

WATER QUALITY CALCULATIONS FOR METALS AND OTHER TOXIC SUBSTANCES
WATER QUALITY BASED EFFLUENT CALCULATIONS
OUTFALL 001

FACILITY: Centerville

PERMIT #: TN024937

DATE: 09/26/23

CALC BY: WDM

regulated stream worksheet (1Q10)

Stream (1Q10)	Stream (30Q5)	Waste Flow (MGD)	Ttl. Susp Solids (mg/l)	Hardness (as CaCO3) (mg/l)	Margin of Safety (%)
155.00	224.00	0.75	20	165	50

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	Stream	Fish/Aqua. Life (F & AL) WQC		F & AL- instream allowable			Calc. Effluent Concentration		Human Health Water Quality Criteria *						effluent
	Bckgrnd.	lab conditions		Fraction	ambient conditions (Tot)		based on F & AL		In-Stream Criteria			Calc. Effluent Concentration **			limited
	Conc.	Chronic	Acute	Dissolved	Chronic	Acute	Chronic	Acute	Organisms	Water/Organisms	DWS	Organisms	Water/Organisms	DWS	case
PARAMETER	[ug/l]	[ug/l]	[ug/l]	[Fraction]	[ug/l]	[ug/l]	[ug/l]	[ug/l]	[ug/l]	[ug/l]	[ug/l]	[ug/l]	[ug/l]	[ug/l]	ug/l
Copper (a,b)	1.300	13.739	21.542	0.206	66.570	104.380	6777.82	10703.82	N/A	N/A	N/A	NA	NA	NA	80.0
Chromium III	1.500	111.692	858.646	0.049	2295.318	17645.507	238175.51	1832036.79	N/A	N/A	N/A	NA	NA	NA	Report
Chromium VI	1.500	11.000	16.000	1.000	11.000	16.000	987.17	1506.33	N/A	N/A	N/A	NA	NA	NA	Report
Chromium, Total	1.500	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	100.0	NA	NA	14759.33	NA
Nickel (a,b)	3.600	79.442	715.247	0.180	442.145	3980.808	45537.37	412968.52	4600.0	610.0	100.0	688695.73	90860.73	14445.73	180.0
Cadmium (a,b)	0.200	1.046	2.877	0.185	5.663	15.570	567.32	1596.04	N/A	N/A	5.0	NA	NA	719.30	5.0
Lead (a,b)	0.700	4.322	110.900	0.110	39.263	1007.568	4004.52	104546.76	N/A	N/A	5.0	NA	NA	644.63	45.0
Mercury (T) (c)	0.050	0.770	1.400	1.000	0.770	1.400	74.79	140.20	0.051	0.05	2.0	0.17	0.02	292.20	0.4
Silver (a,b,e)	3.806	N/A	7.612	1.000	NA	7.612	N/A	397.09	N/A	N/A	N/A	NA	NA	NA	5.0
Zinc (a,b)	3.700	180.579	179.114	0.103	1759.298	1745.023	182291.39	180809.25	26000.0	7400.0	N/A	3895114.13	1108214.13	NA	200.0
Cyanide (d)	0.020	5.200	22.000	1.000	5.200	22.000	537.87	2282.27	140.0	140.0	200.0	20973.68	20973.68	29963.68	230.0
Toluene									15000.0	1300.0	1000.0	2247500.00	194783.33	149833.33	15.0
Benzene									510.0	22.0	5.0	76415.00	3296.33	749.17	3.0
1,1,1 Trichloroethane									N/A	N/A	200.0	NA	NA	29966.67	30.0
Ethylbenzene									2100.0	530.0	700.0	314650.00	79411.67	104883.33	4.0
Carbon Tetrachloride									16.0	2.3	5.0	2397.33	344.62	749.17	15.0
Chloroform									4700.0	57.0	N/A	704216.67	8540.50	NA	85.0
Tetrachloroethylene									33.0	6.9	5.0	4944.50	1033.85	749.17	25.0
Trichloroethylene									300.0	25.0	5.0	44950.00	3745.83	749.17	10.0
1,2 trans Dichloroethylene									10000.0	140.0	100.0	NA	20976.67	14983.33	1.5
Methylene Chloride									5900.0	46.0	5.0	884016.67	6892.33	NA	50.0
Total Phenols									860000.0	10000.0	N/A	128856666.67	1498333.33	NA	50.0
Naphthalene									N/A	N/A	N/A	NA	NA	NA	1.0
Total Phthalates									N/A	N/A	N/A	NA	NA	NA	64.5
Chlorine (T. Res.)	0.000	11.000	19.000	1.000	11.000	19.000	2284.33	3945.67	NA	NA	NA	NA	NA	NA	n/a

