WASTELOAD ALLOCATION DEVELOPMENT

Madill Wastewater Treatment Plant (OPDES OK0031721)

August 2026 (Revision 3)

Prepared For:

City of Madill, Oklahoma

Prepared by:

Alliance Technical Group
219 Brown Lane
Bryant, AR 72022

Submitted By:

S2 Engineering, PLLC
8556 E. 101st Street, Suite D.
Tulsa, OK 74133

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1.0 INTRODUCTION

The City of Madill (City or Madill) has retained Barker & Associates Consulting Engineers (B&A or Engineer) for their wastewater treatment plant expansion project (Project), including the plan to expand its existing plant to 1.5 MGD. Madill's existing WWTP is permitted for a 0.75 MGD design flow and any significant increase in capacity will require additional wasteload allocation (WLA) from the Oklahoma Department of Environmental Quality (ODEQ) including a 208 Plan update to the Oklahoma Water Quality Standards.

Engineer requested S2 Engineering (S2E) for subconsultant services to assist them in obtaining the additional WLA and the 208 Plan update for the Project as required by the ODEQ. S2 Engineering has teamed with Alliance Technical Group from Arkansas as the sub-consultant to S2E for the field work and the modeling efforts

Madill's current wasteload allocation (WLA) for its discharge to an unnamed tributary of Glasses Creek is 0.75 MGD. The proposed design flow for the new plant is 1.5 mgd. A new WLA and 208 Plan amendment from Oklahoma Department of Environmental Quality (ODEQ) is required to increase the WLA above the current level. This report provides a summary of the modeling and the proposed new WLA for Madill.

2.0 WATERSHED DESCRIPTION

The City of Madill is in Marshall County, Oklahoma near Lake Texoma. Madill's wastewater discharges into a very small unnamed tributary, flows for less than 0.2 miles to its confluence with Glasses Creek, which is the primary stream conveying Madill's wastewater to Lake Texoma. Glasses Creek is a 3rd order stream in the Lower Red River (Bois D'Arc-Island) watershed (HUC-8 No. 11140101) that runs directly through Madill.

Figure 2.1 is the location map for the current discharge stream. Where the current discharge enters the unnamed tributary (UT) is a small first order stream with a watershed size of approximately 0.5 mi^2 while the overall Glasses Creek watershed is approximately 43 mi^2 in size (Figure 2.2.) The modeled reach spans approximately 8 miles downstream of the discharge to the upstream end of Lake Texoma. The basin falls in the Western Coastal Plains as defined by major Land Resource Areas (MRLA) in the Continental United States and is in the ODEQ planning basin 3, Lower Red River (sub-basin ID number 10700).

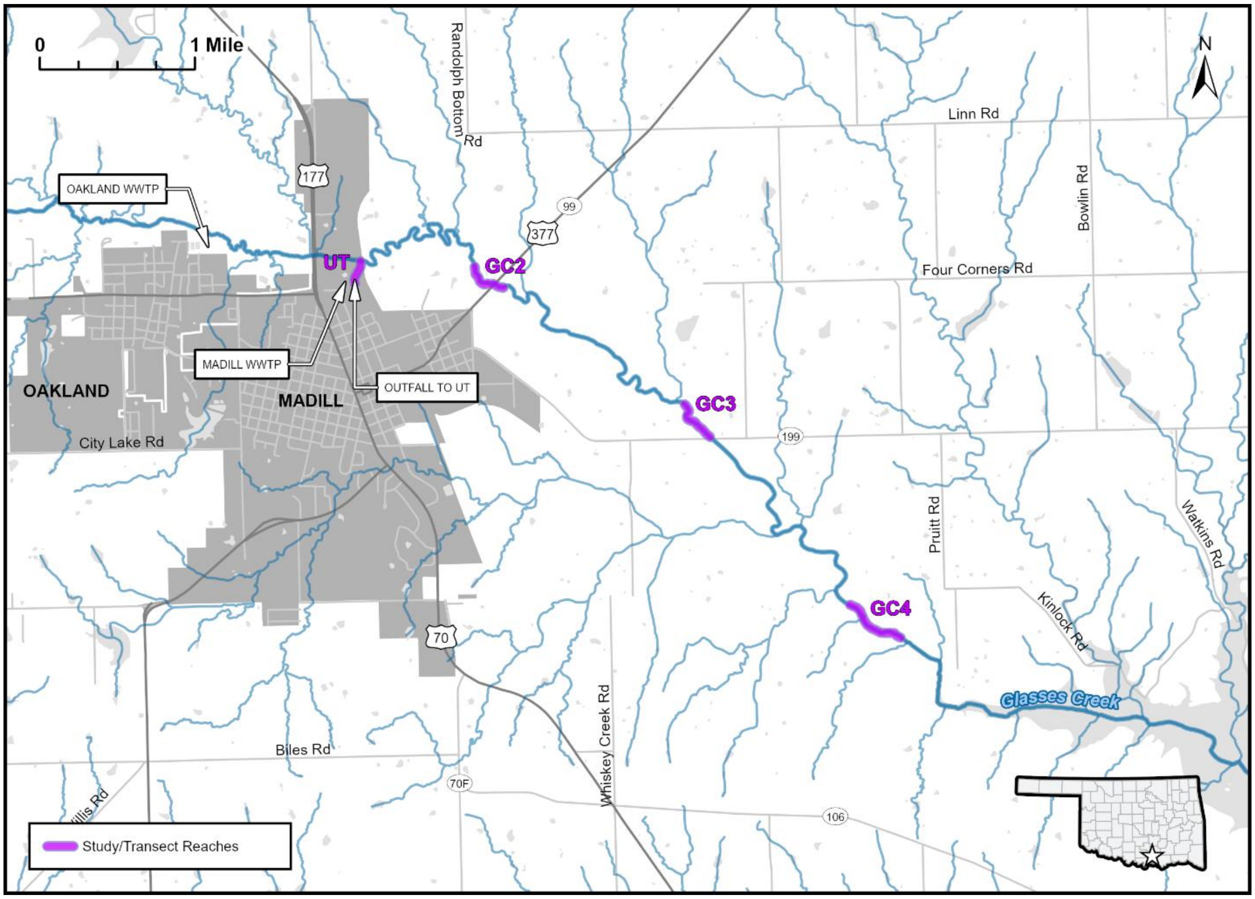


Figure 2.1. Location of the Madill outfall and the study reaches in Glasses Creek.

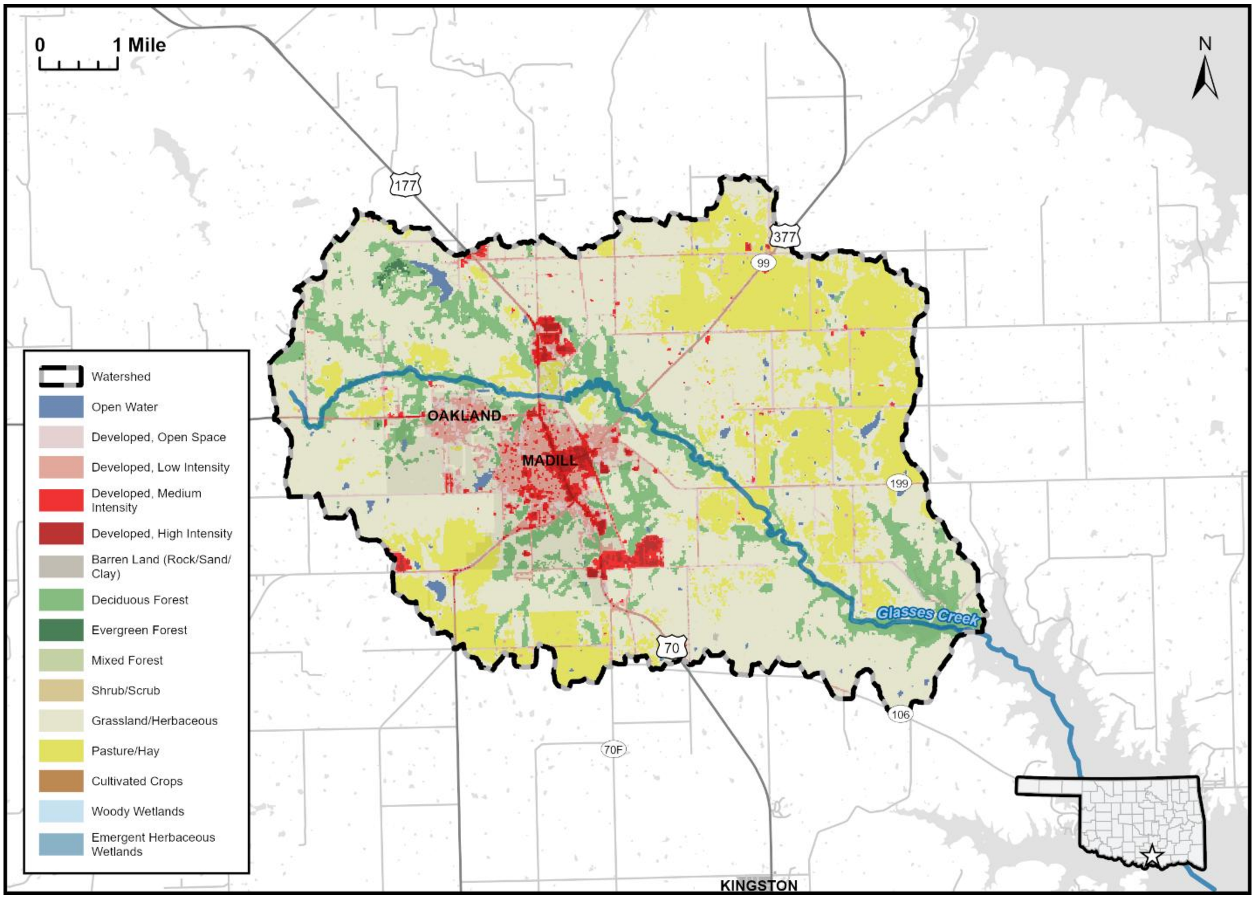


Figure 2.2. Glasses Creek Watershed upstream of the Madill discharge (outfall) location.

Glasses Creek is classified as a warm water aquatic community; therefore, it has dissolved oxygen standards of 5 mg/L in the summer and winter and 6 mg/L in spring. Glasses Creek is listed in the Oklahoma Water Quality Standards (WQS) with designated uses of Public/Private Water Supply, Warm Water Aquatic Community, Agriculture, Primary Body Contact Recreation and Aesthetics.

3.0 DESKTOP MODELING

To develop a new WLA for Madill's flow increase a desktop (uncalibrated) modeling exercise was completed (ODEQ, 2012). The QUAL2K model was utilized. QUAL2K is a one-dimensional steady state river and stream model. The current version is an enhancement of the QUAL2/QUAL2E model which has been used for numerous WLAs across the nation. QUAL2K has capability for enhanced eutrophication kinetics making it well suited to modeling dissolved oxygen, phytoplankton, and nutrient dynamics in stream systems. Since this is a desktop model, the modelling focus was CBOD and ammonia. Therefore, other parameters such as phytoplankton and nutrient dynamics that are available in QUAL2K are turned off/not utilized. Information that the modeler needs to develop/provide are:

- Proposed Effluent flow
- Stream reach length to be modeled
- Upstream flow (7Q2) and background conditions
- Stream geometry
- Velocity (based on geometry and flow)
- Rating curve or Mannings N and key coefficients
- Proposed WLA (CBOD5, ammonia, dissolved oxygen)

Stream channel geometry is an essential component of the QUAL2K model. For the model to predict reasonable water quality, accurate channel geometry, flow, and velocity are required. The QUAL2K model channel hydraulics were based on geomorphic data (channel width, depth, substrate, etc.) collected by Alliance in the UT and Glasses Creek during November 2025 (Appendix A). The field measured channel dimensions were used as targets for adjusting the power equation (rating curve) inputs in QUAL2K. Data inputs required by QUAL2K to determine channel geometry using the power equation/rating curve approach are coefficients and exponents for creek depth and velocity. To achieve an accurate rating curve, these coefficients and exponents are first adjusted until they predict a channel geometry and velocity similar to that observed in the field at the observed flow (Table 3.1). Then higher flows are tested to see that the channel geometry and velocity changes in an appropriate manner as flow changes. These power equations are shown on the following page.

U=a*Q^b – Velocity H=c*Q^d – Depth
Where Q=discharge, a=velocity coefficient, b=velocity exponent, c=depth coefficient, d=depth exponent

Table 3.1. Comparison of field-measured Glasses Creek channel geometry to model output.

Parameter	Glasses Creek			
	Field Measured		Model Calculated	
	meters	feet	meters	feet
Flow below outfall (cms/cfs)	0.02	0.71	.02	0.71
Average Width (m/ft)	8.3	27	8.4	27
Average Depth (m/ft)	0.34	1.1	0.31	1.0
Velocity (mps/fps)	0.008	0.03	0.008	0.03

A summary of the input data noted above is provided in Table 3.2. These inputs were partially based on field data (Appendix A) collected during a synoptic site visit in November 2025. The critical/summer period 7Q2 was assumed to be less than 1 cfs so the default background flow of 1.0 cfs was used for Glasses Creek. For winter and spring, a conservative 7Q2 of 1 cfs was also used.

Table 3.2 Seasonal model inputs for a 1.5 mgd discharge scenario.

Parameter	Summer/Critical	Spring	Winter	Data Source
Discharge Flow Scenarios (MGD)	1.5	1.5	1.5	Engineer
Upstream Flow (cfs)	1.0	1.0	1.0	7Q2/OK WQS
	Glasses Creek	UT		
Velocity Coefficient	0.2	0.225		Field Data/BPJ
Velocity exponent	0.832	0.56		Field Data/BPJ
Depth Coefficient	0.46	0.263		Field Data/BPJ
Depth exponent	0.1	0.02		Field Data/BPJ
Temperature (°C)	32	25	18	OK WQS
Headwater Dissolved oxygen (mg/L)	6.21	7.02	8.05	Field data/85% saturation*
Dissolved Oxygen Water Quality Standard (mg/L)	5	6	5	OK WQS

*Field data shows dissolved oxygen levels above 85% saturation in Glasses Creek (92%) upstream of the Madill outfall during low flow conditions, even with the presence of the Oakland discharge. Therefore, the 85% saturation level that DEQ uses in their uncalibrated desktop dissolved oxygen modeling was utilized.

Glasses Creek was modeled in seven reaches, including the UT reach. There were 17-kilometers of reaches in Glasses Creek and a 0.23 Km reach in the UT. For this desktop effort all reaches in Glasses Creek share the same coefficients and the UT utilizes coefficients developed for it, though some may be the same as those in Glasses Creek. Stream slope, Manning N, velocity, and depth were used to calculate several different reaeration rates. Glasses Creek is a shallow rocky (mostly bedrock) bottom stream that has low flow and fairly low velocity. Several different reaeration rates were explored for the summertime 1.5 mgd discharge scenario from Madill WWTP to the Glasses Creek. The Texas equation (commonly used by DEQ) returned a value of 1.80/day, the Owen's equation 3.20/day, the Louisiana equation 2.95/day, and the Turney-Harris equation 19.82/day (using conservative Mannings N of 0.045 and a conservative slope of 0.00178 ft/ft). When the Qual2k model was run at field conditions the Texas equation did not produce enough reaeration to match the higher oxygen levels observed in the field that day, hence, Texas equation is not a proper representation of the creek. Based on field observed values, values below 2 are considered too low for this stream system. Qual2k has the ability to select its own reaeration equation ("Internal" selection on the "Rates" model tab) which it bases on the best equation for the existing channel hydraulics and flow. Qual2k selected the Owen's equation. Owens equation was developed for streams that have depths in the 0.4-11 foot range and velocities in the 0.1-5 fps range (EPA, 1997). At the 1.5 mgd flow the model predicts a depth of 1.2 feet and a velocity of 0.1 fps, which is in the range that Owen's equation was developed. Therefore, Owen's reaeration equation was selected for use in this model and is still a conservative assumption, as higher rates appear reasonable when compared to observed field conditions. Since the model calculates this reaeration rate internally, it can vary slightly by reach and model scenario.

The typical background levels for CBOD and ammonia used by DEQ for desktop modeling is a 2.0 mg/L CBOD5 and a 0.15 mg/L ammonia (as used in DEQ spreadsheet models "one-reach" and "two-reach"). Samples taken from Glasses Creek above the Madill outfall (but below Oakland's discharge) had a CBOD5 of <2.0 and an ammonia of 0.17 mg/L. Therefore, use of the typical background levels was justified.

Other coefficients used were derived from EPA literature ranges and/or values used by adjacent state agencies or in comparable Oklahoma approved models. The CBOD decay rate and ammonia decay rate was estimated based on those used in past models completed in Oklahoma and verified to be in EPA literature ranges (EPA, 1997). CBOD decay was set at 0.4/day which is consistent with DEQ desktop conservative modeling and is higher than the 0.3/d used in the EPA approved Skeleton Creek model for the City of Enid, which has similar substrate and channel size compared to Glasses Creek (GBMc, 2007). The ammonia decay (nitrification) rate used in the model was 0.3/d which is consistent with the DEQ conservative desktop modeling and is higher on average than that used in the Skeleton Creek model discussed above (where some reaches used 0.2/d and others used 0.3/d). Both of these coefficients are also easily in the range, or higher than those required in the Memorandum of Agreement between EPA Region 6 and Texas TCEQ. In that document they require a BOD decay of 0.1/d and an ammonia decay of 0.3/d for QUALTX desktop modeling (TCEQ, 2018). SOD was set at a very high value (1.0 g/m2/day) not typical for this shallow rocky bottom stream, which generally have low amounts of organic matter which is what exerts sod. A summary of the rate constants/coefficients is provided in Table 3.3.

