Corrective Action Plan and Engineering Report

May 11, 2022

Norris Water Commission
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CANNON & CANNON INC
CONSULTING ENGINEERS · FIELD SURVEYORS

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ACRONYMS AND ABBREVIATIONS

Acronyms/Abbreviations	Definitions
303d	TDEC's Final 2022 List of Impaired and Threatened Waters
BOD	Biological Oxygen Demand
BWF	Base Wastewater Flow
CAP	Corrective Action Plan
CBOD	Carbonaceous Biochemical Oxygen Demand
CCTV	Closed-Circuit Television
CIPP	Cured In Place Pipe
DIP	Ductile Iron Pipe
DMR	Discharge Monitoring Report
DO	Dissolved Oxygen
FM	Flow Monitor/Flow Meter
GIS	Geographic Information System
GPM	Gallons per Minute
GPS	Global Positioning System
GWI	Groundwater Infiltration
I&I	Inflow and Infiltration
LBS	Pounds
LBS./DAY	Pounds/Day
MG	Million Gallons
MGD	Million Gallons per Day
MG/L	Milligram per Liter
MH	Manhole
ML	Milliliter
MLSS	Mixed Liquor Suspended Solids
MOR	Monthly Operating Report
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NWC	Norris Water Commission
PVC	Polyvinyl Chloride
P.F.	Peaking Factor
RAS	Return Activated Sludge
RDII	Rainfall Derived Inflow & Infiltration

ACRONYMS AND ABBREVIATIONS (CONT'D)

Acronyms/Abbreviations	Definitions
SC FM	Standard Cubic Foot per Minute
SLR	Solids Loading Rate
SOR	Surface Overflow Rate
SRT	Solids Retention Time
SSES	Sanitary Sewer Evaluation Survey
SSO	Sanitary Sewer Overflow
STP	Sewage Treatment Plant
SQFT	Square Foot
S&L	Smith and Loveless
TDEC	Tennessee Department of Environment & Conservation
TDH	Total Dynamic Head
TDS	Total Dissolved Solids
TN	Total Nitrogen
TP	Total Phosphorus
TSS	Total Suspended Solids
VCP	Vitrified Clay Pipe
VSS/VS	Volatile Suspended Solids/Volatile Solids
WAS	Waste Activated Sludge
WLR	Weir Loading Rate
WWTP	Wastewater Treatment Plant

1.0 EXECUTIVE SUMMARY

The City of Norris, in response to a Tennessee Department of Environment and Conservation (TDEC) Director's Order received on February 17, 2022, contracted with Cannon and Cannon, Inc. (CCI) on February 25, 2022, to evaluate the existing sewer collection system and wastewater plant to ultimately provide recommendations for improvements to correct the conditions that have resulted in violations. Between the years of 2018 thru 2021, Norris, through its chartered entity Norris Water Commission (NWC), self-reported 47 plant bypasses. These violations suggest there is a likely occurrence of high rainfall derived inflow and infiltration (RDII) entering the collection system. In addition to these violations, NWC has self-reported over 54 exceedances of plant permit limits between the years of 2019-2021.

In an effort to prepare for the planning of necessary Corrective Actions, CCI has already started assessment, monitoring, and evaluation work. This work is intended to assist NWC and CCI in determining the best route forward in the implementation of the required corrective actions.

As required in the Director's Order, CCI has developed various recommended Corrective Actions in the form of a Corrective Action Plan (CAP) that NWC will work to implement in order to fulfill the requirements of the Director's Order. As such, CCI has identified the following Corrective Actions to maintain compliance with current and future NPDES effluent limits as required under NPDES Permit No. 0020630 and reduce the likelihood of future violations from occurring. The Corrective Actions include recommended improvements to both the collection system and the wastewater treatment plant. Improvements to the wastewater treatment plant (WWTP) have been further broken down into Long-Term and Interim improvements, thereby allowing the City of Norris to effectively identify, budget, schedule and ultimately implement these improvements over the course of the Director's Order compliance period.

1.1 Collection System Corrective Actions

1.1.1 Collection System Rehabilitation

CCI recommends that NWC perform a comprehensive rehabilitation of the sewer mains located within public right of way for the Dale and Sawmill sewersheds (refer to Section 6.6 for further details regarding these sewersheds). These sewersheds experience the highest degree of RDII entering the collection system. In addition, CCI recommends performing a targeted rehabilitation approach for the Deer Ridge sewershed by repairing structural defects in pipes and manhole where major inflow and infiltration (I&I) sources have been identified.

At this preliminary stage, it is assumed that comprehensive rehabilitation in the Dale and Sawmill subbasins could result in a 30% reduction in peak flows and a 50% reduction in total volume. Assumptions for the targeted rehabilitation within Deer Ridge could result in a 20% reduction in peak flows and a 30% reduction in volume. These reductions are entirely dependent on the extent to which comprehensive sewer rehabilitation is implemented by NWC and the effectiveness in which RDII sources can be identified and repaired. These reduction values will be later confirmed as part of post-rehabilitation flow monitoring and subsequently used to finalize the sizing of downstream wet weather storage and treatment facilities.

Based on the above approach, the anticipated sewer rehabilitation will likely include approximately 37,000 linear feet (LF) of trenchless pipe rehabilitation, 1,300 vertical feet (VF) of manhole rehabilitation and over 100 manholes that will need to be replaced (quantities to be later confirmed). These improvements will rehabilitate approximately 80% of the existing sewer system. When taking into account historical sewer rehabilitation performed by NWC over the last 20 years, these future improvements, combined with previous work, will have rehabilitated 100% of the sewer system, providing a fully comprehensive strategy of addressing and reducing RDII entering the sewer system. This strategy will reduce the likelihood of plant bypasses and sewer overflows thus providing significant

improvement to the health and safety of the residents of Norris and the overall environment for generations to come.

1.1.2 Equalization Tank

Even after comprehensive sewer rehabilitation efforts are complete, a portion of RDII will still enter the collection system. Although these peak flows and the overall volumes of RDII will be greatly reduced after rehabilitation, it is estimated that an equalization basin (or tank) will be needed to offset the anticipated peak flow events, therefore minimizing the size of needed wastewater treatment plant capacity improvements that would otherwise be needed. This will in turn reduce the required capital cost and the overall operation and maintenance cost of a larger plant. Preliminary modeling suggests, the initial size of the equalization tank at 0.75 MG. The final size of this tank will be later confirmed after sewer rehabilitation and post-rehabilitation flow monitoring.

1.1.3 Analysis of Sewage Redirect to Neighboring Utilities

In order to compare the cost of NWC system improvements to other alternatives, an analysis of sewage redirect options to Anderson County Water Authority and Clinton Utilities Board will be performed. The analysis will be focused on two scenarios: NWC selling all sanitary sewer influent directly (wholesale option) or selling a portion of higher flows during rain events (peak flow option). Costs for each option will be assumed based on conversations with management of neighboring utilities. Analysis will include a limited review of existing infrastructure and plant capacity of these utilities, as well as an overview of required improvements to ensure that NWC sewage volumes are able to be received while maintaining TDEC compliance. NWC plans to retain CCI to perform the analysis.

1.2 Wastewater Treatment Plant Corrective Actions

1.2.1 Interim Corrective Actions

NWC currently operates a Smith & Loveless (S&L) Oxigest package WWTP, originally installed in 1967. Long-term improvements to the WWTP take numerous years to design, permit and construct. In order to reduce the likelihood of violations during normal flow conditions in the interim of these long-term improvements, CCI recommends that NWC implement multiple operational changes at the existing plant. In addition to operational changes to current processes, minor construction modifications are also needed.

It is recommended that plant staff make the following operational changes in the S&L Oxigest unit:

1) Adjust blower run time set points
2) Continue use of chemical additives to help promote total phosphorus removal
3) Increase aeration time

In addition to operational changes, it is recommended that NWC make the following modifications to the S&L Oxigest unit:

1) Install baffle wall to create anaerobic and anoxic zones
2) Install submersible mixers or large recirculation pumps in anoxic zone
3) Install internal recycle feed line of the Mixed Liquor Suspended Solids (MLSS) from aeration to anoxic zone with pump
4) Extend RAS and influent lines to the beginning of the new anaerobic zone

Although implementation of these operational changes and construction of these improvements should greatly improve denitrification and reduction of both total nitrogen and total phosphorus during normal flow conditions, the plant will likely not be able to handle similar reductions in nutrients during wet weather flow events. This is to be expected as the S&L Oxigest unit was not originally designed for the current influent loadings, higher flows, or strict effluent permit limits with biological nutrient reduction in mind. For these reasons, the modifications are assumed to be temporary until more long-term improvements and plant upgrades can be evaluated, designed, and constructed.

1.2.2 Long Term Corrective Actions

Simultaneous to the improvements to the collection system and implementation of interim improvements to the WWTP, NWC will also conduct an evaluation of long-term alternatives to the WWTP. NWC understands that long-term improvements to the existing WWTP are likely needed in order to maintain substantial compliance with the current NPDES permit and reduce the likelihood of violations as recorded in DMRs, as specified in the Director's Order. NWC will perform this long-term alternative evaluation in the form of preliminary engineering reports and studies as part of subsequent engineering tasks which will be initiated in the future.

Given the preliminary nature of this long-term action item at the time of writing of this CAP and the substantial impacts the selected alternative will have on NWC from a budget and planning perspective as well as the potential impact it could have on other neighboring utility infrastructure, NWC believes it is prudent to conduct a thorough investigation of various options before committing to a schedule and cost. For these reasons, further details pertaining to this long-term corrective action have not been included in this CAP, but will be provided to TDEC for review and approval at later phases once the evaluation and study is complete.

Not only will the evaluation and study phase of the long-term WWTP improvements allow adequate time for NWC to review, approve and plan for these improvements, but it will also allow for more accurate plant influent design flows and sizing in order to create a comprehensive plan for long-term operation and compliance for the current plant. Although final sizing or selected improvements have yet to be determined, it is clear additional process volume is required at the existing plant. It is believed a new biological process basin(s) along with other improvements will likely need to be constructed as part of future expansion of the current plant.

The new process basin(s) will allow for adequate volume for the influent constituent loadings as further discussed in Section 7.2. Post treatment filtration will be considered depending on the effluent concentration limits of future NPDES permits and the outcome of the Section 303(d) de-listing of the Buffalo Creek (See Section 3.1 for further details). It is believed various process improvements will be necessary to comply with the current and future NPDES permits especially when it comes to meeting nutrient limits for Total Nitrogen and Total Phosphorus. The collection system rehabilitation and possible raw sewage redirect to neighboring utility will assist in the reduction of the influent flow volume entering the WWTP, but will likely have little to no impact on the reduction of the influent nutrient loadings as these are largely independent of the amount of I&I entering the system.

For all of the reasons mentioned above, it is clear further evaluation of long term WWTP expansion, improvements, and redirect alternatives is recommended and warranted.

2.0 CORRECTIVE ACTION PLAN

2.1 Current Work

As discussed later in Section 6.0, NWC began a proactive SSES process in November 2021. Completed items include Global Positioning System (GPS) field data collection, Geographic Information System (GIS) mapping, and manhole (MH) inspections.

CCTV subcontractors have begun the field work for video inspection of 15,000 LF of 8-inch sanitary sewer mains in the Dale and Sawmill Sewersheds. Smoke testing contractors will perform smoke testing of all 47,700 LF of NWC's system as well, pending anticipated dryer weather in summer months. NWC staff will work closely with subcontractors to identify priority areas from SSES field work, and items requiring urgent response will be performed in accordance with NWC's operational budget and plan.

NWC's initial flow monitoring period is scheduled to end on May 15, 2022. As discussed in following sections, the data used to develop the assumptions in this report are preliminary, and final data will be reviewed and verified after the completion of the flow monitoring period.

For the current work ongoing at the WWTP, the WWTP staff has been proactive on operational changes and are currently working on multiple items (see Sections 5.4 and 8.2). A mixing study is currently ongoing as well as the continued addition of Polyaluminum Hydroxychloride for the reduction of TP effluent concentrations. The Wastewater Treatment Plant Facility Plan as mentioned in earlier sections is currently ongoing and scheduled to be completed by September 2022.

2.2 Planned Work

NWC has already started a proactive plan to create their SSES program and review plant improvement options. Alternatives reviewed and proposed in Section 8.0 are intended to begin immediately following the review and acceptance of the CAP/ER by TDEC.

During the completion of the existing SSES work, comprehensive sewer rehabilitation is the first proposed step to address TDEC's Director Order comments. As noted in the following Sections 6.0 and 8.1, NWC experiences significant I&I in two sewersheds. After the completion of CCTV and SSES investigation, a two-phase approach will be undertaken to target each sewershed with comprehensive sewer rehabilitation in order to reduce I&I.

After the completion of the comprehensive sewer rehabilitation, a one-year post-rehabilitation flow monitoring period will be undertaken to determine the effects of the improvements on flows during dry-weather and storm events. While comprehensive rehabilitation is expected to reduce RDII, it is anticipated that an equalization basin will still be required to attenuate peak flows experienced in NWC's sanitary sewer system. Sizing of an equalization basin will be based on the results of this flow monitoring study. Preliminary sizing information and relevant costs for the EQ basin can be reviewed in detail in Sections 2.3.2 and 8.1.2.

Concurrently with the proposed work within the sewer collection system, NWC WWTP operators can implement a series of interim plant improvements to increase compliance with the NPDES Permit effluent limits related to biological treatment and nutrient removal. Discussion of these improvements are found in Sections 2.3.3 and 8.2.

A combined schedule for the implementation of the comprehensive sanitary sewer rehabilitation, equalization basin, and interim plant improvements can be seen in Table 2.2.1 and Figure 2.2.1 on the following pages.

Table 2.2.1 Corrective Action Plan Table

CORRECTIVE ACTION PLAN					
No.	Category	Action	Responsible Entity	Completion Date	Evidence of Completion
1	Sewer Rehab	**Complete SSES Field Work**	Engineer and NWC	11/9/22	Compile CCTV Videos and Smoke Testing Map
2	Funding	**Develop Funding Sources for CAP Action Items**	City of Norris/NWC	7/8/23	Funding for Phase 1 Rehab is acquired. Future funding sources are identified.
3	Sewer Rehab	**Develop Ordinance Addressing Separation of Storm Sewers and Private Sanitary Sewer Laterals**	City of Norris/NWC	7/8/23	Ratification of City Ordinance
4	Sewer Rehab	**Develop Construction Documents for Comprehensive Rehabilitation of Sawmill Sewershed (Phase 1)**	Engineer and NWC	1/4/24	Phase 1 Construction Documents are Approved by TDEC
5	Sewer Rehab	**Advertise and Bid for Phase 1 Rehabilitation**	Engineer and NWC	2/18/24	Contractor is issued Notice of Award
6	Interim WWTP	**Construct/Maintain Interim WWTP Improvements**	Engineer and NWC	7/9/24	Operational Changes Implemented
7	Sewer Rehab	**Construct Phase 1 Sewer Rehabilitation**	Engineer, Contractor, and NWC	2/17/25	Phase 1 Sewer Record Drawings
8	Interim WWTP	**Evaluate Improvements for 1 Year**	Engineer and NWC	7/9/25	Post-Interim Improvements Report
9	Sewer Rehab	**Monitor Post-Phase 1 Rehabilitation Flow**	Engineer, Flow Monitoring Subcontractor, and NWC	2/17/26	Post-Phase 1 Flow Monitoring Report
11	Sewer Rehab	**Develop Construction Documents for Comprehensive Rehabilitation of Dale Sewershed and Targeted Rehabilitation of Deer Ridge Sewershed (Phase 2)**	Engineer and NWC	10/5/26	Phase 2 Construction Documents are Approved by TDEC
12	Sewer Rehab	**Advertise and Bid for Phase 2 Rehabilitation**	Engineer and NWC	11/19/26	Contractor is issued Notice of Award
10	Long Term WWTP	**Develop Preliminary Engineering Report and Study for WWTP Expansion/ Improvements/ Redirect**	Engineer and NWC	3/1/27	Acceptance of Long Term WWTP PER by TDEC
13	Sewer Rehab	**Construct Phase 2 Sewer Rehabilitation**	Engineer, Contractor, and NWC	11/19/27	Phase 2 Sewer Record Drawings
14	Long Term WWTP	**Funding for WWTP Improvements**	City of Norris/NWC	10/21/28	Funding for WWTP is acquired. Future funding sources are identified.
15	EQ Basin	**Monitor Post-Phase 2 Rehabilitation Flow**	Engineer, Flow Monitoring Subcontractor, and NWC	11/18/28	Post-Phase 2 Flow Monitoring Report
16	EQ Basin	**Develop Flow Equalization Tank Sizing and Construction Documents**	Engineer and NWC	5/17/29	Construction Documents are Approved by TDEC
17	EQ Basin	**Advertise and Bid for Flow Equalization Tank Advertisement**	Engineer and NWC	7/1/29	Contractor is issued Notice of Award
18	Long Term WWTP	**Develop Detailed Design and Development of Construction Documents for WWTP Expansion/ Improvements/ Redirect**	Engineer and NWC	11/20/29	Construction Documents are Approved by TDEC
19	EQ Basin	**Construct Flow Equalization Tank**	Engineer, Contractor, and NWC	7/1/30	Equalization Tank is Operational

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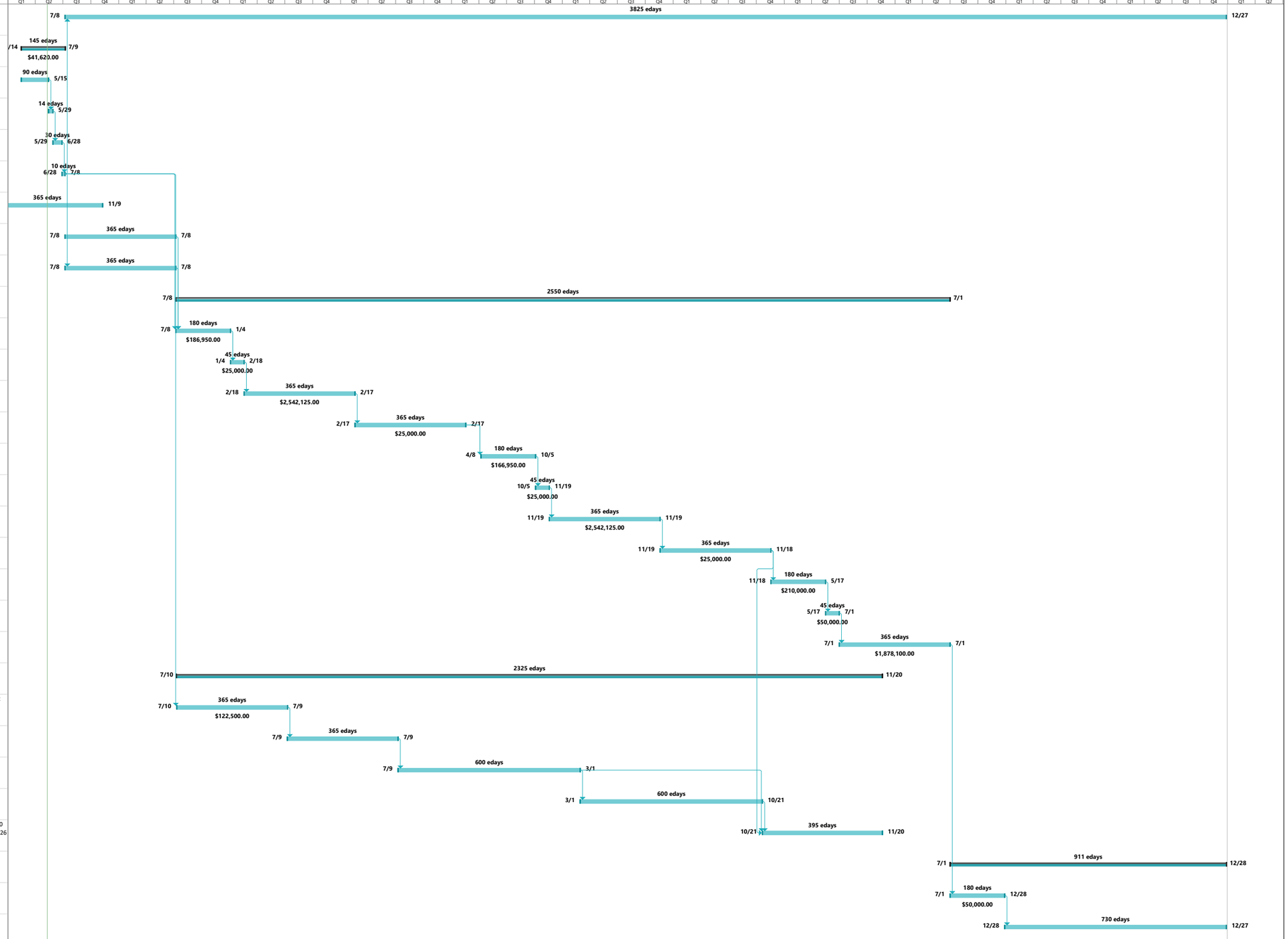
Norris Corrective Action Plan - Schedule Wed 5/11/22

ID	Task Mode	Task Name	Duration	Start	Finish	Predecessors
1		Corrective Action Plan Overall Compliance Period	3825 edays	Fri 7/8/22	Mon 12/27/32	6
2		**Corrective Action Plan Development**	**145 edays**	**Mon 2/14/22**	**Sat 7/9/22**	
3		Submit Corrective Action Plan (CAP) / Engineering Report (ER) to TDEC	90 edays	Mon 2/14/22	Sun 5/15/22	
4		TDEC Review and Comment	14 edays	Sun 5/15/22	Sun 5/29/22	3
5		Submit Amended CAP/ER to TDEC	30 edays	Sun 5/29/22	Tue 6/28/22	4
6		TDEC Approval of CAP	10 edays	Tue 6/28/22	Fri 7/8/22	5
7		**Current (Ongoing) SSES Work**	365 edays	Tue 11/9/21	Wed 11/9/22	
8		**Funding - Collection System**	365 edays	Fri 7/8/22	Sat 7/8/23	
9		**Private Sewer Lateral Ordinance**	365 edays	Fri 7/8/22	Sat 7/8/23	6
10		**Collection System**	**2550 edays**	**Sat 7/8/23**	**Mon 7/1/30**	
11		Ph 1 - Sewer Rehabiliation Construction Documents	180 edays	Sat 7/8/23	Thu 1/4/24	6,9,8
12		Ph 1 - Sewer Rehabilition Advertisement and Bidding	45 edays	Thu 1/4/24	Sun 2/18/24	11
13		Ph 1 - Sewer Rehabiliation Construction	365 edays	Sun 2/18/24	Mon 2/17/25	12
14		Ph 1 - Post Rehabiliation Flow Monitoring	365 edays	Mon 2/17/25	Tue 2/17/26	13
15		Ph 2 - Sewer Rehabiliation Construction Documents	180 edays	Wed 4/8/26	Mon 10/5/26	14
16		Ph 2 - Sewer Rehabilition Advertisement and Bidding	45 edays	Mon 10/5/26	Thu 11/19/26	15
17		Ph 2 - Sewer Rehabiliation Construction	365 edays	Thu 11/19/26	Fri 11/19/27	16
18		Ph 2 - Post Rehabiliation Flow Monitoring	365 edays	Fri 11/19/27	Sat 11/18/28	17
19		Flow Equalization Tank Sizing and Construction Documents	180 edays	Sat 11/18/28	Thu 5/17/29	18
20		Flow Equalization Tank Advertisement and Bidding	45 edays	Thu 5/17/29	Sun 7/1/29	19
21		Flow Equalization Tank Construction	365 edays	Sun 7/1/29	Mon 7/1/30	20
22		**Wastewater Treatment Plant**	**2325 edays**	**Mon 7/10/23**	**Tue 11/20/29**	
23		WWTP Operational Changes/Improvements	365 edays	Mon 7/10/23	Tue 7/9/24	6FS+262 days
24		Evaluation Period of Operational Changes	365 edays	Tue 7/9/24	Wed 7/9/25	23
25		Preliminary Engineering Report and Study for Long Term WWTP Expansion / Improvements / Redirect (Cost $ TBD)	600 edays	Wed 7/9/25	Mon 3/1/27	24
26		Funding - Long-Term WWTP	600 edays	Mon 3/1/27	Sat 10/21/28	25
27		Detailed Design for Long Term WWTP Expansion / Improvements / Redirect - Construction Documents (Cost $ TBD)	395 edays	Sat 10/21/28	Tue 11/20/29	18FS-200 days,25,26
28		**CAP Closeout and Report**	**911 edays**	**Mon 7/1/30**	**Tue 12/28/32**	
29		Final CAP Report	180 edays	Mon 7/1/30	Sat 12/28/30	21
30		Director's Order Closeout	730 edays	Sat 12/28/30	Mon 12/27/32	29



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Date: Wed 5/11/22

Task, Split, Milestone, Summary, Project Summary, Inactive Task, Inactive Milestone, Inactive Summary, Manual Task, Duration-only, Manual Summary Rollup, Manual Summary, Start-only, Finish-only, External Tasks, External Milestone, Deadline, Critical, Critical Split, Progress, Manual Progress

2.3 Cost Analysis

2.3.1 Collection System Rehabilitation

The total estimate of probable project costs for the NWC Comprehensive Sewer Rehabilitation project is approximately $5,488,150.00. These costs have been prepared as an estimate to be used for project evaluation utilizing information including historical construction project data, cost ratios, and cost curves. The final cost of the project will depend on scope of work, material and labor cost and availability, market conditions, and funding. An itemized breakdown is shown in Table 2.3.1.

Table 2.3.1 Opinion of Probable Project Costs, Collection System Rehabilitation

COLLECTION SYSTEM REHABILITATION COSTS					
Item No.	**Description**	**Qty**	**Unit**	**Unit Price**	**Extended**
1	**Sewer Rehabilitation - Engineering, Bidding, and Construction Administration**				
1.01	Field Surveying (as necessary)	1	LS	$20,000	$20,000
1.02	CCTV Review, Engineering Design, Construction Documents	1	LS	$333,900	$333,900
1.03	Bidding and Construction Administration	1	LS	$50,000	$50,000
				Subtotal	**$403,900**
2	**Sewer Rehabilitation Construction**				
2.01	Contractor Mobilization (8.25% max)	1	LS	$329,000	$329,000
2.02	8" Trenchless Rehabilitation (by CIPP or PB)	33,500	LF	$65	$2,177,500
2.03	10" Trenchless Rehabilitation (by CIPP or PB)	800	LF	$75	$60,000
2.04	12" Trenchless Rehabilitation (by CIPP or PB)	2,900	LF	$85	$246,500
2.05	Manhole Cementitious Lining	1,350	VF	$150	$202,500
2.06	Manhole Replacement	100	EA	$6,000	$600,000
2.07	Dig and Replace Sewer Laterals	285	EA	$2,500	$712,500
2.08	Cut and Buff Sewer Laterals	285	EA	$1,250	$356,250
2.09	Restoration (asphalt/seeding) (10%)	1	LS	$400,000	$400,000
				Subtotal	**$5,084,250**
				Low Range (-20%)[1]	*$4,067,400*
				High Range (+30%)[1]	*$6,609,525*
Total Opinion of Probable Project Cost, Comprehensive Sewer Rehabilitation					**$5,488,150**

[1] Estimate ranges are from AACE Class 4 literature

2.3.2 Equalization Basin

The total estimate of probable project costs for the NWC Equalization Basin is difficult to forecast due to the preliminary nature of the data and the future post-rehabilitation flow results. For the purposes of this report, sizing and cost opinions should be considered preliminary and subject to change after review of additional information. As discussed in previous sections, the equalization basin sizing shall be based on a 12-month (365-day) post-rehabilitation flow monitoring period to ensure engineering and construction is based on appropriate levels of data.

The total estimate of probable costs associated with 0.75 MG Equalization Basin is approximately $2,138,100.00. An itemized breakdown is shown in Table 2.3.2.

Table 2.3.2 Opinion of Probable Project Costs, Equalization Basin

EQUALIZATION BASIN COSTS					
Item No.	**Description**	**Qty**	**Unit**	**Unit Price**	**Extended**
3	**Equalization Basin - Engineering, Bidding, and Construction Administration**				
3.01	Field Surveying (as necessary)	1	LS	$40,000	$40,000
3.02	Flow Monitoring, Engineering Design & Construction Documents	1	LS	$170,000	$170,000
3.03	Bidding and Construction Administration	1	LS	$50,000	$50,000
				Subtotal	**$260,000**
4	**Equalization Basin Construction**				
4.01	Contractor Mobilization (8.25% max)	1	LS	$143,100	$143,100
4.02	Diversion Structure	1	LS	$50,000	$50,000
4.03	Wet Well	1	LS	$60,000	$60,000
4.04	Grinder	1	LS	$100,000	$100,000
4.05	Submersible Pumps (2,100 gpm at 50' TDH)	1	LS	$200,000	$200,000
4.06	Tank (0.75 MG)	1	LS	$1,000,000	$1,000,000
4.07	Mixers	1	LS	$75,000	$75,000
4.08	Yard Piping and Valving	1	LS	$50,000	$50,000
4.09	Electrical, Instrumentation, and Controls	1	LS	$100,000	$100,000
4.10	Demolition, Site Prep, and Fencing	1	LS	$75,000	$75,000
4.11	Bypass Pumping	1	LS	$25,000	$25,000
				Subtotal	**$1,878,100**
				Low (-30%)[1]	*$1,314,670*
				High Range (+50%)[1]	*$2,817,150*
	Total Opinion of Probable Project Cost, Equalization Basin				**$2,138,100**

[1] Estimate ranges are from AACE Class 4 literature

2.3.3 Treatment Plant Interim Improvements

The total estimate of probable project costs for the interim improvements for the NWC WWTP are $122,500 and itemized out in Table 2.3.3. For the purposes of this report, sizing and cost opinions should be considered preliminary and subject to change after review of additional information.

Table 2.3.3 Opinion of Probable Cost, WWTP Interim Improvements

WWTP INTERIM IMPROVEMENTS COSTS					
Item No.	**Description**	**Qty**	**Unit**	**Unit Price**	**Extended**
5	**Interim WWTP Improvements**				
5.01	Baffle Wall in Process Basin (Anaerobic/Anoxic Zone)	1	LS	$20,000	$20,000
5.02	Submersible Mixer	1	EA	$5,000	$5,000
5.03	Internal MLSS Recycle (pump)	1	LS	$2,500	$2,500
5.04	Structural Repairs	1	LS	$20,000	$20,000
5.05	Relocate Influent to Anaerobic Zone	1	LS	$40,000	$40,000
5.06	Extend RAS to Anaerobic Zone	1	LS	$5,000	$5,000
5.07	Bypass Pumping/Dewatering	1	LS	$30,000	$30,000
				Subtotal	**$122,500**
				Low Range (-30%)[1]	$85,750
				High Range (+50%) [1]	$183,750
				Total Opinion of Probable Project Cost, WWTP Interim Improvements	**$122,500**

[1] Estimate ranges are from AACE Class 4 literature

2.3.4 Treatment Plant Long-Term Improvements

The total estimate of probable project cost for the NWC WWTP Long-Term Alternative is difficult to forecast due to the not yet determined alternative to be selected. The final cost of each alternative and the recommended option will be determined at a later date and included within the WWTP Facility Plan.

3.0 INTRODUCTION

3.1 Background

The City of Norris, TN is located in the northeast portion of Anderson County and is home to a population of 1,602 per the 2020 U.S. Census. Due to Norris' establishment as a model planned community by the Tennessee Valley Authority (TVA), a significant portion of the infrastructure, including sanitary sewer mains, date to the original TVA construction of the town in 1933. Drinking water and sanitary sewer service is provided to customers within Norris' city limits by the Norris Water Commission (NWC).

NWC owns, operates, and maintains a wastewater collection system and 0.2 million gallons per day (MGD) wastewater treatment plant, which is regulated by the State of Tennessee under National Pollution Discharge Elimination System (NPDES) Permit No. TN 0020630.

Treated effluent from NWC discharges into Buffalo Creek (TN06010207016_0100). In recent years, Buffalo Creek has been listed on Tennessee's List of Impaired and Threatened Waters (commonly known as 303d List), which places restrictions on available loading to watersheds throughout the State. This impacts NWC's WWTP and operations by increasing the treatment quality and imposing stricter limits on effluent.

On March 31, 2022, TDEC sent their Final 2022 List of Impaired and Threatened Waters to the EPA for review and approval. This guidance, which is still pending EPA approval at the time of submittal of this report, proposes that Buffalo Creek be delisted and removed from the 2022 303d list.

3.2 Problem Statement

On February 11, 2022, TDEC issued a Director's Order (No. WPC21-0149) to Norris Water Commission. The order assesses civil financial penalties on NWC and also required a corrective action plan / engineering report (CAP/ER) within 90 days of receipt. The Order requires NWC to address effluent limit exceedances, and TDEC states that NWC is "encouraged to direct the majority of the CAP/ER actions to reduction of treatment system bypasses caused by inflow and infiltration into the collection system during significant rain events." The City of Norris received this Order via certified mail on February 17, 2022. Refer to a copy of Director's Order in Appendix B.

3.3 Compliance

3.3.1 Bypasses and Overflows

Historical data were compiled from NWC's Monthly Operating Reports (MORs) sent to TDEC. NWC's main compliance issues are centered around peak flows from rainfall events exceeding the capacity of the WWTP. As such, the focus of this CAP/ER will be to target inflow and infiltration reduction to reduce the volume entering the sanitary sewer system to reduce bypass events. Below is a summary of plant bypass events as taken from MOR reports from 2018-2021.

Table 3.3.1 Historical Sewer Compliance for Norris Water Commission, 2018-2021

HISTORICAL SEWER COMPLIANCE	
Year	**WWTP Bypass Events**
2018	11
2019	13
2020	11
2021	12

Historical MOR data show consistent plant bypasses on an annual timeline, indicating the same level of RDII is likely entering the system on a regular basis.

3.3.2 DMR Effluent Limit Exceedances

As stated in the Director' Order (reference Appendix B), the plant has self-reported the following permit exceedances as shown in Table 3.3.2. These exceedances were attributed mainly to a plant upset that occurred in February and March of 2021 and was due to the growth of filamentous bacteria in the aeration basins as well as a biomass washout from excessive influent flow amounts. For additional detail on exceedances see Section 7.1.3.

Table 3.3.2 Self-Reported Effluent Limitation Exceedances

EFFLUENT LIMITATION EXCEEDANCES	
Parameter	**Effluent Exceedances: May 1, 2019 – November 30, 2021**
Carbonaceous BOD, 5-day	4
E. Coli	2
Nitrogen, Ammonia (as N)	11
Nitrogen, Total (as N)	14
Phosphorus, Total (as P)	9
Suspended Solids, % removal	2
Suspended Solids, Total	4
Bypass of Treatment Facility	8
Total	**54**

4.0 COLLECTION SYSTEM

4.1 Overview

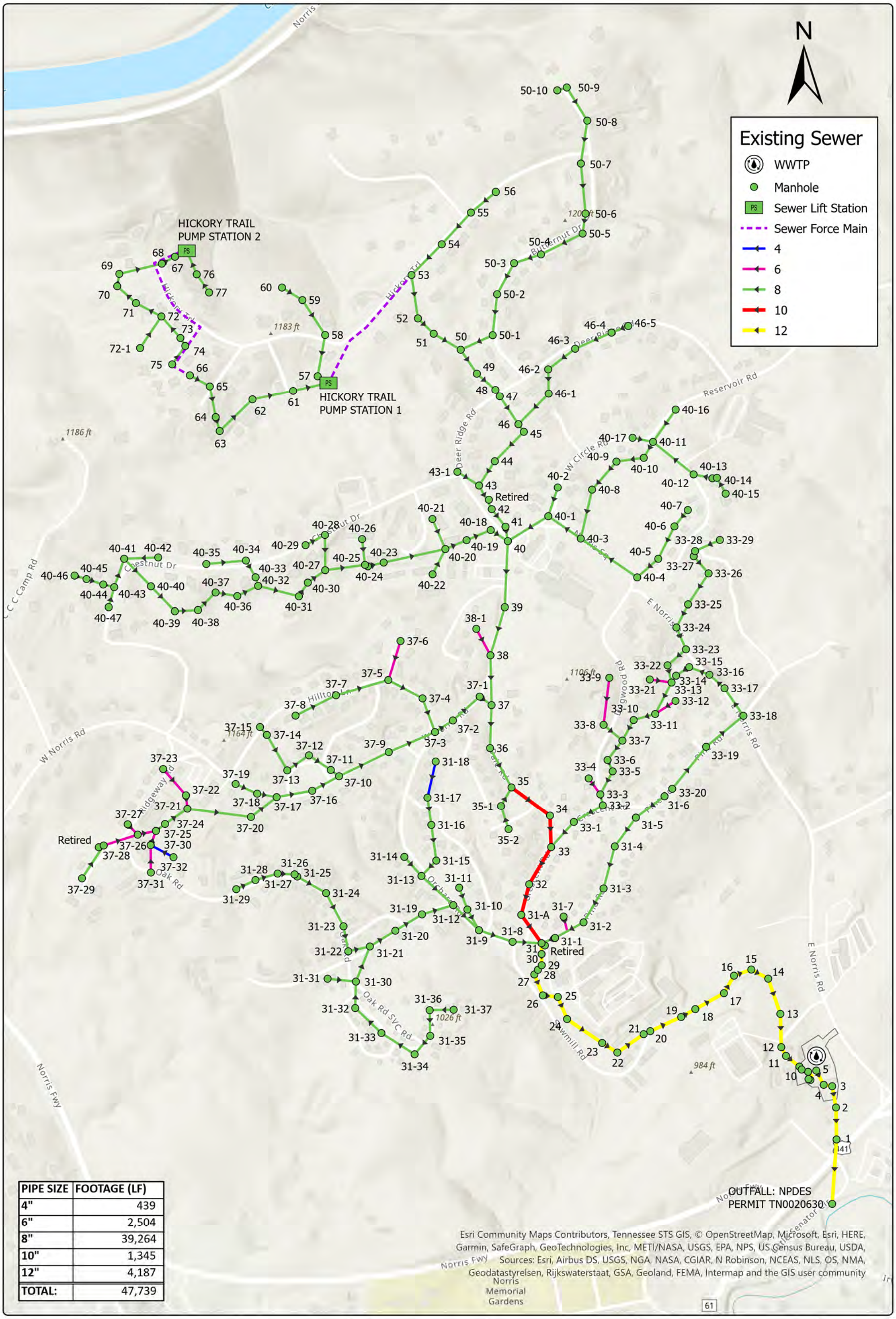
The City of Norris, TN has a smaller service area and customer base than many of its adjacent neighbors. As a chartered entity of the City, NWC operates a primarily gravity system for a majority of its customers, with two small pumping stations to serve approximately 5% of the total sewer system. Reference Figure 4.1.1 Sanitary Sewer System Map on the following page.