- a Denotes metals for which Fish & Aquatic Life Criteria are expressed as a function of total hardness.
b The criteria for this metal is in the dissolved form at lab conditions. The calculated effluent concentration is in the total recoverable form.
c The chronic criteria for mercury is not converted to dissolved, since it is based on fish tissue data rather than toxicity.
d The criteria for this parameter is in the total form.
e Silver limit is daily max if column 8 is most stringent.
f When columns 7 or 8 result in a negative number, use results from columns 5 or 6, respectively.
g When columns 12, 13 or 14 result in a negative number, use results from columns 9, 10 or 11, respectively, as applicable.

* Domestic supply included in river use so pick from columns 7,8,12,13,14,15 or Domestic supply not included in river use so pick from columns 7, 8, 12 or 15.

** Water Quality criteria for stream use classifications other than Fish & Aquatic Life are based on the 30Q5 flow.

Note: A copy of this spreadsheet can be found on h:\mfs\pretreat\Pass-through Limits\Spreadsheets\name of Control Authority.xls

[illegible][illegible]

 PTL < value shown
 Daily Max

Basis of PTL is ELC unless otherwise noted as follows:

	PTL 12/10/2018	85% PTL	PTL 11/3/2023	Apr-23	Oct-22	Apr-22	Oct-21	Apr-21	Oct-20	Apr-20	Oct-19	Apr-19	Oct-18
COPPER	0.08000	0.06800	0.08000	0.00100	0.00527	0.00904	0.00100	0.00132	0.00100	0.00229	0.00301	0.00473	0.00531
CHROMIUM, III	report	N/A	report	0.01000	0.01000	0.01000	0.01000	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100
CHROMIUM, VI	report	N/A	report	0.01000	0.00100	0.01000	0.01000	0.01000	0.01000	0.01000	0.01000	0.01000	0.01000
CHROMIUM, TOTAL	NA	n/a	NA	0.02000	0.02000	0.02000	0.02000	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100
NICKEL	0.18000	0.15300	0.18000	0.00200	0.00200	0.00200	0.00200	0.00100	0.00100	0.00100	0.00324	0.00181	0.00330
CADMIUM	0.00500	0.00425	0.00500	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100
LEAD	0.04500	0.03825	0.04500	0.00200	0.00200	0.00220	0.00200	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100
MERCURY	0.00040	0.00014	0.00017	0.00020	0.00020	0.00020	0.00020	0.00020	0.00020	0.00020	0.00020	0.00020	0.00020
SILVER	0.00500	0.00425	0.00500	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100
ZINC	0.20000	0.17000	0.20000	0.02680	0.02800	0.02000	0.02580	0.02770	0.02080	0.03720	0.03980	0.04810	0.03260
CYANIDE	0.23000	0.19550	0.23000	0.00500	0.00500	0.00500	0.00682	0.00500	0.00500	0.00500	0.00500	0.00500	0.00792
TOLUENE	0.01500	0.01275	0.01500	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100
BENZENE	0.00300	0.00255	0.00300	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100
1,1,1 TRICHLOROETHANE	0.03000	0.02550	0.03000	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100
ETHYLBENZENE	0.00400	0.00340	0.00400	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100
CARBON TETRACHLORIDE	0.01500	0.01275	0.01500	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100
CHLOROFORM	0.08500	0.07225	0.08500	0.00500	0.00791	0.00500	0.00676	0.00500	0.00679	0.00500	0.00500	0.00500	0.00752
TETRACHLOROETHYLENE	0.02500	0.02125	0.02500	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100
TRICHLOROETHYLENE	0.01000	0.00850	0.01000	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100
1,2 TRANS-DICHLOROETHYLENE	0.00150	0.00128	0.00150	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100
METHYLENE CHLORIDE	0.05000	0.04250	0.05000	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500	0.00500
TOTAL PHENOLS	0.05000	0.04250	0.05000	0.04000	0.04000	0.04000	0.04000	0.04000	0.04000	0.04000	0.04000	0.04000	0.04000
NAPHTHALENE	0.00100	0.00085	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100	0.00100
TOTAL PHTHALATES	0.06450	0.05483	0.06450	0.01200	0.01200	0.01200	0.01200	0.01200	0.01200	0.00400	0.00400	0.00400	0.00516

