ESI

EnviroSystems, Inc.
P.O. Box 778
Hampton, NH 03843-0778
603-926-3345

June 6, 2016

Mr. Aram Varjabedian
Woodard & Curran
Hull Water Pollution Control Facility
1111 Nantasket Avenue
Hull, Massachusetts 02045

Dear Mr. Varjabedian:

Enclosed, please find three copies of our report presenting the results of a toxicity test completed using an effluent sample collected from the Hull, Massachusetts Water Pollution Control Facility during the May 2016 sampling period. Acute toxicity was evaluated using the inland silverside minnow, *Menidia beryllina*.

Please do not hesitate to call me or Petra Karbe should you have any questions regarding the report.

Sincerely,

EnviroSystems, Incorporated

Lisa Bordonaro

Digitally signed by Lisa Bordonaro
DN: cn=Lisa Bordonaro, o=Envirosystems, Inc., ou=Microbiology Manager, email=lbordonaro@envirosystems.com, c=US
Date: 2016.06.06 14:39:24 -04'00'

Kirk Cram
Toxicology Laboratory Manager

Enclosure
WET Test Report Certification
Report Number 27398-16-05
Three (3) copies + email

WHOLE EFFLUENT TOXICITY TEST REPORT CERTIFICATION

Permittee Certification

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Executed on: _____

_____

Authorized Signature

_____

Print or Type Name

Hull Permanent Sewer Commission

Print or Type the Permittee's Name

MA0101231

Type or Print the NPDES Permit No.

WHOLE EFFLUENT TOXICITY TEST REPORT CERTIFICATION (Bioassay Laboratory)

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Executed on: June 6, 2016

Kirk Cram
Toxicology Laboratory Manager - EnviroSystems, Inc.

TOXICOLOGICAL EVALUATION
OF A TREATED MUNICIPAL EFFLUENT
BIOMONITORING SUPPORT FOR A NPDES PERMIT:
May 2016

Hull Water Pollution Control Facility
Hull, Massachusetts
NPDES Permit Number MA0101231

Prepared For:

Woodard & Curran
Hull Water Pollution Control Facility
1111 Nantasket Avenue
Hull, Massachusetts 02045

Prepared By:

EnviroSystems, Incorporated
One Lafayette Road
Hampton, New Hampshire 03842

May 2016
Reference Number: Hull27398-16-05

STUDY NUMBER 27398

EXECUTIVE SUMMARY

The following summarizes the results of an acute exposure bioassay completed during May 2016 in support of the NPDES biomonitoring requirements of the Hull, Massachusetts Water Pollution Control Facility, operated by Woodard & Curran. The 48 hour acute definitive assay was completed using the inland silverside minnow, *Menidia beryllina*.

M. beryllina were 10 days old at the start of the test. Dilution water was receiving water collected from Massachusetts Bay at a point away from the discharge. Samples were received under chain of custody in good order. All sample receipt, test conditions and control endpoints were within protocol specifications, except where otherwise noted.

The results presented in this report relate only to the samples described on the chain(s) of custody and sample receipt log(s), and are intended to be used only by the submitter. Results from the acute exposure assay and their relationship to permit limits are summarized in the following matrix.

Acute Toxicity Evaluation

Species	Exposure	LC-50	A-NOEC	Permit Limit (LC-50)	Effluent Meets Permit Limit	Assay Meets Protocol Limits
Menidia beryllina	48 Hours	>100%	NC	≥100%	Yes	Yes

COMMENTS:
NC = Not Calculated.

TOXICOLOGICAL EVALUATION
OF A TREATED MUNICIPAL EFFLUENT
BIOMONITORING SUPPORT FOR A NPDES PERMIT:
May 2016

Hull Water Pollution Control Facility
Hull, Massachusetts
NPDES Permit Number MA0101231

1.0 INTRODUCTION

This report presents the results of an acute toxicity test completed on a composite effluent sample collected from the Hull, Massachusetts Water Pollution Control Facility (Hull WPCF), operated by Woodard & Curran. Testing was based on programs and protocols developed by the US EPA (2002), with exceptions as noted by US EPA Region I (2012), and involved conducting a 48 hour static acute toxicity test with the inland silverside minnow, *Menidia beryllina*. Testing was performed at EnviroSystems, Incorporated (ESI), Hampton, New Hampshire in accordance with the provisions of TNI Standards (2009).

Acute toxicity tests involve preparing a series of concentrations by diluting effluent with control water. Groups of test animals are exposed to each effluent concentration and a control for a specified period. In acute tests, mortality data for each concentration are used to calculate (by regression) the median lethal concentration, or LC-50, defined as the effluent concentration that kills half of the test animals. Samples with high LC-50 values are less likely to cause significant environmental impacts. The no-effect concentration is also determined to provide information about the level of effluent that would have minimal acute effects in the environment. This Acute No Observed Effect Concentration (A-NOEC) is defined as the highest tested effluent concentration that causes no significant mortality.

2.0 MATERIALS AND METHODS

2.1 General Methods

Toxicological and analytical protocols used in this program follow procedures primarily designed to provide standard approaches for the evaluation of toxicological effects of discharges on aquatic organisms (US EPA 2002), and for the analysis of water samples (APHA 2012). See Section 4.0 for a list of references.