4.1.1 Gravity Sewer

The collection system consists of approximately 47,700 LF of gravity sewer, ranging in diameter from 4-inch to 12-inch, and includes approximately 250 manholes. Pipe footages include 439 LF of 4-inch, 2,504 LF of 6-inch, 39,264 LF of 8-inch, 1,345 LF of 10-inch, and 4,187 LF of 12-inch. Gravity sewer line materials are primarily Vitrified Clay Pipe (VCP) and Polyvinyl Chloride (PVC) pipe but also include smaller segments of Ductile Iron Pipe (DIP) and concrete. Historical record drawings date to TVA blueprints from 1934 and indicate that older portions of NWC's collection system are approaching 90 years of service life.

4.1.2 Pumping Stations

Norris Water Commission operates two sewage pumping stations in the northern portion of their system. Both stations are located on Hickory Trail and provide service to 35 total customers. Hickory Trail Pump Station #2 separately serves 10 customers and was rated for a pump design point of 25 gpm at 130 Total Dynamic Head (TDH). PS#2 discharges into a manhole upstream of Hickory Trail Pump Station #1, where it flows through a small section of gravity sewer into the wet well for PS #1. PS #1 serves 25 customers in addition to the discharge from PS #2 and is rated for 50 gpm at 66 TDH. PS#1 discharges into MH 53, at which point it enters the remaining gravity sewer system before reaching the WWTP.



PIPE SIZE	FOOTAGE (LF)
4"	439
6"	2,504
8"	39,264
10"	1,345
12"	4,187
TOTAL:	47,739

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CORRECTIVE ACTION PLAN
SYSTEM MAP

4.1.1

4.2 Historical Collection System Improvement Projects

Over the last twenty years, the Norris Water Commission has initiated a series of improvements to upgrade sanitary sewer service and wastewater treatment capacity for their customers. NWC Staff and Commissioners have been intentional in applying for grants and other funding sources, relying on an Energy Grant (2010) and Community Development Block Grant (2013) for assistance in paying for improvements. NWC has also applied for additional CDBG grants in recent years but has not been chosen for funding due to challenges meeting low-moderate income (LMI) requirements for selection.

Since 2001, NWC has focused their rehabilitation and replacement efforts on larger diameter pipelines in an effort to address inflow and infiltration concerns. In 2001, 1,317 LF of 10-inch PVC was installed, replacing a section of 8-inch pipe to provide greater storage capacity and reduce the hydraulic grade line of the collection system. In 2013 and 2016, NWC completed projects on 12-inch diameter portions of their system, rehabilitating or replacing approximately 45% of their 12-inch pipe footages. Other rehabilitation projects undertaken in 2001, 2008, 2015, and 2017 throughout the system have improved 16% of the 39,000+ LF of 8-inch pipe.

Refer to Figure 4.2.1 Historical Improvements Projects on the following page for a visual representation of the sanitary sewer improvements completed by NWC since 2001.

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N

Existing Sewer

- WWTP
- Sewer Gravity Main
- Manhole
- PS — Sewer Lift Station
- Sewer Force Main

Historical Improvements

- CIPP
- Pipe Bursting
- Open Cut Replacement

2017:
10 LF POINT REPAIR

2008:
435 LF 8" REPLACEMENT
1,827 LF 8" CIPP

2001:
1,317 LF 10" REPLACEMENT
1,783 LF 8" CIPP

2015:
2,332 LF 8" CIPP
202 LF 8" REPLACEMENT

2017:
226 LF 8" CIPP

2016:
892 LF 12" REPLACEMENT
673 LF 12" PIPE BURSTING

WWTP:
2008:
SLUDGE PRESS AND DEWATERING BUILDING

2013:
HEADWORKS, EFFLUENT FLOW METER, AND BLOWER MODIFICATIONS

2013:
330 LF 12" REPLACEMENT

YEAR	IMPROVEMENTS
2001	1,317 LF 10" PVC BY OPEN CUT REPLACEMENT
	1,783 LF 8" REHABILITATION BY CIPP
2008	WWTP: SLUDGE PRESS AND DEWATERING BUILDING
	435 LF 8" DIP BY OPEN CUT REPLACEMENT
	1,827 LF 8" REHABILITATION BY CIPP
2013	WWTP: HEADWORKS, EFFLUENT FLOW METER, AND BLOWER MODIFICATION
	330 LF 12" PVC BY OPEN CUT REPLACEMENT
2015	202 LF 8" PVC BY OPEN CUT REPLACEMENT
	2,332 LF 8" REHABILITATION BY CIPP
2016	892 LF 12" PVC AND DIP BY OPEN CUT REPLACEMENT
	673 LF 12" HDPE BY PIPE BURSTING
2017	226 LF 8" REHABILITATION BY CIPP
	10 LF 8" PVC BY POINT REPAIR

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CORRECTIVE ACTION PLAN
HISTORICAL IMPROVEMENT PROJECTS

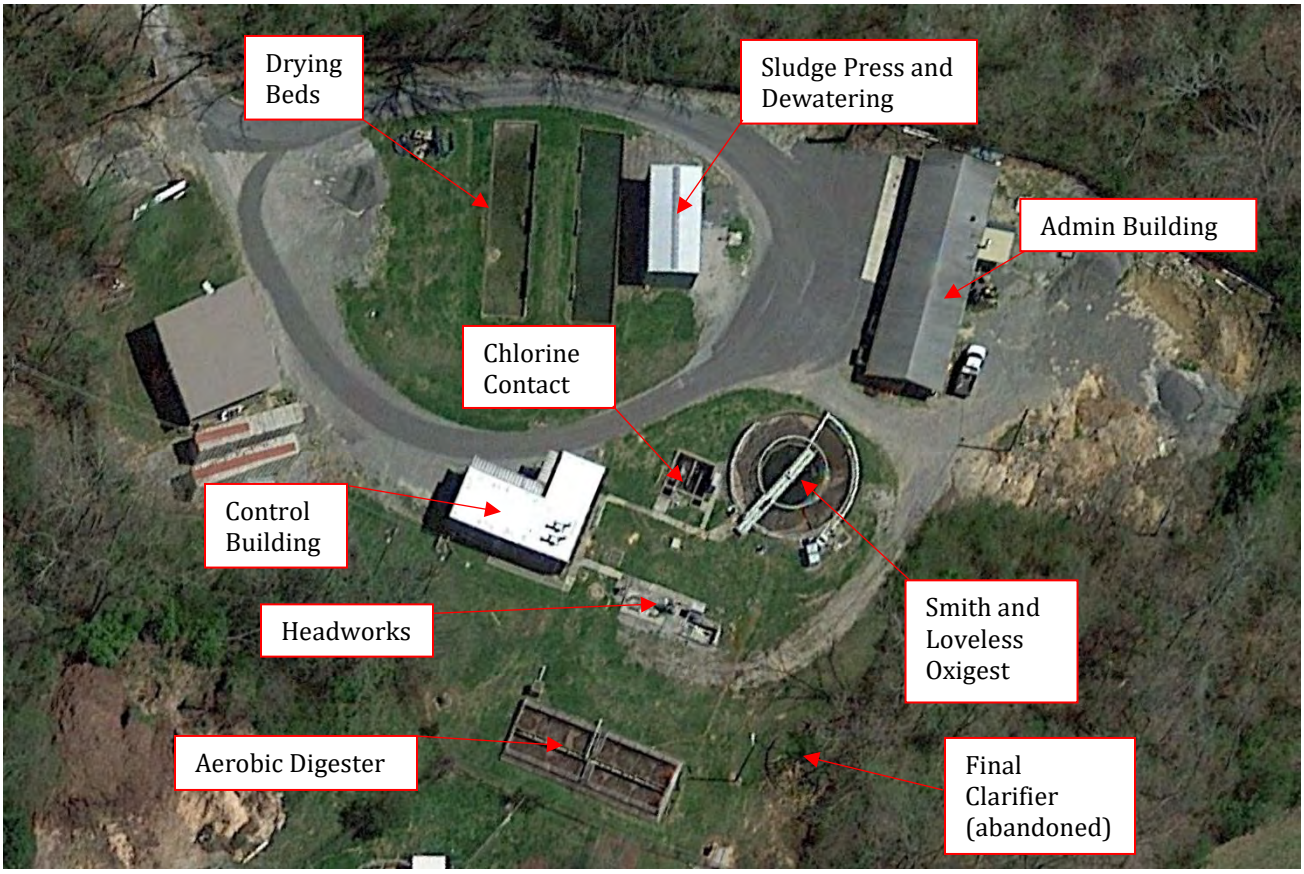
4.2.1

5.0 WASTEWATER TREATMENT PLANT

5.1 Overview

The Norris Wastewater Treatment Plant is located at 94 E. Norris Road in Norris, TN. The plant was originally designed and built in the 1930s by TVA during the Norris Lake Dam construction. The original plant consisted of Imhoff sedimentation and digestion tanks, aeration basins, contact stabilization tanks and sludge drying beds. The plant received major upgrades in the late 1960s which include adding new headworks consisting of screenings removal and flow measurement, new Smith and Loveless Oxigest package plant, new administration building which houses the aeration blowers, chlorine room, and laboratory, and new chlorine contact chamber. The next major upgrade occurred in 2008 when the plant transitioned the solids handling process to mechanical dewatering. The next and most recent improvement at the plant occurred in 2013 when the headworks system installed in the 1960s was retired and a new headworks was installed containing mechanical screenings and new flow measurement systems. An aerial plant layout and schematic flow diagram for the liquid and solids processes are shown in Figure 5.1.1 and Figure 5.1.2.

Figure 5.1.1 Wastewater Treatment Plant Aerial Imagery



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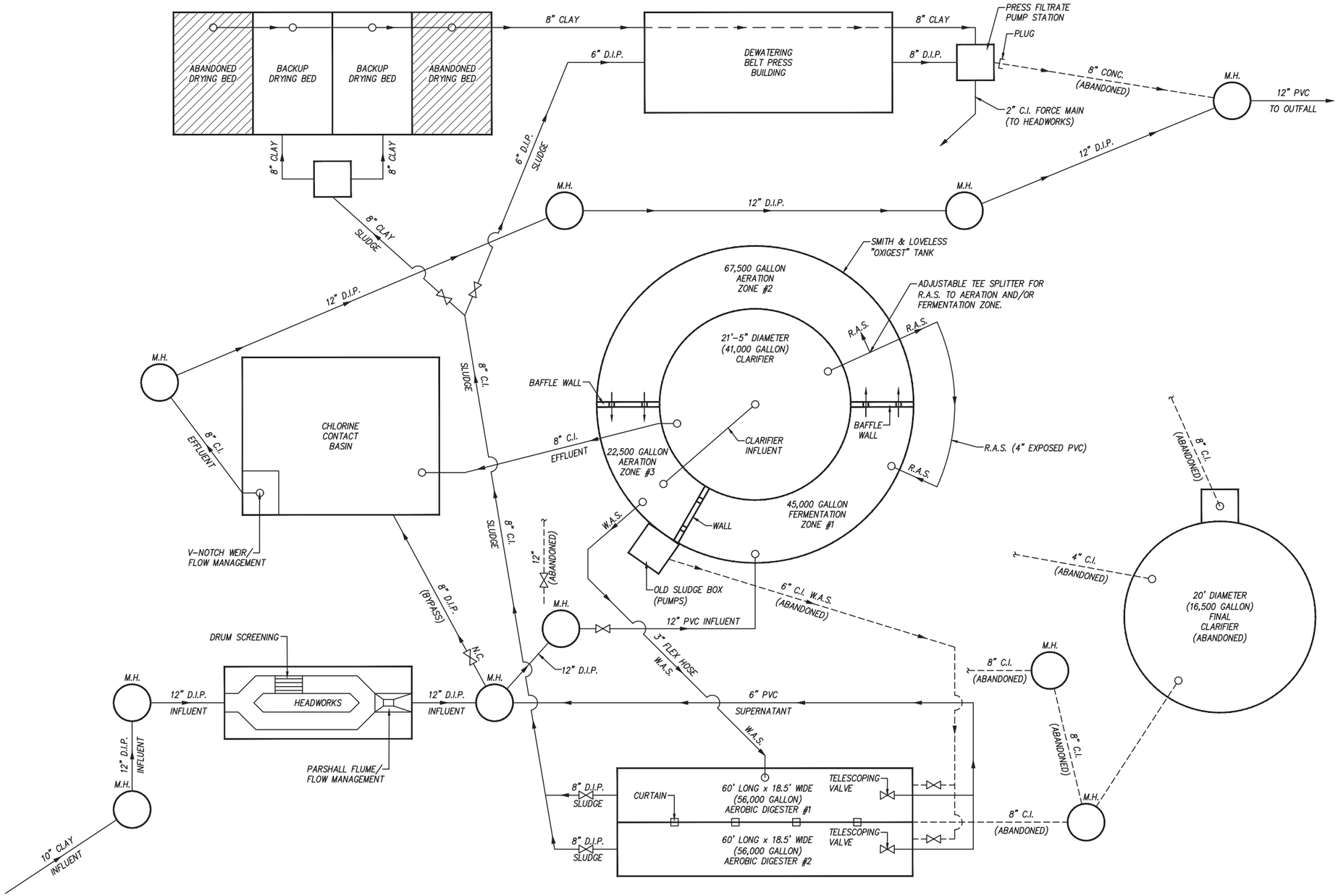

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CITY OF NORRIS
NORRIS WATER COMMISSION
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NORRIS, TN 37828

PROJECT:
NORRIS WASTEWATER SYSTEM
CAP, ENGINEERING REPORT AND SSES
NORRIS, TN

NORRIS W.W.T.P.
PROCESS SCHEMATIC

PRELIMINARY FOR REVIEW ONLY

CCI PROJECT NO.	00292-0020		
DRAWING DATE	MARCH 15, 2022		
PM	JP	PIC	TFT
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5.1.2

SHEET 1 OF 1

5.2 Liquid Process

5.2.1 Headworks

Flow enters the plant through the gravity sewer collection system and is routed to the headworks structure by a 12" Ductile Iron pipe before being discharged into the structure. The structure consists of two concrete channels, one containing a mechanical screen and the other a bypass/ future expansion channel, as well as a Parshall flume on the effluent side of the screenings that is used for flow measurement (as depicted in Appendix C).

5.2.1.1 Mechanical Screen

The mechanical screen is located in the east channel and is a Lakeside Raptor Micro Strainer Rotating Screen Auger, as shown in Figure 5.2.1, which has a maximum operating capacity of 1.14 MGD. This screen operates automatically from differential water levels measured by floats and is sized to remove 0.25-inch and larger material. The material collected by the screen is mechanically removed from the channel and discharged into collection bags to be disposed at the landfill.

Figure 5.2.1 Mechanical Screen

5.2.1.2 Parshall Flume

The Parshall flume is located in the headworks structure after the two influent channels combine into a 12" Ductile Iron pipe. The flow exits the pipe into the Parshall flume basin, where an influent sampler collects composite samples before the flows pass through the flume. The influent flow enters the 3" FRP Parshall flume with an ultrasonic sensor for level measurement. The influent flow readings

from the Parshall flume are shown on a digital screen and logged on a circular chart recorder located in the control building. NWC staff takes daily totalized flow readings for MOR records by manually reading the digital screen daily and subtracting the current total from the previous day's value.

Per manufacturer submittals, the maximum wastewater depth that the flume can accurately convey is 1.5 ft. This maximum depth translates to 2.5 MGD. Since the overall depth of the flume is only 2 ft deep, this maximum flow rate value is likely less depending on what the ultrasonic flow measurement device is calibrated for as there is a required freeboard between the bottom of the sensor and the top of the measured liquid. Further investigation is needed

5.2.2 Smith and Loveless Oxigest

The heart of the wastewater treatment plant is the Smith and Loveless (S&L) Field Erected "Oxigest" Sewage Treatment Plant. This package plant was installed in the 1960s to provide an upgraded system from the Imhoff system that was constructed in the 1930s as the original treatment process. The Oxigest plant was originally designed to be a complete packaged system as aeration, clarification, and digestion processes were all performed inside the unit. These processes were possible as the S&L unit had an outer ring wall made up of concrete that provided various compartments for aeration and digestion zones and the inner ring made of steel functioned as a clarifier as shown Figure 5.2.2. A structural inspection is recommended due to the age of the process unit. The condition of the submerged steel and concrete basin walls are unknown. It is reasonable to assume degradation of the concrete and steel from 60 years of submergence in the wastewater is likely.

Based on the original drawing, the Oxigest plant was rated for a treatment capacity of 200,000 gallons per day. The permitted effluent limits have become more stringent since the initial installation of the S&L treatment unit back in the 1960s. To comply with the changes, operators have modified the basins to an extended aeration process by converting the aerobic digestion zones to full aeration zones This change allowed for longer hydraulic retention time and operation with a longer solids retention time (SRT) to achieve single stage nitrification. These modifications along with others improvements will be discussed further in later sections of the report in Section 5.4.1.

Figure 5.2.2 S&L Oxigest

5.2.3 Control Building – Blower Room

The control building was constructed as part of the 1960s plant upgrades. This building currently houses the laboratory, chlorine storage and feed room, as well as the blower room. The blower room houses two rotary lobe blowers as shown in Figure 5.2.3 that provide the air feed for the entire plant.

The blowers operate off a push pin timer system and are set up to alternate to pumps to keep runtimes comparable to each other. A 2013 plant improvement project replaced one of the blowers and motors. The other blower is original to the S&L installation and dates to the 1960s. Both of the blowers are sized to provide 760 CFM each, allowing for a redundant back up in case of a failure of one of the blowers.

Figure 5.2.3 Blower Room

5.2.4 Chlorine Contact Basin

Treated effluent from the interior clarifier of the Oxigest unit flows through the chlorine contact basin to be disinfected, dechlorinated and aerated before being discharged at the outfall. This basin was installed as part of the 1960s upgrades. The effluent flow gets dosed with chlorine gas, fed from the control building chlorine room, as soon as it enters the basin. Once the flow is dosed with chlorine, it passes through a serpentine flow path to provide contact time for the disinfection process to work as displayed in Figure 5.2.4.

Figure 5.2.4 Chlorine Contact Basin

During this process, air is pumped into the contact channels by a line that is connected to main air feed to the Oxigest basin. This air provides enough dissolved oxygen (DO) into the effluent flow to meet the NPDES discharge requirements. The following process that occurs in the chlorine contact basin is the process of dechlorination. This is accomplished by feeding sulfur dioxide which is stored and fed from the chlorine room in the control building. Once the effluent flow is dechlorinated, it passes through a singular V notch weir and the flow is measured by an ultrasonic level sensor for effluent flow recording. The flow recording from the sensor is recorded and stored by digital recorder as well as a circular chart recorder located in the control building. The effluent sampler is located at this location as well.

5.2.5 Outfall

The outfall line was originally constructed when the initial plant was built in the 1930s. Since then, line rehabilitation was performed during the 2013 plant upgrades. These upgrades replaced a significant amount of the original clay pipe with 12" PVC as shown in Figure 4.2.1 Historical Improvements Projects. The outfall line runs approximately 1/8th of a mile from the WWTP underneath Highway 61 to the headwall discharge along Buffalo Creek.

As mentioned in Section 3.1, TDEC has proposed that Buffalo Creek be removed from the 303d List for 2022. Water quality improvements between 2020 and 2022 along Buffalo Creek include reductions in Total Nitrogen and Total Phosphorous. In their proposed delisting, TDEC explained their rationale and noted NWC's actions as a contributing factor to the improvement of water quality within the stream. The specific language in the draft guidance stated, "The Norris STP had improved nutrient discharges into this segment through plant optimization a few years back." Refer to a copy of the draft guidance in Appendix A.

5.3 Solids Process

5.3.1 Return Activated Sludge & Waste Activated Sludge

The sludge return in the activated sludge process can be separated into two different paths, the first being return activated sludge (RAS) and the second being waste activated sludge (WAS). The RAS stays within the Oxigest basin, as it is pulled from the bottom of the inner clarifier sludge blanket and returned to the aeration basin. This is accomplished by an air lift pump that operates off the same blowers that provide air to the aeration basin and aerobic digester. The WAS is collected in the last zone of the aeration basin and is pumped by a small stand-alone trash pump to the aerobic digesters through a flexible 2" hose. The original Oxigest system had an internal WAS pumping station but due to the modifications and removal of the original digestion compartment the plant has since changed the solids handling process.

5.3.2 Aerobic Digester

With the modification of the original Oxigest system to an extended aeration process, the aerobic digestion is accomplished in external concrete basins. The original 1930s plant design included aeration basins which are used as the Aerobic Digesters now. These basins are approximately 60 feet long by 10 feet wide each and 13.5 feet deep. They are hydraulically connected by square openings in the middle walls as depicted in Figure 5.1.2 providing a total volume of 112,000 gallons.

The basins are equipped with 12 course bubble diffusers each fed from the airline header system located on the top of the middle basin wall, as shown in Figure 5.3.1. This header system distributes the air to each basin providing dissolved oxygen and mixing to allow for volatile solids reduction. The decant from the digesters is released through the 4" telescoping valves and the decant is routed back into the plant influent flow just after the headworks. The solids are removed from the bottom of the basins through 8" valves that are located on the opposite end of the telescoping valves. The sludge is then routed to the dewatering system through an 8" cast iron line.

Figure 5.3.1 Aerobic Digester

5.3.3 Dewatering System

The wastewater treatment plant was originally designed with sludge drying beds to dewater the sludge. The original design had four drying beds that were in use until the dewatering system upgrades in 2008. These upgrades removed two of the drying beds and replaced them with a mechanical dewatering system. The mechanical dewatering system consist of a 1.0 Meter belt press, polymer feed system, and sludge cake transfer pump as shown in Figure 5.3.2.

Figure 5.3.2 Dewatering Press

5.4 Historical Wastewater Plant Improvements Projects

5.4.1 Operational Adjustments

The NWC WWTP staff and operators have taken a proactive approach over the years when it comes to adapting to needed process adjustments and modifications to the plant. These changes have occurred due to new effluent limits, changing influent characteristics, and nutrient studies reviewed by the State. The forward-thinking approach taken by plant operators has been the primary reason for the continuity of the S&L treatment unit for over 60 years. This extends well past what is generally considered the expected useful life of equipment.

As noted in earlier sections, one of the major modifications to the plant has been the removal of the aerobic digester out of the S&L Oxigest. This removal allowed for the addition of another aeration zone and rerouting of the influent flow. The influent flow previously entered the basin in the last aeration zone and would short circuit into the clarifier without receiving the necessary retention time in the aeration zone. The rerouting of the influent into the new zone allowed for additional contact time, proper circulation around the basin.

The operators have experimented with additional diffusers and pure oxygen feed in the aeration basins to provide additional dissolved oxygen levels to increase microbial growth and treatment. The outcome of this experiment has helped the plant fine tune the air cycles and mixing periods to accomplish the necessary treatment to meet permit limits.

More recently, chemical additives have been introduced at the plant since the summer of 2021. The chemical additive consists of Polyaluminum Hydroxychloride. This chemical is an inorganic highly effective coagulant, which helps on the removal of phosphorus by precipitating the phosphorus particles out of the liquid waste stream and turning it into sludge. By getting the phosphorus into the sludge, the phosphorus is then removed through the WAS and sludge dewatering instead of passing through the plant effluent.

5.4.2 Nutrient Studies

NWC's WWTP has been part of the Tennessee Plant Optimization Program (TNPOP) since 2014. This program has provided additional guidance on plant optimization for nutrient removal. Data reviewed for this report dated from 2016 and 2017 and monitored total phosphorus and total nitrogen removal. The results of this study showed through a series of operational changes, including experimental chemical additives, varying air feeds, mixing adjustments, side stream processes, and retention times, the plant can reduce the phosphorus and nitrogen residuals in the effluent.

Since the study has concluded, the plant staff has been recording and providing quarterly rolling average of Total Nitrogen and Total Phosphorus effluent concentrations as required in the NPDES permit. Due largely in part to the extensive operational adjustments performed by operators as part of the study, the recorded effluent concentrations have not increased over time. These process modifications as utilized in the study continue to be used to this day.

6.0 COLLECTION SYSTEM ANALYSIS

In order to develop an inventory of the existing NWC sanitary sewer system, NWC chose to begin a detailed field investigation and data collection effort. Five primary elements were targeted during the field investigation, including collection of Global Positioning System (GPS) data for a Geographic Information System (GIS) map, manhole inspections, smoke testing, closed-circuit television (CCTV) inspections, and flow monitoring. These form the basis of NWC's Sanitary Sewer Evaluation Survey (SSES) program, which were used to create a calibrated sewer model for flow analysis. The goal of NWC's SSES program is to determine the scope of the sewer rehabilitation required to effectively reduce RDII.

6.1 Sewer System GIS Mapping

Norris Water Commission has extensive paper records of their sewer system, beginning with the original blueprints from the establishment of the community as part of the Norris Dam construction in 1934 and including records from the incremental development that has occurred over the past 90 years. However, NWC had never undertaken a comprehensive mapping effort of their public sanitary sewer system.

NWC received a Notice of Violation on September 2021. In response to TDEC's written notice, NWC began the process of identifying steps to take to understand the violation and create a plan to address the issues. In November 2021, NWC contracted with CCI to create a digitized system map of all assets. Initial estimates from record drawings review prior to the project estimated 187 total MHs within NWC's system. CCI collected GPS data on every manhole in NWC's system, totaling 247 MHs and created an ESRI-based GIS system for NWC's continued use. This investigation mapped over 60 MHs that were not specifically identified through other paper records. Additionally, CCI added a sequential numbering system to allow NWC to more clearly identify and locate their manhole assets.

6.2 Manhole Inspections

As part of the field work associated with NWC's GIS Mapping effort, CCI also collected manhole video inspections using a 360° inspection camera. These videos are linked to each asset in the GIS system for future access.

Collecting the video inspections will allow NWC to perform future condition assessments as part of rehabilitation projects. The primary purpose is to identify I&I, structural defects, ensure manhole accessibility, and confirm surface conditions. As part of the SSES effort, NWC inspected all 247 manholes within their system to provide a baseline for future condition assessments.

An example of the video inspection data is shown in Figure 5.2.1.

Figure 6.2.1 Manhole Inspection Data Example

6.3 Smoke Testing

As part of NWC's proactive efforts to collect data on their sewer system, smoke testing of the entire collection system was contracted to CCI in February 2022. Smoke testing is a cost-effective method to identify point sources of I/I and storm sewer cross connections when entering the sanitary sewer collection system.

Smoke Testing will be performed during summer months and anticipated dry weather later in 2022 to minimize groundwater levels and increase the performance of the smoke testing. Each defect will be recorded by field staff and will include notes on category, grade, surface cover, general site description, and photographs. These smoke testing results will be captured using an ESRI-based data collection product and will be integrated into NWC's GIS system.

6.4 Closed-Circuit Television (CCTV) Investigations

In addition to smoke testing, NWC entered into contracted with CCI in February of 2022 to perform CCTV Inspections. Work began in late April 2022 and was not complete at the time of this report. As the first phase of their SSES efforts, NWC contracted the inspection of 15,000 LF (approximately 1/3) of the sewer system to a subcontractor, and the initial scope was targeted to focus on areas that show high RDII response and have not been rehabbed in the last 20 years. Depending on the findings of the first phase of CCTV investigations, subsequent work may be performed if warranted.

After CCTV inspections are complete, characterizations of the CCTV videos will be performed in multi-step process. The first step will include the initial viewing of the CCTV video and creation of the spreadsheets that document the condition of the sewer line. After the initial condition assessment, the second step will categorize and score the defects to determine the appropriate method of correction: leave as-is, replace, or rehabilitate.

6.5 Flow Monitoring

The purpose of flow monitoring is to collect wastewater flow data in order to evaluate flow volumes and changes in flow during dry-weather and wet-weather periods. Flow monitoring data is used to calibrate the hydraulic sewer model, which will allow NWC to analyze and quantify improvements, reduction in I/I, and capacity limitations in their system.

NWC began flow monitoring efforts with the installation of three (3) temporary area/velocity flow monitors installed throughout the system and one (1) rain-gauge installed at the WWTP. The temporary flow monitoring period began on February 15, 2022 and is set to continue for 90 days. In order to meet TDEC's schedule for a response within 90 days of Norris' receipt of the Director's Order, draft flow monitoring data from the first 60 days of the study has been used in order to identify preliminary targets for RDII. Final RDII results will be evaluated after the completion of the flow monitoring study period. See Figure 6.5.1 for a visual representation of the locations of each flow monitor and sub-basins.

Flow monitoring sites were selected to divide the existing sewer system into three equivalent sub-basins, with the intention of identifying smaller areas with the highest observed response to wet-weather events. Identifying high-response areas will allow for the future SSES investigation and rehabilitation efforts to be targeted for more effective results. A graph of the draft data, through April 18, 2022, is included. See Figure 6.5.2.

6.5.1 Rainfall Data

The monitoring period was selected during late winter and early spring seasons, when high-intensity storm rains are commonly seen. However, during the monitoring period for NWC's data, the rain events that occurred were primarily low-intensity storms. For the 60-day period beginning on February 15, 2022, twenty-one (21) individual rain events were recorded, with a 48-hour period from February 22 to February 24 producing the largest two storms during the monitoring period. The February 22 storm produced the most significant event of the monitoring period with an annual recurrence interval (ARI) of 5-years. No other rain events reached the 1-year ARI rating. See Figure 6.5.3 for a comparison between NOAA data and recorded rainfall events.

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N

Existing Sewer

- WWTP
- Dale Road Subbasin
- Deer Ridge Road Subbasin
- Sawmill Road Subbasin
- Not Metered
- Manhole
- PS — Sewer Lift Station
- Sewer Force Main
- M — Flow Meter

MH 42: Flow Meter 2

MH 33: Flow Meter 1

MH 12: Flow Meter 3

Zone	Diameter	Linear Feet
Dale Road Subbasin	4"	180
	6"	1,608
	8"	16,910
	10"	555
	12"	0
Deer Ridge Road Subbasin	4"	0
	6"	0
	8"	10,805
	10"	0
	12"	0
Sawmill Road Subbasin	4"	259
	6"	895
	8"	11,549
	10"	764
	12"	2,832

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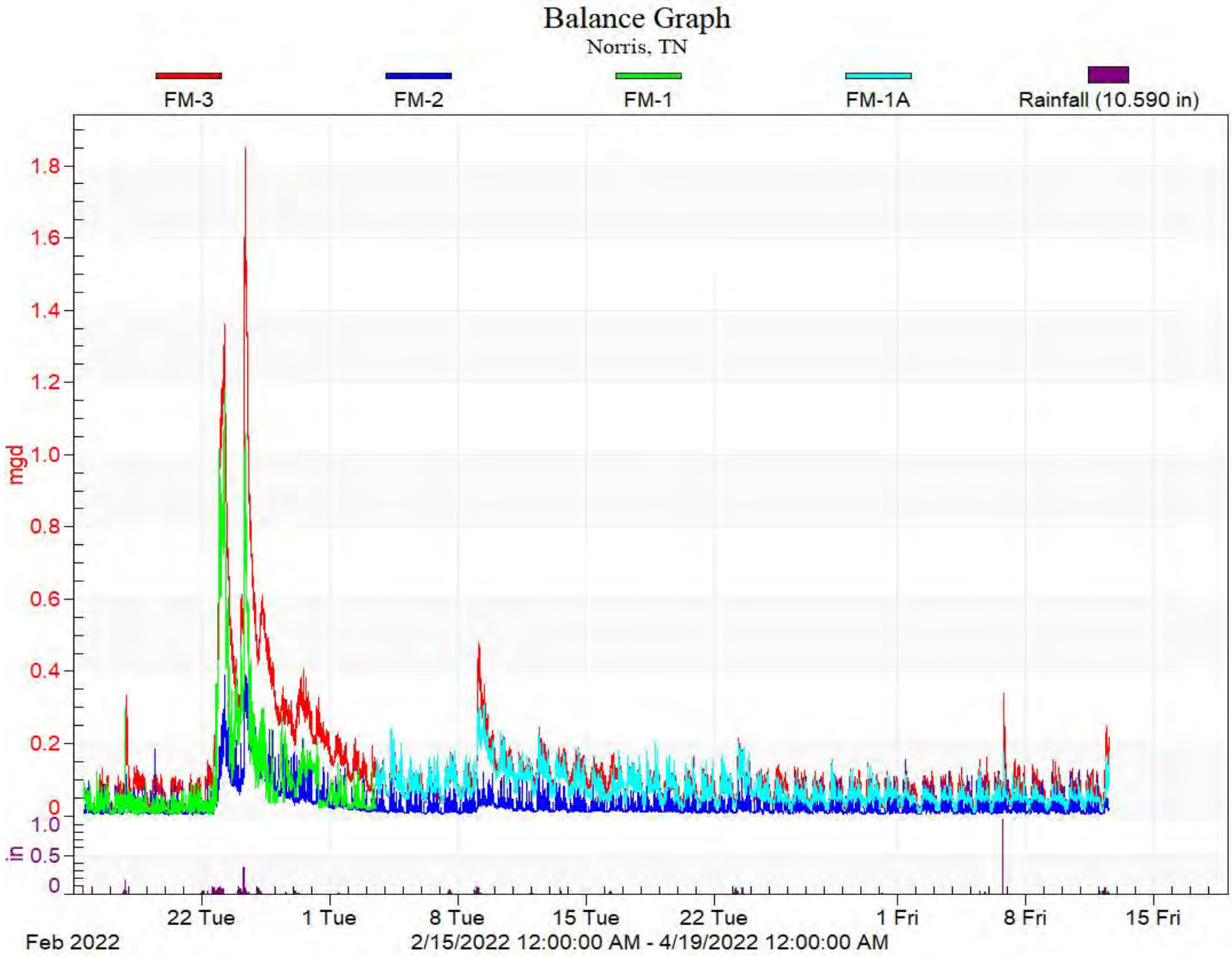
CORRECTIVE ACTION PLAN
FLOW METER ZONES

6.5.1

Figure 6.5.2


Balance Graph
Norris, TN
FM-3
FM-2
FM-1
FM-1A
Rainfall (10.590 in)
mgd
1.8
1.6
1.4
1.2
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0.8
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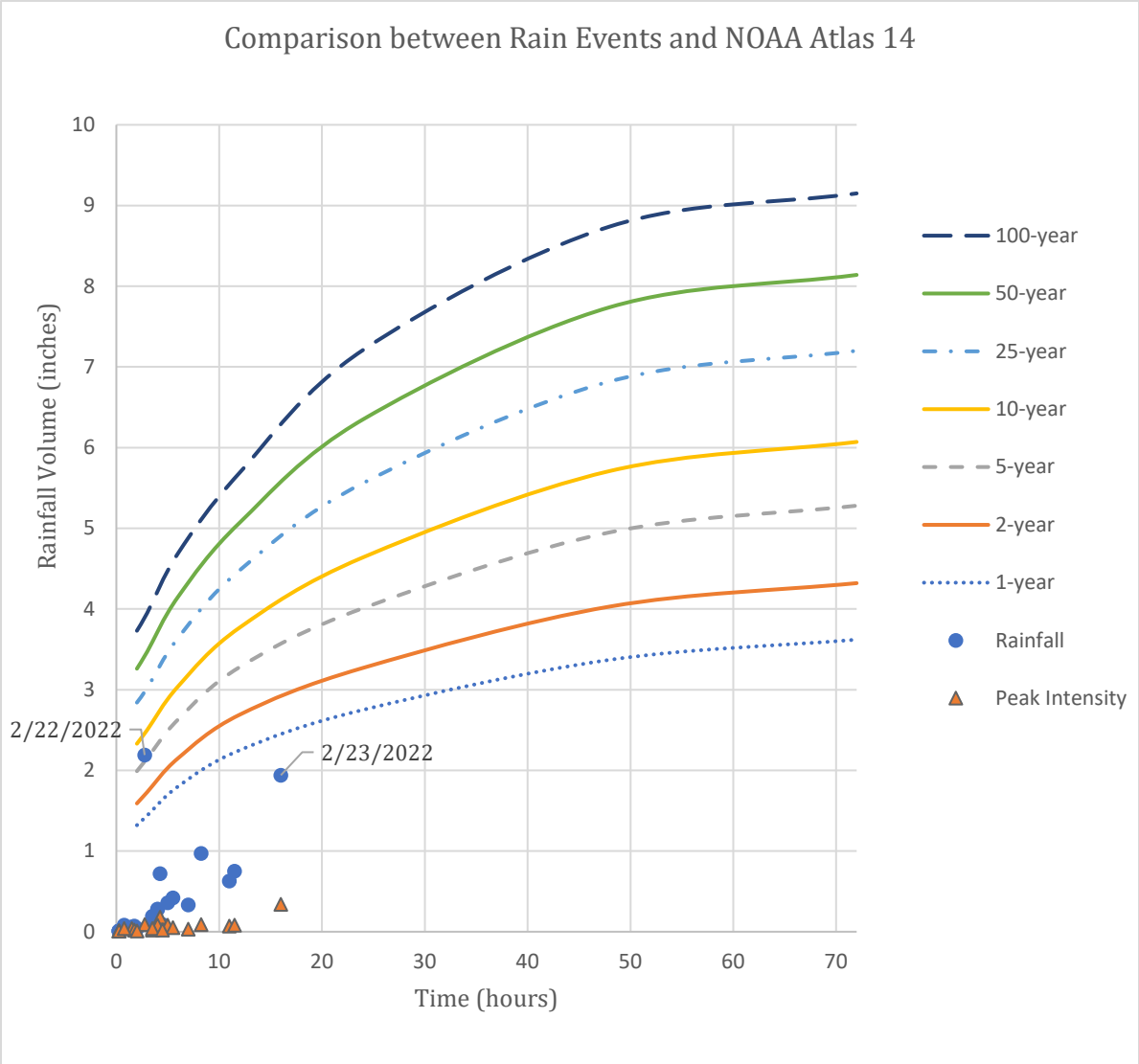
2/15/2022 12:00:00 AM - 4/19/2022 12:00:00 AM

Figure 6.5.3 Rain Event Data Comparison



6.5.2 Existing Flows

In general, wastewater flows into a sanitary sewer system can be divided into three categories: 1) base wastewater flow (BWF) associated with sanitary flow contribution, 2) groundwater infiltration (GWI) associated with flows entering during dry weather periods, and 3) rainfall-derived inflow and infiltration (RDII) associated with extraneous flows from wet weather events. RDII sources can include cracks, openings, open joints in sewer mains, manholes, and building laterals, as well as through direct or indirect connections between storm drains and sanitary sewers and from illegal connections on private property.

