TPH)	10/14/2022 9:15	394.47	4.56	0	1.7	MG/L	1.7
Downstream	26	LCC22-RI-07-D	BOD	Biochemical Oxygen Demand	11/11/2022 9:24	394.66	6.48	6.9	6.9	MG/L	2
Downstream	26	LCC22-P-07-D	BOD	Biochemical Oxygen Demand	11/11/2022 14:45	395.08	21.00	23	23	MG/L	2
Downstream	26	LCC22-RE-07-D	BOD	Biochemical Oxygen Demand	11/12/2022 9:00	394.89	13.32	7.6	7.6	MG/L	2
Downstream	26	LCC22-RI-07-D	E. coli	E. coli	11/11/2022 9:24	394.66	6.48	3076	3076	MPN/100 ML	10
Downstream	26	LCC22-P-07-D	E. coli	E. coli	11/11/2022 14:45	395.08	21.00	241960	241960	MPN/100 ML	100
Downstream	26	LCC22-RE-07-D	E. coli	E. coli	11/12/2022 9:00	394.89	13.32	41060	41060	MPN/100 ML	100

Station	Event_ID	Sample_Name	Analyte_Group	Chemical_Name	Sample_Date	WSEL_NAVD88feet	FlowCFS	Result (ND=0)	Result (ND=MDL)	Unit	MDL
Downstream	26	LCC22-RI-07-D	Inorganics	Hardness as calcium carbonate	11/11/2022 9:24	394.66	6.48	190	190	MG/L	15
Downstream	26	LCC22-P-07-D	Inorganics	Hardness as calcium carbonate	11/11/2022 14:45	395.08	21.00	120	120	MG/L	30
Downstream	26	LCC22-RE-07-D	Inorganics	Hardness as calcium carbonate	11/12/2022 9:00	394.89	13.32	120	120	MG/L	6
Downstream	26	LCC22-RI-07-D	Inorganics	Nitrate Nitrite as N	11/11/2022 9:24	394.66	6.48	0.3	0.3	MG/L	0.04
Downstream	26	LCC22-P-07-D	Inorganics	Nitrate Nitrite as N	11/11/2022 14:45	395.08	21.00	2	2	MG/L	0.04
Downstream	26	LCC22-RE-07-D	Inorganics	Nitrate Nitrite as N	11/12/2022 9:00	394.89	13.32	1.3	1.3	MG/L	0.04
Downstream	26	LCC22-RI-07-D	Inorganics	Total Kjeldahl Nitrogen	11/11/2022 9:24	394.66	6.48	0	0.5	MG/L	0.5
Downstream	26	LCC22-P-07-D	Inorganics	Total Kjeldahl Nitrogen	11/11/2022 14:45	395.08	21.00	2.4	2.4	MG/L	0.5
Downstream	26	LCC22-RE-07-D	Inorganics	Total Kjeldahl Nitrogen	11/12/2022 9:00	394.89	13.32	1.3	1.3	MG/L	0.5
Downstream	26	LCC22-RI-07-D	Inorganics	Total Phosphorus as P	11/11/2022 9:24	394.66	6.48	0.096	0.096	MG/L	0.05
Downstream	26	LCC22-P-07-D	Inorganics	Total Phosphorus as P	11/11/2022 14:45	395.08	21.00	1.1	1.1	MG/L	0.05
Downstream	26	LCC22-RE-07-D	Inorganics	Total Phosphorus as P	11/12/2022 9:00	394.89	13.32	0.5	0.5	MG/L	0.05
Downstream	26	LCC22-RI-07-D	Inorganics	Total Suspended Solids	11/11/2022 9:24	394.66	6.48	9.8	9.8	MG/L	1.1
Downstream	26	LCC22-P-07-D	Inorganics	Total Suspended Solids	11/11/2022 14:45	395.08	21.00	68	68	MG/L	2.9
Downstream	26	LCC22-RE-07-D	Inorganics	Total Suspended Solids	11/12/2022 9:00	394.89	13.32	4.8	4.8	MG/L	1
Downstream	26	LCC22-RI-07-D	Metals	Copper	11/11/2022 9:24	394.66	6.48	1.1	1.1	UG/L	0.36
Downstream	26	LCC22-P-07-D	Metals	Copper	11/11/2022 14:45	395.08	21.00	6.4	6.4	UG/L	0.36
Downstream	26	LCC22-RE-07-D	Metals	Copper	11/12/2022 9:00	394.89	13.32	6.9	6.9	UG/L	0.36
Downstream	26	LCC22-RI-07-D	Metals	Lead	11/11/2022 9:24	394.66	6.48	0.21	0.21	UG/L	0.071
Downstream	26	LCC22-P-07-D	Metals	Lead	11/11/2022 14:45	395.08	21.00	1.5	1.5	UG/L	0.071
Downstream	26	LCC22-RE-07-D	Metals	Lead	11/12/2022 9:00	394.89	13.32	0.37	0.37	UG/L	0.071
Downstream	26	LCC22-RI-07-D	Metals	Zinc	11/11/2022 9:24	394.66	6.48	0	4	UG/L	4
Downstream	26	LCC22-P-07-D	Metals	Zinc	11/11/2022 14:45	395.08	21.00	13	13	UG/L	4
Downstream	26	LCC22-RE-07-D	Metals	Zinc	11/12/2022 9:00	394.89	13.32	0	4	UG/L	4
Downstream	26	LCC22-RI-07-D	Oil & Grease	SGT-HEM (TPH)	11/11/2022 9:24	394.66	6.48	3.7	3.7	MG/L	1.7
Downstream	26	LCC22-P-07-D	Oil & Grease	SGT-HEM (TPH)	11/11/2022 14:45	395.08	21.00	3.1	3.1	MG/L	1.6
Downstream	26	LCC22-RE-07-D	Oil & Grease	SGT-HEM (TPH)	11/12/2022 9:00	394.89	13.32	1.7	1.7	MG/L	1.6
Downstream	30	RI-08-D	BOD	Biochemical Oxygen Demand	2/16/2023 13:00	394.84	11.52	0	2	MG/L	2
Downstream	30	LCC22-P-08-D	BOD	Biochemical Oxygen Demand	2/17/2023 11:00	395.14	24.01	7.5	7.5	MG/L	2
Downstream	30	LCC22-RE-08-D	BOD	Biochemical Oxygen Demand	2/17/2023 13:20	395.05	19.91	5.7	5.7	MG/L	2
Downstream	30	RI-08-D	E. coli	E. coli	2/16/2023 13:00	394.84	11.52	73	73	MPN/100 ML	10
Downstream	30	LCC22-P-08-D	E. coli	E. coli	2/17/2023 11:00	395.14	24.01	8840	8840	MPN/100 ML	100
Downstream	30	LCC22-RE-08-D	E. coli	E. coli	2/17/2023 13:20	395.05	19.91	4640	4640	MPN/100 ML	100
Downstream	30	RI-08-D	Inorganics	Hardness as calcium carbonate	2/16/2023 13:00	394.84	11.52	120	120	MG/L	15