Bolded in effluent data = potential to exceed 85% of proposed PTLs

Shaded means 1/2 detection level

Determining low flows on unregulated streams

Step 1: Use USGS StreamStats to find the drainage area (A_{outfall}) and calculate low flow at the point of discharge ($Q_{\text{outfall_streamstats}}$).
Use print > print to pdf to save this output and insert it into permit appendix

Step 2: Use USGS StreamStats to explore the watershed and determine if an appropriate gage is available.
A gage is useable when the **drainage area** (A_{gage}) and the **period of record** representative of the point of discharge.
As a rule of thumb, the A_{gage} should be 0.5 to 1.5 times the A_{outfall}
The period of record should be > 10 years and “not too old”

Step 3: If enough gage data is available, use SWTtoolbox to download gage data and calculate the low flow at the gage (Q_{gage})

$$Q_{\text{outfall}} = Q_{\text{gage}} * \frac{A_{\text{outfall}}}{A_{\text{gage}}}$$

	square miles
A Outfall:	2050.30
A Gage:	2048.21

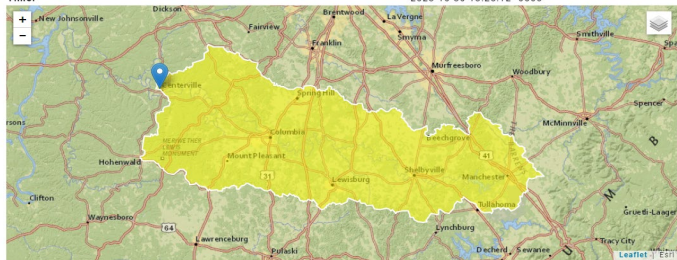
Where:

Q_{Outfall} = Low flow statistic at outfall location
 Q_{Gage} = Low flow statistic at gage location (from SWTtoolbox output)
 A_{Outfall} = Area draining to outfall
 A_{Gage} = Area draining to gage

	1Q10		30Q5	
	cfs	MGD	cfs	MGD
Q Gage:	239.00	154.47	346.02	223.63
Q Outfall:	239.24	155	346.37	224

Outfall Location
StreamStats Report

Region ID: TN
Workspace ID: TN20231030182447112000
Clicked Point (Latitude, Longitude): 35.79400, -87.47600
Time: 2023-10-30 13:25:12 -0500



Low-Flow Statistics

Low-Flow Statistics Parameters [Low Flow Central and East Regions 2009 5159]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	2050.3	square miles	1.3	14441
RECESS	Recession Index	58	days per log cycle	32	175
CLIMFAC2YR	Tennessee Climate Factor 2 Year	2.381	dimensionless	2.056	2.46
SOILPERM	Average Soil Permeability	1.455	inches per hour	0.45	9.72
PERMGTE2IN	Percent permeability gte 2 in per hr	59.765	percent	2	100

Low-Flow Statistics Flow Report [Low Flow Central and East Regions 2009 5159]

PIL: Lower 90% Prediction Interval, PIU: Upper 90% Prediction Interval, ASEp: Average Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	ASEp
7 Day 10 Year Low Flow	100	ft ³ /s	89
30 Day 5 Year Low Flow	166	ft ³ /s	70.2

Low-Flow Statistics Citations

Law, G.S., Tasker, G.D., and Ladd, D.E., 2009, Streamflow-characteristic estimation methods for unregulated streams of Tennessee: U.S. Geological Survey Scientific Investigations Report 2009-5159, 212 p., 1 pl.

Gauge Location

Low-Flow Statistics

Low-Flow Statistics Parameters [Low Flow Central and East Regions 2009 5159]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	2048.21	square miles	1.3	14441
RECESS	Recession Index	58	days per log cycle	32	175
CLIMFAC2YR	Tennessee Climate Factor 2 Year	2.381	dimensionless	2.056	2.46
SOILPERM	Average Soil Permeability	1.455	inches per hour	0.45	9.72
PERMGTE2IN	Percent permeability gte 2 in per hr	59.75	percent	2	100

Low-Flow Statistics Flow Report [Low Flow Central and East Regions 2009 5159]

PIL: Lower 90% Prediction Interval, PIU: Upper 90% Prediction Interval, ASEp: Average Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	ASEp
7 Day 10 Year Low Flow	100	ft ³ /s	89
30 Day 5 Year Low Flow	165	ft ³ /s	70.2

Low-Flow Statistics Citations

Law, G.S., Tasker, G.D., and Ladd, D.E., 2009, Streamflow-characteristic estimation methods for unregulated streams of Tennessee: U.S. Geological Survey Scientific Investigations Report 2009-5159, 212 p., 1 pl.