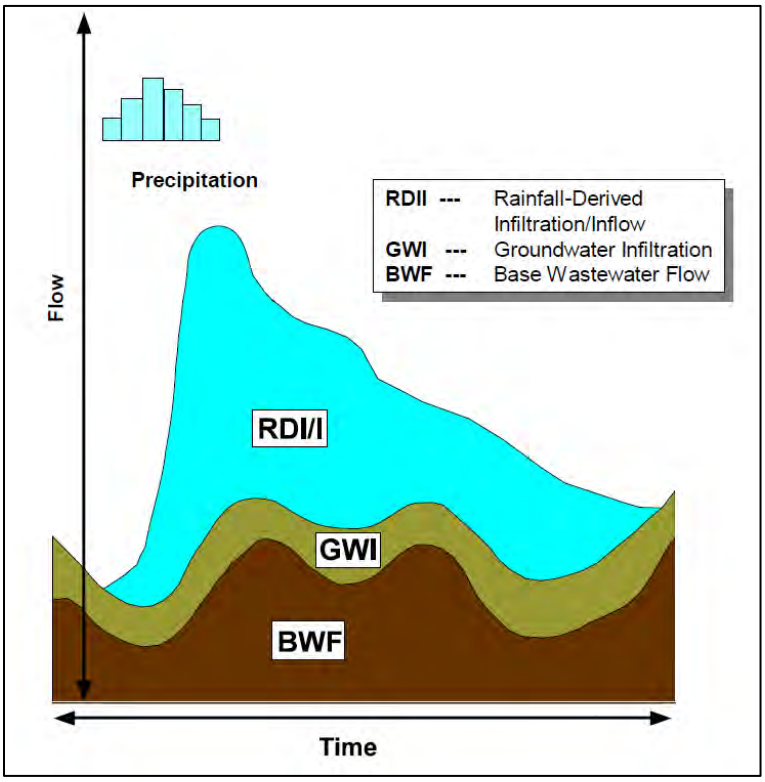
Base Wastewater Flow (BWF) is the residential, commercial, and industrial flows discharged into the sanitary sewer system for collection and treatment. Residential flows are a function of population, population density, water consumption, and land uses. As a result, flow estimation and projections usually involve a review of existing land use and demographic data and metered water billing data. NWC's BWF is primarily residential, as 556 of the 568 total sewer customers are residential users, as of March 2022. Twelve (12) total customers compromise NWC's commercial user base. No industrial customers are in operation within NWC's system at the time of writing of this report.

Groundwater Infiltration (GWI) refers to that portion of the wastewater embedded in the monitored dry-weather flow (DWF) that represents the infiltration of groundwater entering the system through leaking pipes, pipe joints, and manhole walls. GWI varies throughout the year, often trending higher in late winter and early spring as groundwater levels and soil moisture levels rise, and decreasing in late summer or after extended dry periods.

Together, GWI and BWF combine to represent the DWF that occurs in a sanitary sewer system. While there is no exact way of metering GWI and BWF separately, flow monitoring is often performed in early spring, when groundwater tables are high and outdoor water use for irrigation or recreation is low. During this time, residential wastewater is often assumed to be the same as the billed water use, and GWI can be calculated as the difference between the measured DWF and the wastewater flow determined from the billed water use. When looking at minimum flows (often overnight, between 2-4 AM) within a system during dry-weather periods, commonly-accepted engineering guidance indicates that only 10% of DWF is due to BWF, with GWI representing the other 90%.

Rainfall-Derived Inflow and Infiltration (RDII) is the portion of a sewer flow hydrograph above the normal DWF flow pattern. It is a sewer flow response to rainfall or snowmelt in a sewershed. As seen in the hydrograph in Figure 6.5.4, RDII flows are caused by precipitation, increasing during a storm event before declining to zero sometime after a storm has ended. In NWC's system, RDII is the major component of peak wastewater flows and treatment capacity issues. Most bypass violations at the WWTP are attributable to high levels of RDII.

Figure 6.5.4 Three Components of Wet-Weather Wastewater Flow (EPA, 2008)



In order to characterize the existing flows and calculate RDII, preliminary flow monitoring and rain gauge data for the period of February 25 – April 15, 2022 was imported into EPA's Sanitary Sewer Overflow Analysis and Planning (SSOAP) Toolbox.

The SSOAP Toolbox's DWF Analysis feature was used to identify dry-weather flow periods measured for the 2-month monitoring period selected for use in this report. Since the available period of time for flow monitoring data was limited to early spring, rain events occurred frequently during the monitoring period. As a result, no periods were identified through SSOAP's analysis that met the criteria for the 7-day antecedent dry period. Manual adjustments were required to identify the two driest periods, and these were then used to develop average base flow hydrographs for a typical weekday and weekend day. Each dry-weather flow hydrograph was divided by the average daily flow for that hydrograph to obtain a "normalized dry-weather hydrograph."

Once the dry-weather hydrographs were created, the flow monitoring data could be separated into components of BWF, DWF, and RDII. The SSOAP Toolbox was used to compute the volume of RDII and the volume of rain that fell on each of the three sewersheds. Using the volume of RDII, a percentage of the total was calculated by the SSOAP WWF Analysis to identify the amount that enters the sewer system as RDII. This value is known as the R-Value and is the critical component of identifying the worst portions of the sanitary sewer system for targeted rehabilitation. The higher the R-Value, the more rainfall-derived flows are entering the system during storm events.

The RDII prediction method used was the synthetic unit hydrograph (SUH) method, which assumes that RDII in a sewershed is similar to the stormwater runoff in a watershed. This method allows for RDII to be extracted from specific inputs of precipitation volume, duration, and sewershed area.

The RTK method was selected from the many possible SUH methods for use in NWC's analysis. This method applies three triangular unit hydrographs to an observed RDII hydrograph derived by SSOAP from

site-specific flow monitoring data. A unit hydrograph is defined as the flow response that results from one inch of rainfall for a specific time period. The three hydrographs are used to reflect the fast, medium, and long response to the RDII, as the shape of the RDII hydrograph is too complex to be represented by a single average, or composite, hydrograph.

The shape of each of the three-unit hydrographs that comprise the RTK method is defined by the three parameters that make up the name of the method: R, T, and K. R represents the fraction of rainfall falling on the sewershed area that enters the sewer system as RDII. T is the time (in hours) to peak RDII flow. K describes the time for the RDII to recede as a ratio to the time to peak flow. The sum of the R values (R_1 + R_2 + R_3) equals the total R-Value for the storm event, reflecting the percentage of the total rainfall over the sewershed that entered the sewer system.

Iterative analyses of the hydrographs for each flow monitor were performed to find the combination of R, T, and K values for each of the three triangles in the RDII hydrograph.

6.5.3 Projection of Future Flows

As part of the analysis of the flow components, the City of Norris desires to look at historical population trends and in order to make projections for future flow capacity. US Census data were referenced from 1950 to 2020.

Table 6.5.1 Norris Population per US Census, 1950-2020

NORRIS POPULATION		
Census Year	**Total Population**	**% Change from Previous Census**
1950	1,134	
1960	1,389	+22.5%
1970	1,359	-2.2%
1980	1,374	+1.1%
1990	1,303	-5.2%
2000	1,446	+11.0%
2010	1,491	+3.1%
2020	1,602	+7.4%

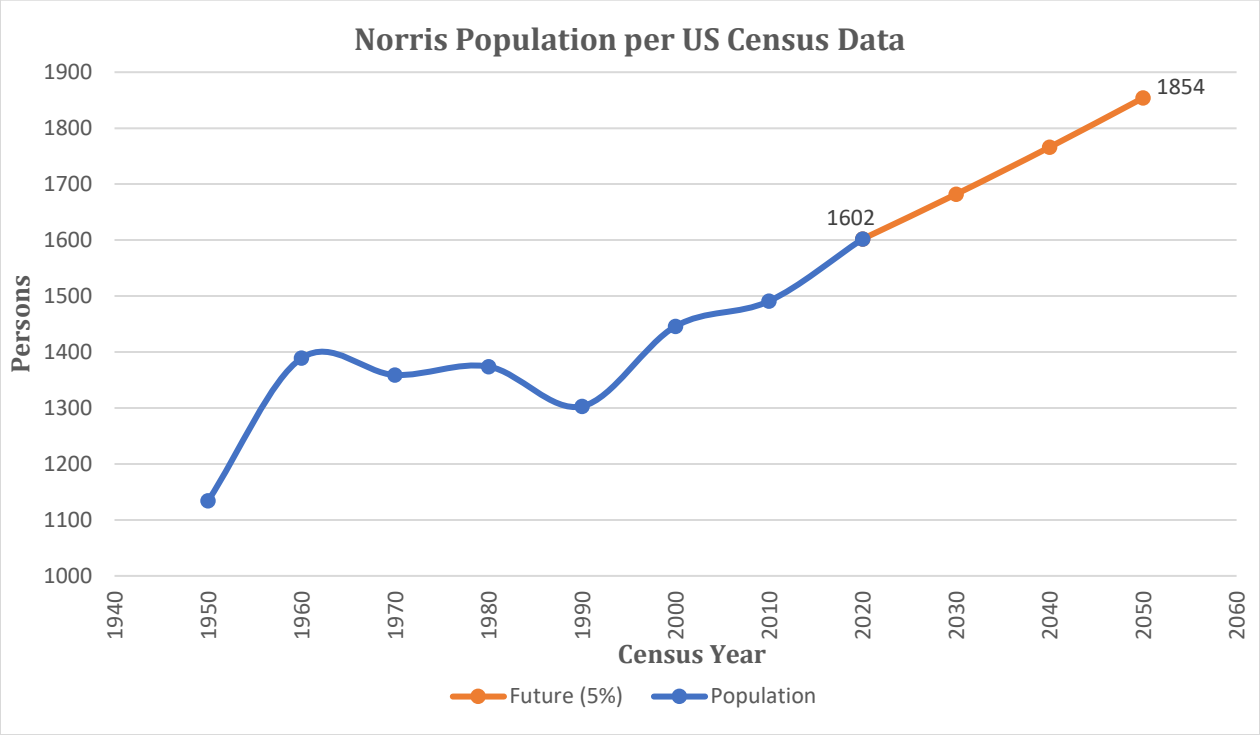
Within the corporate limits of Norris, the majority of parcels have either already been developed for residential use or are dedicated to TVA as recreational easements. Land for new development is believed to be limited. Discussions with City staff indicate that growth prospects for Norris are thought to be limited to 5 larger, undeveloped parcels along Andersonville Highway and Norris Freeway to the southern portions of the city.

Three (3) parcels along Norris Freeway total approximately 100 acres and could be developed into further residential units. Applying Norris' traditional development scale of 1 unit per 2 acres, 50 additional units could be constructed as part of future development. Additionally, two parcels along Andersonville Highway total 18 acres and could see future commercial development due to their proximity to a major arterial road.

Research by the Boyd Center for Business and Economic Research at the University of Tennessee, Knoxville was reviewed to confirm growth prospects for Anderson County. Anderson County is expected to grow by 7.4% over the next 30 years. While Norris can expect to benefit from Anderson

County's higher growth rates, given limitations on available land, an assumption of 5% was used for future demands on the sanitary sewer system.

Figure 6.5.5 Norris Population History and Projections



6.6 Hydraulic Model Development and Results

A hydraulic model was developed using InfoSewer software from Innovyze. GIS data collected during the GPS field efforts provided the base data for the model. Flow monitor and rainfall data were analyzed and used to calibrate the model to dry-weather and wet-weather conditions.

Water billing data from the City of Norris was received for the 12-month period prior to March 2022. Average and peak water demands were allocated to each service address and applied to the GIS base data that was collected during the manhole inspection performed in 2021. This data was used as part of the base wastewater flow (BWF) calculation.

As mentioned in Section 6.5.1, dry-weather and wet-weather hydrographs were created using EPA's SSOAP software. Using the dry-weather hydrograph output, a modeled flow pattern was developed based on the normalized diurnal base flow. Given the vast majority of sewer customers in Norris are residential, the BWF hydrograph reflects the diurnal nature of water use and the sewer flows that follow.

Referencing Figure 6.5.1, FM#2 (Deer Ridge Road Sewershed) experiences peak flows that are heavily influenced by the pump station discharges from Hickory Trail Pump Stations #1 and #2. As a result, the peak dry-weather flows are not able to be matched to the ideal 10%± calibration target for modeled output. While matching peak flows is important, the primary objective to indicate dry-weather flow calibration is peak volume. For FM#1 and FM#3 (downstream flow monitors), volumes were able to be matched in modeled dry-weather scenarios to within 2%, well within the tolerance expected for a calibrated hydraulic model.

FM#2 was able to match peak volume within 15% tolerance as a result of direct effects of the pump station discharges. To highlight the challenge in calibrating FM#2, it is important to note that peak flows are 15-

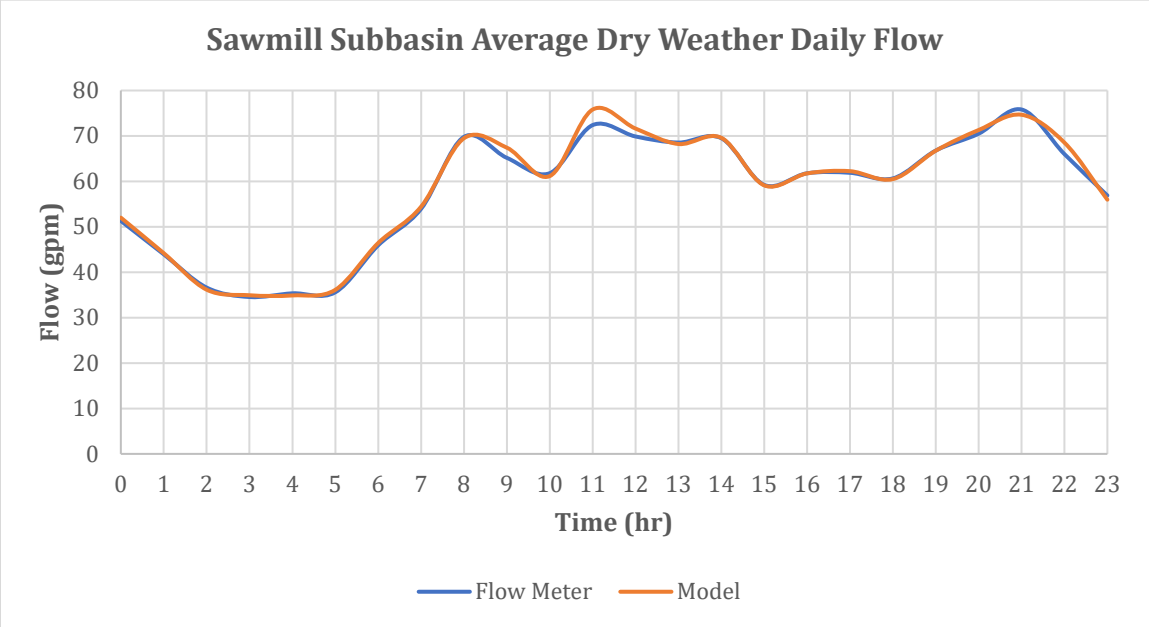
times higher than minimum flows. Further calibration efforts will be performed at the conclusion of the flow monitoring period, and integration of final data is anticipated to bring the volume match range to less than 10%. See Table 6.6.1.

Table 6.6.1 Dry-Weather Flow Calibration

DRY-WEATHER FLOW CALIBRATION							
SITE INFORMATION		**PEAK FLOW (MGD)**			**PEAK VOLUME (MG)**		
Site	**Sewershed**	**Meter**	**Model**	**% Match**	**Meter**	**Model**	**% Match**
FM#1	Dale	0.2	0.0999	50%	0.070	0.070	**100%**
FM#2	Deer Ridge	0.131	0.0238	18%	0.021	0.019	**87%**
FM#3	Sawmill	0.177	0.1154	65%	0.081	0.083	**102%**

A comparison of the normalized dry-weather hydrograph and the modeled flow is shown in Figure 6.6.1.

Figure 6.6.1 Sawmill Subbasin Dry Weather Calibration



The NWC flow monitoring effort began on February 15, 2022 and was scheduled for a 90-day monitoring period. For the purposes of this report, and in order to meet the CAP/ER deadline to TDEC, draft data were analyzed up to April 15, 2022. There were four rainfall events during this period that were selected for analysis and creation of wet-weather hydrographs using the EPA SSOAP toolbox, which were then included in the hydraulic model to calibrate for storm events. These rain events are shown in Table 6.6.2.

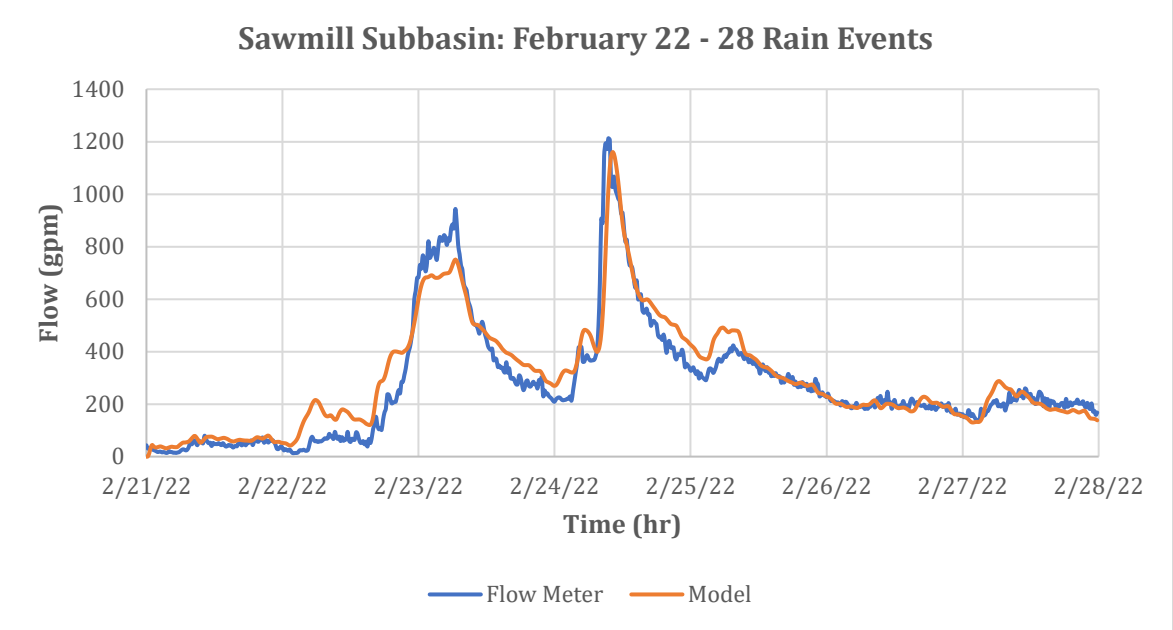
Table 6.6.2 Calibration Storm Events

RAIN GAUGE DATA		
Start Date of Rain Event	**Total Rainfall (inches)**	**Duration (hours)**
February 17	0.54	12.58
February 22	4.92	232.75
March 8	0.97	66.92
March 23	0.63	30.50

Using the EPA SSOAP toolbox, these four events were selected for use in developing the RDII hydrograph for each particular site.

Wet-weather hydrographs were developed by applying the RTK parameters developed in the SSOAP software to each sewershed in the Infosewer model, as discussed in Section 6.5.1. Once the RDII hydrographs were applied to the model, output from these events were compared to the observed wet-weather response at each of the flow monitor locations. An example of a flow comparison between metered and modelled flow can be seen below in Figure 6.6.2.

Figure 6.6.2 Sawmill Subbasin Rain Event Calibration



Results from the SSOAP toolbox produced calculated R-Values for each of the three flow monitoring sites. Table 6.6.3 lists the results.

Table 6.6.3 SSOAP Calculated R-Values

Calculated R-Values		
Site	**Sewershed**	**R-Value (%)**
FM#1	Dale Road	10.0
FM#2	Deer Ridge Road	8.0
FM#3	Sawmill Road	18.5

After the dry-weather, wet-weather, and RDII values were calculated, the final portion of the analysis was the selection of the design storm event. TDEC does not specify a design storm event in the published Design Criteria for Review of Sewage Works. Based on the average rainfall events that occur in Norris and design standards adopted by peer municipalities throughout the East Tennessee region, a 2-year, 24-hour storm event was selected.

The National Weather Service National Oceanic and Atmospheric Administration (NOAA) publishes an online Atlas 14 that provides rainfall frequency estimates for the United States and describes how to determine the rainfall recurrence frequency of a given wet weather event. Specific values based on NOAA's Atlas 14 are shown below.

For Norris, TN, the 2-year, 24-hour storm event simulates 3.27 inches of rainfall over a 24-hour period. Rainfall values, hyetographs and distribution curves for this design storm are depicted in Table 6.6.3, Figure 6.6.3 and Figure 6.6.4.

Table 6.6.4 Precipitation Frequency Estimates for Norris, TN

NOAA ATLAS 14 PRECIPITATION ESTIMATES FOR NORRIS, TN		
DURATION	**1-YEAR**	**2-YEAR**
5-min	0.331	0.392
10-min	0.528	0.627
15-min	0.660	0.789
30-min	0.905	1.09
60-min	1.13	1.37
2-hr	1.32	1.59
3-hr	1.44	1.73
6-hr	1.80	2.15
12-hr	2.25	2.69
24-hr	2.75	3.27

Figure 6.6.3 Design Storm Hyetograph

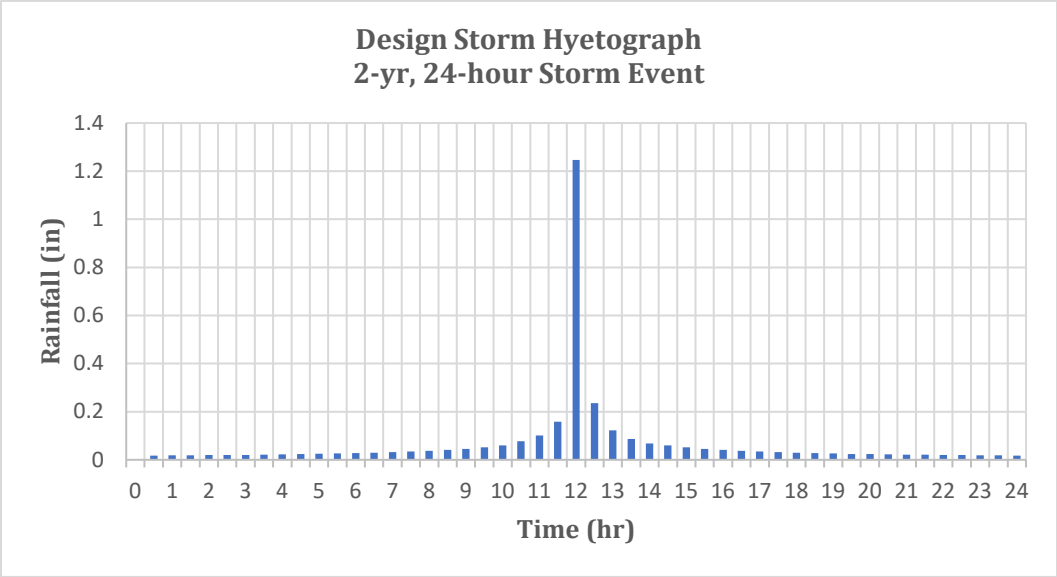
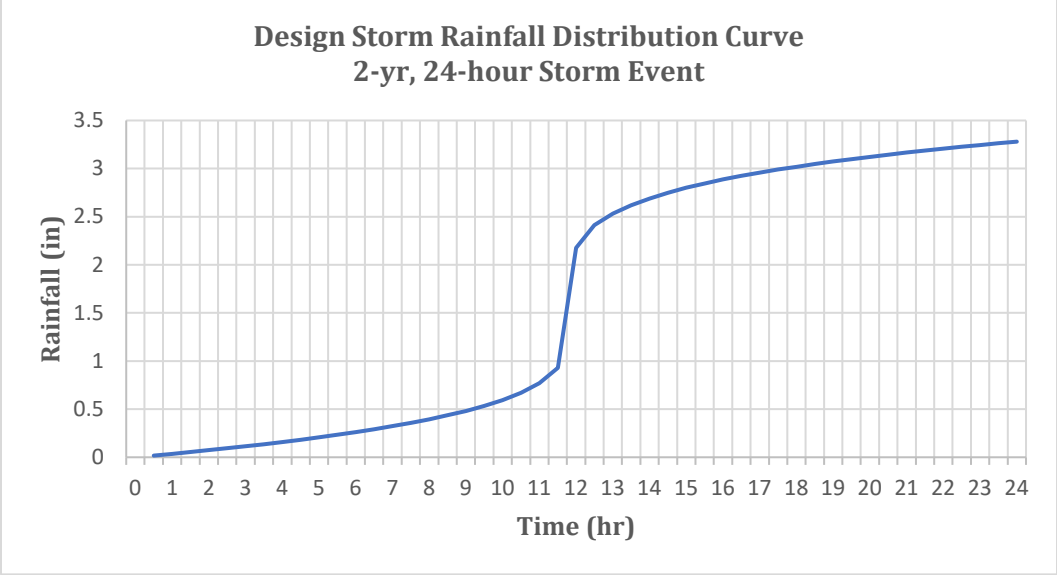


Figure 6.6.4 Rainfall Distribution Curve



7.0 WASTEWATER TREATMENT PLANT ANALYSIS

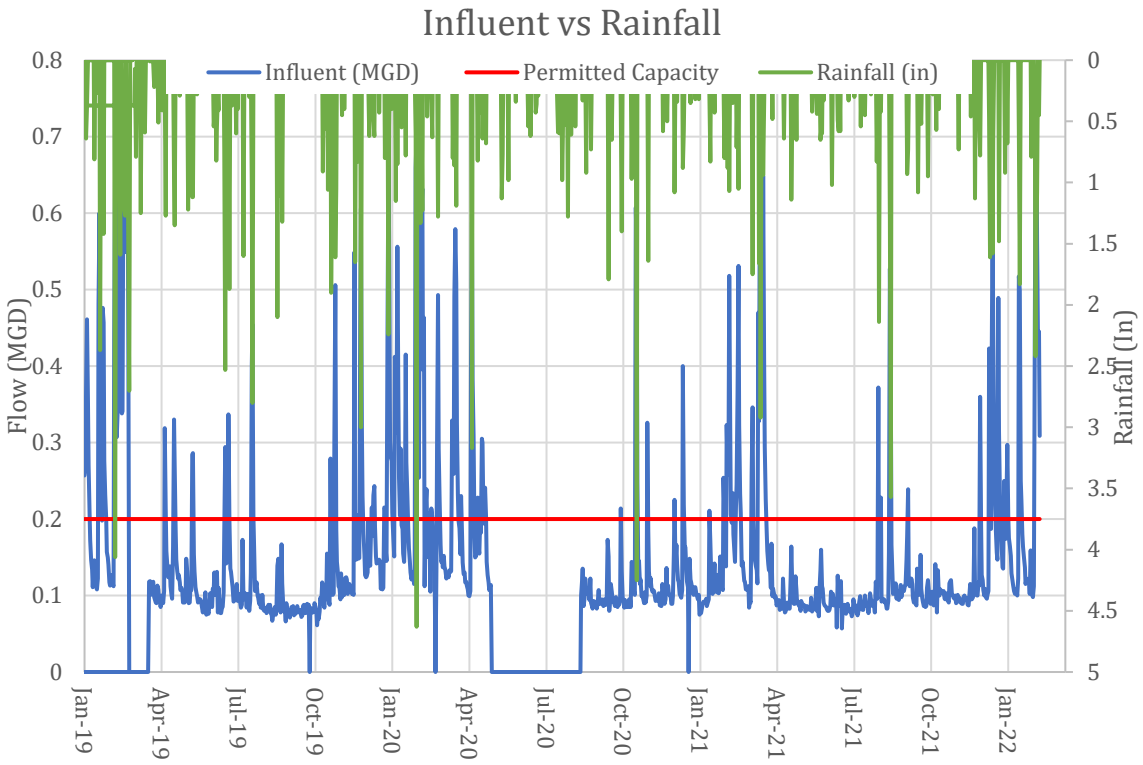
7.1 Monthly Operating Reports Data Review

A review of the MORs from January 2019 through March 2022 was conducted. This review considered the influent characteristics, effluent constituents, influent and effluent flows, and plant process effectiveness.

7.1.1 Plant Flows

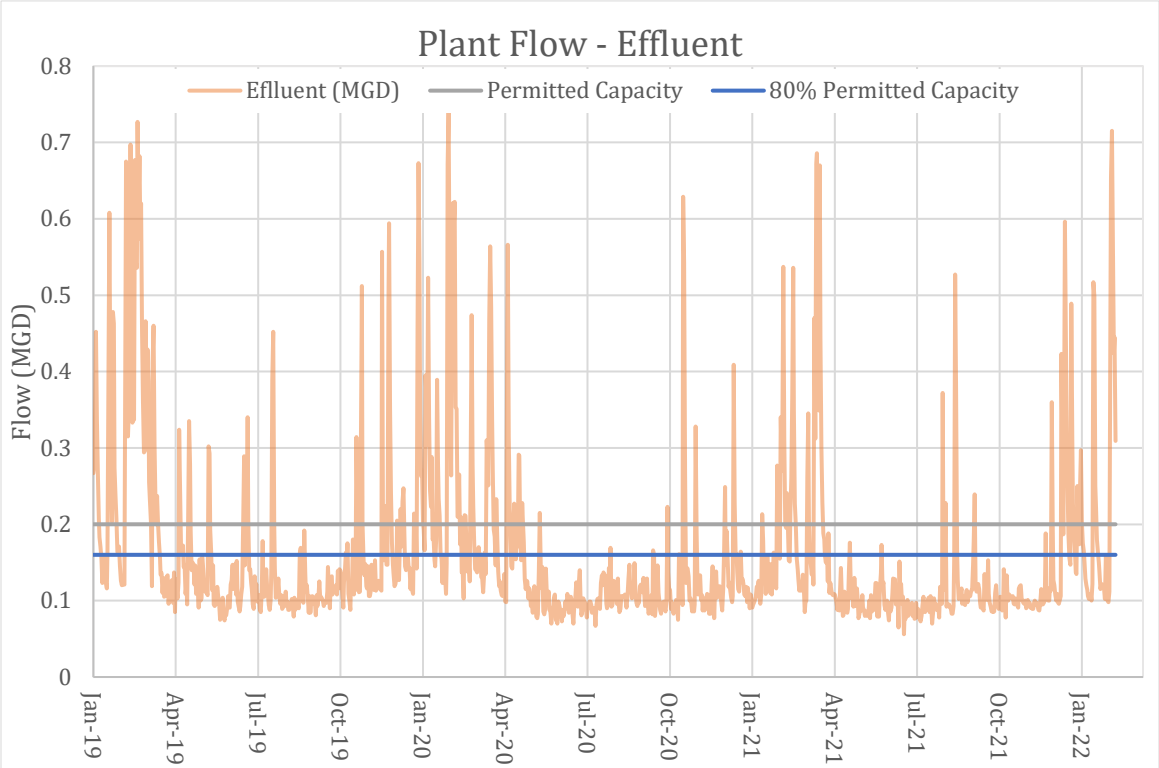
The WWTP's influent and effluent flows are recorded on a daily basis. The influent meter is located at the headworks and the effluent meter is located within the chlorine contact basin. The MOR flow data shows average influent and effluent flow over the last 3 years of approximately 150,000 gallons per day (GPD) or 0.15 million gallons per day (MGD). This value was influenced significantly by inflow and infiltration during rain events, as the average dry-weather flow at the plants is approximately 0.083 MGD, which aligns with the hydraulic model as described in Table 6.6.1, and shown below in Figure 7.1.1. Note that the MOR data includes a period of several months in mid-2020, when problems with NWC's influent meter restricted the ability to accurately monitor and measure flow levels.

Figure 7.1.1 Influent Flow vs Rainfall



Comparatively, the effluent flows over the same time period are shown to exceed the permitted capacity a total number of 211 times (days) or 18.27% of the time. In addition, effluent flows exceeded 80% of the permitted capacity of 0.2 MGD 299 times, equal to 25.89% over the same time frame. This is shown in Figure 7.1.2. The maximum effluent flow recorded over the three years of data reviewed was 0.74 MGD which occurred on February 6, 2020. This value is the highest recorded flow value observed during this time frame; however, on this same date, the plant was bypassing, likely skewing this number lower than the real flow values experienced at the WWTP as the bypass flow is not recorded.

Figure 7.1.2 Plant Effluent Flow



7.1.2 Influent Characteristics

Key wastewater characteristics that are measured at the WWTP are CBOD5, TSS, and Ammonia Concentrations. These items give a good baseline of the wastewater strength, as well as provide the influent and effluent parameters to see how effective the treatment process is operating. These items along with others were evaluated at the average and maximum (90th percentile) concentrations as illustrated below in Table 7.1.1.

Table 7.1.1 Influent Data Summary

NWC INFLUENT DATA SUMMARY		
PARAMETER	**AVERAGE**	**MAXIMUM (90TH PERCENTILE)**
Influent Flow (MGD)	0.15	0.293[1]
CBOD5 (mg/L)	314	420.20
TSS (mg/L)	174	248.80
NH3 (mg/L)	36	48.00
Temp (°C)	18	23.00
pH (n.u.)	8	8.00
[1] Maximum flow amount is for 90th percentile recorded, not true peak flow.		

The first characteristic analyzed was the influent concentrations of the 5-day Carbonaceous Biochemical Oxygen Demand (CBOD5). CBOD5 is an important parameter because it serves as an indicator of the wastewater strength entering the plant which can impact biological activity and removal of organics in the wastewater stream.

The average concentration of the CBOD5 over the 3-year time period was 314 mg/L, with the maximum concentration being 420 mg/L. These values put the influent waste water in the medium to strong range of domestic waste water strength. Using the average concentration and the average plant flow of 0.15 MGD, the influent loading of CBOD5 is 393 lbs/day as calculated in Equation 1. Using the 2020 Census data the population of Norris is 1,602, this equates to a loading of 0.24 lbs/day/person, which is above the typical literature value of 0.2 lbs/day/person. This indicates NWC has slightly higher CBOD5 loading than what is typical for a system made of mostly residential customers. Although this value is higher than normal, the NWC plant can handle CBOD5 under normal to low flow conditions. See Section 7.2.1 for more details.