Station	Event_ID	Sample_Name	Analyte_Group	Chemical_Name	Sample_Date	WSEL_NAV D88feet	FlowCFS	Result (ND=0)	Result (ND=MDL)	Unit	MDL
Downstream	30	LCC22-P-08-D	Inorganics	Hardness as calcium carbonate	2/17/2023 11:00	395.14	24.01	99	99	MG/L	15
Downstream	30	LCC22-RE-08-D	Inorganics	Hardness as calcium carbonate	2/17/2023 13:20	395.05	19.91	95	95	MG/L	15
Downstream	30	RI-08-D	Inorganics	Nitrate Nitrite as N	2/16/2023 13:00	394.84	11.52	3.2	3.2	MG/L	0.08
Downstream	30	LCC22-P-08-D	Inorganics	Nitrate Nitrite as N	2/17/2023 11:00	395.14	24.01	2.3	2.3	MG/L	0.04
Downstream	30	LCC22-RE-08-D	Inorganics	Nitrate Nitrite as N	2/17/2023 13:20	395.05	19.91	1.9	1.9	MG/L	0.04
Downstream	30	RI-08-D	Inorganics	Total Kjeldahl Nitrogen	2/16/2023 13:00	394.84	11.52	0.72	0.72	MG/L	0.5
Downstream	30	LCC22-P-08-D	Inorganics	Total Kjeldahl Nitrogen	2/17/2023 11:00	395.14	24.01	1.5	1.5	MG/L	0.5
Downstream	30	LCC22-RE-08-D	Inorganics	Total Kjeldahl Nitrogen	2/17/2023 13:20	395.05	19.91	1.5	1.5	MG/L	0.5
Downstream	30	RI-08-D	Inorganics	Total Phosphorus as P	2/16/2023 13:00	394.84	11.52	0	0.05	MG/L	0.05
Downstream	30	LCC22-P-08-D	Inorganics	Total Phosphorus as P	2/17/2023 11:00	395.14	24.01	0.36	0.36	MG/L	0.05
Downstream	30	LCC22-RE-08-D	Inorganics	Total Phosphorus as P	2/17/2023 13:20	395.05	19.91	0.2	0.2	MG/L	0.05
Downstream	30	RI-08-D	Inorganics	Total Suspended Solids	2/16/2023 13:00	394.84	11.52	5.8	5.8	MG/L	1
Downstream	30	LCC22-P-08-D	Inorganics	Total Suspended Solids	2/17/2023 11:00	395.14	24.01	96	96	MG/L	4
Downstream	30	LCC22-RE-08-D	Inorganics	Total Suspended Solids	2/17/2023 13:20	395.05	19.91	38	38	MG/L	1.8
Downstream	30	RI-08-D	Metals	Copper	2/16/2023 13:00	394.84	11.52	0.62	0.62	UG/L	0.36
Downstream	30	LCC22-P-08-D	Metals	Copper	2/17/2023 11:00	395.14	24.01	5.4	5.4	UG/L	0.36
Downstream	30	LCC22-RE-08-D	Metals	Copper	2/17/2023 13:20	395.05	19.91	5.5	5.5	UG/L	0.36
Downstream	30	RI-08-D	Metals	Lead	2/16/2023 13:00	394.84	11.52	0.12	0.12	UG/L	0.071
Downstream	30	LCC22-P-08-D	Metals	Lead	2/17/2023 11:00	395.14	24.01	2.1	2.1	UG/L	0.071
Downstream	30	LCC22-RE-08-D	Metals	Lead	2/17/2023 13:20	395.05	19.91	1.5	1.5	UG/L	0.071
Downstream	30	RI-08-D	Metals	Zinc	2/16/2023 13:00	394.84	11.52	0	4	UG/L	4
Downstream	30	LCC22-P-08-D	Metals	Zinc	2/17/2023 11:00	395.14	24.01	9.9	9.9	UG/L	4
Downstream	30	LCC22-RE-08-D	Metals	Zinc	2/17/2023 13:20	395.05	19.91	8.1	8.1	UG/L	4
Downstream	30	RI-08-D	Oil & Grease	SGT-HEM (TPH)	2/16/2023 13:00	394.84	11.52	0	1.6	MG/L	1.6
Downstream	30	LCC22-P-08-D	Oil & Grease	SGT-HEM (TPH)	2/17/2023 11:00	395.14	24.01	0	1.6	MG/L	1.6
Downstream	30	LCC22-RE-08-D	Oil & Grease	SGT-HEM (TPH)	2/17/2023 13:20	395.05	19.91	0	1.5	MG/L	1.5
Downstream	32	LCC22-RI-09-D	BOD	Biochemical Oxygen Demand	3/10/2023 11:30	394.66	6.57	3.8	3.8	MG/L	1.5
Downstream	32	LCC22-P-09-D	BOD	Biochemical Oxygen Demand	3/10/2023 12:50	394.67	6.73	8.9	8.9	MG/L	1.5
Downstream	32	LCC22-RE-09-D	BOD	Biochemical Oxygen Demand	3/10/2023 14:40	394.67	6.67	10	10	MG/L	1.5
Downstream	32	LCC22-RI-09-D	E. coli	E. coli	3/10/2023 11:30	394.66	6.57	422	422	MPN/100 ML	10
Downstream	32	LCC22-P-09-D	E. coli	E. coli	3/10/2023 12:50	394.67	6.73	231	231	MPN/100 ML	1
Downstream	32	LCC22-RE-09-D	E. coli	E. coli	3/10/2023 14:40	394.67	6.67	310	310	MPN/100 ML	100
Downstream	32	LCC22-RI-09-D	Inorganics	Hardness as calcium carbonate	3/10/2023 11:30	394.66	6.57	130	130	MG/L	15
Downstream	32	LCC22-P-09-D	Inorganics	Hardness as calcium carbonate	3/10/2023 12:50	394.67	6.73	82	82	MG/L	15