2.2 Test Species

When necessary, *M. beryllina* were acclimated to approximate test conditions prior to use in the assay. Test organisms were transferred to test chambers using an inverted glass pipette, minimizing the amount of water added to test solutions. Twenty control fish were weighed during the test to confirm loading rates. The loading rate was below the maximum 0.4 g/L recommended for assays conducted at 25°C. Fish weights and loading calculations are included in the data appendix.

2.3 Effluent, Receiving Water, and Laboratory Water

Effluent and receiving water collection information is provided in Table 1. Samples were received at 0-6°C as per 40 CFR §136.3 unless otherwise noted, stored at 4±2°C and warmed to 25±1°C prior to preparing test solutions. Effluent used in the *M. beryllina* assay was salinity adjusted to 25±2 ppt using artificial sea salts according to protocol (US EPA 2002). Laboratory water was collected from the Hampton/Seabrook Estuary. This water has been used to culture marine test organisms since 1981.

Total residual chlorine (TRC) was measured by amperometric titration (MDL 0.02 mg/L) in both the effluent and diluent samples. If chlorine was present, the sample was dechlorinated using sodium thiosulfate and a control treatment using laboratory water adjusted with an equal amount of sodium thiosulfate was run concurrently (US EPA 2002). Data for the sodium thiosulfate laboratory control can be found in Appendix A.

2.4 Acute Exposure Bioassay

The 48 hour static acute exposure bioassay was conducted at 25±1°C with a photoperiod of 16:8 hours light:dark. Test chambers were 250 mL glass beakers containing 200 mL test solution in each of 4 replicates with 10 organisms/replicate. Replicates were not randomized during testing; rather, organisms were added randomly at test initiation by replicate across test solutions in an alternating fashion (alternating allocation). Test concentrations for the assay were 100% (undiluted), 50%, 25%, 12.5%, and 6.25% effluent. Survival and dissolved oxygen were recorded daily in all replicates. Specific conductivity, salinity, temperature, and pH were measured daily in one replicate of each test treatment.

2.5 Data Analysis

When applicable, statistical analysis of acute exposure data was completed using CETIS™ v1.9.2.4, Comprehensive Environmental Toxicity Information System, software. The program computes acute exposure endpoints based on US EPA decision tree guidelines specified in individual test methods. If survival in the highest test concentration is >50%, the LC-50 is obtained by direct observation of the raw data. As needed, the A-NOEC is determined as the highest test concentration that caused no significant mortality.

2.6 Quality Control

As part of the laboratory quality control program, standard reference toxicant assays are completed on a regular basis for each test species. These results provide relative health and response data while allowing for comparison with historic data sets. See Table 2 for details.

3.0 RESULTS AND DISCUSSION

Results of the acute exposure bioassay completed using the inland silverside minnow are summarized in Table 3. Effluent and dilution water characteristics are presented in Table 4. US EPA Region I toxicity test summary sheets can be found after the tables. Support data, including copies of laboratory bench sheets, are included in Appendix A.

Minimum test acceptability criteria require ≥90% survival in the control concentrations. Achievement of these results indicates that healthy test organisms were used and that the dilution water had no significant adverse impact on the outcome of the assay. See the Executive Summary and Table 3 for test acceptability.

4.0 LITERATURE CITED

40 CFR §136.3. *Code of Federal Regulations* (CFR), Protection of the Environment (Title 40), Guidelines Establishing Test Procedures for the Analysis of Pollutants (Part 136), Identification of Test Procedures (sub-part 3), Table II-Required Containers, Preservation Techniques, and Holding Times.

APHA. 2012. *Standard Methods for the Examination of Water and Wastewater*, 22nd Edition. Washington D.C.

The NELAC Institute (TNI). 2009. *Environmental Laboratory Sector, Volume 1: Management and Technical Requirements for Laboratories Performing Environmental Analysis (TNI Standard)*. EL-V1-2009.

US EPA. 2002. *Methods for Measuring the Acute Toxicity of Effluents to Freshwater and Marine Organisms*. Fifth Edition. EPA-821-R-02-012.

US EPA Region I. 2012. *Marine Acute Toxicity Test Procedure and Protocol*. US EPA Region I Office, Boston, Massachusetts. July 2012.

TABLE 1. Summary of Sample Collection Information.
Hull WPCF Effluent Biomonitoring Program. May 2016.

Sample Description	Type	Collection Date	Collection Time	Receipt Date	Receipt Time	Arrival Temp °C
Effluent	Comp	05/10-11/16	0800-0800	05/11/16	0900	2
Receiving Water	Grab	05/11/16	0645	05/11/16	0900	2

TABLE 2. Summary of Reference Toxicant Data.
Hull WPCF Effluent Biomonitoring Program. May 2016.

Date	Endpoint		Value	Historic Mean/ Central Tendency	Acceptable Range	Reference Toxicant
M. beryllina						
04/26/16	Survival	48Hr LC-50	5.9	6.0	3.6 - 8.4	SDS (mg/L)

Means and Acceptable Ranges based on the most recent 20 reference toxicant assays

TABLE 3. Summary of Acute Evaluation Results.
Hull WPCF Effluent Biomonitoring Program. May 2016.