Table 3.3. Model baseline conditions and reaction coefficients.

Parameter	Summer/Critical	Spring	Winter	Data Source
Upstream CBOD (mg/L)	2.0	2.0	2.0	Field data
Upstream Ammonia (mg/L)	0.15	0.15	0.15	Field data
CBOD decay (/day)	0.40	0.40	0.40	Conservative estimate (see explanation above)
N decay (/day)	0.30	0.30	0.30	Conservative estimate (see explanation above)
Reaeration (/day)	3.2	3.4	3.2	Qual2K Internal-Owen's Equation*
Sediment oxygen demand (SOD, g/m2/day)	1.00	1.00	1.00	Conservative estimate for sandy or bedrock streams
Air Temperature	32	25	18	Same as OKWQS (Table 3.2)
Dewpoint	28	15	10	Conservative estimate **
Cloud cover, wind speed	0	0	0	Conservative estimate
Percent Shade	50/25	50/25	50/25	Field data***

*Reaeration varies by reach, season and flow.
**Conservatively high estimate for each season, i.e. at high end of seasonal norms. (summer-top end)
***50% shade for UT and upper reaches in Glasses Creek, and 25% for lower reaches. See photos and aerial photos in appendix documenting canopy.

To evaluate the new discharge flow rate of 1.5 mgd several model runs were completed. To avoid potential anti-backsliding concerns the concentrations of CBOD and ammonia were maintained at current permitted levels or below (Table 3.4) while the discharge flow was increased from the current design flow of 0.75 mgd to the proposed flow of 1.5 mgd. The model was then run to test if the stream could sufficiently assimilate the additional loading of oxygen-demanding substances generated for this discharge including a 25% margin of safety (MOS) that is required by ODEQ for uncalibrated models with multiple dischargers. The City of Oakland, which is upstream of Madill, was also included in the model at their current permitted WLA (Table 3.4). The 25% MOS (i.e., 25% more WLA) was added to both the Madill CBOD and ammonia concentration in the model. Scenarios were modeled for each season, summer, spring, and winter.

Table 3.4. Current WLA for City of Madill and City of Oakland.

	Flow (mgd)	CBOD5 (mg/l)	Ammonia (mg/l)	Dissolved Oxygen (mg/l)
Madill-Summer	0.75	9.0	2.0	5.0
Madill-Spring	0.75	10.0	3.0	6.0
Madill-Winter	0.75	20.0	7.0	6.0
Oakland-Year-Round	0.06	30.0 (as BOD5)	n/a	5.0

After initial model review by ODEQ, ODEQ had several changes they wished to see made to the model inputs. These changes were:

1. Increased the number of elements from 2-5 to 20 in all reaches except the confluence reach.
2. Revised the Oakland 30 mg/L BOD5 allocation to 25 mg/L CBOD year-round and 7.4 mg/L ammonia in the summer and 15.4 mg/L for spring and winter.
3. Use a 1.16 (based on 0.4/day Kd) multiplier to convert CBOD to CBODu.
4. Reduce cloud cover to zero
5. Justify any shade above 0% (see table 3.3)
6. The DO inputs for Oakland WWTP were adjusted to 2 mg/L instead of 5 mg/L for Spring and Winter. OAC 252:740-15-3(f)(3) states that the Fish and Wildlife Propagation beneficial use is not attained when dissolved oxygen falls below 2 mg/L more than two times a year. Because the 208 Plan does not specify a minimum DO requirement in the spring and winter for Oakland WWTP, DEQ applies the 2 mg/L threshold to ensure the designated beneficial use is protected.

Model results reflected in this report reflect these changes.

At the request of DEQ the Madill outfalls dissolved oxygen level was reduced from the requested dissolved oxygen level for the WLA to approximately 25% less (new value X 1.25 equals requested value). The result of those model runs for each season are provided in Table 3.5 below.

Table 3.5. Results of model predictions at various Madill outfall dissolved oxygen levels (mg/L).

Season	Dissolved Oxygen Level in current permit and WLA request	Lower Dissolved Oxygen Level Evaluated	Minimum Dissolved Oxygen Predicted by Model at Requested Dissolved Oxygen level	Minimum Dissolved Oxygen Predicted by Model at Lower Dissolved Oxygen Level
Summer	5.0	4.0	5.1	4.9
Winter	6.0	4.8	5.0	4.9
Spring	6.0	4.8	6.0	5.8

Applying 25% MOS to the DO input for Madill as requested by DEQ, resulted in only minimal (0.2 mg/L maximum) decreases in Glasses Creek. For each season the minimum level fell slightly below (0.1 mg/L summer/winter and 0.2 mg/L spring) the OK WQS in Glasses Creek. The DO level in the UT also fell below the standards which is expected since UT is a 100% effluent dominant creek. This variation is considered acceptable, (and unavoidable in the UT that is 100% effluent)considering the fact that the outfall dissolved oxygen levels is an enforceable
permit limit parameter and controlled by plant operator. We submit that the concept that the required 25% MOS (DEQ, 2012) should include a reduction in dissolved oxygen at the outfall is a new and more conservative DEQ premise. We submit that 25% MOS is typically applied to the load (lbs/d or kg/d) of whatever constituent is of concern, in this case oxygen demanding substances, is the only focus of the MOS component (EPA, 1997). Dissolved oxygen is affected by oxygen demand but is not actual oxygen demand.

A sensitivity analysis was completed to evaluate how much affect the variation of key coefficients/inputs would have on the dissolved oxygen predictions for the summer model run with 25% MOS included. To accomplish this, each key coefficient/input was varied by +/-25% and the change in model oxygen predictions at the lowest point below the outfall(s) (the sag) was recorded. A summary of these results is provided in Table 3.6.

Table 3.6. Summary of Sensitivity Analysis. Baseline dissolved oxygen is 5.05 mg/L.

		Parameter/ Coefficient Adjustment	DO at sag (mg/L)	Percent Difference from Baseline	Parameter/ Coefficient Adjustment	DO at Sag (mg/L)	Percent Difference from Baseline
Parameter/ Coefficient	Current Value	+25%			-25%		
Fast CBOD Oxidation (Kd)	0.4	0.5	4.93	-2.4	0.3	5.19	2.8
Ammonium nitrification (Kn)	0.3	0.375	4.95	-2.0	0.225	5.17	2.4
Reaeration (Ka)	Varies*	Varies*	5.33	5.5	Varies**	4.49	-11.1
SOD	1.0	1.25	4.90	-3.0	0.75	5.20	3.0
Headwater (Glasses Creek DO)	6.21	7.76	5.05	0.0	4.66	5.05	0.0
PS (Madill WWTP) DO	5.0	6.25	5.15	2.0	3.75	4.89	-3.2

*+25% values are 2.606, 4.00, and 11.60 **-25% values are 1.56, 2.40, and 6.959

The sensitivity analysis demonstrated that the greatest percent difference noted was 11.1% for reaeration. This is less than 20%, which is considered acceptable and well within typical model uncertainty allowances.

4.0 MODEL RESULTS FOR MADILL AND PROPOSED WLA

A model scenario for a discharge of 1.5 MGD, for each season utilizing the ODEQ changes above was evaluated. Based on this modeling, the critical season was the most restrictive, producing a dissolved oxygen drop to 5.3 mg/L for the proposed WLA (Table 3.5), while the dissolved oxygen dropped to 5.1 mg/L (Figure 4.0) when the 25% MOS was included. Winter and spring model outputs are provided in Figures 4.1 and 4.2 with and without the MOS applied. The UT remained above the OK WQS in all seasons. Therefore, results of the modeling indicate that the critical season maximum assimilative capacity of the stream at a design effluent flow of 1.5 MGD, with the required 25% MOS included, is approximately 8.8 mg/L of CBOD5 and 1.9 mg/L of ammonia. This results in a summer WLA (load minus MOS) for Madill of 7 CBOD and 1.5 ammonia. The proposed WLA for each season at 1.5 mgd is provided in Table 4.1.

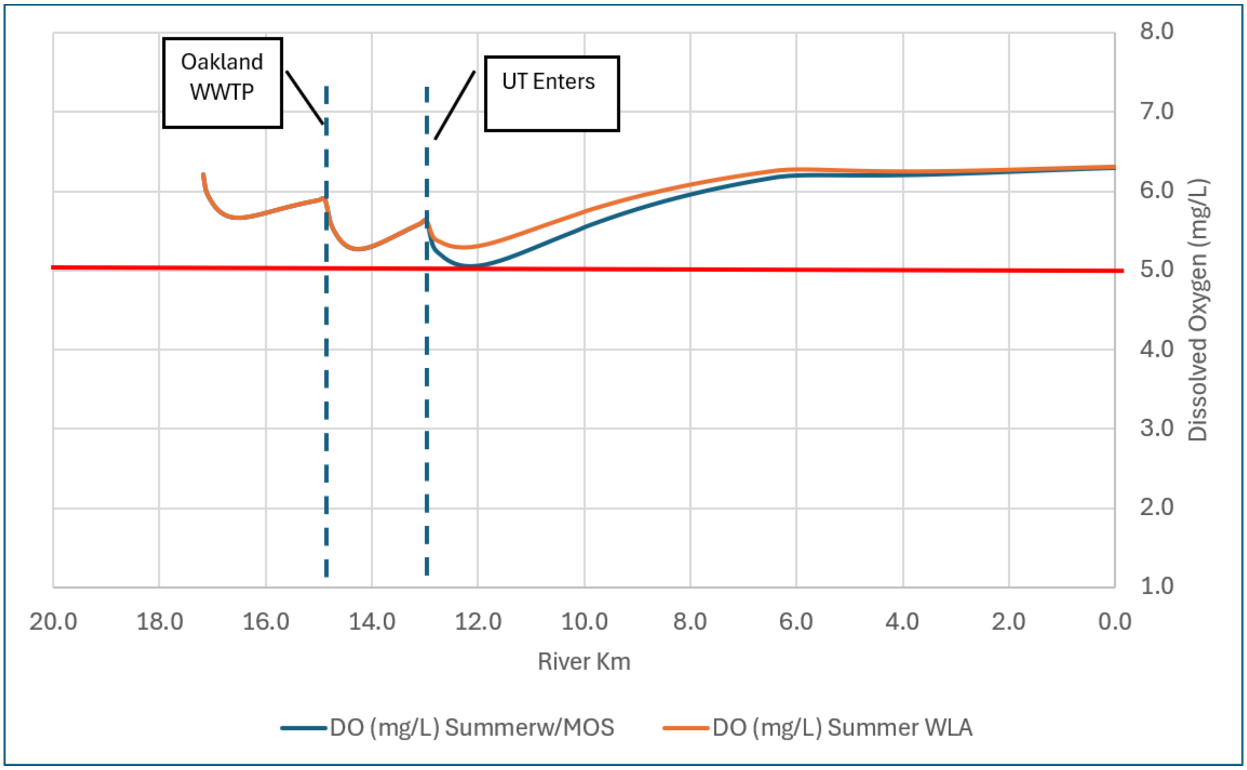


Figure 4.0. Dissolved oxygen predictions for summer (critical) conditions in Glasses Creek at 1.5 MGD design flow. Summer WQS=5.0 mg/L dissolved oxygen.

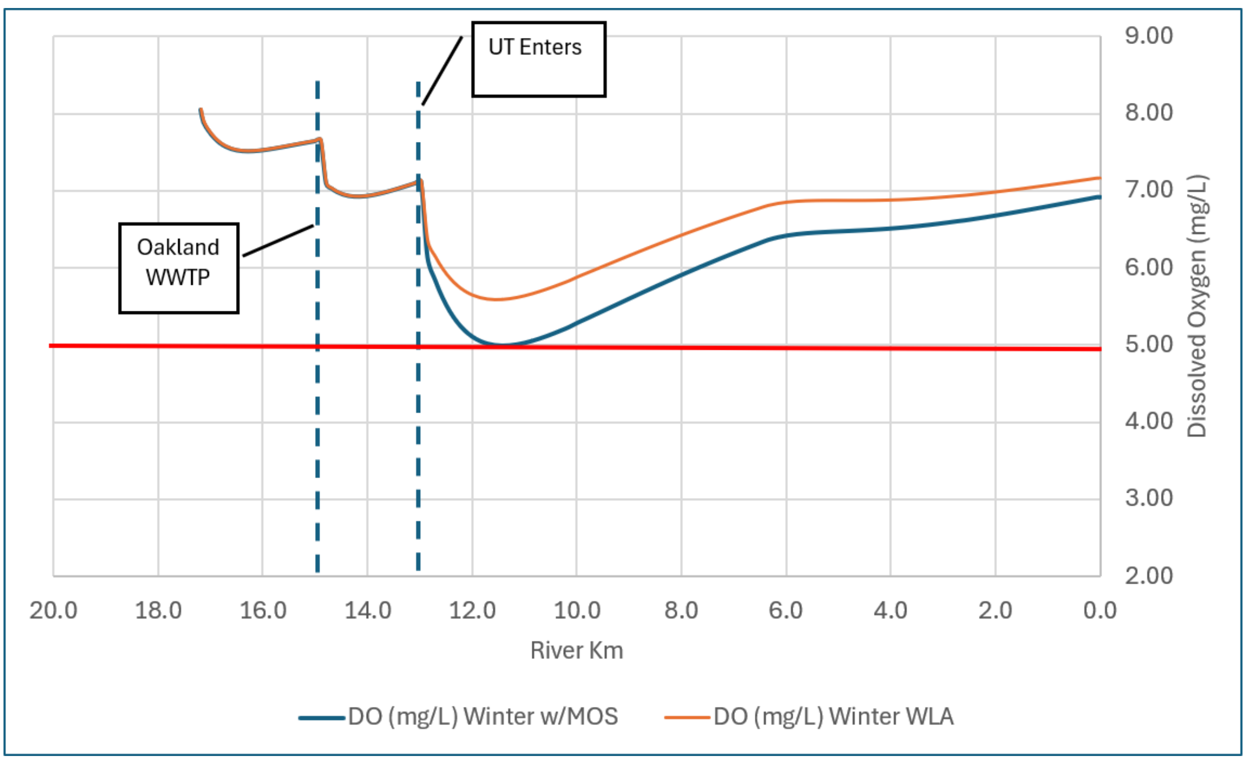


Figure 4.1. Model predicted dissolved oxygen for winter at 1.5 mgd. Winter WQS=5.0 mg/L dissolved oxygen

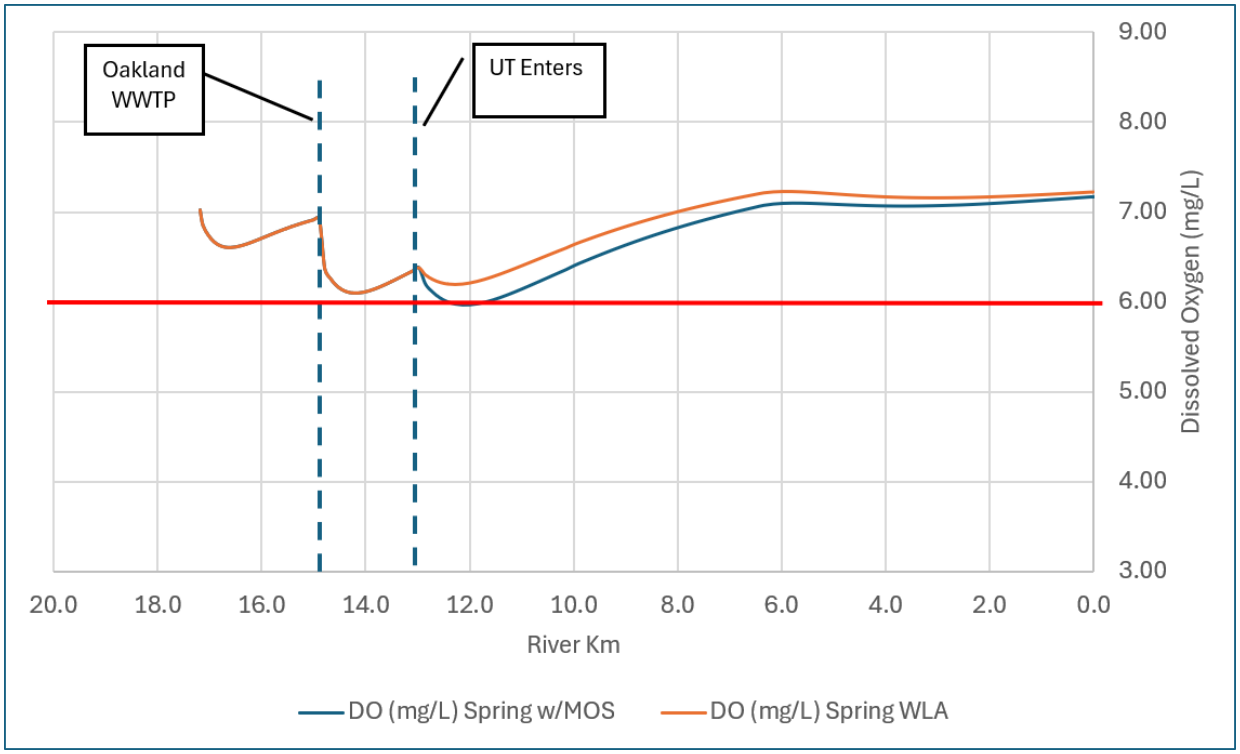


Figure 4.2. Model predicted dissolved oxygen for spring at 1.5 mgd. Spring WQS=6.0 mg/L dissolved oxygen.