Station	Event_ID	Sample_Name	Analyte_Group	Chemical_Name	Sample_Date	WSEL_NAVD88feet	FlowCFS	Result (ND=0)	Result (ND=MDL)	Unit	MDL
Downstream	32	LCC22-RE-09-D	Inorganics	Hardness as calcium carbonate	3/10/2023 14:40	394.67	6.67	110	110	MG/L	15
Downstream	32	LCC22-RI-09-D	Inorganics	Nitrate Nitrite as N	3/10/2023 11:30	394.66	6.57	4.4	4.4	MG/L	0.08
Downstream	32	LCC22-P-09-D	Inorganics	Nitrate Nitrite as N	3/10/2023 12:50	394.67	6.73	4.3	4.3	MG/L	0.08
Downstream	32	LCC22-RE-09-D	Inorganics	Nitrate Nitrite as N	3/10/2023 14:40	394.67	6.67	4.1	4.1	MG/L	0.08
Downstream	32	LCC22-RI-09-D	Inorganics	Total Kjeldahl Nitrogen	3/10/2023 11:30	394.66	6.57	0.66	0.66	MG/L	0.5
Downstream	32	LCC22-P-09-D	Inorganics	Total Kjeldahl Nitrogen	3/10/2023 12:50	394.67	6.73	0.77	0.77	MG/L	0.5
Downstream	32	LCC22-RE-09-D	Inorganics	Total Kjeldahl Nitrogen	3/10/2023 14:40	394.67	6.67	1.1	1.1	MG/L	0.5
Downstream	32	LCC22-RI-09-D	Inorganics	Total Phosphorus as P	3/10/2023 11:30	394.66	6.57	0.08	0.08	MG/L	0.05
Downstream	32	LCC22-P-09-D	Inorganics	Total Phosphorus as P	3/10/2023 12:50	394.67	6.73	0.072	0.072	MG/L	0.05
Downstream	32	LCC22-RE-09-D	Inorganics	Total Phosphorus as P	3/10/2023 14:40	394.67	6.67	0.093	0.093	MG/L	0.05
Downstream	32	LCC22-RI-09-D	Inorganics	Total Suspended Solids	3/10/2023 11:30	394.66	6.57	9.3	9.3	MG/L	1
Downstream	32	LCC22-P-09-D	Inorganics	Total Suspended Solids	3/10/2023 12:50	394.67	6.73	1.6	1.6	MG/L	1
Downstream	32	LCC22-RE-09-D	Inorganics	Total Suspended Solids	3/10/2023 14:40	394.67	6.67	2.1	2.1	MG/L	1
Downstream	32	LCC22-RI-09-D	Metals	Copper	3/10/2023 11:30	394.66	6.57	0.59	0.59	UG/L	0.36
Downstream	32	LCC22-P-09-D	Metals	Copper	3/10/2023 12:50	394.67	6.73	1	1	UG/L	0.36
Downstream	32	LCC22-RE-09-D	Metals	Copper	3/10/2023 14:40	394.67	6.67	0.61	0.61	UG/L	0.36
Downstream	32	LCC22-RI-09-D	Metals	Lead	3/10/2023 11:30	394.66	6.57	0	0.071	UG/L	0.071
Downstream	32	LCC22-P-09-D	Metals	Lead	3/10/2023 12:50	394.67	6.73	0	0.071	UG/L	0.071
Downstream	32	LCC22-RE-09-D	Metals	Lead	3/10/2023 14:40	394.67	6.67	0	0.071	UG/L	0.071
Downstream	32	LCC22-RI-09-D	Metals	Zinc	3/10/2023 11:30	394.66	6.57	0	4	UG/L	4
Downstream	32	LCC22-P-09-D	Metals	Zinc	3/10/2023 12:50	394.67	6.73	0	4	UG/L	4
Downstream	32	LCC22-RE-09-D	Metals	Zinc	3/10/2023 14:40	394.67	6.67	0	4	UG/L	4
Downstream	32	LCC22-RI-09-D	Oil & Grease	SGT-HEM (TPH)	3/10/2023 11:30	394.66	6.57	0	1.5	MG/L	1.5
Downstream	32	LCC22-P-09-D	Oil & Grease	SGT-HEM (TPH)	3/10/2023 12:50	394.67	6.73	0	1.5	MG/L	1.5
Downstream	32	LCC22-RE-09-D	Oil & Grease	SGT-HEM (TPH)	3/10/2023 14:40	394.67	6.67	0	1.6	MG/L	1.6
Downstream	34	LCC23-RI-10-D	BOD	Biochemical Oxygen Demand	3/24/2023 9:30	394.75	8.92	5.9	5.9	MG/L	2
Downstream	34	LCC23-P-10-D	BOD	Biochemical Oxygen Demand	3/25/2023 9:00	394.76	9.19	3.7	3.7	MG/L	2
Downstream	34	LCC23-RE-10-D	BOD	Biochemical Oxygen Demand	3/25/2023 9:45	394.84	11.63	3.4	3.4	MG/L	2
Downstream	34	LCC23-RI-10-D	E. coli	E. coli	3/24/2023 9:30	394.75	8.92	5664	5664	MPN/100 ML	10
Downstream	34	LCC23-P-10-D	E. coli	E. coli	3/25/2023 9:00	394.76	9.19	4352	4352	MPN/100 ML	10
Downstream	34	LCC23-RE-10-D	E. coli	E. coli	3/25/2023 9:45	394.84	11.63	2909	2909	MPN/100 ML	10
Downstream	34	LCC23-RI-10-D	Inorganics	Hardness as calcium carbonate	3/24/2023 9:30	394.75	8.92	110	110	MG/L	6
Downstream	34	LCC23-P-10-D	Inorganics	Hardness as calcium carbonate	3/25/2023 9:00	394.76	9.19	110	110	MG/L	6
Downstream	34	LCC23-RE-10-D	Inorganics	Hardness as calcium carbonate	3/25/2023 9:45	394.84	11.63	110	110	MG/L	15

Station	Event_ID	Sample_Name	Analyte_Group	Chemical_Name	Sample_Date	WSEL_NAVD88feet	FlowCFS	Result (ND=0)	Result (ND=MDL)	Unit	MDL
Downstream	34	LCC23-RI-10-D	Inorganics	Nitrate Nitrite as N	3/24/2023 9:30	394.75	8.92	2.5	2.5	MG/L	0.08
Downstream	34	LCC23-P-10-D	Inorganics	Nitrate Nitrite as N	3/25/2023 9:00	394.76	9.19	2.2	2.2	MG/L	0.04
Downstream	34	LCC23-RE-10-D	Inorganics	Nitrate Nitrite as N	3/25/2023 9:45	394.84	11.63	3.7	3.7	MG/L	0.08
Downstream	34	LCC23-RI-10-D	Inorganics	Total Kjeldahl Nitrogen	3/24/2023 9:30	394.75	8.92	1.3	1.3	MG/L	0.5
Downstream	34	LCC23-P-10-D	Inorganics	Total Kjeldahl Nitrogen	3/25/2023 9:00	394.76	9.19	2	2	MG/L	0.5
Downstream	34	LCC23-RE-10-D	Inorganics	Total Kjeldahl Nitrogen	3/25/2023 9:45	394.84	11.63	1.6	1.6	MG/L	0.5
Downstream	34	LCC23-RI-10-D	Inorganics	Total Phosphorus as P	3/24/2023 9:30	394.75	8.92	0.21	0.21	MG/L	0.05
Downstream	34	LCC23-P-10-D	Inorganics	Total Phosphorus as P	3/25/2023 9:00	394.76	9.19	0.14	0.14	MG/L	0.05
Downstream	34	LCC23-RE-10-D	Inorganics	Total Phosphorus as P	3/25/2023 9:45	394.84	11.63	0.11	0.11	MG/L	0.05
Downstream	34	LCC23-RI-10-D	Inorganics	Total Suspended Solids	3/24/2023 9:30	394.75	8.92	8	8	MG/L	1.4
Downstream	34	LCC23-P-10-D	Inorganics	Total Suspended Solids	3/25/2023 9:00	394.76	9.19	11	11	MG/L	1
Downstream	34	LCC23-RE-10-D	Inorganics	Total Suspended Solids	3/25/2023 9:45	394.84	11.63	7.7	7.7	MG/L	1.4
Downstream	34	LCC23-RI-10-D	Metals	Copper	3/24/2023 9:30	394.75	8.92	2.7	2.7	UG/L	0.36
Downstream	34	LCC23-P-10-D	Metals	Copper	3/25/2023 9:00	394.76	9.19	2.4	2.4	UG/L	0.36
Downstream	34	LCC23-RE-10-D	Metals	Copper	3/25/2023 9:45	394.84	11.63	2.3	2.3	UG/L	0.36
Downstream	34	LCC23-RI-10-D	Metals	Lead	3/24/2023 9:30	394.75	8.92	0.51	0.51	UG/L	0.071
Downstream	34	LCC23-P-10-D	Metals	Lead	3/25/2023 9:00	394.76	9.19	0.37	0.37	UG/L	0.071
Downstream	34	LCC23-RE-10-D	Metals	Lead	3/25/2023 9:45	394.84	11.63	0.36	0.36	UG/L	0.071
Downstream	34	LCC23-RI-10-D	Metals	Zinc	3/24/2023 9:30	394.75	8.92	4.6	4.6	UG/L	4
Downstream	34	LCC23-P-10-D	Metals	Zinc	3/25/2023 9:00	394.76	9.19	0	4	UG/L	4
Downstream	34	LCC23-RE-10-D	Metals	Zinc	3/25/2023 9:45	394.84	11.63	0	4	UG/L	4
Downstream	34	LCC23-RI-10-D	Oil & Grease	SGT-HEM (TPH)	3/24/2023 9:30	394.75	8.92	0	1.5	MG/L	1.5
Downstream	34	LCC23-P-10-D	Oil & Grease	SGT-HEM (TPH)	3/25/2023 9:00	394.76	9.19	0	1.6	MG/L	1.6
Downstream	34	LCC23-RE-10-D	Oil & Grease	SGT-HEM (TPH)	3/25/2023 9:45	394.84	11.63	0	1.6	MG/L	1.6
Downstream	36	LCC23-RI-11-D	BOD	Biochemical Oxygen Demand	4/28/2023 9:30	394.69	7.13	0	2	MG/L	2
Downstream	36	LCC23-P-11-D	BOD	Biochemical Oxygen Demand	4/28/2023 15:40	394.83	11.41	10	10	MG/L	2
Downstream	36	LCC23-RE-11-D	BOD	Biochemical Oxygen Demand	4/29/2023 7:50	394.78	9.71	3.5	3.5	MG/L	2
Downstream	36	LCC23-RI-11-D	E. coli	E. coli	4/28/2023 9:30	394.69	7.13	983	983	MPN/100 ML	10
Downstream	36	LCC23-P-11-D	E. coli	E. coli	4/28/2023 15:40	394.83	11.41	24196	24196	MPN/100 ML	10
Downstream	36	LCC23-RE-11-D	E. coli	E. coli	4/29/2023 7:50	394.78	9.71	24196	24196	MPN/100 ML	10
Downstream	36	LCC23-RI-11-D	Inorganics	Hardness as calcium carbonate	4/28/2023 9:30	394.69	7.13	120	120	MG/L	15
Downstream	36	LCC23-P-11-D	Inorganics	Hardness as calcium carbonate	4/28/2023 15:40	394.83	11.41	110	110	MG/L	15
Downstream	36	LCC23-RE-11-D	Inorganics	Hardness as calcium carbonate	4/29/2023 7:50	394.78	9.71	110	110	MG/L	15
Downstream	36	LCC23-RI-11-D	Inorganics	Nitrate Nitrite as N	4/28/2023 9:30	394.69	7.13	1.1	1.1	MG/L	0.04