Percent Survival

Species	Exposure	Lab	RW	6.25%	12.5%	25%	50%	100%
M. beryllina	48 hours	95%	100%	100%	100%	100%	95%	100%

LC-50 and A-NOEC Results

Species	Exposure	Spearman-Kärber	Probit	Direct Observation	A-NOEC
M. beryllina	48 Hours	NC	NC	>100%	NC

COMMENTS:
RW = Receiving Water; used as the diluent.
NC = Not Calculated.

TABLE 4. Summary of Effluent and Diluent Characteristics. Hull WPCF Effluent Biomonitoring Program. May 2016.

PARAMETER	UNIT	EFFLUENT	RECEIVING WATER
Specific Conductivity - As Received	µmhos/cm	18750	45700
pH - As Received	SU	6.89	7.83
Salinity - As Received	ppt	11	30
Total Residual Chlorine	mg/L	0.097 [a]	<0.02
Total Solids	mg/L	28000	34000
Total Suspended Solids	mg/L	15	6.9
Ammonia as N	mg/L	0.9	<0.1
Total Organic Carbon	mg/L	7.8	1 [b]
Aluminum, total	mg/L	0.034	0.092
Cadmium, total	mg/L	<0.0005	<0.0005
Calcium, total	mg/L	160	370
Chromium, total	mg/L	<0.002	<0.002
Copper, total	mg/L	0.011	<0.002
Lead, total	mg/L	<0.0005	<0.0005
Magnesium, total	mg/L	410	1100
Nickel, total	mg/L	<0.002	<0.002
Zinc, total	mg/L	0.047	<0.002

COMMENTS:

[a] The total residual chlorine of the effluent sample was 0.097 mg/L upon receipt, but following salinity adjustment was <0.02 mg/L.

[b] Estimate. MS %R below limit.

TOXICITY TEST SUMMARY SHEET

FACILITY NAME: Hull WPCF TEST START DATE: 05/12/16
NPDES PERMIT NO.: MA0101231 TEST END DATE: 05/14/16

TEST TYPE	TEST SPECIES	SAMPLE TYPE	SAMPLE METHOD
_X_ Acute	___ *Pimephales promelas*	___ Prechlorinated	___ Grab
___ Chronic	___ *Ceriodaphnia dubia*	___ Dechlorinated	_X_ Composite
___ Modified Chronic (Reporting Acute Values)	___ *Daphnia pulex*	_X_ Chlorine Spiked in Lab	___ Flow-thru
	___ *Americamysis bahia*	___ Chlorinated on Site	___ Other
	___ *Cyprinodon variegatus*	___ Unchlorinated	
___ 24 Hour Screen	_X_ *Menidia beryllina*	___ No Detectable Chlorine Upon Receipt	
	___ *Arbacia punctulata*	___ Dechlorinated at lab	

DILUTION WATER:

_X_ Receiving water collected at a point upstream or away from the discharge, free from toxicity or other sources of contamination; Receiving Water Name: Massachusetts Bay

___ Alternate surface water of known quality and hardness, to generally reflect the characteristics of the receiving water; Receiving Water Name: _____

___ Synthetic water prepared using either Millipore Milli-Q or equivalent deionized water and reagent grade chemicals; or deionized water combined with mineral water.

___ Artificial sea salts mixed with deionized water

___ Deionized water and hypersaline brine

___ Other

EFFLUENT SAMPLING DATES: 05/10-11/16 _____ _____

EFFLUENT CONCENTRATIONS TESTED (%): 6.25; 12.5; 25; 50; 100

Permit Limit Concentration: ≥100 %

Was the effluent salinity adjusted? Yes If yes, to what level? 24 ppt

REFERENCE TOXICANT TEST DATE: 04/26/16 LC-50: 5.9 mg/L Sodium Dodecyl Sulfate

PERMIT LIMITS AND TEST RESULTS

Test Acceptability Criteria

Mean Control Survival: 100 %

LIMITS		**RESULTS**	
LC-50:	≥100 %	LC-50	>100 %
		Upper Limit:	- %
A-NOEC:	- %	Lower Limit:	- %
		Method:	Direct Observation
C-NOEC:	- %	A-NOEC:	- %
		C-NOEC:	- %
		C-LOEC:	-
IC- ____	- %	IC- ____	- %

APPENDIX A

DATA SHEETS

STATISTICAL SUPPORT

Contents	Number of Pages
Methods Used in NPDES Permit Biomonitoring Testing	1
Massachusetts DEP Accreditation Certification and Certified Parameter List	3
M. beryllina Acute Bioassay Bench Sheet	2
Organism Wet Weights	1
M. beryllina Statistical Analysis	0
Organism Culture Data	1
Sodium Thiosulfate Adjusted Laboratory Control Bench Sheets	0
Preparation of Dilutions and Record of Meters Used	1
Analytical Chemistry Support Data Summary Report	1
Sample Receipt Record	1
Chain of Custody	1
Assay Review Checklist	1
Total Appendix Pages	13