Table 4.1. Summary of WLA for Madill based on a design flow of 1.5 MGD.

Season	Flow (mgd)	Dissolved Oxygen (mg/L)	CBOD5 (mg/L)	CBOD5 Load (lbs/day)	Ammonia (mg/L)	Ammonia Load (lbs/day)
Summer	1.5	5.0	7.0	87.6	1.5	18.8
Spring	1.5	6.0	9.0	112.6	1.8	22.5
Winter	1.5	6.0	20	250.2	7.0	87.6

Print outs of select model runs are provided in Appendix B and photos of the stream are provided in Appendix A.

References

EPA. 1997. Technical Guidance Manual for Developing Total Maximum Daily Loads, Book 2: Streams and Rivers. EPA 823-B-97-002

GBMc, 2007, Oxygen Demanding Wasteload Allocation to
Boggy and Skeleton Creeks for the City of Enid

Oklahoma DEQ, 2012, Continuing Planning Process

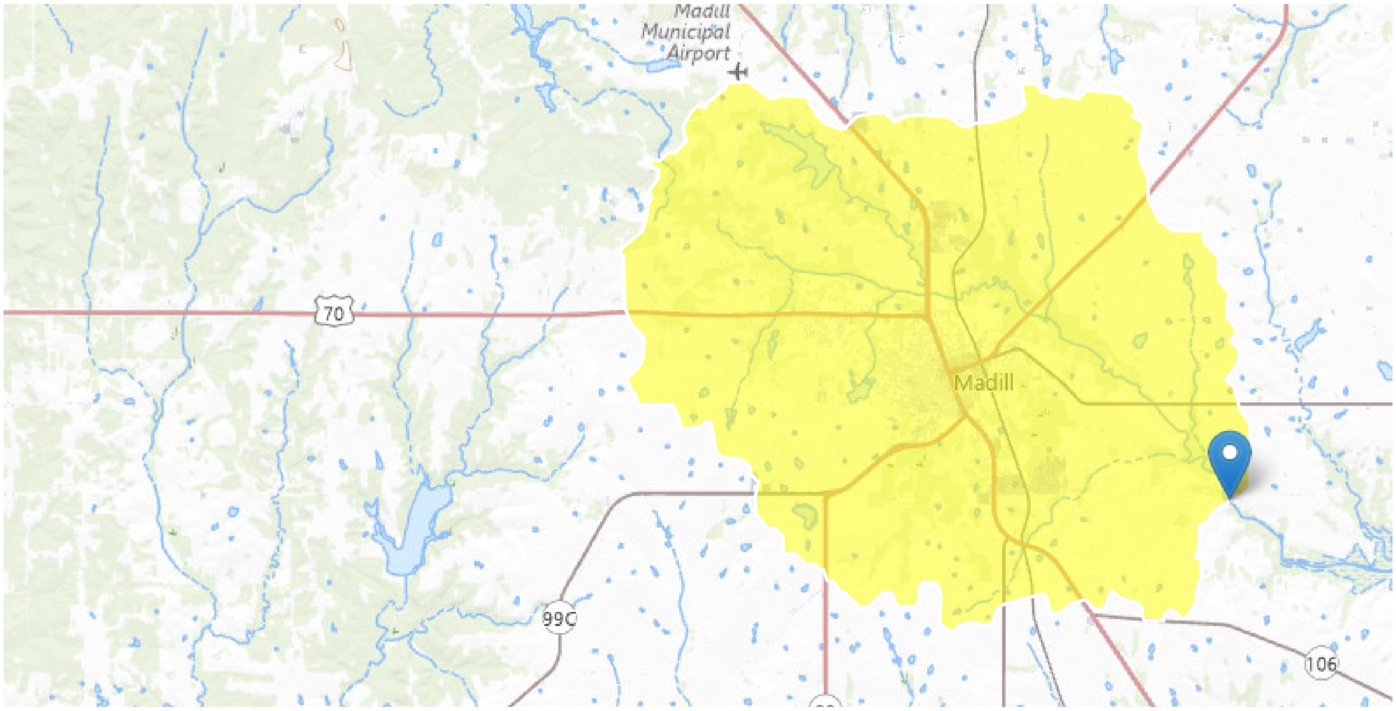
Texas CEQ, 2018, Methods for Analyzing Dissolved Oxygen in Freshwater Streams Using an Uncalibrated QUAL-TX Model.

APPENDIX A

StreamStats, Field Data and Photos

Glasses Creek

Region ID: OK
Clicked Point (Latitude, Longitude): 34.06969, -96.71702
NHD Stream GNIS Name of Click Point: Glasses Creek
Time: 2025-12-16 14:37:39 -0600



Below madill wwtp

StreamStats Update

Starting with version 4.30.0, the StreamStats application uses services that were redeveloped with open-source software components. Users may observe minor variations in computed results when compared to those from previous versions. These differences are expected and do not reflect errors in the underlying data or analytical methods. Users are advised to consider these potential variations when interpreting or comparing results generated across different versions of StreamStats. Please email streamstats@usgs.gov with any questions or concerns. A full list of changes can be found at **https://www.usgs.gov/streamstats/news/streamstats-data-updates-open-source-code-release (https://www.usgs.gov/streamstats/news/streamstats-data-updates-open-source-code-release)** .

Collapse All

Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
BSLDEM10M	Mean basin slope computed from 10 m DEM	3.7	percent

Parameter Code	Parameter Description	Value	Unit
CONTDA	Area that contributes flow to a point on a stream	32.179	square miles
CSL10_85fm	Change in elevation between points 10 and 85 percent of length along main channel to basin divide divided by length between points ft per mi	16.74	feet per mi
OUTLETELEV	Elevation of the stream outlet in feet above NAVD88	660	feet
PREG_06_10	Mean precipitation at gaging station location for June to October summer period	19.379	inches
PREG_11_05	Mean monthly precipitation for November through May at the stream outlet	23.267	inches

Flow-Duration Statistics

Flow-Duration Statistics Parameters [Duration Region 2 2009 5267]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
CONTDA	Contributing Drainage Area	32.179	square miles	4.02	7159
CSL10_85fm	Stream Slope 10 and 85 Method ft per mi	16.74	feet per mi	2.07	27
OUTLETELEV	Elevation of Gage	660	feet	518	1190
PREG_11_05	Nov to May Gage Precipitation	23.267	inches	21.7	24.8

Flow-Duration Statistics Flow Report [Duration Region 2 2009 5267]

PIL: Lower 90% Prediction Interval, PIU: Upper 90% Prediction Interval, ASEp: Average Standard Error of Prediction, SE: Standard Error, PC: Percent Correct, RMSE: Root Mean Squared Error, PseudoR^2: Pseudo R Squared (other -- see report)

Statistic	Value	Unit	PIL	PIU
20 Percent Duration	16.9	ft^3/s	6.96	34.6
50 Percent Duration	2.87	ft^3/s	0.947	6.94
80 Percent Duration	0.341	ft^3/s	0.0572	1.22
90 Percent Duration	0.096	ft^3/s	0.00378	0.603
95 Percent Duration	0	ft^3/s		

Flow-Duration Statistics Citations

Esralew, R.A., Smith, S.J.,2009, Methods for estimating flow-duration and annual mean-flow statistics for ungaged streams in Oklahoma: U.S. Geological Survey Scientific Investigations Report 2009-5267, 131 p. (http://pubs.usgs.gov/sir/2009/5267/)

Seasonal Flow Statistics

Seasonal Flow Statistics Parameters [Duration Region 2 2009 5267]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
CONTDA	Contributing Drainage Area	32.179	square miles	4.02	7159
CSL10_85fm	Stream Slope 10 and 85 Method ft per mi	16.74	feet per mi	2.07	27
OUTLETELEV	Elevation of Gage	660	feet	518	1190
PREG_11_05	Nov to May Gage Precipitation	23.267	inches	21.7	24.8

Seasonal Flow Statistics Flow Report [Duration Region 2 2009 5267]

PIL: Lower 90% Prediction Interval, PIU: Upper 90% Prediction Interval, ASEp: Average Standard Error of Prediction, SE: Standard Error, PC: Percent Correct, RMSE: Root Mean Squared Error, PseudoR^2: Pseudo R Squared (other -- see report)

Statistic	Value	Unit	PIL	PIU
Jun to Oct 20 Percent Flow	6.45	ft^3/s	2.95	12.3
Jun to Oct 50 Percent Flow	0.956	ft^3/s	0.243	2.65
Jun to Oct 80 Percent Flow	0	ft^3/s		
Jun to Oct 90 Percent Flow	0	ft^3/s		
Jun to Oct 95 Percent Flow	0	ft^3/s		
Nov to May 20 Percent Flow	25.2	ft^3/s	9.26	55.6
Nov to May 50 Percent Flow	5.75	ft^3/s	1.86	13.9
Nov to May 80 Percent Flow	0.884	ft^3/s	0.16	3.03
Nov to May 90 Percent Flow	0.243	ft^3/s	0.0162	1.4
Nov to May 95 Percent Flow	0.031	ft^3/s	0.00267	0.166

Seasonal Flow Statistics Citations

Esralew, R.A., Smith, S.J.,2009, Methods for estimating flow-duration and annual mean-flow statistics for ungaged streams in Oklahoma: U.S. Geological Survey Scientific Investigations Report 2009-5267, 131 p. (http://pubs.usgs.gov/sir/2009/5267/)

General Flow Statistics

General Flow Statistics Parameters [Duration Region 2 2009 5267]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
CONTDA	Contributing Drainage Area	32.179	square miles	4.02	7159
PREG_06_10	Jun to Oct Gage Precipitation	19.379	inches	15.7	18

General Flow Statistics Disclaimers [Duration Region 2 2009 5267]

One or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errors.

General Flow Statistics Flow Report [Duration Region 2 2009 5267]

Statistic	Value	Unit
Average daily streamflow	24	ft^3/s

General Flow Statistics Citations

Esralew, R.A., Smith, S.J.,2009, Methods for estimating flow-duration and annual mean-flow statistics for ungaged streams in Oklahoma: U.S. Geological Survey Scientific Investigations Report 2009-5267, 131 p. (http://pubs.usgs.gov/sir/2009/5267/)

NHD Features of Delineated Basin

NHD Streams Intersecting Basin Delineation Boundary

This functionality attempts to find the stream name at the delineation point. The name of the nearest intersecting National Hydrography Dataset (NHD) stream is selected by default to appear in the report above. NHD streams do not correspond to the StreamStats stream grid and may not be accurate. If you would like a different stream to appear in the above section, please make a selection below.

GNIS ID	GNIS Name	Distance from Clicked Point (ft)	Feature Type	Selected Stream Name
01102956	Glasses Creek	20.31	Perennial	Glasses Creek

Watershed Boundary Dataset (WBD) HUC 8 Intersecting Basin Delineation Boundary

This functionality attempts to find the intersecting HUC 8 of the delineated watershed. HUC boundaries do not correspond to the StreamStats data and may not be accurate.

HUC 8	Name
11130210	Lake Texoma
11130304	Lower Washita

NHD Hydrologic Features Citations

U.S. Geological Survey, 2022, USGS TNM - National Hydrography Dataset, accessed July 21, 2022 at URL https://hydro.nationalmap.gov/arcgis/rest/services/nhd/MapServer/6. (https://hydro.nationalmap.gov/arcgis/rest/services/nhd/MapServer/6) U.S. Geological Survey, 2022, USGS TNM - National Hydrography Dataset, accessed July 21, 2022 at URL https://hydro.nationalmap.gov/arcgis/rest/services/wbd/MapServer/4. (https://hydro.nationalmap.gov/arcgis/rest/services/wbd/MapServer/4)

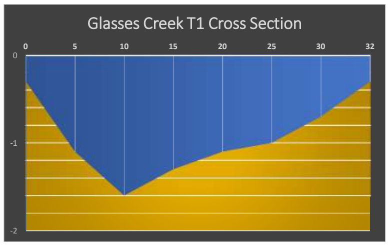
Application Version: 4.30.0
SSHydro Services Version: 1.0.0
SSDelineate Services Version: 1.0.0
NSS Services Version: 2.2.1
GageStats Services Version: 1.2.1
Pourpoint Services Version: 1.2.0
Batch Processor Version: 1.6.0

Glasses Creek, OK Cross Section Data GC2

Average Reach Depth - 1.4
Average Reach Width - 28

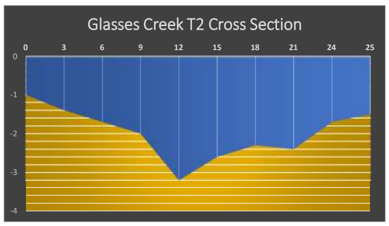
T-1								
Position (ft from LB)	0	5	10	15	20	25	30	32
Depth	-0.3	-1.1	-1.6	-1.3	-1.1	-1	-0.7	-0.3

Width: 32 ft
Avg Depth: 0.9 ft
Max Depth: 1.6 ft
slope LB: 80
Slope RB: 45
substrate sand/silt
waypoint 412



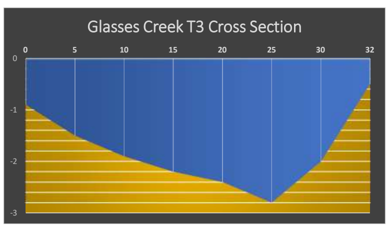
T-2										
Position (ft from RB)	0	3	6	9	12	15	18	21	24	25
Depth	-1	-1.4	-1.7	-2	-3.2	-2.6	-2.3	-2.4	-1.7	-1.5

Width: 25 ft
Avg Depth: 2.0 ft
Max Depth: 3.2 ft
slope LB: 90
Slope RB: 80
substrate sand/silt
waypoint 413



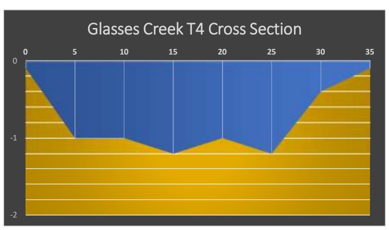
T3								
Position (ft from RB)	0	5	10	15	20	25	30	32
Depth	-0.9	-1.5	-1.9	-2.2	-2.4	-2.8	-2	-0.5

Width: 26 ft
Avg Depth: 1.8 ft
Max Depth: 2.8 ft
slope LB: 45
Slope RB: 50
substrate sand/silt
waypoint 414



T4								
Position (ft from RB)	0	5	10	15	20	25	30	35
Depth	-0.1	-1	-1	-1.2	-1	-1.2	-0.4	-0.1

Width: 27.5 ft
Avg Depth: 0.8 ft
Max Depth: 1.2 ft
slope LB: -
Slope RB: 90
substrate sandy substrate
waypoint 415



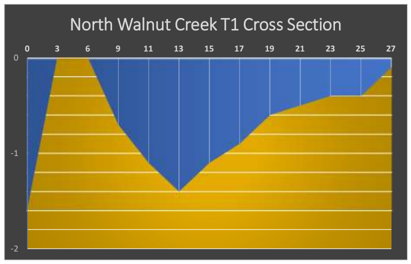
Creek transects taken in homogenous portions of reach, other transects expected to deliver similar results

Glasses Creek, OK Cross Section Data GC3

Average Reach Depth - 0.8
Average Reach Width - 26

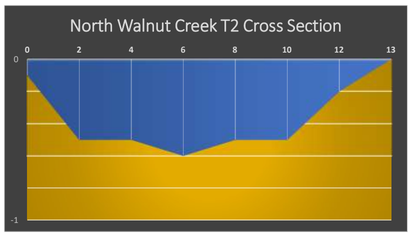
T-1													
Position (ft from RB)	0	3	6	9	11	13	15	17	19	21	23	25	27
Depth	-1.6	0	0	-0.7	-1.1	-1.4	-1.1	-0.9	-0.6	-0.5	-0.4	-0.4	-0.1

Width: 27
Avg Depth: 0.7
Max Depth: 1.6
slope LB: -
Slope RB: -
substrate bedrock/boulder
waypoint 416



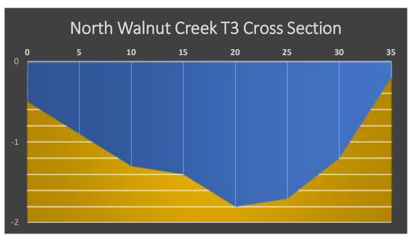
T-2								
Position (ft from RB)	0	2	4	6	8	10	12	13
Depth	-0.1	-0.5	-0.5	-0.6	-0.5	-0.5	-0.2	0

Width: 13
Avg Depth: 0.4
Max Depth: 0.6
slope LB: 35
Slope RB: 35
substrate cobble/bedrock
waypoint 418



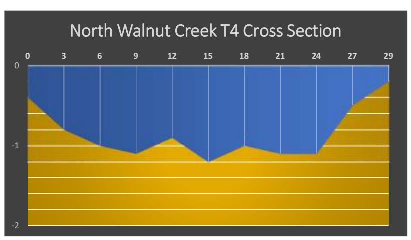
T3								
Position (ft from RB)	0	5	10	15	20	25	30	35
Depth	-0.5	-0.9	-1.3	-1.4	-1.8	-1.7	-1.2	-0.2