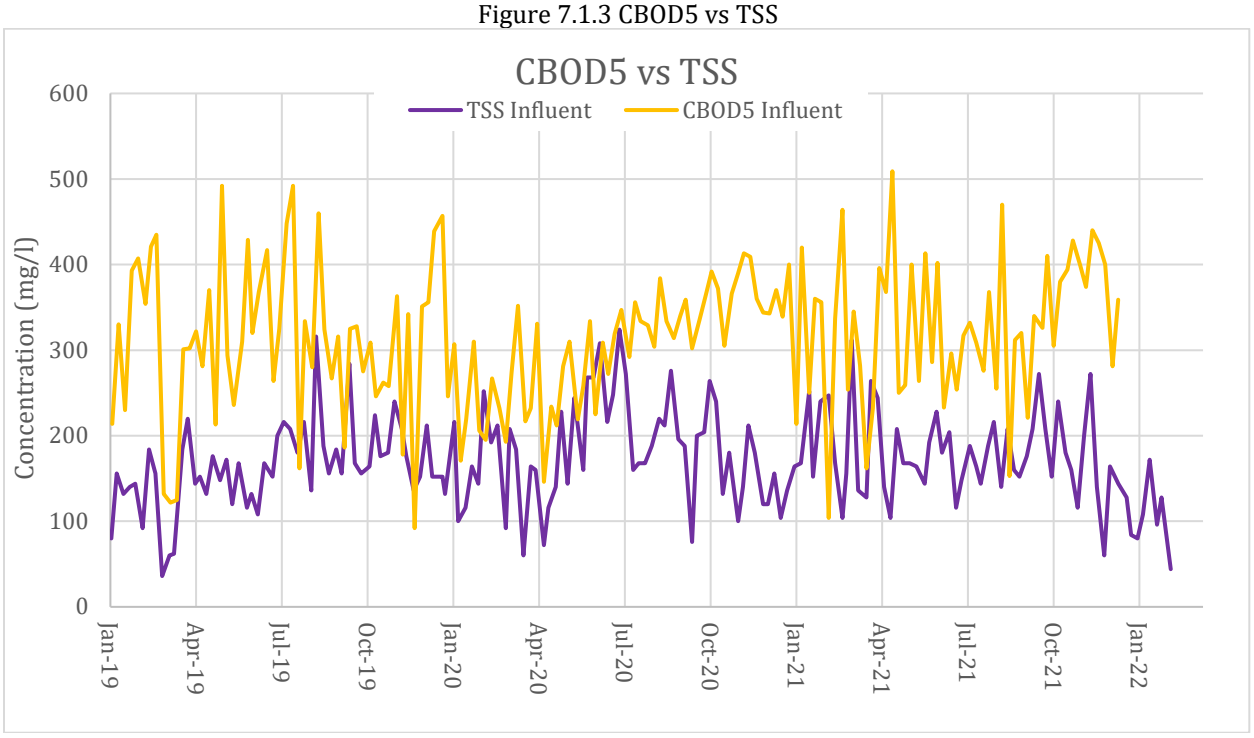
Equation 1 Mass Loading Rate

$$Mass\ Loading\ Rate\ (lb/day) = Flow(MGD) * \frac{8.34\ Lb}{Mgal * (mg/L)} * Concentration(mg/L)$$

The second characteristic analyzed was the Total Suspended Solids (TSS). Similar to CBOD5, TSS is an important parameter because it serves as another indicator of the wastewater quality as it relates to the concentration of particles in the wastewater, which can impact settleability and disinfection.

The average TSS recorded over the time span was 174 mg/L, with the maximum being 249 mg/L. These values are in the low to medium strength range based off of literature values. When comparing the CBOD5 average influent to the TSS average influent, the CBOD5 is 1.8 times the strength of the TSS. This indicates high levels of soluble CBOD5 in the influent as shown in Figure 7.1.3 below. If the influent CBOD5 was more aligned with the concentrations of TSS, the physical characteristics of the influent CBOD5 would consist more of particulate matter than soluble. The physical characteristics of CBOD5 is important as it impacts how CBOD5 is treated and removed from the wastewater. This can impact and influence various processes within a wastewater plant.

Figure 7.1.3 CBOD5 vs TSS



7.1.3 Effluent Characteristics

Norris' current NPDES Permit (TN0020630) expires September 30, 2023, and it includes numerical limits for CBOD, TSS, Ammonia, DO, pH, TRC and E. coli. In addition, the permit also has numerical limits for Total Nitrogen and Total Phosphorous. Based on the review of the MORs for the same time frame as mentioned above, the following effluent summary is provided in Table 7.1.2.

Table 7.1.2 Effluent Data Summary

NWC EFFLUENT DATA SUMMARY			
PARAMETER	**AVERAGE**	**MAXIMUM (90TH PERCENTILE)**	**TN0020630 Permit Limits**
Effluent Flow (MGD)	0.157	0.2906	0.2
CBOD5 (mg/L)	4.59	7.00	10mg/L, Monthly Average
TSS (mg/L)	5.65	10.00	30mg/L, Monthly Average
NH3 as N	1.63	3.06	1.5mg/L, Monthly Average, Summer
			3.25mg/L, Monthly Average, Winter
TN	6.58	14.92	10lbs/day, (3650lbs/year annual)
TP	2.54	5.68	1.7lbs/day, (621lbs/year annual)
pH	7.0	7.2	6.0 to 9.0
Temp (°C)	7.64	8.00	
E. coli	18.23	23.00	126#/100mL G.M.
Dissolved Oxygen (DO)	7.63	5.00	5.0mg/L, Instantaneous Minimum
Notes: Dissolved Oxygen is shown as the average and minimum value recorded as the permit limit is a minimum value in lieu of a maximum value.			

Two important indicators in evaluating the effectiveness of the treatment plant processes are the CBOD5 and TSS removal. The NWC WWTP has operated efficiently on removing these two items as shown in Figure 7.1.4 and Figure 7.1.5. These figures depict the percent removal and CBOD5 and TSS effluent limits compared to the permit requirements. The plant has effectively removed the CBOD5 and TSS over the last 3 years as the percent removal averages 98.3% and 96.3% respectively, which greatly exceed the permit requirements of 85% removal. The few times when the CBOD5 and TSS exceed the permit limits as mentioned previously in Section 3.3.2, the plant was experiencing a filamentous outbreak as well as a biomass washout. Both of these periods can be observed in the below Figures.

Figure 7.1.4 CBOD5 Effluent Concentration and Percent Removal

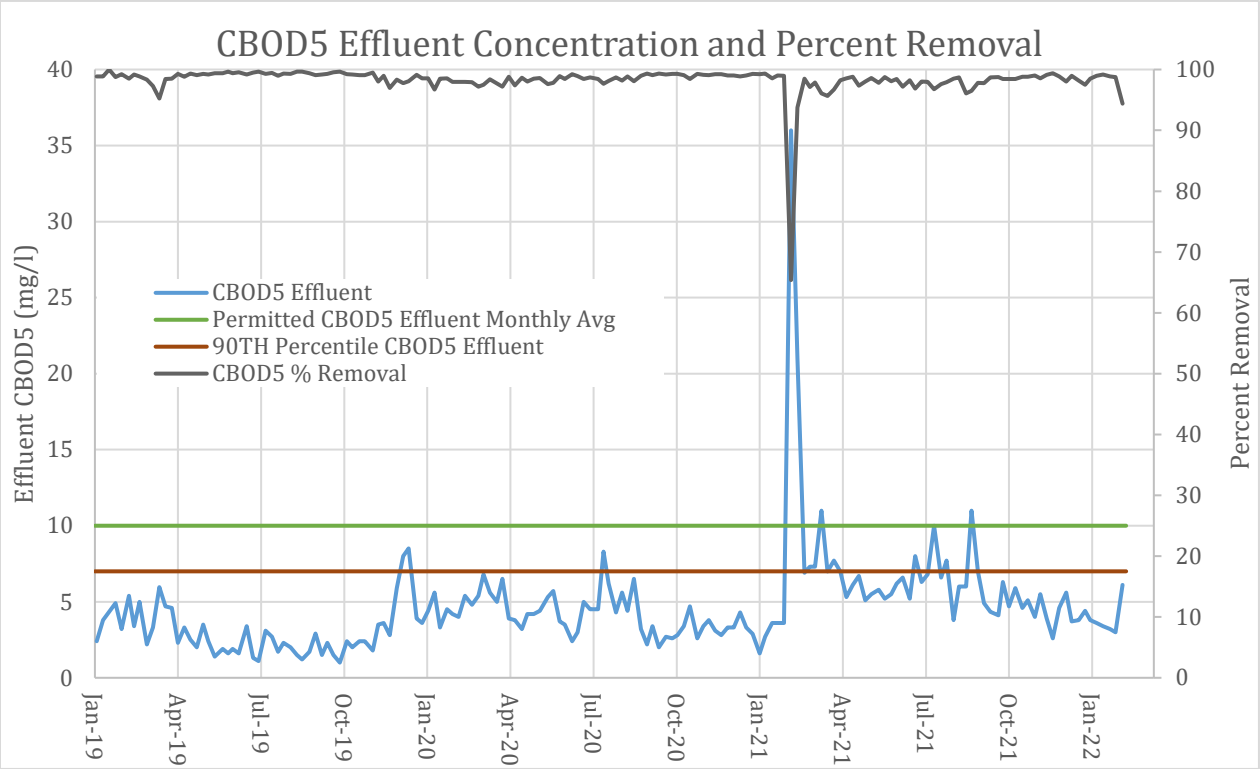
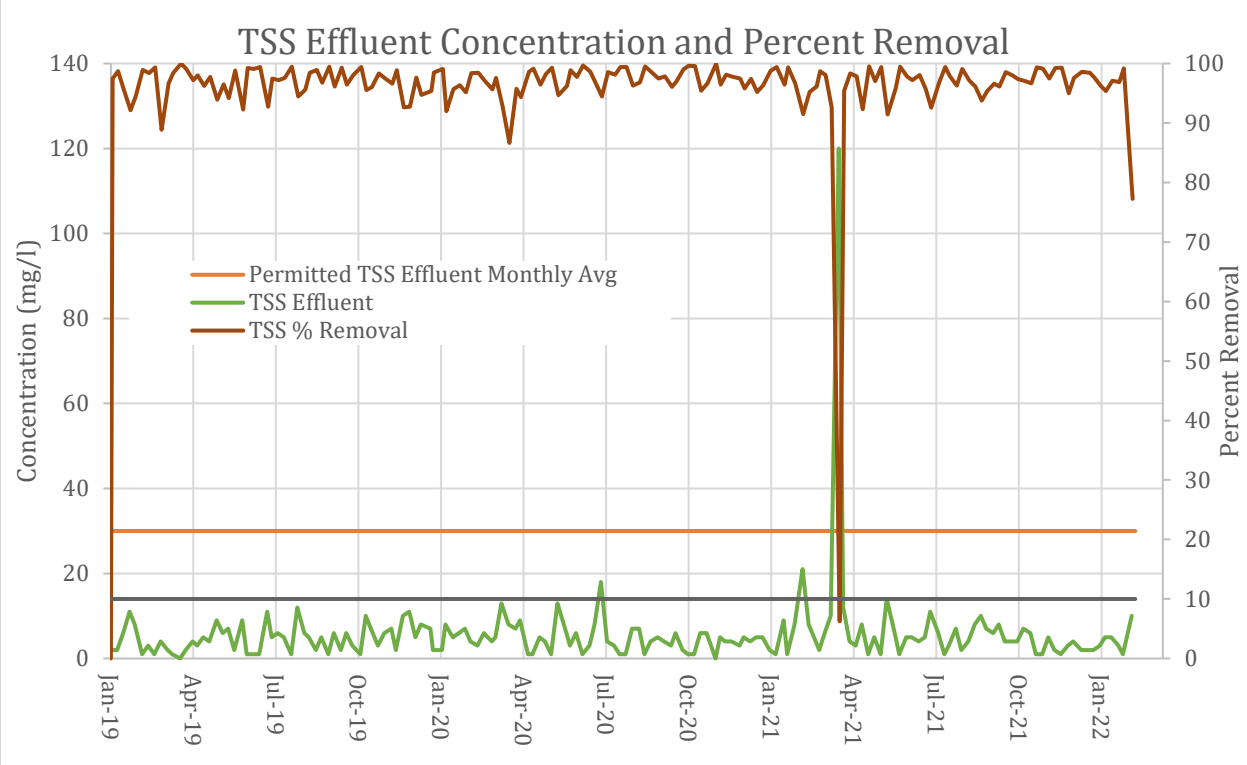


Figure 7.1.5 Total Suspended Solids (TSS) Effluent Concentration and Percent Removal

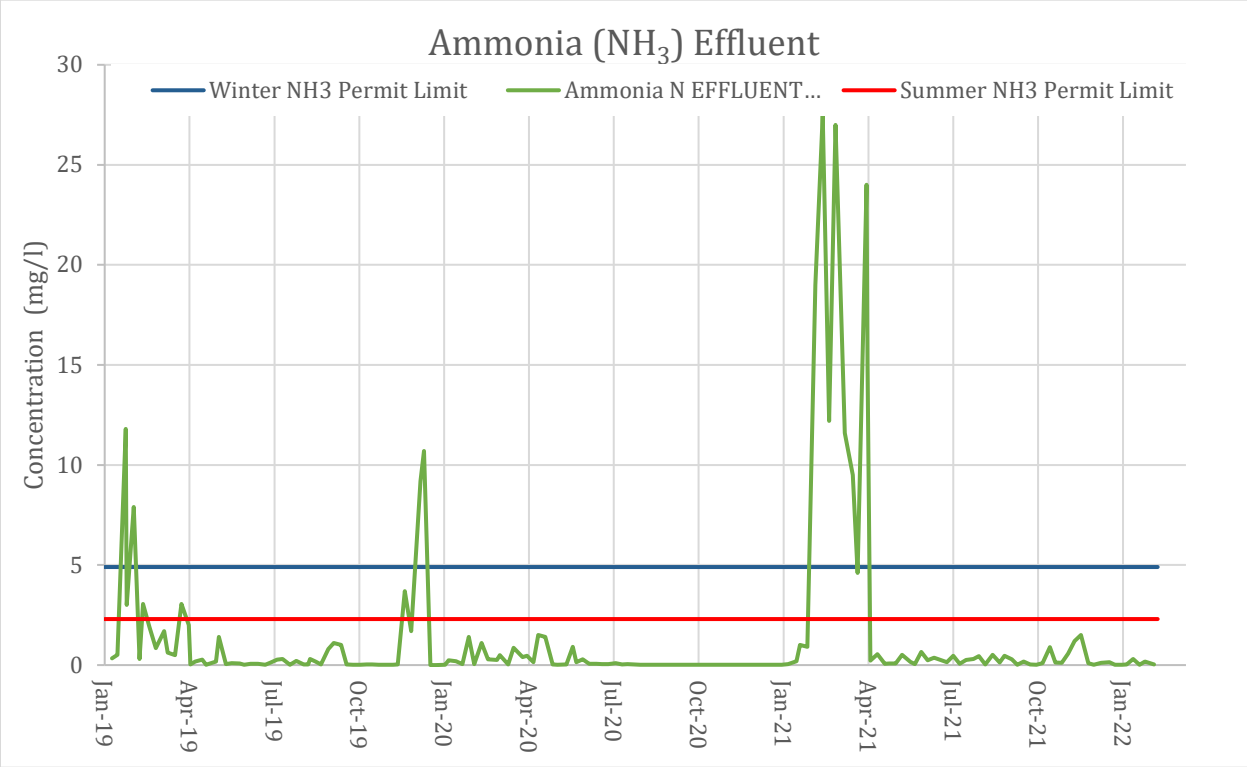


The other major constituents that were mentioned in the Director's Order (Appendix B) for effluent violations were the following: Nitrogen as Ammonia, Nitrogen as Total N, Phosphorus as Total P, and E. coli. These items violated the effluent permit multiple times, as the plant struggled to meet biological removal standards throughout the year.

The Director' Order states there were eleven (11) self-reported permit violations of the effluent ammonia (NH3). As illustrated below in Figure 7.1.6 and above in Table 7.1.2, the average NH3 concentration over the time span was 1.63mg/L. This value is above the summer permit limit of 1.5mg/L but below the 3.25mg/L winter permit limit. The summer season is considered months May through October and winter season is November through April.

Figure 7.1.6 below shows that the plant nitrifies the NH3 efficiently in the summer but does not get the same result during the winter months. Nitrification is extremely dependent on temperature, as the microorganisms that oxidize the ammonia into nitrites operate efficiently at 30-degrees Celsius and can completely shut down as the temperature approaches 0-degree Celsius. The other cause for the effluent violations could be contributed to significant amounts of infiltration and inflow into the treatment plant, creating shorter retention and solids washout compromising nitrification.

Figure 7.1.6 Ammonia Effluent Concentrations

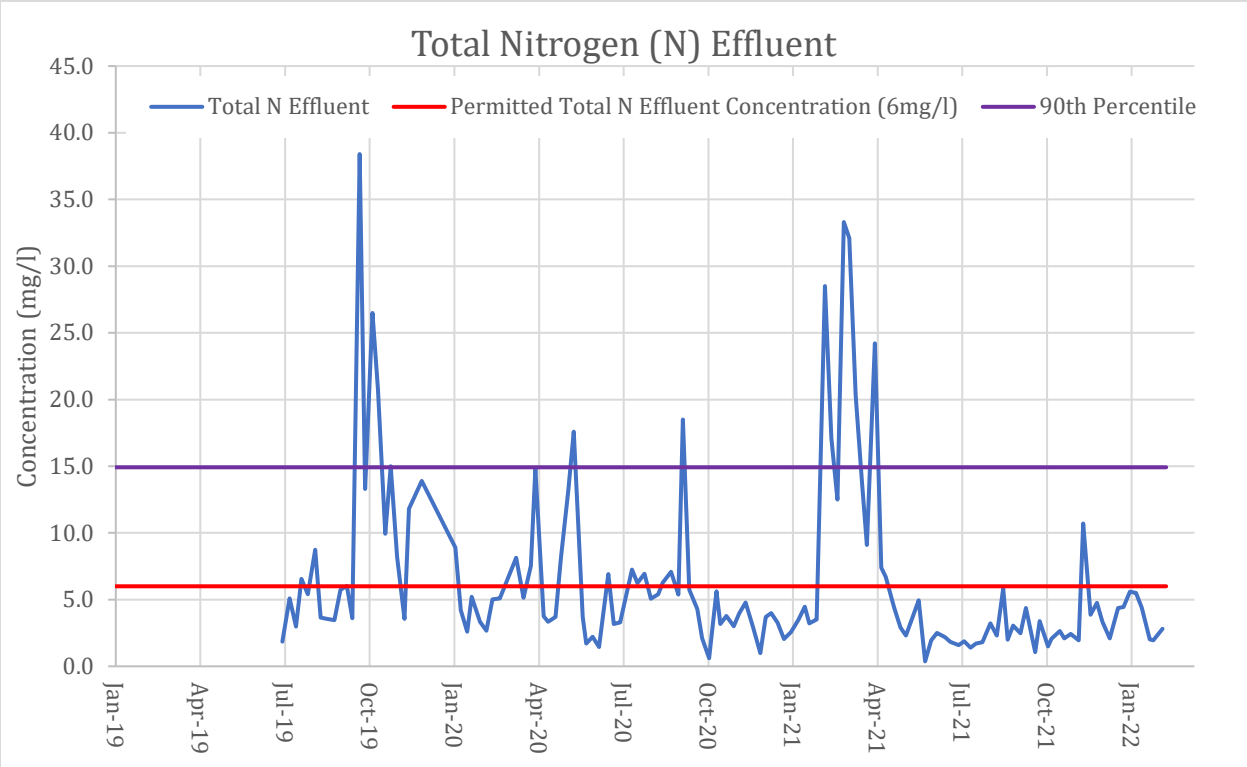


Norris' NPDES permit has an annual rolling average for the Total N and Total P effluent concentrations. The Total N is based on a limit of 10lbs/ day or 3650lbs/year. When rearranging Equation 1 to calculate the concentration in mg/L for the daily limit as shown in Equation 2 the concentration limit equals 6mg/L using the design flow rate of 0.2MGD. This value is reflected below in Figure 7.1.7.

Equation 2 Concentration

$$Concentration(mg/L) = \frac{Mass\ Loading\ Rate\ (lb/day)}{\left\{Flow(MGD) * \frac{8.34\ Lb}{Mgal * (mg/L)}\right\}}$$

Figure 7.1.7 Total Nitrogen Effluent Concentrations



The NWC WWTP Total N effluent concentration has averaged 6.58mg/L with a 90th percentile value of 14.92mg/L through the time frame of July 2019 to February 2022. As indicated in the figure above, effluent concentrations suggest the plant is not regularly denitrifying while in the Smith and Loveless Oxigest basin. Denitrification is the process of converting nitrates into nitrogen gas as well as other gaseous end products containing nitrogen. This process occurs after ammonia has been oxidized into nitrates and then recirculated back into an anoxic zone. This process is not currently achieved with the current basin and flow set up as the basin does not have an internal recycle feed or anoxic zone. This will be discussed in Section 8.2.

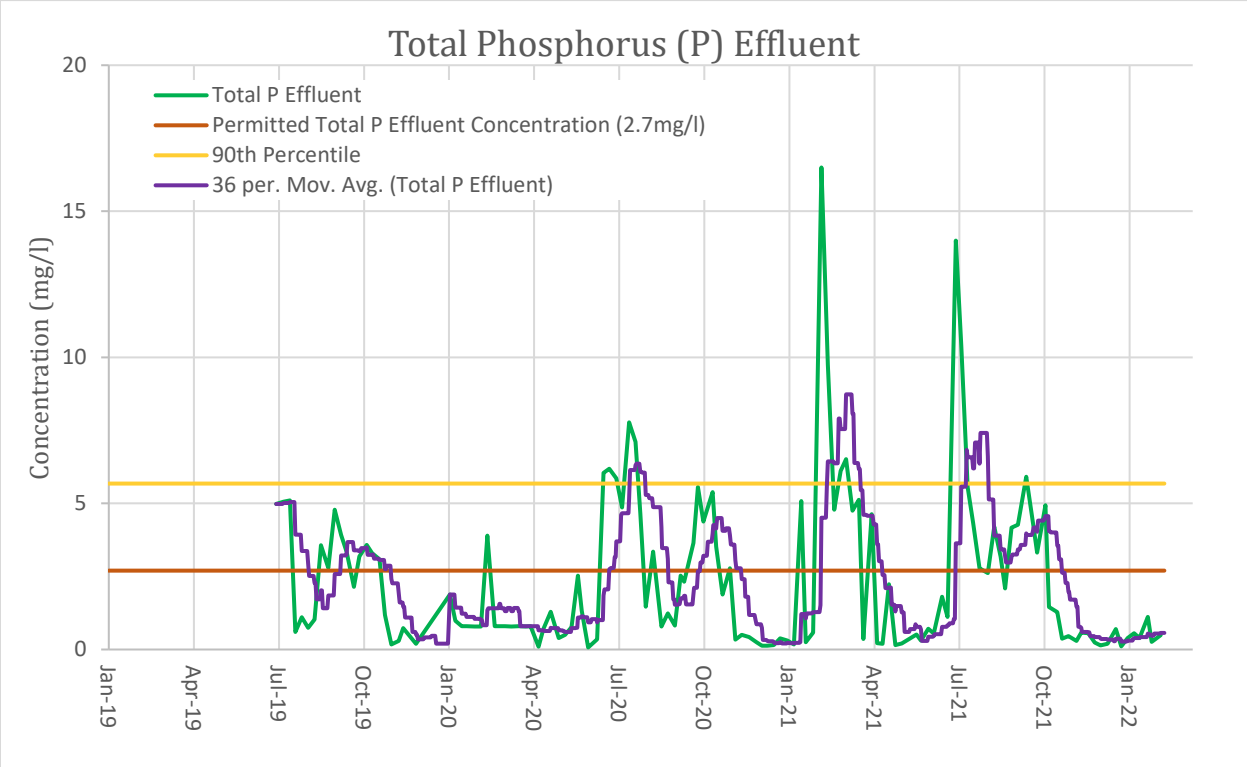
The Total Phosphorus recording period is similar to the Total Nitrogen limit as it is an annual average. The main difference between the Total N and Total P average values is measurement time period, as the Total P is taken from a 36-month period, instead of a 12-month period for Total N. The permit limit for Total P is broken out into two time periods throughout the duration of the permit. The first time period being the first 36-month since the permit became effective on January 01, 2019. This time

period runs until December 31, 2022. The second period is the next 36 month rolling average, until permit expiration which occurs on September 30, 2023.

The first period has a permit limit of 4.5lbs/day which equates to an effluent concentration of 2.7mg/L using Equation 2 and a flow rate of 0.2MGD. The second period has a yearly limit of 621lbs/year which equates to an effluent concentration 1.0mg/L, this value is significant as major plant modifications will be needed to reach such a low concentration. This will be further discussed in Section 0.

The WWTP had self-reported violations of the Total P limit nine (9) times in the time period of May 1, 2019 to November 30, 2021, as stated in the Director's Order. This follows the Figure 7.1.8 below as the reporting time frame is on a quarterly basis.

Figure 7.1.8 Total Phosphorus Effluent Concentrations



7.2 Plant Process Basins vs. State Required Regulations

To be able to determine long term needs for the NWC WWTP, the current plant had to be compared to the State regulations and TDEC's design criteria. Table 7.2.1 breaks this out per chapter and process in the TDEC design criteria manual.

Table 7.2.1 Process Items vs State Regulations

NWC WWTP PROCESS VS STATE REGULATIONS				
PROCESS		**NWC**	**STATE REQUIREMENTS**	**NOTES**
Preliminary and Pretreatment	Screening and Grinding	Yes	State Regulations require some type of screening or grinding device on all types of mechanical treatment plants.	NWC has mechanical screening as described in previous headworks section
Activated Sludge	Aeration Basin Volume	No, reference Section 7.2.2	Required	18-36 hours of Detention Time, F:M Ratio 0.05-0.15, Sludge Age 10-30 days, MLSS 2,000-6,000 mg/L, Basin Loading 10-25 lb/day BOD per 1,000 CF tank volume.
	Aeration Equipment	No, reference Section 7.2.2	Required	1.1 lbs oxygen per lb peak BOD5
Nitrification	Aeration Equipment	No, reference Section 7.2.2	Required, based on Permit Limits	4.6 lbs Oxygen per TKN, Safety Factor 2.5,
Clarifiers	Final Clarifiers	No, reference Section 7.2.3	Required, based on Secondary Treatment Process	Table 5-1 Final Clarifier Design Parameters, Activated Sludge Process, Maximum Surface Overflow Rate (gpd/sqft)- Average Flow =400, Peak Design Flow=1,000, Solids Loading Rate (lbm/day-sqft) - Average Flow =25, Peak Design Flow=35
Disinfection	Chlorination	Yes	Required	Dosage Capacity = 2 mg/L, Contact Time = 30 Minutes Average Flow 15 Minutes Peak Flow,
	Dechlorination	Yes	Required	1mg/L of SO2 for 1 mg/L of Chlorine Residual expressed as Cl2
Flow Measurement and Sampling	Influent	Yes	Required	Totalizing Equipment or Circular Charts, Parshall Flume, Automatic Sampling
	Effluent	Yes	Required	Totalizing Equipment or Circular Charts, Sharp Crested Weir, Automatic Sampling
Solids Processing	Aerobic Digestion	Yes	Required	Detention Time= 15-25 Days, Mixing Energy = 20-35 SCFM per 1000CF
	Dewatering	Yes	Required	Mechanical Dewatering, Sludge Drying Beds
Emergency Power Supply	Power Supply	No, reference Section 7.2.4	Required	Two Independent Public Utility Sources, or Internal Combustion Engine Equipment

7.2.1 Preliminary and Pretreatment

NWC's WWTP currently meets the requirement for screening devices for a mechanical plant which was previously described in Section 5.2.1.1. The treatment plant currently does not have a grit removal system, which is recommended but not required by the State.

7.2.2 Activated Sludge

NWC currently treats the wastewater through an activated sludge process using extended aeration. Two major items are considered by the State in the design manual when evaluating these types of plants; the first being the basin volume and biological loading, and the second being the air supply. The specified ranges shown above and below are from Appendix 7-A of the TDEC design manual.

The Smith and Loveless Oxigest has an outer ring diameter of 44.25FT and an inner ring diameter dimension of 21.5FT. The side water depth in this basin is approximately 15.25FT therefore creating a volume of 135,000 Gallons as shown above in Figure 5.1.2. To determine if the basin has adequate size Equation 3 Basin Loading is shown below.

Equation 3 Basin Loading

Aeration Basin Loading Range = 10-25 BOD5 per 1000 FT^3/day
*Historical NWC Average Influent CBOD5 loading is = 0.15MGD * 314mg/L * 8.34 = 392.8lbs/Day*
= 392.8lbs/day / (135,000 Gallons/7.48 FT^3 / Gallon/ 1000)
= 21.8 lbs/ 1000 FT^3 / Day

This value is in terms of CBOD5. Assuming a CBOD5/BOD5 factor of 1.2, this will put the loading above the TDEC criteria. Assuming the same CBOD5 influent concentration, the maximum flow that could be effectively treated is 0.17 MGD, or a loading of 451lbs/ day of CBOD5, which is less than the design flow rate of 0.2 MGD. The existing S&L reactor is overloaded in respect to CBOD5 loading.

The required detention time for aeration of the S&L reactor is 18 to 36 hours as shown below in Equation 4.

Equation 4 Detention Time

Detention Time Range = 18-36 Hours
NWC Aeration Basin Volume = 135,000 Gallons / 0.15MGD = 0.9 Days
*= 0.9 Days*24 Hours*
= 21.6 Hours

Similar to CBOD5, this value is within the acceptable range, but it is on the lower end of acceptable detention times. When using the plants design flow rate of 0.2 MGD the detention time drops to 16.2 hours which is below the specified 18 hour minimum. The detention time is not adequate based on the design flow rate of 0.2 MGD.

Another important wastewater parameter is air supply which provides vital oxygen to the micro-organisms that need it in order to oxidize and breakdown organics and other contaminants in the waste stream. The NWC plant air supply is discussed in above in Section 5.2.3. As previously discussed, the blowers are rated for a capacity of 760 CFM.

Equation 5 and Equation 6 below calculates the air needed by the blowers to provide necessary dissolved oxygen to the process basin. This value not only considers the CBOD5 aeration but also the aeration required for NH3 Nitrification.

Equation 5 Air Supply

Aeration for CBOD5 = 0.15 MGD x 314 mg/l CBOD5 x 8.34 x 1.1 lb O2/lb CBOD5 = 432 lbs. O2/Day

Aeration for NH3 Nitrification = 0.15 MGD x 36 mg/l NH3 x 1.2 TKN/NH3 (factor assumed) x 8.34 x 4.6 lb O2/lb NH3 = 249 lbs. O2/Day

*Total Oxygen Requirement = 432 + 249 = 681 lbs of O2/day * 2.5 Factor of Safety = 1,702.5 lbs of O2/Day*

Assuming air density of 0.075lbs/ft^3, 20% Oxygen, approximately 12% transfer efficiency, and actual O_2 required to standard O_2 required factor of 2.2, the air required is calculated as show below in Equation 6.

Equation 6 Air Required

*Air Required = 1,702.5 lbs of O_2/Day * 2.2 / (0.075*20%*12%*24 Hours * 60 Minutes) = 1,445 SCFM*

This value shows the blowers are severely undersized as they are not able to provide enough air to the aeration basin to meet the State's criteria on air required for CBOD5 and Ammonia Nitrification using the plants current average flow (0.15 MGD) which is less than the permitted capacity (0.2 MGD).

7.2.3 Clarifiers

Chapter 5 in the TDEC design manual guidelines require final clarifiers to be sized on surface overflow rate (SOR) to not exceed 400 gallons per day per square foot, solids loading rate (SLR) of 35 pounds mass per day per square foot, and the weir loading rate (WLR) to not exceed 15,000 gallons per day per linear feet. NWC has a final clarifier with a diameter of 21.5FT which is located in the interior circle of the Smith and Loveless Oxigest unit. These parameters for the final clarifier are calculated below using 100% of the design flow rate:

Equation 7 Surface Overflow Rate

TDEC Maximum Surface Overflow Rate (SOR) for Extended Aeration Plants = 400gpd/SQFT
*NWC SOR = 0.2MGD / ((π/4) * 21.5^2) = 551 gpd/sqft*

Equation 8 Solids Loading Rate

TDEC Solids Loading Rate (SLR) lbm/day-sqft = Average 25 lbm/day-sqft
Assumed MLSS Concentration = 2500mg/L
*NWC SLR = (0.2MGD*2,500mg/L*8.34)/(((π/4) * 21.5^2)*
SLR = 4,170 lbm/day / 363 sqft
SLR = 11.48 lbm/day-sqft

The TDEC maximum SLR during peak design is 35 pounds mass per day per square foot (lbm/day-sqft). When applying a peak design flow rate of 2.5 times of the design flow, the peak SLR for the clarifier at NWC's WWTP equates to 28.7 lbm/day-sqft.

Equation 9 Weir Loading Rate

Weir Loading Rate < 15,000 gallons per day per linear feet
Assume Circular Weir Diameter to be 2FT less than Clarifier Diameter= 21.5-2 = 19.5FT
*Weir Length = π*19.5FT*
Weir Length = 61.3FT
WLR = 0.2MGD/61.3FT
WLR = 3,264 gallons/day / linear feet.

While the clarifier meets the requirements for the weir loading rate and solids loading, the clarifier is undersized for the surface overflow rate with the plant design flow. For the plant to meet the SOR requirements of 400gpd/sqft, the maximum flow through the existing clarifier should be less than 0.145 MGD.

7.2.4 Emergency Power Supply

The State requires all treatment plants to have a provision of an emergency power supply in case of power failure to be able to maintain treatment. The emergency supply could be dual power supply from two independent utility suppliers or an onsite combustion engine power supply generator. The NWC WWTP currently does not have a secondary or emergency power generator.

8.0 ALTERNATIVES CONSIDERED

8.1 Collection System

The main alternative evaluated at this stage of the SSES program is a comprehensive sewer replacement and rehabilitation program of sanitary sewer mains. NWC's two pump stations at the upstream reaches of the sewer system serve limited customers and were not considered for improvements or replacement.

8.1.1 Sewer Rehabilitation

The goal of NWC's SSES program is to determine the scope of the sewer rehabilitation required within the sewer system. Once an area is identified as a contributor of high RDII, there are three general sewer rehabilitation approaches that are considered:

1. Rehabilitate all sewer, including service laterals located within both public right-of-way (ROW) and on private property;

2. Rehabilitate only sewer located in public ROW, including service laterals within public ROW only;

3. Repair structural defects in pipes and manholes and remove major inflow sources identified.

The first and second approaches are considered "comprehensive rehabilitation." A comprehensive rehabilitation approach consists of rehabilitating every foot of sewer line to eliminate all potential points of I&I. Literature reviewed for this report indicates that the greatest cost/benefit ratios can be achieved by comprehensive sewer rehabilitation of the sewersheds with the highest RDII values.

The highest R-values within NWC's collection system were identified at FM#1 and FM#3. Given the significant peak volumes and flows seen during the preliminary flow monitoring period, it is recommended that NWC pursue a comprehensive rehabilitation, utilizing Option 2, of these two sewersheds (Dale and Sawmill) and pursue a targeted rehabilitation effort (Option 3) in the Deer Ridge sewershed. Areas that have been previously rehabbed in the last 20-years (reference Figure 4.2.1 Historical Improvements Projects) will be reviewed with the intention of reducing scope and subsequent costs.

For modeling purposes, it was assumed that comprehensive rehabilitation in the Dale and Sawmill subbasins would result in a 30% reduction in peak flows and a 50% reduction in volume. Assumptions for the targeted rehabilitation within Deer Ridge would result in a 20% reduction in peak flows and a 30% reduction in volume.

Table 8.1.1 R-Value Reduction Analysis

R-VALUE REDUCTION ANALYSIS							
Site	**Sewer-shed**	**R-Value (%)**	**Current Wet-Weather Peak Flow (MGD)[(1)]**	**Current Wet-Weather 72-hr Total (MG)[(1)]**	**Reduced R-Value (%)**	**Wet-Weather Peak Flow after Predicted Reduction (MGD)**	**Wet-Weather 72-hr Total after Predicted Reduction (MG)**
FM#1	Dale	10	2.30	1.98	5.0	1.61	0.99
FM#2	Deer Ridge	8	1.10	0.58	4.0	0.77	0.29
FM#3	Sawmill	18.5	4.94	3.15	9.25	3.45	1.58

[(1)] Peak flows are from 2-year, 24-hour design storm event using the preliminary hydraulic model.

In addition to the improvements and anticipated reduction through comprehensive rehabilitation in public ROW, private sewer laterals are anticipated to be reviewed and noted as sources of I&I through the smoke testing portion of the SSES work. It is recommended that the City of Norris develop and consider an ordinance for mechanisms to enforce the separation of storm gutters and drains from the sanitary sewer laterals on private property.

8.1.2 Peak Flow Attenuation

In recognition of the significant peaking factors that are experienced in NWC's system and the size of the existing WWTP, peak flow attenuation is expected to be required to reduce wastewater treatment plant improvement costs and allow for flows to be regulated during storm events. NWC can accomplish this effectively through an equalization tank installed in the vicinity of the WWTP.

The sizing of any proposed equalization tank is heavily contingent on the real-world results of the comprehensive rehabilitation efforts. In order to accurately measure the rehabilitation reduction in peak flow and volume, a 365-day post-rehabilitation flow monitoring period is proposed to both confirm effectiveness of the rehabilitation program, as well as provide a baseline for equalization basin sizing.

For the purposes of this report, assumptions were made based on the reduced values shown in Table 8.1.1. These design parameters and associated opinions of cost should be considered preliminary and not complete.

An equalization basin with a storage capacity of 0.75 MG is the preliminary recommendation to provide adequate flow attenuation and prevent bypass events at the WWTP. The final size of the tank will be determined after the completion of sewer rehabilitation. Approximate tank dimensions for a concrete tank of this volume would be 65-ft diameter by 24-ft wall height. Construction access would require a 25-ft work zone around the tank footprint for installation and staging.