Station	Event_ID	Sample_Name	Analyte_Group	Chemical_Name	Sample_Date	WSEL_NAV D88feet	FlowCFS	Result (ND=0)	Result (ND=MDL)	Unit	MDL
Downstream	36	LCC23-P-11-D	Inorganics	Nitrate Nitrite as N	4/28/2023 15:40	394.83	11.41	1.4	1.4	MG/L	0.04
Downstream	36	LCC23-RE-11-D	Inorganics	Nitrate Nitrite as N	4/29/2023 7:50	394.78	9.71	1.9	1.9	MG/L	0.04
Downstream	36	LCC23-RI-11-D	Inorganics	Total Kjeldahl Nitrogen	4/28/2023 9:30	394.69	7.13	0.9	0.9	MG/L	0.5
Downstream	36	LCC23-P-11-D	Inorganics	Total Kjeldahl Nitrogen	4/28/2023 15:40	394.83	11.41	1.5	1.5	MG/L	0.5
Downstream	36	LCC23-RE-11-D	Inorganics	Total Kjeldahl Nitrogen	4/29/2023 7:50	394.78	9.71	1.8	1.8	MG/L	0.5
Downstream	36	LCC23-RI-11-D	Inorganics	Total Phosphorus as P	4/28/2023 9:30	394.69	7.13	0.064	0.064	MG/L	0.05
Downstream	36	LCC23-P-11-D	Inorganics	Total Phosphorus as P	4/28/2023 15:40	394.83	11.41	0.34	0.34	MG/L	0.05
Downstream	36	LCC23-RE-11-D	Inorganics	Total Phosphorus as P	4/29/2023 7:50	394.78	9.71	0.13	0.13	MG/L	0.05
Downstream	36	LCC23-RI-11-D	Inorganics	Total Suspended Solids	4/28/2023 9:30	394.69	7.13	6.3	6.3	MG/L	1.3
Downstream	36	LCC23-P-11-D	Inorganics	Total Suspended Solids	4/28/2023 15:40	394.83	11.41	28	28	MG/L	1
Downstream	36	LCC23-RE-11-D	Inorganics	Total Suspended Solids	4/29/2023 7:50	394.78	9.71	10	10	MG/L	1
Downstream	36	LCC23-RI-11-D	Metals	Copper	4/28/2023 9:30	394.69	7.13	0.77	0.77	UG/L	0.36
Downstream	36	LCC23-P-11-D	Metals	Copper	4/28/2023 15:40	394.83	11.41	3.7	3.7	UG/L	0.36
Downstream	36	LCC23-RE-11-D	Metals	Copper	4/29/2023 7:50	394.78	9.71	3.8	3.8	UG/L	0.36
Downstream	36	LCC23-RI-11-D	Metals	Lead	4/28/2023 9:30	394.69	7.13	0.11	0.11	UG/L	0.071
Downstream	36	LCC23-P-11-D	Metals	Lead	4/28/2023 15:40	394.83	11.41	1	1	UG/L	0.071
Downstream	36	LCC23-RE-11-D	Metals	Lead	4/29/2023 7:50	394.78	9.71	0.29	0.29	UG/L	0.071
Downstream	36	LCC23-RI-11-D	Metals	Zinc	4/28/2023 9:30	394.69	7.13	0	4	UG/L	4
Downstream	36	LCC23-P-11-D	Metals	Zinc	4/28/2023 15:40	394.83	11.41	7.3	7.3	UG/L	4
Downstream	36	LCC23-RE-11-D	Metals	Zinc	4/29/2023 7:50	394.78	9.71	0	4	UG/L	4
Downstream	36	LCC23-RI-11-D	Oil & Grease	SGT-HEM (TPH)	4/28/2023 9:30	394.69	7.13	0	1.5	MG/L	1.5
Downstream	36	LCC23-P-11-D	Oil & Grease	SGT-HEM (TPH)	4/28/2023 15:40	394.83	11.41	2.4	2.4	MG/L	1.6
Downstream	36	LCC23-RE-11-D	Oil & Grease	SGT-HEM (TPH)	4/29/2023 7:50	394.78	9.71	0	1.6	MG/L	1.6
Downstream	38	LCC23-RI-D-12	BOD	Biochemical Oxygen Demand	6/12/2023 13:15	394.57	4.50	0	2	MG/L	2
Downstream	38	LCC23-P-D-12	BOD	Biochemical Oxygen Demand	6/12/2023 16:15	394.61	5.22	0	2	MG/L	2
Downstream	38	LCC23-RE-D-12	BOD	Biochemical Oxygen Demand	6/12/2023 16:50	394.61	5.36	0	2	MG/L	2
Downstream	38	LCC23-RI-D-12	E. coli	E. coli	6/12/2023 13:15	394.57	4.50	1246	1246	MPN/100 ML	10
Downstream	38	LCC23-P-D-12	E. coli	E. coli	6/12/2023 16:15	394.61	5.22	11199	11199	MPN/100 ML	10
Downstream	38	LCC23-RE-D-12	E. coli	E. coli	6/12/2023 16:50	394.61	5.36	11199	11199	MPN/100 ML	10
Downstream	38	LCC23-RI-D-12	Inorganics	Hardness as calcium carbonate	6/12/2023 13:15	394.57	4.50	110	110	MG/L	15
Downstream	38	LCC23-P-D-12	Inorganics	Hardness as calcium carbonate	6/12/2023 16:15	394.61	5.22	110	110	MG/L	15
Downstream	38	LCC23-RE-D-12	Inorganics	Hardness as calcium carbonate	6/12/2023 16:50	394.61	5.36	140	140	MG/L	15
Downstream	38	LCC23-RI-D-12	Inorganics	Nitrate Nitrite as N	6/12/2023 13:15	394.57	4.50	0.43	0.43	MG/L	0.04
Downstream	38	LCC23-P-D-12	Inorganics	Nitrate Nitrite as N	6/12/2023 16:15	394.61	5.22	1.4	1.4	MG/L	0.04