METHODS USED IN NPDES PERMIT BIOMONITORING TESTING

Parameter	Method
Acute Exposure Bioassays:	
Ceriodaphnia dubia	EPA-821-R-02-012 2002.0
Daphnia pulex	EPA-821-R-02-012 2021.0
Pimephales promelas	EPA-821-R-02-012 2000.0
Americamysis bahia	EPA-821-R-02-012 2007.0
Menidia beryllina	EPA-821-R-02-012 2006.0
Cyprinodon variegatus	EPA-821-R-02-012 2004.0
Chronic Exposure Bioassays:	
Ceriodaphnia dubia	EPA-821-R-02-013 1002.0
Pimephales promelas	EPA-821-R-02-013 1000.0
Cyprinodon variegatus	EPA-821-R-02-014 1004.0
Menidia beryllina	EPA-821-R-02-014 1006.0
Arbacia punctulata	EPA-821-R-02-014 1008.0
Champia parvula	EPA-821-R-02-014 1009.0
Trace Metals:	
Trace Metals	EPA 200.8/SW 6020, EPA 245.7
Hardness	EPA SW846 3rd Ed. 6010
Wet Chemistries:	
Alkalinity	EPA 310.2
Chlorine, Residual	Standard Methods 22nd Edition - Method 4500-Cl D
Total Organic Carbon	Standard Methods 22nd Edition - Method 5310 C
Specific Conductance	Standard Methods 22nd Edition - Method 2510 B
Nitrogen - Ammonia	Standard Methods 22nd Edition - Method 4500-NH_3G
pH	Standard Methods 22nd Edition - Method 4500-H+ B
Solids, Total (TS)	Standard Methods 22nd Edition - Method 2540 B
Solids, Total Dissolved (TDS)	Standard Methods 22nd Edition - Method 2540 C
Solids, Total Suspended (TSS)	Standard Methods 22nd Edition - Method 2540 D
Dissolved Oxygen	Standard Methods 22nd Edition - Method 4500-O G

Please visit our web site at www.envirosystems.com for a copy of our accreditations and state certifications.

The Commonwealth of Massachusetts

Department of Environmental Protection

Division of Environmental Analysis
Senator William X. Wall Experiment Station

certifies

M-NH906 **ENVIROSYSTEMS INC**
1 LAFAYETTE RD
HAMPTON, NH 03842-0000

Laboratory Director: **RUSSELL D. FOSTER**

for the analysis of **NON POTABLE WATER (CHEMISTRY)**

pursuant to 310 CMR 42.00

This certificate supersedes all previous Massachusetts certificates issued to this laboratory. The laboratory is regulated by and shall be responsible for being in compliance with Massachusetts regulations at 310 CMR 42.00.

This certificate is valid only when accompanied by the latest dated Certified Parameter List as issued by the Massachusetts D.E.P. Contact the Division of Environmental Analysis to verify the current certification status of the laboratory.

Certification is no guarantee of the validity of the data. This certification is subject to unannounced laboratory inspections.

Issued: **01 JUL 2015**
Expires: **30 JUN 2016**

Oscar C. Jacobs

Director, Division of Environmental Analysis

COMMONWEALTH OF MASSACHUSETTS
DEPARTMENT OF ENVIRONMENTAL PROTECTION

Certified Parameter List as of: 01 JUL 2015

M-NH906 **ENVIROSYSTEMS INC**
HAMPTON NH

NON POTABLE WATER (CHEMISTRY) **Effective Date** **01 JUL 2015** **Expiration Date** **30 JUN 2016**

Analytes	Methods
ALUMINUM	EPA 200.8
ANTIMONY	EPA 200.8
ARSENIC	EPA 200.8
BERYLLIUM	EPA 200.8
CADMIUM	EPA 200.8
CHROMIUM	EPA 200.8
COBALT	EPA 200.8
COPPER	EPA 200.8
IRON	EPA 200.8
LEAD	EPA 200.8
MANGANESE	EPA 200.8
MERCURY	EPA 245.7
MOLYBDENUM	EPA 200.8
NICKEL	EPA 200.8
SELENIUM	EPA 200.8
SILVER	EPA 200.8
THALLIUM	EPA 200.8
VANADIUM	EPA 200.8
ZINC	EPA 200.8
PH	SM 4500-H-B
SPECIFIC CONDUCTIVITY	SM 2510B
TOTAL DISSOLVED SOLIDS	SM 2540C
ALKALINITY, TOTAL	EPA 310.2
CHLORIDE	SM 4500-CL-C
CHLORIDE	EPA 300.0
SULFATE	EPA 300.0
AMMONIA-N	SM 4500-NH3-B, G
NITRATE-N	SM 4500-NO3-F
KJELDAHL-N	SM 4500-NH3-B, G
ORTHOPHOSPHATE	SM 4500-P-E
PHOSPHORUS, TOTAL	SM 4500-P-B,E
BIOCHEMICAL OXYGEN DEMAND	SM 5210B
TOTAL ORGANIC CARBON	SM 5310C
CYANIDE, TOTAL	SM 4500-CN-C,E
NON-FILTERABLE RESIDUE	SM 2540D
OIL AND GREASE	EPA 1664
VOLATILE HALOCARBONS	EPA 624
VOLATILE AROMATICS	EPA 624
CHLORDANE	EPA 608
ALDRIN	EPA 608
DIELDRIN	EPA 608
DDD	EPA 608
DDE	EPA 608