Roof options were considered, and the preliminary recommendation is that a roof is not required due to the short period of time (~1-5 days) of each anticipated use. Due to the short attenuation time, odor control issues are not anticipated. If it is determined that a roof would be necessary for odor control, a domed roof could be added. However, roof installation would come at an added construction cost.

The proposed equalization basin would operate by installing a diversion structure on the 12-inch diameter gravity sewer upstream of the WWTP and prior to the headworks. When rain events occur, peak flows would be redirected by this structure into a proposed pump station. As the wet well of this proposed pump station fills, pumps would run to divert the sewage into the storage tank. The storage tank would control the release of the sewage through orifice sizing and valving once the wet-weather event has subsided and plant flows return to normal.

This proposed pump station has been preliminary sized to provide a peak diversion flow rate of 3.0 MGD, or 2,083 gpm. Assuming an extended peak flow rate from a design storm of 3.5 MGD, the pumps would fill the tank in approximately 6 hours at this rate. However, flow data indicates that the peak flow rate quickly recedes following the rain event. Total reduced 72-hour volume of the design storm is 1.58 MGD. Dual pumps would be installed, with 1 duty and 1 stand-by pump providing the firm capacity of the station. Pumps of this size are anticipated to be 40 hp.

A future design element that will be considered is whether to provide screening and de-gritting of influent wastewater before diverting to the equalization tank. These processes minimize the amount of maintenance required for grit removal that may otherwise accumulate in the tank once a rain event has subsided. Grinders can be added to handle the screenings, while mixers or jet nozzles can be added to the tank to try and keep grit material in suspension. However, over time, this equipment is prone to wear and can add to operator's maintenance responsibilities. Future design will analyze these options.

When coupled with future treatment plant capacity improvements, the peak diversion flow rate should allow the design storm events to be regulated, reducing the number of plant bypasses and bringing NWC into compliance with the NPDES permit requirements.

8.2 Interim Wastewater Treatment Plant Improvements

Long-term improvements such as plant expansion, take a long time (years) to secure funding, permits and implement design and construction. Certain interim improvements are recommended to reduce the likelihood of violations. These interim improvements include certain operational changes and modifications to the process as further discussed below.

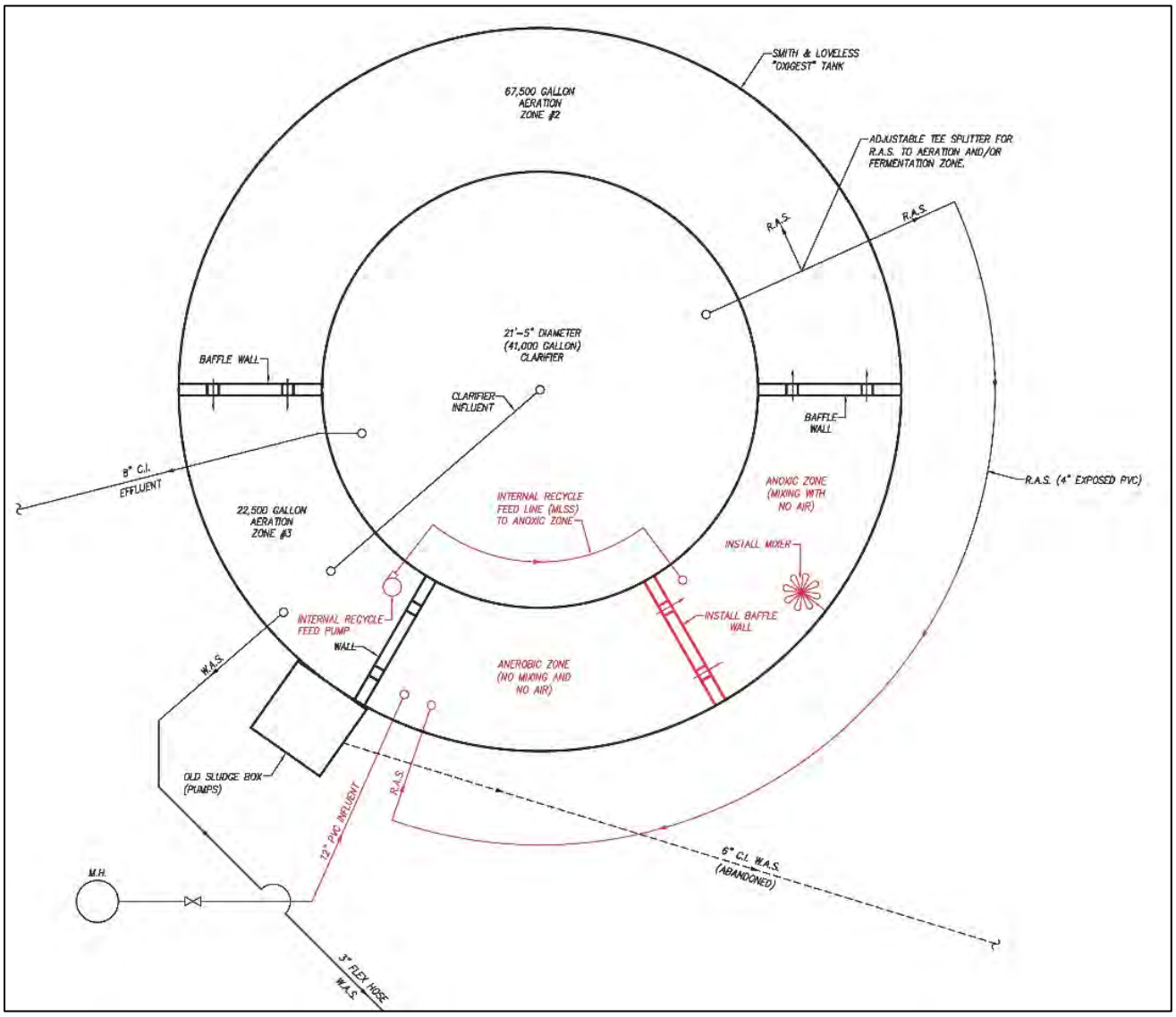
The operational changes that are recommended for implementation by plant staff are primarily to the S&L Oxigest unit. These modifications include adjusting blower run times, chemical additives to help promote TP precipitation into the sludge (currently ongoing), improved mixing, and aeration time changes. The blower run times will be modified to allow for longer aeration periods to meet the process demand for nitrification. The plant staff is currently conducting jar testing as part of a mixing zone study. This testing monitors the TSS throughout different locations and depths in the S&L Oxigest unit. The result of the testing will determine if and where additional mixing is needed, consequently eliminating dead zones within the basin.

The minor construction modifications to be completed as part of the interim improvements include adding a baffle wall inside the biological process basin of the S&L unit. The baffle would be installed in the current fermentation zone as shown below in Figure 8.2.1. The installation of the baffle wall is to create an anaerobic-anoxic-oxic zones within the S&L unit to achieve increased biological nutrient removal for TP and TN limits. The first zone would an anerobic zone with no aeration. This would act similar to the current fermentation zone and would help with the biological phosphorus removal. The second zone would be an anoxic zone. This zone would be completely mixed with internal recycle from the end of the oxic zone to the front of this anoxic zone. This configuration is similar to Modified Ludzack-Ettinger (MLE) process to achieve denitrification. The anoxic zone should be well mixed and the current level of mixing is field verified by plant staff. If additional mixing energy is required, it will be accomplished by adding in submersible mixers or large recirculation pumps. For internal recycle to the anoxic zone, an internal recycle feed of the MLSS would need to be installed. This could be accomplished by using a small submersible pump located at the end of the oxic zone and

recycling nitrate-rich mixed liquor back to the anoxic zone. In addition, the RAS and influent lines would both need to be extended and relocated to the beginning of the new anaerobic zone for optimum contact time.

Figure 8.2.1Figure 8.2.1. The installation of the baffle wall is to create an anaerobic-anoxic-oxic zones within the S&L unit to achieve increased biological nutrient removal for TP and TN limits. The first zone would an anerobic zone with no aeration. This would act similar to the current fermentation zone and would help with the biological phosphorus removal. The second zone would be an anoxic zone. This zone would be completely mixed with internal recycle from the end of the oxic zone to the front of this anoxic zone. This configuration is similar to Modified Ludzack-Ettinger (MLE) process to achieve denitrification. The anoxic zone should be well mixed and the current level of mixing is field verified by plant staff. If additional mixing energy is required, it will be accomplished by adding in submersible mixers or large recirculation pumps. For internal recycle to the anoxic zone, an internal recycle feed of the MLSS would need to be installed. This could be accomplished by using a small submersible pump located at the end of the oxic zone and recycling nitrate-rich mixed liquor back to the anoxic zone. In addition, the RAS and influent lines would both need to be extended and relocated to the beginning of the new anaerobic zone for optimum contact time.

Figure 8.2.1 Interim Improvements Schematic



8.3 Long Term Wastewater Treatment Plant Expansion/Improvements/ Redirect

NWC contracted with CCI in February of 2022, to conduct a full Wastewater Treatment Plant Facility Plan. This plan is ongoing and is scheduled to be completed by September 2022. This facility plan will allow CCI to conduct the necessary analysis of the NWC WWTP to further develop more detailed process evaluations, alternative improvements, and cost analysis typically associated with facility plans of similar nature. CCI will evaluate the following alternatives in the facility plan:

1) Plant Improvements
2) Expansion of Current Plant
3) Sewage Redirect to Neighboring Utility

The first alternative to be considered is the plant improvements. This alternative will consist of the evaluation of a new location for the wastewater treatment plant. The second option is the expansion of the current plant. The expansion of current plant will consider adding additional process basins and equipment to the existing plant. The final alternative to be gauged will be the redirect of sewage to Anderson County Water Authority / Clinton Utilities Board.

Theses long term WWTP improvement alternatives are preliminary in nature and will be further fine-tuned in the facility plan at a later time. The long-term improvements as noted above are not comprehensive and are only meant to provide the reviewer an idea of some of the options being considered.

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APPENDIX A: Final 2022 List of Impaired and Threatened Waters, Rationales of Delisting Parameters

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Segment Number	Assessment Unit Name	Parameter	Delisting Rationale
TN06010207016_0100	Buffalo Creek	NITRATE/NITRITE (NITRITE + NITRATE AS N)	Buffalo Creek was listed as impaired for Fish and Aquatic Life Use in 2012 due to poor biological surveys at four locations in 2007 and one location again in 2008. Elevated levels of NO2+NO3 were recorded during monthly chemical sampling in 2008-2009, and was listed as a contributing Cause to the impairment. Chemical monitoring in 2013-2014 again documented elevated NO2+NO3 levels. 2018 TDEC biological samples at 3 locations (RM 0.3, 3.9 & 4.6) showed improvements, and that the stream was now meeting regional goals for biological integrity. Additionally, monthly chemical data during 2018-2019 monitoring showed NO2+NO3 levels significantly reduced and generally meeting regional targets. The Norris STP had improved nutrient discharges into this segment through plant optimization a few years back. Because of this significant improvement in biology, this stream can be delisted, as our narrative nutrient criterion requires that evidence of biological harm is needed to consider the criterion violated.
TN06010207016_0100	Buffalo Creek	PHOSPHORUS, TOTAL	Buffalo Creek was listed as impaired for Fish and Aquatic Life Use in 2012 due to poor biological surveys at four locations in 2007 and one location again in 2008. Elevated levels of Total Phosphorous were recorded during monthly chemical sampling in 2008-2009, and was listed as a contributing Cause to the impairment. Chemical monitoring in 2013-2014 again documented elevated Total Phosphorous levels. 2018 TDEC biological samples at 3 locations (RM 0.3, 3.9 & 4.6) showed improvements, and that the stream was now meeting regional goals for biological integrity. Additionally, monthly chemical data during 2018-2019 monitoring showed Total Phosphorous levels significantly reduced and generally meeting regional targets. The Norris STP had improved nutrient discharges into this segment through plant optimization a few years back. Because of this significant improvement in biology, this stream can be delisted, as our narrative nutrient criterion requires that evidence of biological harm is needed to consider the criterion violated.
TN06020001020T_0400	Lick Branch	ESCHERICHIA COLI (E. COLI)	Lick Branch was listed as being impaired for its Recreation Designated Use due to pathogen monitoring in 2014 that documented 3 of 8 samples violating the 941 cfu criterion, and a failing geomean. Currently, data from 2018-2019 TDEC pathogen station at mile 1.5 documented that all 12 monthly samples were below criteria levels. These current data indicate the Recreation Use is no longer impaired and supports delisting at this time.
TN06020001020T_0510	Unnamed Trib to Dry Branch	ESCHERICHIA COLI (E. COLI)	This unnamed tributary to Dry Branch was listed as being impaired for its Recreation Designated Use due to pathogen monitoring in 2013-2014 that documented 1 of 9 samples violating the 941 cfu criterion, and a failing geomean. Currently, data from 2018-2019 TDEC pathogen station at mile 0.6 documented that 11 of the 12 monthly samples were below criteria levels. These current data indicate the Recreation Use is no longer impaired and supports delisting at this time.
TN06020001029_0100	Wolfe Branch	ESCHERICHIA COLI (E. COLI)	Wolfe Branch was listed as being impaired for its Recreation Designated Use due to pathogen monitoring in 2008-2009 that documented 2 of 17 samples violating the 941 cfu criterion, and a failing geomean. Better results were documented in 2013-2014 where 0/5 samples exceeded 941 cfu, but the geomean was still just slightly over 126 cfu. Currently, data from 2018-2019 TDEC pathogen station at mile 0.4 documented that all 12 monthly samples were well below criteria levels, with most being under 100 cfu. These current data indicate the Recreation Use is no longer impaired and supports delisting at this time.
TN06020001029_0100	Wolfe Branch	SEDIMENTATION/SILTATION	Wolfe Branch was listed as impaired for the Fish & Aquatic Life Designated Use initially after it scored poorly on a biological survey in 2008. Based on habitat surveys and field notes, excessive sedimentation was determined to be a listed Cause of this impairment. Biological surveys in 2013, 2014, and 2019 still reflected impairment and were moderately lower than regional goals. However, the sediment-sensitive biological submetrics scored well in both the 2014 and 2019 benthic surveys, and the 2019 habitat assessment and field survey notes noted that sediment no longer appeared to be a contributing factor in the continued observed impairment to F&AL, therefore will be removed as one of the listed causes.
TN06020001029_0200	Unnamed Trib to Savannah Creek	ESCHERICHIA COLI (E. COLI)	This unnamed tributary to Savannah Creek has been listed as being impaired for its Recreation Designated Use due to extremely elevated E. coli levels documented in sampling during 2008-2009, where 13 of 18 samples violated the 941 cfu criteria and a geomean of over 2000 cfu was recorded. Pathogen levels improved considerably during geomean sampling in 2013-2014, where 0/5 samples exceeded 941, but the geomean was still slightly high at 176 cfu. 2018-2019 TDEC pathogen station at mile 0.4 showed low E. coli levels once again, with zero out of 12 monthly E. coli observations over 941 cfu. These current data, coupled with the steady improvements seen over previous cycles, supports delisting at this time. Improvements likely due to former dairy operations in watershed no longer in operation.
TN06020001029_1000	Savannah Creek	ESCHERICHIA COLI (E. COLI)	Savannah Creek was listed as being impaired for its Recreation Designated Use due to elevated E. coli levels documented in TVA sampling during 2003 where 4 of 7 samples violated the 941 cfu criterion. Levels remained elevated during 2008-2009 monitoring cycle, where 5 of 20 samples exceeded 941 cfu, and additionally a geomean did not pass. Levels were a little bit lower during a geomean survey in 2013, with only 1/5 exceeding 941 cfu, but the geomean overall failed the more stringent criteria. Results from 2018-2019 TDEC monthly pathogen showed improvements, recording only a single monthly E. coli sample out of 12 over 941 cfu. The single exceedance was in proximity to a rain event. These current data indicate that the Recreation Use is no longer impaired, and supports delisting at this time. Improvement in recent years may be due to Dairies previously in watershed that have generally closed down.

APPENDIX B: TDEC Director's Order

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STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF WATER RESOURCES
William R. Snodgrass - Tennessee Tower
312 Rosa L. Parks Avenue, 11th Floor
Nashville, Tennessee 37243-1102

February 11, 2022

Honorable Chris Mitchell, Mayor
Town of Norris
20 Chestnut Drive
P.O. Box 1090
Norris, Tennessee 37828

CERTIFIED MAIL
RETURN RECEIPT REQUESTED
9414 7266 9904 2120 5212 24

Subject: **DIRECTOR'S ORDER WPC21-0149**
Norris Water Commission
Anderson County, Tennessee

Dear Mayor Mitchell,

Enclosed is a Director's Order and Assessment issued by the Tennessee Department of Environment and Conservation, Division of Water Resources for violations of the Water Quality Control Act.

These violations have resulted in a **full penalty assessment of $23,460.00. An upfront civil penalty payment of $4,692.00 is due on or before the 31st day after receipt of this Order.** The remaining penalties are contingent upon timely completion of the requirements of this Order. Additional penalties may be assessed if the requirements of this Order are not timely met, or if the Site does not stay in compliance with the Act.

Please read the Order carefully and pay special attention to the Notice of Rights section. The required due dates in the Order are based on the date the Respondent receives the Order, and not the date that the Order was signed by the Director. The Division appreciates your cooperation in this matter. Should you have any questions, please contact Mr. Michael Lancaster at (615) 532-6371 (email michael.lancaster@tn.gov), or you may contact me at (615) 532-0676 (email Jessica.Murphy@tn.gov).

Sincerely,

Jessica Murphy, Manager
Compliance and Enforcement Unit

EJM: MSL

cc: DWR – Case File WPC21-0149

DWR – Michael Atchley	Michael.Atchley@tn.gov	DWR – Robert Ramsey	Robert.Ramsey@tn.gov
DWR – Sara Page	Sara.Page@tn.gov	DWR – Wade Murphy	Wade.Murphy@tn.gov
DWR – Karina Bynum	Karina.Bynum@tn.gov		

STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION

IN THE MATTER OF:	**)**	**DIVISION OF WATER RESOURCES**
	)	
	)	
NORRIS WATER COMMISSION,	**)**	
	)	
	)	
RESPONDENT.	**)**	**CASE NO. WPC21-0149**

DIRECTOR'S ORDER AND ASSESSMENT

NOW COMES Jennifer Dodd, Director of the Tennessee Division of Water Resources, and states:

PARTIES

I.

Jennifer Dodd is the duly appointed Director of the Tennessee Division of Water Resources ("Division") by the Commissioner of the Tennessee Department of Environment and Conservation ("Department").

II.

Norris Water Commission ("Respondent") operates a publicly owned wastewater treatment plant in Anderson County, Tennessee at 94 East Norris Road, Norris, Tennessee 37828 ("Site"). Service of process may be made on the Respondent through the Honorable Chris Mitchell at 20 Chestnut Drive, P O Box 1090, Norris, Tennessee 37828.

JURISDICTION

III.

Whenever the Commissioner has reason to believe that a violation of the Water Quality Control Act, Tenn. Code Ann. §§ 69-3-101 to -148 (the "Act"), has occurred, is occurring, or is

about to occur, the Commissioner may issue a complaint to the violator and the Commissioner may order corrective action be taken. Tenn. Code Ann. § 69-3-109(a). Further, the Commissioner has authority to assess civil penalties against any violator of the Act, Tenn. Code Ann. § 69-3-115, and has authority to assess damages incurred by the State resulting from the violation, Tenn. Code Ann. § 69-3-116. The Board of Water Quality, Oil and Gas has promulgated rules governing general water quality criteria and use classifications for surface waters. Tenn. Comp. R. & Regs. Chapters 0400-40-03 and 0400-40-04. The Commissioner may delegate to the Director any of the powers, duties, and responsibilities of the Commissioner under the Act, Tenn. Code Ann. § 69-3-107(13), and has delegated such authorities to Jennifer Dodd.

IV.

The Respondent is a "person" under the Act. Tenn. Code Ann. § 69-3-103.

V.

Buffalo Creek constitutes "waters" of the state and a "stream." Tenn. Code Ann. § 69-3-103. All streams have been classified by the Tennessee Board of Water Quality, Oil and Gas for suitable uses. Tenn. Comp. R. & Regs. Chapter 0400-40-04. Buffalo Creek is classified for the following uses: fish and aquatic life, irrigation, livestock watering and wildlife, and recreation.

VI.

Any person engaged in or planning to engage in the discharge of sewage, industrial wastes, or other wastes into waters, or to a location from which it is likely that the discharged substance will move into waters must obtain and comply with a permit from the Department. Tenn. Code Ann. § 69-3-108. Each permit requires a set of effluent limitations to indicate adequate operation of performance of treatment units used and to appropriately limit those harmful parameters present in the wastewater. Tenn. Comp. R. & Regs. 0400-40-05-.08. The permittee shall at all times

properly operate and maintain all facilities and systems (and related appurtenances) for collection and treatment which are installed or used by the permittee to achieve compliance with the conditions of the permit. Tenn. Comp. R. & Regs. 0400-40-04-.07. It is unlawful for any person to violate the conditions of a discharge permit issued by the Department. Tenn. Code Ann. §§ 69-3-108(b) and -114(b).

FACTS

VII.

On December 4, 2018, the Division issued National Pollutant Discharge Elimination System (NPDES) permit TN0020630 ("Permit") to the Respondent, which became effective January 1, 2019, and expires September 30, 2023. The Permit authorizes the discharge of treated domestic wastewater from Outfall 001 to Buffalo Creek at mile 4.4 in accordance with all effluent limitations and monitoring requirements set forth.

VIII.

In January 2016, the Respondent began voluntary participation in the Tennessee Nutrient Plant Optimization Program ("TN POP"), a training program conducted by the Department to develop and promote innovative, low-cost approaches to optimizing water quality and reducing energy consumption in wastewater treatment. The Respondent's participation in the program generated significant reductions in effluent nutrient levels and energy consumption.

IX.

The Respondent has appeared on the EPA Quarterly Non-Compliance Report (the "QNCR") for effluent limitation exceedances in multiple quarters during the monitoring period of May 1, 2019 through November 30, 2021.

X.

During the monitoring period of May 1, 2019 through November 30, 2021, the Respondent self-reported the following effluent limitation exceedances on its Discharge Monitoring Reports:

Parameter	Effluent Exceedances from May 1, 2019 – November 30, 2021
Carbonaceous BOD, 5-day	4
E. coli	2
Nitrogen, Ammonia [as N]	11
Nitrogen, Total [as N]	14
Phosphorus, Total [as P]	9
Suspended Solids, % removal	2
Suspended Solids, Total	4
Bypass of Treatment Facility	8
Total	**54**

VIOLATIONS

XI.

By exceeding effluent limitations and violating the terms of the Permit, the Respondent has violated the Act:

Tenn. Code Ann. § 69-3-108(b):

> It is unlawful for any person, other than a person who discharges into a publicly owned treatment works or a person who is a domestic discharger into a privately owned treatment works, to carry out any of the following activities, except in accordance with the conditions of a valid permit:
>
> (3) The increase in volume or strength of any wastes in excess of the permissive discharges specified under any existing permit;
>
> (6) The discharge of sewage, industrial wastes or other wastes into waters, or a location from which it is likely that the discharged substance will move into waters;

Tenn. Code Ann. § 69-3-114(b):

> In addition, it is unlawful for any person to act in a manner or degree that is violative of any provision of this part or of any rule, regulation, or standard of water quality promulgated by the Board of any permits or orders issued pursuant to this part; or fail or refuse to file an application for a permit as required in § 69-3-108; or to refuse to furnish, or to falsify any records, information, plans, specifications, or other data required by the Board or the Commissioner under this part.

ORDER AND ASSESSMENT

XII.

Pursuant to the Act, Tenn. Code Ann. § 69-3-109, -115, and -116, the Respondent is issued the following Order and Assessment ("Order"). All documentation relating to compliance schedule items in this Order should be submitted electronically to DWRWater.Compliance@tn.gov or in duplicate to the addresses listed below:

Manager
Knoxville Environmental Field Office
Division of Water Resources
3711 Middlebrook Pike
Knoxville, Tennessee 37921

AND

Manager
Enforcement and Compliance Unit
Division of Water Resources
William R. Snodgrass Tennessee Tower
312 Rosa L. Parks Ave., 11th Floor
Nashville, Tennessee 37243

Payment of all penalties and damages shall be submitted to the following address:

Treasurer, State of Tennessee
Division of Fiscal Services – Consolidated Fees Section
William R. Snodgrass Tennessee Tower
312 Rosa L. Parks Ave., 10th Floor
Nashville, Tennessee 37243

For all payments submitted, please include reference to case number **WPC21-0149**.

1. The Respondent is assessed a total civil penalty of $23,460.00. **The Respondent shall pay $4,692.00 to the Division as an upfront allocation of this penalty on or before the thirty-first day following receipt of this Order**.
2. No later than 90 days after receipt of this Order, the Respondent shall submit a corrective action plan / engineering report (CAP/ER) to address the effluent limitation exceedances listed in paragraph IX of this Order. Considering the Respondent's continued use of nutrient reduction techniques developed in the TN POP, the Respondent is encouraged to direct the majority of the CAP/ER actions to reduction of treatment system bypasses caused

by inflow and infiltration into the collection system during significant rain events. The CAP/ER shall include a schedule with a specific date of completion for each corrective action necessary to bring the facility into compliance. Any changes or modifications to the CAP/ER requested by the Division shall be submitted within 30 days following receipt of Division notice. If the Respondent fails to comply with this Item, the Respondent shall pay $156.00 to the Division for each day this CAP/ER is late, not to exceed a total of $4,680.00.

3. Upon Division approval of the CAP/ER, each milestone date of the project schedule shall become an enforceable component of this Order. Upon completion of each scheduled action, the Respondent shall write a concise progress report detailing the corrective actions taken to that point. The Respondent shall submit each report to the Division not later than the 7th business day following the respective milestone date. If the Respondent fails to comply with this Item, the Respondent shall pay $156.00 for each day that a progress report is late, not to exceed a total of $4,680.00.
4. Within 180 days following completion of all measures in the CAP/ER, the Respondent shall write and submit a Final Report to the Division for approval. The Final Report shall include descriptions of each scheduled action from initiation to completion, a detailed study evaluating the success of the CAP/ER in achieving substantial compliance with the Permit, and an analysis of the study. If the Respondent fails to comply with this Item, the Respondent shall pay $156.00 for each day that the Final Report is late, not to exceed a total of $4,680.00.
5. For one year following completion of the CAP/ER, the Respondent shall maintain substantial compliance with the Permit. If the Respondent fails to comply with this Item,

as evidenced by effluent violations on the DMRs, the Respondent shall pay $591.00 per effluent violation, not to exceed a total of $4,728.00.

This Order shall be considered closed no later than two years after Division receipt of the Final Report so long as the Respondent has complied with all Order requirements, all penalties owed have been paid, and the Respondent is in substantial compliance with the Act.

The Director may, for good cause shown, extend the compliance dates contained within this Order. To be eligible for this time extension, the Respondent shall submit a written request to be received in advance of the compliance date. The written request must include sufficient detail to justify such an extension and include at a minimum the anticipated length of the delay, the precise cause or causes of the delay, and all preventative measures taken to minimize the delay. Any such extension by the Director will be in writing. Should the Respondent fail to meet the requirement by the extended date, any associated civil penalty shall become due 30 days thereafter.

Failure to comply with any of the requirements of this Order could lead to further enforcement actions, which may include additional civil penalties, assessment of damages, and/or recovery costs.

RESERVATION OF RIGHTS

In issuing this Order and Assessment, the Department does not implicitly or expressly waive any provision of the Act or the regulations promulgated thereunder or the authority to assess costs, civil penalties, and/or damages incurred by the State against the Respondent. The Department expressly reserves all rights it has at law and in equity to order further corrective action, assess civil penalties and/or damages, and to pursue further enforcement action including,

but not limited to, monetary and injunctive relief. Compliance with this Order will be considered as a mitigating factor in determining the need for future enforcement action(s).

NOTICE OF RIGHTS

The Respondent may appeal this Order and Assessment. Tenn. Code Ann. §§ 69-3-109, -115, and -116. To do so, a written petition setting forth the reasons for requesting a hearing must be received by the Commissioner within 30 days of the date the Respondent received this Order or this Order will become final.

If an appeal is filed, an initial hearing of this matter will be conducted by an Administrative Law Judge (ALJ) as a contested case hearing. Tenn. Code Ann. § 69-3-110; Tenn. Code Ann. §§ 4-5-301 to -325 (the Uniform Administrative Procedures Act); Tenn. Comp. R. & Regs. 1360-04-01 (the Department of State's Uniform Rules of Procedure for Hearing Contested Cases before State Administrative Agencies). Such hearings are legal proceedings in the nature of a trial. Individual Respondents may represent themselves or be represented by an attorney licensed to practice law in Tennessee. Artificial Respondents (corporations, limited partnerships, limited liability companies, etc.) cannot engage in the practice of law and therefore may only pursue an appeal though an attorney licensed to practice law in Tennessee. Low-income individuals may be eligible for representation at a reduced or no cost through a local bar association or legal aid organization.

At the conclusion of any initial hearing, the ALJ has the authority to affirm, modify, or deny the Order and Assessment. Furthermore, the ALJ on behalf of the Board has the authority to assess additional damages incurred by the Department including, but not limited to, all docketing expenses associated with the setting of the matter for a hearing and the hourly fees incurred due to the presence of the ALJ and a court reporter.

Any petition for review must be directed to the Commissioner of the Department of Environment and Conservation, c/o Jenny L. Howard, General Counsel, William R. Snodgrass Tennessee Tower, 312 Rosa L. Parks Ave., 2nd Floor, Nashville, Tennessee 37243. Technical questions involving compliance issues should be sent to Jessica Murphy, State of Tennessee, Division of Water Resources, William R. Snodgrass Tennessee Tower, 312 Rosa L. Parks Ave., 11th Floor, Nashville, Tennessee 37243. Attorneys should contact the undersigned counsel of record. The case number WPC21-0149, should be written on all correspondence concerning this matter.

Issued by the Director of the Division of Water Resources, Tennessee Department of Environment and Conservation, on this 11 day of February, 2022.

_____
Jennifer Dodd, Director
Division of Water Resources
TN Department of Environment and Conservation

Reviewed by:

_____
Sara Page
BPR #: 034381
Associate Counsel
Department of Environment and Conservation
312 Rosa L. Parks Ave., 2nd Floor
Nashville, Tennessee 37243
Phone: 615-532-0121
Email: sara.page@tn.gov

APPENDIX C: 2013 Wastewater Treatment Plant Upgrades – Headworks Plan and Section

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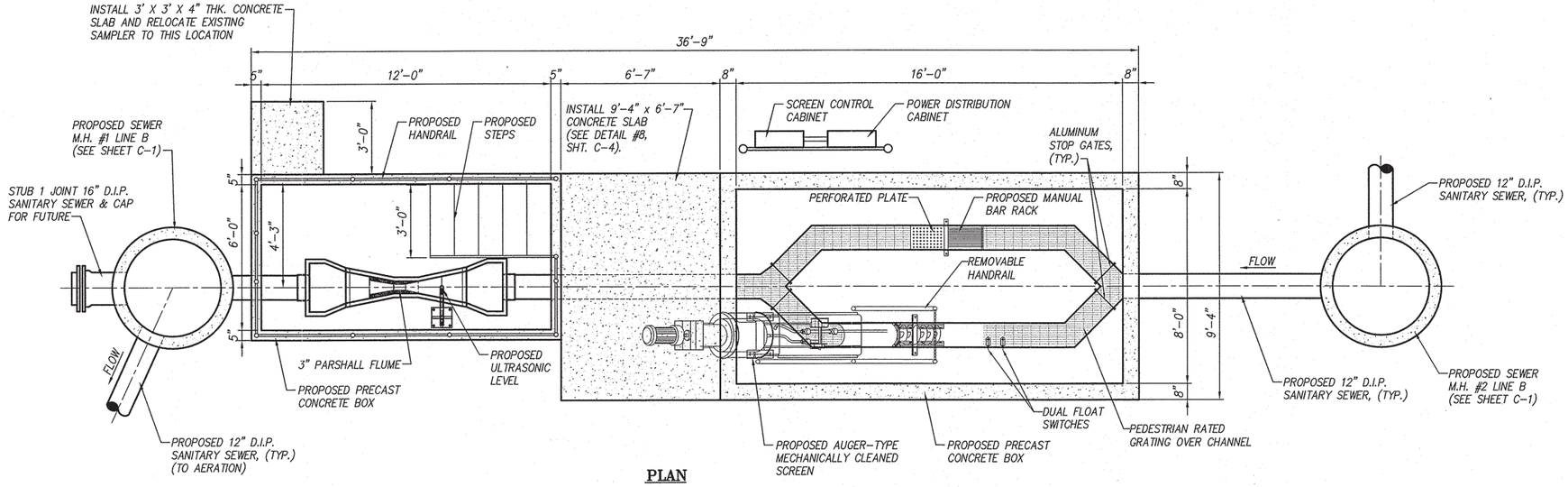
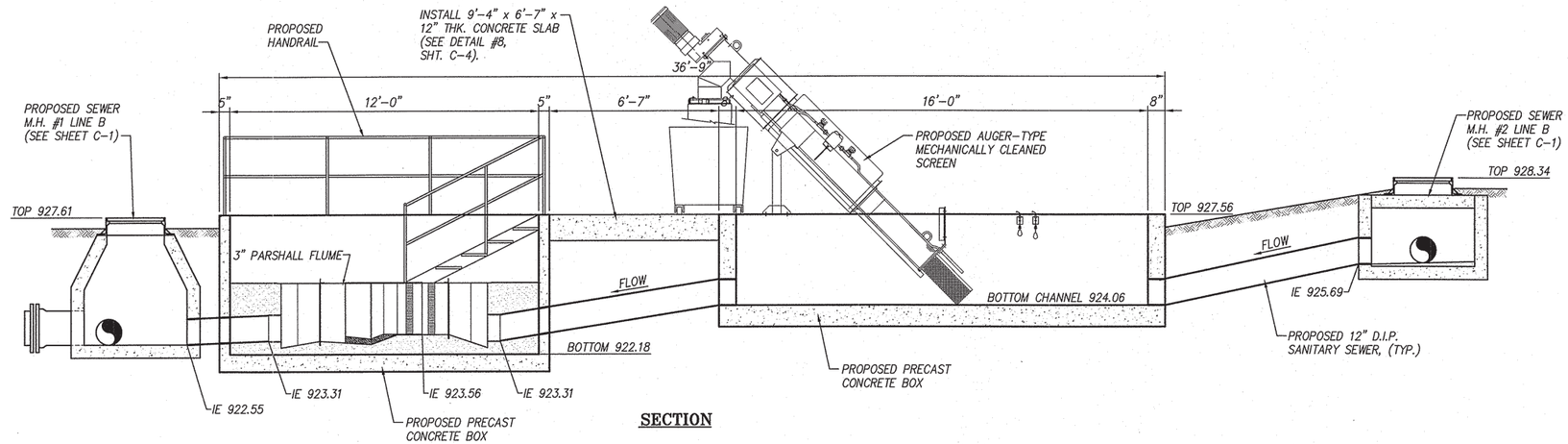


PLAN



SECTION

MECHANICAL PLAN AND SECTION

SCALE: 3/8" = 1'-0"

Know what's below. Call before you dig.

WASTEWATER TREATMENT PLANT IMPROVEMENTS PROJECT

ENGINEER

Cannon&Cannon, Inc.
Consulting Engineers • Field Surveyors
8550 Kingston Pike
Knoxville, Tennessee 37919
Telephone: (865) 670-8555 • Fax: (865) 670-8866
www.cannon-cannon.com

DESIGNED BAG
DRAWN WBW
CHECKED DLU

DOUGLAS L. UNSELL — REGISTERED ENGINEER — AGRICULTURE — COMMERCE — No. 18053 — STATE OF TENNESSEE

SUBCONSULTANT

NO.	DATE	REVISION	APPR.

SCALE AS SHOWN

DATE 1-18-2013

NORRIS WATER COMMISSION
NORRIS, TN

20 Chestnut Dr., P.O. Box 1090
(865) 494-7645 Office
(865) 494-7302 Fax

NORRIS WWTP IMPROVMENTS
CDBG Contract No. 33106

HEADWORKS
PLAN AND SECTION

CCI PROJECT NO: 00292-0010

SHEET M-1

SHEET 8 OF 19

APPENDIX D: NPDES Permit

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STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF WATER RESOURCES
William R. Snodgrass - Tennessee Tower
312 Rosa L. Parks Avenue, 11th Floor
Nashville, Tennessee 37243-1102

December 4, 2018

Mr. Tony Wilkerson
Water Superintendent
e-copy: norriswaterdept@att.net
Norris Water Commission
20 Chestnut Drive
Norris, TN 37828

Subject: **Final NPDES Permit No. TN0020630**
Norris STP
Norris, Anderson County, Tennessee

Dear Mr. Wilkerson:

In accordance with the provisions of the Tennessee Water Quality Control Act, Tennessee Code Annotated (T.C.A.), Sections 69-3-101 through 69-3-120, the Division of Water Resources hereby issues the enclosed NPDES Permit. The continuance and/or reissuance of this NPDES Permit is contingent upon your meeting the conditions and requirements as stated therein.