Station	Event_ID	Sample_Name	Analyte_Group	Chemical_Name	Sample_Date	WSEL_NAVD88feet	FlowCFS	Result (ND=0)	Result (ND=MDL)	Unit	MDL
Downstream	38	LCC23-RE-D-12	Inorganics	Nitrate Nitrite as N	6/12/2023 16:50	394.61	5.36	1.1	1.1	MG/L	0.04
Downstream	38	LCC23-RI-D-12	Inorganics	Total Kjeldahl Nitrogen	6/12/2023 13:15	394.57	4.50	0.61	0.61	MG/L	0.5
Downstream	38	LCC23-P-D-12	Inorganics	Total Kjeldahl Nitrogen	6/12/2023 16:15	394.61	5.22	0.86	0.86	MG/L	0.5
Downstream	38	LCC23-RE-D-12	Inorganics	Total Kjeldahl Nitrogen	6/12/2023 16:50	394.61	5.36	0.75	0.75	MG/L	0.5
Downstream	38	LCC23-RI-D-12	Inorganics	Total Phosphorus as P	6/12/2023 13:15	394.57	4.50	0.11	0.11	MG/L	0.05
Downstream	38	LCC23-P-D-12	Inorganics	Total Phosphorus as P	6/12/2023 16:15	394.61	5.22	0.11	0.11	MG/L	0.05
Downstream	38	LCC23-RE-D-12	Inorganics	Total Phosphorus as P	6/12/2023 16:50	394.61	5.36	0.16	0.16	MG/L	0.05
Downstream	38	LCC23-RI-D-12	Inorganics	Total Suspended Solids	6/12/2023 13:15	394.57	4.50	55	55	MG/L	2
Downstream	38	LCC23-P-D-12	Inorganics	Total Suspended Solids	6/12/2023 16:15	394.61	5.22	7.5	7.5	MG/L	1
Downstream	38	LCC23-RE-D-12	Inorganics	Total Suspended Solids	6/12/2023 16:50	394.61	5.36	5.5	5.5	MG/L	1
Downstream	38	LCC23-RI-D-12	Metals	Copper	6/12/2023 13:15	394.57	4.50	0.87	0.87	UG/L	0.36
Downstream	38	LCC23-P-D-12	Metals	Copper	6/12/2023 16:15	394.61	5.22	1.2	1.2	UG/L	0.36
Downstream	38	LCC23-RE-D-12	Metals	Copper	6/12/2023 16:50	394.61	5.36	1.5	1.5	UG/L	0.36
Downstream	38	LCC23-RI-D-12	Metals	Lead	6/12/2023 13:15	394.57	4.50	0.2	0.2	UG/L	0.071
Downstream	38	LCC23-P-D-12	Metals	Lead	6/12/2023 16:15	394.61	5.22	0.15	0.15	UG/L	0.071
Downstream	38	LCC23-RE-D-12	Metals	Lead	6/12/2023 16:50	394.61	5.36	0.57	0.57	UG/L	0.071
Downstream	38	LCC23-RI-D-12	Metals	Zinc	6/12/2023 13:15	394.57	4.50	0	4	UG/L	4
Downstream	38	LCC23-P-D-12	Metals	Zinc	6/12/2023 16:15	394.61	5.22	0	4	UG/L	4
Downstream	38	LCC23-RE-D-12	Metals	Zinc	6/12/2023 16:50	394.61	5.36	0	4	UG/L	4
Downstream	38	LCC23-RI-D-12	Oil & Grease	SGT-HEM (TPH)	6/12/2023 13:15	394.57	4.50	0	1.5	MG/L	1.5
Downstream	38	LCC23-P-D-12	Oil & Grease	SGT-HEM (TPH)	6/12/2023 16:15	394.61	5.22	0	1.6	MG/L	1.6
Downstream	38	LCC23-RE-D-12	Oil & Grease	SGT-HEM (TPH)	6/12/2023 16:50	394.61	5.36	1.9	1.9	MG/L	1.7

APPENDIX G: STREAM RESTORATION ANALYSIS SUMMARY REPORT

Prepared for

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State Highway Administration
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Prepared by

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September 2023

CONTENTS

TABLES

ATTACHMENTS

INTRODUCTION

The Maryland State Highway Administration (SHA) has implemented fifty-three (53) stream restoration projects to support compliance with its National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) discharge permit number 11-DP-3313 MD0068276 that was administratively continued by the Maryland Department of the Environment (MDE) following the October 8, 2020 expiration date. The stream restoration projects applied stream restoration Protocol 1: Credit for Prevented Sediment During Stormflow and Protocol 5: Credit for Outfall and Gully Stabilization Practices approved by the Chesapeake Bay Program and referenced in the following approved guidance documents titled *Recommendation of the Expert Panel to Define Removal Rates for Individual Stream Restoration Projects* (Schueler and Stack, 2014) and A *Unified Guide for Crediting Stream and Floodplain Restoration Projects in the Chesapeake Bay Watershed* (Wood et al., 2021).

The calculated Equivalent Impervious Acre (EIA) and Total Maximum Daily Load (TMDL) pollutant load reductions generated by these projects were revised during FY2023 based on the implementation period and consistency with the CAST 6 model. For stream restoration projects implemented prior to the October 8, 2020 SHA MS4 permit expiration date, SHA followed MDE's older MS4 guidance referenced in *Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated* (MDE, 2014) for use of the stream protocols to compute project-specific equivalent impervious acre (EIA) credits accountable for compliance the 2015-2020 SHA MS4 permit term restoration goal/conditions. Pollutant load reductions generated by these projects were also updated by applying the current 2021 MDE guidance *Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated* (MDE, 2021) for calculating project-specific pollutant load reductions which aligned them with the current CAST 6 model. For all stream restoration projects implemented after October 8, 2020, SHA followed the 2021 MDE guidance (MDE, 2021) for computing both EIA credits and TMDL pollutant load reductions.