COMMONWEALTH OF MASSACHUSETTS
DEPARTMENT OF ENVIRONMENTAL PROTECTION

Certified Parameter List as of: 01 JUL 2015

M-NH906 **ENVIROSYSTEMS INC**
HAMPTON NH

NON POTABLE WATER (CHEMISTRY) **Effective Date** **01 JUL 2015** **Expiration Date** **30 JUN 2016**

Analytes	Methods
DDT	EPA 608
HEPTACHLOR	EPA 608
HEPTACHLOR EPOXIDE	EPA 608
SVOC-ACID EXTRACTABLES	EPA 625
SVOC-BASE/NEUTRAL EXTRACTABLES	EPA 625
POLYCHLORINATED BIPHENYLS (WATEF	EPA 608

ACUTE BIOASSAY DATA SUMMARY

STUDY: 27398	Brine Shrimp: A- 4090	"AS RECEIVED" EFFLUENT AND DILUENT CHEMISTRIES								
CLIENT: United Water	TEST ORGANISM: *M. beryllina*		T. Metals	TOC	AMM	TS/TSS	pH	S/C	SALINITY	TRC
SAMPLE: Hull WWTF Effluent	ORGANISM SUPPLIER / BATCH / AGE: *See Organism Culture Sheet*	EFF	002	003	004	005/006	6.89	18750	11.1	0.097/0.002
DILUENT: Receiving Water		DIL		009	010	011/012	7.83	45700	29.9	<0.02

SALINITY ADJUSTMENT RECORD : 4000 ML EFFLUENT + 256 G SEA SALTS (A- 3969) = 100% ACTUAL PERCENTAGE
8000 mL Diluent + 1000 mL DI H_2O = 89% Actual Percentage

CONC	REP	SURVIVAL 0	SURVIVAL 24	SURVIVAL 48	DO (mg/L) 0	DO (mg/L) 24	DO (mg/L) 48	pH (SU) 0	pH (SU) 24	pH (SU) 48	TEMP (°C) 0	TEMP (°C) 24	TEMP (°C) 48	S/C (µmhos/cm) 0	S/C (µmhos/cm) 24	S/C (µmhos/cm) 48	SALINITY (ppt) 0	SALINITY (ppt) 24	SALINITY (ppt) 48
LAB	A	10	10	9	7.0	5.5	6.0	8.01	7.75	7.80	22	23	24	38270	38650	38570	24	25	25
	B	10	10	10	7.0	4.9	6.0												
	C	10	10	9	7.0	5.3	5.9												
	D	10	10	10	7.0	5.5	5.9												
RW	A	10	10	10	8.1	5.6	6.0	8.01	7.74	7.76	23	24	24	35720	36280	36950	23	23	23
	B	10	10	10	8.1	5.6	6.0												
	C	10	10	10	8.1	4.9	5.9												
	D	10	10	10	8.1	5.1	5.7												
6.25%	A	10	10	10	7.1	5.3	5.7	7.97	7.68	7.76	22	24	24	35940	36340	36980	23	23	23
	B	10	10	10	7.1	5.3	5.8												
	C	10	10	10	7.1	5.2	5.9												
	D	10	10	10	7.1	5.3	5.9												
12.5%	A	10	10	10	7.1	5.2	5.9	7.94	7.61	7.74	22	24	24	36090	36610	37050	23	33	24
	B	10	10	10	7.1	4.9	5.8												
	C	10	10	10	7.1	5.1	5.7												
	D	10	16	10	7.1	5.1	5.7												
DATE		05/12/16	05/13/16	05/14/16	05/12/16	05/13/16	05/14/16												
TIME		1325	1515	1410	1045	0925	1330												
INITIALS		HK	NP	BG	NP	NP	BG												

Page 1 of 2

ACUTE BIOASSAY DATA SUMMARY

STUDY: 27398	Brine Shrimp: A- 4090
CLIENT: United Water	TEST ORGANISM: *M. beryllina*
SAMPLE: Hull WWTF Effluent	ORGANISM SUPPLIER / BATCH / AGE: *See Organism Culture Sheet*
DILUENT: Receiving Water	