Please be advised that a petition for permit appeal may be filed, pursuant to T.C.A. Section 69-3-105, subsection (i), by the permit applicant or by any aggrieved person who participated in the public comment period or gave testimony at a formal public hearing whose appeal is based upon any of the issues that were provided to the commissioner in writing during the public comment period or in testimony at a formal public hearing on the permit application. Additionally, for those permits for which the department gives public notice of a draft permit, any permit applicant or aggrieved person may base a permit appeal on any material change to conditions in the final permit from those in the draft, unless the material change has been subject to additional opportunity for public comment. Any petition for permit appeal under this subsection (i) shall be filed with the Technical Secretary of the Water Quality, Oil and Gas Board within thirty (30) days after public notice of the commissioner's decision to issue or deny the permit. A copy of the filing should also be sent to TDEC's Office of General Counsel.

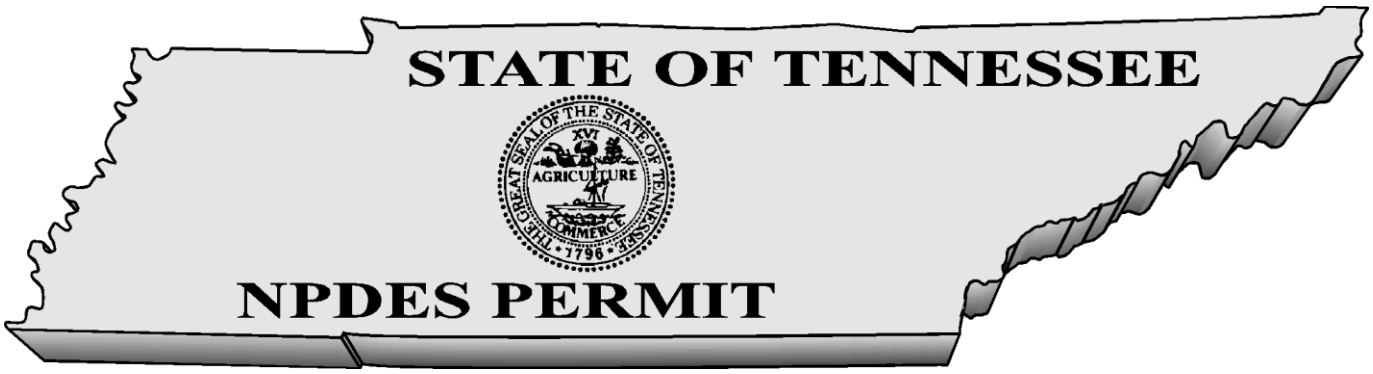
If you have questions, please contact the Knoxville Environmental Field Office at 1-888-891-TDEC; or, at this office, please contact Mr. Wade Murphy at (615) 532-0666 or by E-mail at *Wade.Murphy@tn.gov*.

Sincerely,

Vojin Janjić
Manager, Water-Based Systems

Enclosure

cc: Mr. Doug Snelson, Senior Operator, Norris Water Commission, norriswaterdept@att.net
Ms. Janet Parks, City Recorder/Finance Officer, Norris Water Commission, cityrecorder@comcast.net
EFO-Knoxville-DWR, greg.mize@tn.gov
DWR-Compliance & Enforcement Section, sarah.elias@tn.gov
Permit File



No. TN0020630

Authorization to discharge under the
National Pollutant Discharge Elimination System (NPDES)

Issued By

STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF WATER RESOURCES
William R. Snodgrass - Tennessee Tower
312 Rosa L. Parks Avenue, 11th Floor
Nashville, Tennessee 37243-1102

Under authority of the Tennessee Water Quality Control Act of 1977 (T.C.A. 69-3-101 et seq.) and the delegation of authority from the United States Environmental Protection Agency under the Federal Water Pollution Control Act, as amended by the Clean Water Act of 1977 (33 U.S.C. 1251, et seq.)

Discharger:	**Norris Water Commission/City of Norris STP**
is authorized to discharge:	**treated domestic wastewater from Outfall 001**
from a facility located:	**in Norris, Anderson County, Tennessee**
to receiving waters named:	**Buffalo Creek at mile 4.4**

in accordance with effluent limitations, monitoring requirements and other conditions set forth herein.

This permit shall become effective on:	**January 01, 2019**
This permit shall expire on:	**September 30, 2023**
Issuance date:	**December 04, 2018**

for Jennifer Dodd
Director

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Page

1.0. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

1.1. NUMERIC AND NARRATIVE EFFLUENT LIMITATIONS

The Norris Water Commission/City of Norris is authorized to discharge treated domestic wastewater from Outfall 001 to the Buffalo Creek at mile 4.4. Discharge 001 consists of municipal wastewater from a treatment facility with a design capacity of .2 MGD. Discharge 001 shall be limited and monitored by the permittee as specified below:

Description : External Outfall, Number : 001, Monitoring : Effluent Gross, Season : All Year

Code	Parameter	Qualifier	Value	Unit	Sample Type	Monitoring Frequency	Statistical Base
00300	Oxygen, dissolved (DO)	>=	5.0	mg/L	Grab	Five Per Week	Instantaneous Minimum
00400	pH	>=	6.0	SU	Grab	Five Per Week	Daily Minimum
00400	pH	<=	9.0	SU	Grab	Five Per Week	Daily Maximum
00530	Total Suspended Solids (TSS)	<=	30	mg/L	Composite	Weekly	Monthly Average
00530	Total Suspended Solids (TSS)	<=	40	mg/L	Composite	Weekly	Weekly Average
00530	Total Suspended Solids (TSS)	<=	50	lb/d	Composite	Weekly	Monthly Average
00530	Total Suspended Solids (TSS)	<=	67	lb/d	Composite	Weekly	Weekly Average
00530	Total Suspended Solids (TSS)	<=	45	mg/L	Composite	Weekly	Daily Maximum
00545	Settleable Solids	<=	1.0	mL/L	Grab	Quarterly	Daily Maximum
00600	Nitrogen, total (as N)	Report	-	mg/L	Composite	Weekly	Monthly Average
00600	Nitrogen, total (as N)	Report	-	lb/d	Composite	Weekly	Monthly Average
00600	Nitrogen, total (as N)	Report	-	mg/L	Composite	Weekly	Daily Maximum
00600	Nitrogen, total (as N)	Report	-	lb/d	Composite	Weekly	Daily Maximum
00600	Nitrogen, total (as N)	<=	3650	lb/yr	Calculated	Monthly	Annual Rolling Average
00665	Phosphorus, total (as P)	Report	-	mg/L	Composite	Weekly	Monthly Average
00665	Phosphorus, total (as P)	Report	-	lb/d	Composite	Weekly	Monthly Average
00665	Phosphorus, total (as P)	Report	-	mg/L	Composite	Weekly	Daily Maximum
00665	Phosphorus, total (as P)	Report	-	lb/d	Composite	Weekly	Daily Maximum
00665	Phosphorus, total (as P)	<=	4.5	lb/d	Calculated	Monthly	Annual Rolling Average first 36 months
00665	Phosphorus, total (as P)	<=	621	lb/yr	Calculated	Monthly	Annual Rolling Average after 36 months
50050	Flow	Report	-	Mgal/d	Continuous	Daily	Monthly Average

50050	Flow	Report	-	Mgal/d	Continuous	Daily	Daily Maximum
50060	Chlorine, total residual (TRC)	<=	.04	mg/L	Grab	Five Per Week	Daily Maximum
51040	E. coli	<=	941	#/100mL	Grab	Weekly	Daily Maximum
51040	E. coli	<=	126	#/100mL	Grab	Weekly	Geometric Mean
80082	CBOD, 5-day, 20 C	<=	10	mg/L	Composite	Weekly	Monthly Average
80082	CBOD, 5-day, 20 C	<=	17	lb/d	Composite	Weekly	Monthly Average
80082	CBOD, 5-day, 20 C	<=	15	mg/L	Composite	Weekly	Weekly Average
80082	CBOD, 5-day, 20 C	<=	25	lb/d	Composite	Weekly	Weekly Average
80082	CBOD, 5-day, 20 C	<=	20	mg/L	Composite	Weekly	Daily Maximum

Description : External Outfall, Number : 001, Monitoring : Effluent Gross, Season : Summer

Code	Parameter	Qualifier	Value	Unit	Sample Type	Monitoring Frequency	Statistical Base
00610	Nitrogen, Ammonia total (as N)	<=	1.5	mg/L	Composite	Weekly	Monthly Average
00610	Nitrogen, Ammonia total (as N)	<=	2.5	lb/d	Composite	Weekly	Monthly Average
00610	Nitrogen, Ammonia total (as N)	<=	2.3	mg/L	Composite	Weekly	Weekly Average
00610	Nitrogen, Ammonia total (as N)	<=	3.8	lb/d	Composite	Weekly	Weekly Average
00610	Nitrogen, Ammonia total (as N)	<=	3	mg/L	Composite	Weekly	Daily Maximum

Description : External Outfall, Number : 001, Monitoring : Effluent Gross, Season : Winter

Code	Parameter	Qualifier	Value	Unit	Sample Type	Monitoring Frequency	Statistical Base
00610	Nitrogen, Ammonia total (as N)	<=	3.25	mg/L	Composite	Weekly	Monthly Average
00610	Nitrogen, Ammonia total (as N)	<=	5.4	lb/d	Composite	Weekly	Monthly Average
00610	Nitrogen, Ammonia total (as N)	<=	4.9	mg/L	Composite	Weekly	Weekly Average
00610	Nitrogen, Ammonia total (as N)	<=	8.2	lb/d	Composite	Weekly	Weekly Average
00610	Nitrogen, Ammonia total (as N)	<=	6.5	mg/L	Composite	Weekly	Daily Maximum

Description : External Outfall, Number : 001, Monitoring : Percent Removal, Season : All Year

Code	Parameter	Qualifier	Value	Unit	Sample Type	Monitoring Frequency	Statistical Base
80358	CBOD, 5-day, 20 C, % removal	>=	85	%	Composite	Weekly	Monthly Average Minimum
80358	CBOD, 5-day, 20 C, % removal	>=	40	%	Composite	Weekly	Daily Minimum
81011	TSS, % removal	>=	85	%	Calculated	Weekly	Monthly Average Minimum
81011	TSS, % removal	>=	40	%	Composite	Weekly	Daily Minimum

Description : External Outfall, Number : 001, Monitoring : Raw Sewage Influent, Season : All Year

Code	Parameter	Qualifier	Value	Unit	Sample Type	Monitoring Frequency	Statistical Base
00530	Total Suspended	Report	-	mg/L	Composite	Weekly	Monthly Average

	Solids (TSS)						
00530	Total Suspended Solids (TSS)	Report	-	mg/L	Composite	Weekly	Daily Maximum
50050	Flow	Report	-	Mgal/d	Continuous	Daily	Monthly Average
50050	Flow	Report	-	Mgal/d	Continuous	Daily	Daily Maximum
80082	CBOD, 5-day, 20 C	Report	-	mg/L	Composite	Weekly	Monthly Average
80082	CBOD, 5-day, 20 C	Report	-	mg/L	Composite	Weekly	Daily Maximum

Monitoring : All Weather

Code	Parameter	Qualifier	Value	Unit	Sample Type	Monitoring Frequency	Statistical Base
51929	Bypass of Treatment Facility	Report	-	occur/mo	Occurrences	Continuous	Monthly Total
51929	Bypass of Treatment Facility	Report	-	gal/mo	Estimate	Continuous	Monthly Total

Monitoring : Dry Weather

Code	Parameter	Qualifier	Value	Unit	Sample Type	Monitoring Frequency	Statistical Base
51925	SSO, Dry Weather	Report	-	gal/mo	Estimate	Continuous	Monthly Total
51925	SSO, Dry Weather	Report	-	occur/12 Mo Cumulative Total	Calculated	Continuous	Total
51925	SSO, Dry Weather	<=	0	occur/mo	Occurrences	Continuous	Monthly Total
51927	Release [Sewer], Dry Weather	Report	-	occur/mo	Occurrences	Continuous	Monthly Total
51927	Release [Sewer], Dry Weather	Report	-	gal/mo	Estimate	Continuous	Monthly Total

Monitoring : Wet Weather

Code	Parameter	Qualifier	Value	Unit	Sample Type	Monitoring Frequency	Statistical Base
51926	SSO, Wet Weather	Report	-	gal/mo	Estimate	Continuous	Monthly Total
51926	SSO, Wet Weather	Report	-	occur/12 Mo Cumulative Total	Calculated	Continuous	Total
51926	SSO, Wet Weather	<=	0	occur/mo	Occurrences	Continuous	Monthly Total
51928	Release [Sewer], Wet Weather	Report	-	gal/mo	Estimate	Continuous	Monthly Total
51928	Release [Sewer], Wet Weather	Report	-	occur/mo	Occurrences	Continuous	Monthly Total

Notes: The permittee shall achieve 85% removal of $CBOD_5$ and TSS on a monthly average basis. The permittee shall report all instances of releases, overflows and/or bypasses. See Part 2.3.3.a for the definition of overflow and Part 1.3.5.1 for reporting requirements.

Unless elsewhere specified, summer months are May through October; winter months are November through April.

See Part 1.2.3 for test procedures.

See Part 3.4 for biomonitoring test and reporting requirements. See Page 5 for percent removal calculations.

Total residual chlorine (TRC) monitoring shall be applicable when chlorine, bromine, or any other oxidants are added. The acceptable methods for analysis of TRC are any methods specified in Title 40 CFR, Part 136 as amended. The method

detection level (MDL) for TRC shall not exceed 0.05 mg/l unless the permittee demonstrates that its MDL is higher. The permittee shall retain the documentation that justifies the higher MDL and have it available for review upon request. In cases where the permit limit is less that the MDL, the reporting of TRC at less than the MDL shall be interpreted to constitute compliance with the permit.

Monitoring and reporting requirements for both total nitrogen (TN) and total phosphorus (TP) begin the effective date of the permit. For phosphorus, the 4.5 lb/d limit applies beginning the effective date of the permit and then for 36 months. The 621 lb/year limit for phosphorus applies begins the 37th month of permit effectiveness.

Each daily load is calculated by multiplying the day's sample concentration (mg/l) by the effluent flow rate (MGD) for the day of the sample was collected by 8.34.

$$Load = \left(\begin{matrix} Effluent \\ Concentration \end{matrix}\right) x \left(\begin{matrix} Effluent\ flow\ for\ the\ day\ the \\ day\ the\ sample\ was\ collected \end{matrix}\right) x\ (8.34)$$

The average pound per day is the mathematical average where the sum of all the calculated loads during the current month and previous 11 months is divided by the number of calculated loads. Each load is calculated using the day's sample concentration (mg/l) and the effluent flow rate for the day the sample was collected.

$$Average\ Pounds\ per\ Day = \left(\begin{matrix} Sum\ of\ All\ Loads\ in\ \frac{lbs}{day}\ During\ the \\ \underline{Current\ Month\ and\ the\ Previous\ 11\ Months} \\ Total\ Number\ of\ Loads\ \ Calculated\ During \\ the\ Current\ Month\ and\ Previous\ 11\ Months \end{matrix}\right)$$

The annual rolling load for the current month is calculated by multiplying the average of all sample loads for the current month and the previous 11 months by 365.

$$Annual\ Rolling\ Load\ = \left(\frac{Sum\ of\ All\ Loads\ in\ \frac{lbs}{day}\ During\ the\ Current\ Month\ and\ Previous\ 11\ Months}{Total\ Number\ of\ Loads\ \ Calculated\ During\ the\ Current\ Month\ and\ Previous\ 11\ Months}\right) x\ (365)$$

----------End of Notes----------

Permit No	Narrative Condition Description	Schedule (Due) Date	Schedule Event Description	Status	Pollutant of Concern	ICIS Number	ICIS Action
TN0020630	Pollutant Minimization	See Section 3.6	Status/Progress Report	Active - Voluntary	Phosphorus	607	-
TN0020630	Benthic Organism Study	31-MAR-23	Plan, Report, or Scope of Work	Active - Voluntary	Macro-invertebrates	608	-

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The wastewater discharge must be disinfected to the extent that viable coliform organisms are effectively eliminated. The concentration of the *E. coli* group after disinfection shall not exceed 126 cfu per 100 ml as the geometric mean calculated on the actual number of samples collected and tested for *E. coli* within the required reporting period. The permittee may collect more samples than specified as the monitoring frequency. Samples may not be collected at intervals of less than 12 hours. For the purpose of determining the geometric mean, individual samples having an *E. coli* group concentration of less than one (1) per 100 ml shall be considered as having a concentration of one (1) per 100 ml. In addition, the concentration of the *E. coli* group in any individual sample shall not exceed a specified maximum amount. A maximum daily limit of 487 colonies per 100 ml applies to lakes and exceptional Tennessee waters. A maximum daily limit of 941 colonies per 100 ml applies to all other recreational waters.

There shall be no distinctly visible floating scum, oil or other matter contained in the wastewater discharge. The wastewater discharge must not cause an objectionable color contrast in the receiving stream.

The wastewater discharge shall not contain pollutants in quantities that will be hazardous or otherwise detrimental to humans, livestock, wildlife, plant life, or fish and aquatic life in the receiving stream.

Sludge or any other material removed by any treatment works must be disposed of in a manner that prevents its entrance into or pollution of any surface or subsurface waters. Additionally, the disposal of such sludge or other material must be in compliance with the Tennessee Solid Waste Disposal Act, TCA 68-31-101 et seq. and the Tennessee Hazardous Waste Management Act, TCA 68-46-101 et seq.

Nothing in this permit authorizes take for the purposes of a facility's compliance with the Endangered Species Act. (40 C.F.R. 125.98(b)(1)).

For the purpose of evaluating compliance with the permit limits established herein, where certain limits are below the State of Tennessee published required detection levels (RDLs) for any given effluent characteristics, the results of analyses below the RDL shall be reported as Below Detection Level (BDL), unless in specific cases other detection limits are demonstrated to be the best achievable because of the particular nature of the wastewater being analyzed.

For $CBOD_5$ and TSS, the treatment facility shall demonstrate a minimum of 85% removal efficiency on a monthly average basis. This is calculated by determining an average of all daily influent concentrations and comparing this to an average of all daily effluent concentrations. The formula for this calculation is as follows:

$$\left[1 - \frac{\text{average of daily effluent concentration}}{\text{average of daily influent concentration}}\right] \times 100\% = \%\ \text{removal}$$

The treatment facility will also demonstrate 40% minimum removal of the $CBOD_5$ and TSS based upon each daily composite sample. The formula for this calculation is as follows:

$$\left[1 - \frac{\text{daily effluent concentration}}{\text{daily influent concentration}}\right] \times 100\% = \%\ \text{removal}$$

1.2. MONITORING PROCEDURES

1.2.1. Representative Sampling

Samples and measurements taken in compliance with the monitoring requirements specified herein shall be representative of the volume and nature of the monitored discharge, and shall be taken after treatment and prior to mixing with uncontaminated storm water runoff or the receiving stream. Appropriate flow measurement devices and methods consistent with accepted scientific practices shall be selected and used to insure the accuracy and reliability of measurements of the volume of monitored discharges. The devices shall be installed, calibrated and maintained to insure that the accuracy of the measurements is consistent with accepted capability of that type of device. Devices selected shall be capable of

measuring flows with a maximum deviation of less than plus or minus 10% from the true discharge rates throughout the range of expected discharge volumes.

Samples and measurements taken in compliance with the monitoring requirements specified above shall be representative of the volume and nature of the monitored discharge, and shall be taken at the following location(s):

Influent samples must be collected prior to mixing with any other wastewater being returned to the head of the plant, such as sludge return. Those systems with more than one influent line must collect samples from each and proportion the results by the flow from each line.

Effluent samples must be representative of the wastewater being discharged and collected prior to mixing with any other discharge or the receiving stream. This can be a different point for different parameters, but must be after all treatment for that parameter or all expected change:

a. The chlorine residual must be measured after the chlorine contact chamber and any dechlorination. It may be to the advantage of the permittee to measure at the end of any long outfall lines.

b. Samples for *E. coli* can be collected at any point between disinfection and the actual discharge.

c. The dissolved oxygen can drop in the outfall line; therefore, D.O. measurements are required at the discharge end of outfall lines greater than one mile long. Systems with outfall lines less than one mile may measure dissolved oxygen as the wastewater leaves the treatment facility. For systems with dechlorination, dissolved oxygen must be measured after this step and as close to the end of the outfall line as possible.

d. Total suspended solids and settleable solids can be collected at any point after the final clarifier.

e. Biomonitoring tests (if required) shall be conducted on final effluent.

1.2.2. Sampling Frequency

Where the permit requires sampling and monitoring of a particular effluent characteristic(s) at a frequency of less than once per day or daily, the permittee is precluded from marking the “No Discharge” block on the Discharge Monitoring Report if there has been any discharge from that particular outfall during the period which coincides with the required monitoring frequency; i.e. if the required monitoring frequency is once per month or 1/month, the monitoring period is one month, and if the discharge occurs during only one day in that period then the permittee must sample on that day and report the results of analyses accordingly.

1.2.3. Test Procedures

a. Test procedures for the analysis of pollutants shall conform to regulations published pursuant to Section 304 (h) of the Clean Water Act (the "Act"), as amended, under which such procedures may be required.

b. Unless otherwise noted in the permit, all pollutant parameters shall be determined according to methods prescribed in Title 40, CFR, Part 136, as amended, promulgated pursuant to Section 304 (h) of the Act.

c. Composite samples must be proportioned by flow at time of sampling. Aliquots may be collected manually or automatically. The sample aliquots must be maintained at ≤ 6 degrees Celsius during the compositing period.

d. In instances where permit limits established through implementation of applicable water criteria are below analytical capabilities, compliance with those limits will be determined using the detection limits described in the TN Rules, Chapter 0400-40-03-.05(8).

1.2.4. Recording of Results

For each measurement or sample taken pursuant to the requirements of this permit, the permittee shall record the following information:

a. The exact place, date and time of sampling or measurements;

b. The exact person(s) collecting samples or measurements;

c. The dates and times the analyses were performed;

d. The person(s) or laboratory who performed the analyses;

e. The analytical techniques or methods used, and;

f. The results of all required analyses.

1.2.5. Records Retention

All records and information resulting from the monitoring activities required by this permit including all records of analyses performed and calibration and maintenance of instrumentation shall be retained for a minimum of three (3) years, or longer, if requested by the Division of Water Resources.

1.3. REPORTING

1.3.1. Monitoring Results

Monitoring results shall be recorded monthly and submitted monthly using NetDMR. Submittals shall be no later than 15 days after the completion of the reporting period. If NetDMR is not functioning, a completed DMR with an original signature shall be submitted to the following address:

STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF WATER RESOURCES
COMPLIANCE & ENFORCEMENT SECTION
William R. Snodgrass - Tennessee Tower
312 Rosa L. Parks Avenue, 11th Floor
Nashville, Tennessee 37243-1102

If NetDMR is not functioning, a copy of the completed and signed DMR shall be mailed to the Knoxville Environmental Field Office (EFO) at the following address:

STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF WATER RESOURCES
Knoxville Environmental Field Office
3711 Middlebrook Pike
Knoxville, Tennessee 37921

In addition, any communication regarding compliance with the conditions of this permit must be sent to the two offices listed above.

The first DMR is due on the 15th of the month following permit effectiveness.

DMRs and any other information or report must be signed and certified by a responsible corporate officer as defined in 40 CFR 122.22, a general partner or proprietor, or a principal municipal executive officer or ranking elected official, or his duly authorized representative. Such authorization must be submitted in writing and must explain the duties and responsibilities of the authorized representative.

For purposes of determining compliance with this permit, data provided to the division electronically is legally equivalent to data submitted on signed and certified DMR forms.

1.3.2. Additional Monitoring by Permittee

If the permittee monitors any pollutant more frequently than required at the location(s) designated, using approved analytical methods as specified herein, the results of such monitoring shall be included in the calculation and reporting of the values required in the DMR form. Such increased frequency shall also be indicated on the form.

1.3.3. Falsifying Results and/or Reports

Knowingly making any false statement on any report required by this permit or falsifying any result may result in the imposition of criminal penalties as provided for in Section 309 of the Federal Water Pollution Control Act, as amended, and in Section 69-3-115 of the Tennessee Water Quality Control Act.

1.3.4. Monthly Report of Operation

Monthly operational reports shall be submitted on standard forms to the appropriate Division of Water Resources Environmental Field Office in Jackson, Nashville, Chattanooga, Columbia, Cookeville, Memphis, Johnson City, or Knoxville. Reports shall be submitted by the 15th day of the month following data collection.

1.3.5. Bypass, Release and Overflow Reporting

1.3.5.1. Report Requirements

A summary report of known instances of sanitary sewer overflows, releases, and bypasses shall accompany the Discharge Monitoring Report (DMR). The report must contain the date(s), estimated duration in hours, estimated quantity of wastewater in gallons, and if applicable, the receiving stream for each instance of sanitary sewer overflow, release, or bypass. For each sanitary sewer overflow and release, the report shall identify (using the permittee's naming conventions) the next downstream pump station. For each sanitary sewer overflow, the report shall also identify whether it was a dry weather overflow.

The report must also detail activities undertaken during the reporting period to correct the reported sanitary sewer overflows and releases.

On the DMR, the permittee must separately report: the total number of sanitary sewer overflows for the reporting month and the cumulative total for the previous 12 months; the total number of dry-weather overflows for the reporting month and the cumulative total for the previous 12 months; the total number of releases for the reporting month; and the total number of bypasses for the reporting month. On the DMR, sanitary sewer overflows are coded "SSO, Dry Weather and SSO, Wet Weather" and releases are coded "Release [Sewer], Dry Weather and Release [Sewer], Wet Weather." Estimated total monthly volume for each type of event will be reported as gallons per month. Each release due to improper operation or maintenance shall be reported as such. Each discrete location of a sanitary sewer overflow or a release shall be reported as a separate value.

1.3.5.2. Anticipated Bypass Notification

If, because of unavoidable maintenance or construction, the permittee has need to create an in-plant bypass which would cause an effluent violation, the permittee must notify the division as soon as possible, but in any case, no later than 10 days prior to the date of the bypass.

1.3.6. Reporting Less Than Detection; Reporting Significant Figures

A permit limit may be less than the accepted detection level. If the samples are below the detection level, then report “BDL” or “NODI =B” on the DMRs. The permittee must use the correct detection levels in all analytical testing required in the permit. The required detection levels are listed in the Rules of the Department of Environment and Conservation, Division of Water Resources, Chapter 0400-40-03-.05(8).

For example, if the limit is 0.02 mg/l with a detection level of 0.05 mg/l and detection is shown; 0.05 mg/l must be reported. In contrast, if nothing is detected reporting “BDL” or “NODI =B” is acceptable.

Reported results are to correspond to the number of significant figures (decimal places) set forth in the permit conditions. The permittee shall round values, if allowed by the method of sample analysis, using a uniform rounding convention adopted by the permittee.

1.4. COMPLIANCE WITH SECTION 208

The limits and conditions in this permit shall require compliance with an area-wide waste treatment plan (208 Water Quality Management Plan) where such approved plan is applicable.

1.5. REOPENER CLAUSE

This permit shall be modified, or alternatively revoked and reissued, to comply with any applicable effluent standard or limitation issued or approved under Sections 301(b)(2)(C) and (D), 307(a)(2) and 405(d)(2)(D) of the Clean Water Act, as amended, if the effluent standard, limitation or sludge disposal requirement so issued or approved:

a. Contains different conditions or is otherwise more stringent than any condition in the permit; or

b. Controls any pollutant or disposal method not addressed in the permit.

The permit as modified or reissued under this paragraph shall also contain any other requirements of the Act then applicable.

1.6. SCHEDULE OF COMPLIANCE

Full compliance and operational levels shall be attained from the effective date of this permit.

2.0. GENERAL PERMIT REQUIREMENTS

2.1. GENERAL PROVISIONS

2.1.1. Duty to Reapply

Permittee is not authorized to discharge after the expiration date of this permit. In order to receive authorization to discharge beyond the expiration date, the permittee shall submit such information and forms as are required to the Director of the Division of Water Resources (the "director") no later than 180 days prior to the expiration date. Such forms shall be properly signed and certified.

2.1.2. Right of Entry

The permittee shall allow the director, the Regional Administrator of the U.S. Environmental Protection Agency, or their authorized representatives, upon the presentation of credentials:

a. To enter upon the permittee's premises where an effluent source is located or where records are required to be kept under the terms and conditions of this permit, and at reasonable times to copy these records;

b. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit; and

c. Sample or monitor at reasonable times, for the purposes of assuring permit compliance or as otherwise authorized by the Director.

2.1.3. Availability of Reports

Except for data determined to be confidential under Section 308 of the Federal Water Pollution Control Act, as amended, all reports prepared in accordance with the terms of this permit shall be available for public inspection at the offices of the Division of Water Resources. As required by the Federal Act, effluent data shall not be considered confidential.

2.1.4. Proper Operation and Maintenance

a. The permittee shall at all times properly operate and maintain all facilities and systems (and related appurtenances) for collection and treatment which are installed or used by the permittee to achieve compliance with the terms and conditions of this permit. Proper operation and maintenance also includes adequate laboratory and process controls and appropriate quality assurance procedures. This provision requires the operation of backup or auxiliary facilities or similar systems, which are installed by a permittee only when the operation is

necessary to achieve compliance with the conditions of the permit. Backup continuous pH and flow monitoring equipment are not required.

b. Dilution water shall not be added to comply with effluent requirements to achieve BCT, BPT, BAT and or other technology based effluent limitations such as those in Tennessee Rule 0400-40-05-.09.

2.1.5. Treatment Facility Failure (Industrial Sources)

The permittee, in order to maintain compliance with this permit, shall control production, all discharges, or both, upon reduction, loss, or failure of the treatment facility, until the facility is restored or an alternative method of treatment is provided. This requirement applies in such situations as the reduction, loss, or failure of the primary source of power.

2.1.6. Property Rights

The issuance of this permit does not convey any property rights in either real or personal property, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of federal, state, or local laws or regulations.

2.1.7. Severability

The provisions of this permit are severable. If any provision of this permit due to any circumstance, is held invalid, then the application of such provision to other circumstances and to the remainder of this permit shall not be affected thereby.

2.1.8. Other Information

If the permittee becomes aware of failure to submit any relevant facts in a permit application, or of submission of incorrect information in a permit application or in any report to the director, then the permittee shall promptly submit such facts or information.

2.2. CHANGES AFFECTING THE PERMIT

2.2.1. Planned Changes

The permittee shall give notice to the director as soon as possible of any planned physical alterations or additions to the permitted facility. Notice is required only when:

a. The alteration or addition to a permitted facility may meet one of the criteria for determining whether a facility is a new source in 40 CFR 122.29(b); or

b. The alteration or addition could significantly change the nature or increase the quantity of pollutants discharged. This notification applies to pollutants, which are

subject neither to effluent limitations in the permit, nor to notification requirements under 40 CFR 122.42(a)(1).

c. The alteration or addition results in a significant change in the permittee's sludge use or disposal practices.

2.2.2. Permit Modification, Revocation, or Termination

a. This permit may be modified, revoked and reissued, or terminated for cause as described in 40 CFR 122.62 and 122.64, Federal Register, Volume 49, No. 188 (Wednesday, September 26, 1984), as amended.

b. The permittee shall furnish to the director, within a reasonable time, any information which the director may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit, or to determine compliance with this permit. The permittee shall also furnish to the director, upon request, copies of records required to be kept by this permit.

c. If any applicable effluent standard or prohibition (including any schedule of compliance specified in such effluent standard or prohibition) is established for any toxic pollutant under Section 307(a) of the Federal Water Pollution Control Act, as amended, the director shall modify or revoke and reissue the permit to conform to the prohibition or to the effluent standard, providing that the effluent standard is more stringent than the limitation in the permit on the toxic pollutant. The permittee shall comply with these effluent standards or prohibitions within the time provided in the regulations that establish these standards or prohibitions, even if the permit has not yet been modified or revoked and reissued to incorporate the requirement.

d. The filing of a request by the permittee for a modification, revocation, reissuance, termination, or notification of planned changes or anticipated noncompliance does not halt any permit condition.

2.2.3. Change of Ownership

This permit may be transferred to another party (provided there are neither modifications to the facility or its operations, nor any other changes which might affect the permit limits and conditions contained in the permit) by the permittee if:

a. The permittee notifies the director of the proposed transfer at least 30 days in advance of the proposed transfer date;

b. The notice includes a written agreement between the existing and new permittees containing a specified date for transfer of permit responsibility, coverage, and liability between them; and

c. The director, within 30 days, does not notify the current permittee and the new permittee of his intent to modify, revoke or reissue, or terminate the permit and to require that a new application be filed rather than agreeing to the transfer of the permit.

Pursuant to the requirements of 40 CFR 122.61, concerning transfer of ownership, the permittee must provide the following information to the division in their formal notice of intent to transfer ownership: 1) the NPDES permit number of the subject permit; 2) the effective date of the proposed transfer; 3) the name and address of the transferor; 4) the name and address of the transferee; 5) the names of the responsible parties for both the transferor and transferee; 6) a statement that the transferee assumes responsibility for the subject NPDES permit; 7) a statement that the transferor relinquishes responsibility for the subject NPDES permit; 8) the signatures of the responsible parties for both the transferor and transferee pursuant to the requirements of 40 CFR 122.22(a), “Signatories to permit applications”; and, 9) a statement regarding any proposed modifications to the facility, its operations, or any other changes which might affect the permit limits and conditions contained in the permit.

2.2.4. Change of Mailing Address

The permittee shall promptly provide to the director written notice of any change of mailing address. In the absence of such notice the original address of the permittee will be assumed to be correct.

2.3. NONCOMPLIANCE

2.3.1. Effect of Noncompliance

The permittee shall comply with all conditions of this permit. Any permit noncompliance constitutes a violation of applicable state and federal laws and is grounds for enforcement action, permit termination, permit modification, or denial of permit reissuance.

2.3.2. Reporting of Noncompliance

a. 24-Hour Reporting

In the case of any noncompliance which could cause a threat to public drinking supplies, or any other discharge which could constitute a threat to human health or the environment, the required notice of non-compliance shall be provided to the Division of Water Resources in the appropriate Environmental Field Office within 24-hours from the time the permittee becomes aware of the circumstances. (The Environmental Field Office should be contacted for names and phone numbers of environmental response team).

A written submission must be provided within five days of the time the permittee becomes aware of the circumstances unless the director on a case-by-case

basis waives this requirement. The permittee shall provide the director with the following information:

i. A description of the discharge and cause of noncompliance;

ii. The period of noncompliance, including exact dates and times or, if not corrected, the anticipated time the noncompliance is expected to continue; and

iii. The steps being taken to reduce, eliminate, and prevent recurrence of the noncomplying discharge.

b. Scheduled Reporting

For instances of noncompliance which do not cause a threat to public drinking supplies, or any other discharge which could constitute a threat to human health or the environment,, the permittee shall report the noncompliance on the Discharge Monitoring Report. The report shall contain all information concerning the steps taken, or planned, to reduce, eliminate, and prevent recurrence of the violation and the anticipated time the violation is expected to continue.

2.3.3. Overflow

a. Sanitary sewer overflows, including dry-weather overflows, are prohibited.

b. The permittee shall operate the collection system so as to avoid sanitary sewer overflows and releases due to improper operation or maintenance. A “release” may be due to improper operation or maintenance of the collection system or may be due to other cause(s). Releases caused by improper operation or maintenance of the permittee’s collection and transmission system are prohibited.

c. The permittee shall take all reasonable steps to minimize any adverse impact associated with overflows and releases.

d. No new or additional flows shall be added upstream of any point in the collection or transmission system that experiences greater than 5 sanitary sewer overflows and/or releases per year[1] or would otherwise overload any portion of the system. Unless there is specific enforcement action to the contrary, the permittee is relieved of this requirement after: 1) an authorized representative of the Commissioner of the Department of Environment and Conservation has approved an engineering report and construction plans and specifications prepared in accordance with accepted engineering practices for correction of the problem; 2) the correction work is underway; and 3) the cumulative, peak-design, flows potentially added from new connections and line extensions upstream of any chronic overflow or release point are less than or proportional to the amount

[1] This includes dry weather overflows, wet weather overflows, dry weather releases and wet weather releases.

of inflow and infiltration removal documented upstream of that point. The inflow and infiltration reduction must be measured by the permittee using practices that are customary in the environmental engineering field and reported in an attachment to a Monthly Operating Report submitted to the local TDEC Environmental Field Office. The data measurement period shall be sufficient to account for seasonal rainfall patterns and seasonal groundwater table elevations.

e. In the event that chronic sanitary sewer overflows or releases have occurred from a single point in the collection system for reasons that may not warrant the self-imposed moratorium of the actions identified in this paragraph, the permittee may request a meeting with the Division of Water Resources EFO staff to petition for a waiver based on mitigating evidence.

2.3.4. Upset

a. "***Upset***" means an exceptional incident in which there is unintentional and temporary noncompliance with technology-based effluent limitations because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

b. An upset shall constitute an affirmative defense to an action brought for noncompliance with such technology-based permit effluent limitations if the permittee demonstrates, through properly signed, contemporaneous operating logs, or other relevant evidence that:

   i. An upset occurred and that the permittee can identify the cause(s) of the upset;

   ii. The permitted facility was at the time being operated in a prudent and workman-like manner and in compliance with proper operation and maintenance procedures;

   iii. The permittee submitted information required under "Reporting of Noncompliance" within 24-hours of becoming aware of the upset (if this information is provided orally, a written submission must be provided within five days); and

   iv. The permittee complied with any remedial measures required under "Adverse Impact."