2014 MDE ACCOUNTING GUIDANCE UPDATES

During FY2023, SHA updated its computations for EIA credits generated by projects constructed prior to October 8, 2020 by applying the 2014 version of the MDE accounting guidance for thirty-three (33) eligible stream and outfall stabilization projects following stream Protocol 1 or Protocol 5 methodologies. The updates to the EIA credits are a result of guidance received from MDE on February 17, 2023 following their review of SHA calculations submitted for assessment during FY2023 (see **Attachment A**). The revised EIA crediting calculations follow the 2014 MDE accounting guidance by applying the physiographic province Sediment Delivery Factor and the approved 56% efficiency factor to each project. The conversion of pollutant load reductions to an EIA applied the pollutant load deltas shown in **Table 1**.

TABLE 1. POLLUTANT LOADS FOR IMPERVIOUS LAND COVER AND FOREST COVER FOR CALCULATING EIA CREDIT (MDE, 2014)

Parameter	*Impervious (lbs/acre/yr)*	*Forest (lbs/acre/yr)*	*Delta . (lbs/acre/yr)*
TN	10.85	3.16	7.69
TP	2.04	0.13	1.91
TSS (tons)	0.46	0.03	0.43

Source: CBWM version 5.3.0. Maryland statewide average urban loading rates without BMP's provided by the Science Services Administration. MDE, 2011.

The revised EIA credits we computed using a modified version of MDE's Stream Restoration Credit Calculator (May 2022 version) that applied the 2014 MDE accounting guidance as shown in **Attachment B**. The revised EIA credits from SHA stream restoration and outfall stabilization projects constructed by the expiration of its current MS4 permit on October 8, 2020 are summarized in **Table 2** and the associated computation files are referenced as **Attachment C** and provided as independent electronic files submitted in tandem with the SHA FY2023 MS4 annual report. The Attachment C files/computations should only be referenced for the EIA credits claimed by SHA and should not be referenced for the TMDL pollutant load reductions generated by those projects.

TABLE 2. PROJECTS APPLYING 2014 MDE ACCOUNTING GUIDANCE

BMP Type	*Number of Projects*	*Total EIA*
Stream Restoration and Outfall Stabilization	33	4,469

TMDL pollutant load reductions generated by the 33 stream restoration and outfall stabilization projects constructed prior by the MS4 permit term expiration on October 8, 2020 were recalculated in accordance with MDE's February 17, 2023 guidance by applying the 2021 MDE accounting guidance to align with the current CAST 6 model. SHA used the (unmodified) May 2022 version of MDE's Stream Restoration Credit Calculator for the TMDL pollutant load reduction recalculations. The associated computation files are referenced as **Attachment D** and are provided as independent electronic files submitted in tandem with the SHA FY2023 MS4 annual report. The Attachment D files/computations should only be reference for the TMDL pollutant load reductions claimed by SHA and should not be reference for the EIA credits generated by these projects (EIA credit computations are provided in Attachment C).

2021 MDE ACCOUNTING GUIDANCE UPDATES

Twenty (20) projects implemented after the expiration of the current SHA MS4 permit term expiration on October 8, 2020 applied the 2021 MDE guidance (MDE, 2021) for eligible projects following stream Protocol 1 or Protocol 5 methodologies referenced in *A Unified Guide for Crediting Stream and Floodplain Restoration Projects in the Chesapeake Bay Watershed*. The credit calculations were generated using MDE's Stream Restoration Credit Calculator (unmodified

May 2022 version; see **Attachment E**). The computation files are referenced as **Attachment F** and are provided as independent electronic files submitted in tandem with the SHA FY2023 MS4 annual report. The updated EIA credit values for these 20 projects are included in **Table 3**.

TABLE 3. PROJECTS APPLYING 2021 MDE ACCOUNTING GUIDANCE

BMP Type	*Number of Projects*	*Total EIA*
Stream Restoration and Outfall Stabilization	20	601

The Attachment F files/computations should be referenced for both the EIA credits and TMDL pollutant load reductions claimed by SHA for projects completed after the expiration of the current SHA MS4 permit term on October 8, 2020.

REFERENCES

MDE. 2014. Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated. Guidance for National Pollutant Discharge Elimination System Stormwater Permits. Maryland Department of the Environment, Baltimore, MD.

MDE. 2021. Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated. Guidance for National Pollutant Discharge Elimination System Stormwater Permits. Maryland Department of the Environment, Baltimore, MD.

Schueler, T. and B. Stack. 2014. Recommendations of the Expert Panel to Define Removal Rates for Individual Stream Restoration Projects.

Wood, David, Tom Schueler and Bill Stack. 2021. A Unified Guide for Crediting Stream and Floodplain Restoration Projects in the Chesapeake Bay Watershed.

ATTACHMENT At

MDE correspondence/guidance dated February 17, 2023

Ft m: Sophia G lo1 i1 -MDE- <[redacted]> 1
S n : F liday, F1b lua ly 17, 2023 3:22 PM1
Tt: Ch li1 ltoph1 Zink <[redacted]1
Cc: Jonathan L1iman -MDE- <[redacted] B lian Coop1 -MDE- 1
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Table D.1 Pollutant Loads for Impervious and Forest Cover			
Parameter	Impervious (lbs/acre/yr)	Forest (lbs/acre/yr)	Delta (lbs/acre/yr)
TN	10.85	3.16	7.69
TP	2.04	0.13	1.91
TSS (tons)	0.46	0.03	0.43
Source: CBWM version 5.3.0, Maryland statewide average urban loading rates without BMPs provided by the Science Services Administration, MDE, 2011.			

P1 a1 l1t m1 kno1 if you hav1 any oth1 qu1 tion1 o1 1 i1h to di1cu1 thi1 fu1th1 .1

Thank you,1

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Sophia Grossweiler
Regulatory and Compliance Engineer
Water and Science Administration
Maryland Department of the Environment
1800 Washington Boulevard
Baltimore, Maryland 21230
[redacted]

ATTACHMENT B

2014 Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated

Modified Stream Restoration Credit Calculator (May 2022)

(For revised **EIA** c**redit** associated with BMPs constructed before 10/09/2020)

tream RestorationS 4 Credit CalSulator forSTN,STP,STS , andS IS

Version:c 3c -cMODIFIEDc 17c 3ctocallowcforc 14cTMDLc reditingcguidance forcProtocols 1candc

MarylandcDepartmentcofctheEnvironmentcWatercandcSciences Administration

Abou lcul or

1.xThix alxulatorxestimatesxthe pollutantxloadxreduxtionx andxEquivalentxImperviouxAxre (EIA)x reditxforx treamxrestorationxprojectx.x

2.xThe MinimumxQualifyingxConditionx tax outlinesx onditionx thatxprojectx muxtxmeetxtox e eligixle forx redit.xThix riteriaxix foundxinxthe expertxpanelxapprovedx yxCBP:x

http://xhesapeakestormx ater.net/xmp-resourxes/urxan-xtream-restoration/x

*3.xThe **lookup** tax inxthix preadxheetxdrax Aggregate Imperviouxand Turf loadingxrate informationxfromxaxCASTx2010xNoxAxtionxSxenariox onxixtentx ithxthe 2020xMS4xAx ountingxGuidanxe x doxumentxandxStreamxBedxandxBank loadingxrate informationxfromxaxCASTx2019xProgresx Sxenario.x*