Width: 35
Avg Depth: 1.1
Max Depth: 1.8
slope LB: 45
Slope RB: 90
substrate sand/fine gravel
waypoint 419



T4											
Position (ft from RB)	0	3	6	9	12	15	18	21	24	27	29
Depth	-0.4	-0.8	-1	-1.1	-0.9	-1.2	-1	-1.1	-1.1	-0.5	-0.2

Width: 29
Avg Depth: 0.8
Max Depth: 1.2
slope LB: 20
Slope RB: 90
substrate bedrock/sand
waypoint 420



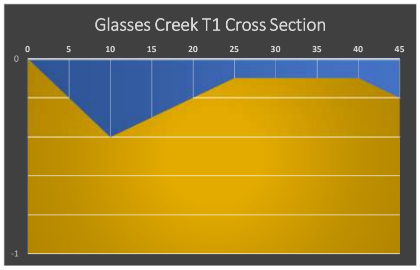
Creek transects taken in homogenous portions of reach, other transects expected to deliver similar results

Glasses Creek, OK Cross Section Data GC4

Average Reach Depth - 1.0
Average Reach Width - 60

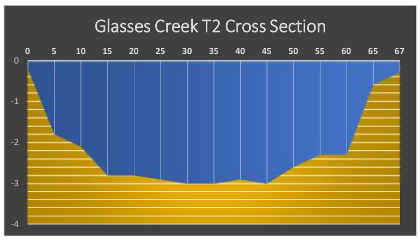
T-1										
Position (ft from LB)	0	5	10	15	20	25	30	35	40	45
Depth	0	-0.2	-0.4	-0.3	-0.2	-0.1	-0.1	-0.1	-0.1	-0.2

Width: 45
Avg Depth: 0.2
Max Depth: 0.4
slope LB: 15
Slope RB: 25
substrate bedrock/silt/sand pools
waypoint 401



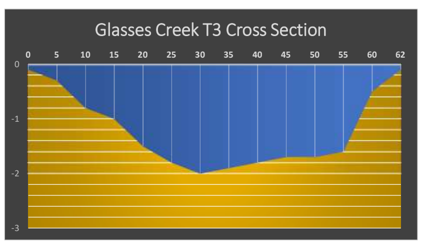
T-2															
Position (ft from LB)	0	5	10	15	20	25	30	35	40	45	50	55	60	65	67
Depth	-0.2	-1.8	-2.1	-2.8	-2.8	-2.9	-3	-3	-2.9	-3	-2.6	-2.3	-2.3	-0.6	-0.3

Width: 67
Avg Depth: 2.2
Max Depth: 3
slope LB: 45
Slope RB: 50
substrate silt/sand
waypoint 402



T3														
Position (ft from LB)	0	5	10	15	20	25	30	35	40	45	50	55	60	62
Depth	-0.1	-0.3	-0.8	-1	-1.5	-1.8	-2	-1.9	-1.8	-1.7	-1.7	-1.6	-0.5	-0.1

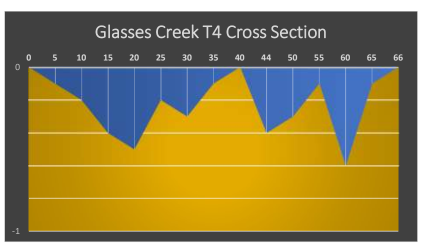
Width: 62
Avg Depth: 1.2
Max Depth: 2
slope LB: -
Slope RB: -
substrate silt/sand buildup
waypoint 403



T4															
Position (ft from LB)	0	5	10	15	20	25	30	35	40	44	50	55	60	65	66
Depth	0	-0.1	-0.2	-0.4	-0.5	-0.2	-0.3	-0.1	0	-0.4	-0.3	-0.1	-0.6	-0.1	0

36 - 41 ft dry 45 dry 51 - 54 dry

Width: 66
Avg Depth: 0.2
Max Depth: 0.6
slope LB: 40
Slope RB: 25
substrate cobble/boulder
waypoint 404



Creek transects taken in homogenous portions of reach, other transects expected to deliver similar results

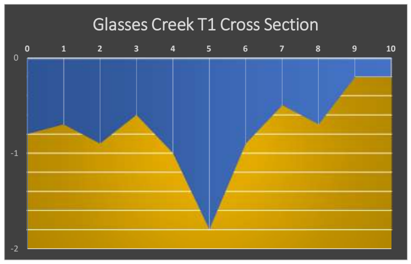
Average Reach Depth - 0.8
Average Reach Width - 10

Glasses Creek, OK Cross Section Data UT1

T-1

Position (ft from RB)	0	1	2	3	4	5	6	7	8	9	10
Depth	-0.8	-0.7	-0.9	-0.6	-1	-1.8	-0.9	-0.5	-0.7	-0.2	-0.2

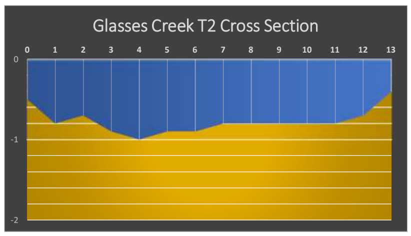
Width: 10
Avg Depth: 0.8
Max Depth: 1.8
slope LB: 90
Slope RB: 85
substrate silt/clay/sand
waypoint 407



T-2

Position (ft from RB)	0	1	2	3	4	5	6	7	8	9	10	11	12	13
Depth	-0.5	-0.8	-0.7	-0.9	-1	-0.9	-0.9	-0.8	-0.8	-0.8	-0.8	-0.8	-0.7	-0.4

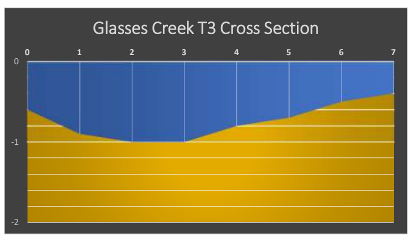
Width: 13
Avg Depth: 0.8
Max Depth: 1
slope LB:
Slope RB: 85
substrate silt
waypoint 408



T3

Position (ft from RB)	0	1	2	3	4	5	6	7
Depth	-0.6	-0.9	-1	-1	-0.8	-0.7	-0.5	-0.4

Width: 7
Avg Depth: 0.7
Max Depth: 1
slope LB: 90
Slope RB: 80
substrate sand/clay/loam/silt
waypoint 409



Creek transects taken in homogenous portions of reach, other transects expected to deliver similar results

Glasses Creek, In-situ Data

GC-1

Time	Temp (°C)	pH (S.U)	DO (mg/L)	DO (%)	Spec Cond (µs/cm)	Turb (NTU)
1010	15.2	7.5	9.21	92.5	397	-

GC-2

Time	Temp (°C)	pH (S.U)	DO (mg/L)	DO (%)	Spec Cond (µs/cm)	Turb (NTU)
1036	14.5	7.6	10.2	100.5	669	-

GC-3

Time	Temp (°C)	pH (S.U)	DO (mg/L)	DO (%)	Spec Cond (µs/cm)	Turb (NTU)
1230	16.8	7.5	4.9	51.2	390.7	-

UT-1

Time	Temp (°C)	pH (S.U)	DO (mg/L)	DO (%)	Spec Cond (µs/cm)	Turb (NTU)
858	20.6	7.8	3.8	40.7	1018	-

Photos of Glasses Creek and the UT

Glasses Creek-Reach GC-2

Glasses Creek-Reach GC-2

Glasses Creek-Reach GC-3

Glasses Creek-Reach GC-3

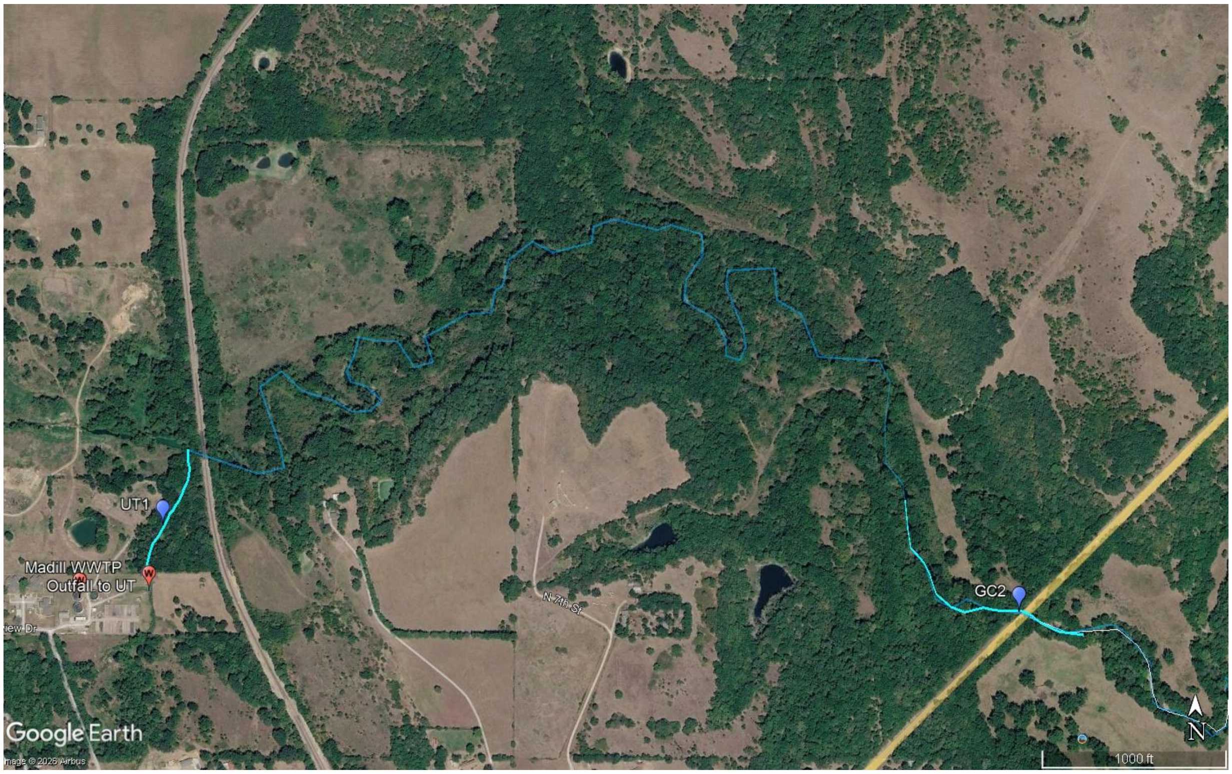
Glasses Creek-Reach GC-4

Glasses Creek-Reach GC-4

UT

UT

Aeiral photos of stream channel showing shade potential



Reaches UT and GC1/GC2

Reaches GC2/GC3

APPENDIX B

Model Runs

Summer 25%MOS run Key Inputs and Outputs

Number of Headwaters	2

Headwater 0 (Mainstem)

Headwater label	Reach No	Flow	Elevation	Weir				Rating Curves				Manning Formula						Prescribed							
		Rate		Weir	Height	Width	adam	bdam	Velocity		Depth		Channel	Manning	Bot Width	Side	Side	Dispersion							
		(m^3/s)	(m)	Type	(m)	(m)			Coefficient	Exponent	Coefficient	Exponent	Slope	n	m	Slope	Slope	m2/s							
Glasses Creek	1	0.028	200.000		0.0000	0.0000	1.2500	0.9000	0.2000	0.832	0.4600	0.100	0.000008	0.0400	0.00	0.00	0.00	0.00							
Water Quality Constituents	Units	12:00 AM	1:00 AM	2:00 AM	3:00 AM	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM	10:00 PM	11:00 PM
Temperature	C	32.00	32.00	32.00	32.00	32.00	32.00	32.00	32.00	32.00	32.00	32.00	32.00	32.00	32.00	32.00	32.00	32.00	32.00	32.00	32.00	32.00	32.00	32.00	32.00
Conductivity	umhos	350.00	350.00	350.00	350.00	350.00	350.00	350.00	350.00	350.00	350.00	350.00	350.00	350.00	350.00	350.00	350.00	350.00	350.00	350.00	350.00	350.00	350.00	350.00	350.00
Inorganic Solids	mgD/L	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Dissolved Oxygen	mg/L	6.21	6.21	6.21	6.21	6.21	6.21	6.21	6.21	6.21	6.21	6.21	6.21	6.21	6.21	6.21	6.21	6.21	6.21	6.21	6.21	6.21	6.21	6.21	6.21
CBODslow	mgO2/L																								
CBODfast	mgO2/L	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Organic Nitrogen	ugN/L																								
NH4-Nitrogen	ugN/L	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00
NO3-Nitrogen	ugN/L																								
Organic Phosphorus	ugP/L																								
Inorganic Phosphorus (SRP)	ugP/L																								
Phytoplankton	ugA/L																								
Internal Nitrogen (INP)	ugN/L																								
Internal Phosphorus (IPP)	ugP/L																								
Detritus (POM)	mgD/L																								
Pathogen	cfu/100 mL																								
Alkalinity	mgCaCO3/L	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00
Constituent i																									
Constituent ii																									
Constituent iii																									
pH	s.u.	7.40	7.40	7.40	7.40	7.40	7.40	7.40	7.40	7.40	7.40	7.40	7.40	7.40	7.40	7.40	7.40	7.40	7.40	7.40	7.40	7.40	7.40	7.40	7.40

Headwater 1 (Tributary 1)

Headwater label	Reach No	Flow	Elevation	Weir				Rating Curves				Manning Formula						Prescribed							
		Rate		Weir	Height	Width	adam	bdam	Velocity		Depth		Channel	Manning	Bot Width	Side	Side	Dispersion							
		(m^3/s)	(m)	Type	(m)	(m)			Coefficient	Exponent	Coefficient	Exponent	Slope	n	m	Slope	Slope	m2/s							
UT	3	0.001	199.000		0.0000	0.0000	1.2500	0.9000	0.2250	0.560	0.2630	0.020	0.000008	0.0400	0.00	0.00	0.00	0.00							
Water Quality Constituents	Units	12:00 AM	1:00 AM	2:00 AM	3:00 AM	4:00 AM	5:00 AM	6:00 AM	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM	10:00 PM	11:00 PM
Temperature	C	32.00	32.00	32.00	32.00	32.00	32.00	32.00	32.00	32.00	32.00	32.00	32.00	32.00	32.00	32.00	32.00	32.00	32.00	32.00	32.00	32.00	32.00	32.00	32.00
Conductivity	umhos	350.00	350.00	350.00	350.00	350.00	350.00	350.00	350.00	350.00	350.00	350.00	350.00	350.00	350.00	350.00	350.00	350.00	350.00	350.00	350.00	350.00	350.00	350.00	350.00
Inorganic Solids	mgD/L	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Dissolved Oxygen	mg/L	6.21	6.21	6.21	6.21	6.21	6.21	6.21	6.21	6.21	6.21	6.21	6.21	6.21	6.21	6.21	6.21	6.21	6.21	6.21	6.21	6.21	6.21	6.21	6.21
CBODslow	mgO2/L																								
CBODfast	mgO2/L	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Organic Nitrogen	ugN/L																								
NH4-Nitrogen	ugN/L	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00	150.00
NO3-Nitrogen	ugN/L																								
Organic Phosphorus	ugP/L																								
Inorganic Phosphorus (SRP)	ugP/L																								
Phytoplankton	ugA/L																								
Internal Nitrogen	ugN/L																								
Internal Phosphorus	ugP/L																								
Detritus (POM)	mgD/L																								
Pathogen	cfu/100 mL																								
Alkalinity	mgCaCO3/L	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00
Constituent i																									
Constituent ii																									
Constituent iii																									
pH	s.u.	7.40	7.40	7.40	7.40	7.40	7.40	7.40	7.40	7.40	7.40	7.40	7.40	7.40	7.40	7.40	7.40	7.40	7.40	7.40	7.40	7.40	7.40	7.40	7.40

Reach for diel plot	6									
Element for diel plot	2	Reach	Headwater	Reach			Location		Element	Eleva
Reach	Downstream	Number	Reach	length	Downstream		Upstream	Downstream	Number	Upstream
Label	end of reach label			(km)	Latitude	Longitude	(km)	(km)	>=1	(m)
Headwater at Hawkins Rd	Halfway to UT	1	Yes	2.13	0.00	0.00	17.180	15.050	20	237.000
Halfway to UT	UT-Outfall Trib	2		2.13	0.00	0.00	15.050	12.920	20	233.000
Madill Outfall Location	Trib Conflu. to Glasses	3	Yes	0.23	0.00	0.00	0.230	0.000	2	227.000
Outfall Trib Conflu.	GC2 - Hwy 377 bridge	4		2.85	0.00	0.00	12.920	10.070	20	226.000
GC2 -Hwy 377 bridge	GC3 - Highway 199	5		3.82	0.00	0.00	10.070	6.250	20	223.000
GC3 - Highway 199	GC4	6		3.59	0.00	0.00	6.250	2.660	20	220.000
GC4	Lake Texoma	7		2.66	0.00	0.00	2.660	0.000	20	215.000