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Frequency Statistics						
File Edit View Analysis Help						
Data Set	Probability	Recurrence Interval	1-day	1-day	1-day	30-day
OBSERVED 03601990 Streamflow	0.2000	5	277.82	262.67	246.02	
OBSERVED 03601990 Streamflow	0.1000	10	239	250.33	293.33	

Program SWStat U.S. GEOLOGICAL SURVEY Seq 00001
Ver. 5.0 Log-Pearson & Pearson Type III Statistics Run Date / Time
03/13/2018 based on USGS Program A193 9/25/2023 8:28 AM

Notice -- Log-Pearson Type III or Pearson Type III distributions are used
for these computations. Users are responsible for assessment
and interpretation.

Description: 03601990 DUCK RIVER AT HWY 100 AT CENTERVILLE, TN
Year Boundaries: April 1 - March 31
Period in report: April 1, 2002 - March 31, 2023

Parameter: 1-day low

Non-zero values: 21
Zero values: 0
Negative values: 0 (ignored)

Input time series (zero and negative values not included in listing.)

424.000 439.000 479.000 405.000 296.000 180.000 240.000 309.000
254.000 299.000 246.000 381.000 400.000 445.000 314.000 566.000
364.000 299.000 588.000 558.000 390.000

LOG PEARSON TYPE III Frequency Curve Parameters
(based on logs of the non-zero values)

Mean (logs) 2.555
Variance (logs) 0.018
Standard Deviation (logs) 0.135
Skewness (logs) -0.297
Standard Error of Skewness (logs) 0.501
Serial Correlation Coefficient (logs) 0.442
Coefficient of Variation (logs) 0.053

Frequency Curve - Parameter values at selected probabilities

Non-exceedance Probability	Variance Interval	95-Pct Confidence Parameter Estimate	of Intervals Lower	Upper
0.1000	10.00	239.000	1.002	175.900 282.440
0.2000	5.00	277.820	1.011	223.130 323.790

Program SWStat U.S. GEOLOGICAL SURVEY Seq 00003
Ver. 5.0 Log-Pearson & Pearson Type III Statistics Run Date / Time
03/13/2018 based on USGS Program A193 9/25/2023 8:28 AM

Notice -- Log-Pearson Type III or Pearson Type III distributions are used
for these computations. Users are responsible for assessment
and interpretation.

Description: 03601990 DUCK RIVER AT HWY 100 AT CENTERVILLE, TN
Year Boundaries: April 1 - March 31
Period in report: April 1, 2002 - March 31, 2023

Parameter: 30-day low

Non-zero values: 21
Zero values: 0
Negative values: 0 (ignored)

Input time series (zero and negative values not included in listing.)

535.000 567.970 954.730 430.730 342.800 228.930 341.130 456.270
288.600 577.300 342.730 487.870 520.600 732.830 337.670 862.600
460.800 341.470 855.970 864.330 454.900

LOG PEARSON TYPE III Frequency Curve Parameters
(based on logs of the non-zero values)

Mean (logs) 2.686
Variance (logs) 0.030
Standard Deviation (logs) 0.173

Skewness (logs) 0.156
Standard Error of Skewness (logs) 0.501
Serial Correlation Coefficient (logs) 0.083
Coefficient of Variation (logs) 0.064

Frequency Curve - Parameter values at selected probabilities

Non-exceedance Probability	Variance Interval	95-Pct Confidence Parameter Estimate	of Intervals Lower	Upper
0.1000	10.00	293.330	1.007	216.200 354.590
0.2000	5.00	346.020	1.028	275.520 416.010

PRETREATMENT PASS-THROUGH LIMIT REQUEST SHEET

DATE: 09/26/23
NPDES: TN0024937
FACILITY: Centerville
COUNTY: Hickman
DESIGN FLOW (MGD): 0.75
TOTAL DESIGN FLOW (MGD), if different: NA

EXPLANATION, if applicable: _____

RECEIVING STREAM: Duck River

DISCHARGE POINT (RIVER MILE): 71.5

7Q10	_____	(CFS)	_____	(MGD)
30Q5	<u>346</u>	(CFS)	<u>224</u>	(MGD)
1Q10	<u>239</u>	(CFS)	<u>154</u>	(MGD)