2.3.5. Adverse Impact

The permittee shall take all reasonable steps to minimize any adverse impact to the waters of Tennessee resulting from noncompliance with this permit, including such accelerated or additional monitoring as necessary to determine the nature and impact of the noncomplying discharge. It shall not be a defense for the permittee in

an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

2.3.6. Bypass

a. "***Bypass***" is the intentional diversion of waste streams from any portion of a treatment facility. "Severe property damage" means substantial physical damage to property, damage to the treatment facilities which would cause them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.

b. Bypasses are prohibited unless all of the following 3 conditions are met:

   i. The bypass is unavoidable to prevent loss of life, personal injury, or severe property damage;

   ii. There are no feasible alternatives to bypass, such as the construction and use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate back-up equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass, which occurred during normal periods of equipment downtime or preventative maintenance;

   iii. The permittee submits notice of an unanticipated bypass to the Division of Water Resources in the appropriate Environmental Field Office within 24 hours of becoming aware of the bypass (if this information is provided orally, a written submission must be provided within five days). When the need for the bypass is foreseeable, prior notification shall be submitted to the director, if possible, at least 10 days before the date of the bypass.

c. Bypasses not exceeding permit limitations are allowed **only** if the bypass is necessary for essential maintenance to assure efficient operation. All other bypasses are prohibited. Allowable bypasses not exceeding limitations are not subject to the reporting requirements of 2.3.6.b.iii, above.

2.3.7. Washout

a. For domestic wastewater plants only, a "washout" shall be defined as loss of Mixed Liquor Suspended Solids (MLSS) of 30.00% or more. This refers to the MLSS in the aeration basin(s) only. This does not include MLSS decrease due to solids wasting to the sludge disposal system. A washout can be caused by improper operation or from peak flows due to infiltration and inflow.

b. A washout is prohibited. If a washout occurs the permittee must report the incident to the Division of Water Resources in the appropriate Environmental Field Office within 24 hours by telephone. A written submission must be provided within five days. The washout must be noted on the discharge monitoring report. Each day of a washout is a separate violation.

2.4. LIABILITIES

2.4.1. Civil and Criminal Liability

Except as provided in permit conditions for "***Bypassing***," "***Overflow,***" and "***Upset***," nothing in this permit shall be construed to relieve the permittee from civil or criminal penalties for noncompliance. Notwithstanding this permit, the permittee shall remain liable for any damages sustained by the State of Tennessee, including but not limited to fish kills and losses of aquatic life and/or wildlife, as a result of the discharge of wastewater to any surface or subsurface waters. Additionally, notwithstanding this Permit, it shall be the responsibility of the permittee to conduct its wastewater treatment and/or discharge activities in a manner such that public or private nuisances or health hazards will not be created.

2.4.2. Liability Under State Law

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties established pursuant to any applicable state law or the Federal Water Pollution Control Act, as amended.

3.0. PERMIT SPECIFIC REQUIREMENTS

3.1. CERTIFIED OPERATOR

The waste treatment facilities shall be operated under the supervision of a certified wastewater treatment operator and the collection system shall be operated under the supervision of a certified collection system operator in accordance with the Water Environmental Health Act of 1984.

3.2. POTW PRETREATMENT PROGRAM GENERAL PROVISIONS

As an update of information previously submitted to the division, the permittee will undertake the following activity.

a. The permittee shall submit the results of an Industrial Waste Survey (IWS) in accordance with 40 CFR 403.8(f)(2)(i), including any industrial users (IU) covered under Section 301(i)(2) of the Act. As much information as possible must be obtained relative to the character and volume of pollutants contributed to the POTW by the IUs. This information will be submitted to the Division of Water Resources, Pretreatment Section within one hundred twenty (120) days of the effective date of this permit, unless such a survey has been submitted within 3 years of the effective date. Development of a pretreatment program may be required after completion of the industrial user review. All requirements and conditions of the pretreatment program are enforceable through the NPDES permit.

b. The permittee shall enforce 40 CFR 403.5, "prohibited discharges". Pollutants introduced into the POTW by a non-domestic source shall not cause pass through or interference as defined in 40 CFR Part 403.3. These general prohibitions and the specific prohibitions in this section apply to all non-domestic sources introducing pollutants into the POTW whether the source is subject to other National Pretreatment Standards or any state or local pretreatment requirements.

   Specific prohibitions. Under no circumstances shall the permittee allow introduction of the following wastes in the waste treatment system:

   i. Pollutants which create a fire or explosion hazard in the POTW;

   ii. Pollutants which will cause corrosive structural damage to the treatment works, but in no case discharges with pH less than 5.0 unless the system is specifically designed to accept such discharges.

   iii. Solid or viscous pollutants in amounts which will cause obstruction to the flow in the treatment system resulting in interference.

iv. Any pollutant, including oxygen-demanding pollutants (BOD, etc.) released in a discharge at a flow rate and/or pollutant concentration which will cause interference with the treatment works.

v. Heat in amounts which will inhibit biological activity in the treatment works resulting in interference, but in no case heat in such quantities that the temperature at the treatment works exceeds 40°C (104°F) unless the works are designed to accommodate such heat.

vi. Any priority pollutant in amounts that will contaminate the treatment works sludge.

vii. Petroleum oil, nonbiodegradable cutting oil, or products of mineral oil origin in amounts that will cause interference or pass through;

viii. Pollutants which result in the presence of toxic gases, vapors or fumes within the POTW in a quantity that may cause acute worker health and safety problems;

ix. Any trucked or hauled pollutants except at discharge points designated by the POTW.

c. The permittee shall notify the Tennessee Division of Water Resources of any of the following changes in user discharge to the system no later than 30 days prior to change of discharge:

i. New introductions into such works of pollutants from any source which would be a new source as defined in Section 306 of the Act if such source were discharging pollutants.

ii. New introductions of pollutants into such works from a source which would be subject to Section 301 of the "Federal Water Quality Act as Amended" if it were discharging such pollutants.

iii. A substantial change in volume or character of pollutants being introduced into such works by a source already discharging pollutants into such works at the time the permit is issued.

This notice will include information on the quantity and quality of the wastewater introduced by the new source into the publicly owned treatment works, and on any anticipated impact on the effluent discharged from such works. If this discharge necessitates a revision of the current NPDES permit or pass-through guidelines, discharge by this source is prohibited until the Tennessee Division of Water Resources gives final authorization.

3.3. BIOSOLIDS MANAGEMENT PRACTICES

All sludge and/or biosolids use or disposal must comply with 40 CFR 503 et seq. Biosolids shall be sampled and analyzed at a frequency dependent on the amount used annually.

Any facility that land applies non-exceptional quality biosolids must obtain an appropriate permit from the division in accordance with Chapter 0400-40-15.

a. Reopener: If an applicable "acceptable management practice" or numerical limitation for pollutants in sewage sludge promulgated under Section 405(d)(2) of the Clean Water Act, as amended by the Water Quality Act of 1987, is more stringent than the sludge pollutant limit or acceptable management practice in this permit, or controls a pollutant not limited in this permit, this permit shall be promptly modified or revoked and reissued to conform to the requirements promulgated under Section 405(d)(2). The permittee shall comply with the limitations by no later than the compliance deadline specified in the applicable regulations as required by Section 405(d)(2) of the Clean Water Act.

b. Notice of change in sludge disposal practice: The permittee shall give prior notice to the director of any change planned in the permittee's sludge disposal practice.

Sludge disposal in a solid waste landfill is controlled by the rules of the Tennessee Division of Solid Waste Management (DSWM) and Federal Regulations at 40 CFR 258. If the permittee anticipates changing its disposal practices to either land application or surface disposal, the Division of Water Resources shall be notified prior to the change. A copy of the results of pollutant analyses required by the Tennessee Division of Solid Waste Management (DSWM) and / or 40 CFR 258 shall be submitted to the Division of Water Resources.

Division of Solid Waste Management			
Office	**Location**	**Zip Code**	**Phone No.**
Knoxville	3711 Middlebrook Pike	37921	(865) 594-6035
Memphis	8383 Wolf Lake Drive, Bartlett	38133	(901) 371-3000
Nashville	711 R.S. Gass Boulevard	37216	(615) 687-7000

3.4. PLACEMENT OF SIGNS

Within sixty (60) days of the effective date of this permit, the permittee shall place and maintain a sign at each overflow/release point in the collection system. For the purposes of this requirement, any point that has had a total of five (5) or more overflows plus releases in the last year must be so posted. The sign(s) should be clearly visible to the public from the bank and the receiving stream. The minimum sign size should be two feet by two feet (2' x 2') with one-inch (1") letters. The sign should be made of durable material and have a white background with black letters.

The sign(s) are to provide notice to the public as to the nature of the discharge and, in the case of the permitted outfalls, that the discharge is regulated by the Tennessee Department of Environment and Conservation, Division of Water Resources. The following is given as an example of the minimal amount of information that must be included on the sign:

Permitted CSO or unpermitted release/overflow point:

UNTREATED WASTEWATER DISCHARGE POINT
Norris STP

(865) 494-7645
NPDES Permit NO. TN0020630
TENNESSEE DIVISION OF WATER RESOURCES
1-888-891-8332 ENVIRONMENTAL FIELD OFFICE - Knoxville

NPDES Permitted Municipal/Sanitary Outfall:

TREATED MUNICIPAL/SANITARY WASTEWATER
Norris STP

(865) 494-7645
NPDES Permit NO. TN0020630
TENNESSEE DIVISION OF WATER RESOURCES
1-888-891-8332 ENVIRONMENTAL FIELD OFFICE - Knoxville

No later than sixty (60) days from the effective date of this permit, the permittee shall have the above sign(s) on display in the location specified.

3.5. ANTIDEGRADATION

Pursuant to the Rules of the Tennessee Department of Environment and Conservation, Chapter 0400-40-03-.06, titled “Tennessee Antidegradation Statement,” which prohibits the degradation of exceptional Tennessee waters and the increased discharges of substances that cause or contribute to impairment, the permittee shall further be required, pursuant to the terms and conditions of this permit, to comply with the effluent limitations and schedules of compliance required to implement applicable water quality standards, to comply with a State Water Quality Plan or other state or federal laws or regulations, or where practicable, to comply with a standard permitting no discharge of pollutants.

3.6. PLANT OPTIMIZATION FOR PHOSPHORUS REMOVAL

The permittee shall continue to seek plant optimization for biological removal of phosphorus over the first 24 months of permit effectiveness. For the purposes of nutrient removal, optimization shall mean methods that maximize removal with the least amount of intentional introduction of chemical compounds into the waste treatment process possible. The permittee shall seek to implement the changes necessary to reduce loading to 621 lb/year total phosphorus as annual rolling averages calculated and reported monthly beginning the 37th month of permit effectiveness (2 years to optimize; 1 year to collect 12 months of optimized results for compliance reporting).

Enforcement Discretion
In order to qualify for enforcement discretion associated with optimization improvements, the permittee shall give the division written notice of when optimization efforts with potential for upset will begin. Notice shall be submitted to water.permits@tn.gov and directed to the attention of the permit writer for NPDES permit # TN0020630. After receipt of that written notification and for the duration of the implementation and start-up of that optimization effort, if optimization activities result in a value or values that cause excursion of permit parameters (e.g. lb/day rolling average(s), effluent ammonia, or TSS), the permittee shall report the test result value in the comment section of the discharge monitoring report (DMR), attach the spreadsheet identifying the excursion-causing values and related calculations, and code the associated parameter as NODI=3 (report attached) on the DMR.

Interim Annual Status Report
The permittee shall provide a brief annual update on progress toward phosphorus removal optimization for calendar years 2019 and 2020 (due January 15th of the following calendar year). The interim report is to summarize the optimization efforts during the previous 12 months. The report shall be submitted electronically to water.permits@tn.gov and include reference to NPDES permit # TN0020630.

Test Methods
Wastewater characterization conducted internally by the permittee for nutrient optimization purposes may deviate from approved methods contained in 40 CFR Part 136. However, effluent characterization conducted for monthly DMR reporting shall use approved methods in 40 CFR Part 136.

3.7. BIOLOGICAL MONITORING

The permittee shall develop and implement a biological monitoring plan to define the biological impact of its waste water discharges on the receiving stream(s) during the low flow period in 2023 (late summer/early fall). To complete this, monitoring will be required to determine the biological integrity and diversity of the receiving streams, pursuant to the relevant Tennessee Water Quality Criteria for those streams. Specifically, this permit requires assessment of the biological integrity of the receiving streams in accordance with the Tennessee Water Quality Criteria for all streams classified for Fish and Aquatic life per Rule

0400-40-03-.03(k). The receiving stream of interest is located in Bioregion 67f and in the Lower-Clinch Watershed.

The permittee must perform stream monitoring as specified below. Adherence by the permittee or its consultant at the time of the assessment to any modifications of these specified procedures recommended in writing by either division biologists or division permit or assessment staff shall not be construed as a violation of this part.

Pursuant to the permittee's coordination with the division's Knoxville Environmental Field Office (EFO) regarding sampling location(s) and timing, the permittee shall submit a monitoring plan to the division central office permit section for review and comment in coordination with its field biologists **no later than May 31, 2023**. The permittee shall proceed with its plan if no written comments are received on the plan within 60 days of its receipt by the division.

1. Frequency

Once during each 5-year permit cycle, samples collected during low flow, high temperature conditions. (Exceptions are for specific streams that are dry in low flow). For intermittent or batch discharges, sampling should take place within 30 days of discharge in lowest flow conditions.

2. Sampling

The survey will be conducted by a qualified biologist. The permittee will notify the appropriate field office, Division of Water Resources, at least two weeks prior to conducting the biological survey.

3. Location

One location upstream of Outfall 001 and one location downstream of Outfall 001 and preferably those used by the division in its water quality assessments.

The sites selected must provide appropriate habitat and must be generally comparable. Prior to sampling, all selected sampling points shall be marked on a topographical map, submitted to and approved by the EFO.

4. **Biosurvey**

The biosurvey will consist of a single habitat semi-quantitative macroinvertebrate sample and a habitat survey. Habitat assessments, sample collection, subsampling, taxonomy and metric calculation must adhere exactly to the methodology found in the most recent revision of the State of Tennessee Department of Environment and Conservation, Division of Water Resources, Quality System Standard Operating Procedure for Macroinvertebrate Stream Surveys (referred to as TDEC QSSOP).

a. Habitat Assessment

Appropriate habitat assessment forms will be completed concurrent with each biological survey. These forms can be found in Appendix B in the TDEC QSSOP. The High Gradient Form will be used in conjunction with riffle kick collections and the Low Gradient Form will be used in conjunction with rooted bank collections.

b. Macroinvertebrate Sample Collection

A semi-quantitative single habitat macroinvertebrate sample will be collected at each site following Protocol G in the TDEC QSSOP. The habitat to be sampled will be appropriate for ecoregion 67f.

In ecoregions 65j, 66d, 66e, 66f, 66g, 67f, 67g, 67h, 67i, 68a, 68b, 68c,69d, 71e, 71f, 71g, 71h, appropriate 71i and 74a; 2 one meter square riffle kicks using a 500 micron mesh net will be collected . Additional kicks are collected if needed to insure at least 200 organisms. The debris from all kicks will be composited and preserved. All sorting and identification is to be conducted in the laboratory.

In ecoregions 65a, 65b, 65e, 65i, appropriate 71i, 73a and 74b; 3 rooted bank jabs will be collected using a 500 micron mesh triangular dip net. These are to include at least one jab from each bank, jabs from different velocities and incorporate different bank types when available. Approximately one meter is to be sampled during each jab. Additional banks jabs are collected if needed to insure at least 200 organisms. The debris from all jabs will be composited and preserved. All sorting and identification is to be conducted in the laboratory.

c. Subsampling

All samples will be reduced to 200+/- 20% organisms following subsampling protocols detailed in Protocol I of the TDEC QSSOP.

d. Taxonomy

All taxa in the subsample will be identified to genus level.

e. Biometrics

The following biometrics will be calculated for each subsample (without extrapolation).

Taxa Richness (TR)
EPT Richness (EPT)
EPT Abundance – Cheumatopsyche (%EPT-Cheum)
Chironomidae and Oligochaeta Abundance (%OC)
North Carolina Biotic Index (NCBI) using values found in Appendix C of the TDEC QSSOP
Percent Contribution of TN Nutrient Tolerant Organisms (%TNUTOL)
Percent Clingers 1 Cheumatopsyche (%CLINGERS - Cheum) using designations found in Appendix C of the TDEC QSSOP

5. Station Information

The following information will be recorded at each station during the biosurvey

a. Water temperature (^{o}C)
b. Dissolved Oxygen (mg/l)
c. pH (S.U.)

d. Conductivity (umhos)
e. Stream Flow (cfs)

6. Reporting

Results of the biological stream sampling including complete taxa lists and habitat assessments shall be submitted electronically to the water.permits@tn.gov. Electronic format specified in SOP should be used to report biometrics, taxa lists habitat assessments and field survey sheets.

4.0. DEFINITIONS AND ACRONYMS

4.1. DEFINITIONS

"***Biosolids***" are treated sewage sludge that have contaminant concentrations less than or equal to the contaminant concentrations listed in Table 1 of subparagraph (3)(b) of Rule 0400-40-15-.02, meet any one of the ten vector attraction reduction options listed in part (4)(b)1, 2, 3, 4, 5, 6, 7, 8, 9, or 10 of Rule 0400-40-15-.04, and meet either one of the six pathogen reduction alternatives for Class A listed in part (3)(a)3, 4, 5, 6, 7, or 8, or one of the three pathogen reduction alternatives for Class B listed in part (3)(b)2, 3, or 4 of Rule 0400- 40-15-.04.

A "***bypass***" is defined as the intentional diversion of waste streams from any portion of a treatment facility.

A "***calendar day***" is defined as the 24-hour period from midnight to midnight or any other 24-hour period that reasonably approximates the midnight to midnight time period.

A "***composite sample***" is a combination of not less than 8 influent or effluent portions, of at least 100 ml, collected over a 24-hour period. Under certain circumstances a lesser time period may be allowed, but in no case, less than 8 hours.

The "***daily maximum concentration***" is a limitation on the average concentration in units of mass per volume (e.g. milligrams per liter), of the discharge during any calendar day. When a proportional-to-flow composite sampling device is used, the daily concentration is the concentration of that 24-hour composite; when other sampling means are used, the daily concentration is the arithmetic mean of the concentrations of equal volume samples collected during any calendar day or sampling period.

"***Discharge***" or "discharge of a pollutant" refers to the addition of pollutants to waters from a source.

A "***dry weather overflow***" is a type of sanitary sewer overflow and is defined as one day or any portion of a day in which unpermitted discharge of wastewater from the collection or treatment system other than through the permitted outfall occurs and is not directly related to a rainfall event. Discharges from more than one point within a 24-hour period shall be counted as separate overflows.

"Degradation" means the alteration of the properties of waters by the addition of pollutants, withdrawal of water, or removal of habitat, except those alterations of a short duration, withdrawal of water, or removal of habitat, except those alterations of a short duration.

"***De Minimis***" - Degradation of a small magnitude, as provided in this paragraph.

(a) Discharges and withdrawals

1. Subject to the limitation in part 3 of this subparagraph, a single discharge other than those from new domestic wastewater sources will be considered de minimis if it uses less than five percent of the available assimilative capacity for the substance being discharged.
2. Subject to the limitation in part 3 of this subparagraph, a single water withdrawal will be considered de minimis if it removes less than five percent of the 7Q10 flow of the stream.
3. If more than one activity described in part 1 or 2 of this subparagraph has been authorized in a segment and the total of the authorized and proposed impacts uses no more than 10% of the assimilative capacity, or 7Q10 low flow, they are presumed to be de minimis. Where the total of the authorized and proposed impacts uses 10% of the assimilative capacity, or 7Q10 low flow, additional degradation may only be treated as de minimis if the Division finds on a scientific basis that the additional degradation has an insignificant effect on the resource.

(b) Habitat alterations authorized by an Aquatic Resource Alteration Permit (ARAP) are de minimis if the Division finds that the impacts, individually and cumulatively are offset by impact minimization and/or in-system mitigation, provided however, in ONRWs the mitigation must occur within the ONRW.

An "***ecoregion***" is a relatively homogeneous area defined by similarity of climate, landform, soil, potential natural vegetation, hydrology, or other ecologically relevant variables.

The "***geometric mean***" of any set of values is the n^{th} root of the product of the individual values where "n" is equal to the number of individual values. The geometric mean is equivalent to the antilog of the arithmetic mean of the logarithms of the individual values. For the purposes of calculating the geometric mean, values of zero (0) shall be considered to be one (1).

A "***grab sample***" is a single influent or effluent sample collected at a particular time.

The "***instantaneous maximum concentration***" is a limitation on the concentration, in milligrams per liter, of any pollutant contained in the wastewater discharge determined from a grab sample taken from the discharge at any point in time.

The "***instantaneous minimum concentration***" is the minimum allowable concentration, in milligrams per liter, of a pollutant parameter contained in the wastewater discharge determined from a grab sample taken from the discharge at any point in time.

The "***monthly average amount***", is the arithmetic mean of all the measured daily discharges by weight during the calendar month when the measurements were made.

The "***monthly average concentration***", other than for *E. coli* bacteria, is the arithmetic mean of all the composite or grab samples collected in a one-calendar month period.

A "***one week period***" (or "***calendar-week***") is defined as the period from Sunday through Saturday. For reporting purposes, a calendar week that contains a change of month shall be considered part of the latter month.

"***Pollutant***" means sewage, industrial wastes, or other wastes.

A "***quarter***" is defined as any one of the following three-month periods: January 1 through March 31, April 1 through June 30, July 1 through September 30, and/or October 1 through December 31.

A "***rainfall event***" is defined as any occurrence of rain, preceded by 10 hours without precipitation that results in an accumulation of 0.01 inches or more. Instances of rainfall occurring within 10 hours of each other will be considered a single rainfall event.

A "***rationale***" (or "fact sheet") is a document that is prepared when drafting an NPDES permit or permit action. It provides the technical, regulatory and administrative basis for an agency's permit decision.

A "***reference site***" means least impacted waters within an ecoregion that have been monitored to establish a baseline to which alterations of other waters can be compared.

A "***reference condition***" is a parameter-specific set of data from regional reference sites that establish the statistical range of values for that particular substance at least-impacted streams.

A "***release***" is the flow of sewage from any portion of the collection or transmission system owned or operated by the permittee other than through permitted outfalls that does not add pollutants to waters. In addition, a "release" includes a backup into a building or private property that is caused by blockages, flow conditions, or other malfunctions originating in the collection and transmission system owned or operated by the permittee. A "release" does not include backups into a building or private property caused by blockages or other malfunctions originating in a private lateral.

A ***"sanitary sewer overflow (SSO)"*** is defined as an unpermitted discharge of wastewater from the collection or treatment system other than through the permitted outfall.

"***Sewage***" means water-carried waste or discharges from human beings or animals, from residences, public or private buildings, or industrial establishments, or boats,

together with such other wastes and ground, surface, storm, or other water as may be present.

"***Severe property damage***" when used to consider the allowance of a bypass or SSO means substantial physical damage to property, damage to the treatment facilities which causes them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass or SSO. Severe property damage does not mean economic loss caused by delays in production.

"***Sewerage system***" means the conduits, sewers, and all devices and appurtenances by means of which sewage and other waste is collected, pumped, treated, or disposed.

"***Sludge***" or "***sewage sludge***" is solid, semi-solid, or liquid residue generated during the treatment of domestic sewage in a treatment works. Sewage sludge includes, but is not limited to, domestic septage; scum or solids removed in primary, secondary, or advanced wastewater treatment processes; and a material derived from sewage sludge. Sewage sludge does not include ash generated during the firing of sewage sludge in a sewage sludge incinerator or grit and screenings generated during preliminary treatment of domestic sewage in a treatment works.

A "***subecoregion***" is a smaller, more homogenous area that has been delineated within an ecoregion.

"***Upset***" means an exceptional incident in which there is unintentional and temporary noncompliance with technology-based effluent limitations because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

The term, "***washout***" is applicable to activated sludge plants and is defined as loss of mixed liquor suspended solids (MLSS) of 30.00% or more from the aeration basin(s).

"***Waters***" means any and all water, public or private, on or beneath the surface of the ground, which are contained within, flow through, or border upon Tennessee or any portion thereof except those bodies of water confined to and retained within the limits of private property in single ownership which do not combine or effect a junction with natural surface or underground waters.

The "***weekly average amount***", shall be determined by the summation of all the measured daily discharges by weight divided by the number of days during the calendar week when the measurements were made.

The "***weekly average concentration***", is the arithmetic mean of all the composite samples collected in a one-week period. The permittee must report the highest weekly average in the one-month period.

4.2. ACRONYMNS AND ABBREVIATIONS

1Q10 – 1-day minimum, 10-year recurrence interval

30Q5 – 30-day minimum, 5-year recurrence interval

7Q10 – 7-day minimum, 10-year recurrence interval

BAT – best available technology economically achievable

BCT – best conventional pollutant control technology

BDL – below detection level

BOD_5 – five day biochemical oxygen demand

BPT – best practicable control technology currently available

$CBOD_5$ – five day carbonaceous biochemical oxygen demand

CEI – compliance evaluation inspection

CFR – code of federal regulations

CFS – cubic feet per second

CFU – colony forming units

CIU – categorical industrial user

CSO – combined sewer overflow

DMR – discharge monitoring report

D.O. – dissolved oxygen

E. coli – *Escherichia coli*

EFO – environmental field office

LB(lb) - pound

IC_{25} – inhibition concentration causing 25% reduction in survival, reproduction and growth of the test organisms

IU – industrial user

IWS – industrial waste survey

LC_{50} – acute test causing 50% lethality

MDL – method detection level

MGD – million gallons per day

MG/L(mg/l) – milligrams per liter

ML – minimum level of quantification

ml – milliliter

MLSS – mixed liquor suspended solids

MOR – monthly operating report

NODI – no discharge

NPDES – national pollutant discharge elimination system

PL – permit limit

POTW – publicly owned treatment works

RDL – required detection limit

SAR – semi-annual [pretreatment program] report

SIU – significant industrial user

SSO – sanitary sewer overflow

STP – sewage treatment plant

TCA – Tennessee code annotated

TDEC – Tennessee Department of Environment and Conservation

TIE/TRE – toxicity identification evaluation/toxicity reduction evaluation

TMDL – total maximum daily load

TRC – total residual chlorine

TSS – total suspended solids

WQBEL – water quality based effluent limit

RATIONALE

Norris STP
NPDES Permit No. TN0020630
Date: 12/4/2018
Permit Writer: Wade Murphy

1. FACILITY INFORMATION

Norris STP
Mr. Tony Wilkerson - Water Superintendent
Norris, Anderson County, Tennessee
(865) 494-7645
Treatment Plant Average Design Flow:0.2 MGD
Percentage Industrial Flow: 0%
Treatment Description: Activated sludge with chlorine disinfecting
Certified Operator Grades: STP: III; CS: I; Date Rated: 07/21/03

2. RECEIVING STREAM INFORMATION

Buffalo Creek at mile 4.4
Watershed Group: Clinch-Lower
Hydrocode: 06010207
Low Flow: 7Q10 = 0.23 MGD (0.36 CFS); 30Q5 = 0.30 MGD (0.47 CFS)
Low Flow Reference:
USGS Water-Resource Investigation Report 09-5159
Station #03534500
Water Quality Designation: Unavailable Conditions
Stream Classification Categories:

Domestic Wtr Supply	Industrial	Fish & Aquatic	Recreation
		X	X
Livestock Wtr & Wlife	**Irrigation**	**Navigation**	
X	X		

Water Quality Assessment: Not supporting

3. CURRENT PERMIT STATUS

Permit Type:	**Municipal**
Classification:	**Minor**
Issuance Date:	**30-SEP-14**
Expiration Date:	**30-SEP-18**
Effective Date:	**01-NOV-14**

4. NEW PERMIT LIMITATIONS AND COMPLIANCE SCHEDULE SUMMARY

a. This permit proposes to reduce the monitoring and reporting frequency for settleable solids. Refer to Section 6.1 below.

This permit additionally proposes revisions to the limits and conditions associated with total nitrogen and total phosphorus. It proposes to revise the total nitrogen limit based on the optimization effort by Norris during the 2014-2018 permit. It proposes an extended compliance schedule for optimizing biological phosphorus removal in conjunction with an annual status report requirement. It proposes an interim phosphorus limit for the optimization period. It proposes to remove the bi-monthly sampling for other nutrient parameters. It requests a macro-invertebrate study in Buffalo Creek for the 2023 watershed assessment cycle. It proposes to track the annual reports and benthic plan submission as voluntary activities in ICIS. Refer to Section 6.4.

This permit incorporates a new parameter for reporting releases of sewage from the collection system that do not reach waters of the state. Refer to Section 6.7.

b. Compliance Schedule Summary

Description of Report to be Submitted	Reference Section in Permit
Monthly Discharge Monitoring Reports	1.3.1
Monthly Operational Reports	1.3.4
Monthly Bypass and Overflow Summary Report	1.3.5.1
Industrial Waste Survey Report within 120 days of the effective permit date	3.2.a
Submit nutrient optimization status reports annually for 2019 and 2021 with the December DMR (due January 15th)	3.6
Submit a biological monitoring plan of Buffalo Creek no later than May 31, 2023	3.7

c. For comparison, this rationale contains a table depicting the previous permit limits and effluent monitoring requirements in Appendix 1.

5. PREVIOUS PERMIT DISCHARGE MONITORING REPORT REVIEW

A review of the DMR summary from September 2014- August 2018 reveals that the City of Norris consistently achieved permit effluent limits for the traditional conventional and non-conventional parameters (e.g. CBOD, TSS, ammonia, pH). It did report 27 overflows and bypasses. Twenty of those occurrences were reported as bypasses with comment. Additionally, the city did not achieve its annual rolling load limits for total nitrogen and total phosphorus. A complete discharge monitoring report summary is located in Appendix 2.

6. PROPOSED EFFLUENT LIMITS AND RATIONALE

PARAMETERS	MONTHLY AVERAGE CONCENTRATION (MG/L)	MONTHLY AVERAGE AMOUNT (LB/DAY)	WEEKLY AVERAGE CONCENTRATION (MG/L)	WEEKLY AVERAGE AMOUNT (LB/DAY)	DAILY MAXIMUM CONCENTRATION (MG/L)	DAILY MINIMUM PERCENT REMOVAL	RATIONALE
$CBOD_5$	10	17	15	25	20	40	D.O. protection, Refer to 6.1 below (or) T.C.A. 0400-40-05-.09 (for BOD_5)
NH_3-N (May 1- Oct. 31)	1.5	2.5	2.3	3.8	3	—	D.O. protection, Refer to 6.2 below
NH_3-N (Nov. 1- April 30)	3.25	5.4	4.9	8.2	6.5	—	D.O. protection, Refer to 6.2 below
Total Suspended Solids	30	50	40	67	45	40	T.C.A. 0400-40-05-.09
Dissolved Oxygen (mg/l)	5.0 (daily minimum) instantaneous	—	—	—	—	—	D.O. protection, Refer to 6.1 below
Total Chlorine Residual (mg/l)	—	—	—	—	0.04 (daily maximum)	—	Refer to 6.3 below
Total Nitrogen	Report	Report	—		Report	Report (load)	Refer to 6.4 below
Total Nitrogen	3,650 lb/yr as a 12-month rolling average						Refer to 6.4 below
Total Phosphorus	Report	Report	—	—	Report	Report (load)	Refer to 6.4 below
Total Phosphorus	4.5 lb/d as 12-month rolling average for first 36 months						Refer to 6.4 below
Total Phosphorus	621 lb/yr as a 12-month rolling average after 36 months						Refer to 6.4 below
E. coli (colonies/100ml)	126/100 ml	—	—	—	941/100 ml	—	T.C.A. 0400-40-03-.03, Refer to 6.5 below
Settleable Solids (ml/l)		—	—	—	1.0 (daily maximum)	—	T.C.A. 0400-40-05-.09
pH (standard units)	6.0-9.0	—	—	—	—	—	T.C.A. 0400-40-03-.03
Flow (MGD):							
Influent	Report	—	—	—	Report	—	Used to quantify pollutant load
Effluent	Report	—	—	—	Report	—	Used to quantify pollutant load

	Monthly Total		**Volume (gal/mo)**	**12 Month Cumulative Total**	Refer to 6.9 below
Dry Weather	Overflows	0	Report	Report	Refer to 6.9 below
	Releases	Report	Report		Refer to 6.9 below
Wet Weather	Overflows	0	Report	Report	Refer to 6.9 below
	Releases	Report	Report		Refer to 6.9 below
All Weather	Bypass of Treatment	Report	Report		Refer to 6.9 below

Note: Weekly limitations on $CBOD_5$ and TSS concentrations are given as required per 40 CFR 133.102(a)(2) or 133.102(a)(4)(2) & 133.102 (b)(2) respectively; daily $CBOD_5$ and TSS limitations are authorized by T.C.A. 0400-40-05-.09; monthly and weekly mass loads are limited per 40 CFR 122.45(f) and based on the design flow as per 40 CFR 122.45(b); monthly average percent removal rates for $CBOD_5$ and TSS are required per 40 CFR 133.102(a)(3) or 133.102(a)(4)(iii) and 133.102 (b)(3) respectively. A minimum 40% daily removal rate is required as equivalent to a daily mass load limitation.

6.1. $CBOD_5$, DISSOLVED OXYGEN, AND PERCENT REMOVALS REQUIREMENTS

a. Streeter-Phelps modeling was performed during a previous issuance of this permit at various conditions to determine allowable organic loadings. The monthly average limits for $CBOD_5$ (10 mg/l), NH_3-N (1.5 mg/l-summer, 3.25 mg/l-winter), and D.O. (5.0 mg/l) still apply and are considered sufficient to result in an instream dissolved oxygen concentration that remains above the required minimum of 5.0 mg/l. Modeling results are located in the permit file administrative record.

   In addition to $CBOD_5$, NH_3-N undergoes biological oxidation in a receiving stream thereby utilizing in stream oxygen and potentially reducing oxygen levels below water quality standards. Ammonia as N is also a pollutant that exhibits toxicity to fish and other aquatic life. The two affects are analyzed separately and the division imposes the most stringent limit in the permit.

b. The treatment facility is required to remove 85% of the $CBOD_5$ and TSS that enter the facility on a monthly basis. This is part of the minimum requirement for all municipal treatment facilities contained in Code of Federal Regulations 40 Part 133.102. The reasons stated by the U.S.E.P.A. for these requirements are to achieve these two basic objectives:

   (1) To encourage municipalities to correct excessive inflow and infiltration (I/I) problems in their sanitary sewer systems, and
   (2) To help prevent intentional dilution of the influent wastewater as a means of meeting permit limits.

   The treatment facility is required to remove 40% of the $CBOD_5$ and TSS that enter the facility on a daily basis. This percent removal will be calculated three times per week and recorded on the Monthly Operation Report. The number of excursions (days when $CBOD_5$ and/or TSS removal is less than 40%) will be reported on the Discharge Monitoring Report.

c. The settleable solids limit of 1.0 ml/L is a technology-based limit in Rule 0400-40-05-.09. It is a measure of primary treatment (primary clarification) and may be considered for monitoring frequency reduction when there is history of compliance. This facility has a history of compliance with the effluent limit and does not appear to be reasonably subject to washout of solids. Inflow and infiltration (I/I) as a percent of annual is estimated at 25% based on an analysis of 2014 monthly operating report data. Therefore, this permit proposes to reduce the monitoring frequency of this parameter to quarterly. Quarterly monitoring and reporting allows the permittee to demonstrate compliance with this technology-based limit during the variable flow rates which occur seasonally.

6.2. NH_3-N TOXICITY

To access toxicity impacts, the state utilizes the EPA document, 1999 Update to Ambient Water Quality Criteria for Ammonia, pursuant to 1200-4-3-.0-3(3)(j), and assumed stream temperatures of 25°C and 15°C and pH of 7.5 or 8.0 to derive an

allowable instream protection value protective of chronic exposure to a continuous discharge. A mass balance equation with sewage treatment facility and stream flows and this allowable value determines the monthly average permit limit. The criteria document states that a 30Q5 flow value is protective in deriving allowable values. Where the division has 30Q5 flow values, the division may use them. Otherwise, the division utilizes the available 7Q10 or 1Q10 values that are generally more conservative. The criteria continuous concentrations (CCC) derived from assumed temperature and pH values are as follows:

CCC values based on temperature and pH, in mg/L:

Temperature (°C)	7.5 pH	8.0 pH
25	2.22	1.24
27	1.94	1.09
30	1.61	0.90

Temperature (°C)	7.5 pH	8.0 pH
15	4.22	2.36
17	3.72	2.07
20	3.06	1.71

The mass balance equation is as follows:

$$CCC = \frac{Q_S C_S + Q_{STP} C_{STP}}{Q_S + Q_{STP}} \qquad \text{or,} \qquad C_{STP=} \frac{CCC(Q_S + Q_{STP}) - (Q_S C_S)}{Q_{STP}}$$

where:

CCC = Criteria continuous concentration (mg/l)
Q_S = 7Q10 flow of receiving stream (0.23 MGD)
Q_{STP} = Design flow of STP (0.2 MGD)
C_S = Assumed/Measured instream NH_3 (0.1 mg/l)
C_{STP} = Allowable STP discharge of NH_3 (mg/l)

$$C_{STP} = \frac{1.24\ (0.23\ MGD + .2\ MGD) - (0.23\ MGD \times 0.1 mg/l)}{.2\ MGD} = 2.55\text{- mg/l (summer)}$$

$$C_{STP} = \frac{2.36\ (0.23\ MGD + .2\ MGD) - (0.23\ MGD \times 0.1 mg/l)}{.2\ MGD} = 4.96\text{- mg/l (winter)}$$

Because the NH_3-N concentration limits calculated to protect dissolved oxygen are more restrictive than the toxicity limits calculated above, the monthly average limits for NH_3-N (1.5 mg/l-summer, 3.25 mg/l-winter) are applied to the permit.