4.xEOSxloadxinxthix preadxheetxix alxulatedxfollox ingxthe protoxolx recommendedx yxthe expertxpanelxapprovedx yxCBP.x

5.xEOTxloadxinxthix preadxheetxix alxulatedxuxingxChesapeake BayxPhaxe 6x aterxhedxmodelxNoxAxtionx(NoxBMP)x enarioxdeliveryxfaxtorx atxthe land-riverx egmentx ale.xDeliveryxfaxtorx have xeenx

6.xEIAx reditxix alxulatedxuxingxForest-Imperviouxloadxdeltax ithxStreamxBedxandxBank (STB)xLoad.xThese deltax ax ountxforxinxonxixtenxiesxinxloadxdixtrixutionx etx eenxthe Phaxe 5xandx6xmodel.x

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Revision ReSord:S

DateS	RevisionS
8 4 1c	1stcVersionc
3c	CorrectedcEOTcloadcformulacerrors incsummaryctab;cCorrectedcformulas incProtocolc1cStepc ;cProtocolc adjustedctoc alculateclbs/yrcandcallowcforcscenariocofcmultiplechyporheic boxes;cProtocolc Stepc4crevisedctocdirectcusers tocthecCBPcModelingcTeamctocassurecthatcthec4c%c apcis notcbeingcexceeded;cProtocolc3cStepc4cformulas corrected;cProtocolc4cRunoffc VolumecTreatedcformulac orrectedcandcremovalcratec urvecformulacaddedc

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ProjectcNamec	Outfallc3c18c4.c 1c	AKAcWhitecMarshc@cMD43cOutfallcStabilization
Countyc	Baltimorec	
Addressc	43c8cNECKERcAVE,cNOTTINGHAM,cMDc 1c36c	
Latc(XX.XXXXXX)c	39.38c94c	
Longc(-XX.XXXXXX)c	-76.48c819c	

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Segment-shedc	GUNOHc	
MDc8digitc	13c8c3c	
MDcLand-RiverSegmentc	Nc4c WUc_367c_c 1c	
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TRS RS TORS TION CRSDIT CS LCULS TORS

Indicatecwhethercyoucwillcbecusingcrevisedcprotocolc alculations outlinedcincthec Consensus Recommendations tocImprovecProtocols c andc3cforcDefiningcStreamcRestorationcPollutantcRemovalcCredit

Using Revised Protocols?	Noc

Protocolc	EOScLoadc(lbs/yr)c			EOTcLoadc(lbs/yr)c			EIAcCreditc(c 14cGuidance)c (lbs/ac yr)***c
	TN	TP	TSS**	TN	TP	TSS*	
1c	-	-	-	-	-	-	-
	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-
	337.87	1c9.c8	87,c39.c8	93.18	63.c7	9,991.41	7c.99
Totalc	337.87c	1c9.c8c	87,c39.c8c	93.18c	63.c7c	9,991.41c	7c.99c

***Note:cFormulas incEIAc reditc olumncwerecmodifiedctocusec Deltas consistentcwithc 14c GuidanceincTablecD.1cbelow.c

**AdditionalcSedimentcDeliverycFactorcforcTSScdeterminedcbycpresencec withincCoastalcPlainc(.c61)cornon-CoastalcPlainc(.181):c
.181

Table D.1 Pollutant Loads for Impervious and Forest Cover

Parameter	Impervious (lbs/acre/yr)	Forest (lbs/acre/yr)	Delta (lbs/acre/yr)
TN	10.85	3.16	7.69
TP	2.04	0.13	1.91
TSS (tons)	0.46	0.03	0.43

Source: CBWM version 5.3.0, Maryland statewide average urban loading rates without BMPs provided by the Science Services Administration, MDE, 2011.

2014S DS ounting GuidanSe RevisionsS

Revised formulas and guidanSe applied toShighlighted redS ells above.S

AdditionalcSedimentcDeliverycFactorcforcTSScdeterminedcbycpresencecwithincCoastalcPlainc(.c61)cornon-Coastalc Plainc(.181):cAppliedctocEOScLoadcTSScvaluec

***cEIAcCreditcappliedc 14cAc ountingcGuidancecDeltas ceferencedcincTablecD.1.c

Applyingc 14cMDEcGuidancecOnlycAc ounts forcSHA's EIAcPortfoliocandcEOScandcEOTcLoads (TMDLcLoads)cDocNotc ApplyctocSHAcTMDLcLoadcReductions c

Protocol 5: Alternative Prevented Sediment for Outfalls

Please populate the blue cells in this sheet with applicable project data.

Step 1

Define the existing channel conditions. Measurements must be collected from the existing headwater channel

Length of Proposed Project Reach	720.00	fto
Representative Bulk Density Sample	90.32	lb/ft3

Measuremento	Cross-Section			Averageo						
	1	2	3							
Channel Slope	/a				ft/ft					
Bank Height	/a				ft					
Bottom Width	3(			3(	ft	5.5	5.5	:	:	8.4
Top Width	/a				ft					

Step 2

Define the equilibrium channel conditions.

***If no pipe outfall or other defining infrastructure is present upstream, choose T "Other" and fill in the cells below:T*

Drainage Area	52.50	cres
Max upstream channel length o	1647.35o	ft

Base Level Control:T		
Type Upstream	Hard point controlo	
Type Downstream	Confluenceo	
Upstream Limit		ft
Downstream Limit	720o	ft
Equilibrium Bed Slope:T		
Project Site Bed Conditions	Beds Coarser than Sando	
Drainage Area	21o	km2
Mean Flow Depth		ft

*If project site bed is coarser than sand, input the following variables to calculate the equilibrium bed slope:o

Ɵc, Shields parametero	47o	
Dc, critical bed parametero	951o	ft
q, channel forming discharge per unit widtho	18.888888889o	ft2/s
, Manning's roughness coefficiento	35o	
Dm, mean grain sizeo	3o	mm
Qd, design dischargeo	119o	ft3/s
D50, median grain sizeo	361o	ft
Equilibrium Bed Slopeo	1:	ft/ft
Equilibrium Bank Slope:T		
Equilibrium Bank Slope	1.76	*Use conservative estimate of bank slope in expert panel or justify another measurement. T*

Future Bottom Width:T								
Cross-Sectiono			Average Bottom Widtho					
1	2	3						
3(			30o	5.5	5.5	:	:	8.4

Step 3

Calculate total volume of prevented sediment erosion. ***This step is completed using 3D surface modeling programs.T*

Total Prevented Sediment	285878.70o	ft3

Step 4

Convert total sediment volume to annual prevented sediment load.

Project Efficiencyo	56o	%, ***Justify enhanced efficiency with monitoring data or assume 50%*** (SHA Appliedo Approved 56% Efficiency)o
Annual Volume of Prevented Sedimento	5336.40o	ft3
Annual Prevented Sediment Loado	240.99o	tons

Step 5

Determine annual prevented nutrient loads.