CONC	REP	SURVIVAL 0	SURVIVAL 24	SURVIVAL 48	DO (mg/L) 0	DO (mg/L) 24	DO (mg/L) 48	pH (SU) 0	pH (SU) 24	pH (SU) 48	TEMP (°C) 0	TEMP (°C) 24	TEMP (°C) 48	S/C (µmhos/cm) 0	S/C (µmhos/cm) 24	S/C (µmhos/cm) 48	SALINITY (ppt) 0	SALINITY (ppt) 24	SALINITY (ppt) 48
25%	A	10	10	10	7.2	4.9	5.9	7.88	7.67	7.76	22	24	24	36380	36960	37770	23	23	24
	B	10	10	10	7.2	5.0	5.9												
	C	10	10	10	7.2	5.1	5.8												
	D	10	10	10	7.2	5.1	5.7												
50%	A	10	10	10	7.2	5.2	5.7	7.76	7.64	7.80	22	24	24	36860	37760	38680	23	24	25
	B	10	9	8	7.2	5.1	5.7												
	C	10	10	10	7.2	5.1	5.6												
	D	10	10	10	7.2	5.3	5.5												
100%	A	10	10	10	8.3	5.3	5.7	7.51	7.67	7.83	23	24	24	38300	39200	40410	24	25	26
	B	10	10	10	8.3	5.1	5.8												
	C	10	10	10	8.3	5.1	5.7												
	D	10	10	10	8.3	5.1	5.6												
DATE		05/12/16	05/13	05/14/16	05/12/16	05/13/16	05/14/16												
TIME		1325	1515	1410	1045	0925	1330												
INITIALS		HK	NP	BG	NP	NP	BG												

STUDY: 27398
CLIENT: Hull
PROJECT:
ASSAY: MB48AD
SPECIES: *M. beryllina*
TASK: **Wet Weight Data - Balance Output File**
BALANCE: **Ohaus Discovery Balance Model DV215CD**
Serial #: **1124024313**

Date / Intials:	05/12/16 HK
Rep	
1	0.00159
2	0.00164
3	0.00074
4	0.00164
5	0.00137
6	0.00159
7	0.00091
8	0.00095
9	0.00137
10	0.00135
11	0.00126
12	0.00067
13	0.00156
14	0.00161
15	0.00103
16	0.00114
17	0.00092
18	0.00063
19	0.00126
20	0.00160
Mean Weight (g):	0.00124
Test Volume (L):	0.2
Loading Rate(g/L):	0.06207

1300 Blue Spruce Drive, Suite C
Fort Collins, Colorado 80524

08MbABS051016

Toll Free: 800/331-5916
Tel: 970/484-5091 Fax:970/484-2514

ORGANISM HISTORY

DATE: 5/9/2016

SPECIES: *Menidia beryllina*

AGE: 7 day

LIFE STAGE: Juvenile

HATCH DATE: 5/2/2016

BEGAN FEEDING: Immediately

FOOD: Rotifers, *Artemia* sp.

Water Chemistry Record:	**Current**	**Range**
TEMPERATURE:	25°C	23-26 °C
SALINITY/CONDUCTIVITY:	25 ppt	23-26 ppt
TOTAL HARDNESS (as $CaCO_3$):	--	--
TOTAL ALKALINITY (as $CaCO_3$):	205 mg/l	165-210 mg/l
pH:	8.32	7.88-8.39

Comments:

Facility Supervisor

RECORD OF METERS USED

STUDY: 27398	CLIENT: United Water - Hull, MA WWTF

	Exposure (Hours)		
	0	24	48
Water Quality Station #	1	1	2
Initials / Date	NP 05/12/16	NP 05/13/16	BG 05/14/16

Water Quality Station #1		Water Quality Station #2	
DO meter #	24	DO meter #	23
DO probe #	94	DO probe #	93
pH meter #	1097	pH meter #	470
pH probe #	140	pH probe #	139
S/C meter #	YSI30D	S/C meter #	YSI30D
S/C probe #	↓	S/C probe #	↓
Salinity meter #		Salinity meter #	

COMMENTS

PREPARATION OF DILUTIONS

Diluent: Receiving Water (RW)	Day: 0 Sample:	
Concentration %	Vol. Eff.(mls)	Final Vol.(mls)
Lab	0	800
RW	0	↓
6.25%	50	
12.5%	100	
25%	200	
50%	400	
100%	800	
INITIALS:	NP	
TIME:	1035	
DATE:	05/17/16	

Report No: 27398 SDG:
Project: Hull

Sample ID: Effluent Start
Matrix: Water
Sampled: 05/11/16 0800

Parameter		Result	Qualifiers	Quant Limit	Units	Date Prepared	Date of Analysis	INIT/Method/Reference
Total solids	27398-006	28000		10	mg/L	05/12/16 1515	05/17/16 1015	BG /SM 2540B
Total suspended solids	27398-005	15		1	mg/L	05/12/16 1210	05/17/16 0950	BG /SM 2540D
Total organic carbon	27398-003	7.8	J15	0.8	mg/L	05/26/16	05/26/16	AC /SM 5310 C
Ammonia-N	27398-004	0.9		0.1	mg/L as N	05/25/16	05/25/16	AC /SM 4500-NH3 G
Aluminum, total	27398-002	0.034		0.02	mg/L	05/20/16 0930	05/27/16 2230	JLH/EPA 200.8
Cadmium, total	27398-002	ND		0.0005	mg/L	05/20/16 0930	05/27/16 2230	JLH/EPA 200.8
Calcium, total	27398-002	160		0.1	mg/L	05/20/16 0930	05/27/16 2230	JLH/EPA 200.8
Chromium, total	27398-002	ND		0.002	mg/L	05/20/16 0930	05/27/16 2230	JLH/EPA 200.8
Copper, total	27398-002	0.011		0.002	mg/L	05/20/16 0930	05/27/16 2230	JLH/EPA 200.8
Lead, total	27398-002	ND		0.0005	mg/L	05/20/16 0930	05/27/16 2230	JLH/EPA 200.8
Magnesium, total	27398-002	410		0.1	mg/L	05/20/16 0930	05/27/16 2230	JLH/EPA 200.8
Nickel, total	27398-002	ND		0.002	mg/L	05/20/16 0930	05/27/16 2230	JLH/EPA 200.8
Zinc, total	27398-002	0.047		0.002	mg/L	05/20/16 0930	05/27/16 2230	JLH/EPA 200.8