6.3. CHLORINATION

The residual chlorine limit is derived using the mass balance formula and the EPA instream protection value of 0.019 mg/l for fish and aquatic life. Applying this formula yields the following calculation:

$$\frac{0.019\ (Qd + Qs)}{Qd} = \text{Limit (mg/l)} = \frac{0.019(.2 + 0.23)}{.2} = 0.041 \text{ mg/l} \approx 0.04 \text{ mg/l}$$

where:

0.019	=	instream protection value (acute)
.2	=	Qd, design flow of STP (MGD)
0.23	=	Qs, 7Q10 flow of receiving stream (MGD)

6.4. TOTAL NITROGEN AND TOTAL PHOSPHORUS MONITORING/REPORTING

Nutrients are naturally occurring and essential components of healthy aquatic systems. Excessive amounts of nutrients, however, can impact water quality. The enrichment of a waterbody with nutrients, called eutrophication, can result in dense, rapidly multiplying growths, or blooms, of algal species and other nuisance aquatic plants. These have potential for negatively impacting the habitat for fish and aquatic life and degrading the water quality for drinking water supply and recreation uses. These impacts can present both locally from an individual activity and much further downstream from the cumulative impact of multiple activities. The division has therefore developed and begun to implement a strategy to accomplish long-term nutrient reduction in Tennessee waters. The document referred to as the Tennessee Nutrient Reduction Framework (NRF), contains proposed rationale and the methodology for implementing the strategy within a watershed area. Consequently, the framework considers impacts from both point and non-point sources of nutrients and potentially recommends reduction goals for both point and non-point sources. The NRF approach to nutrient reduction is intended to utilize an adaptive management approach in consideration of the facts presenting within a watershed and reevaluation of the effectiveness of progress being made. Regular reassessments of goals and action plans will be conducted by reviewing monitoring data, modeling results and other measures of success. As additional data becomes available (such as WWTP effluent characterization and instream water quality data), model results can be re-evaluated. Therefore, for purposes of implementing this strategy, the division is imposing a minimum of quarterly effluent characterization for total nitrogen and total phosphorus on all discharges of treated domestic wastewater. These values will be used to reevaluate the nutrient loads from discharges within a watershed over time for comparison with those loads from non-point sources. The framework may be reviewed on the division's webpage at http://www.tn.gov/environment/article/wr-ws-tennessee-nutrient-reduction-framework.

The data supporting the rationale that follows is located in Appendix 3. The nutrient limits and conditions in this permit stem from the nutrient optimization effort conducting during the previous permit term. The previous permit imposed initial effluent loads limits on a very limited dataset. The permit recognized that and set an initial total nitrogen limit of 4.7 lb/d but allowed for a revised value anywhere between the 4.7 lb/d limit and 13.3 lb/d based on additional effluent characterization. On a similarly sized dataset for effluent phosphorus, the permit imposed an initial 1.8 lb/day limit and an optimized limit of 1.7 lb/d. To date, Norris has been unable to successfully meet either of these limits with its existing technology.

Norris participated with TDEC in a nutrient optimization effort in 2016. The following is an excerpt from the concluding report, *Final Report, Wastewater Nutrient Optimization Project, Water Planet, December 14, 2016, G. Weaver.*

"*By project's end, Norris' small staff gained an incredibly strong understanding of nitrogen removal and is able to operate the facility such that the effluent is very low in nitrogen. A creative effort to biologically remove phosphorus has so far been unsuccessful but staff are continuing to seek modifications……..*

"Given plant staff's interest, commitment, and intellect – given their informed use of TDEC supplied equipment – Norris is certain to produce fantastically clean water once optimized such that no facility upgrade will be required to meet anticipated nutrient limits."

The facility was designed for both nitrification and denitrification. With optimization, Norris can achieve effluent concentrations averaging 5.5 mg/L to 5.8 mg/l. This is well within the targets established in the statewide nutrient reduction framework for biological optimization. Those targets are loads equivalent to 8 mg/L and 5 mg/L for medium and high, watershed impact categories respectively. However, flows at the facility cause the effluent loads to average about 7 lb/d which exceeds the previous target of 4.7 lb/d. Again, the 4.7 value was based on the results of only 3 effluent scans. In light of the demonstrated ability of the existing technology, this permit revises the total nitrogen limit to an annual rolling load, calculated monthly, on the basis of an effluent concentration of 6 mg/L (the post optimization effluent averages rounded to a single significant figure. This amounts to 10 lb/d as follows:

6 mg/L TN x 0.2 MGD design flow x 8.34 = 10 lb/d. This converts to an annual rolling load of 3650 lb/year.

The facility was not designed for biological phosphorus removal, but the Norris Water Commission is committed to continuing the optimization effort. At the time of this draft, they have plans to install a curtain to reduce the size of the fermentation area necessary to generate fatty acids necessary to support a population of bacteria capable of up-taking soluble phosphorus. This permit proposes an additional 2-year optimization period for this effort followed by 12-months in which to generate effluent data for complying with the optimization target. The permit proposes an immediate limit to prevent worsening of impairment based on the actual effluent concentrations and the 0.134 MGD average flow rate used to derive the initial limit in the previous permit. This works out to be 4.5 lb/d as follows:

4 lb/d TP (pre-optimization) x 0.134 MGD (average flow rate from previous permit) x 8.34 = 4.5 lb/d

The optimization target is 1.0 mg/L TP x 0.2 MGD design flow rate x 8.34 x 365 days/yr = 621 lb/year

The initial lb/d unit and the future lb/year unit differ intentionally. The nutrient reduction framework promotes annual loads while optimization efforts focus on daily loads and concentrations.

This permit proposes to eliminate all required chemical sampling for nutrients except for weekly effluent total nitrogen and total phosphorus. Norris may sample influent and effluent for other nutrient parameters (nitrate/nitrite, TKN, ortho-phosphate, etc.) at its discretion during implementation of the optimization effort and beyond and simply keep record of them on their monthly operating reports (MOR).

The permit asks Norris to submit an annual status update on the optimization effort for both the 2019 and 2020 calendar years with each report due by January 15th following each year. These due dates will be tracked in ICIS.

Additionally, this permit asks the Norris Water Commission conduct 1 macro-invertebrate survey again in this permit cycle. The division's watershed assessment cycle has stream sampling scheduled for 2018/2019 and then again in 2023/2024. Since optimization is to continue during the current assessment cycle, this permit proposes the study be done in the low flow period of 2023 (late summer/early fall). This will allow for stream biology to reflect impacts of the optimization effort. The permit asks that a benthic sampling plan be prepared for division review/concurrence before May 31, 2023 in order to allow for any suggestions be incorporated into a 2023 summer/fall sampling event.

The Norris Water Commission conducted a benthic survey in 2015. The division appreciates Norris's willingness to participate in the assessment effort. Generally, the survey in the fall of 2015 shows that sampling locations both up and down stream of Outfall 001 just met the target score for the comparable eco-region (Eco-region 67f). Additionally, the metric scores within the overall score were the same for most metrics including concentration of nutrient tolerant species of organisms. The metrics also suggest that habitat is better downstream of the outfall than upstream of it. A quick look at historical data reflects that the concentration of nutrient tolerant organisms is trending down over time at locations both up and down stream of the waste water discharge. This possibly reflects efforts both at the plant and in controls on urban runoff and grazing in riparian zones. Overall, these trends toward water quality improvement suggest that continued optimization of the existing treatment plant for biological phosphorus removal continues to be an appropriate reduction measure.

6.5. *E. COLI* REQUIREMENTS

Disinfection of wastewater is required to protect the receiving stream from pathogenic microorganisms. Fecal coliform and *E. coli* are indicator organisms used as a measure of bacteriological health of a receiving stream and the effectiveness of disinfection.

As of September 30, 2004, the criterion for fecal coliform has been removed from the State's Water Quality Standards. Thus, the division imposes an *E. coli* limit on discharges of treated sewage for the protection of recreational use of the stream in lieu of the fecal coliform limit. The *E. coli* daily maximum limit of 487 colonies per 100 ml applies to lakes and exceptional Tennessee waters. A maximum daily limit of 941 colonies per 100 ml applies to all other recreational waters.

6.6. BIOMONITORING

The division evaluates all dischargers for reasonable potential to exceed the narrative water quality criterion, "no toxics in toxic amounts". The division has determined that for municipal facilities with stream dilutions of less than 500 to 1, any of the following conditions may demonstrate reasonable potential to exceed this criterion.

a. Toxicity is suspected or demonstrated.
b. A pretreatment program is required.
c. The design capacity of the facility is greater than 1.0 MGD.

6.7. OVERFLOW (SANITARY SEWER AND DRY-WEATHER), RELEASE AND BYPASS REPORTING

For the purposes of demonstrating proper operation of the collection, transmission and treatment system, the permit treats releases separately from overflows and bypass. State regulations at 0400-40-05-.07(2) establish "standard conditions." These standard conditions include 0400-40-05-.07(2)(n) that sets forth specific language prohibiting sanitary sewer overflows (defined in the regulations as a "discharge") and standard conditions in 0400-40-05-.07(2)(l) and (m) pertaining to bypass. While the regulations prohibit sanitary sewer overflow (i.e., discharges that reach receiving waters) it does not prohibit "releases" that do not reach receiving waters. However, releases that do not reach receiving waters may be indicative of other problems, such as improper operation and maintenance of the sewer system. Whether another violation occurs or whether, for example, there is an unavoidable accident (see, e.g., § 69-3-114(a)), will involve case-specific evaluations. Regardless, the permit assures, without waiving rights to pursue other violations associated with a release, as applicable, that the permittee would, at a minimum be reporting and responding to releases. Any release potentially warrants permittee mitigation of human health risks via direct or indirect contact and demonstrates a hydraulic problem in the system that warrants permittee consideration as part of proper operation and maintenance of the system.

When determining if a location experiences chronic sanitary sewer overflows or releases the term "event(s)" includes dry weather overflows, wet weather overflows, dry weather releases and wet weather releases.

7. OTHER PERMIT REQUIREMENTS AND CONDITIONS

7.1. CERTIFIED WASTEWATER TREATMENT OPERATOR

The waste treatment facilities shall be operated under the supervision of a Grade III certified wastewater treatment operator in accordance with the Water Environmental Health Act of 1984. Operator grades are under jurisdiction of the Water and Wastewater Operators Certification Board. This NPDES permit is under jurisdiction of the Tennessee Board of Water Quality, Oil and Gas. Operator grades are rated and recommended by the Division of Water Resources pursuant to Rule 0400-49-01 (formerly 1200-05-03) and are included in this fact sheet for reference. The grades are intentionally not specified in the permit so that the operation certification board can authorize changes in grade without conflicting with this permit.

7.2. COLLECTION SYSTEM CERTIFIED OPERATOR

The collection system shall be operated under the supervision of a Grade I certified collection system operator in accordance with the Water Environmental Health Act of 1984.

7.3. PRETREATMENT PROGRAM

The Norris STP has received an exemption from development of a pretreatment program due to the lack of any significant industrial users. To keep the exemption, the City of Norris must complete an updated Industrial Waste Survey within 120 days of the effective date of the permit, unless such a survey has been submitted within 3 years of the effective date. The City of Norris must notify the division immediately of its intent to connect a significant industrial user to the sewage system.

7.4. BIOSOLIDS MANAGEMENT PRACTICES

The Clean Water Act (CWA) requires that any NPDES permit issued to a publicly owned treatment works or any other treatment works treating domestic sewage shall comply with 40 CFR Part 503, the federal regulation governing the use and disposal of sewage sludge. It is important to note that “biosolids” are sewage sludge that have been treated to a level so that they can be land applied.

The language in subpart 3.3 of the permit, relative to biosolids management, a CWA requirement, allows the “permitting authority” under 40 CFR Part 503.9(p) to be able to enforce the provisions of Part 503. The “permitting authority” relative to Part 503 is either a state that has been delegated biosolids management authority or the applicable EPA Region; in the case of Tennessee it is EPA-Region 4.

Tennessee regulates the land application of non-exceptional quality biosolids under state rules, Chapter 0400-40-15. The state rules became effective on June 30, 2013. Under these state rules, all facilities that land apply non-exceptional quality biosolids must obtain a biosolids permit from the division. The land application of non-exceptional quality biosolids under state rules is regulated through either a general permit or by an individual permit. Questions about the division’s biosolids regulations and permitting program should be directed to the State Biosolids Coordinator at:

State of Tennessee
Department of Environment and Conservation
Division of Water Resources
William R. Snodgrass - Tennessee Tower
312 Rosa L. Parks Avenue, 11th Floor
Nashville, Tennessee 37243-1102
(615) 532-0625

7.5. PERMIT TERM

This permit is being reissued for 5 years in order to coordinate its reissuance with other permits located within the Clinch-Lower Watershed.

7.6. ELECTRONIC REPORTING

Monitoring results shall be recorded monthly and submitted monthly using Discharge Monitoring Reports (DMRs) based on the effluent limits in Section 1.1 of the permit. DMRs and DMR attachments, including laboratory data and overflow reports, shall

be submitted electronically in NetDMR, or other electronic reporting tool approved by the State, no later than the 15th of the month following the end of the monitoring period. All NPDES program reports must be signed and certified by a responsible official or a duly authorized representative, as defined in 40 CFR 122.22.

The NPDES Electronic Reporting Rule, which became effective on December 21, 2016, replaces most paper-based reporting requirements with electronic reporting requirements. NetDMR allows NPDES permittees to submit DMRs electronically to EPA through a secure internet application and has been approved by Tennessee as the official electronic reporting tool for DMRs.

According to 40 CFR 127.15, states have the flexibility to grant temporary or episodic waivers from electronic reporting to NPDES permittees who are unable to meet the electronic reporting requirements. To obtain an electronic reporting waiver, an electronic reporting waiver request must be submitted by email to DWRwater.compliance@tn.gov or by mail to the following address:

Division of Water Resources
Compliance and Enforcement Unit
William R. Snodgrass Tennessee Tower
312 Rosa L. Parks Avenue, 11th Floor
Nashville, TN 37243

For contact and training information about NetDMR electronic reporting, visit TDEC's website at http://tn.gov/environment/topic/wr-netdmr-and-electronic-reporting.

8. ANTIDEGRADATION STATEMENT/WATER QUALITY STATUS

Tennessee's Antidegradation Statement is found in the Rules of the Tennessee Department of Environment and Conservation, Chapter 0400-40-03-.06. It is the purpose of Tennessee's standards to fully protect existing uses of all surface waters as established under the Act.

Stream determinations for this permit action are associated with the waterbody segment identified by the division as segment ID# TN06010207016_1000.

The division has made a water quality assessment of the receiving waters associated with the subject discharge(s) and has found the receiving stream to be neither an exceptional nor outstanding national resource water. Additionally, this water partially support(s) its Fish and Aquatic Life and Recreation designated uses due to *nitrate/nitrite and phosphorus attributed to grazing in riparian zones and point source discharges and from pathogens (E. coli) attributed to grazing in riparian zones*. This permit requires the sewage treatment plant to disinfect the treated wastewater to meet the water quality standard for recreation in the discharge pipe. This permit continues to impose limits and conditions consistent with the state-wide nutrient reduction strategy so that the discharge does not contribute to a worsening of the nutrient loading to the watershed. These conditions are discussed in Section 6.4 above.

TMDLs have been developed and approved for this waterbody segment on the following parameters and dates:

Parameter	TMDL Approval Date
E.coli	2017

The proposed terms and conditions of this permit comply with the wasteload allocations of this TMDL

APPENDIX 1
PREVIOUS PERMIT LIMITS

PARAMETERS	MONTHLY AVERAGE CONCENTRATION (MG/L)	MONTHLY AVERAGE AMOUNT (LB/DAY)	WEEKLY AVERAGE CONCENTRATION (MG/L)	WEEKLY AVERAGE AMOUNT (LB/DAY)	DAILY MAXIMUM CONCENTRATION (MG/L)	DAILY MINIMUM PERCENT REMOVAL	MEASUREMENT FREQUENCY
$CBOD_5$	10	17	15	25	20	40	1/week
NH_3-N (May 1- Oct. 31)	1.5	2.5	2.3	3.8	3	—	1/week
NH_3-N (Nov. 1- April 30)	3.25	5.4	4.9	8.2	6.5	—	1/week
Total Suspended Solids	30	50	40	67	45	40	1/week
Dissolved Oxygen (mg/l)	5.0 (daily minimum) instantaneous	—	—	—	—	—	5/week
Total Chlorine Residual (mg/l)	—	—	—	—	0.04 (daily maximum)	—	5/week
Total Nitrogen	Report	Report					1/week
Total Nitrogen	4.7 lb/d as annual rolling average after 12 months of permit effectiveness; Subject to change based on new info						1/month
Total Phosphorus	Report	Report					1/week
Total Phosphorus	1.8 lb/d as rolling average after 12 months of permit effectiveness then 1.7 lb/d as rolling average thereafter						1/month
Nitrite plus Nitrate						Report (load)	Once per 2 months
TKN						Report (load)	Once per 2 months
Ortho-phosphate						Report (load)	Once per 2 months
E. coli (colonies/100ml)	126/100 ml	—	—	—	941 cfu per 100 ml	—	1/week
Settleable Solids (ml/l)		—	—	—	1.0 (daily maximum)	—	5/week
pH (standard units)	6.0-9.0	—	—	—	—	—	5/week
Flow (MGD):							
Influent	Report	—	—	—	Report	—	7/week
Effluent	Report	—	—	—	Report	—	7/week
Sanitary Sewer Overflows, Total Occurrences			Report				continuous
Dry Weather Overflows, Total Occurrences			Report				continuous
Bypass of Treatment, Total Occurrences			Report				continuous

APPENDIX 2
Discharge Monitoring Report Summary

	Flow (MGD)		Biochemical Oxygen Demand				Suspended Solids				Effluent (mg/l)									Over-flow; Bypass
			Influent	Effluent (mg/l)		%	Influent	Effluent (mg/l)		%	Settleable	pH		Cl_2	Ammonia		D.O.	E. coli		
	Monthly Average	Daily Max	(mg/l)	Monthly Average	Daily Max	Removal	(mg/l)	Monthly Average	Daily Max	Removal	Solids (ml/l)	(std. units) Min	Max	Daily Max	Monthly Average	Daily Max	Daily Min	Monthly Average	Daily Max	
Limits	Report	Report	Report			85	Report			85	1.0	6.0	9.0				5.0	126	941	
Summer				10	20			30	45					0.04	1.5	3.0				
Winter				10	20			30	45					0.04	3.25	6.5				
Average	0.148	0.367	290	2	4	99	205.6	7	12	96	0.2	6.5	7.3	0.04	0.6	1.5	6.7	41	90	
Maximum	0.315	0.747	471	5	9	99	312.0	23	36	99	1.0	7.0	7.9	0.04	4.2	7.9	9.5	102	360	
Minimum	0.090	0.119	0.197	1	2	97	123.0	2	3	87	0.1	6.1	6.9	0.03	0.0	0.0	5.1	12	20	
+ = Exceedence														1	4	5				27

Date																				
Sep/14	0.111	0.208	317	1.9	2	98.8	312	23	32	90.4	0.9	6.5	6.9	0.04	0.02	0.05	6.8	52	150	
Oct/14	0.157	0.595	218	2.3	6	98.4	273	17	33	93.5	0.5	6.3	7.0	0.03	0.31	0.42	6.4	50	110	
Nov/14	0.121	0.209	274	1.7	2	99.0	224	16	36	92.0	0.8	6.7	6.9	0.03	1.45	4.10	8.3	53	110	
Dec/14	0.186	0.483	231	3.2	8	98.0	273	9	14	95.0	0.1	6.2	6.9	0.04	0.27	0.65	8.5	28	110	
Jan/15	0.168	0.313	274	2.7	6	98.8	171	8	14	95.0	0.1	6.4	7.0	0.04	0.46	1.00	7.7	13	20	
Feb/15	0.176	0.509	195	3.1	4	97.0	123	13	18	87.0	0.1	6.3	7.2	0.03	0.86	3.10	9.5	28	30	
Mar/15	0.262	0.693	312	3.8	4	98.0	192	8	12	95.0	0.1	6.4	7.2	0.04	0.27	1.20	7.5	52	180	1
Apr/15	0.221	0.642	307	3.0	4	98.0	220	8	14	96.0	0.5	6.2	7.2	0.04	0.66	2.50	5.2	25	50	2
May/15	0.094	0.119	311	2.5	4	98.8	303	9	14	95.8	0.1	6.8	7.3	0.03	0.06	0.14	7.9	38	80	1
Jun/15	0.090	0.129	215	2.2	4	98.0	144	7	20	94.0	0.1	6.1	7.1	0.04	0.03	0.05	7.4	70	130	1
Jul/15	0.124	0.282	325	1.8	2	99.0	205	8	14	95.0	0.1	6.5	7.2	0.04	0.01	0.03	7.2	40	70	
Aug/15	0.119	0.479	378	1.7	2	99.0	243	10	19	95.5	0.1	7.0	7.6	0.03	0.01	0.04	6.9	28	40	
Sep/15	0.121	0.248	252	1.3	2	99.0	251	5	10	97.6	0.1	6.7	7.3	0.04	0.03	0.05	7.1	28	50	
Oct/15	0.144	0.334	298	1.9	3	98.8	188	12	34	92.5	0.1	6.3	7.8	0.03	0.21	0.70	6.2	23	40	
Nov/15	0.156	0.542	312	2.1	3	99.0	216	13	28	93.2	0.1	6.8	7.3	0.04	0.10	0.25	6.4	18	20	1
Dec/15	0.239	0.583	390	2.3	3	99.0	230	8	15	94.0	0.1	6.7	7.3	0.04	0.19	0.45	6.5	50	90	
Jan/16	0.175	0.456	190	1.6	2	98.5	159	3	4	97.0	0.1	6.4	7.8	0.04	0.44	1.00	7.2	23	40	1
Feb/16	0.306	0.682	162	2.4	3	NODI *	224	2	3	98.5	0.1	6.4	7.1	0.03	1.34	5.00	5.4	35	70	2
Mar/16	0.148	0.396	208	2.0	4	98.8	170	3	5	97.0	0.1	6.5	7.1	0.03	0.18	0.32	6.4	12	30	
Apr/16	0.129	0.268	381	2.1	3	99.0	187	4	8	97.5	0.1	6.8	7.3	0.04	0.53	1.40	5.6	30	40	
May/16	0.112	0.211	269	2.7	4	98.5	286	5	6	97.2	0.1	6.7	7.3	0.04	2.19 +	6.50 +	6.4	50	110	
Jun/16	0.098	0.159	316	2.1	4	98.6	261	4	8	98.0	0.1	6.9	7.5	0.04	2.10 +	6.40 +	5.8	36	70	
Jul/16	0.108	0.139	312	1.4	2	99.0	188	4	7	97.5	0.1	6.7	7.2	0.04	0.10	0.33	5.9	75	210	
Aug/16	0.123	0.222	184	1.2	2	99.0	239	2	3	98.8	0.1	6.9	7.3	0.04	0.15	0.32	6.6	20	50	
Sep/16	0.105	0.224	280	1.8	3	99.0	209	7	16	96.5	0.1	6.6	7.2	0.04	0.27	0.80	6.5	50	110	
Oct/16	0.099	0.137	285	2.3	3	98.8	212	10	18	95.5	0.1	6.6	7.3	0.04	0.15	0.20	6.9	40	80	
Nov/16	0.117	0.481	363	1.8	3	99.0	193	4	10	97.0	0.5	6.4	7.3	+	0.33	0.50	7.1	28	60	1
Dec/16	0.184	0.517	175	1.3	2	98.8	149	4	7	97.2	1.0	6.7	7.9	0.04	0.34	0.56	6.8	45	80	2
Jan/17	0.190	0.506	240	2.5	3	98.2	191	4	7	97.4	0.1	6.4	7.1	0.03	0.40	0.68	6.2	50	110	1
Feb/17	0.110	0.246	288	2.3	3	99.0	239	5	12	97.5	0.1	6.6	7.1	0.04	0.39	0.84	6.9	35	50	
Mar/17	0.178	0.520	0	1.5	3	98.8	126	4	8	96.7	0.1	6.1	7.0	0.04	0.31	0.90	6.8	58	240	2
Apr/17	0.237	0.747	217	1.8	3	98.7	152	6	10	95.5	0.5	6.6	7.2	0.04	0.06	0.13	5.9	75	110	2
May/17	0.131	0.309	293	1.2	2	99.0	304	5	12	98.0	0.1	6.6	7.0	0.04	0.07	0.13	6.1	60	160	1
Jun/17	0.111	0.276	213	1.5	2	99.0	215	4	6	98.0	0.1	6.3	7.3	0.03	0.12	0.24	6.2	48	100	
Jul/17	0.119	0.264	213	1.3	2	99.0	218	2	5	98.8	< .1	6.3	7.5	0.03	0.11	0.19	6.6	48	60	1
Aug/17	0.125	0.277	323	2.7	3	98.6	216	4	8	97.4	0.1	6.8	7.2	0.04	0.20	0.23	6.3	46	70	
Sep/17	0.104	0.366	263	2.1	2	98.8	200	6	9	96.0	0.1	6.1	7.5	0.04	0.29	0.80	6.4	83	160	1
Oct/17	0.125	0.336	318	2.9	4	98.5	149.6	4	6	97.0	0.1	6.3	7.2	0.04	0.29	0.60	6.2	36	80	1
Nov/17	0.132	0.389	308	2.8	6	98.6	143	5	8	96.7	0.1	6.5	7.1	0.04	1.48	5.00	6.1	55	140	1
Dec/17	0.140	0.566	471	2.4	4	99.0	189	6	6	96.2	0.1	6.8	7.3	0.04	0.52	0.70	7.4	15	20	
Jan/18	0.121	0.179	326	3.5	4	98.0	202.4	3	5	98.0	< .1	6.9	7.1	0.04	2.07	4.70	7.9	16	30	
Feb/18	0.315	0.717	414	5.2	9	98.2	170	7	14	95.0	0.1	6.7	7.1	0.04	4.24 +	7.90 +	6.1	73	150	3
Mar/18	0.200	0.576	429	3.7	5	98.8	128.8	4	7	96.6	0.1	6.3	7.2	0.04	0.77	1.40	5.9	20	40	1
Apr/18	0.142	0.307	402	3.8	5	98.8	175	4	7	97.5	0.1	6.9	7.4	0.03	2.24	4.20	5.1	35	80	1
May/18	0.098	0.133	399	4.0	5	98.6	180	6	9	96.2	0.1	6.7	7.2	0.03	NODI +	NOD +	7.2	102	360	
Jun/18	0.107	0.310	332	4.3	6	98.0	267	6	9	96.7	< .1	6.4	7.9	0.04	1.09	3.20 +	6.6	28	40	
Jul/18	0.105	0.200	389	1.9	3	99.0	222	3	5	97.8	0.1	6.3	7.2	0.04	0.23	0.38	7.0	26	40	
Aug/18	0.104	0.139	360	2.6	5	98.8	136	3	5	97.3	0.1	6.6	7.2	0.03	0.26	0.40	6.6	20	40	
Sep/18																				

APPENDIX 3, TABLES 1 OF 2
NUTRIENT CHARACTERIZATION, DISCHARGE MONITORING REPORT DATA

Month	Nitrogen Total, as N (mg/L)	Nitrogen Total as N, lb/d	TKN, as N, lb/d	Nox as N, lb/d	Nitrogen Total, as N (Annual Rolling Load)		Phosphorus Total, as P (mg/L)	Phosphorus Total as P, lb/d	Ortho Phosphate as PO4, lb/d	Phosphorus Total, as P (Annual Rolling Load)	
11/30/2014	25.3	25.5	1.3	17.8	25.5	11/30/2014	4.56	4.6	2.79	4.6	11/30/2014
12/31/2014	22.2	34.4				12/31/2014	4.29	6.65			01/31/2015
01/31/2015	19.1	26.7	1.88	17.2		01/31/2015	3.39	4.74	4.18		03/31/2015
02/28/2015	16.3	23.9				02/28/2015	3.25	4.77			05/31/2015
03/31/2015	17.5	38.2	4.63	15.3		03/31/2015	2.9	6.3	2.3		07/31/2015
04/30/2015	14.97	27.22				04/30/2015	3.52	6.39			09/30/2015
05/31/2015	21.88	16.61	3.4	24.3		05/31/2015	5.5	4.31	NODI 9		11/30/2015
06/30/2015	24.8	18.6				06/30/2015	5.98	4.48			01/31/2016
07/31/2015	19.4	20.1	1.84	29.4		07/31/2015	4.36	4.5	NODI **X**		03/31/2016
08/31/2015	13.3	14.5				08/31/2015	5.15	5.63			05/31/2016
09/30/2015	13.51	14.08	3.07	18.24		09/30/2015	6.07	6.32	6.49		07/31/2016
10/31/2015	21.5	25.8				10/31/2015	4.8	5.76			09/30/2016
11/30/2015	10.2	13.2	2.3	17	22.8	11/30/2015	4.5	5.8	4.4	5.23	11/30/2016
12/31/2015	4.37	9.14				12/31/2015	1.17	2.45			01/31/2017
Averages	17	22					4.2	5.2			
OPTIMIZATION PERIOD AND BEYOND											
01/31/2016	4.8	7	2.09	8		01/31/2016	2.67	3.89	3.85		03/31/2017
02/29/2016	4.6	11.7				02/29/2016	1.39	3.54			05/31/2017
03/31/2016	3.62	4.46	1.72	2.58		03/31/2016	2.93	3.61	5.92		07/31/2017
04/30/2016	3.69	3.96				04/30/2016	3.1	3.3			09/30/2017
05/31/2016	10.53	9.83	24	3.29		05/31/2016	3.6	3.36	0.7		11/30/2017
06/30/2016	9.87	9.21				06/30/2016	4.05	3.78			01/31/2018
07/31/2016	3.68	3.31	3.45	2.41		07/31/2016	3.59	3.23	2.85		03/31/2018
08/31/2016	2.63	2.69				08/31/2016	5.4	5.5			05/31/2018
09/30/2016	4.81	4.21	4.29	13.2		09/30/2016	7.51	6.57	19		07/31/2018
10/31/2016	11.12	9.18				10/31/2016	5.76	4.75			
11/30/2016	4.23	4.12	1.05	5.08	12.62	11/30/2016	4.54	4.43	1.84	4.5	
12/31/2016	8.15	12.5				12/31/2016	3.22	4.94			
01/31/2017	12.5	19.8	10.2	16.99		01/31/2017	3.45	5.47	2.39		
02/28/2017	5.91	5.42				02/28/2017	4.33	3.97			
03/31/2017	2.75	4.52	1.57	4.12		03/31/2017	1.94	3.19	2.66		
04/30/2017	3.77	8.04				04/30/2017	2.78	5.94			
05/31/2017	6.52	8.48	1.77	10.9		05/31/2017	3.26	4.24	2.59		
06/30/2017	3.22	3.59				06/30/2017	2.89	3.22			
07/31/2017	3.3	3.28	1.16	3.61		07/31/2017	3.74	3.71	3.32		
08/31/2017	8.39	9.37				08/31/2017	4.86	5.43			
09/30/2017	4.29	3.72	1.73	3.7		09/30/2017	4.18	3.62	2.35		
10/31/2017	4.4	5.17				10/31/2017	4.59	5.4			
11/30/2017	3.86	4.24	1.32	4.27	7.4	11/30/2017	3.42	3.77	4.14	4.61	
12/31/2017	5.16	6.32				12/31/2017	3.24	3.97			
01/31/2018	4.7	4.74	6.64	3.91		01/31/2018	2.8	2.82	3.89		
02/28/2018	10.17	26.71				02/28/2018	2.25	5.91			
03/31/2018	2.92	4.87	5.05	2.54		03/31/2018	0.3	0.5	0.42		
04/30/2018	3.59	4.46				04/30/2018	3.28	4.07			
05/31/2018	8.31	6.79	13.24	0.89		05/31/2018	1.74	1.422	3.96		
06/30/2018	4.47	3.98				06/30/2018	2.61	2.32			
07/31/2018	6.34	5.55	6.36	8.32		07/31/2018	5.34	4.67	8.49		
08/31/2018	8.08	7				08/31/2018	9.44	8.18			
Averages	5.8	7.1					3.7	4.1			

APPENDIX 3, TABLES 2 OF 2
NUTRIENT CHARACTERIZATION, OPTIMIZATION PROJECT

Norris TN0020630 *Gray cells will calculate for you

	Flow	Influent Total Nitrogen		Influent Total Phosphorus		Influent Nitrate-Nitrite			Effluent Total Nitrogen		Effluent Total Phosphorus		Effluent Nitrate-Nitrite		Effluent TSS		Rain Fall
Date	MGD	mg/L	Lbs./day	mg/L	Lbs./day	mg/L	Lbs./day		mg/L	Lbs./day	mg/L	Lbs./day	mg/L	Lbs./day	mg/L		in
04/29/13	0.144								9.6	11.52922	3.92	4.707763					
05/01/13	0.124								2.2	2.275152	1.92	1.985587					
05/20/13	0.124								4.92	5.088067	1.42	1.468507					
01/07/16	0.116								9.04	8.745658	2.97	2.873297	7.880	7.623427			
01/12/16	0.129								4.4	4.733784	4.14	4.45406	3.440	3.700958			
01/21/16	0.215								3.91	7.011021	2.45	4.393095	2.670	4.787577			
01/25/16	0.200								1.86	3.10248	1.14	1.90152	1.120	1.86816			0.03
02/01/16	0.267								3.54	7.882801	2.97	6.613537	2.280	5.077058			0.03
02/08/16	0.188								4.62	7.24379	1.55	2.430276	3.780	5.926738			
02/18/16	0.289								5.36	12.91899	0.508	1.224412	3.700	8.917962			
02/22/16	0.291								5.3	12.86278	0.192	0.465972	3.600	8.736984			0.39
02/29/16	0.203								4.2	7.110684	nd		1.700	2.878134			
03/07/16	0.139								3.66	4.242892	0.22	0.255037	2.370	2.747446			
03/14/16	0.237								3.38	6.68084	3.71	7.333112	1.970	3.893863			0.45
03/21/16	0.144								4.09	4.911926	4.74	5.69255	2.240	2.69015			
03/28/16	0.125								3.37	3.513225	3.08	3.2109	1.990	2.074575			0.08
04/04/16	0.145								0.778	0.940835	2.29	2.769297	nd	#VALUE!	0.1		
04/11/16	0.110								4.16	3.816384	3.99	3.660426	3.080	2.825592	0.1		0.03
04/18/16	0.115								3.41	3.270531	2.43	2.330613	1.850	1.774335	0.1		
04/25/16	0.095								6.44	5.102412	3.7	2.93151	5.250	4.159575	0.1		
05/01/16	0.211								6.66	11.71987	5.58	9.819349	3.530	6.211882			2.16
05/10/16	0.108								25.8	23.23858	3.42	3.080462	nd	#VALUE!	0.1		
05/16/16	0.119								4.09	4.059161	0.514	0.510124	1.690	1.677257	0.1		
05/23/16	0.087								5.57	4.041481	4.9	3.555342	nd	#VALUE!	0.1		
06/02/16	0.106								19.4	17.15038	1.67	1.476347	nd	#VALUE!	0.1		0.1
06/06/16	0.370								9.29	28.66708	2.82	8.701956	nd	#VALUE!	0.1		0.37
06/14/16	0.113								4.7	4.429374	3.18	2.996896	nd	#VALUE!	0.1		
06/20/16	0.087								7.39	5.362036	8.15	5.913477	nd	#VALUE!	0.1		
06/27/16	0.081								8.6	5.809644	4.47	3.019664	nd	#VALUE!	0.1		0.62
07/05/16	0.113			6.76	6.370759	Non detect	#VALUE!		4.67	4.401101	4.34	4.090103	1.420	1.338236			
07/11/16	0.090			6	4.5036	9.29	6.973074		3.78	2.837268	2.81	2.109186	2.520	1.891512			
07/18/16	0.082			7.21	4.930775	Non detect	#VALUE!		3.07	2.099512	3.7	2.530356	2.060	1.408793			
07/25/16	0.118			6.74	6.632969	1.98	1.948558		3.21	3.159025	3.54	3.483785	1.950	1.919034			
08/01/16	0.124			6.29	6.504866	Non detect	#VALUE!		3.75	3.8781	5.46	5.646514	Non detect	#VALUE!			
08/08/16	0.157			3.96	5.185145	Non detect	#VALUE!		1.68	2.199758	3.68	4.818518	Non detect	#VALUE!			
08/15/16	0.222			7.13	13.20105	Non detect	#VALUE!		1.63	3.017912	5.44	10.07205	Non detect	#VALUE!			
08/22/16	0.109			6.28	5.708897	Non detect	#VALUE!		4.85	4.408941	5.35	4.863471	3.250	2.954445			
08/29/16	0.113			5.14	4.844039	Non detect	#VALUE!		1.27	1.196873	7.05	6.644061	Non detect	#VALUE!			
09/06/16	0.094			9.35	7.330026	Non detect	#VALUE!		5.48	4.296101	6.75	5.29173	3.680	2.884973			
09/12/16	0.096			6.34	5.076058	Non detect	#VALUE!		8.52	6.821453	11.4	9.127296	7.080	5.668531			
									5.538595	6.672559	3.730667	4.174731					
									mg/L	Lbs./day	mg/L	Lbs./day					