Nutriento	lbs/ton sedimento	Load Reduction, lbs/yro
Nitrogeno	1.402o	337.87o
Phosphoruso	5356o	129.08o

Because of the high variability, samples from the project reach should be T ollected and analyzed for TN and TP concentrations.T

ATTACHMENT C

Pre October 8, 2020 EIA Crediting Computations

See electronic file: "FY23AR_AppendixG_Attachment_C_Pre10092020_4EIA_Only.zip"

ATTACHMENT D

Pre October 8, 2020 TMDL Load Reduction Crediting Computations

See electronic file: "FY23AR_AppendixG_Attachment_D_Pre10092020_4LoadRedux_Only.zip"

ATTACHMENT E

2021 Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated
Stream Restoration Credit Calculator (May 2022)

(For revised **TMDL pollutant load reductions** associated with **all SHA BMPs** and revised **EIA credit** associated with BMPs built after 10/08/2020)

Stream Restoration MS4 Credit Calculator for TN, TP, TSS, and EIA
Version: 05/23/2022
Maryland Department of the Environment - Water and Sciences Administration

About the Calculator

1. This calculator estimates the pollutant load reductions and Equivalent Impervious Acre (EIA) credit for stream restoration projects.

2. The Minimum Qualifying Conditions tab outlines conditions that projects must meet to be eligible for credit. This criteria is found in the expert panel approved by CBP: http://chesapeakestormwater.net/bmp-resources/urban-stream-restoration/

*3. The **lookup** tab in this spreadsheet draws Aggregate Impervious and Turf loading rate information from a CAST 2010 No Action Scenario consistent with the 2020 MS4 Accounting Guidance document and Stream Bed and Bank loading rate information from a CAST 2019 Progress Scenario.*

4. EOS load in this spreadsheet is calculated following the protocols recommended by the expert panel approved by CBP.

5. EOT load in this spreadsheet is calculated using Chesapeake Bay Phase 6 watershed model No Action (No BMP) scenario delivery factors at the land-river segment scale. Delivery factors have been capped at 1.

6. EIA credit is calculated using Forest-Impervious load deltas with Stream Bed and Bank (STB) Load. These deltas account for inconsistencies in load distribution between the Phase 5 and 6 model.

7. Please populate the blue cells in this worksheet with applicable project data. The calculator will subsequently generate the TN, TP, and TSS load reduction and EIA credit for the project. Once finished, email this spreadsheet along with supporting documentation for Protocols 3 and 5 and to justify changing any default values to <<insert contact info>>.

Revision Record:

Date	Revision
08/04/21	1st Version
05/23/22	Corrected EOT load formula errors in summary tab; Corrected formulas in Protocol 1 Step 2; Protocol 2 adjusted to calculate lbs/yr and allow for scenario of multiple hyporheic boxes; Protocol 2 Step 4 revised to direct users to the CBP Modeling Team to assure that the 40% cap is not being exceeded; Protocol 3 Step 4 formulas corrected; Protocol 4 Runoff Volume Treated formula corrected and removal rate curve formula added

BASIC PROJECT INFORMATION

Populate blue cells with basic project information

Project Name	Israel Creek at Stauffer Road Stream Restoration Project
County	Frederick
Address	9203 STAUFFER RD, WALKERSVILLE, MD 21793
Lat (XX.XXXXXX)	39.461128
Long (-XX.XXXXXX)	-77.351536

WATERSHED INFORMATION

Populate blue cells below with information regarding Chesapeake Bay model geography. To determine the applicable geography, locate your project on MDE's interactive webmap at <<mde.state.md.us>>. Locate your project site and identify the segment-shed, MD 8 digit watershed, and land-river segment it is located in.

Segment-shed	POTTF_MD
MD 8digit	02140302
MD Land-River Segment	N24021PM4_3341_4040

STREAM RESTORATION CREDIT CALCULATOR

Indicate whether you will be using revised protocol calculations outlined in the 2020 Consensus Recommendations to Improve Protocols 2 and 3 for Defining Stream Restoration Pollutant Removal Credits.

Using Revised Protocols?	No

Protocol	EOS Load (lbs/yr)			EOT Load (lbs/yr)			EIA Credit
	TN	TP	TSS	TN	TP	TSS	(lbs/ac/yr)
1	592.33	200.79	353,456.05	452.24	137.27	173,345.78	55.58
2	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-
Total	592.33	200.79	353,456.05	452.24	137.27	173,345.78	55.58

2021 MDE Accounting Guidance

Applying 2021 MDE Guidance Applies to SHA TMDL and EIA Credit For Projects Completed Post October 8, 2020.

Protocol 5: Alternative Prevented Sediment for Outfalls

Please populate the blue cells in this sheet with applicable project data.

Step 1

Define the existing channel conditions. Measurements must be collected from the existing headwater channel

Length of Proposed Project Reach	720.00	ft
Representative Bulk Density Sample	90.32	lb/ft3

Measurement	Cross-Section			Average								
	1	2	3									
Channel Slope	n/a			0.00	ft/ft							
Bank Height	n/a			0.00	ft							
Bottom Width	6.30			6.30	ft	5.5	5.5	6.1	6.3	6	8.4
Top Width	n/a			0.00	ft							

Step 2

Define the equilibrium channel conditions.

***If no pipe outfall or other defining infrastructure is present upstream, choose "Other" and fill in the cells below:*

Drainage Area	52.50	acres
Max upstream channel length	1647.35	ft

Base Level Control:		
Type Upstream	Hard point control	
Type Downstream	Confluence	
Upstream Limit	0	ft
Downstream Limit	720	ft
Equilibrium Bed Slope:		
Project Site Bed Conditions	Beds Coarser than Sand	
Drainage Area	0.21	km2
Mean Flow Depth		ft

*If project site bed is coarser than sand, input the following variables to calculate the equilibrium bed slope:

Ɵc, Shields parameter	0.047	
Dc, critical bed parameter	0.0951	ft
q, channel forming discharge per unit width	18.88888889	ft2/s
n, Manning's roughness coefficient	0.035	
Dm, mean grain size	3	mm
Qd, design discharge	119	ft3/s
D50, median grain size	0.0361	ft
Equilibrium Bed Slope	0.0012	ft/ft
Equilibrium Bank Slope:		
Equilibrium Bank Slope	1.76	*Use conservative estimate of bank slope in expert panel or justify another measurement.*

Future Bottom Width:										
Cross-Section			Average Bottom Width							
1	2	3								
6.30			6.30	5.5	5.5	6.1	6.3	6	8.4

Step 3

Calculate total volume of prevented sediment erosion. ***This step is completed using 3D surface modeling programs.*

Total Prevented Sediment	285878.70	ft3

Step 4

Convert total sediment volume to annual prevented sediment load.

Project Efficiency	56	%, ***Justify enhanced efficiency with monitoring data or assume 50%*** (SHA Applied Approved 56% Efficiency)
Annual Volume of Prevented Sediment	5336.40	ft3
Annual Prevented Sediment Load	240.99	tons

Step 5

Determine annual prevented nutrient loads.

Nutrient	lbs/ton sediment	Load Reduction, lbs/yr
Nitrogen	1.402	337.87
Phosphorus	0.5356	129.08

Because of the high variability, samples from the project reach should be collected and analyzed for TN and TP concentrations.

ATTACHMENT F

Post October 8, 2020 EIA and TMDL Loads Reduction Crediting Computations

See electronic file: "FY23AR_AppendixG_Attachment_F_Post10082020.zip"