Sample ID: Receiving Water Start
Matrix: Water
Sampled: 05/11/16 0645

Parameter		Result	Qualifiers	Quant Limit	Units	Date Prepared	Date of Analysis	INIT/Method/Reference
Total solids	27398-012	34000		10	mg/L	05/12/16 1515	05/17/16 1015	BG /SM 2540B
Total suspended solids	27398-011	6.9		1	mg/L	05/12/16 1210	05/17/16 0950	BG /SM 2540D
Total organic carbon	27398-009	1	J15, J5	0.8	mg/L	05/26/16	05/26/16	AC /SM 5310 C
Ammonia-N	27398-010	ND		0.1	mg/L as N	05/25/16	05/25/16	AC /SM 4500-NH3 G
Aluminum, total	27398-008	0.092		0.02	mg/L	05/20/16 0930	05/27/16 2236	JLH/EPA 200.8
Cadmium, total	27398-008	ND		0.0005	mg/L	05/20/16 0930	05/27/16 2236	JLH/EPA 200.8
Calcium, total	27398-008	370		0.1	mg/L	05/20/16 0930	05/27/16 2236	JLH/EPA 200.8
Chromium, total	27398-008	ND		0.002	mg/L	05/20/16 0930	05/27/16 2236	JLH/EPA 200.8
Copper, total	27398-008	ND		0.002	mg/L	05/20/16 0930	05/27/16 2236	JLH/EPA 200.8
Lead, total	27398-008	ND		0.0005	mg/L	05/20/16 0930	05/27/16 2236	JLH/EPA 200.8
Magnesium, total	27398-008	1100		0.1	mg/L	05/20/16 0930	05/27/16 2236	JLH/EPA 200.8
Nickel, total	27398-008	ND		0.002	mg/L	05/20/16 0930	05/27/16 2236	JLH/EPA 200.8
Zinc, total	27398-008	ND		0.002	mg/L	05/20/16 0930	05/27/16 2236	JLH/EPA 200.8

Notes:

ND = Not Detected
J15 = CCV %RPD above limit. CCV %R acceptable.
J5 = Estimate. MS %R below limit.

ESI

SAMPLE RECEIPT AND CONDITION DOCUMENTATION

STUDY NO:	27398		
SDG No:			
Project:	Hull		
Delivered via:	ESI		
Date and Time Received:	05/11/16 0900	Date and TIme Logged into Lab:	05/11/16 1429
Received By:	DW	Logged into Lab by:	EH EH
Air bill / Way bill:	No	Air bill included in folder if received?	NA
Cooler on ice/packs:	Yes	Custody Seals present?	NA
Cooler Blank Temp (C) at arrival:	1.8	Custody Seals intact?	NA
Number of COC Pages:	1		
COC Serial Number(s):	A1013325		
COC Complete:	Yes	Does the info on the COC match the samples?	Yes
Sampled Date:	Yes	Were samples received within holding time?	Yes
Field ID complete:	Yes	Were all samples properly labeled?	Yes
Sampled Time:	Yes	Were proper sample containers used?	Yes
Analysis request:	Yes	Were samples received intact? (none broken or leaking)	Yes
COC Signed and dated:	Yes	Were sample volumes sufficient for requested analysis?	Yes
Were all samples received?	Yes	Were VOC vials free of headspace?	NA
Client notification/authorization:	Not required	pH Test strip ID number:	A-4231

Field ID	Lab ID	Mx	Analysis Requested	Bottle	Req'd Pres'n	Verified Pres'n
Effluent Start	27398-001	W	MB48AD StartSample	1x3750 P	4 C	
Effluent Start	27398-002	W	Total Metals Cd,Cr,Ni,Pb,Cu,Zn,Al,Ca,Mg;	250 P	HNO3	Yes
Effluent Start	27398-003	W	TOC	1x40 G	H2SO4	Yes
Effluent Start	27398-004	W	NH3;	125 P	H2SO4	Yes
Effluent Start	27398-005	W	TSS	1000 P	4 C	
Effluent Start	27398-006	W	TS	250 P	4 C	
Receiving Water Start	27398-007	W	MB48AD StartDiluent	2x3750 P	4 C	
Receiving Water Start	27398-008	W	Total Metals Cd,Cr,Ni,Pb,Cu,Zn,Al,Ca,Mg;	250 P	HNO3	Yes
Receiving Water Start	27398-009	W	TOC	1x40 G	H2SO4	Yes
Receiving Water Start	27398-010	W	NH3;	125 P	H2SO4	Yes
Receiving Water Start	27398-011	W	TSS	1000 P	4 C	
Receiving Water Start	27398-012	W	TS	250 P	4 C	