							Hydraulic Model (Weir Overrides Manning Formula; M							
ation	*Downstream*						*Weir*					Rating Curves		
Downstream	*Latitude*			*Longitude*			*Weir*	*Height*	*Width*	*adam*	*bdam*	*Velocity*		*Dep*
(m)	*Degrees*	*Minutes*	*Seconds*	*Degrees*	*Minutes*	*Seconds*	*Type*	*(m)*	*(m)*			*Coefficient*	*Exponent*	*Coefficient*
233.000	0.00	0	0	0.00	0	0		0.0000	0.0000	1.2500	0.9000	0.2000	0.832	0.4600
226.000	0.00	0	0	0.00	0	0		0.0000	0.0000	1.2500	0.9000	0.2000	0.832	0.4600
226.000	0.00	0	0	0.00	0	0		0.0000	0.0000	1.2500	0.9000	0.2250	0.560	0.2630
223.000	0.00	0	0	0.00	0	0		0.0000	0.0000	1.2500	0.9000	0.2000	0.832	0.4600
220.000	0.00	0	0	0.00	0	0		0.0000	0.0000	1.2500	0.9000	0.2000	0.832	0.4600
215.000	0.00	0	0	0.00	0	0		0.0000	0.0000	1.2500	0.9000	0.2000	0.832	0.4600
200.000	0.00	0	0	0.00	0	0		0.0000	0.0000	1.2500	0.9000	0.2000	0.832	0.4600

Manning Formula Override Rating Curves)													
	Manning Formula					Prescribed	Bottom	Bottom	Prescribed	Prescribed	Prescribed	Prescribed	Prescribed
th	Channel	Manning	Bot Width	Side	Side	Dispersion	Algae	SOD	SOD	CH4 flux	NH4 flux	Inorg P flux	Evap
Exponent	Slope	n	m	Slope	Slope	m2/s	Coverage	Coverage	gO2/m2/d	gO2/m2/d	mgN/m2/d	mgP/m2/d	mm/d
0.100	0.0000	0.0400	0.00	0.0000	0.0000	0.00	0.00%	100.00%	1.00	0.0000	0.0000	0.0000	0.0000
0.100	0.0000	0.0400	0.00	0.0000	0.0000	0.00	0.00%	100.00%	1.00	0.0000	0.0000	0.0000	0.0000
0.020	0.0000	0.0400	0.00	0.0000	0.0000	0.00	0.00%	100.00%	1.00	0.0000	0.0000	0.0000	0.0000
0.100	0.0000	0.0400	0.00	0.0000	0.0000	0.00	0.00%	100.00%	1.00	0.0000	0.0000	0.0000	0.0000
0.100	0.0000	0.0400	0.00	0.0000	0.0000	0.00	0.00%	100.00%	1.00	0.0000	0.0000	0.0000	0.0000
0.100	0.0000	0.0400	0.00	0.0000	0.0000	0.00	0.00%	100.00%	1.00	0.0000	0.0000	0.0000	0.0000
0.100	0.0000	0.0400	0.00	0.0000	0.0000	0.00	0.00%	100.00%	1.00	0.0000	0.0000	0.0000	0.0000

Parameter	*Value*	*Units*	*Symbol*
Stoichiometry:			
Carbon	**40**	**gC**	gC
Nitrogen	**7.2**	**gN**	gN
Phosphorus	**1**	**gP**	gP
Dry weight	**100**	**gD**	gD
Chlorophyll	**1**	**gA**	gA
Inorganic suspended solids:			
Settling velocity	**0.05**	**m/d**	v_i
Oxygen:			
Reaeration model	**Internal**		
User reaeration coefficient α	**0**		α
User reaeration coefficient β	**0**		β
User reaeration coefficient γ	**0**		γ
Temp correction	**1.024**		θ_a
Reaeration wind effect	**None**		
O2 for carbon oxidation	**2.69**	**gO_2/gC**	r_{oc}
O2 for NH4 nitrification	**4.57**	**gO_2/gN**	r_{on}
Oxygen inhib model CBOD oxidation	**Exponential**		
Oxygen inhib parameter CBOD oxidation	**0.60**	**L/mgO2**	K_{socf}
Oxygen inhib model nitrification	**Exponential**		
Oxygen inhib parameter nitrification	**0.60**	**L/mgO2**	K_{sona}
Oxygen enhance model denitrification	**Exponential**		
Oxygen enhance parameter denitrification	**0.60**	**L/mgO2**	K_{sodn}
Oxygen inhib model phyto resp	**Exponential**		
Oxygen inhib parameter phyto resp	**0.60**	**L/mgO2**	K_{sop}
Oxygen enhance model bot alg resp	**Exponential**		
Oxygen enhance parameter bot alg resp	**0.60**	**L/mgO2**	K_{sob}
Slow CBOD:			
Hydrolysis rate	**0.1**	**/d**	k_{hc}
Temp correction	**1.047**		θ_{hc}
Oxidation rate	**0.1**	**/d**	k_{dcs}
Temp correction	**1.047**		θ_{dcs}
Fast CBOD:			
Oxidation rate	**0.4**	**/d**	k_{dc}
Temp correction	**1.047**		θ_{dc}
Organic N:			
Hydrolysis	**0.04**	**/d**	k_{hn}
Temp correction	**1.07**		θ_{hn}
Settling velocity	**0.01**	**m/d**	v_{on}
Ammonium:			
Nitrification	**0.3**	**/d**	k_{na}
Temp correction	**1.07**		θ_{na}
Nitrate:			
Denitrification	**0.12**	**/d**	k_{dn}
Temp correction	**1.045**		θ_{dn}
Sed denitrification transfer coeff	**0**	**m/d**	v_{di}
Temp correction	**1.07**		θ_{di}
Organic P:			
Hydrolysis	**0.05**	**/d**	k_{hp}
Temp correction	**1.07**		θ_{hp}
Settling velocity	**0.01**	**m/d**	v_{op}
Inorganic P:			
Settling velocity	**0.03**	**m/d**	v_{ip}
Inorganic P sorption coefficient	**0**	**L/mgD**	K_{dpi}
Sed P oxygen attenuation half sat constant	**0.05**	**mgO_2/L**	k_{spi}
Phytoplankton:			
Max Growth rate	**0**	**/d**	k_{gp}
Temp correction	**1.07**		θ_{gp}
Respiration rate	**0**	**/d**	k_{rp}
Temp correction	**1.07**		θ_{rp}
Excretion rate	**0**	**/d**	k_{ep}
Temp correction	**1.07**		θ_{dp}

Death rate	0.1	/d	k_{dp}
Temp correction	1.07		θ_{dp}
External Nitrogen half sat constant	50	ugN/L	k_{sPp}
External Phosphorus half sat constant	10	ugP/L	k_{sNp}
Inorganic carbon half sat constant	1.30E-05	moles/L	k_{sCp}
Light model	Smith		
Light constant	50	langleys/d	K_{Lp}
Ammonia preference	10	ugN/L	k_{hnxp}
Subsistence quota for nitrogen	0	mgN/mgA	q_{0Np}
Subsistence quota for phosphorus	0	mgP/mgA	q_{0Pp}
Maximum uptake rate for nitrogen	0	mgN/mgA/d	ρ_{mNp}
Maximum uptake rate for phosphorus	0	mgP/mgA/d	ρ_{mPp}
Internal nitrogen half sat constant	0	mgN/mgA	K_{qNp}
Internal phosphorus half sat constant	0	mgP/mgA	K_{qPp}
Settling velocity	0.2	m/d	v_a
Bottom Algae:			
Growth model	Zero-order		
Max Growth rate	0	mgA/m^2/d or /d	C_{gb}
Temp correction	1.07		θ_{gb}
First-order model carrying capacity	1000	mgA/m^2	$a_{b,max}$
Respiration rate	0	/d	k_{rb}
Temp correction	1.07		θ_{rb}
Excretion rate	0.05	/d	k_{eb}
Temp correction	1.07		θ_{db}
Death rate	0.05	/d	k_{db}
Temp correction	1.07		θ_{db}
External nitrogen half sat constant	300	ugN/L	k_{sPb}
External phosphorus half sat constant	100	ugP/L	k_{sNb}
Inorganic carbon half sat constant	1.30E-05	moles/L	k_{sCb}
Light model	Half saturation		
Light constant	50	langleys/d	K_{Lb}
Ammonia preference	50	ugN/L	k_{hnxb}
Subsistence quota for nitrogen	0.72	mgN/mgA	q_{0N}
Subsistence quota for phosphorus	0.1	mgP/mgA	q_{0P}
Maximum uptake rate for nitrogen	72	mgN/mgA/d	ρ_{mN}
Maximum uptake rate for phosphorus	5	mgP/mgA/d	ρ_{mP}
Internal nitrogen half sat constant	0.9	mgN/mgA	K_{qN}
Internal phosphorus half sat constant	0.13	mgP/mgA	K_{qP}
Detritus (POM):			
Dissolution rate	0	/d	k_{dt}
Temp correction	1.07		θ_{dt}
Fraction of dissolution to fast CBOD	0.50		F_f
Settling velocity	0.03	m/d	v_{dt}
Pathogens:			
Decay rate	0	/d	k_{dx}
Temp correction	1.07		θ_{dx}
Settling velocity	1	m/d	v_x
Light efficiency factor	1.00		α_{path}
pH:			
Partial pressure of carbon dioxide	372	ppm	p_{CO2}
Constituent i			
First-order reaction rate	0	/d	
Temp correction	1		θ_{dx}
Settling velocity	0	m/d	v_{dt}
Constituent ii			
First-order reaction rate	0	/d	
Temp correction	1		θ_{dx}
Settling velocity	0	m/d	v_{dt}
Constituent iii			
First-order reaction rate	0	/d	
Temp correction	1		θ_{dx}
Settling velocity	0	m/d	v_{dt}

	Tributary	Headwater	Location	Point		Temperature			Specific Conducta[nce]	
				Abstraction	Inflow	mean	range/2	time of	mean	range/2
Name	No.	Label	km	m3/s	m3/s	°C	°C	max	umhos	umhos
Oakland WWTP	0	Glasses Creek	14.82	0.0000	0.0026	32.00	0.00	12:00 AM	600.00	0.00
Madill WWTP	1	UT	0.23	0.0000	0.0657	32.00	0.00	12:00 AM	600.00	0.00

nce	Inorganic Suspended Solids			Dissolved Oxygen			Slow CBOD			Fast CBOD			
time of	mean	range/2	time of	mean	range/2	time of	mean	range/2	time of	mean	range/2	time of	mean
max	mg/L	mg/L	max	mg/L	mg/L	max	mgO2/L	mgO2/L	max	mgO2/L	mgO2/L	max	ugN/L
12:00 AM	0.00	0.00	12:00 AM	5.00	0.00	12:00 AM	0.00	0.00	12:00 AM	29.00	0.00	12:00 AM	0.00
12:00 AM	0.00	0.00	12:00 AM	5.00	0.00	12:00 AM	0.00	0.00	12:00 AM	10.15	0.00	12:00 AM	0.00

Organic N		Ammonia N			Nitrate + Nitrite N			Organic P			Inorganic P		
range/2	time of	mean	range/2	time of	mean	range/2	time of	mean	range/2	time of	mean	range/2	time of
ugN/L	max	ugN/L	ugN/L	max	ugN/L	ugN/L	max	ugP/L	ugP/L	max	ugP/L	ugP/L	max
0.00	12:00 AM	7400.00	0.00	12:00 AM	0.00	0.00	12:00 AM	0.00	0.00	12:00 AM	0.00	0.00	12:00 AM
0.00	12:00 AM	1875.00	0.00	12:00 AM	0.00	0.00	12:00 AM	0.00	0.00	12:00 AM	0.00	0.00	12:00 AM

Phytoplankton			Internal Nitrogen			Internal Phosphorus			Detritus		
mean	*range/2*	*time of*	*mean*	*range/2*	*time of*	*mean*	*range/2*	*time of*	*mean*	*range/2*	*time of*
ugA/L	*ugA/L*	*max*	*ugN/L*	*ugN/L*	*max*	*ugP/L*	*ugP/L*	*max*	*mgD/L*	*mgD/L*	*max*
0.00	0.00	12:00 AM	0.00	0.00	12:00 AM	0.00	0.00	12:00 AM	0.00	0.00	12:00 AM
0.00	0.00	12:00 AM	0.00	0.00	12:00 AM	0.00	0.00	12:00 AM	0.00	0.00	12:00 AM