___ Domestic in stream uses (use columns 7, 8, 12 – 15 in PTL spreadsheet)

___X___ Domestic NOT in stream uses (use columns 7, 8, 12 & 15 in PTL spreadsheet)

___ Not on 303(d) list ___ Not on 305(b) report

___X___ On 303(d) list as **NOT** or **PARTIALLY** supporting (circle one)

___ On 305(b) report, page NA

___Y___ WQ evaluated and if evaluated, WQ designation ETW

OTHER DISCHARGERS ON SAME STREAM +/- 5 RM

(FACILITY, PERMIT #, FLOW, RM):

None

LIST ANY CONCERNS, SPECIAL CONSIDERATIONS:

I use ambient data mostly from upstream at RM 113.

For ambient mercury, I only use results from more sensitive tests having MDLs < 0.2 ug/L.

Everything remains effluent limited case except for mercury due, in part to detected mercury levels in the ambient.

This permit expires at the end of October and needs to be public noticed 9/26/23.

INFORMATION PROVIDED BY: WDM

CALCULATED BY: WDM **REVIEWED BY:** GRH

DATE: 09/26/23 **DATE:** 10/30/2023

RE: Centerville PTL



Wade Murphy

To: Gordon Holcomb

[Reply](#) [Reply All](#) [Forward](#) [T](#) [...](#)

Mon 10/30/2023 2:25 PM

Retention Policy 90 Day Delete (90 days)

Expires 1/28/2024

Gordon, I'm fine with the changes for the PTL file. I'm going to leave the permit as drafted though since the edits don't change the results of the reasonable potential calculations which are only more conservative without these edits. This way the draft permit shows, with the more conservative interpretation, that no WQ based limits are required in the permit, and the PTLs show that, with the more liberal interpretation, that PTLs are the best we can offer via our current procedures.



Wade D. Murphy | E.I.

Division of Water Resources, Water-Based Systems Unit

William R. Snodgrass TN Tower, 11th Fl

312 Rosa L. Parks Ave 37243

p. 615-532-0666

wade.murphy@tn.gov

tn.gov/environment

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External Customers: We value your feedback! Please complete our [customer satisfaction survey](#).

From: Gordon Holcomb <Gordon.Holcomb@tn.gov>

Sent: Monday, October 30, 2023 2:01 PM

To: Wade Murphy <Wade.Murphy@tn.gov>

Subject: Centerville PTL

Wade,

I've reviewed the Centerville PTL. While none of the limits changed, I do have a couple of comments. Both have Orange Highlighter on the 1Q10 Tab in the attached spreadsheet.

1. Taking account of the relative drainage areas of the outfall and gauge increased the rounded 1Q10 value by 1 MGD
2. The background value for Lead was skewed upward quite a bit by 4 values in 2011 that had very high detection levels and also looked suspect because one of them had a result of 0.74 ug/l with a MDL of 32 ug/l. Taking those 4 points out reduced the average from 1.9 to 0.7 ug/l as the background average.

CHAPTER 0400-40-04

[illegible]

PASS THROUGH LIMITATIONS

Centerville STP 11/03/23 Hickman County
Design Flow: 0.75 MGD TN0024937 1Q10: 154 MGD

Parameter	Concentration (µg/l)
Copper	80.00
Chromium, III	Report only
Chromium, VI	Report only
Nickel	180.00
Cadmium	5.00
Lead	45.00
Mercury	0.17
Silver	5.00
Zinc	200.00
Cyanide	230.00
Toluene	15.00
Benzene	3.00
1,1,1 Trichloroethane	30.00
Ethylbenzene	4.00
Carbon Tetrachloride	15.00
Chloroform	85.00
Tetrachloroethylene	25.00
Trichloroethylene	10.00
1,2 trans Dichloroethylene	1.50
Methylene Chloride	50.00
Phenols, Total	50.00
Naphthalene	1.00
Phthalates, Total ¹	64.50

¹ Total Phthalates is the sum of Bis (2-ethylhexyl) phthalate, Butyl ~~benzylphthalate~~, Di-n-butylphthalate and Diethyl phthalate.

Note: These limits are monthly averages. All sampling and analysis must be in accordance with 40 CFR 136 unless explicitly allowed by the NPDES permit. See Part 3.2. of the NPDES permit for sample type requirements. References include T.C.A. 0400-40-14-.12(7)(c), 40 CFR 136, and EPA Form 3510-2C (8/90 version).