Notes and qualifications:

See COC

ESI

EnviroSystems, Inc.
1 Lafayette Road
Hampton, NH 03842

Voice: 603-926-3345
FAX: 603-926-3521

ESI Job No: 27398

CHAIN OF CUSTODY DOCUMENTATION

Client: Hull	Contact: Aram Varjabedian	Project Name: Hull WWTF	
Report to: Aram Varjabedian	Address: 1111 Nantasket Avenue	Project Number: P0036	Task: 0001
Invoice to: Aram Varjabedian	Address: Hull, MA 02045	Project Manager: Aram Varjabedian	
Voice: 781-925-0906	Fax: 781-925-3056	email:	

Protocol: NPDES

Lab Number (assigned by lab)	Your Field ID: (must agree with container)	Date Sampled	Time Sampled	Sampled By	Grab or com-posite (G/C)	Container No	Container Size (mL)	Container Type (P/G/T)	Field Preser-vation	Matrix S=Solid W=Water	Filter N=Not needed F=Done in field L=Lab to do	Analyses Requested\ Special Instructions:
001	Effluent Start	5/10-11/16	8A-8A	[illegible]	C	1	3750	P	4 C	Water	N	MB48AD StartSample
002	Effluent Start	5/10-11/16	8A-8A	[illegible]	C	1	250	P	HNO3	Water	N	Total Metals Cd,Cr,Ni,Pb,Cu,Zn,Al,Ca,Mg;
003	Effluent Start	5/10-11/16	8A-8A	[illegible]	C	1	40	G	H2SO4	Water	N	TOC
004	Effluent Start	5/10-11/16	8A-8A	[illegible]	C	1	125	P	H2SO4	Water	N	NH3;
005	Effluent Start	5/10-11/16	8A-8A	[illegible]	C	1	1000	P	4 C	Water	N	TSS
006	Effluent Start	5/10-11/16	8A-8A	[illegible]	C	1	250	P	4 C	Water	N	TS
007	Receiving Water Start	5/11/16	6:45AM	[illegible]	G	2	3750	P	4 C	Water	N	MB48AD StartDiluent
008	Receiving Water Start	5/11/16	6:45AM	[illegible]	G	1	250	P	HNO3	Water	N	Total Metals Cd,Cr,Ni,Pb,Cu,Zn,Al,Ca,Mg;
009	Receiving Water Start	5/11/16	6:45AM	[illegible]	G	1	40	G	H2SO4	Water	N	TOC
010	Receiving Water Start	5/11/16	6:45AM	[illegible]	G	1	125	P	H2SO4	Water	N	NH3;
011	Receiving Water Start	5/11/16	6:45AM	[illegible]	G	1	1000	P	4 C	Water	N	TSS
012	Receiving Water Start	5/11/16	6:45AM	[illegible]	G	1	250	P	4 C	Water	N	TS

Relinquished By: [illegible]	Date: 5/11/16 Time: 9:00 AM	Received By: [illegible]	Date: 5-11-16 Time: 0900 AM
Relinquished By:	Date: Time:	Received at Lab By:	Date: Time:

Comments: 1.8°C

COC Number: A1013325

Sample Delivery Group No: May 2016

Page 1 of 1

Assay Review Checklist

DATE IN: 05/11/16
DATE DUE: 06/10/16

STUDY#: 27398
CLIENT: United Water
PROJECT: Hull
ASSAY: MB48AD

Project Paperwork Check for Completeness			
	Date	Initials	Comments
Day 0	05/12/16	HK	
Day 1	05/13/16	NP	
Day 2	05/14/16	BG	
Day 3			
Day 4			
Day 5			
Day 6			
Day 7			
Day 8			

Analyst Data Review	Date	Initials	Comments
Chains of Custody Complete	05/17/16	BG	
Sample Receipt Complete	↓	↓	
Organism Culture Sheet(s)	↓	↓	
Bench Sheets Complete (dates, times, initials, etc...)	↓	↓	
Water Quality Data Complete	↓	↓	
TRC Values & Bottle Numbers	↓	↓	
Daphnid Calculations Complete	NA	EH	
Weights Reported	06/01/16	↓	
Assay Acceptability Review	↓	↓	

Technical Report Review	Date	Initials	Comments
Statistical Analysis Complete	N/A	LB	
Statistical Analysis Reviewed	↓	↓	
Data Acceptability Review	5/27/16	LB	
Supporting Chemistry Report	6/6/16	LB	
Draft Report	5/31/16	LB	
QA Audit/Review Complete			
Final Report Reviewed	06/01-02/16	[illegible]	
Final Report Printed - PDF	6/6/16	LB	
Executive Summary / Chems Sent			
Report E-mailed / Faxed	6/6/16	LB	
Report Logged Out / Invoice Sent	↓	↓	
Report Scanned to Archive	↓	↓	

P:\GENERAL PROJECTS\FORMS\LABFORMS\$ Assay Review Checklist.wpd