Tributary	Reach	Downstream	Downstream	Hydraulics								Reaeration	Reaeration formulas	Water
No.	Label	Label	Distance	Q, m3/s	E', m3/s	H, m	Btop, m	Ac, m^2	U, mps	trav time, d	Slope	ka,20, /d	water/wind	Drop (m)
0	Glasses Creek		17.18	0.03	0.01	0.32	8.53	2.75	0.01	0.00	0.000010			
0	Headwater at Hawkins Rd		17.07	0.03	0.01	0.32	8.53	2.75	0.01	0.12	0.000000	2.02	Owens/No wind	0.00
0	Headwater at Hawkins Rd		16.97	0.03	0.01	0.32	8.53	2.75	0.01	0.24	0.000000	2.02	Owens/No wind	0.00
0	Headwater at Hawkins Rd		16.86	0.03	0.01	0.32	8.53	2.75	0.01	0.36	0.000000	2.02	Owens/No wind	0.00
0	Headwater at Hawkins Rd		16.75	0.03	0.01	0.32	8.53	2.75	0.01	0.48	0.000000	2.02	Owens/No wind	0.00
0	Headwater at Hawkins Rd		16.65	0.03	0.01	0.32	8.53	2.75	0.01	0.60	0.000000	2.02	Owens/No wind	0.00
0	Headwater at Hawkins Rd		16.54	0.03	0.01	0.32	8.53	2.75	0.01	0.72	0.000000	2.02	Owens/No wind	0.00
0	Headwater at Hawkins Rd		16.43	0.03	0.01	0.32	8.53	2.75	0.01	0.84	0.000000	2.02	Owens/No wind	0.00
0	Headwater at Hawkins Rd		16.33	0.03	0.01	0.32	8.53	2.75	0.01	0.96	0.000000	2.02	Owens/No wind	0.00
0	Headwater at Hawkins Rd		16.22	0.03	0.01	0.32	8.53	2.75	0.01	1.08	0.000000	2.02	Owens/No wind	0.00
0	Headwater at Hawkins Rd		16.12	0.03	0.01	0.32	8.53	2.75	0.01	1.20	0.000000	2.02	Owens/No wind	0.00
0	Headwater at Hawkins Rd		16.01	0.03	0.01	0.32	8.53	2.75	0.01	1.32	0.000000	2.02	Owens/No wind	0.00
0	Headwater at Hawkins Rd		15.90	0.03	0.01	0.32	8.53	2.75	0.01	1.44	0.000000	2.02	Owens/No wind	0.00
0	Headwater at Hawkins Rd		15.80	0.03	0.01	0.32	8.53	2.75	0.01	1.56	0.000000	2.02	Owens/No wind	0.00
0	Headwater at Hawkins Rd		15.69	0.03	0.01	0.32	8.53	2.75	0.01	1.68	0.000000	2.02	Owens/No wind	0.00
0	Headwater at Hawkins Rd		15.58	0.03	0.01	0.32	8.53	2.75	0.01	1.79	0.000000	2.02	Owens/No wind	0.00
0	Headwater at Hawkins Rd		15.48	0.03	0.01	0.32	8.53	2.75	0.01	1.91	0.000000	2.02	Owens/No wind	0.00
0	Headwater at Hawkins Rd		15.37	0.03	0.01	0.32	8.53	2.75	0.01	2.03	0.000000	2.02	Owens/No wind	0.00
0	Headwater at Hawkins Rd		15.26	0.03	0.01	0.32	8.53	2.75	0.01	2.15	0.000000	2.02	Owens/No wind	0.00
0	Headwater at Hawkins Rd		15.16	0.03	0.01	0.32	8.53	2.75	0.01	2.27	0.000000	2.02	Owens/No wind	0.00
0	Headwater at Hawkins Rd		15.05	0.03	0.01	0.32	8.53	2.75	0.01	2.39	0.000000	2.02	Owens/No wind	0.00
0	Halfway to UT		14.94	0.03	0.01	0.32	8.53	2.75	0.01	2.51	0.000000	2.02	Owens/No wind	0.00
0	Halfway to UT		14.84	0.03	0.01	0.32	8.53	2.75	0.01	2.63	0.000000	2.02	Owens/No wind	0.00
0	Halfway to UT		14.73	0.03	0.02	0.32	8.58	2.79	0.01	2.74	0.000000	2.08	Owens/No wind	0.00
0	Halfway to UT		14.62	0.03	0.02	0.32	8.58	2.79	0.01	2.85	0.000000	2.08	Owens/No wind	0.00
0	Halfway to UT		14.52	0.03	0.02	0.32	8.58	2.79	0.01	2.97	0.000000	2.08	Owens/No wind	0.00
0	Halfway to UT		14.41	0.03	0.02	0.32	8.58	2.79	0.01	3.08	0.000000	2.08	Owens/No wind	0.00
0	Halfway to UT		14.30	0.03	0.02	0.32	8.58	2.79	0.01	3.19	0.000000	2.08	Owens/No wind	0.00
0	Halfway to UT		14.20	0.03	0.02	0.32	8.58	2.79	0.01	3.30	0.000000	2.08	Owens/No wind	0.00
0	Halfway to UT		14.09	0.03	0.02	0.32	8.58	2.79	0.01	3.41	0.000000	2.08	Owens/No wind	0.00
0	Halfway to UT		13.99	0.03	0.02	0.32	8.58	2.79	0.01	3.52	0.000000	2.08	Owens/No wind	0.00
0	Halfway to UT		13.88	0.03	0.02	0.32	8.58	2.79	0.01	3.63	0.000000	2.08	Owens/No wind	0.00
0	Halfway to UT		13.77	0.03	0.02	0.32	8.58	2.79	0.01	3.74	0.000000	2.08	Owens/No wind	0.00
0	Halfway to UT		13.67	0.03	0.02	0.32	8.58	2.79	0.01	3.86	0.000000	2.08	Owens/No wind	0.00
0	Halfway to UT		13.56	0.03	0.02	0.32	8.58	2.79	0.01	3.97	0.000000	2.08	Owens/No wind	0.00
0	Halfway to UT		13.45	0.03	0.02	0.32	8.58	2.79	0.01	4.08	0.000000	2.08	Owens/No wind	0.00
0	Halfway to UT		13.35	0.03	0.02	0.32	8.58	2.79	0.01	4.19	0.000000	2.08	Owens/No wind	0.00
0	Halfway to UT		13.24	0.03	0.02	0.32	8.58	2.79	0.01	4.30	0.000000	2.08	Owens/No wind	0.00
0	Halfway to UT		13.13	0.03	0.02	0.32	8.58	2.79	0.01	4.41	0.000000	2.08	Owens/No wind	0.00
0	Halfway to UT		13.03	0.03	0.02	0.32	8.58	2.79	0.01	4.52	0.000000	2.08	Owens/No wind	0.00
0	Halfway to UT		12.92	0.03	0.01	0.32	8.58	2.79	0.01	4.63	0.000000	2.08	Owens/No wind	0.00
0	Outfall Trib Conflu.		12.78	0.10	0.05	0.36	9.28	3.38	0.03	4.69	0.000000	3.20	Owens/No wind	0.00
0	Outfall Trib Conflu.		12.64	0.10	0.05	0.36	9.28	3.38	0.03	4.75	0.000000	3.20	Owens/No wind	0.00
0	Outfall Trib Conflu.		12.49	0.10	0.05	0.36	9.28	3.38	0.03	4.81	0.000000	3.20	Owens/No wind	0.00
0	Outfall Trib Conflu.		12.35	0.10	0.05	0.36	9.28	3.38	0.03	4.86	0.000000	3.20	Owens/No wind	0.00
0	Outfall Trib Conflu.		12.21	0.10	0.05	0.36	9.28	3.38	0.03	4.92	0.000000	3.20	Owens/No wind	0.00
0	Outfall Trib Conflu.		12.07	0.10	0.05	0.36	9.28	3.38	0.03	4.98	0.000000	3.20	Owens/No wind	0.00
0	Outfall Trib Conflu.		11.92	0.10	0.05	0.36	9.28	3.38	0.03	5.03	0.000000	3.20	Owens/No wind	0.00
0	Outfall Trib Conflu.		11.78	0.10	0.05	0.36	9.28	3.38	0.03	5.09	0.000000	3.20	Owens/No wind	0.00
0	Outfall Trib Conflu.		11.64	0.10	0.05	0.36	9.28	3.38	0.03	5.15	0.000000	3.20	Owens/No wind	0.00
0	Outfall Trib Conflu.		11.50	0.10	0.05	0.36	9.28	3.38	0.03	5.21	0.000000	3.20	Owens/No wind	0.00
0	Outfall Trib Conflu.		11.35	0.10	0.05	0.36	9.28	3.38	0.03	5.26	0.000000	3.20	Owens/No wind	0.00
0	Outfall Trib Conflu.		11.21	0.10	0.05	0.36	9.28	3.38	0.03	5.32	0.000000	3.20	Owens/No wind	0.00
0	Outfall Trib Conflu.		11.07	0.10	0.05	0.36	9.28	3.38	0.03	5.38	0.000000	3.20	Owens/No wind	0.00
0	Outfall Trib Conflu.		10.93	0.10	0.05	0.36	9.28	3.38	0.03	5.43	0.000000	3.20	Owens/No wind	0.00
0	Outfall Trib Conflu.		10.78	0.10	0.05	0.36	9.28	3.38	0.03	5.49	0.000000	3.20	Owens/No wind	0.00
0	Outfall Trib Conflu.		10.64	0.10	0.05	0.36	9.28	3.38	0.03	5.55	0.000000	3.20	Owens/No wind	0.00
0	Outfall Trib Conflu.		10.50	0.10	0.05	0.36	9.28	3.38	0.03	5.60	0.000000	3.20	Owens/No wind	0.00
0	Outfall Trib Conflu.		10.36	0.10	0.05	0.36	9.28	3.38	0.03	5.66	0.000000	3.20	Owens/No wind	0.00
0	Outfall Trib Conflu.		10.21	0.10	0.05	0.36	9.28	3.38	0.03	5.72	0.000000	3.20	Owens/No wind	0.00
0	Outfall Trib Conflu.		10.07	0.10	0.04	0.36	9.28	3.38	0.03	5.78	0.000000	3.20	Owens/No wind	0.00
0	GC2 -Hwy 377 bridge		9.88	0.10	0.05	0.36	9.28	3.38	0.03	5.85	0.000000	3.20	Owens/No wind	0.00
0	GC2 -Hwy 377 bridge		9.69	0.10	0.05	0.36	9.28	3.38	0.03	5.93	0.000000	3.20	Owens/No wind	0.00
0	GC2 -Hwy 377 bridge		9.50	0.10	0.05	0.36	9.28	3.38	0.03	6.01	0.000000	3.20	Owens/No wind	0.00
0	GC2 -Hwy 377 bridge		9.31	0.10	0.05	0.36	9.28	3.38	0.03	6.08	0.000000	3.20	Owens/No wind	0.00
0	GC2 -Hwy 377 bridge		9.12	0.10	0.05	0.36	9.28	3.38	0.03	6.16	0.000000	3.20	Owens/No wind	0.00
0	GC2 -Hwy 377 bridge		8.92	0.10	0.05	0.36	9.28	3.38	0.03	6.24	0.000000	3.20	Owens/No wind	0.00
0	GC2 -Hwy 377 bridge		8.73	0.10	0.05	0.36	9.28	3.38	0.03	6.31	0.000000	3.20	Owens/No wind	0.00
0	GC2 -Hwy 377 bridge		8.54	0.10	0.05	0.36	9.28	3.38	0.03	6.39	0.000000	3.20	Owens/No wind	0.00
0	GC2 -Hwy 377 bridge		8.35	0.10	0.05	0.36	9.28	3.38	0.03	6.47	0.000000	3.20	Owens/No wind	0.00
0	GC2 -Hwy 377 bridge		8.16	0.10	0.05	0.36	9.28	3.38	0.03	6.54	0.000000	3.20	Owens/No wind	0.00
0	GC2 -Hwy 377 bridge		7.97	0.10	0.05	0.36	9.28	3.38	0.03	6.62	0.000000	3.20	Owens/No wind	0.00
0	GC2 -Hwy 377 bridge		7.78	0.10	0.05	0.36	9.28	3.38	0.03	6.69	0.000000	3.20	Owens/No wind	0.00
0	GC2 -Hwy 377 bridge		7.59	0.10	0.05	0.36	9.28	3.38	0.03	6.77	0.000000	3.20	Owens/No wind	0.00
0	GC2 -Hwy 377 bridge		7.40	0.10	0.05	0.36	9.28	3.38	0.03	6.85	0.000000	3.20	Owens/No wind	0.00
0	GC2 -Hwy 377 bridge		7.21	0.10	0.05	0.36	9.28	3.38	0.03	6.92	0.000000	3.20	Owens/No wind	0.00
0	GC2 -Hwy 377 bridge		7.01	0.10	0.05	0.36	9.28	3.38	0.03	7.00	0.000000	3.20	Owens/No wind	0.00
0	GC2 -Hwy 377 bridge		6.82	0.10	0.05	0.36	9.28	3.38	0.03	7.08	0.000000	3.20	Owens/No wind	0.00
0	GC2 -Hwy 377 bridge		6.63	0.10	0.05	0.36	9.28	3.38	0.03	7.15	0.000000	3.20	Owens/No wind	0.00
0	GC2 -Hwy 377 bridge		6.44	0.10	0.05	0.36	9.28	3.38	0.03	7.23	0.000000	3.20	Owens/No wind	0.00
0	GC2 -Hwy 377 bridge		6.25	0.10	0.05	0.36	9.28	3.38	0.03	7.31	0.000000	3.20	Owens/No wind	0.00
0	GC3 - Highway 199		6.07	0.10	0.05	0.36	9.28	3.38	0.03	7.38	0.000000	3.20	Owens/No wind	0.00
0	GC3 - Highway 199		5.89	0.10	0.05	0.36	9.28	3.38	0.03	7.45	0.000000	3.20	Owens/No wind	0.00
0	GC3 - Highway 199		5.71	0.10	0.05	0.36	9.28	3.38	0.03	7.52	0.000000	3.20	Owens/No wind	0.00
0	GC3 - Highway 199		5.53	0.10	0.05	0.36	9.28	3.38	0.03	7.59	0.000000	3.20	Owens/No wind	0.00
0	GC3 - Highway 199		5.35	0.10	0.05	0.36	9.28	3.38	0.03	7.67	0.000000	3.20	Owens/No wind	0.00
0	GC3 - Highway 199		5.17	0.10	0.05	0.36	9.28	3.38	0.03	7.74	0.000000	3.20	Owens/No wind	0.00
0	GC3 - Highway 199		4.99	0.10	0.05	0.36	9.28	3.38	0.03	7.81	0.000000	3.20	Owens/No wind	0.00
0	GC3 - Highway 199		4.81	0.10	0.05	0.36	9.28	3.38	0.03	7.88	0.000000	3.20	Owens/No wind	0.00
0	GC3 - Highway 199		4.63	0.10	0.05	0.36	9.28	3.38	0.03	7.95	0.000000	3.20	Owens/No wind	0.00
0	GC3 - Highway 199		4.46	0.10	0.05	0.36	9.28	3.38	0.03	8.03	0.000000	3.20	Owens/No wind	0.00
0	GC3 - Highway 199		4.28	0.10	0.05	0.36	9.28	3.38	0.03	8.10	0.000000	3.20	Owens/No wind	0.00
0	GC3 - Highway 199		4.10	0.10	0.05	0.36	9.28	3.38	0.03	8.17	0.000000	3.20	Owens/No wind	0.00
0	GC3 - Highway 199		3.92	0.10	0.05	0.36	9.28	3.38	0.03	8.24	0.000000	3.20	Owens/No wind	0.00
0	GC3 - Highway 199		3.74	0.10	0.05	0.36	9.28	3.38	0.03	8.31	0.000000	3.20	Owens/No wind	0.00
0	GC3 - Highway 199		3.56	0.10	0.05	0.36	9.28	3.38	0.03	8.39	0.000000	3.20	Owens/No wind	0.00
0	GC3 - Highway 199		3.38	0.10	0.05	0.36	9.28	3.38	0.03	8.46	0.000000	3.20	Owens/No wind	0.00
0	GC3 - Highway 199		3.20	0.10	0.05	0.36	9.28	3.38	0.03	8.53	0.000000	3.20	Owens/No wind	0.00
0	GC3 - Highway 199		3.02	0.10	0.05	0.36	9.28	3.38	0.03	8.60	0.000000	3.20	Owens/No wind	0.00
0	GC3 - Highway 199		2.84	0.10	0.05	0.36	9.28	3.38	0.03	8.67	0.000000	3.20	Owens/No wind	0.00
0	GC3 - Highway 199		2.66	0.10	0.06	0.36	9.28	3.38	0.03	8.75	0.000000	3.20	Owens/No wind	0.00
0	GC4		2.53	0.10	0.05	0.36	9.28	3.38	0.03	8.80	0.000000	3.20	Owens/No wind	0.00
0	GC4		2.39	0.10	0.05	0.36	9.28	3.38	0.03	8.85	0.000000	3.20	Owens/No wind	0.00
0	GC4		2.26	0.10	0.05	0.36	9.28	3.38	0.03	8.91	0.000000	3.20	Owens/No wind	0.00
0	GC4		2.13	0.10	0.05	0.36	9.28	3.38	0.03	8.96	0.000000	3.20	Owens/No wind	0.00
0	GC4		2.00	0.10	0.05	0.36	9.28	3.38	0.03	9.01	0.000000	3.20	Owens/No wind	0.00
0	GC4		1.86	0.10	0.05	0.36	9.28	3.38	0.03	9.07	0.000000	3.20	Owens/No wind	0.00
0	GC4		1.73	0.10	0.05	0.36	9.28	3.38	0.03	9.12	0.000000	3.20	Owens/No wind	0.00
0	GC4		1.60	0.10	0.05	0.36	9.28	3.38	0.03	9.17	0.000000	3.20	Owens/No wind	0.00
0	GC4		1.46	0.10	0.05	0.36	9.28	3.38	0.03	9.23	0.000000	3.20	Owens/No wind	0.00
0	GC4		1.33	0.10	0.05	0.36	9.28	3.38	0.03	9.28	0.000000	3.20	Owens/No wind	0.00
0	GC4		1.20	0.10	0.05	0.36	9.28	3.38	0.03	9.33	0.000000	3.20	Owens/No wind	0.00
0	GC4		1.06	0.10	0.05	0.36	9.28	3.38	0.03	9.39	0.000000	3.20	Owens/No wind	0.00
0	GC4		0.93	0.10	0.05	0.36	9.28	3.38	0.03	9.44	0.000000	3.20	Owens/No wind	0.00
0	GC4		0.80	0.10	0.05	0.36	9.28	3.38	0.03	9.49	0.000000	3.20	Owens/No wind	0.00
0	GC4		0.67	0.10	0.05	0.36	9.28	3.38	0.03	9.55	0.000000	3.20	Owens/No wind	0.00
0	GC4		0.53	0.10	0.05	0.36	9.28	3.38	0.03	9.60	0.000000	3.20	Owens/No wind	0.00
0	GC4		0.40	0.10	0.05	0.36	9.28	3.38	0.03	9.65	0.000000	3.20	Owens/No wind	0.00
0	GC4		0.27	0.10	0.05	0.36	9.28	3.38	0.03	9.71	0.000000	3.20	Owens/No wind	0.00
0	GC4		0.13	0.10	0.05	0.36	9.28	3.38	0.03	9.76	0.000000	3.20	Owens/No wind	0.00
0	GC4		0.00	0.10	0.05	0.36	9.28	3.38	0.03	9.81	0.000000	3.20	Owens/No wind	0.00
1	UT		0.23	0.00	0.00	0.23	0.97	0.22	0.00	0.00	0.000010			
1	Madill Outfall Location		0.12	0.07	0.03	0.25	5.42	1.35	0.05	0.03	0.000000	9.28	Owens/No wind	0.00
1	Madill Outfall Location		0.00	0.07	0.03	0.25	5.42	1.35	0.05	0.05	0.000000	9.28	Owens/No wind	0.00

Tributary No.	Reach Label	x(km)	cond (umhos	ISS (mgD/L)	DO(mgO2/L)	CBODs (mgO2/L)	CBODf (mgO2/L)	No(ugN/L)	NH4(ugN/L)	NO3(ugN/L)	Po (ugP/L)	Inorg P (ugP/L)	Phyto (ugA/L)	INp(ugN/L)	IPp (ugP/L)	Detritus (mgD/L	Pathogen	Alk	Constituen i	Constituen ii	Constituent iii	pH	Bot Algae (mgA/m2)	QNb (ugN/mgA)	QPb (ugP/mgA)	TOC	TN	TP	TKN	TSS (mgD/L)	CBODu	NH3	DO sat	pHsat
0	Glasses Creek	17.18	350.00	2.00	6.21	0.00	2.00	0.00	150.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20.00	0.00	0.00	0.00	7.40	0.00	0.00	0.00	0.74	150.00	0.00	150.00	2.00	2.00	3.39	7.14	7.81
0	Headwater at Ha	17.13	350.00	1.96	6.00	0.00	1.85	0.00	139.04	2729.78	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19.93	0.00	0.00	0.00	7.39	0.00	NaN	NaN	0.69	2868.82	0.00	139.04	1.96	1.85	3.02	7.13	7.81
0	Headwater at Ha	17.02	350.00	1.93	5.86	0.00	1.70	0.00	129.01	5089.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19.87	0.00	0.00	0.00	7.39	0.00	NaN	NaN	0.63	5218.02	0.00	129.01	1.93	1.70	2.76	7.16	7.81
0	Headwater at Ha	16.91	350.00	1.89	5.77	0.00	1.57	0.00	119.80	7080.93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19.82	0.00	0.00	0.00	7.39	0.00	NaN	NaN	0.58	7200.73	0.00	119.80	1.89	1.57	2.56	7.18	7.81
0	Headwater at Ha	16.81	350.00	1.86	5.71	0.00	1.44	0.00	111.31	8714.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19.77	0.00	0.00	0.00	7.40	0.00	NaN	NaN	0.54	8825.66	0.00	111.31	1.86	1.44	2.41	7.19	7.80
0	Headwater at Ha	16.70	350.00	1.82	5.68	0.00	1.33	0.00	103.49	10007.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19.73	0.00	0.00	0.00	7.41	0.00	NaN	NaN	0.49	10110.77	0.00	103.49	1.82	1.33	2.28	7.20	7.80
0	Headwater at Ha	16.59	350.00	1.79	5.66	0.00	1.22	0.00	96.25	10989.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19.69	0.00	0.00	0.00	7.42	0.00	NaN	NaN	0.45	11085.84	0.00	96.25	1.79	1.22	2.17	7.21	7.80
0	Headwater at Ha	16.49	350.00	1.76	5.66	0.00	1.12	0.00	89.55	11702.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19.65	0.00	0.00	0.00	7.44	0.00	NaN	NaN	0.42	11792.13	0.00	89.55	1.76	1.12	2.07	7.22	7.80
0	Headwater at Ha	16.38	350.00	1.73	5.67	0.00	1.04	0.00	83.34	12195.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19.62	0.00	0.00	0.00	7.45	0.00	NaN	NaN	0.39	12278.76	0.00	83.34	1.73	1.04	1.99	7.23	7.80
0	Headwater at Ha	16.27	350.00	1.69	5.68	0.00	0.96	0.00	77.58	12519.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19.58	0.00	0.00	0.00	7.47	0.00	NaN	NaN	0.36	12596.91	0.00	77.58	1.69	0.96	1.90	7.23	7.80
0	Headwater at Ha	16.17	350.00	1.66	5.70	0.00	0.88	0.00	72.23	12721.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19.54	0.00	0.00	0.00	7.48	0.00	NaN	NaN	0.33	12794.07	0.00	72.23	1.66	0.88	1.83	7.24	7.80
0	Headwater at Ha	16.06	350.00	1.63	5.71	0.00	0.81	0.00	67.26	12842.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19.51	0.00	0.00	0.00	7.49	0.00	NaN	NaN	0.30	12909.86	0.00	67.26	1.63	0.81	1.75	7.24	7.80
0	Headwater at Ha	15.96	350.00	1.60	5.73	0.00	0.75	0.00	62.64	12911.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19.48	0.00	0.00	0.00	7.51	0.00	NaN	NaN	0.28	12974.37	0.00	62.64	1.60	0.75	1.68	7.25	7.80
0	Headwater at Ha	15.85	350.00	1.57	5.75	0.00	0.69	0.00	58.35	12950.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19.44	0.00	0.00	0.00	7.52	0.00	NaN	NaN	0.26	13008.55	0.00	58.35	1.57	0.69	1.61	7.25	7.79
0	Headwater at Ha	15.74	350.00	1.55	5.77	0.00	0.64	0.00	54.35	12971.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19.41	0.00	0.00	0.00	7.54	0.00	NaN	NaN	0.24	13025.85	0.00	54.35	1.55	0.64	1.55	7.25	7.79
0	Headwater at Ha	15.64	350.00	1.52	5.79	0.00	0.59	0.00	50.63	12983.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19.39	0.00	0.00	0.00	7.55	0.00	NaN	NaN	0.22	13034.29	0.00	50.63	1.52	0.59	1.48	7.25	7.79
0	Headwater at Ha	15.53	350.00	1.49	5.81	0.00	0.55	0.00	47.17	12991.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19.36	0.00	0.00	0.00	7.56	0.00	NaN	NaN	0.20	13038.35	0.00	47.17	1.49	0.55	1.42	7.25	7.79
0	Headwater at Ha	15.42	350.00	1.46	5.83	0.00	0.51	0.00	43.95	12996.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19.34	0.00	0.00	0.00	7.57	0.00	NaN	NaN	0.19	13040.35	0.00	43.95	1.46	0.51	1.36	7.26	7.79
0	Headwater at Ha	15.32	350.00	1.44	5.84	0.00	0.47	0.00	40.95	13000.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19.31	0.00	0.00	0.00	7.59	0.00	NaN	NaN	0.17	13041.44	0.00	40.95	1.44	0.47	1.30	7.26	7.79
0	Headwater at Ha	15.21	350.00	1.41	5.86	0.00	0.43	0.00	38.17	13003.97	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19.29	0.00	0.00	0.00	7.60	0.00	NaN	NaN	0.16	13042.13	0.00	38.17	1.41	0.43	1.24	7.26	7.79
0	Headwater at Ha	15.10	350.00	1.38	5.87	0.00	0.40	0.00	35.57	13007.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19.27	0.00	0.00	0.00	7.61	0.00	NaN	NaN	0.15	13042.68	0.00	35.57	1.38	0.40	1.19	7.26	7.79
0	Halfway to UT	15.00	350.00	1.36	5.89	0.00	0.37	0.00	33.15	13010.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19.25	0.00	0.00	0.00	7.62	0.00	NaN	NaN	0.14	13043.16	0.00	33.15	1.36	0.37	1.13	7.26	7.79
0	Halfway to UT	14.89	350.00	1.33	5.90	0.00	0.34	0.00	30.91	13012.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19.24	0.00	0.00	0.00	7.63	0.00	NaN	NaN	0.13	13043.63	0.00	30.91	1.33	0.34	1.08	7.26	7.79
0	Halfway to UT	14.78	371.04	1.20	5.60	0.00	2.56	0.00	608.79	12149.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	25.75	0.00	0.00	0.00	7.47	0.00	NaN	NaN	0.95	12757.90	0.00	608.79	1.20	2.56	14.91	7.25	7.91
0	Halfway to UT	14.68	371.04	1.18	5.45	0.00	2.38	0.00	569.63	12353.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	25.48	0.00	0.00	0.00	7.42	0.00	NaN	NaN	0.88	12922.84	0.00	569.63	1.18	2.38	12.39	7.25	7.91
0	Halfway to UT	14.57	371.04	1.16	5.36	0.00	2.21	0.00	533.15	12530.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	25.24	0.00	0.00	0.00	7.38	0.00	NaN	NaN	0.82	13063.92	0.00	533.15	1.16	2.21	10.78	7.25	7.90
0	Halfway to UT	14.46	371.04	1.14	5.30	0.00	2.06	0.00	499.12	12682.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	25.01	0.00	0.00	0.00	7.37	0.00	NaN	NaN	0.76	13181.73	0.00	499.12	1.14	2.06	9.67	7.26	7.90
0	Halfway to UT	14.36	371.04	1.12	5.27	0.00	1.91	0.00	467.31	12809.89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	24.79	0.00	0.00	0.00	7.36	0.00	NaN	NaN	0.71	13277.20	0.00	467.31	1.12	1.91	8.84	7.26	7.90
0	Halfway to UT	14.25	371.04	1.10	5.27	0.00	1.78	0.00	437.55	12914.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	24.59	0.00	0.00	0.00	7.35	0.00	NaN	NaN	0.66	13351.87	0.00	437.55	1.10	1.78	8.21	7.26	7.89
0	Halfway to UT	14.14	371.04	1.08	5.27	0.00	1.65	0.00	409.70	12998.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	24.40	0.00	0.00	0.00	7.35	0.00	NaN	NaN	0.61	13407.96	0.00	409.70	1.08	1.65	7.70	7.26	7.89
0	Halfway to UT	14.04	371.04	1.07	5.29	0.00	1.54	0.00	383.62	13064.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	24.22	0.00	0.00	0.00	7.36	0.00	NaN	NaN	0.57	13448.24	0.00	383.62	1.07	1.54	7.28	7.26	7.89
0	Halfway to UT	13.93	371.04	1.05	5.32	0.00	1.43	0.00	359.19	13116.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	24.05	0.00	0.00	0.00	7.36	0.00	NaN	NaN	0.53	13475.82	0.00	359.19	1.05	1.43	6.93	7.26	7.88
0	Halfway to UT	13.83	371.04	1.03	5.35	0.00	1.33	0.00	336.31	13157.49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	23.89	0.00	0.00	0.00	7.37	0.00	NaN	NaN	0.49	13493.80	0.00	336.31	1.03	1.33	6.62	7.26	7.88
0	Halfway to UT	13.72	371.04	1.01	5.38	0.00	1.24	0.00	314.86	13190.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	23.74	0.00	0.00	0.00	7.38	0.00	NaN	NaN	0.46	13504.96	0.00	314.86	1.01	1.24	6.34	7.26	7.88
0	Halfway to UT	13.61	371.04	1.00	5.42	0.00	1.15	0.00	294.77	13216.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00	23.60	0.00	0.00	0.00	7.40	0.00	NaN	NaN	0.43	13511.56	0.00	294.77	1.00	1.15	6.10	7.26	7.87
0	Halfway to UT	13.51	371.04	0.98	5.45	0.00	1.07	0.00	275.94	13239.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	23.46	0.00	0.00	0.00	7.41	0.00	NaN	NaN	0.40	13515.30	0.00	275.94	0.98	1.07	5.87	7.26	7.87
0	Halfway to UT	13.40	371.04	0.96	5.49	0.00	1.00	0.00	258.29	13259.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	23.34	0.00	0.00	0.00	7.42	0.00	NaN	NaN	0.37	13517.36	0.00	258.29	0.96	1.00	5.66	7.26	7.87
0	Halfway to UT	13.29	371.04	0.95	5.52	0.00	0.93	0.00	241.76	13276.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	23.22	0.00	0.00	0.00	7.43	0.00	NaN	NaN	0.34	13518.46	0.00	241.76	0.95	0.93	5.47	7.27	7.87
0	Halfway to UT	13.19	371.04	0.93	5.56	0.00	0.86	0.00	226.27	13292.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	23.11	0.00	0.00	0.00	7.45	0.00	NaN	NaN	0.32	13519.07	0.00	226.27	0.93	0.86	5.28	7.27	7.87
0	Halfway to UT	13.08	371.04	0.92	5.59	0.00	0.80	0.00	211.75	13307.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	23.01	0.00	0.00	0.00	7.46	0.00	NaN	NaN	0.30	13519.42	0.00	211.75	0.92	0.80	5.10	7.27	7.86
0	Halfway to UT	12.97	371.04	0.90	5.62	0.00	0.74	0.00	198.15	13321.49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	22.91	0.00	0.00	0.00	7.48	0.00	NaN	NaN	0.28	13519.65	0.00	198.15	0.90	0.74	4.93	7.27	7.86
0	Outfall Trib Co	12.85	524.77	0.30	5.30	0.00	6.60	0.00	1235.21	6200.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	74.10	0.00	0.00	0.00	7.53	0.00	NaN	NaN	2.45	7435.26	0.00	1235.21	0.30	6.60	36.32	7.18	8.35
0	Outfall Trib Co	12.71	524.77	0.30	5.20	0.00	6.35	0.00	1191.56	6915.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	73.81	0.00	0.00	0.00	7.54	0.00	NaN	NaN	2.36	8106.79	0.00	1191.56	0.30	6.35	35.08	7.19	8.35
0	Outfall Trib Co	12.56	524.77	0.30	5.12	0.00	6.12	0.00	1149.65	7580.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	73.53	0.00	0.00	0.00	7.54	0.00	NaN	NaN	2.28	8730.07	0.00	1149.65	0.30	6.12	34.05	7.20	8.35
0	Outfall Trib Co	12.42	524.77	0.30	5.08	0.00	5.90	0.00	1109.36	8195.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	73.25	0.00	0.00	0.00	7.54	0.00	NaN	NaN	2.19	9305.15	0.00	1109.36	0.30	5.90	33.17	7.20	8.35
0	Outfall Trib Co	12.28	524.77	0.30	5.06	0.00	5.68	0.00	1070.60	8761.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	73.00	0.00	0.00	0.00	7.55	0.00	NaN	NaN	2.11	9832.13	0.00	1070.60	0.30	5.68	32.41	7.21	8.34
0	Outfall Trib Co	12.14	524.77	0.29	5.05	0.00	5.47	0.00	1033.27	9277.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00	72.75	0.00	0.00	0.00	7.56	0.00	NaN	NaN	2.04	10311.13	0.00	1033.27	0.29	5.47	31.74	7.21	8.34
0	Outfall Trib Co	11.99	524.77	0.29	5.06	0.00	5.27	0.00	997.31	9745.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	72.51	0.00	0.00	0.00	7.57	0.00	NaN	NaN	1.96	10742.33	0.00	997.31	0.29	5.27	31.15	7.22	8.34
0	Outfall Trib Co	11.85	524.77	0.29	5.07	0.00	5.08	0.00	962.65	10163.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	72.28	0.00	0.00	0.00	7.58	0.00	NaN	NaN	1.89	11126.12	0.00	962.65	0.29	5.08	30.61	7.22	8.34
0	Outfall Trib Co	11.71	524.77	0.29	5.10	0.00	4.89	0.00	929.21	10533.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00	72.05	0.00	0.00	0.00	7.59	0.00	NaN	NaN	1.82	11463.12	0.00	929.21	0.29	4.89	30.12	7.23	8.34
0	Outfall Trib Co	11.57	524.77	0.28	5.13	0.00	4.72	0.00	896.94	10857.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	71.84	0.00	0.00	0.00	7.60	0.00	NaN	NaN	1.75	11754.40	0.00	896.94	0.28	4.72	29.65	7.23	8.34
0	Outfall Trib Co	11.42	524.77	0.28	5.16	0.00	4.54	0.00	865.80	11135.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	71.63	0.00	0.00	0.00	7.61	0.00	NaN	NaN	1.69	12001.60	0.00	865.80	0.28	4.54	29.22	7.23	8.33
0	Outfall Trib Co	11.28	524.77	0.28	5.19	0.00	4.38	0.00	835.73	11371.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	71.43	0.00	0.00	0.00	7.62	0.00	NaN	NaN	1.63	12207.08	0.00	835.73	0.28	4.38	28.80	7.24	8.33
0	Outfall Trib Co	11.14	524.77	0.28	5.23	0.00	4.22	0.00	806.70	11567.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	71.23	0.00	0.00	0.00	7.63	0.00	NaN	NaN	1.57	12373.97	0.00	806.70	0.28	4.22	28.39	7.24	8.33
0	Outfall Trib Co	11.00	524.77	0.28	5.27	0.00	4.07	0.00	778.67	11727.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	71.04	0.00	0.00	0.00	7.64	0.00	NaN	NaN	1.51	12506.11	0.00	778.67	0.28	4.07	28.00	7.24	8.33
0	Outfall Trib Co	10.85	524.77	0.27	5.31	0.00	3.92	0.00	751.60	11856.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	70.86	0.00	0.00	0.00	7.65	0.00	NaN	NaN	1.46	12607.90	0.00	751.60	0.27	3.92	27.62	7.24	8.33
0	Outfall Trib Co	10.71	524.77	0.27	5.35	0.00	3.78	0.00	725.45	11958.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	70.68	0.00	0.00	0.00	7.66	0.00	NaN	NaN	1.41	12684.03	0.00	725.45	0.27	3.78	27.24	7.25	8.33
0	Outfall Trib Co	10.57	524.77	0.27	5.39	0.00	3.64	0.00	700.19	12039.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	70.51	0.00	0.00	0.00	7.67	0.00	NaN	NaN	1.35	12739.23	0.00	700.19	0.27	3.64	26.87	7.25	8.33
0	Outfall Trib Co	10.43	524.77	0.27	5.43	0.00	3.51	0.00	675.80	12102.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	70.34	0.00	0.00	0.00	7.68	0.00	NaN	NaN	1.31	12777.96	0.00	675.80	0.27	3.51	26.50	7.25	8.33
0	Outfall Trib Co	10.28	524.77	0.26	5.46	0.00	3.39	0.00	652.24	12151.98	0.00	0.00	0.00	0.00	0.00	0.00	0.00	70.18	0.00	0.00	0.00	7.69	0.00	NaN	NaN	1.26	12804.22	0.00	652.24	0.26	3.39	26.14	7.25	8.32
0	Outfall Trib Co	10.14	524.77	0.26	5.50	0.00	3.27	0.00	629.48	12191.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	70.02	0.00	0.00	0.00	7.70	0.00	NaN	NaN	1.21	12821.38	0.00	629.48	0.26	3.27	25.79	7.25	8.32
0	GC2 -Hwy 377 br	9.97	524.77	0.26	5.55	0.00	3.11	0.00	600.36	12233.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	69.82	0.00	0.00	0.00	7.71	0.00	NaN	NaN	1.16	12834.05	0.00	600.36	0.26	3.11	25.32	7.25	8.32
0	GC2 -Hwy 377 br	9.78	524.77	0.26	5.60	0.00	2.97	0.00	572.55	12268.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	69.63	0.00	0.00	0.00	7.73	0.00	NaN	NaN	1.10	12840.54	0.00	572.55	0.26	2.97	24.86	7.26	8.32
0	GC2 -Hwy 377 br	9.59	524.77	0.25	5.64	0.00	2.83	0.00	545.99	12297.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	69.44	0.00	0.00	0.00	7.74	0.00	NaN	NaN	1.05	12843.52	0.00	545.99	0.25	2.83	24.40	7.26	8.32
0	GC2 -Hwy 377 br	9.40	524.77	0.25	5.69	0.00	2.69	0.00	520.62	12323.97	0.00	0.00	0.00	0.00	0.00	0.00	0.00	69.27	0.00	0.00	0.00	7.75	0.00	NaN	NaN	1.00	12844.59	0.00	520.62	0.25	2.69	23.95	7.26	8.32
0	GC2 -Hwy 377 br	9.21	524.77	0.25	5.73	0.00	2.56	0.00	496.39	12348.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	69.10	0.00	0.00	0.00	7.77	0.00	NaN	NaN	0.95	12844.68	0.00	496.39	0.25	2.56	23.50	7.26	8.32
0	GC2 -Hwy 377 br	9.02	524.77	0.25	5.77	0.00	2.44	0.00	473.26	12371.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	68.94	0.00	0.00	0.00	7.78	0.00	NaN	NaN	0.91	12844.28	0.00	473.26	0.25	2.44	23.05	7.26	8.32
0	GC2 -Hwy 377 br	8.83	524.77	0.24	5.81	0.00	2.33	0.00	451.17	12392.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	68.79	0.00	0.00	0.00	7.79	0.00	NaN	NaN	0.86	12843.64	0.00	451.17	0.24	2.33	22.60	7.26	8.32
0	GC2 -Hwy 377 br	8.64	524.77	0.24	5.84	0.00	2.21	0.00	430.07	12412.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	68.65	0.00	0.00	0.00	7.80	0.00	NaN	NaN	0.82	12842.89	0.00	430.07	0.24	2.21	22.16	7.26	8.32
0	GC2 -Hwy 377 br	8.45	524.77	0.24	5.88	0.00	2.11	0.00	409.93	12432.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	68.51	0.00	0.00	0.00	7.82	0.00	NaN	NaN	0.78	12842.08	0.00	409.93	0.24	2.11	21.71	7.26	8.31
0	GC2 -Hwy 377 br	8.26	524.77	0.24	5.91	0.00	2.01	0.00	390.70	12450.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	68.38	0.00	0.00	0.00	7.83	0.00	NaN	NaN	0.75	12841.24	0.00	390.70	0.24	2.01	21.27	7.26	8.31
0	GC2 -Hwy 377 br	8.06	524.77	0.23	5.95	0.00	1.91	0.00	372.35	12468.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	68.26	0.00	0.00	0.00	7.84	0.00	NaN	NaN	0.71	12840.40	0.00	372.35	0.23	1.91	20.82	7.27	8.31
0	GC2 -Hwy 377 br	7.87	524.77	0.23	5.98	0.00	1.82	0.00	354.83	12484.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	68.14	0.00	0.00	0.00	7.85	0.00	NaN	NaN	0.68	12839.54	0.00	354.83	0.23	1.82	20.38	7.27	8.31
0	GC2 -Hwy 377 br	7.68	524.77	0.23	6.01	0.00	1.73	0.00	338.11	12500.57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	68.03	0.00	0.00	0.00	7.87	0.00	NaN	NaN	0.64	12838.67	0.00	338.11	0.23	1.73	19.93	7.27	8.31
0	GC2 -Hwy 377 br	7.49	524.77	0.23	6.04	0.00	1.65	0.00	322.15	12515.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	67.92	0.00	0.00	0.00	7.88	0.00	NaN	NaN	0.61	12837.81	0.00	322.15	0.23	1.65	19.49	7.27	8.31
0	GC2 -Hwy 377 br	7.30	524.77	0.22	6.06	0.00	1.57	0.00	306.92	12530.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	67.82	0.00	0.00	0.00	7.89	0.00	NaN	NaN	0.58	12836.94	0.00	306.92	0.22	1.57	19.04	7.27	8.31
0	GC2 -Hwy 377 br	7.11	524.77	0.22	6.09	0.00	1.49	0.00	292.39	12543.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	67.72	0.00	0.00	0.00	7.90	0.00	NaN	NaN	0.56	12836.08	0.00	292.39	0.22	1.49	18.60	7.27	8.31
0	GC2 -Hwy 377 br	6.92	524.77	0.22	6.11	0.00	1.42	0.00	278.53	12556.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	67.62	0.00	0.00	0.00	7.91	0.00	NaN	NaN	0.53	12835.22	0.00	278.53	0.22	1.42	18.16	7.27	8.31
0	GC2 -Hwy 377 br	6.73	524.77	0.22	6.14	0.00	1.35	0.00	265.30	12569.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	67.54	0.00	0.00	0.00	7.93	0.00	NaN	NaN	0.50	12834.36	0.00	265.30	0.22	1.35	17.72	7.27	8.31
0	GC2 -Hwy 377 br	6.54	524.77	0.22	6.16	0.00	1.29	0.00	252.68	12580.83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	67.45	0.00	0.00	0.00	7.94	0.00	NaN	NaN	0.48	12833.51	0.00	252.68	0.22	1.29	17.28	7.27	8.31
0	GC2 -Hwy 377 br	6.35	524.77	0.21	6.18	0.00	1.22	0.00	240.64	12592.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	67.37	0.00	0.00	0.00	7.95	0.00	NaN	NaN	0.45	12832.66	0.00	240.64	0.21	1.22	16.85	7.27	8.31
0	GC3 - Highway 1	6.16	524.77	0.21	6.19	0.00	1.17	0.00	229.62	12602.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	67.30	0.00	0.00	0.00	7.96	0.00	NaN	NaN	0.43	12831.81	0.00	229.62	0.21	1.17	16.66	7.24	8.31
0	GC3 - Highway 1	5.98	524.77	0.21	6.20	0.00	1.11	0.00	218.92	12611.98	0.00	0.00	0.00	0.00	0.00	0.00	0.00	67.23	0.00	0.00	0.00	7.96	0.00	NaN	NaN	0.41	12830.90	0.00	218.92	0.21	1.11	16.43	7.21	8.31
0	GC3 - Highway 1	5.80	524.77	0.21	6.20	0.00	1.06	0.00	208.55	12621.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	67.16	0.00	0.00	0.00	7.97	0.00	NaN	NaN	0.39	12829.92	0.00	208.55	0.21	1.06	16.16	7.19	8.31
0	GC3 - Highway 1	5.62	524.77	0.21	6.20	0.00	1.01	0.00	198.53	12630.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	67.10	0.00	0.00	0.00	7.98	0.00	NaN	NaN	0.37	12828.88	0.00	198.53	0.21	1.01	15.86	7.16	8.31
0	GC3 - Highway 1	5.44	524.77	0.20	6.20	0.00	0.96	0.00	188.88	12638.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00	67.03	0.00	0.00	0.00	7.99	0.00	NaN	NaN	0.36	12827.79	0.00	188.88	0.20	0.96	15.54	7.14	8.31
0	GC3 - Highway 1	5.26	524.77	0.20	6.20	0.00	0.91	0.00	179.60	12647.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	66.97	0.00	0.00	0.00	8.00	0.00	NaN	NaN	0.34	12826.66	0.00	179.60	0.20	0.91	15.20	7.13	8.31
0	GC3 - Highway 1	5.08	524.77	0.20	6.20	0.00	0.86	0.00	170.68	12654.83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	66.92	0.00	0.00	0.00	8.01	0.00	NaN	NaN	0.32	12825.51	0.00	170.68	0.20	0.86	14.84	7.11	8.31
0	GC3 - Highway 1	4.90	524.77	0.20	6.20	0.00	0.82	0.00	162.14	12662.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	66.86	0.00	0.00	0.00	8.02	0.00	NaN	NaN	0.30	12824.38	0.00	162.14	0.20	0.82	14.47	7.10	8.31
0	GC3 - Highway 1	4.72	524.77	0.20	6.20	0.00	0.78	0.00	153.96	12669.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	66.81	0.00	0.00	0.00	8.03	0.00	NaN	NaN	0.29	12823.27	0.00	153.96	0.20	0.78	14.09	7.08	8.31
0	GC3 - Highway 1	4.54	524.77	0.19	6.20	0.00	0.74	0.00	146.13	12676.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	66.76	0.00	0.00	0.00	8.04	0.00	NaN	NaN	0.27	12822.21	0.00	146.13	0.19	0.74	13.71	7.07	8.31
0	GC3 - Highway 1	4.37	524.77	0.19	6.20	0.00	0.70	0.00	138.66	12682.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	66.71	0.00	0.00	0.00	8.04	0.00	NaN	NaN	0.26	12821.20	0.00	138.66	0.19	0.70	13.31	7.06	8.31
0	GC3 - Highway 1	4.19	524.77	0.19	6.20	0.00	0.66	0.00	131.52	12688.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	66.67	0.00	0.00	0.00	8.05	0.00	NaN	NaN	0.25	12820.24	0.00	131.52	0.19	0.66	12.92	7.05	8.31
0	GC3 - Highway 1	4.01	524.77	0.19	6.20	0.00	0.63	0.00	124.71	12694.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	66.62	0.00	0.00	0.00	8.06	0.00	NaN	NaN	0.23	12819.34	0.00	124.71	0.19	0.63	12.52	7.05	8.31
0	GC3 - Highway 1	3.83	524.77	0.19	6.20	0.00	0.59	0.00	118.23	12700.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	66.58	0.00	0.00	0.00	8.07	0.00	NaN	NaN	0.22	12818.48	0.00	118.23	0.19	0.59	12.12	7.04	8.31
0	GC3 - Highway 1	3.65	524.77	0.19	6.21	0.00	0.56	0.00	112.05	12705.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	66.54	0.00	0.00	0.00	8.08	0.00	NaN	NaN	0.21	12817.66	0.00	112.05	0.19	0.56	11.72	7.03	8.31
0	GC3 - Highway 1	3.47	524.77	0.18	6.21	0.00	0.53	0.00	106.18	12710.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	66.50	0.00	0.00	0.00	8.09	0.00	NaN	NaN	0.20	12816.88	0.00	106.18	0.18	0.53	11.33	7.03	8.31
0	GC3 - Highway 1	3.29	524.77	0.18	6.21	0.00	0.50	0.00	100.59	12715.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	66.47	0.00	0.00	0.00	8.09	0.00	NaN	NaN	0.19	12816.14	0.00	100.59	0.18	0.50	10.94	7.02	8.31
0	GC3 - Highway 1	3.11	524.77	0.18	6.22	0.00	0.47	0.00	95.28	12720.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	66.43	0.00	0.00	0.00	8.10	0.00	NaN	NaN	0.18	12815.42	0.00	95.28	0.18	0.47	10.55	7.02	8.31
0	GC3 - Highway 1	2.93	524.77	0.18	6.22	0.00	0.45	0.00	90.23	12724.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	66.40	0.00	0.00	0.00	8.11	0.00	NaN	NaN	0.17	12814.73	0.00	90.23	0.18	0.45	10.17	7.01	8.31
0	GC3 - Highway 1	2.75	524.77	0.18	6.23	0.00	0.42	0.00	85.44	12728.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	66.37	0.00	0.00	0.00	8.12	0.00	NaN	NaN	0.16	12814.07	0.00	85.44	0.18	0.42	9.79	7.01	8.31
0	GC4	2.59	524.77	0.18	6.23	0.00	0.41	0.00	82.02	12731.57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	66.35	0.00	0.00	0.00	8.12	0.00	NaN	NaN	0.15	12813.60	0.00	82.02	0.18	0.41	9.51	7.01	8.31
0	GC4	2.46	524.77	0.18	6.23	0.00	0.39	0.00	78.74	12734.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	66.33	0.00	0.00	0.00	8.13	0.00	NaN	NaN	0.14	12813.14	0.00	78.74	0.18	0.39	9.24	7.01	8.31
0	GC4	2.33	524.77	0.17	6.24	0.00	0.37	0.00	75.58	12737.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	66.31	0.00	0.00	0.00	8.13	0.00	NaN	NaN	0.14	12812.70	0.00	75.58	0.17	0.37	8.98	7.01	8.31
0	GC4	2.19	524.77	0.17	6.24	0.00	0.36	0.00	72.54	12739.74	0.00	0.00	0.00	0.00	0.00	0.00	0.00	66.29	0.00	0.00	0.00	8.14	0.00	NaN	NaN	0.13	12812.28	0.00	72.54	0.17	0.36	8.71	7.00	8.31
0	GC4	2.06	524.77	0.17	6.24	0.00	0.34	0.00	69.62	12742.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	66.27	0.00	0.00	0.00	8.14	0.00	NaN	NaN	0.13	12811.87	0.00	69.62	0.17	0.34	8.45	7.00	8.31
0	GC4	1.93	524.77	0.17	6.25	0.00	0.33	0.00	66.82	12744.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	66.25	0.00	0.00	0.00	8.15	0.00	NaN	NaN	0.12	12811.48	0.00	66.82	0.17	0.33	8.20	7.00	8.31
0	GC4	1.80	524.77	0.17	6.25	0.00	0.31	0.00	64.12	12746.99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	66.24	0.00	0.00	0.00	8.15	0.00	NaN	NaN	0.12	12811.11	0.00	64.12	0.17	0.31	7.95	7.00	8.31
0	GC4	1.66	524.77	0.17	6.25	0.00	0.30	0.00	61.53	12749.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	66.22	0.00	0.00	0.00	8.16	0.00	NaN	NaN	0.11	12810.75	0.00	61.53	0.17	0.30	7.71	7.00	8.31
0	GC4	1.53	524.77	0.17	6.26	0.00	0.29	0.00	59.04	12751.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	66.20	0.00	0.00	0.00	8.16	0.00	NaN	NaN	0.11	12810.41	0.00	59.04	0.17	0.29	7.47	7.00	8.31
0	GC4	1.40	524.77	0.17	6.26	0.00	0.28	0.00	56.65	12753.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	66.19	0.00	0.00	0.00	8.17	0.00	NaN	NaN	0.10	12810.08	0.00	56.65	0.17	0.28	7.24	7.00	8.31
0	GC4	1.26	524.77	0.17	6.26	0.00	0.26	0.00	54.35	12755.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	66.17	0.00	0.00	0.00	8.17	0.00	NaN	NaN	0.10	12809.76	0.00	54.35	0.17	0.26	7.01	7.00	8.31
0	GC4	1.13	524.76	0.17	6.27	0.00	0.25	0.00	52.15	12757.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	66.16	0.00	0.00	0.00	8.18	0.00	NaN	NaN	0.09	12809.45	0.00	52.15	0.17	0.25	6.78	7.00	8.31
0	GC4	1.00	524.76	0.17	6.27	0.00	0.24	0.00	50.03	12759.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	66.15	0.00	0.00	0.00	8.18	0.00	NaN	NaN	0.09	12809.16	0.00	50.03	0.17	0.24	6.57	7.00	8.31
0	GC4	0.86	524.76	0.17	6.27	0.00	0.23	0.00	48.00	12760.86	0.00	0.00	0.00	0.00	0.00	0.00	0.00	66.13	0.00	0.00	0.00	8.18	0.00	NaN	NaN	0.09	12808.87	0.00	48.00	0.17	0.23	6.35	7.00	8.31
0	GC4	0.73	524.76	0.17	6.28	0.00	0.22	0.00	46.05	12762.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	66.12	0.00	0.00	0.00	8.19	0.00	NaN	NaN	0.08	12808.59	0.00	46.05	0.17	0.22	6.15	7.00	8.31
0	GC4	0.60	524.76	0.17	6.28	0.00	0.21	0.00	44.18	12764.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	66.11	0.00	0.00	0.00	8.19	0.00	NaN	NaN	0.08	12808.31	0.00	44.18	0.17	0.21	5.94	7.00	8.31
0	GC4	0.47	524.76	0.16	6.28	0.00	0.20	0.00	42.39	12765.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	66.10	0.00	0.00	0.00	8.20	0.00	NaN	NaN	0.08	12808.04	0.00	42.39	0.16	0.20	5.75	7.00	8.31
0	GC4	0.33	524.75	0.16	6.29	0.00	0.19	0.00	40.66	12767.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	66.09	0.00	0.00	0.00	8.20	0.00	NaN	NaN	0.07	12807.77	0.00	40.66	0.16	0.19	5.55	7.00	8.31
0	GC4	0.20	524.75	0.16	6.29	0.00	0.18	0.00	39.01	12768.49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	66.07	0.00	0.00	0.00	8.20	0.00	NaN	NaN	0.07	12807.50	0.00	39.01	0.16	0.18	5.37	7.00	8.31
0	GC4	0.07	524.75	0.16	6.29	0.00	0.18	0.00	37.42	12769.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	66.06	0.00	0.00	0.00	8.21	0.00	NaN	NaN	0.07	12807.23	0.00	37.42	0.16	0.18	5.19	7.00	8.31
0	Terminus	0.00	524.75	0.16	6.29	0.00	0.18	0.00	37.42	12769.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	66.06	0.00	0.00	0.00	8.21	0.00	NaN	NaN	0.07	12807.23	0.00	37.42	0.16	0.18	5.19	7.00	8.31
1	UT	0.23	350.00	2.00	6.21	0.00	2.00	0.00	150.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20.00	0.00	0.00	0.00	7.40	0.00	0.00	0.00	0.74	150.00	0.00	150.00	2.00	2.00	3.39	7.14	7.81
1	Madill Outfall	0.17	595.88	0.03	5.22	0.00	9.84	0.00	1813.86	905.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	98.46	0.00	0.00	0.00	7.47	0.00	NaN	NaN	3.66	2719.52	0.00	1813.86	0.03	9.84	47.83	7.12	8.47
1	Madill Outfall	0.06	595.88	0.03	5.38	0.00	9.67	0.00	1781.50	1786.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	98.24	0.00	0.00	0.00	7.53	0.00	NaN	NaN	3.59	3567.96	0.00	1781.50	0.03	9.67	53.95	7.13	8.46
1	Terminus	0.00	595.88	0.03	5.38	0.00	9.67	0.00	1781.50	1786.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	98.24	0.00	0.00	0.00	7.53	0.00	NaN	NaN	3.59	3567.96	0.00	1781.50	0.03	9.67	53.95	7.13	8.46